

By:

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I. Introduction

In this country, the Colorado River is known for many things. For some, it is the river that winds its way through the Grand Canyon of Arizona, a river that provides recreation for whitewater rafting and spectacular views as it traverses mountain passes. Others, however, see the Colorado River differently. For many it is their primary source of water, the water that irrigates fields, supplies major metropolitan areas, and supports the diverse wildlife of the Southwestern United States and a large portion of Mexico. For literally millions of people, animals, and plants, the Colorado River is more than a beautiful landscape. It is life.

When settlers first arrived in the United States, the Colorado River Delta (Delta) was a prominent feature in the Sonoran Desert. It was a lush habitat of forests, wetlands, and lagoons that covered 1,930,000 acres (475 square miles) and was supported by freshwater, silt, and nutrients from the Colorado River.¹ When naturalist Aldo Leopold visited the Delta in 1922, he wrote this memorable description:

...the still waters were of a deep emerald hue...a verdant wall of mesquite and willow separated the channel from the thorny desert beyond. At each bend we saw egrets standing in the pools ahead...Fleets of cormorants drove their black prows in quest of skittering mullets; avocets, willets, and yellowlegs dozed one-legged on the bars...Often we came upon a bobcat...Families of raccoons waded in the shallows...At every shallow ford were tracks of burro deer.²

Unfortunately, the Delta did not remain in this condition for long. Today, large portions of the river that once supported steamboats full of people could not even float a canoe.³ In less than a century, human actions transformed the river from its original state to what it is today: a carefully monitored and controlled river that has every drop of its water assigned to a designated purpose. "In the West, to waste water is not to consume it – to let it flow unimpeded and undiverted down rivers."⁴ For decades, the United States and Mexican governments and others have diverted the river from its original course through a series of dams and reservoirs, assigning the water's use to various parties. These diversions reduced the size of the Delta from almost two million acres to approximately 40,000 acres and ravaged the native wildlife and local communities.⁵

Flood flows began to revive the Delta in the 1980s after Lake Mead filled behind the Grand Canyon Dam.⁶ From 1980 to 1998, floodwaters and agricultural and municipal wastewater reached the Delta, initiating a slow process of rebirth for the ecosystem.⁷ Through the unintentional dispersals of water, the Delta grew back to its current size of more than 150,000 acres.⁸ It is the largest remaining wetland in the Southwestern United States and is home to more riparian habitat than upstream portions of the Colorado River five times its length.⁹

Recently, researchers have explored and recognized the crucial role that the Delta plays in the ecosystems of the United States, Mexico, and the North American continent as a whole. It is a species reservoir home to thousands of species of plants, animals, and fish. Among these are endangered and threatened species living in both the United States and Mexico. These species include the Yuma clapper rail, the bobcat, the vaquita porpoise, and the totoaba bass.¹⁰ The Delta also serves as an important bird sanctuary. It is a stopover point on the Pacific Flyway, a major migratory route that ranges from Baja California, Mexico to Alaska. It supports over seventy-five percent of North American birds during their migration.¹¹ The Delta is also home to indigenous peoples, especially in Mexico. The *Cucapá* are one minority group that inhabits the Delta floodplain; they have lived in the area for nearly a thousand years.¹² The *Cucapá* and others that live on the Delta depend on it for food, water, and the money brought in by ecotourism.¹³

Despite its importance, the Delta, even in its current reduced state, is not safe from further deterioration. "Long-term restoration of the Delta will require one critical ingredient – more water."¹⁴ Recent studies estimate that the Delta requires annual flows of 32,000 acre-feet (af)¹⁵ per year with periodic pulse flows of 260,000 af to maintain the Delta habitat, sustain vegetation, and stimulate germination.¹⁶ These flows are only a small percentage of the total flow of the Colorado River,¹⁷ and without them the Delta will not survive.

Legally procuring these flows to protect the Delta will not be an easy task, however, due to increased demand on the Colorado River water from municipalities, agriculture, and industry. Current demands for Colorado River water from municipalities and irrigation districts are already stretching the river to its limits; environmentalists have to convince these parties to forego their water use to procure what is needed to maintain the Delta. In addition, the current laws governing the

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Colorado River do not give priority to leaving water in the river for environmental purposes. Recent changes in the laws further threaten the future amounts of water available for the Delta.

The Delta also represents an international relations problem. Mexico and the United States share the water of the Colorado River, and conflicts regarding the quantity and quality of the water delivered to Mexico have been frequent over the last fifty years. The salinity of the water delivered to Mexico is a problem that still plagues the United States. Also, difficulties have emerged due to the United States' unilateral decision-making in regard to allocations of the water. New criteria that determine the allocation of water in surplus years will likely reduce the quantity and quality of the water released to Mexico, creating new tensions between the two nations.¹⁸ A recent U.S. federal court ruling also determined that the United States does not have to consider environmental impacts on Mexico when making allocation decisions.¹⁹ These developments pose a further threat to the Delta and, as I will argue, underscore the need for multilateral decision-making.

In order to protect the Colorado River Delta, the United States and Mexico must work together to create a market-based allocation system for water and establish environmental protection as a clear priority for all future decision-making. These steps will ensure that current parties in the United States and Mexico retain the water they need while providing enough water to sustain the critical habitat the Delta provides. While these are not the only means available to solve the problems facing the Colorado River and its Delta, they are realistic suggestions to improve difficult problems that currently show no sign of abatement.

Part II of this Article will discuss the environment of the Colorado River, including its history, current conditions, and key areas of environmental concern. Part III will discuss the Law of the River, the name for the conglomeration of laws that governs the Colorado River. The Law of the River includes two major parts. First, the Colorado River Compact of 1922 allocates the Colorado River water in the United States. Second, the Mexico-U.S. Water Treaty of 1944 and its subsequent amendments, or Minutes, govern the division of water between the United States and Mexico. In this section, I will also discuss more recent developments in the Law of the River, including water banking, the move from agricultural to municipal use, the new surplus criteria, and a recent case in which plaintiffs challenged the United States' obligation to protect the environment outside of its borders.

Part IV will discuss the major problems that are threatening the quantity and quality of the Colorado River water and, in turn, the Delta. These problems include rapid population growth, salinity, and the rights of Indian reservations to water. Part V proposes steps that can be taken to ensure protection of the Delta's environment and improve the current system of allocation in the United States. These steps include teaching the population about the environmental issues, making the environment a priority through the creation of an environmental Minute, creating a market-based system of allocation, and reducing water usage through sustainable practices. Any steps to change the Law of the River and improve the ecosystem must be taken on an international, multilateral level in order to be successful,²⁰ and Part V will stress the need for international cooperation. I will conclude with a summary of the challenges facing the Colorado River.

II. The Environment of the Colorado River

The Colorado River's ecosystems are dynamic and powerful. The river flows through nine states in two countries and encompasses 244,000 square miles.²¹ It begins in the Rocky Mountains in Colorado and Wyoming and travels south for 1,000 miles before the Delta begins (see figure 1). The Delta itself, which encompasses 400 miles, is entirely within Mexico, formed in the area between the Southern International Boundary (SIB), which is where the international boundary between the United States and Mexico leaves the path of the river, and the Gulf of California, where the Colorado River eventually empties. Below the SIB, the Colorado River forms the Delta, which is confined by levees. Near the center of the Delta, the Río Hardy joins the Colorado River with brackish water that drains from agricultural fields. To the east, the Main Outlet Drain Extension (MODE) canal brings brackish agricultural wastewater from Arizona to the Delta.²² This section will discuss the environment of the Colorado River and the Delta.

