

WATER RESOURCE ALLOCATION IN THE COLORADO RIVER BASIN:
MANAGEMENT ISSUES, EXISTING LEGAL INSTITUTIONS, AND
EMERGING TRENDS

by

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INTRODUCTION

The Southwestern region of the United States is undergoing rapid growth and transformation from a mostly rural, agriculturally based region into one which is becoming more urbanized and dependent on manufacturing, industry and energy development. Because of its arid environment, this region has been heavily dependent on the waters of the Colorado River Basin to sustain its domestic and agricultural needs and to promote the new emerging land uses. The combination of rapid growth and new land use activities has substantially increased the competition for scarce water resources, creating a "water management crisis" which is affecting both the region and the nation.

Historically, increased agricultural and mineral development and the expanding demand for water beyond the confines of river valleys, required the development of water projects to facilitate diversion of water from its source, to the place of need. In addition, the need to protect water rights during times of scarcity was recognized, as a result of the often undependable flows associated with arid river basins.

A system of legal institutions was devised, during the era of cheap and abundant water, to facilitate the process of water development and diversion, and to identify and protect the water rights of those who put

the water to beneficial use. However, these institutions did not specifically address the problem of reallocating or transferring water and water rights to new and competing uses, once all the water had been developed in a particular area (Kneese and Brown 1981; Castle 1980).

During times of relative water abundance it has been economically and politically less costly to develop new sources of water, as opposed to attempting the difficult decision of allocating water between competing uses (Kneese and Brown 1981). However, it is now recognized that water resources in the Colorado River Basin are almost fully developed, and are over appropriated, if not yet fully utilized. There will not be enough water to meet all of the demands, both within and around the basin (Lamm 1977; Kneese and Brown 1981).

As a result, water resource planning in the southwestern United States is undergoing a major transition from the development phase to the management phase. Many experts agree (Lamm 1977; Anderson 1983; Kneese and Brown 1981) that the emphasis of water institutions must change from development, diversion and storage of new water sources, to the management, allocation and transfer of existing resources from old uses to new higher valued uses. In addition,

increasing competition over scarce water resources and the emerging "water management crisis" will require changes in existing institutions to facilitate transfers "under socially acceptable practices that balance the need for economically efficient use with societal norms of fairness and equity" (Kneese and Brown 1981, 94).

This Masters Report examines issues surrounding water rights and water allocation in the Colorado River Basin, as well as the existing legal institutions and how they are changing to meet new demands on the basin's water resources.

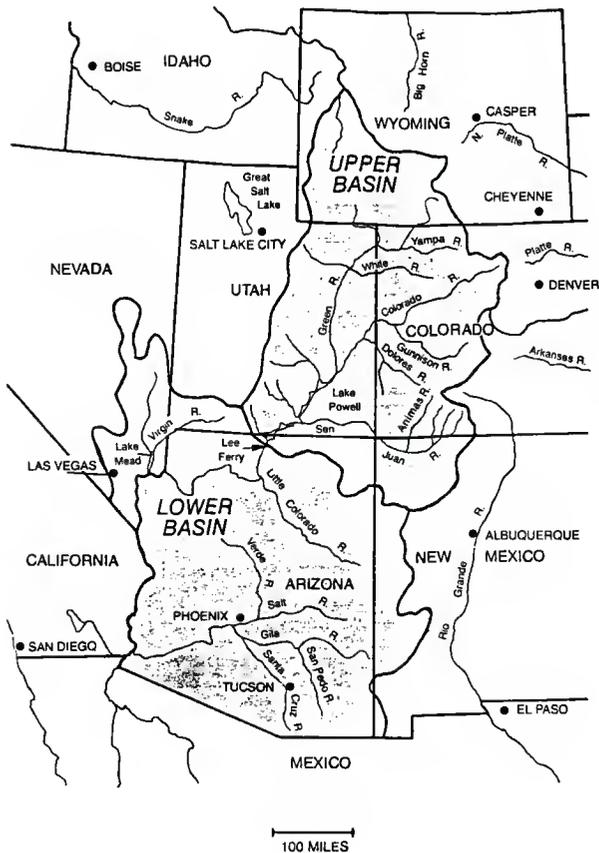
Chapter One examines the significance of the Colorado River Basin to the Southwest region and the nation, and reviews some of the management issues and controversies surrounding the allocation of its water. Chapter Two examines the existing legal institutions controlling the ownership and allocation of the basin's water, concentrating on the appropriation doctrine and the interstate compact. Included is a review of some of the case law involved with the development and interpretation of these institutions. Chapter Three discusses some of the problems, recommendations and emerging trends in these institutions, and discusses their implications on future water planning and management in the Colorado River Basin.

Chapter 1

THE SIGNIFICANCE OF THE COLORADO RIVER BASIN: WATER
MANAGEMENT AND RELATED ISSUES

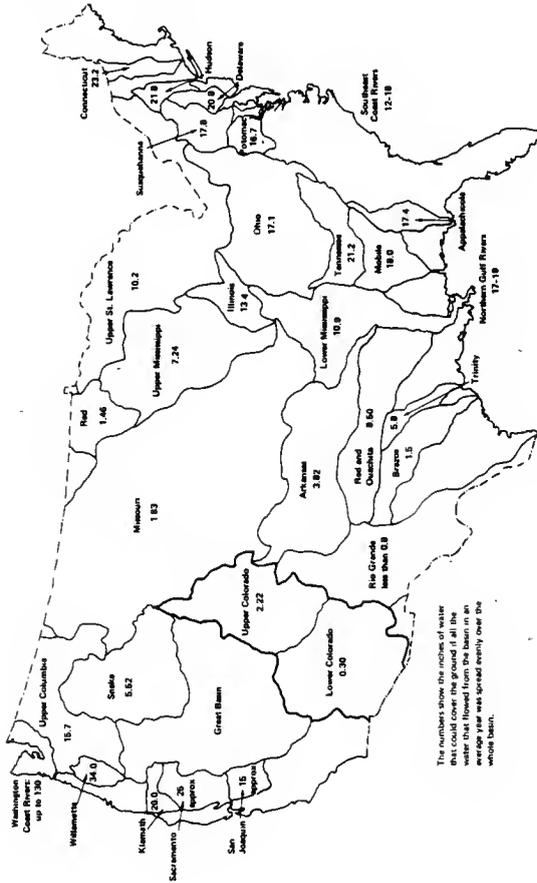
The Colorado River Basin is comprised of parts of seven western states: Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada and California, and part of Mexico. It is divided into the Upper Basin and Lower Basin at Lee Ferry in northern Arizona (see Figure 1). Draining one twelfth of the United States, 242,000 square miles, it is the largest arid river basin in the country. However, it "produces the lowest outflow per unit area (60 acre-feet per square mile) of any river basin in the United States" (Kneese and Brown 1981, 44) (see Figure 2). In addition, this basin exports more water than any other, almost one-third of its virgin flow. Intense competition over this water has resulted in the most regulated, politicized, over-utilized and litigated river in the world (National Research Council 1968, 2-17; Plummer 1983, 3). It is so thoroughly utilized by the arid Southwest region that "except for occasional local flood flows, no water has reached the Gulf of California . . . in the last twenty years" (Fradkin 1981, 16).

FIGURE 1. THE UPPER AND LOWER COLORADO RIVER BASIN



Source: U.S. Congress Office of Technology Assessment (1980, 38).

FIGURE 2. POTENTIAL SURFACE-WATER RESOURCES



Source: National Research Council (1968, 6).

Numerous controversies involving the Basin and the allocation of its waters have permeated the economic, social, political, environmental and legal aspects of daily life in the southwestern United States, and increasingly affect the nation. A number of issues have come together to focus national attention on the significance of this region and its water management.

Political Influence

Although the seven basin states have often been at odds with each other over the allocation of the basin's water, they have been able to unify themselves as a powerful political force within Congress on matters concerning western land and water resources. Fradkin describes the extent of the political power of the seven basin states and their Committee of Fourteen, through which they served as advisors to the State Department and the Department of Interior during negotiations with Mexico in 1945 and 1973 concerning the quantity and quality of water which would be allocated to Mexico. As a result of their political influence the basin states were successful in shifting the obligation for supplying Mexico's 1.5 million acre-feet per year allocation to a national obligation. This meant the basin states were no longer solely

responsible for supplying the water, or paying for the expensive desalination projects needed to meet treaty obligations (Fradkin 1981, 299-318).

Since their unification under the Colorado River Compact of 1922, the Colorado Basin states have controlled the House Interior and Insular Affairs Committee, as well as other Congressional subcommittees which deal with western lands and water projects (Ingram 1978, 64). Under the leadership of Wayne Aspinall, and later Morris Udall, these western states have been successful in getting Congressional approval of massive water acts and appropriations which have often been controversial, but which remained relatively untouchable until President Carter's "war on water projects" in 1977 (Fradkin 1981, 3-110).¹

The most significant water project acts which have gained approval include: the Boulder Canyon Project Act of 1928 which included major Lower Basin projects such as Hoover Dam and the All American Canal; the Colorado River Storage Project Act of 1956 which included Glen Canyon Dam and three other Upper Basin storage projects; and the Colorado River Basin Project Act of 1968 which included the massive Central Arizona Project in the Lower Basin, as well as additional Upper Basin projects (Goslin 1978, 33-50). The locations of these projects are shown in Figure 3.

FIGURE 3. WATER PROJECTS AND PUBLIC LANDS



Source: Fradkin (1981, 1).

The complexities and expense of these water projects, as well as the need for economies of scale, has required the leadership of the federal government for planning, funding and construction. The major controversies surrounding these large water projects have centered on the inequities and limitations of distributive politics and the use of benefit-cost analysis to justify which projects were approved. Critics cite the inability of benefit-cost analysis to adequately account for often less quantifiable public values, benefits and costs. They assert that benefit-cost analysis has limited application in allocation of scarce water between competing uses, and that it should be used in conjunction with more comprehensive planning techniques (Bromley 1980, 27-28; Chan 1981, 85-107). "It is true that BCA [benefit-cost analysis] was useful in separating the clearly inferior projects from those that were more reasonable, but its primary role has been one of legitimating political decisions" (Bromley 1980, 231).

These large water projects have been characterized as omnibus porkbarrel "raids on the national treasury" which benefit a local region, but are often not in the national interest and do not reflect true costs (Ingram 1978, 62). Ingram describes how distributive politics has also discouraged state and local planning by

limiting the information and range of choice on which water resource decisions are made so that projects would fit federal criteria. The result has been piecemeal planning and uncoordinated projects which are insensitive to environmental concerns or the needs of the basin. She suggests that comprehensive basin-wide planning is more effective for protecting the interests and needs of the basin. The emergence of the environmental movement, more regulatory decisionmaking, e.g. National Environmental Policy Act of 1970, and federal decentralization appear to signal a shift to a political climate which will encourage increased state involvement in water resource planning (1978, 62-74).

One of the most important factors affecting the water management crisis are the institutions related to different aspects of planning land and water resource use. The Reagan Administration has initiated a policy of federal decentralization. For planning and natural resource management this means that much of the technical assistance and policy decisions previously provided at the federal level will become the responsibility of state and local agencies. Because most states and regions have become dependant on federal assistance of all kinds, this transition will require organizational, technical and administrative

revitalization of their planning and management systems.

Federal v. State Management

The seven basin states, along with other western states, are continuing their historical rivalry with the federal government's land acts. Approximately 70 percent of the Colorado River Basin is owned or administered by the federal government in the form of Indian reservations, national parks and forests, military reservations and other holdings (see Table 1). The emergence of the "Sagebrush Rebellion" is an attempt by these states to gain control of federal lands within their borders and establish self-determination over the use of their resources.²

TABLE 1 LAND OWNERSHIP IN STATES OF THE COLORADO RIVER BASIN AS A PERCENT OF THE TOTAL AREA OF EACH STATE

State	Private	Indian	State	Federal	FS	BLM	NPS	FWS
Ariz.	28.7	27.2	13.2	44.1	15.5	17.3	2.6	2.1
Calif.	51.9	0.6	0.6	47.5	20.3	16.6	4.5	—
Colo.	61.6	1.1	4.5	37.3	21.6	12.0	0.8	—
Nev.	10.6	1.7	—	87.7	7.3	69.9	0.4	3.1
N. Mex.	57.6	9.2	11.9	33.2	11.9	16.5	0.3	0.4
Utah	32.1	4.3	6.9	63.6	15.3	41.9	1.6	0.2
Wyo.	48.4	3.0	5.9	48.6	14.8	28.5	3.8	—
Mean	41.6	6.7	6.1	51.7	15.2	29.0	2.0	0.8

Sources of data: Bureau of Land Management (1978) and Patric (1981). FS = Forest Service, BLM = Bureau of Land Management, NPS = National Park Service, FWS = Fish and Wildlife Service. "Federal" column is for all federal lands and exceeds the sums of FS + BLM + NPS + FWS because of other unspecified federal holdings, mostly military.

Source: Graf (1985, 7).

Central to this issue is the legal question concerning quantification of federal and Indian water rights on the large percentage of federal and Indian lands which comprise western states. Ruling on the case of Winters v. United States, 207 U.S. 564 (1908), the U.S. Supreme Court found the establishment of Indian reservations by treaty, or statute also implied the withdrawal of a sufficient amount of unappropriated water to satisfy the purposes and needs of the reservation (Simms 1980, 69). The date of the reservation, or treaty established the priority date of the water right with respect to other rights. At issue is the interpretation of what purposes these reservations include. Are Indian water rights limited to historically agricultural uses, or do they include other potential purposes such as energy development?

The federal government asserts similar implied "federal reserved rights" on its public domain lands. These implied federal and Indian water rights are in direct conflict with the established state laws of prior appropriation (Kneese and Brown 1981, 70). In addition, the early dates of these reserved rights makes them senior, or of a higher priority than most other rights in the basin. When these rights are quantified there could be major shifts in allocation away from established water users, such as mining and

agriculture, resulting in increased tension between competing water users, as well as intensifying the dispute between federal or state control over land and water resources.

The Energy Crisis

More than any other issue, the 1973 OPEC oil embargo and the continuing world-wide energy crisis may have focused national attention on the Colorado River Basin. Recognizing our vulnerability to political and economic incidents in the international energy market, the United States has established a national energy policy aimed at energy independence. Implementation of this policy will require development of the vast coal, oil shale, tar sand and uranium deposits which are located in and around the basin, some of which are the largest remaining reserves in the nation. This energy development can not be accomplished without utilizing water resources.

Virtually all energy technologies dealing with fossil, mineral and synthetic fuels require large amounts of water during some phase of extraction, transportation, conversion, production, cooling, waste disposal, or land reclamation. It is certain that any development of these energy resources in the Colorado

River Basin will conflict with other water dependent activities such as agriculture which accounts for as much as 90 percent of the basin's water consumption. One of the major factors affecting how quickly and to what extent these energy resources will be developed, other than energy prices, is the availability of sufficient quantities of water. Mineral energy development will also adversely affect water quality in the basin due to surface runoff, waste water, and various salts and heavy metal pollutants. While treatment technologies exist for some energy processes, they have not been perfected for more complicated processes, such as those found in oil shale production (U.S. Environmental Protection Agency 1981, 1-18).

Sunbelt Migration

The Colorado River Basin and Southwest region have gained national attention as a result of sunbelt migration caused by the influx of high-technology industries and energy companies, in addition to other factors such as the increased importance of amenity resources. The arid regions both surrounding and within the Basin have shown high growth rates as people and industries migrate out of the frostbelt and into the sunbelt states.

A 1986 U.S. Census report indicates that the western United States has grown at a rate of 10.8 percent since 1980, twice the national average. All of the Colorado River Basin states, except Wyoming, were among the ten fastest growing states in the country: Arizona 17.2 %, Nevada 16.9 %, Utah 12.6 %, Colorado 11.8 %, California 11.4 %, and New Mexico 11.3 % (U.S. Bureau of the Census 1986, 2).

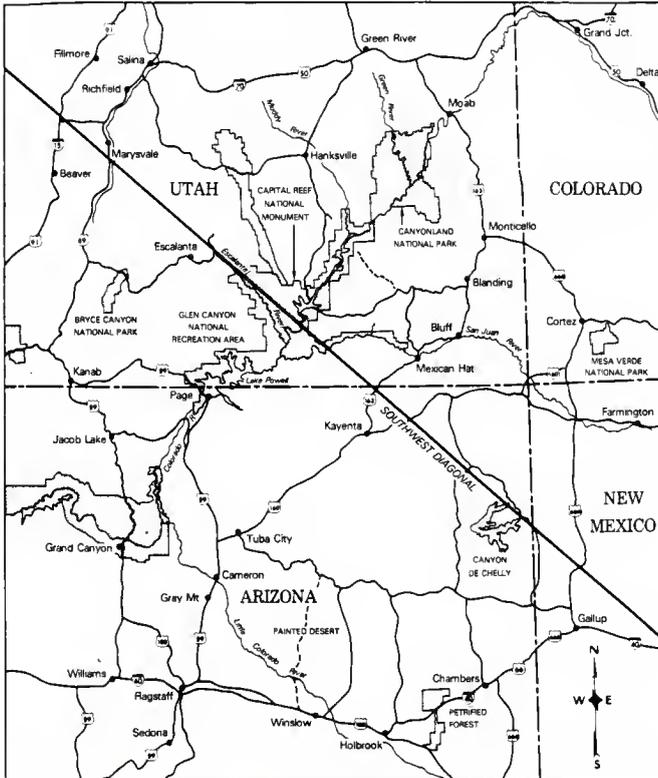
This massive migration, linked with the accompanying urban and economic growth has placed additional strain on government agencies which must deal with growth problems and other planning issues, in addition to allocation of scarce water resources. This growth has often occurred in rural areas which lack adequate planning organizations, or administrative procedures to handle the impact on rural or environmentally sensitive areas. The impact of this growth on the Basin's water resources has been magnified by large water exports to areas outside the basin in southern California and parts of Arizona, Utah and Colorado to support industry, agriculture and large urban growth centers (Los Angeles, Phoenix, Salt Lake City and Denver).

Balancing Development and Preservation

This rapid growth raises the fundamental issue facing land and water planning in the Southwest: balancing development with preservation of the environmental and cultural character of the region (Vlachos and Hendricks 1977, 3). Except for the large urban centers surrounding the Colorado River Basin, this region is characterized as a rural, resource rich, poverty stricken area which has been called the "Southwest Poverty Diagonal" (see Figure 4) (Kneese and Brown 1981, 8). As a result, there are strong pressures for development of the region's vast resources to create economic growth, raise income levels and reduce the energy crisis. This must be balanced with the conflicting goal of preserving the recreational and amenity resources of a region containing large undeveloped open spaces and a great number of national parks, monuments and national forests which have a high value to the nation in their undeveloped state.

At stake is the totality of the western character, of values contained in the associated natural environments, and of the images of the western frontier concerning open spaces. (Vlachos and Hendricks 1977, 3)

FIGURE 4. THE SOUTHWEST POVERTY DIAGONAL



Source: Kneese and Brown (1981, 9).

The Colorado River Basin must serve the water needs of approximately 20 million people throughout the Southwest and Mexico. A long history of heavy water use has resulted in the over-appropriation of water rights, making water a major limiting factor for most land use activities. This has caused increased competition between municipal, agricultural, industrial and energy interests, which are mostly off-stream water uses.³ Instream uses for fish and wildlife, recreation, power generation and minimum stream flows are also facing increased competition.

For water resource management, the issue becomes allocation between and among these various uses, and transfers of water from old uses to new higher valued uses. Most water transfers will come from agriculture, which is the largest water user in the basin. As competition over water increases it may be cheaper and much quicker for energy companies and other large consumers to buyout agricultural rights instead of waiting for state and federal governments to build new storage projects. Agricultural rights valued at \$20.00/acre-foot can not compete with energy uses which can pay up to \$200.00/acre-foot, or municipal rights valued at \$1,300/acre-foot (Lamm 1977, 222; U.S. Water News 1985, 1). In the case of municipalities, this

could involve condemnation of agricultural rights, although this is not yet a common practice (Vlachos and Hendricks 1977, 60, 95).

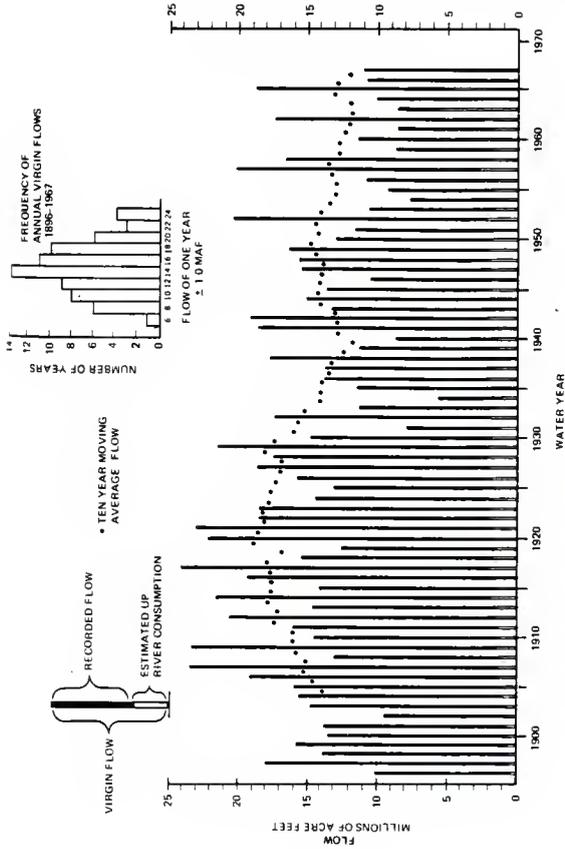
Agriculture in the Basin states accounts for 15.2 percent of the total value of national crop production, and 13 percent of the value of national livestock production (U.S. Water Resources Council 1978a., 25). While some of this production may be replaced by other regions, an argument can be made that large transfers of water out of agriculture, a renewable long-range resource, into nonrenewable transient energy resources and industrialization, may destabilize the existing socio-economic structure and character of the Southwest. Experts warn against converting too much of the existing structure to short term uses and falling into the "boom and bust" cycle which has characterized the region in the past (Kneese and Brown 1981, 72-73; Vlachos and Hendricks 1977, 113; Bromley 1980, 244). This boom and bust cycle was typical of abandoned mining towns in the region. A recent example is Battlement Mesa, a new town built for the oil shale industry in Colorado. With the recent drop in energy prices, oil shale is no longer economically feasible to produce and Battlement Mesa is attempting to convert to a resort town.

From the national perspective these transfers out of agriculture may help meet national economic goals. However, the state and regional perspective may be quite different as a result of the loss of jobs and agricultural income multipliers, and the alteration of the social and environmental character of the region (Howe 1980, 25-27). Water allocation policies of the basin states will play an important role in determining the economic, social and environmental character of the Southwest.

Water Quantity, Quality and Use

The Colorado River Basin consists mostly of semi-arid to arid regions which receive annual precipitation ranging from 50 inches in the northern mountains to 4 inches in the southern deserts. As stated previously, the basin produces the least amount of water per unit area in the country, but is called on to export as much as a third of its water to surrounding urban centers. As is common in arid environments, stream flows vary widely from season to season and from year to year, mostly due to variations in precipitation and spring run-off (see Figure 5). The virgin, or natural undepleted flow of the Colorado River from the Upper Basin, as measured at Lee Ferry

FIGURE 5. COLORADO RIVER FLOW AT LEE'S FERRY



Source: National Research Council (1968, 9).

has varied from approximately 6 million acre-feet in 1934 to approximately 24 million acre-feet in 1917 (National Research Council 1968, 9). This uncertainty in the reliability of available water is one of the reasons western water laws and institutions developed as they did, in an attempt to provide a degree of security and priority to an established water right. This uncertainty has also created problems in the measurement of available water for allocation, and has created obstacles to the transfer of rights to new uses (Hartman and Seastone 1970, 15-16).

Water Quantity

The negotiators of the Colorado River Compact of 1922 based their allotments to the Upper and Lower Basins on a twenty five year average flow which was approximately 17 million acre-feet. As it turned out, this average was the result of unusually wet years. The average for the period from 1931-1965 was approximately 13 million acre-feet which is generally accepted as a more realistic figure (Howe 1980, 22; National Research Council 1968, 24). The Colorado River is already over-appropriated, although not all rights are fully utilized in the Upper Basin due to the lack of enough storage space for its allotment.

However, the U.S. Water Resources Council has found "[t]he water supply in the Upper Colorado Region is not sufficient to meet projected needs, adequate instream flows, and the terms of the Colorado River Compact" (U.S. Water Resources Council 1978b., 19).

Water is apportioned between the Upper and Lower Basins, and the seven states and Mexico by various compacts, treaties and decrees known as the "Law of the River". The Colorado River Compact of 1922 guarantees 7.5 million acre-feet per year, or an average of 75 million acre-feet for every ten year period to the Lower Basin, and 7.5 million acre-feet per year to the Upper Basin. The Mexican Water Treaty of 1944 allocates 1.5 million acre-feet per year to Mexico, which is taken equally from the Upper and Lower Basins. This means the Upper Basin must allow an average 8.25 million acre-feet (maf) per year flow into the Lower Basin. The Upper Colorado River Basin Compact of 1948 allocates 50,000 acre-feet per year to Arizona, out of its 7.5 maf allotment. The remaining water is divided as follows: Colorado 51.75 percent, New Mexico 11.25 percent, Utah 23 percent, and Wyoming 14 percent.

In 1963, the United States Supreme Court ruled in Arizona v. California, 373 U.S. 546 that water in the Lower Basin would be apportioned as follows: California 4.4 maf plus half of any surplus over

7.5 maf; Arizona 2.8 maf plus half of any surplus over 7.5 maf; Nevada 300,000 acre-feet plus a possible 4 per cent of any surplus from Arizona's share.

Water Quality

In addition to increasing competition and over appropriation of water resources, the Colorado River Basin faces severe water quality problems. Water quality in the arid basin is difficult to maintain due to low flushing volumes and high concentrations of salts. Much of the salinity occurs naturally as a result of high levels of salts in the exposed sedimentary rock of the basin, surface runoff, mineralized springs, and high erosion rates. The salinity problem is magnified by many of man's activities which can often increase levels of runoff, erosion, sedimentation, permeability and leaching. Heavy water use in the fragile arid environment has raised salinity concentrations to levels which often prohibit its use for irrigation by the time it reaches Mexico. Return flows from irrigation leach out salts from the soil. Salt loads become more concentrated with each successive reuse, as the water moves down the basin, due to consumptive use and evapotranspiration.

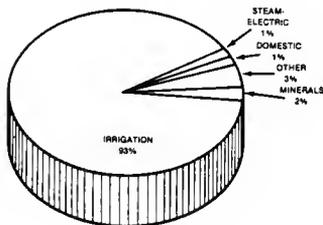
Salt loads of the Colorado River average around 500-600 mg/l at Lee Ferry, and can be as high as 1,150 mg/l at Imperial Dam located just north of Mexico (U.S. Water Resources Council 1978a., 21). This problem became so acute in 1961, when levels rose to 2,700 mg/l, that Mexico and the United States entered into negotiations to reduce salinity levels entering Mexico (Fradkin 1981, 302). As a result, Congress established the Colorado River Water Quality Improvement Program (Colorado River Basin Salinity Control Act of 1974), to control Upper Basin salinity sources, and to provide desalination of return flows from irrigation projects in Arizona so that fresh water requirements stipulated by the negotiations could be met (Vranesh and Cope 1977, 36). Reducing the salinity problem will be of great benefit to all water users in the region.⁴ A reduction of 1 mg/l at Imperial Dam could create \$472,000 of added benefit to water users (Plummer 1983, 9).

Water Use

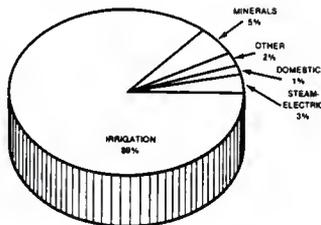
Water use in the Colorado River Basin is dominated by agricultural irrigation for both withdrawal and consumption (see Figure 6 & 7). In 1975 irrigation accounted for 93 percent of total water withdrawals in

**FIGURE 6. ANNUAL WITHDRAWALS AND CONSUMPTION:
UPPER COLORADO RIVER BASIN**

ANNUAL FRESHWATER WITHDRAWALS

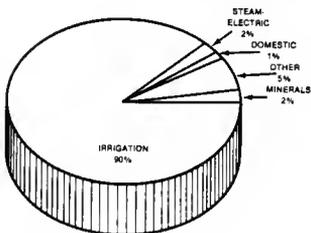


1975
Total Withdrawals — 6,869 MGD

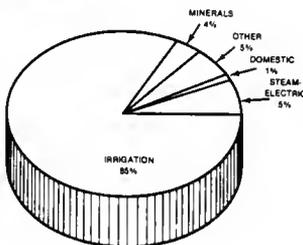


2000
Total Withdrawals — 7,519 MGD

ANNUAL FRESHWATER CONSUMPTION



1975
Total Consumption — 2,440 MGD

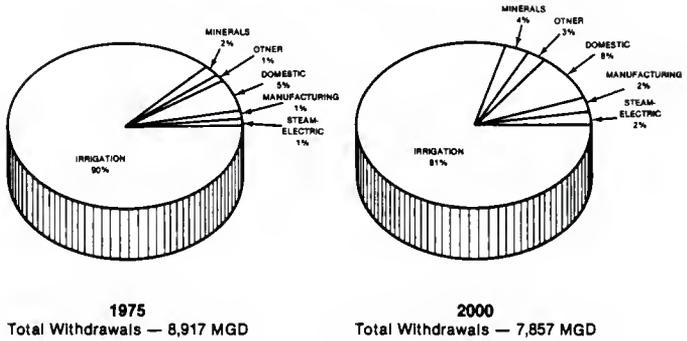


2000
Total Consumption — 3,232 MGD

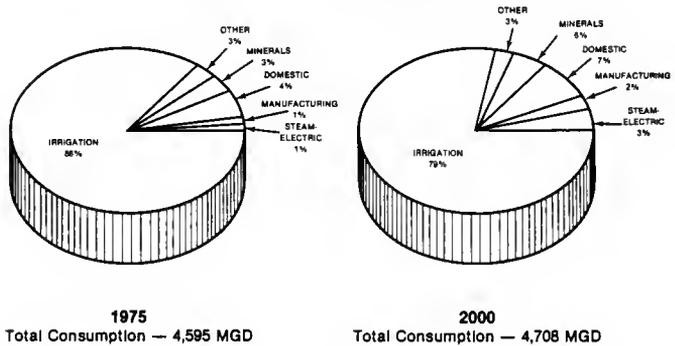
Source: U.S. Water Resources Council (1978b., 13).