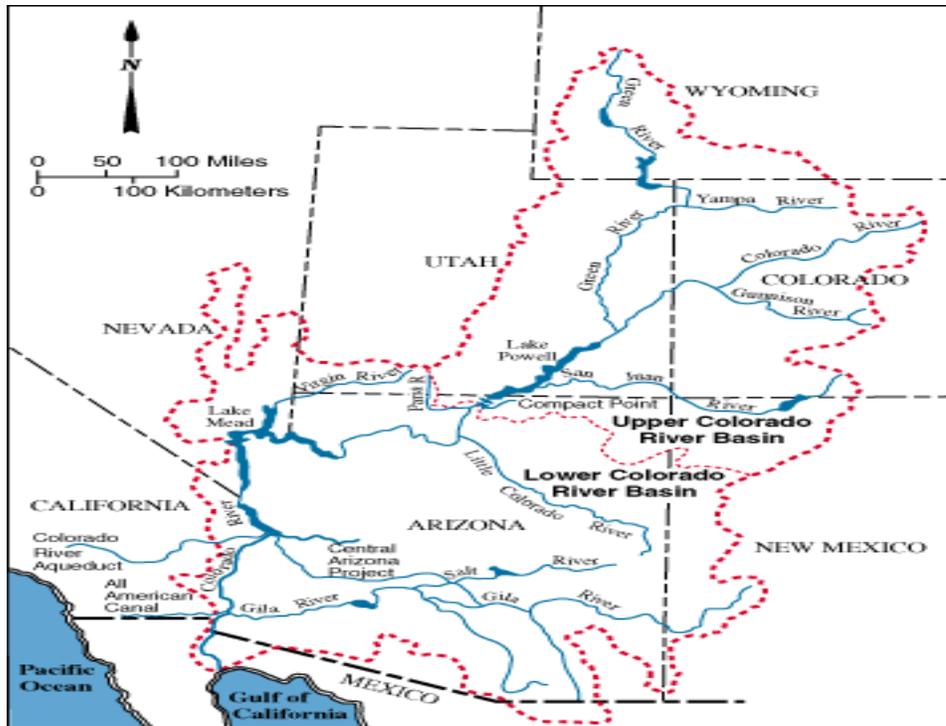
A. History

The Colorado River was a free flowing river less than one hundred years ago. In the early 1900s, California settlers began to take water from the river for drinking and irrigation and regularly used the river as a mode of transportation.²³ The river carried silt and nutrients through the United States and into Mexico, where it supported an ecosystem home to thousands of species of birds, animals, plants, and fish. Indigenous people, including the *Cucapá* Indians, thrived with a culture based on fishing, harvesting, and irrigation farming. Variable flood flows frequently reached the Delta until the 1930s, increasing the Delta's richness and resiliency.²⁴

The Colorado River did not stay in its original state for long. As irrigation increased in the Mexicali Valley, United States citizens grew irritated with the variable flows of the river.²⁵ They asked the federal government to control the river and provide a more constant and reliable flow of water for their fields. The United States government responded by building a series of dams, starting with the Hoover Dam in Nevada in the 1930s. The dam was valuable for its ability to store water in the newly created Lake Mead and create electricity. During the six-year period that it took to fill Lake Mead, no Colorado River water reached the Delta.²⁶ It was transformed into a dry ecosystem in the area north of the Río Hardy. Although flows

to the Delta did return, they were much smaller than the original amount. The Morelos Dam in Mexico, completed in 1950, further reduced the amount of water that reached the Delta. More reductions to the water flow occurred between 1963 and 1981 when the Glen Canyon Dam in Arizona was created and water filled Lake Powell. The construction of dams continued, restricting the flow of water to the Delta and reducing the Colorado River's and the Delta's habitat.²⁷

Figure 1 – The Colorado River



B. Current Conditions

Today, there are ten major dams on the Colorado River, and more than eighty substantial diversions channel water away from the river.²⁸ They are managed by the United States Bureau of Reclamation (BOR), a government agency that predicts and monitors flows, and releases water from major reservoirs when the flows exceed the system's capacity.²⁹ Most flood flows are containable and can be added to the reservoirs that regulate the river's flows. In the 1980s and early 1990s, however, El Niño weather cycles produced heavy precipitation, leading to floods that surpassed system capacity.³⁰ The BOR released flood flows from the United States reservoirs that reached the Delta and caused a substantial rebound in the ecosystem, revitalizing it from its previous near-dead state to a thriving ecosystem of 150,000 acres.³¹

Agricultural wastewater has also contributed to the revitalization of the Delta. Agricultural drains carry saline wastewater away from the fields and deposit it in the Delta. The Río Hardy brings in more agricultural wastewater from the 50,000 acres of irrigated farmland that surround the Delta. The MODE drain empties east and north of the Colorado River's mouth in Mexico.

The improvements in the Delta habitat created by floods, agricultural runoff, and the work of the local governments have been threatened in recent years due to a decrease in freshwater flows. In the late 1990s, the Colorado River basin suffered from the worst drought in recorded history.³² In 2002, the drought decreased the water's flow to only fourteen percent of its normal volume.³³ This, coupled with increased demands on the Colorado River water,³⁴ reduced the freshwater flows that reach the Delta. In fact, less than two percent of the Colorado River's typical flow reaches the Delta most years.³⁵ No freshwater from the Colorado River reaches the Delta in years without flood releases. In these years, the only water that feeds the Delta comes from groundwater seepage, agricultural drains like the MODE, and tidewater from the Gulf of California.³⁶

The reduction in fresh water flows has many negative effects on the environment of the Delta. It increases the salinity and concentration of pollutants in the water. Without the freshwater to dilute the salt water flowing in from the Gulf of California, the Delta water becomes too brackish to support the native fish, shrimp, and other marine animals.³⁷ There is also less water to carry the necessary silt and nutrients to protect the native species of plants; heartier non-native species, such as the salt cedar, have taken over. These species, while better able to survive in high saline, low-flow environments, lessen

the ecological value of the region.³⁸ The native plants, mainly cottonwoods and willows, supported species diversity and density.³⁹

Environmentalists are concerned about other parts of the Colorado River habitat as well. The Salton Sea is California's largest inland lake, located about ninety miles east of San Diego. It was created in the early 1900s when canals created to divert the Colorado River flooded and the river water flooded the Imperial Valley. Although engineers eventually were able to push the river back to its natural location, an inland sea was left behind in a low-lying area.⁴⁰ The sea grew due to irrigation wastewater flows from the United States and Mexico, which are the only inflows the Sea now receives. Because the Sea has no outlet, its size now depends on the rate of wastewater inflows versus the rate of evaporation.⁴¹ The wastewater inflows are likely to decrease in the coming years. Agricultural irrigation is becoming more efficient, creating less runoff to feed the Sea.⁴² Municipalities and others are also focusing on water re-use and conservation, again reducing the water inflows.

The Sea functions as an important stopping point for over 380 species of birds on the Pacific Flyway. However, there are several problems with the Sea that limits its ability to provide the proper habitat for the birds. Because its only inflows are brackish agricultural wastewater, the Sea now has higher salinity than the ocean. The wastewater also contains pesticides and other toxins that are not diluted by any freshwater flows. For these and other reasons, the mortality rate of the birds that stop at the Salton Sea is high.