**FIGURE 7. ANNUAL WITHDRAWALS AND CONSUMPTION:
LOWER COLORADO RIVER BASIN**

ANNUAL FRESHWATER WITHDRAWALS



ANNUAL FRESHWATER CONSUMPTION



Source: U.S. Water Resources Council (1978a., 15).

the Upper Basin, and 90 percent of total consumption. Irrigated crop land is projected to increase 19 percent by the year 2000 (U.S. Water Resources Council 1978b., 7). Not only will agriculture require increased water supplies for expansion of irrigated acreage, it will also require increased supplies for 45 percent of present irrigated acreage which lacks adequate water for optimum crop production (U.S. WRC. 1978b., 19). Agriculture will continue to be the major water user in the year 2000, accounting for 89 percent of total withdrawals in the Upper Basin and 85 percent of total consumption. Figure 6 shows the percentage of annual fresh water withdrawal and consumption for the other major land use categories in the Upper Basin in 1975 and the year 2000. Steam electric generation and mineral production show projected increases in the percentage of total withdrawal and consumption. These increases account for the relative drop in the percentage of total withdrawal and consumption by agriculture. Total withdrawals in the Upper Basin are projected to increase 9.5 percent by the year 2000, and total consumption is projected to increase 32 percent.

Figure 7 indicates that water withdrawal and consumption follow a similar pattern in the Lower Basin. Irrigation is presently the major water user and will continue to be in the year 2000, although its

relative percentage of total withdrawal and consumption will drop due to increased production of energy and mineral resources. However, irrigated acreage in the Lower Basin is projected to decrease approximately 8.6 percent by the year 2000 (U.S.WRC. 1978a.,7). Unlike the Upper Basin, more than half of all water withdrawals in the Lower Basin are from groundwater. This reliance on ground water to sustain the economy is causing severe over-drafts, resulting in depletion of aquifers as much as 4 to 10 feet a year. It is expected that this depletion should decrease by 60 percent upon the completion of the Central Arizona and Southern Nevada projects (U.S.WRC. 1978a., 17-21). Total withdrawals in the Lower Basin are projected to decrease 12 percent by the year 2000, and total consumption is projected to increase 2.4 percent. When compared with Upper Basin projections, it is clear that the Lower Basin has almost fully utilized its water resources. Appendix A contains more complete data on the water budget for both the Upper and Lower Basins.

Public Interest and Privatization

Federal decentralization will encourage stronger state and regional planning and management of land and water resources, however, decentralization has not been

without controversy. Along with this decentralization policy there has been the suggestion that private market forces and increased privatization should play a more significant role in issues of growth, energy development, natural resource management and water allocation. Authors supporting this view cite government failure caused by special interest politics, short sighted policies, and the lack of incentives for bureaucratic efficiency. They assert that private rights and entrepreneurship within the private market lead to better understanding of opportunity costs, more informed and long range decision making, improved efficiency and greater economic benefits (Anderson 1983, 3-7).

Those opposing this view are concerned that increased privatization poses a continuing threat to the protection of the public interest. They contend that a pure market system in common pool resources such as water does not adequately account for and internalize third party impacts, or nonmarket factors such as open space and environmental quality. In this case, extra-market institutions are required to insure compliance with public interests (Hartman and Seastone 1970, 1-3; Vlachos and Hendricks 1977, 85; Castle 1980, 5-6). These conflicting viewpoints have been demonstrated by the controversies which surrounded

Secretary James Watt and the Department of Interior. Water allocation institutions in the Southwest have also been surrounded by this controversy.

Allocation institutions in the Southwest are usually influenced by the doctrine of prior appropriation, based on the premise: "first in time - first in right". This doctrine was established by miners and ranchers prior to statehood in the seven basin states and subsequently adopted by all seven through legislation. Water rights are granted by a permit system on the basis of beneficial use and protection of the public interest, or as in the case of Colorado, through water courts on the basis of "beneficial use" without specific public interest protection (Petros 1985, 4).⁵

Those who suggest changes in existing appropriation law charge that it is a frontier doctrine which encourages waste, is inflexible to changing demands, and discourages transfers to higher valued uses (Kneese and Brown 1981, 89-90; Gisser and Johnson 1983, 137-161). Other experts express concern that the definition of beneficial use used by water courts and development agencies often does not extend beyond the economic well-being of the applicant, or target group, to encompass the sometimes unquantifiable "general

public welfare" (White 1977, 127; Dewsnut and Jensen 1973, 30).

Coordinated Land and Water Planning

Most of the water resources in the Colorado River Basin have been fully developed, and water planning is undergoing a transition from project development to management of scarce resources. Some experts are also suggesting future water planning must now consider allocation and management alternatives which are more coordinated with land use policies at the state level (Sherman 1977, 225-229).

. . . the method and place of using water is nearly always dictated by the use of land. It is difficult if not impossible to control the use of water unless we also control the use of land.

Gov. Lamm, Colorado (1977, 222)

Water and land use in the arid Southwest are inseparable and it appears that while Governor Lamm's statement is correct, the use of land is more often determined by the quality and availability of water. Water is important as a factor of production and as an essential component of life. This raises the issue of utilizing water allocation laws as a form of land use planning and growth management tool. While many

experts agree water and land use planning should become more coordinated, they have reservations about limiting allocation to certain land uses.

Most existing water planning organizations, both public and private, are single purpose agencies dealing with water development, water delivery or water quality. The Bureau of Reclamation, Corps of Engineers and the Upper Colorado River Commission all fall in this category, as do the hundreds of private ditch companies and municipal water departments which operate in the basin. It appears that there are few regional agencies which attempt to coordinate their water policies with those of land use agencies. In addition to this lack of coordination, there is a proliferation of agencies dealing with water in any one area, from the federal government, down to the local utility. This creates fragmentation of authority, overlapping jurisdictions, duplication of capital investment and excessive private and social costs. Haws states that,

[t]he proliferation of water resources organizations that exist within a given area is a restraint to effective utilization of water resources and a hinderance to desirable overall basin planning and management (1975, 1).

Regional river basin commissions appear to be a logical organizational structure to coordinate land and water policy in the Southwest. However, state

governments have usually given such commissions limited authority and small budgets (Ingram 1978, 72). As long as the agencies which deal with land and water remain uncoordinated, land and water use policies will continue to contradict each other and magnify the water management crisis in the Southwest.

Summary

There are many controversies and interrelated issues involving the management and allocation of water in the Colorado River Basin. The institutions used to allocate scarce water among competing users will affect the outcome of these issues, and will have a significant impact on the future of both the Southwest and the nation. As Phillip Fradkin points out in River No More,

. . . the river's waters and the land surrounding it in the basin--the heartland of the West--are fused together in a common destiny, as are those areas outside the watershed to which Colorado River water is diverted. . . . The quantity and quality of the river's flows are a mirror image of what is upon the land--indeed, are the prime reason for there being something built upon or scratched out of the soil in the first place. How easily this is forgotten in the urban areas of this oasis civilization. Not the Rocky Mountains nor the Pacific Ocean, but the Colorado River . . . is the single most unifying geographical and political factor in the West. (Fradkin 1981, 16)

For this reason, it is important to understand the legal institutions surrounding the ownership and allocation of water resources in the Colorado River Basin, and examine how they are changing to meet demands for an increasingly scarce resource. Chapter Two will examine the appropriation doctrine and the interstate compact, the major legal institutions behind allocation in the basin.

Chapter 2.

EXISTING LEGAL INSTITUTIONS:
ALLOCATION OF WATER RIGHTS WITHIN AND BETWEEN STATES

The future of the southwestern United States will be significantly affected by water allocation among competing users in the region. Water institutions will play a major role in how the water resources of the Colorado River Basin will be allocated. Fox describes institutions as either:

. . . an entity; an organization or an individual, or a rule; a law, regulation, or established custom. An institutional arrangement is defined as an interrelated set of entities and rules that serve to organize societies' activities so as to achieve social goals. (1978, 9)

This chapter will examine the existing legal institutions surrounding the ownership and allocation of water resources. The chapter is divided into four sections. Part one reviews the characteristics of water rights and examines the "appropriation doctrine", the water law generally used in the Southwest to establish water rights within each state. The legal basis behind the formation of this doctrine is reviewed.

Part two addresses the interstate compact, the legal tool used to apportion Colorado River water between the seven basin states. This section reviews the history, Constitutional basis and legal structure of the interstate compact.

The third section explains the apportionment of water between the seven basin states, as authorized by the Colorado River Compact of 1922 and the Upper Colorado River Basin Compact of 1948.

Part four examines the court's interpretation of interstate compacts and equity in allocation, by reviewing some of the landmark cases in western water law.

Part 1
WATER RIGHTS AND THE DOCTRINE OF PRIOR APPROPRIATION

Prior to examining how water is allocated between the basin states, or to an individual within a state, it is important to review the characteristics of water rights.

Characteristics of Water Rights:

Trelease (1974, 5-6) explains that water rights are similar to other property rights, such as those for minerals or land, except that the renewable and mobile nature of water requires that the water right be tied only to its beneficial use, and not the ownership of water itself. Therefore water rights are usufructuary property rights.¹ The right to use water can substantially increase the value of land, or a water dependant activity. In the arid Southwest, water is the key ingredient to most activities, and usually requires substantial capital investment in facilities for its withdrawal and utilization.

Water laws, the rules governing water rights, are generally designed to protect investments in water resources by maximizing the future security of the

right of utilization. Without this insurance, the long-term growth of a region like the Southwest would be questionable. Balanced with providing long-run security of an individual owner's benefits, water law seeks to maximize benefits to the general public as well. This is accomplished through regulation to insure reasonable and beneficial use of water, while minimizing uses which conflict with the general public welfare. For example, these regulations include state water quality standards, as well as restrictions on wasteful use of water.

The most important aspect of western water rights is that they help define and enforce a right during times of scarcity (Howe, Alexander and Moses 1982). Definition of a right includes: quantity diverted, location of diversion and use, duration, and priority with respect to other rights. As shortages occur, a water right guarantees its owner exclusive use of the full quantity before lower priority rights can be utilized. Clear definition and enforcement of a water right also facilitates the sale, or transfer of the right to higher valued uses (Trelease 1977).

Types of Water Rights

All seven states comprising the Colorado River Basin exclusively utilize some form of the prior appropriation doctrine, except for California which uses both the appropriation and riparian systems, to establish water rights within the state (see Table 2).

Riparian Rights

The riparian doctrine generally allocates water rights only to the owners of land abutting a river, lake or stream. The riparian right allows these land owners to use water only on those adjacent riparian lands, and the diversion, or sale of water for use on non-riparian land is usually prohibited. The riparian user has the right to withdraw as much water as he wants, as long as he returns enough water so as not to alter the natural stream course, flow level, or water quality for down-stream users. Riparian rights are appurtenant to a piece of land and are acquired through land purchase.² Riparian rights "run with the land" and are not alienated when there is a change in land ownership.

TABLE 2. SUMMARY OF WATER LAWS BY STATE IN THE COLORADO RIVER BASIN

Water Law Distinctions			Legal Feature													
1	2	3	4	5	6	7	8	9	10	11	12	13	14			
State	Surface Water	Ground Water	Ownership	Right	Allocation	Criteria of Allocation	Preference (Order) ^d	Date of Priority	Appropriacy	Regularity	Quality	Enfranchise	Transfer	Reason of Origin		
	P.A.	R.U. ^b	Public	Permit	B.U.	B.U.	1-2,3-4-5	D.O.A.	Strict	Original	Case	5 yrs	C.E. & C.L.J.			
-Ariz.	P.A.	R.U. ^b	Public	Permit	B.U.	B.U.	1-2,3-4-5	D.O.A.	Strict	Original	Case	5 yrs	C.E. & C.L.J.			
-Calif.	P.A. & R.	C.R.	People	Permit ^c	B. & R.U.	B. & R.U.	1-2	D.O.A. post 1914	Unlimited	Current	Case + Statute	5 yrs < 1914	Yes			
-Colo.	P.A.	P.A.	Public	S.W. - decree G.W. - permit	B.U.	B.U.	1-2 over 5	S.W. - 1st step G.W. - D.O.A.	None	Original (unperturbed)	Case	1	C.L. (unsubsidized)	Yes		
-Nev.	P.A.	P.A.	Public	Permit	B.U.	Conditions & needs	None	D.O.A.	D.O.A.	Original	Case	5 yrs	C.L.			
-N.Mex.	P.A.	P.A.	Public	Permit	B.U.	B.U. & good agr. practices	None	D.O.A.	D.O.A.	Original	Case	4 yrs + 1 yr after notice	C.L.			
-Utah	P.A.	P.A.	Public	Permit	B.U.	Nature of Use	1-2	D.O.A.	D.O.A.	Current	Case	5 yrs	C.E.			
-Wyo.	P.A.	P.A.	State	Permit	B.U.	1 cfr 70*	1-5	D.O.A.	Strict	Original	Case	5 yrs	Unsubsidized			

KCV P.A. = Prior Appropriation, R. = Riparian, A.U. = Absolute Ownership, R.U. = Reasonable Use, C.R. = Correlative Rights, B.U. = Beneficial Use, B. & R.U. = Beneficial and Reasonable Use, D.O.A. = Date of Application, D.B.U. = Date of Beneficial Use, C.E. = Common Enemy, C.L. = Civil Law, R. D. = Reasonable Discharge.