In the 1990s, a United States Representative from California, Sonny Bono, began to work to protect the Sea. In 1998, the United States Congress passed the Salton Sea Reclamation Act, which led to a feasibility study on restoration of the Sea.⁴³ Several options for restoration were considered, but none of them included taking more water from the Colorado River. Because of this, all of the restoration alternatives were prohibitively expensive and did not address how to replace the decreasing supply of water that feeds the Sea, the most critical part of preserving the habitat.⁴⁴ "The Colorado is the lifeblood of the [Salton] Sea, and if the Sea is to survive...at least some of the Colorado River water will eventually need to be dedicated to restoration purposes."⁴⁵ Using more water from the Colorado River to preserve the Salton Sea could reduce water available for restoring the Delta. Thus, restoration of one area could harm the other.

The Cienega de Santa Clara is another important environmental site that is part of the Colorado River habitat. The Cienega is a 50,000-acre open water wetland that houses thousands of species of plants and animals, including the endangered Yuma Clapper Rail.⁴⁶ It was created by water from the MODE that was diverted because it was too saline to be sent directly to Mexico. It is currently the "largest emergent wetland habitat in the Sonoran Desert."⁴⁷ In 1993, the Mexican government established the Cienega as part of the Biosphere Reserve of the Colorado River Delta and Upper Gulf of California.⁴⁸ Now, besides its invaluable ecological function, the Cienega also serves as an educational center for children and others. Local fishermen lead boat tours of the Biosphere on electric boats that minimize pollution, and others guide visitors on sport fishing outings. In the villages, locals prepare housing for tourists. In 1997, the Secretary of the Environment, Natural Resources, and Fisheries in Mexico (SEMARNAP – *Secretaría del Medio Ambiente, Recursos Naturales y Pesca*),⁴⁹ in conjunction with the United States Department of Interior, built a bird-watching tower in the Biosphere and did aerial surveys of the Delta.⁵⁰

The future of the Cienega is uncertain as well. The water that supplies it, agricultural wastewater from the MODE, was diverted from the main stream of the Colorado River because it was too brackish.⁵¹ However, the United States government has to replace the water that it diverted from the Colorado River. Currently, the federal government is replacing the water that flows through the MODE with water "credits." The government procured these credits by conserving water through lining the Coachella Canal.⁵² However, the use of the credits is an interim solution, and the United States government will soon need to find a new source to replace the water that currently flows down the MODE to the Cienega de Santa Clara. Many of the proposed long-term solutions for this problem will bypass the water from the Colorado River, either through storage or through other means, further reducing the water available to sustain the Delta ecosystem.⁵³ Another option, desalinating the MODE water, would destroy the Cienega de Santa Clara.⁵⁴

The Colorado River and its Delta have changed substantially in the twentieth century, reducing its flows by seventy-five percent.⁵⁵ Increased demand for Colorado River water threatens the remaining flows to the Delta and the Cienega de Santa Clara. Changes must be made to protect the delicate environment of these areas and to ensure that the Colorado River will be a viable source of water for years to come.

III. The Law of the River

Just as the environment of the Colorado River Basin is complex, so are the laws that govern it. There are statutes, administrative agreements, court decisions, interstate compacts, state laws, Mexican federal and state laws, and international treaties that govern use of the Colorado River. Collectively, these agreements, made up of United States federal and state law, Mexican law, and international law, are known as the "Law of the River." While many view the Law of the River as sacred,⁵⁶ it is a dynamic set of laws subject to frequent reinterpretation. It is also not precise; some scholars even describe it as a set of "poorly, drafted, vague and ambiguous documents."⁵⁷

Unfortunately, the Law of the River is resistant to assigning water to environmental uses. It divides the flow of the Colorado River through a rigid system of water rights in the United States and Mexico. These water rights claim more than

the entire flow of the Colorado River, creating shortage problems.⁵⁸ The two main parts of the Law of the River, the Colorado River Compact of 1922 and the Mexico-U.S. Water Treaty of 1944, allocate at least 17.5 million acre-feet (maf). These allocations were based on a study from 1906 to 1921 that estimated Colorado River flows at 18.1 maf.⁵⁹ However, over the past 400 years the Colorado River's flows averaged only 13.5 maf.⁶⁰ This over-allocation is further complicated because the Law of the River does not include evaporation in its calculations; evaporation usually causes losses of 1.5 maf annually.⁶¹

The Law of the River also creates a system of priorities for Colorado River water. The first priority is delivering water to Mexico as required by the Mexico-U.S. Water Treaty of 1944 described in detail below. The second priority is "present perfected rights," which are water rights that were exercised prior to 1922, including rights established by state law.⁶² The third priority is delivery of water to the Lower Basin for consumptive uses (e.g., municipal and industrial use), and the fourth priority is consumptive use in the Upper Basin. The fifth priority is economic, non-consumptive uses, such as power generation. Any remaining water is used for non-economic, non-consumptive purposes, with fishing, hunting, and navigation ranking above environmental protection.⁶³

"The Law of the River developed under the premise that water left instream was 'wasted.'"⁶⁴ It places restrictions on transferring water from its existing uses to accomplish goals such as environmental protection; these restrictions have become more severe due to increased pressure on water resources.⁶⁵ Historical interests have priority in this system and are resistant to giving up their water rights to maintain and protect the environment. With the growing pressures on the water and the entrenched interests in place, it will be difficult to ensure the freshwater flows needed to protect the Delta.

This section will outline the major parts of the Law of the River. First, I will discuss the Colorado River Compact of 1922. Next, I will describe the Mexico-U.S. Water Treaty of 1944 and two of its subsequent amendments. Lastly, I will introduce some of the recent developments on the Colorado River.

A. The Colorado River Compact of 1922

The Colorado River Compact of 1922 is the most important document allocating Colorado River water in the United States.⁶⁶ It is a five-page contract between Arizona, California, Nevada, Wyoming, Colorado, Utah, and New Mexico that divides the water among them. The Compact is not an environmentally friendly document because it restricts parties to only "beneficial uses" of the water.⁶⁷ "Beneficial use" is never explicitly defined in the Compact, but its meaning can be approximated by the wording in Article III(e). That Article allows the parties to receive water only if that water can be "reasonably applied to domestic and agricultural uses."⁶⁸ Domestic use, as defined by the Compact, includes water for households, stock, municipalities, industrial, and other like purposes. It does not, however, include leaving the water instream to protect fish, native wildlife, or for other environmental reasons. Thus, restricting the parties to "beneficial uses" of water only does not allow them to protect the environment.

The Compact separates the Colorado River Basin into the Upper Basin (Colorado, Wyoming, Utah, New Mexico, and part of Arizona) and the Lower Basin (California, Nevada, and the rest of Arizona). Each Basin is given annual use of at least 7.5 maf of Colorado River water.⁶⁹ In surplus years, the Lower Basin is granted an additional 1 maf per year, which the Upper Basin must release before it can consume any surplus water.⁷⁰ Each Basin is permitted to divide its share of the Colorado River water among the states it includes, and each has a separate means to regulate how its allotted water is divided among the states.

1. Upper Basin

The Upper Basin allocates its 7.5 maf of water among its states according to the Upper Colorado River Basin Compact of 1948.⁷¹ The allocations are as follows: Colorado, 51.75%; New Mexico, 11.25%; Utah, 23%; Wyoming, 14%; and Arizona, 50,000 af.⁷² Within each state, state law regulates how water is used, which largely follows a system of prior appropriations. Through this system, water is given to the parties that first put the water to beneficial use.⁷³

The Upper Basin states have never used their full share of Colorado River water due to fewer irrigation projects and a smaller population than that of the Lower Basin. In 2003, the Upper Basin only used about 4.89 maf, approximately 64% of the total allocated to it under the Colorado River Compact.⁷⁴ Currently, the additional water not used by the Upper Basin flows down the river to be consumed by the Lower Basin at no cost. However, the population of the Upper Basin is increasing, and water use is increasing along with it. Experts predict that by 2025, use will increase by more than 70,000 af.⁷⁵

The 1968 Colorado River Basin Project Act controls the Upper Basin's Compact delivery obligations through releases at the Glen Canyon Dam.⁷⁶ Under the "Long Range Operating Criteria" developed in the Act, the Secretary of the Interior (Secretary) specifies the required releases of the dam and the criteria that must be met to deviate from those required releases. In normal years, the target release at the Glen Canyon Dam is 8.23 maf. This satisfies the requirements of the Lower Basin and Mexico. Each year, the Secretary of the Interior releases the Annual Operating Plan (AOP) that determines whether the river is under normal, surplus, or shortage conditions. Additional releases from the Glen Canyon Dam can only be made in surplus years.⁷⁷ The power to determine surplus and shortage conditions gives the Secretary of the Interior significant power over the Colorado River water.

2. Lower Basin and *Arizona v. California*

The 1928 Boulder Canyon Project Act (BCPA) regulates water use within the Lower Basin.⁷⁸ The act authorizes the Lower Basin states to create a compact to divide the water as long as California is limited to 4.4 maf in normal years.⁷⁹ The BCPA also states that, in order to use the water, every party must contract with the Secretary. The Secretary creates permanent water contracts with parties in the Lower Basin. These contracts cannot exceed the amount allocated to each state. The Secretary is also authorized to contract for surplus water or unused portions of other states' allocations.⁸⁰ The parties that contract with the Secretary are usually large entities such as irrigation districts or water utilities.⁸¹

The states of the Lower Basin never entered into the compact that they were authorized to create by the BCPA. States were unsure of how the Secretary's power to allocate the river water affected state laws. Thus, states were in conflict over the allocation of the water. In 1963, the conflict between two states, Arizona and California, resulted in a case before the Supreme Court.⁸² The Court held that below Lee's Ferry, Arizona, the dividing point between the Upper and Lower Basins, the Colorado River is under federal, not state, control.⁸³ Water rights in place before 1929 under state law are not preempted by federal law.⁸⁴ Water may only be allocated through federal water delivery contracts, as discussed above.

The Court also determined that Congress created a system of apportionments for the states of the Lower Basin: Arizona receives 2.8 maf, California receives 4.4 maf, and Nevada receives 0.3 maf.⁸⁵ The allocations include only mainstream waters; each state has the exclusive rights to its tributaries. The system gives the highest priority to present perfected rights, which include the rights of Indian tribes in the Colorado River Basin. After these historical rights, the Secretary has discretion to apportion the remaining water.⁸⁶ In 1968, Congress, through the Colorado River Basin Project Act, further refined the system and authorized the Central Arizona Project (CAP), another entity that can contract with the Secretary for water rights on the Colorado River. Under the legislation that established the CAP, Arizona agreed that California should receive its full allocation of water before the CAP receives any water.⁸⁷

B. The Mexico-U.S. Water Treaty of 1944

In 1944, the United States and Mexico signed an agreement regarding the waters of the Colorado, Tijuana, and Río Grande rivers.⁸⁸ According to the Treaty, the United States must deliver 1.5 maf of Colorado River water to Mexico annually, which is slightly more than ten percent of its average annual flow.⁸⁹ In years of surplus, Mexico is entitled to an additional 0.2 maf. The United States delivers ninety percent of this water at the Northerly International Boundary (NIB), where it is diverted via the Central Canal to the Mexicali and San Luis Río Colorado irrigation districts and the municipalities of Mexicali and Tijuana.⁹⁰ The remaining ten percent goes to the Southerly International Boundary (SIB), where it is diverted for irrigation.

The Treaty also created the International Boundary and Water Commission (IBWC).⁹¹ The IBWC manages transborder water resources, applies provisions of the water agreements and treaties, builds and manages waterworks, negotiates future agreements regarding international waters, and settles Treaty disputes.⁹² It has jurisdiction over boundary delineation, the boundary sections of the Río Grande and Colorado Rivers, all water works located on the border, and any projects that will affect compliance with the Treaty.⁹³ The IBWC also took over the International Boundary Commission, which was founded in 1889. This gives the organization power over the dry lands and rivers of the border region.⁹⁴ While the IBWC's stated mission is to "provide environmentally sensitive, timely, and fiscally responsible boundary and water services along the United States and Mexico border...in an atmosphere of binational cooperation and in a manner responsible to public concerns,"⁹⁵ it has generally limited its scope of activities to water issues along the border, leaving environmental concerns to other governmental agencies in the United States and Mexico.⁹⁶

Amendments to the Mexico-U.S. Water Treaty of 1944 are called "Minutes." The IBWC signed Minute 242 in 1973 to deal with water quality, or, specifically, the salinity of water delivered to Mexico.⁹⁷ Each year, nine tons of salt pass through the Colorado River. About half of this salt is naturally occurring, and an additional thirty-seven percent comes from agricultural wastewater.⁹⁸ In the 1960s, agricultural runoff from the Wellton-Mohawk region of Arizona introduced highly saline water into the Colorado River, raising its concentration of salt from 800 parts per million (ppm) to 1,500 ppm near the border.⁹⁹ The increased salinity of the Colorado River water damaged agriculture in Mexicali, Mexico.¹⁰⁰ In 1965, Minute 218 forced the United States to reroute this saline water via the MODE.¹⁰¹ However, Mexico was still concerned with the salinity of the water delivered to it at the NIB. It negotiated Minute 242, which states that water delivered to Mexico must not be 115 ppm (plus or minus 30 ppm) more saline than the water that passes over the Imperial Dam in the United States. To accomplish this, the United States implemented salinity control measures, added salinity standards to the United States Clean Water Act,¹⁰² and constructed the Yuma Desalting Plant, which has yet to be used.¹⁰³

The IBWC adopted another amendment, Minute 306, in 2000.¹⁰⁴ Minute 306 states that the IBWC must establish binational studies that examine means to secure water for ecological purposes. The IBWC must also create cooperative projects to preserve the riparian ecology of the Colorado River and its Delta with "a focus on defining the habitat needs of fish, and marine and wildlife species..."¹⁰⁵ A symposium was held in September 2001 as a follow up to the December 2000 agreement. Though the symposium was cut short by September 11, it accomplished its goal of sharing information between

the two countries. At the symposium, speakers also acknowledged the work done since the signing of Minute 306. Besides an increase in information sharing, the IBWC has also begun pilot restoration projects and flow modeling.¹⁰⁶

C. Recent Developments

The Law of the River has changed dramatically since 1944, due in large part to the changes in the Colorado River region since that time. Changes such as population increases, increased movement to cities, and increased use of water have added strain on river resources, necessitating refinements to ensure adequate water for all parties in the future. An increasing focus on environmental protection beginning in the 1970s has also resulted in new attempts to make the Law of the River more environmentally friendly. In this section, I will describe a few changes that are affecting how Colorado River water is used today.