* All new water by P.A.
^a See comprehensive ground water laws
^b Different types: Not for 1914 rights, riparian rights, riparian rights and percolation ground waters
^c Different types: 1 = surface and riparian, 2 = agricultural (irrigation), 3 = power, 4 = mining, 5 = manufacturing and industrial, 6 = recreation, and 7 = navigation
^d In this column: 1 = absolute abandonment before 2, 2 = 5
^e In this column: Strict = eas transfer but criteria are established, Limited = water right for specific parcel but transferable
^f In this column: Original = initial filing recorded, Current = user must notify agency of name, use, place, etc. - transfers unlimited
^g All states recognize loss by abandonment.
^h Ten years is evidence of abandonment.
ⁱ In this instance C.E. = flood waters, C.L. = natural flows.

Source: Radosevich (1980, 258-259).

The riparian doctrine, which is governed by common law, was imported from England where it was developed for agriculturally based land uses. It is best suited for humid, water abundant regions characterized by constant stream flows and a water surplus. A riparian right is perpetual and is not lost through non-use (Radosevich 1980). The riparian doctrine is designed to insure water availability to all reasonable and non-injurious uses on riparian lands. Because stream flows and water quality must remain substantially unaltered, water use must be generally non-consumptive in nature. These parameters make the riparian doctrine less adaptive to urban, industrial, or arid regions (Dewsnut and Jensen 1973; Trelease 1974).

Appropriation Rights

Appropriation rights are governed by state statutes. Trelease describes these rights as,

. . . a state administrative grant that allows the use of a specific quantity of water for a specific beneficial purpose if water is available in the source free from the claims of others with earlier appropriations. (1974, 11)

All seven of the states comprising the Colorado River Basin have made constitutional, or statutory declarations that all water is public, or state

property (Dewsnut and Jensen 1973). As a result, the appropriation doctrine "creates the right of private use of a public resource under certain conditions and for uses that have been declared to have a public interest" (Radosevich 1980, 262).

The appropriation doctrine evolved out of local customs to meet the specific needs of water use in an arid environment characterized by irregular stream flows, and often requiring diversion of water to the place of need. The doctrine promotes economically oriented consumptive uses.

Priority of Right. The doctrine is based on the principle of "first-in-time, first-in-right". The person who makes the first diversion of water for a beneficial use can take as much water as can be applied to that use. The priority of the right is established by the date of diversion, or the date initial actions were taken to establish the right. In times of water shortages, the owners of the older, more senior rights will receive their full allotment before junior rights receive any water. Water rights are granted freely until unappropriated water is no longer available, after which new uses must purchase rights from established owners. In addition to priority by date, all the basin states have established statutory

preferences for certain water uses (Dewsnut and Jensen 1973, 35). This preference system generally accords domestic, municipal and agricultural uses a higher priority than manufacturing, or industrial uses. The preference system operates differently in each state. Sometimes preferred uses are accounted for during allocation of unappropriated water, and sometimes the system is implemented only during times of shortage. Preferred uses in Colorado are given the right of condemnation, upon payment of compensation (Petros 1985, 6).

Establishing a Right. Petros (1985, 6-7) describes three steps in establishing an appropriation right. The first involves intent to appropriate. This includes notification of interested and affected parties as to the nature and extent of the appropriation. Application is made to the state engineer for a permit to appropriate, except in Colorado, in which the right is established through adjudication in district water courts. The second step involves diversion of the water from its natural course. This is not a requirement in California and Colorado for cases involving instream rights, or minimum stream flows. The third step is the reasonable application of water to the specified beneficial use.

The date of the appropriation right relates back to the date on which the first step was initiated.

Beneficial Use. The fundamental criteria of the appropriation right is that the water must be put to beneficial use. Dewsnut and Jensen (1973, 30) explain that most uses of water are considered beneficial uses, and that beneficial use is generally equated with public interest. In addition, the public interest has often been narrowly interpreted to mean those uses creating the greatest economic returns (White 1977, 127; Davis 1983, 605). Not only must water be put to a beneficial use, it must also be applied in a reasonably efficient and non-wasteful manner. Radosevich refers to this criteria as the "statutory duty of water" (1980, 266), in which states establish guidelines on the number of acre-feet of water per acre of crop land that is reasonable for irrigation purposes. Several states such as California and Colorado, have also begun to recognize in-stream uses of water as beneficial and in the public interest, and have made it possible to acquire in-stream appropriation rights without diverting water (Vlachos and Hendricks 1977, 61). This allows uses such as recreation, fish and wildlife, minimum stream flow, and aesthetic value to have protected rights and continued use of water.

Definition of a Right. An appropriation right is defined by a specific amount of water diverted from a specific location, for a specific beneficial use. Additional parameters include: nature of use (storage or direct flow), place of use, and time of diversion and use, i. e. days or months (Petros 1985). There is also an implied maintenance of water quality to meet the needs of the specific use for which the right is appropriated (Radosevich 1980).

Transfers and Reallocation. Appropriation rights are generally considered appurtenant to the land to which the water is applied. However, the right may be alienated from the land, sold, and transferred to a new location subject to certain statutory restrictions such as non-injury to other users and continued beneficial use (Valachos and Hendricks 1977). Colorado has the "purest" form of appropriation and is the least restrictive on the sale and transfer of water rights. Describing the distinguishing features of the Colorado system, Petros indicates that:

Allocation and transfers of water rights are based on private market forces without consideration of public interest values.

Water rights are freely changed to other uses and locations, provided other water rights are not injured. (1985, 4)

One of the most difficult problems in evaluating if a transfer will injure other rights concerns the affect on stream flow. Many water rights rely on the return flows of water from upstream users, and have a right to maintenance of these flows (Petros 1985). Most uses of water consume only a portion of the diverted right and return the remaining water to the stream. Because the diversion and use of a right is tied to a specific location, a change in the location of the right could alter downstream flows on which other established rights depend. This is most pronounced in cases where the new right exports water outside the basin of origin. To protect down stream return flow rights, transfered or reallocated rights may only include a quantity equal to that consumed by the prior use, and not the amount originally diverted (Dewsnut and Jensen 1973). In additon to the problem of return flows, when a right is sold and transfered to a new location, it often loses its original date of priority and is given a priority based on the new date of transfer. If a stream is fully appropriated, the new right will have a low priority, and is therefore less valuable.

Abandonment and Forfeiture. (Radosevich 1980; Dewsnut and Jensen 1973) Unlike riparian rights, appropriation

rights are required to be continuously used for a beneficial use, or they can be lost by abandonment or statutory forfeiture. Nonuse or misuse of the right can result in loss of the entire appropriation, or a portion of it, depending on how much of the right is involved. Abandonment requires nonuse and the intent to abandon, and usually is not tied to a specific length of time. Statutory forfeiture results from misuse, or nonuse for the specified period of time. Appropriation rights may also be lost through condemnation.

Formation of Appropriation Rights:
Federal v. State Authority

Despite the common utilization of the appropriation doctrine in the Southwest, water law differs from state to state. These differences came about during the evolution of the appropriation doctrine, in part due to the actions of Congress, and the conflict between federal and state authority over water rights (Trelease 1974).

After the aquisition of the territories comprising the southwestern states from Mexico in 1848, the federal government gained complete sovereignty over this new public domain. The English Common Law riparian system was extended over these territories, as

it was in the eastern part of the nation (Kiechel and Green 1978, 235).

It is generally believed that prior appropriation was devised in the American West by miners and early settlers. However, Trelease states that,

. . . the protection of vested rights and a preference for the eldest rights is the most common of all systems of distribution of water, and many of these go back to antiquity and can in no sense be said to be derived from American law (1977, 59).

As miners and settlers moved to public lands in the western territories, they began diverting water for mining and irrigation needs. Because they were often trespassing on public lands for which they were not receiving title, they acquired "incomplete possessory interests" (Simms 1980, 67). Establishment of water rights according to the riparian system was inappropriate due to lack of ownership of the land, hydrologic constraints of the arid environment, and the need to divert water. Because there was no local government, or federal laws governing water use, these appropriators established their own rules and customs governing mining claims, irrigation, and water rights. Common laws and local customs developed into the doctrine of prior appropriation, and were adopted by statute in the newly forming western states. This

doctrine is also known as the Colorado Doctrine, because Colorado was the first state to adopt it in its constitution in 1876.

As growth continued in the western states, it became apparent that a conflict was developing between state and federal authority in administering water rights on western public lands. Recognizing this conflict and the importance of promoting mineral and agricultural development, Congress passed three acts which recognized prior appropriation rights on public lands: the Mining Act of 1866, the Act of 1870, and the Desert Land Act of 1877.

A number of authors explain that the western states, including all the Colorado Basin states except California, allocated water rights on public lands based on the premise that through these three acts, the federal government had transferred to the states its authority over water rights and its claim to unappropriated water (see Kiechel and Green 1978; Trelease 1974; Davis 1983; and Simms 1980). The Mining Act of 1866 recognized prior appropriations and rights-of-way for diversions on public lands, provided they followed state laws. The Act of 1870 made all federal patents, preemptions and homesteads subject to previously vested water rights established under state laws. The Desert Land Act of 1877 allowed a settler to

buy tracts of desert land on public domain by filing a declaration stating an intent to use irrigation to reclaim the land subject to prior appropriation, and limiting diversions to the quantity needed for irrigation.

California posed the only threat to the premise of state authorized appropriation rights on public lands (Hundley 1975, 69-72). In Lux v. Haggin, 69 Cal. 225 (1886), the California court found that a person receiving title to federal lands also received riparian rights on that land by virtue of the federal patent. Both doctrines would apply in California, but the riparian doctrine would be superior, limited only by prior appropriations of water established before the patent date. The court also found that the federal government owned all unappropriated water on public lands, based on the "right of absolute territorial sovereignty" (Hundley 1975, 71). While the federal government had delegated authority to the states to distribute water, the court found that Congress had not surrendered its rights to unappropriated water, and could revoke state authority over distribution.

More recently, the western states relied on an interpretation of the Desert Land Act of 1877 made by the United States Supreme Court. In ruling on Oregon

Power Company v. Beaver Portland Cement, the court found:

If this language is to be given its natural meaning . . . it effected a severance of all waters upon the public domain, not theretofore appropriated, from the land itself. . . . What we hold is that following the Act of 1877, if not before, all non-navigable waters then a part of the public domain became public juris, subject to the plenary control of the designated states . . . with the right in each to determine for itself to what extent the rule of appropriation or . . . riparian rights should obtain. For since 'Congress cannot enforce any rule upon any state' . . . the full power of choice must remain with the state. (295 U.S. 142, 1935)³

Trelease asserts that the reasoning behind this ruling is weak, and that while the three Acts do recognize existing appropriations made according to state laws, their language does not authorize state law to establish future water rights (1974, 29-32).

Trelease finds that,

. . . state laws have validity not because of an act of Congress but because of the 'silent acquiescence' of the federal government. Water law was the subject of concurrent federal and state jurisdiction. The states could exercise their traditional jurisdiction unless their laws were superseded by a federal law disposing of the water. Since the federal government never enacted such a law, the state law stood. (1974, 33)

Kiechel and Green make a similar argument, adding that the federal government holds riparian rights on all lands which it has reserved for federal purposes,

subject only to appropriations made prior to the reservation. Therefore, federal reserved rights are actually riparian rights based on the ownership of the public domain, as found in Winters v. United States, 207 U.S. 564 (1908). They find that the existence of federal reserved rights is well established. However, there is still much controversy over how much water these rights can claim for federal purposes (1978, 233-238). This controversy also extends to Indian reserved rights. Quantification of Indian rights may have more impact on established appropriators than federal rights. Congress may dispose of federal land and reserved rights as it wishes. However, Congress can not disclaim Indian rights, some of which may be based on original property claims (Dewsnut and Jensen 1973, 72).

In addition to the federal proprietary rights on public domain, Dewsnut and Jensen (1973, 8-9) describe federal regulatory powers over water which come from the commerce clause of the Constitution. This clause gives Congress the power to regulate interstate and foreign commerce. This power is usually manifested in the regulation of navigable and tributary waters, to insure the continued navigability of rivers and other bodies of water. In addition, Congress may regulate any water activity which somehow affects interstate

commerce, such as overly restrictive limitations on water export out of a basin.

Part 2
INTERSTATE ALLOCATION OF WATER RESOURCES:
THE INTERSTATE COMPACT

States have three legal alternatives for solving interstate conflicts, and all three have been used in disputes involving the apportionment of water resources in the Southwest (see Dewsnut and Jensen 1973; Muys 1971; Muys 1977; and Trelease 1974). Perhaps the most costly and time consuming alternative is litigation in the Supreme Court of the United States, in which the court makes an "original action" based on the doctrine of equitable apportionment.⁴ This alternative has frequently been used, producing such cases as Kansas v. Colorado (1907), Wyoming v. Colorado (1922), and Nebraska v. Wyoming (1945).

The second alternative, statutory apportionment, became apparent after the Supreme Court ruled on Arizona v. California in 1963. Statutory apportionment involves a Congressional action, and is based on Congressional authority to regulate interstate commerce. This is the only case involving statutory apportionment of water resources (Dewsnut and Jensen 1973).

The third alternative, the interstate compact, is the oldest and perhaps most beneficial alternative for resolving interstate conflicts. Both the Supreme Court and Congress recommend the use of the interstate compact to apportion water resources because it promotes better cooperation and coordination among the concerned states (Muys 1971). Water problems, such as those found in the Colorado River Basin, often require coordinated regional solutions beyond the scope of a single state. Litigation and statutory apportionment can not provide coordinated planning efforts, as does the interstate compact.

The Colorado Basin states have used all three alternatives for resolving interstate water disputes. No matter which method of apportionment is used, the result is a quantification of water rights among the states. These rights remain subordinate to the superior federal power to regulate interstate commerce and navigation. As a result, Congress may at any time restrict these rights, even if it has approved an interstate compact (Dewsnut and Jensen 1973, 70).

Historical and Legal Foundation

The interstate compact comes directly from colonial America, when boundary disputes between

colonies were resolved by agreements drawn-up by the colonies and approved by the Crown (Vlachos and Hendricks 1977; Muys 1971, 241). This approach was adopted in the Articles of Confederation, and was later included in the Constitution of the United States as the compact clause.

No state shall, without the consent of Congress, . . . enter into any agreement or compact with another state or with a Foreign power. (U.S. Const. article I, section 10, clause 3)

It is believed that this clause was included in the Constitution to provide relief for the continuing border disputes between the emerging states. The Supreme Court has held in a series of cases (Rhode Island v. Massachusetts, 1838; Florida v. Georgia, 1854; and Virginia v. Tennessee, 1893) that the compact clause is protective in nature, and provides Congress with a veto power over interstate agreements to insure the protection of other states and the national interest (Muys 1971).