1. Water Banking

Even after the Supreme Court's decision in *Arizona v. California*, tensions persisted between the two states regarding allocations of water. Arizona, which was not using its full apportionment, feared that California would claim its excess water, leaving it unable to support a growing population. To stop California's reliance on its unused apportionment, in 1996 Arizona created the Arizona Water Bank.¹⁰⁷ The Bank uses the CAP to store water to be withdrawn in the future. This allows Arizona to use its full allotment so it cannot be drawn upon by California. There are two versions of water banking: direct recharge and in lieu recharge. In direct recharge, CAP water is stored underground until users need it. With in lieu recharge, users withdrawing groundwater switch to CAP water. The groundwater they save by using CAP water can be withdrawn later by the Arizona Water Bank.¹⁰⁸ The system does not save water; it just delays unsustainable groundwater withdrawals. Other states can also use the system. In water surplus years, California and Nevada can store water that they would otherwise not use. Then, in shortage years, they can draw upon this stored water. California or Nevada may access up to 10,000 af of Arizona's allotment annually.¹⁰⁹

The United States Department of the Interior (DOI) extended water banking in November 1999 when it created regulations for interstate water banking on the Lower Colorado River.¹¹⁰ State law authorizes water bank customers to store "intentionally created unused apportionments" (ICUAs) in other states. The bank can return the water to the bank customer when it is needed. Water can also be released on credit in anticipation of future storable water flows.¹¹¹ If all parties approve, water bank customers can sell their ICUAs. This would allow parties to market water in the Lower Basin. However, commoditizing water would not promote sustainable use.¹¹²

2. Moving Water from Agricultural to Municipal Use

The landscape of the United States has changed substantially since the 1920s. Population density more than doubled between 1920 and 1990, and cities are growing at an astounding rate.¹¹³ Because of this, the demand for water has shifted from agricultural purposes to municipal and industrial uses. These uses create a greater economic benefit and, thus, municipal and industrial users are willing to pay more for water.¹¹⁴ For example, cotton produces a return of \$192 per acre-foot of water, while in Tucson, Arizona, residential users pay \$700 per acre-foot.¹¹⁵ Despite this significant difference, the Law of the River grants agricultural interests high priority. Farming is an important part of the United States culture, and farmers will not soon be willing to give up their water rights.

In the 1930s, California created the Seven Party Agreement to establish a system of priorities for its allocation of Colorado River water.¹¹⁶ This Agreement placed agricultural uses first and municipal uses last in its list of priorities. Specifically, the Agreement divided its first 3.85 maf among agricultural parties with the following priorities: (1) the Palo Verde Irrigation District (PVID); (2) the Yuma Project; and (3) the Imperial Irrigation District (IID) and the Coachella Valley Water District (CVWD). Next, 1.212 maf was split among the fourth priority, the Metropolitan Water District (MWD) of Southern California and the City of Los Angeles, and the fifth priority, additional water for the MWD and Los Angeles as well as water for the San Diego County Water Authority (SDCWA). The sixth priority gave an additional 0.3 maf to IID and the seventh priority gave all the remaining water to agricultural interests. In total, the Seven Party Agreement allocated 1 maf more than what was allocated to California under the BCPA.¹¹⁷ Thus, California was dependent on the unused portions of other states' allocated water and any water available in surplus years. If California was unable to secure this additional water, the MWD, Los Angeles, and San Diego could lose their supplies of water from the Colorado River.¹¹⁸

As water use increased in the Upper and Lower Basins, California municipalities became nervous about the safety of future water flows. In the 1980s, the MWD and others attempted to create transfers of water from agricultural to urban users.¹¹⁹ The IID agreed to give the MWD 106,100 af of additional water, but the CVWD sued and claimed the right to the IID's unused water under the Seven Party Agreement.¹²⁰ The transfer of water never went through.

In 1996, due to water banking, Arizona and Nevada began to use their full apportionments of water.¹²¹ California was then reliant on the Secretary to declare a surplus; otherwise, many Southern California municipalities would be without water. Then-Secretary Bruce Babbitt used his power to get local water users, such as the IID and the MWD, to draft the

California Colorado River Use Plan, or the 4.4 Plan.¹²² Under this plan, California would reduce its water use to 4.7 maf by 2015 and continue reducing it thereafter until it reached 4.4 maf. It also had to show an improvement in water use by December 31, 2002.¹²³ The initial agreement fell apart, but pressure from Babbitt and California Governor Gray Davis forced the parties involved to sign the Quantification Settlement Agreement (QSA) in 1999.¹²⁴ The QSA set out key terms, to be included in a future agreement, that included legitimizing water transfers and shifting agricultural water to municipal use. The MWD, Los Angeles, and the SDCWA were given an additional 400,000 af of water that was formerly given to agriculture.¹²⁵ “We are acknowledging a new reality,” said University of California Los Angeles historian Norris Hundley Jr. “When people, meaning cities, need water, they are going to get priority. When there are cutbacks, farmers will be cut back before cities.”¹²⁶

3. The Colorado River Surplus Criteria

To convince the states of the Lower Basin to adopt the QSA, Secretary Babbitt had to agree to adopt new criteria that specified what to do with surplus water that emphasized the needs of municipalities.¹²⁷ California drafted its proposal for the new criteria in an appendix to the QSA; it guaranteed California more than 4.4 maf of river water each year through drawing water out of reservoirs.¹²⁸ California argued that if reservoirs were drawn down, more floodwaters could be contained in surplus years instead of flowing into Mexico. The other Colorado River Basin states (Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming) created another proposal that limited the use of surplus flows.¹²⁹ These states feared that California would never cut down its water use and would eventually require some of their water.

After Arizona and the MWD negotiated an agreement that would guarantee Arizona’s rights to water until 2015, the Basin states renegotiated their proposal and submitted the “Basin States Alternative” proposal, which was ultimately selected. The proposal’s first goal is to allocate the unused normal apportionment in the Lower Basin. The Secretary must allocate this water first to the MWD and the Southern Nevada Water Authority (SNWA) for domestic use and off-stream banking; any additional water would go to California to be divided according to the QSA. The second goal is to identify surplus water, which the proposal defined as water that exceeds downstream demand and that must be released for flood control purposes. The third goal is to deliver surplus waters according to a system of priorities, which vary depending on the water levels at Lake Mead.¹³⁰ The final Record of Decision implementing the Basin States Alternative was signed on January 16, 2001.¹³¹

According to the National Environmental Policy Act (NEPA), government projects must create Environmental Impact Statements (EISs) that investigate the environmental impact of actions taken and any possible alternatives.¹³² The BOR’s Final EIS for the new surplus criteria articulated the major problem with the new criteria: it limits the amount of water that will flow to the Delta. Lake Mead, behind the Hoover Dam, would be drawn down to ensure maximum capture of surplus flows that would normally flow into Mexico.¹³³ This would severely limit the surplus flows that reach Mexico and, therefore, the Delta. Thus, the new surplus criteria will actually harm the future of the Delta environment in favor of ensuring water use for cities in the United States.