Legal Characteristics

Muys describes a number of legal characteristics concerning interstate compacts which have been identified by the Supreme Court (1971, 241-322).

Congressional Consent

As previously mentioned, the compact clause of the Constitution provides a veto power to Congress to insure protection of all state and federal interests in any interstate agreement. The consent requirement is assumed to apply to any water compact, although compacts which do not affect national interests, or conflict with state and federal statutes, have an apparent "blanket consent". Examples of compacts covered by blanket consent are administrative compacts, and compacts designed to promote planning coordination without placing any restrictions on the signatory states or the federal government.

Timing and Form of Consent

The Constitution makes no specific mention of when or how consent by Congress should be made, however the Supreme Court has found that some action by Congress is required. Congressional action may either precede or follow negotiation, and expressly or impliedly indicate consent to the compact. Congress often grants "consent to negotiate" to the compacting states, on the condition that a federal representative will participate in the negotiations, and that any resulting compact must be approved by Congress.

Conditions and Reservations

Congress may amend or revoke its consent to a compact. The act of consenting does not prevent Congress from subsequently enacting legislation which conflicts with its consent. Congress often attaches provisions, or conditions to its consent which must be met by the signatory states. In addition, the states usually protect federal rights by including disclaimers in the compact which claim that the provisions of the compact in no way effect the rights, powers or obligations of the federal government.

Enforceability

Any signatory state is unconditionally bound to the provisions of an interstate compact until the agreement has expired. In addition, the compact is superior to any subsequently conflicting state statutes, by provision of the Constitutional restriction against state impairment of contracts. The compact obligations are also superior to water rights established prior to the compact.

Delegation of Powers

A state may delegate some or all of its police powers, including its taxing authority, to an interstate compact agency. In addition, the federal government may delegate greater powers to such a commission than the states possess, if it so wishes.

Judicial Review

Interstate compacts are ratified into state law and therefore are subject to interpretation as a "federal question" by the Supreme Court.

Types of Interstate Water Compacts

There are four types of interstate compacts: water allocation, pollution control, planning and flood control, and multipurpose-regulatory compacts (Muys 1971; 1977, 88-90).

The first interstate water compacts in the country were established in the Colorado River Basin, and dealt with water allocation. Both the Colorado River Compact of 1922, and the Upper Colorado River Compact of 1948 fall within this category. The early allocation compacts provided equitable apportionment of water

between the signatory states, and authorized state officials to collect hydrologic data and keep records. Later compacts, including the Upper Colorado River Basin Compact (1948), provided a permanent commission and administrative staff to perform data collection and administration of the compact provisions, including such duties as use curtailment during water shortages (Goslin 1977, 201). The compact commission is made up of one voting representative from each signatory state, and a non-voting representative of the federal government. All eighteen water allocation compacts involve western states.

There are ten interstate pollution control compacts addressing either single purpose pollution issues, or more comprehensive water quality planning and management. The authority given their commissions ranges from enforcing pollution standards, to making recommendations and setting quality standards.

Muys explains there are a small number of planning and flood control compacts which were associated with the the federal flood control program during the 1930's. These have been very limited in scope, and are for the most part no longer active (1977, 88).

The multipurpose-regulatory compact (usually a federal-interstate compact) is a more recent development in which the commission has greater

authority to regulate water resources, as well as coordinate and develop comprehensive management plans on a basin-wide level. This management authority includes the power to license, regulate and construct development projects. The comprehensive nature of this type of compact, requires that the federal government be an equal, voting signatory partner so that state and federal policies will be coordinated under, and accountable to the terms of the compact. The federal-interstate compact differs from the other three types of compacts, in which the federal government usually has a non-voting representative on the commission. In addition, these other compacts provide less coordination between state and federal policies (Trelease 1974; Muys 1977).

Part 3
APPORTIONMENT OF THE COLORADO RIVER:
THE TWO COMPACTS

Water rights in the Colorado River Basin are established within each of the seven basin states according to the doctrine of prior appropriation. Water resources are apportioned between the seven basin states according to two major interstate water compacts: the Colorado River Compact of 1922, and the Upper Colorado River Basin Compact of 1948. There are also a handful of lesser interstate compacts which cover various tributaries of the Colorado River. This section will provide a general overview of the two principal compacts and their apportionment provisions.

The Colorado River Compact-1922

There are a number of authors who give accounts of the development of the 1922 compact (see Fradkin 1981; Hundley 1975; and Goslin 1977). The Colorado River Compact of 1922 was the first interstate, allocative water compact in the United States. The compact was the result of unsuccessful negotiations to apportion specific amounts of water to each of the seven basin

states. The compact is a compromise, apportioning the basin's waters between the Upper and Lower Basins.

During the negotiations, Arizona was apprehensive about the lack of an interstate agreement between the Lower basin states, and expressed concern that California would attempt to pre-empt most of the Lower Basin's allocation, based on the decision in Wyoming v. Colorado, 259 U.S. 419 (1922), which upheld prior appropriation across state lines. For this reason, Arizona refused to sign the 1922 compact. This action delayed Congressional consent of the compact as well as authorization of the Boulder Canyon project, the first major multipurpose project on the river, which would largely benefit California. Congressional consent was given to a six state compact excluding Arizona in 1928, and the Boulder Canyon Project Act was enacted. Consent was given upon the condition that California pass legislation limiting its consumption to a specific quantity of water. California accepted this condition and the six states, excluding Arizona, ratified the Colorado River compact in 1929. Arizona finally ratified the compact in 1944 after three unsuccessful suits against California.

Major Provisions of the Compact

Pub.L.No.70-642, Sec.12-19, 43 Stat.1057 (1928)

Article I of the Colorado River Compact states the purposes of the interstate agreement.

The major purposes of this compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River System; to establish the relative importance of different beneficial uses of water; to promote interstate comity; to remove causes of present and future controversies; and to secure the expeditious agricultural and industrial development of the Colorado River Basin, the storage of its waters, and the protection of life and property from floods. To these ends the Colorado River Basin is divided into two Basins, and an apportionment of the use of part of the water of the Colorado River System is made to each of them with the provision that further equitable apportionments may be made.

These same general statements have served as a model for other allocative interstate compacts, including the Upper Colorado River Compact (Goslin 1977, 197).

Article III (a) establishes the apportionment to each basin as:

. . . the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist.

Article III (b) allows the Lower Basin "to increase its beneficial consumptive use of such waters by one million acre-feet per annum."

Article III (c) provides that if the United States recognizes any rights by Mexico to the use of Colorado River Basin water, those rights will be supplied first by surplus water. If a surplus is too low, then the deficiency will be supplied equally by the Upper and Lower Basins.

Article III (d) provides that the Upper Basin may not allow the flow at Lee Ferry to fall below 75,000,000 acre-feet for any ten-consecutive year period.

Article III (e) establishes that the Upper Basin may not withhold water, and the Lower Basin shall not require deliveries beyond what can reasonably be used for domestic and agricultural purposes. The compact's definition of domestic use includes: household, stock, municipal, mining, milling and industrial uses, but excludes power generation.

Article VII is a disclaimer.

Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian Tribes.

Article VIII and IX establish that the Compact does not affect previously established water rights, or

limit any state from actions which protect rights under the compact.

The most important provisions made in the compact are the terms of apportionment under Article III and the disclaimer in Article VII concerning Indian tribes. Compacts similar to this one, which do not quantify federal and Indian reserved rights, underestimate the true water needs of each state. As these federal and Indian rights are quantified, they may have to come out of the appropriations in the state in which they are vested. It is also important to note that this compact makes allocations based on the idea of equitable apportionment for beneficial consumptive uses. As shown in Chapter One, the 7.5 maf allotment per basin has caused further problems because it was based on an assumed annual flow of 17 million acre-feet, which has been found to be much too high. This has resulted in an over appropriation of more water than actually exists in most years. This compact did not provide for a commission to oversee its implementation.

The Upper Colorado River Basin Compact-1948

In 1946, following the enactment of the Compact of 1922 and the Boulder Canyon Project Act of 1928, the Bureau of Reclamation made a comprehensive study of the

whole basin. It recommended a series of projects to promote development and facilitate deliveries of water under the Compact of 1922 (see Fradkin 1981; Muys 1971; and Goslin 1977). Many of these projects were designed for the Upper Basin states, which had been warned that they would not be pushed through Congress, unless an interstate agreement was ratified apportioning water between the Upper Basin states. This precaution was a reaction to the endless litigations between the Lower Basin states of Arizona and California over water rights. The Lower Basin states never reached an agreement to apportion water, and the matter was finally settled by the Supreme Court in Arizona v. California, 373 U.S. 546 (1963).

The enactment of the Boulder Canyon Project Act carried with it, Congressional consent for the Upper Basin states to begin negotiation of a compact, on the condition that a representative of the United States be involved in the negotiations. The Upper Basin states began negotiations in 1946 on an interstate compact which would apportion the Upper Basin's allotment, under the Compact of 1922. The compact was approved by Congress in 1949.

Major Provisions of the Compact
Pub.L.No. 81-37, 63 Stat. 31 (1949)

Article I (a) establishes the purposes of the compact.

The major purposes of this Compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River system, the use of which was apportioned in perpetuity to the Upper Basin by the Colorado River Compact; to establish the obligations of each State of the Upper Division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River Compact; to promote interstate comity; to remove causes of present and future controversies; to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of water and to protect life and property from floods.

Article I (b) establishes recognition of the Colorado River Compact of 1922, and acknowledges all of its provisions.

Article III apportions the waters of the Upper Basin between the five states. Arizona is apportioned 50,000 acre-feet per annum for consumptive use. The remaining annual Upper Basin apportionment is allocated to the other states based on a percentage figure. This is to account for the fluctuations in actual available water from one year to the next. The percentages are as follows:

State of Colorado.....	51.75	per cent,
State of New Mexico.....	11.25	per cent,
State of Utah.....	23.00	per cent,
State of Wyoming.....	14.00	per cent.

Article IV explains the procedure for use curtailment in the Upper Basin, if it becomes necessary, to insure that the flow at Lee Ferry will not fall below the 7.5maf/10 year average, as stipulated in the 1922 Compact.

Article VII explains that consumptive use "by the United States or any of its agencies, instrumentalities or wards" will be charged to the state in which it is used. This applies to federal and Indian rights.

Article VIII establishes an interstate commission with the authority to curtail water use during shortages, and to perform other duties including: data collection, and finding of fact concerning water quality and consumption.

Article XVI establishes that failure by any state to use its apportionment in full will not constitute a forfeiture or abandonment of rights.

Article XVIII establishes recognition of the rights of Arizona and New Mexico, as Lower Basin states, under the Colorado River Compact of 1922.

Article XIX is a disclaimer stating that this Compact in no way affects federal obligations to Indian

tribes, the Mexican government under the Treaty of 1944, or any federal rights or powers.

Article XX explains that "this Compact may be terminated at any time by the unanimous agreement of the signatory states. In the event of such termination, all rights established under it shall continue unimpaired".

As in the earlier compact, the most important Articles are I and III where the purpose of the compact is set out, and the apportionments to each state are established. Article VII and XIX create an under-appropriation to states having large federal and Indian rights which may be quantified against their allocation.

Unlike other traditional compacts, the Upper Basin Compact creates a commission in which the federal representative is a voting member, similar to the federal-interstate compact. This promotes better coordination of state and federal planning within the basin.

Together, the Colorado River Compact of 1922 and the Upper Colorado River Basin Compact of 1948 establish definite apportionments of water use rights between the seven basin states. The major drawback with both compacts is that they do not account for specific quantities of federal and Indian rights, which

make up a large percentage of senior water rights in the basin. Both the federal government and the Indian tribes are beginning to express the desire to develop their water rights. As these rights become quantified within the courts, the seven basin states may have to make difficult decisions over which water users must forgo their rights. However, once the federal and Indian rights are quantified, the Upper Basin Compact appears to be more capable of providing coordinated federal and state management, due to its similarities to the federal-interstate compact. As Muys (1971; 1977) has asserted, the federal-interstate approach is the best way to promote comprehensive water planning in the Southwest.

Part 4
LANDMARK CASES IN WESTERN WATER LAW

Part One of this chapter examined water rights and the doctrine of prior appropriation, the water law which dictates the establishment of water rights within western states. Part Two and Three examined the characteristics of the interstate compact, and reviewed the two major compacts which control interstate water allocations in the Colorado River Basin. This section will briefly review the courts interpretation of interstate apportionments established under the doctrine of prior appropriation and the interstate water compact.

As was noted in the introduction to Part Two, there are three approaches available for solving conflicts in allocating interstate waters: the interstate compact, Congressional "statutory apportionment", and litigation in the Supreme Court of the United States. The first few cases concern the Supreme Court's interpretation of the doctrine of prior appropriation.

Equitable Apportionment and
the Supreme Court

The only tribunal with original jurisdiction over interstate disputes is the Supreme Court of the United States. Until the development of the Colorado River Compact of 1922, litigation in the Supreme Court was the only method used by the Colorado Basin states to solve their conflicts over interstate water allocation. The negotiators of the 1922 Compact had two landmark cases on which to base their compact: Kansas v. Colorado (1907) and Wyoming v. Colorado (1922).

Kansas v. Colorado
Supreme Court of the United States, 1907.
206 U.S.46, 27 S.Ct. 655, 51 L.Ed. 956.

The conflict involved the Arkansas River which originates in Colorado and flows eastward into Kansas. As the number of diversions increased, Kansas became concerned that Colorado would divert all the water, causing substantial injury to Kansas farmers. Kansas took the case to the Supreme Court in 1901.

Justice Brewer delivered the majority opinion:

One cardinal rule, underlying all the relations of the states to each other, is that of equity of right. Each state stands on the same level with all the rest. . . this court is called upon to settle that dispute in such a way as will:

recognize the equal rights of both and at the same time establish justice between them. . . through these successive disputes and decisions this court is practically building up what may not improperly be called interstate common law. (206 U.S. 46, 1907) 5

The Court found that although there is presently no injury to Kansas, continued diversions may destroy the equitable apportionment of benefits in the future, at which time Kansas may bring a new claim to court.

The importance of this case is that the Court established that the rule of "equitable apportionment of benefits" would be used on a case by case basis to determine each state's share. Until a series of cases established an interstate common law, the states would have to continue to use Supreme Court litigations, or use interstate agreements, to rectify interstate water disputes.

The controversy between Kansas and Colorado came up again in 1943. The Supreme Court again found that Kansas failed to show serious injury to its equitable apportionment (Trelease 1974, 662). In 1986, Kansas has again filed suit against Colorado over the apportionment of the Arkansas River. This shows that despite previous litigation and the development of the Arkansas River Compact (1949), there can be continued disputes over interstate allocation.