4. *Defenders of Wildlife v. Babbitt*

When implementing the new surplus criteria for the Colorado River, the BOR argued that it did not have to consider the environmental impact on the Delta because it is in Mexico. The BOR also presented this argument when, as part of a consultation regarding the Endangered Species Act (ESA), it organized the Lower Colorado River Basin Multi-Species Conservation Program (MSCP).¹³⁴ Environmental groups, once part of the MSCP, challenged BOR’s decision not to consider the Delta’s environment in the suit *Defenders of Wildlife v. Babbitt* in 2000.¹³⁵ The suit alleged that BOR, the Fish and Wildlife Service, the National Marine Fisheries Service, and the Department of Commerce violated the ESA by failing “to satisfy the consultation requirements of the ESA with regard to protected species in the Colorado River Delta in Mexico.”¹³⁶

The issue in *Defenders of Wildlife* was whether the BOR had to consider extra-territorial species in its consultation even though they live in parts of the Delta that it has no control over.¹³⁷ The Plaintiffs attempted to force the BOR and other agencies to view the Colorado River and its Delta as one interconnected ecosystem that cannot be analyzed in parts.¹³⁸ Certain species, such as the totoaba bass, live solely in Mexico, while many others, like the Southwestern Willow Flycatcher and the Yuma Clapper Rail, migrate between the two countries. While the BOR completed the required consultations on certain species, it refused to perform a formal consultation on the totoaba bass. It claimed that it did not have discretion over how Mexico used the water delivered to it, and, therefore, it did not have to consider the Colorado River Delta.¹³⁹

Environmentalists were hoping that the ruling in this case would force the BOR and the other parties involved in creating the surplus criteria to consider extraterritorial species and create an alternative plan that would not put the Delta at risk. However, the United States District Court in the District of Columbia ruled in March 2003 that the BOR had no discretionary control over the water south of the Mexican border where the Delta is located.¹⁴⁰ The section of the ESA that was the basis of the challenge required consultation only in actions “in which there is discretionary Federal involvement or control.”¹⁴¹ This victory for the BOR ended the Plaintiffs’ attempt to force United States agencies to consider the effects

their actions have on the Mexican environment; it allows the surplus criteria, which pose a serious threat to the Delta environment, to be enforced.

The Law of the River has changed considerably since the signing of the Colorado River Compact in 1922. It is a complex legal framework that is widely debated and not easily understood. As it exists today, the Law of the River provides a rigid, inflexible set of water rights that values historical claims over environmental concerns. As the values of the population in the Colorado River Basin continue to change and pressures on the water grow, the Law of the River must shift to satisfy new social and economic concerns and ensure sufficient water for irrigation, municipalities, and the environment.

IV. Problems

Eighty years ago, when the Colorado River Compact was still a new document, the Colorado River Basin was a different place. Southern California was populated with small towns, not large cities. Las Vegas was home to more tumbleweeds than humans, and Salt Lake City was an agricultural center, not a metropolis.¹⁴² Since that time, urban sprawl has turned deserts into cities, existing cities have seen their populations increase exponentially, and agriculture has changed from sustenance to large cooperatives. Each of these shifts has changed how much and by what means water is used. These shifts have also presented the Colorado River Basin with a unique set of challenges that it will have to resolve in the future to ensure adequate water supplies in the future. This section will discuss a few of the most dramatic problems affecting the Colorado River in the United States and Mexico.

A. Population Growth

The population of the United States-Mexico border region is growing twice as fast as that of the rest of the United States.¹⁴³ Since 1950, the population has increased by over six million people.¹⁴⁴ No one could have predicted this kind of population growth when the original decisions dividing the Colorado River water were made. The growth puts a strain on resources that will only worsen as time goes on. Currently, twenty-three million people in the Lower Basin rely upon the Colorado River for water.¹⁴⁵ The number of people in California that are dependent on Colorado River water is expected to increase by sixteen million people by 2025, and the populations served by the water in Arizona and Nevada are also expected to double.¹⁴⁶ This increase in the population is further complicated by a trend towards higher per capita use of water.¹⁴⁷

The Upper Basin has never used its full apportionment of water, allowing the excess flows to move freely to the Lower Basin. This, however, will change, and surplus flows will eventually disappear. By 2050, the Upper Basin will likely use 1.1 maf more water than it uses now.¹⁴⁸ Also, the Upper Basin could, at any time, begin a system of water banking. This would allow the states of the Upper Basin to preserve more of their allotments of water, leaving less water to flow to the Lower Basin and Mexico.

Much of the population of the Lower Basin relies upon groundwater. However, withdrawals of groundwater are currently unsustainable: the aquifers are being depleted at a much faster rate than they can be recharged.¹⁴⁹ In Arizona, withdrawals exceed recharge by more than 2.5 maf per year.¹⁵⁰ Nevada is also putting substantial pressure on its groundwater resources. The Las Vegas metropolitan area has increased substantially, and its demand is significantly greater than the current supply.¹⁵¹ As this unsustainable use continues and groundwater resources are exhausted, it is likely that the Lower Basin states will look to the Colorado River for replacement water.

There are also problems with the quantity of water in Mexico. This is due not only to population increases, but also to a lack of infrastructure to purify water for use. The population growth in the region, especially in cities like Tijuana and Mexicali, has increased faster than the development of wastewater infrastructure, creating problems with water pollution.¹⁵² Many border communities do not have potable water, and, in some cities, raw sewage and untreated wastewater are released into sources of drinking water.¹⁵³ These pollution problems are creating health problems for the people that inhabit the region and the fragile ecosystem.

The increased population of the Colorado River Basin has already made a serious impact on water use in California. According to the 4.4 Plan, California had to progress towards reducing its water use by December 31, 2002. As the date approached, California municipalities attempted to form agreements with local agricultural interests to transfer part of their 3.3 maf share of water to Southern California cities. Environmentalists objected to these agreements, however, because they would have reduced the agricultural wastewater flows that fed the Salton Sea.¹⁵⁴ Farmers and others were hesitant to stop raising crops on some of their fields, fearing that the reduced activity would cut jobs and further hurt the economy.¹⁵⁵ Eventually, the agreements were loaded with conditions that made them unacceptable to the parties involved, and the deal fell through.¹⁵⁶

On January 1, 2003, Secretary of the Interior Gale Norton cut off the additional supply of water to California, forcing the state, for the first time, to live within its allotted 4.4 maf.¹⁵⁷ This reduction in freshwater will likely force farms to cut production and municipalities to spend more money in water conservation efforts. Some large cities, like San Diego and Los Angeles, are planning to withdraw additional water from their reservoirs.¹⁵⁸ Other users are considering filing lawsuits against the government to increase the water flows. Cities are also considering utilizing non-hydrological sources, such as

desalinizing seawater or recycling water.¹⁵⁹ Action must be taken quickly to reduce water use in California and create a sustainable system of water management.

B. Salinity

Salinity is also a problem that continuously plagues the users of Colorado River water. While the salt concentration at the river's source in Wyoming is only 50 ppm, at the Imperial Dam in California, concentrations can reach 879 ppm.¹⁶⁰ This salt largely comes from agricultural runoff and can be prevented only through the application of more water, which would further compound the shortage problems. It would also require the application of more fertilizer, raising costs for farmers.¹⁶¹

High salinity causes many problems. It damages waterworks, corrodes plumbing, increases construction and maintenance costs, harms water quality, and increases water use, as described above.¹⁶² Because of the damage that salt does to fields, farmers depending on Colorado River water may have to switch to lower-value, heartier crops that can handle higher salt concentrations.¹⁶³ Combined with the additional costs that farmers would have to bear, this could severely impact farmers' ability to make a profit. According to the BOR, salinity in the Imperial Valley cost farmers \$204,000 in 2000 and increase of 1 ppm would cost an additional \$108,000.¹⁶⁴

Salinity also creates high costs for municipalities. A study done by the City of Los Angeles determined that a 1-ppm increase in salinity causes \$300,000 of damage to the water delivery system each year.¹⁶⁵ Consumers must also bear some costs of higher salinity. More soap and detergent are needed, additional water softening is needed, water heaters can be damaged, and fabrics wear out more rapidly.¹⁶⁶ The MWD estimates that reducing salinity by only 100 ppm would save customers \$95 million per year.¹⁶⁷ Increased salinity can also harm human, fish, and animal health. In total, the economic costs of salinity are almost \$1 billion per year; these costs increase by \$2.5 million per ppm in the Lower Basin alone.¹⁶⁸

Minute 242 of the Mexico-U.S. Water Treaty addressed the salinity of water flowing into Mexico. However, the addition of this Minute did not create any permanent solutions to the salinity problem. Salinity is inversely related to Colorado River flows; the higher the flow, the lower the salinity. With Colorado River flows likely to decrease over the years, salinity will increase. Salinity also increases when water is reused.¹⁶⁹ Even if the United States fulfills its duties under Minute 242, salinity could reach unacceptably high levels in Mexico.¹⁷⁰

The high salinity levels could make it difficult for the United States to fulfill the requirements of Minute 242. Removing the necessary amount of salt, about 1.5 million tons, costs between \$27 and \$76 per ton.¹⁷¹ With the federal government decreasing funding to desalination efforts, removing this salt will become increasingly difficult. Already, the United States is in violation of EPA standards. In 1996, the Colorado River Basin Salinity Control Forum (CRBSCF) found that the river's high salinity violated the Clean Water Act.¹⁷²

The federal government has a few options for reducing the salinity of Colorado River water. One option is operating the Yuma Desalting Plant. Built in 1992 at a total cost of \$258 million, the Plant has the capacity to produce 68,000 af of desalinated water annually at a cost of \$350 to \$480 per acre-foot, or \$26 to \$34 million annually.¹⁷³ The Plant has never been used, however, and currently sits idle. In its idle state, the Plant costs \$5.1 million per year in maintenance costs.¹⁷⁴ Even if it is operated, the Plant is not a cost-effective way to deliver low-saline water to Mexico.

It also creates environmental concerns. If government begins operation of the Plant, it would treat water from the Wellton-Mohawk District. Normally, this water would flow down the MODE to create the Cienega de Santa Clara. Treating this water would produce wastewater with extremely high salinity, about 9,400 ppm.¹⁷⁵ This wastewater would be returned to the MODE, where it would flow to the Cienega. This would more than triple the salinity of the water flowing to the Cienega while reducing the overall water flows by seventy percent.¹⁷⁶ The effect on the Cienega habitat and the people who live there would be devastating. Operation of the Yuma Desalting Plant is an expensive option that would irreparably harm the Cienega de Santa Clara. Other alternatives need to be examined.

Another way that the federal government could reduce salinity is to increase flows down the Colorado River by purchasing water rights from farmers.¹⁷⁷ The farmers would not irrigate as much land, reducing the salinity created in the river from agricultural runoff. The increased flow through the Colorado River would also help to dilute the salt that was in the river, creating a lower level of salinity. However, this method would again decrease the water flow to the Cienega, which is largely from agricultural runoff.

B. Indian reservations

Another source of pressure on the already strained resources of the Colorado River is the water rights of Indian reservations. In 1908, the United States Supreme Court ruled in *Winters v. United States* that Indian reservations created by the federal government were implicitly reserved water to "fulfill the purposes for which the reservation was made."¹⁷⁸ These water rights were created at the time of the establishment of the reservation, and therefore fall under the highest priority of the Law of the River in the United States, or "present perfected rights." In the past, Indian tribes in the Lower Basin did not use their water rights due to a lack of funding. Much of the water used by the Indian reservations was really used by farmers leasing reservation lands. Between 1987 and 1993, Indian reservations used only 769,360 af of their 917,552 af allocation.¹⁷⁹

Water use on Indian reservations has been increasing, however. Tribes have begun to develop economically and assert their rights to Colorado River water. In 1992, ten tribes from the Colorado River Basin formed the Ten Tribes Partnership to develop their resources and expand the reservations' water rights.¹⁸⁰ The Partnership is also considering marketing its water to off-reservation users and using the money gained for further economic development. Because of the development of the tribes, experts expect water use on the reservations to increase dramatically. In the Lower Basin, tribal water use is supposed to increase by 0.537 maf by 2050.¹⁸¹ Upper Basin tribal water use is expected to more than double in the next fifty years.¹⁸²

Many Indian tribes are using legal means to secure more water for reservations as well. In Arizona, tribes are attempting to exchange their rights to surface water for rights to CAP water through a settlement between the BOR and the Central Arizona Water Conservation District.¹⁸³ A related settlement pending before Congress would dedicate nearly half of CAP's water to tribal use and provide additional funding for water development on the reservations.¹⁸⁴ Indian water rights could also lead to further shortages for California. There, the Quechan Indian Tribe is in the midst of a land claim proceeding that could reallocate 78,000 af of California's water.¹⁸⁵

As more Indian tribes develop economically, the demand on Colorado River water will increase. While some encourage this development because it could allow municipal users to purchase water rights from the tribes, tribal development will ultimately put a greater strain on Colorado River resources and take needed water away from environmental purposes.

V. The Need for International Cooperation and Other Suggestions for Improvement

The Colorado River Basin and Delta are in a state of crisis. There are increasing demands on the river water from a growing population that conflict with groups seeking to preserve the water for environmental purposes. Historical water interests are protective of their rights and reluctant to give up water to protect the Delta, and new parties are trying to develop what little water remains.

The Delta's survival depends on receiving a permanent supply of water, which necessarily must be taken from existing water interests in the United States or Mexico. This task will be difficult, as "Colorado River water interests represent billions of dollars worth of productive agriculture, business, industry, and the domestic needs of tens of millions of people."¹⁸⁶ Because of the large number of stakeholders affected by decisions made about Colorado River water, any solution to the problems of decreasing flows and environmental damage must be politically and economically viable.

This task is complicated by the two different systems that control the Colorado River. The United States is a large, industrialized country, while Mexico is still in stages of development. Each side of the boundary has different historical, socio-cultural, political, and socio-economic conditions that affect how it makes decisions.¹⁸⁷ Unilateral decisions cannot take all of these important factors into account. Experts agree that any decisions made regarding the fate of the Colorado River and its Delta must be made bilaterally. "[W]hen government actions on the border are taken in isolation from one another, there are bound to be unforeseen negative results."¹⁸⁸ The region needs to be treated as an ecological whole, and though the entire Delta is in Mexico, Mexico alone should not shoulder the responsibility for the area's protection. It is not given sufficient water to protect the environment and provide for its people in large part because the United States diverts ninety percent of the river water before it reaches the NIB.¹⁸⁹ It also is significantly less economically developed than the United States.