Wyoming v. Colorado
Supreme Court of the United States, 1922
259 U.S. 419, 42 S.Ct. 552, 66 L.Ed. 999.

The second case of importance involving interstate apportionment was decided in the same year that the first interstate water compact was established, the Colorado River Compact of 1922. The negotiators for the Upper and Lower Basins were keenly interested in the outcome of this case because it could influence the apportionments in the Compact. In delivering the opinion of the Court, Justice Van Devanter stated that the case was similar to Kansas v. Colorado (1907) in that it required the Court to look at the "equitable rights" of the states.

The Court upheld the doctrine of prior appropriation across state boundaries, stating that:

Each of these states applies and enforces this rule in her own territory, and it is the one to which intending appropriators naturally would turn for guidance. The principle on which it proceeds is not less applicable to interstate streams. . . (259 U.S. 419, 1922)6

This case was important because it established prior appropriation as the rule to apply in interstate water disputes where both states utilize this doctrine to establish rights within their boundaries. Because the Colorado River Compact of 1922 was signed in the same year establishing the interstate compact as a new

tool for interstate apportionment, the full impact of this case may never be known.

Nebraska v. Wyoming

Supreme Court of the United States, 1945
325 U.S. 589, 65 S.Ct. 1332, 89 L.Ed. 1815

Nebraska filed suit claiming that a severe water shortage existed due to over-appropriation and mis-appropriation by upstream users (Wyoming and Colorado). Nebraska sought the relief of equitable apportionment under the prior appropriation doctrine.

The opinion of the Court was delivered by Justice Douglas and established that prior appropriation would be applied in this case, because all three states in the dispute were appropriation states. This finding following the ruling in Wyoming v. Colorado (1922). But, in an interesting development the Court continued by saying:

But if an allocation between appropriation states is to be just and equitable, strict adherence to the priority rule may not be possible. For example, the economy of a region may have been established on the basis of junior appropriations. So far as possible those established uses should be protected though strict application of the priority rule might jeopardize them. Apportionment calls for the exercise of an informed judgement on a consideration of many factors. (325 U.S. 589, 1945)7

In this case the Court came back to the original ruling of Kansas v. Colorado (1907), in which it established equitable apportionment as the rule for interstate disputes. This softened the impact of the decision in Wyoming v. Colorado (1922) by saying that prior appropriations would be used as a guiding principle. However, other factors would also be considered to insure equitable apportionment of benefits.

Interstate Compacts and
the Supreme Court

Interstate water compacts were established between disputing states as an alternative to the costly, time-consuming litigation in the Supreme Court. The case which is presented here is not between the compacting states, but between a corporation and one of the compacting states.

Hinderlider v. La Plata River &
Cherry Creek Ditch Co.
Supreme Court of the United States, 1938
304 U.S. 92, 58 S.Ct. 803, 82 L.Ed. 1202

The Court found that apportionments made by interstate compacts, with congressional consent or by Supreme Court decree, are binding upon the citizens of each state and all water claimants, even when the state

has granted rights prior to the date of the compact. This meant that interstate compacts are superior to any prior right established by the state, particularly when such prior right exceeded a state's apportionment under the compact.

Congressional Apportionment

The Court's interpretation of interstate compacts, and water rights based on prior appropriation has been demonstrated. The third method of establishing interstate apportionments is through Congressional statutory apportionment, which was brought to light in Arizona v. California (1963).

Arizona v. California
Supreme Court of the United States, 1963
373 U.S. 546, 83 S.Ct.1468, 10L.Ed.2d 572

This is the last of a long series of cases between Arizona and California. In 1952 Arizona appealed once more to the Supreme Court, asking for a determination of Lower Basin water rights.

The Court found that Congress had imposed "statutory apportionment" on the Lower Basin States when it passed the Boulder Canyon Project Act of 1928. These apportionments were as follows:

California	4.4 maf/year,
Nevada3 maf/year,
Arizona	2.8 maf/year.

Congress had also given the Secretary of Interior the authority to determine how future water surpluses and shortages would be divided between the three states. The most controversial part of the Court's decision was its interpretation that this authority could go as far as authorizing the Secretary of Interior to allocate water to specific users within a state during times of shortage.

The major impact of this case was three-fold. First, Arizona got all the water it had been fighting for since it first refused to sign the Colorado River Compact of 1922, thus putting to rest the long conflict between Arizona and California. Now the Lower Basin had specific apportionments for each state to follow, as established through statutory apportionment.

Secondly, the Court identified and sustained the federal government's claims that it had established Indian reserved rights on reservations within the basin. The Court ruled that these reservations had prior rights providing enough water to irrigate all the practicably irrigable land on the reservations. Although the Court stopped short of adjudicating specific quantities of water for this purpose, it did

considerably strengthen Indian reserved rights in the western states.

The third major impact of the decision was the identification of a third method of allocating water between states, that being Congressional statutory apportionment. In essence, this meant that Congress had the power and the tool to determine priorities for water, both between states and within states. State law no longer had supreme rule over western apportionments. The Court stated that Congress derived this authority from the interstate commerce clause of the Constitution.

It appears that Arizona v. California (1963) is the land-mark case in western water law, because Congress now has the confirmed authority to indirectly determine the growth rates, and land-use patterns within the West, through its statutory allocation of water resources. It remains to be seen how far Congress will actually go with this power to shape the future of the West and the nation.

Chapter 3

PROBLEMS AND EMERGING TRENDS:
TOWARDS PRIVATIZATION OR PUBLIC TRUST

Chapter Two examined the doctrine of prior appropriation and the interstate compact, the two major legal institutions utilized for establishing and allocating water rights in the Colorado River Basin. Chapter Three will examine some of the problems, recommendations and emerging trends in these institutions, and discuss their implications on future water planning and management in the Colorado River Basin.

Interstate Compacts:
Regional Allocation and Coordinated Planning

As discussed in Chapter Two, water is allocated between the Colorado Basin states through two major interstate water compacts. There are many advantages to using this approach for interstate allocation and coordination of planning efforts, as opposed to the alternative of using interstate ad hoc committees.

Advantages of Interstate Compacts

A number of authors describe the advantages of using interstate compacts to address water resource planning and management (see Muys 1971, 1977; Trelease 1974; and Goslin 1977). Because the interstate compact is a negotiated agreement between signatory states, it can be tailored to the unique conditions and needs of a region. The compact can be directed at a single objective, or a comprehensive regional management plan. Compacts can provide an administrative institution with equal representation of individual state, federal, or Indian interests, as well as providing a regional perspective. With respect to water allocation, the compact is a cooperative agreement, as opposed to an adjudicatory process, which results in better communication and coordination of planning and management policies between states. Coordination of planning and management efforts provides the opportunity to combine professional, capital and data resources, and reduce duplication. Federal-interstate compacts facilitate coordination between national and state policies, and promote greater public participation in the planning process (Muys 1977, 90-99).

Goslin (1977, 208) identifies some additional advantages of the interstate compact. First, it protects a state's unused apportionment of water from prior appropriation, or adverse possession by other states. This is important to the Upper Colorado Basin states because they have not fully developed or utilized their allotments of water. Because the compact defines the rights of each state, it reduces the potential for litigation. Secondly, the Upper Colorado River Basin Compact (1948) has politically unified the Upper Basin states behind passage of federal legislation which will facilitate development and growth in the region, as was seen with the Colorado River Storage Project Act (1956). Finally, the existence of interstate compacts in the western states, has promoted better cooperation of federal agencies because they feel more obligated to abide by a Congressionally approved agreement (Goslin 1977, 208).

Disadvantages of Compacts

There are four major problems with traditional interstate water compacts identified by Muys (1977, 94-100). First, many states have shown a lack of commitment to a truly regional planning approach, and are more concerned with protection of their individual

interests. States are reluctant to delegate planning and decision making authority to interstate commissions. Secondly, interstate compacts require negotiation and ratification by state legislatures, and must be approved by Congress. This can be a slow process to complete, and on occasion, has been used to delay implementation of federal or state programs.

Thirdly, many of the allocation compacts were ratified before the Supreme Court decision in Arizona v. California (1963), in which the Court clarified the reservation doctrine applying to federal and Indian water rights. Because these compacts do not account for federal and Indian reserved rights, they under-estimate the required allocations to states with large tracts of federal and Indian lands. This problem occurred with both the Upper Colorado River Basin Compact (1948), and the Colorado River Compact (1922). A related problem involves the interpretation of use curtailment procedures during times of water shortages (Goslin 1977). If the language of the compact is not specific enough, it can lead to potential litigations.

Finally, Muys says the major problem with traditional interstate compacts has been the lack of federal participation on a level greater than a non-voting observer. The ubiquitous role of the federal government in western land and water planning

requires its participation in any comprehensive planning effort. The development of the federal-interstate compact has resolved many of these problems (1977, 94-101).

The Future of Interstate Compacts

The federal-interstate compact appears to be an appropriate institutional arrangement for coordinated comprehensive water planning in the western states. In the conclusion of his extensive study of interstate compacts, Muys recommends,

[t]he federal-interstate compact should be encouraged as the preferred institutional arrangement for regional water resource planning and management. (1971, 388)

With improvements to streamline the ratification process, and installation of greater authority to the compact commission, the federal-interstate compact will provide an effective coordinating mechanism between federal, state and Indian interests in the West. This institution can insure that federal and Indian rights are accounted for in allocating and reallocating water among the compact members. The federal government becomes a voting member of the compact, and is bound to the compact provisions "to the extent constitutionally permissible" (Muys 1977, 100).

Because the Upper Colorado Basin Compact (1948) includes the federal government as a voting partner, it appears to have potential for coordinating state and federal water resource planning in the future, once federal and Indian reserved rights have been fully quantified. The Colorado Basin Compact (1922), having no provisions for a commission or equal federal involvement, is limited to dividing the waters between the Upper and Lower Basin. While it is unlikely that Colorado Basin states would agree to reallocating interstate apportionments, it may be necessary to negotiate a new multipurpose compact, with specific provisions aimed at achieving comprehensive planning in the entire basin. An interstate compact could also be expanded to include land resources as well to achieve coordinated land and water planning.

Permit v. Court System:
Public Interest and Administration of Transfers

During the early development of the Colorado Basin, water rights were self-created property rights established by an appropriator's actions to divert water in accordance with the doctrine of prior appropriation. The only limitations were that the water be put to beneficial use, and that existing rights

could not be injured by the new diversion. As competition for water increased and unappropriated water became less available, it became necessary to develop a system of state administration to oversee water laws and control the appropriation, adjudication, transfer and distribution of water rights (Dewsnut and Jensen 1973, 13-14; Radosevich 1980, 269-270; Trelease 1977, 61).

There are two systems used to administer water rights in the Southwest: the Colorado court system and the permit system. All the basin states, except Colorado, utilize administrative law under the permit system. Two criteria by which these institutions can be compared are: the extent to which they provide representation of public interests; and their ability to efficiently administer water right reallocations and transfers from old to new uses, or to new locations of diversion and use. These criteria have particular significance in the Southwest due to increasing water scarcity and conflicting public and private demands on water resources.

Colorado Court System

In 1879, Colorado became the first state to establish an administrative system to oversee the

doctrine of prior appropriation. This system divides authority between water courts and the state engineer. The water courts are responsible for allocation and adjudication of water rights. The state engineer is responsible for distribution of water, and administration of water laws (Radosevich 1980, 269-271). Colorado is the only basin state in which the establishment of a water right is not controlled by administrative law. Under the court system, a water right is still a self-created right, but the priority of the appropriation is established through adjudication in the courts.

The process for establishing or transferring a water right requires the appropriator to file a private suit which is advertised so that any protesting users can be heard. The petitioner is required to provide evidence that there is available water and that there will be no injury to other rights. All evidence and hydrologic data is provided by the contesting parties. The state engineer and other water related agencies are generally not involved in the adjudication, and serve only to keep records of the court's water decrees and to administer rights once they have been determined (Hartman and Seastone 1970, 18-19). The only concern of the court in making reallocation decrees is to determine availability of water to insure noninjury of

prior existing rights. There is no provision for the protection or representation of public interests during adjudication (Colorado Energy Research Institute 1981, 260-261; White 1977, 118-127; Petros 1985, 4). Public interests which are unrepresented include: instream uses for aesthetics, wildlife and recreation; protection of water quality; and economic and social stability in traditional water use sectors (CERI 1981, 261). The Colorado Energy Research Institute states that:

Neither is there any existing mechanism for the public as a whole to indicate its preferences regarding the value of community-shared water uses. (1981, 261)

Administrative Permit System

For the other basin states, self-created rights were replaced with administrative law. Under administrative law, a water right is granted through a permit system administered by the state engineer. Radosevich explains that in 1890, Wyoming was the first state to recognize the need for more administrative control over acquisition and transfer of water rights, and developed the first permit system with public interest limitations. Unlike the Colorado court system, the permit system combines all the major

administrative activities under the authority of the state engineer, or a natural resources agency (1980, 269-273). In addition to determining availability of water and noninjury of existing rights, the significance of the permit system was that a state now reviewed the proposed appropriation, or transfer of water rights, and could deny the permit if it was found to be contrary to the public interest. Aside from the general concept of public interest, permits have been denied as a result of adverse social costs, or lost opportunity costs (Trelease 1980, 202).

Applications for establishing, transferring, or adjudicating a water right are generally made to the state engineer's office (see Dewsnut and Jensen 1973; Hartman and Seastone 1970, 19-22). Publication of the request is made to notify other water users, who may protest the application to the state engineer. The evidence provided by the applicant and any contesting parties is evaluated by the engineer and compared to hydrologic data collected by the state engineer's office. The state engineer determines if unappropriated water is available, if existing rights will be affected, and if the public interest will be protected. Throughout the process, public interest values in water are represented by the state engineer's office, or other state water agencies. The only time

adjudication reaches the courts is on appeal of the engineer's decision.

Administering Water Transfers

In a study comparing the New Mexico permit system and the Colorado court system, Hartman and Seastone (1970, 23-25) found that one of the greatest obstacles to making efficient transfer decisions to new water uses is the lack of accurate hydrologic data and uncertainties in its interpretation (see also Kneese and Brown 1981, 93). The Colorado court system relies on case by case surveys of water use which are prepared by contending parties to support their own interests. The state engineer is not involved and the court must develop an understanding of the complex problems involving interrelated return flows and their affect on various water users. "The court, without professional engineering skills, then must make a choice or a compromise between conflicting sets of engineering data" (Hartman and Seastone 1970, 24). In addition, there is no public interest representation (unless it involves one of the contending parties), or attempt to make transfers as economically efficient as possible. The Colorado system only attempts to protect existing water rights from adverse impacts.

By comparison, the permit system utilizes hydrologic data which is continuously collected by competent state agencies. Proposed allocations and transfers of water rights are evaluated by state hydrologists, who are better equipped than the courts to understand and evaluate the complex interrelationships of various water rights. In addition, the engineers who provide the hydrologic evaluations represent the public interest, not the interests of a contending party. As an administrative institution, the permit system is more capable of providing efficient water transfer decisions that are coordinated with public interest values in water resources (Hartman and Seastone 1970, 23-25).

A major factor involved with transferring water rights to new uses, or in changing the location of diversion and use, is determining the impact on return flows and third party rights not directly involved in the transaction. Hartman and Seastone state that,

. . . obstacles to transfers do not inhere so much in existing laws as in the uncertainties associated with the physical hydrologic system and the effects accompanying the transaction[,] and that these uncertainties are effected by the procedures through which factual evidence is generated and evaluated. (1970, 15-16)

The permit approach to administering appropriation rights provides a superior mechanism for reducing

uncertainties in evaluating the hydrologic facts associated with a water right transfer, and arriving at a decision based on appropriation law and the public interest. The major difference between the two administrative institutions is that the court system is adversarial in nature, from the first step in establishing a water right, to the final decree. The permit system is one of negotiated administrative discretion, based on unbiased information, informed analysis and statutory law.

Proposed Improvements

White asserts that the major problem associated with the permit system and the appropriation doctrine is the prevailing definition of public interest and beneficial use which is "usually restricted to economic or utilitarian concerns" (1977, 127). He finds that, while states are beginning to recognize environmental concerns, the definition needs to be expanded to include agricultural preservation and other concerns. Tregarthen, an advocate of a free market in water rights allocation, acknowledges market failure in recognizing nonmarket concerns such as openspace created by cropland preservation. He suggests these factors can be accounted for by adjusting prices paid

for agricultural water rights to include this openspace value (1977, 149).

Improvements could be made to the court system by providing comprehensive hydrologic data collected by state agencies to establish present conditions of water use, and hydrologic relationships between rights. In addition, representation of public interests could be provided by establishing an advocate within the court system. This could be a private advocate, such as a conservation group, or it could be a state agency, as with the permit system. A state agency would provide more consistent representation and would not be limited to certain cases. However, the adversarial nature of the court system is likely to preclude public interest factors which are not directly involved with the case, no matter which advocate is used (Colorado Energy Research Institute 1981, 263).

Marcum found that the proposal to transfer allocation authority from water courts to the state engineer's office in Colorado was supported by those who felt the courts lacked technical competence in making water decrees. In addition, it was felt that unification of all administrative duties into the state engineer's office would promote more rational decisions. Marcum found those opposing the idea included water lawyers, and agricultural groups who

felt the district water judge would better represent their interests. He concluded that such a change in the Colorado court system was politically unlikely (1978, 55-56).

The Colorado Energy Research Institute suggests that Colorado could also use state police powers and tax authority to promote public interest protection. Police powers to limit certain less desirable water uses could be applied to the private water right, or taxes could be applied to those uses as a disincentive (1981, 263-264). Colorado has taken some steps to improve its system of prior appropriation. The Water Right Determination and Administration Act of 1969 was passed to improve records of existing water rights and hydrologic data, and to establish seven water courts (Petros 1985). In addition, Colorado is one of the only states which has given statutory authorization to state agencies to acquire instream water rights through the market system. Both of these actions may improve protection of public interests in water allocation.

Flexibility of Transfers and Duration of Permits

Under the appropriation doctrine water rights are granted in perpetuity. Trelease suggests this is what insures the security of a water right and encourages

the necessary long term capital investments in its diversion and distribution facilities. This also gives greater security to the specific water use for which a right is intended. Flexibility in transferring a water right is accomplished through the market system, whereby rights are transferred to new higher valued uses by compensating water losers for the unamortized portion of the investment. As with rights in land, flexibility increases with the security of a water right (1977, 64-66).

Authors opposed to this view suggest that compensation is rarely provided to third party losers. Therefore, permits for water rights should be granted for specified periods of time, after which the state reevaluates the continued application of water to a specific use, according to public interest policies and changing water demands (see Bromley 1980; Radosevich 1980; and Kelso 1980). This could go as far as having the state acquire water rights which it then administers through contract permits. This type of permit would give the state more control over water management and allocation to protect against third party externalities. Flexibility in transferring a right would be established through periodic evaluation of its use (Radosevich 1980, 285-286).

Implications For Planning

In addition to providing representation of public policy interests, Trelease (1980, 203) asserts that the permit system provides a coordinating mechanism for implementing state water plans. Comprehensive water plans can establish public interest policies and identify those water uses which need special protection, or uses which should be discouraged. The water plan provides guidelines for the state engineer, or other water resource agency, which will insure the allocation of water use permits in accordance with public interest policies.

Coordinated implementation of a state water plan would be difficult to achieve in the court system in Colorado, under which water rights are more privatized and remain self created. There is no mechanism for allocating in accordance with public interest policies established in a water plan (Sherman 1977). Marcum (1978, 84-85) found some experts suggest changing the Colorado court system to a permit system because it would provide the state with better management of water use. In addition, the permit system would,

. . . afford a more comprehensive planning approach to water allocation and use, as well as allow for an integration of water related factors into land use and other types of natural resource planning. (1978, 85)

The permit system of water right administration is the dominant institution in the western states, including the Colorado River Basin. Because of its ability to allocate water according to public interest guidelines, it is likely to remain as the primary administrative institution for allocation and management within a state. As a result of the success of this institution, it is being utilized by more of the eastern states, which are also beginning to suffer water shortages and conflicting uses (Dewsnut and Jensen 1973).

Impediments To Efficient Use and Transfer of Water

As competition over scarce water resources increases, the promotion of efficient water use, incentives to conserve, and improved transferability to new higher valued uses becomes more essential. There are a number of characteristics and emerging trends associated with the doctrine of prior appropriation which create impediments to the efficient use, or transfer of water to new uses.

An appropriation right is defined as a specific diverted quantity. This quantity must be continually applied to a beneficial use, or the owner risks

forfeiture of all or a portion of his right. This creates an incentive to divert the entire quantity, even if it is not needed. The result is wasted water which could have been applied to another use. If states allowed an owner to sell surplus water which he has conserved, an economic incentive would be created to encourage more efficient use of water, resulting in greater conservation efforts (Tregarthen 1983). New Mexico does permit the sale of conserved water if it can be metered. However, the high cost of metering has discouraged conservation (Gisser and Johnson 1983, 147). In addition, some authors suggest that beneficial use and forfeiture limitations should be removed to allow speculative, or anticipatory water rights (Tregarthen 1983; Williams 1983).

A related problem concerns return flows. When a water right is transferred to a new use or location, the court or state engineer determines the amount of water consumed by the previous use and limits the new right to that amount, and not the quantity of the original diversion. This is essential to insure continued return flows to downstream rights. However, it creates uncertainties for the buyer and seller in knowing in advance how much water can be transferred, and it encourages waste by the seller in an effort to maximize the quantity consumed. Determining the historic

consumption of the original user can often be difficult. In addition, reducing the quantity of the diverted right to the quantity historically consumed may limit the incentive to transfer water to higher valued uses (Tregarthen 1977, 148). Many authorities suggest that economic efficiency and water conservation would be improved if water rights were defined in terms of consumptive use, and not quantity diverted, for both original rights and transferred rights (Tregarthen 1983, 136; Gisser and Johnson 1983, 161; Kneese and Brown 1981, 94).

There is a growing trend in the establishment of impediments to efficient water use and transferability, arising from legislative or political actions which are often protectionist in nature. These include anti-export statutes from one state to another, basin of origin protections, minimum stream flows, and statutory preferences for certain uses (see White 1977; and Trelease 1980). While these limitations often serve public interests, restrictions on water export and basin of origin have recently been used by western and midwestern states to block unpopular interstate coal-slurry pipelines, or the transfer of agricultural water from one state to another.

Trelease warns against this politicization of water law by legislative bodies. Water management

decisions made in the public interest should encourage economic efficiency and consideration of alternative uses of water. These decisions are best made by state water agencies, having the technical expertise to evaluate alternative uses. This results in administrative decisions based on factual evidence, which are limited by statutory standards, instead of political pressures (1980, 206-212). State water laws that become too protectionist in nature run the risk of being found unconstitutional, based on the interstate commerce clause. These laws invite federal intervention. The federal government could allocate water from federal reservoirs to accommodate these uses, or it could supersede state appropriation law and develop a national water law, eliminating state control over allocation (Trelease 1980, 213).

Many authorities view traditional single-purpose interstate allocation compacts as impediments to transfers because these compacts establish specific apportionments for each state (Kneese and Brown 1981, 93). This problem could be overcome by eliminating export restrictions by providing for the states to sell water to other states, using term permits.

Economic Efficiency and Preservation:
The Trend Towards Privatization or Public Trust

Kneese and Brown find that many of the impediments to economically efficient water transfers are legitimate reflections of the region's public interest concerns for agricultural and environmental preservation (1981, 93). This raises the question, should water allocations and transfers be made in the most economically efficient manner, or should public interest limitations be involved ?

Castle states that this is the fundamental issue in natural resources policy and can be characterized by the problem of balancing market oriented economic growth with nonmarket environmental preservation (1980, 5). This issue manifests itself in the conflict between individual decision making and group decisionmaking (1980, 6). With respect to water resources, there is definite disagreement over this issue and the direction water allocation institutions should follow in the future. This is illustrated by the following statements:

Water is too valuable a resource not to be left to profit-seeking firms. (Tregarthen 1983, 135)

Water has been too well recognized as a scarce, socially important resource belonging to and controlled by the state to permit a pure market system as a substitute. (Vlachos and Hendricks 1977, 245)

Some experts advocate a return to more privatized, self-created water rights that are allocated through a free market system to improve economic efficiency in water use and transfers (see Tregarthen 1983; Gisser and Johnson 1983; and Cuzan 1983). They assert that water laws should be improved to provide clearer definition and enforcement of private water rights, and that impediments to transfers in use should be removed. This would result in an economically efficient free market, more capable of determining the highest and best use of water. Allocation decisions would be made by individual buyers and sellers. Externalities and third party impacts would be mitigated through compensation.

Those opposed to this approach advocate continued expansion of state administrative control under the permit system to protect public interests in water allocation (see Radosevich 1980; Kelso 1980; and Peak 1977). They agree that improvements in efficient water use and increased flexibility in water transfers need to be made. However, "the most rational economic approach in water allocation is not necessarily the most socially desirable" (Vlachos and Hendricks 1977, 85), particularly when it destabilizes the existing socio-economic structure of the Southwest.

These authors propose that state water agencies appropriate remaining water and allocate it according to state water plans which have identified public interest priorities in water use. Allocation decisions are based on public trust, utilizing term or contract permits which can be periodically reviewed. Kelso suggests states could adopt a more formal public landlord - private tenant relationship with respect to water use permits. This would provide: improved protection of the public resource; security of use for the leasee; increased flexibility in transfers to new uses; and improved conditions for promoting long range planning (1980, 291-297).

It is interesting to note that authors representing both sides of the privatization - public trust issue advocate the establishment of some form of water brokerage agency to keep records of existing water rights (quantity and ownership) and hydrologic data, and to serve as a clearing house of available rights and proposed transfers (see Kelso 1980; Radosevich 1980; Howe, Alexander and Moses 1982). Such an agency, whether public or private, could facilitate more efficient transfer of water to new uses and provide a forum for buyers and sellers.

Ultimately, the question should not be posed as a choice between privatization or public trust. The best

solution to the need for increased economic efficiency and public interest protection in water use is finding the appropriate mixture of public and private control over allocation decisions (Castle 1980). This requires a balance between "economic efficiency and societal norms of fairness and equity" (Kneese and Brown 1981, 94). The process of determining this appropriate balance can best be facilitated through comprehensive land and water planning.

Water Allocation Law As A Land Use Tool

It is apparent that water allocation and management will significantly affect the future of the Colorado River Basin. The interstate compact and the permit system of allocation can both be improved to accommodate more comprehensive water planning and management, and could be utilized to coordinate land and water planning efforts. This raises the question of using water law as a land use tool for growth management and land use planning. As with most issues involving water in the Southwest, there are opposing views on this issue.

As discussed above, Trelease sees a trend in the politicization of water law by the states, which is the result of protectionist reactions to unwanted land

uses. He asserts that water law is an inappropriate tool for accomplishing land use control, and that "distorting water law into a land use regulating tool" (1980, 212) threatens its integrity as an efficient allocation tool for water. Restrictive water laws, by themselves, will not achieve the desired land use control. He suggests the use of sound comprehensive land use planning, utilizing growth management techniques, zoning and environmental controls to determine the desired land use activities. Water law should then be used to allocate according to the established public interest (1980, 212-217).

Marcum found that most experts opposed the utilization of water management as a tool for land use planning or growth management in Colorado, the only basin state still utilizing self created water rights. Opposition was based on the fear that this would undermine the private ownership of water rights (1978, 62, 75).

Generally, those who advocate stronger state control over water allocation, in conformance with identified public interests, also see water law as an effective tool for land use control. In addition, they see the importance of integrating and coordinating state land and water planning so that water allocation will not conflict with growth management policies (see

Lamm 1977, 220; Sherman 1977, 226-229; Castle 1980, 10). Some authorities propose that water be zoned for certain uses, just as land is zoned (Marcum 1978, 81). This proposal could prove difficult to accomplish due to the transient nature of water, and because in the Southwest, it is alienated from the land. Vlachos and Hendricks suggest that,

. . . it seems possible that natural resources policies can utilize water as a major means for either controlling or, if wanted, stimulating growth. . . . Around water as an organizing concept the broader policies of development can be interwoven into an integrated effort for managing growth in an ecologically fragile region. (1977, 242)

It may be more appropriate to consider this controversy in terms of finding the socially acceptable balance between keeping water law as a pure institution for defining, enforcing and transferring private property rights, and utilizing it as a less passive tool for land use planning. Water law could be a very effective tool for land use control, if used in conjunction with comprehensive land planning. No matter what balance is established, it is clear that water law should be coordinated with land planning to achieve comprehensive management in the Colorado River Basin.

Chapter 4

CONCLUSION

The Colorado River Basin and the allocation of its water resources will play a significant role in the future of the southwestern United States and the nation as a whole. The management issues discussed in Chapter One are all important, however it appears that two of these issues will have more long term impact on the region and its water.

The first is the quantification of federal and Indian reserved rights associated with the large percentage of public lands in the region. The courts have established an implied right of sufficient quantity to serve the needs of the land reservation. If this is interpreted to include all potential uses of the land, there could be significant quantities of water transferred out of private ownership, resulting in increased competition over water and loss of economic activities and jobs. One solution to this problem would be the leasing of federal or Indian water to existing private users so that economic activities would be less disrupted. Quantification of reserved rights should be completed as soon as possible to

remove uncertainties over available water and to facilitate a more accurate evaluation of its impacts on the region through the planning process.

The second issue involves the development and transformation of the mostly rural, agricultural Southwest into an urban industrial region. The transfer of agricultural water and land to other uses, such as energy development which may be more transient or short term, could destabilize the long term socio-economic fabric of the region. Once this underlying infrastructure is removed, it may be difficult to guard against the boom and bust cycle which has characterized the region in the past. Comprehensive land use planning, coordinated with agricultural preservation and water law, could help retain a portion of the traditional socio-economic structure while accommodating new land and water uses. Changes should be made in water laws to recognize nonmarket instream uses and minimum stream flows as a beneficial use, to help preserve environmentally sensitive or aesthetically valuable areas which characterize much of the region.

The nexus between the interrelated planning and management issues discussed in Chapter One, and the problem of allocating increasingly scarce water resources among competing uses, is the need for a

comprehensive approach towards coordinating water and land use planning in the basin. Federal, state and local governments have not established basin-wide policies, or institutions specifically aimed at coordinating land and water use activities in the Southwest.

Although the permit system of prior appropriation and the interstate water compact are old institutions, established during a time of unlimited land development, it appears that these institutions could be adapted to facilitate comprehensive resource planning and growth management. The federal-interstate compact can be utilized as a framework for coordinated interstate resource planning. The permit system of water allocation can be coordinated with state and local land use planning to achieve coordinated implementation of land and water planning within a state.

The two major interstate compacts in the Colorado Basin are presently limited to allocating water between states and the promotion of agricultural and industrial development. However, new federal-interstate compacts could be negotiated with expanded multipurpose objectives that specifically address coordinated comprehensive resource planning between the states and the federal government. A major obstacle to achieving

an effective multipurpose planning compact will be the state's reluctance to delegate greater planning and decision making authority to an interstate commission. In addition, there is the historic rivalry between the states and the federal government over the control of resources in the basin, and the recent trend towards federal decentralization. This may make the states hesitant about giving the federal government an equal voice on interstate resource planning commissions. Because of the large tracts of public lands in the Colorado River Basin, it is important that the states include the federal government in this type of interstate planning effort. The federal-interstate compact has a strong legal foundation in the United States Constitution and is strengthened by the requirement of Congressional approval. The signatory parties, including the federal government, are bound to the compact provisions by law. The courts have found that compact provisions are superior to state law. This should make it a good foundation on which to base interstate comprehensive planning.

Water resource planning is undergoing a transition from development and diversion of water to management and allocation of scarce water among competing uses. It appears that water allocation policy is also at a turning point. There is strong support for a return to

more privatized market oriented water rights which emphasize economically efficient allocation and transfers. This approach may be currently popular because it reflects the policies of the Reagan administration. The alternative is one in which water rights are allocated and transferred by state agencies according to economic efficiency, but with the inclusion of public interest limitations. Given the desire for coordinated land and water planning, the permit system of water allocation has been shown to be superior to the privatized Colorado court system. The national trend is towards the permit approach as competition over scarce water increases.

No matter which alternative future is followed, there are a number of improvements that can be made to increase the efficiency of existing institutions in establishing original rights, transferring water to new uses, and for providing better incentives for water conservation in the Southwest. The most important improvement is to measure water rights by the quantity consumed, not the quantity diverted, and to allow an owner to sell unused or conserved portions of a right. Other improvements include the removal of basin of origin restrictions and restrictions on water export, as long as there is provision for the protection of public trust by utilizing the permit system.

The most difficult question to answer will be the extent to which water laws should be used as a direct growth management tool. It is important to keep in mind that water laws are intended to provide clear definition, enforcement and security of a private usufructuary right, so that an owner is assured of continued future use and protection of investments. In addition, water laws should facilitate economically efficient transfers and use of water. However, water has been declared to be the property of the public and its allocation should follow the public interest policies established through the process of land and water planning. It is clear that water law should not be used by itself, or in place of comprehensive planning to address the land and water issues facing the Southwest. Effective comprehensive planning requires that water allocation policies not conflict with growth management policies. This may require water laws to be integrated into the comprehensive planning and implementation process, and it may require some limitations on strict economic efficiency. Ultimately, the public must decide the extent to which water laws are used as a planning tool, as well as the balance between economic efficiency and socially acceptable norms of fairness and equity in water allocation. As demands on water resources in the Colorado River Basin

increase, efforts should be made to include greater levels of demand oriented management in the planning process. This is a logical extension of water planning's transition from developing new supplies to managing existing supplies.

The authority to allocate water rights rests with the states for all water except federal and Indian reserved rights, and navigable waters. It appears that while this authority is based on the premise that federal land acts transferred this authority from the federal government to the states, the authority actually comes from the inaction of the federal government to enact legislation superseding state laws. Unless states enact overly restrictive water laws which burden interstate commerce, it is likely that this authority will remain with the states. This should facilitate implementation of more comprehensive state land and water planning.

The intent of this Master's Report was to provide a general understanding of the issues surrounding water resource allocation in the Colorado River Basin by examining: planning and management issues; existing legal institutions for water rights and allocation; as well as the problems and emerging trends in these institutions and their implications on future planning.

Future research should concentrate on the following topics:

1. Procedures for establishing greater public participation in the planning process, particularly as it relates to state and interstate resource planning.
2. Procedures for facilitating greater levels of state land use planning and growth management. State level water planning is generally accepted in most states, however land use planning has, for the most part, remained at the local level.
3. Agriculture is the largest user of water in the Southwest, for both diversion and consumption. Improvements to increase the efficiency of irrigation and diversion practices should be explored. Any increases in efficiency would free more water for other uses.
4. Studies need to be made to establish procedures for reducing the time it takes to ratify interstate compacts at the state and federal level. In addition, procedures need to be found which will facilitate states in delegating greater powers to interstate compact commissions, if these compacts are to be used for comprehensive resource planning.

02

APPENDIX A

TABLE 3. WATER BUDGET: UPPER COLORADO BASIN

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
VOLUMETRIC DATA (mgd)						
-Base conditions-						
Total streamflow	12,440	NE	12,440	NE	12,440	NE
Streamflow at outflow points(s)	10,000	10,077	9,232	8,875	8,901	8,153
Fresh-water withdrawals	6,869	7,949	7,841	9,505	7,519	8,795
Agriculture	6,427	7,639	7,254	8,809	6,706	7,580
Steam electric	103	53	157	172	201	248
Manufacturing	4	<1	2	<1	2	<1
Domestic	70	105	76	159	83	201
Commercial	10	^a	10	^a	11	^a
Minerals	132	120	195	304	355	698
Public lands	103	32	120	61	127	68
Fish hatcheries	20	NE	27	NE	34	NE
Other	0	NE	0	NE	0	NE
Fresh-water consumption	2,440	2,118	3,018	2,890	3,232	3,419
Agriculture	2,221	1,956	2,688	2,479	2,775	2,668
Steam electric	39	50	106	164	151	241
Manufacturing	2	<1	1	<1	2	<1
Domestic	25	39	27	58	29	74
Commercial	3	^a	4	^a	4	^a
Minerals	47	45	72	137	144	376
Public lands	103	27	120	52	127	60
Fish hatcheries	0	NE	0	NE	0	NE
Other	0	NE	0	NE	0	NE
Ground-water withdrawals	126	105	NE	105	NE	105
Exports	805	635	985	866	1,095	1,059
Evaporation	711	662	721	860	728	860
Instream approximation						
Fish and wildlife	7,947	0	7,947	0	7,947	0
Treaties and compacts	6,700	6,698	6,700	6,698	6,700	6,698

NE - Not estimated.

^a SRF domestic water use includes commercial and institutional requirements.

NF - National Future Estimates

SRF - State & Regional Future Estimates

Source: U.S. Water Resources Council (1978b., 17).

TABLE 4. WATER BUDGET: LOWER COLORADO BASIN

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
VOLUMETRIC DATA (mgd)						
-Base conditions-						
Total streamflow	6,170	NE	6,170	NE	6,170	NE
Streamflow at outflow point(s)	1,550	1,340 ^a	-1,433	1,340 ^a	-1,544	1,340 ^a
Fresh-water withdrawals	8,917	7,962	8,528	8,522	7,857	8,882
Agriculture	8,036	6,955	7,351	6,838	6,403	6,635
Steam electric	68	56	150	167	154	267
Manufacturing	89	124	92	192	138	247
Domestic	423	580	520	879	658	1,110
Commercial	75	^b	92	^b	114	^b
Minerals	184	156	252	281	311	436
Public lands	20	23	49	57	56	65
Fish hatcheries	22	NE	22	NE	23	NE
Other	0	68	0	108	0	122
Fresh-water consumption	4,595	4,891	4,754	5,268	4,708	5,556
Agriculture	4,073	4,229	4,014	4,161	3,780	4,062
Steam electric	63	53	134	162	126	250
Manufacturing	55	63	54	94	104	123
Domestic	199	317	245	440	310	544
Commercial	35	^b	43	^b	54	^b
Minerals	151	142	217	262	280	412
Public lands	19	23	47	56	54	65
Fish hatcheries	0	NE	0	NE	0	NE
Other	0	64	0	93	0	100
Ground-water withdrawals	5,008	4,324	NE	2,447	NE	3,609
Exports	4,498	4,465	4,129	3,929	4,032	3,929
Evaporation	1,202	1,230	1,222	1,232	1,236	1,240
Instream approximation						
Fish and wildlife	6,864	0	6,864	0	6,864	0

NE - Not estimated.

^a SRF streamflow is the minimum flow required by the Mexican Water Treaty.^b SRF domestic water use includes commercial and institutional requirements.

NF - National Future Estimates

SRF - State & Regional Future Estimates

Source: U.S. Water Resources Council (1978a., 20).

NOTES: Chapter 1

1. Wayne Aspinall, Congressman from Colorado from 1949 to 1972, was chairman of the House Interior and Insular Affairs Committee. Morris Udall, Congressman from Arizona, succeeded Aspinall as chairman.
2. The Sagebrush Rebellion is the name given to various actions taken by Western states in recent years in their attempt to gain control over federal lands and natural resources that lie within their borders.
3. Off-stream uses require the diversion of water away from the river to the location of use.
4. While salinity is the major water quality problem in the Colorado Basin, other problems such as turbidity are also significant.
5. Beneficial use is a term used by the courts and within water law, which generally means any use of water that creates an economic benefit.

NOTES: Chapter 2

1. A usufruct is the legal right of using, enjoying and profiting from something not owned by the person holding the usufruct.
2. Appurtenance is "an incidental right attached to a principal property right and passing in possession with it" (Webster's New Collegiate Dictionary 1979, 56).
3. Excerpt with deletions from Trelease (1974, 32).
4. The doctrine of equitable apportionment is based on the premise that every state has equal rights and standing with respect to every other state.
5. Excerpt from Trelease (1974, 660).
6. Excerpt with deletions from Trelease (1974, 666).
7. Excerpt from Trelease (1974, 675).

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295 U.S. 142 (1935)
- Rhode Island v. Massachusetts, 37 U.S. 657 (1838)
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WATER RESOURCE ALLOCATION IN THE COLORADO RIVER BASIN:
MANAGEMENT ISSUES, EXISTING LEGAL INSTITUTIONS, AND
EMERGING TRENDS

by

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ABSTRACT

The Southwestern region of the United States is undergoing rapid growth and transformation from a mostly rural, agriculturally based region into one which is becoming more urbanized and dependent on manufacturing, industry and energy development. Due to the arid environment, this region has been heavily dependent on the waters of the Colorado River Basin. A system of legal institutions was established early in the region to facilitate development and diversion of water; however, they did not specifically account for reallocation and transfer to new uses, once all the water had been appropriated. It is now recognized that the Colorado Basin's water is fully allocated, and water management is undergoing a transition from water development, to management and allocation of existing supplies among competing uses.

The significance of the Colorado River Basin to the Southwest and the nation is examined, as well as management and planning issues surrounding allocation of water resources. Issues examined include: political influence of states; federal v. state management; the energy crisis; growth of the sunbelt; balancing development and preservation; water quantity, quality and use; public interest and privatization; and coordinated land and water planning. The existing

legal institutions controlling water rights and allocation are examined, concentrating on the doctrine of prior appropriation and the interstate compact. The legal basis and case law surrounding the development and interpretation of these institutions is discussed. Finally, the problems, recommendations and emerging trends in these institutions are examined, as well as their implications on future planning and management in the basin.

It was found that the Colorado River Basin and the allocation of its water resources will play a significant role in the future of the Southwest and the nation. Important issues facing the basin include quantification of federal and Indian reserved water rights which are tied to the large tracts of public domain and Indian lands within the basin. These rights could transfer large quantities of water away from existing private rights. Development and transfer of rural agricultural lands and water to urban-industrial transient uses, such as energy development, could destabilize the traditional long term socio-economic structure of the Southwest resulting in a renewed boom and bust cycle. This impact can be mitigated through comprehensive planning, coordinated with agricultural land preservation and water laws.

The nexus between resource management issues facing the basin and the problem of allocating scarce

water resources among competing uses is the need for a comprehensive approach towards coordinating water and land use planning. It was found that the federal-interstate compact could provide a framework for coordinated interstate resource planning. Interstate compacts have a strong legal foundation in the United States Constitution and are required to have Congressional approval. Signatory parties and the federal government are bound to compact provisions, which are superior to state law, making the institution a good foundation for interstate planning. The permit system of water allocation was found to be capable of providing a coordinating mechanism for implementing land and water planning within a state, and is superior to the Colorado court system for this purpose. Water allocation policies are at a juncture in which water rights could become more privatized to promote economic efficiency in use and water transfers, or water rights could follow the national trend towards utilizing the permit system to include public interest limitations in allocation and transfer decisions.

Improvements can be made to existing institutions to increase efficiency in water use, conservation, allocation, and transfers to new uses. These include: allowing the sale of unused portions of water rights; removal of the requirement to divert water; measuring original and transferred rights in quantity consumed;

and removal of export and basin of origin restrictions. Water law is inappropriate as a growth management tool if used by itself, but it could be effective if coordinated with comprehensive land use planning. Ultimately the public will have to determine the appropriate balance between economic efficiency, and socially acceptable levels of fairness and equity in water allocation decisions. Competition over scarce water in the basin requires greater levels of demand oriented management and planning. State authority to allocate water is likely to continue, unless states enact restrictive laws which conflict with the interstate commerce clause. State authority in water allocation should facilitate comprehensive land and water planning. Research is needed in: establishing state level resource planning; more efficient irrigation and water diversion to promote conservation; public participation in resource planning; and procedures to facilitate use of interstate compacts for comprehensive resource planning.