The BOR has argued that it does not have to consider Mexico's environment when making its decisions regarding Colorado River water because it does not have discretionary control over what Mexico does with its water. Mexico has little storage capacity on the river, however, and is largely unable to divert water delivered via the Morelos Dam.¹⁹⁰ The water that currently reaches the Delta is spring floodwater that farmers cannot use because the flows do not arrive during the irrigation season. Despite these facts, the United States has proven that it is unwilling to send surplus waters to Mexico to protect the environment without some kind of guarantee that Mexico will use the waters to improve the environment of the Delta.¹⁹¹

Ecosystems do not know borders; environmental problems do not just stop where one country ends and another begins. Because the ecosystems are interconnected, the decision-making bodies need to be integrated as well. A binational agreement to protect the environment of the Delta, the Cienega de Santa Clara, and the Colorado River Basin as a whole is desperately needed. This process will be complicated, highly charged, and resource intensive. However, without such an agreement, the fragile environment of the Delta will likely not survive. This section will examine a few of the steps that the governments of the United States and Mexico can take to ensure that the Colorado River Basin and the Delta are protected. These suggestions are some of the many tactics that the governments could incorporate into a binational agreement to protect the environment.

A. Making the Environment a Priority

The first critical step in any agreement to protect the Colorado River and its Delta is the realization that the environment must be a priority. Any agreements dealing with the Colorado River must not be made without first considering the ecological impacts in the entire ecosystem, not just on one side of the border.¹⁹² These environmental considerations

must also consider the future of the region and the long-term effects of changes in the flows of the river. While the instantaneous effects may be minimal, the long-term effects of increased pollution, reduced flows, and increased salinity can be devastating.

Many of the water interests in the United States currently do not consider saving the environment a priority. This is also true in Mexico, where the environmental movement is just beginning to take hold.¹⁹³ Until water interests on both sides of the border begin to see the true value of a clean, diverse environment, it will be difficult to convince them to forego their water use to protect the environment. Currently, they underestimate the true value of the water they use because it is difficult to assess the monetary value of a clean environment and the species that live there.¹⁹⁴

Education must be an integral part of any agreement to protect the environment of the Colorado River Basin. Residents in local communities must be educated not only on how to protect the Basin and the Delta, but why such protection is important. Without this education, people would not feel the need to protect the environment when it is not economically advantageous for them to do so. Teaching this generation also ensures that lessons about the importance of the environment become a part of the value structure of the next generation.¹⁹⁵ Education is an important part of democracy, and teaching people about the environment will allow them to make their own decisions about their future water consumption.¹⁹⁶

Another important step in making the environment a priority for the governments of the United States and Mexico would be to add an environmental Minute to the Mexico-U.S. Water Treaty of 1944. When the Treaty was written, there was little concern for environmental protection.¹⁹⁷ Now, it is clear that protecting the environment of the Colorado River is necessary. "Available evidence clearly establishes the necessity of certain minimum regular and periodic flows to sustain the incidence and distribution of fauna and flora that comprise the ecosystem."¹⁹⁸ The values of people in the United States and Mexico have also changed, putting a greater emphasis on environmental protection.¹⁹⁹

The environmental Minute should include certain features. First, it must provide a conceptual framework for how the environment should be prioritized under the Treaty and how future environmental values should be recognized. It needs to state clearly what priority is given to the environment and how that change in prioritization affects the other uses of water specified in the Treaty. Second, it should define relevant terms, such as "ecological use." Third, the Minute should specify its relationship to relevant domestic and international laws. Fourth, it should require environmental impact review through EISs and research into new technologies and techniques to save the environment.²⁰⁰ Fifth, the Minute should include means to educate the population of the area on the importance of environmental protection. To reach these goals, the Minute must also dedicate significant resources to environmental protection and define the steps that need to be taken to achieve success.²⁰¹

Currently, environmental protection is the lowest priority of the Colorado River water according to the Treaty, because it is not directly related to economic development.²⁰² Some of the beneficial uses that are currently given precedence over environmental protection do not reflect the current values of the United States. Navigation, once used for commercial purposes on the river, is now limited to recreational uses.²⁰³ Navigation, hunting, and fishing, all uses prioritized higher than environmental protection, directly depend on the health of the ecosystem. Strengthening the environmental protections in the Treaty through an environmental Minute would ensure the quality of future navigation, hunting, and fishing, thus strengthening these functions within the Treaty.²⁰⁴ Additionally, an environmental Minute would strengthen Minutes 242 and 306.

An environmental Minute would also help reconcile the Treaty with domestic and international laws, specifically those relating to endangered species. It is unclear how the ESA, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and Mexico's 1988 Environmental Law relate to the Treaty. For example, the ESA states that United States federal water managers may enter into international agreements to preserve ecosystems if those ecosystems are critical to threatened or endangered species.²⁰⁵ This provides a statutory basis for the United States to protect the Delta environment, as it is home to both threatened and endangered species. Adding an environmental Minute to the Treaty would bring the Treaty's goals in line with those of the ESA. In Mexico, the federal government is also authorized to "regulate the extraction and use of national waters, establish prohibited use zones or to restrict water uses in the public interest."²⁰⁶ The creation of an environmental Minute would make the Treaty more compatible with its domestic environmental laws, including its laws on biodiversity and ecosystem protection.²⁰⁷

Creating an environmental Minute would give the United States and Mexico the opportunity to change the system of priorities for Colorado River water and establish environmental protection as one of the "beneficial uses" of the water. This would give current water interests the basis they need to protect the environment. It would also clarify the governments' perceptions of the relative importance of environmental protection.²⁰⁸ If the federal governments demonstrate their commitment to environmental protection, citizens will likely follow.

The Mexico-U.S. Water Treaty of 1944 does not reflect current societal views about the importance of environmental protection. It does not properly prioritize ecological beneficial use and gives precedent to other uses of water that are directly dependent on the health of the ecosystem. It also does not intermingle easily with environmental protection laws at the national or international level. Creating an environmental Minute that re-prioritizes the use of Colorado River water to emphasize the importance of ecological uses of water would be a significant step towards solving these problems and protecting the environment of the Colorado River Basin and Delta.

B. Creating a Market-Based System

One practical solution for overcoming the difficulties surrounding environmental protection in the Colorado River Basin is to create a market-based system. There are many different ways to create a market-based system for Colorado River water. The Sonoran Institute, a nonprofit organization dedicated to conservation, created one system of voluntary purchases and transfers to help restore the Delta. Under the Sonoran Institute's proposal, conservation-oriented nongovernmental organizations (NGOs) would buy water rights from irrigators in the United States. These water rights would then be retired, and the water would be transferred through the reservoir system and the river to provide instream flows for the Delta.²⁰⁹ By leaving more water in the river, salinity conditions would also improve. The Sonoran Institute believes that this proposal would not upset the current water regime because it is a voluntary system; organizations would raise their own money to buy water only from those who want to sell it.²¹⁰ The Sonoran Institute specifically targets the Wellton-Mohawk Irrigation and Drainage District because the farmers there pay only \$3 per acre-foot of water and produce low economic value crops. Therefore, they may be more willing to sell their water for a lower price than other districts.

Another proposal came from the firm Michael Clinton Engineering (MCE).²¹¹ The MCE proposal includes two separate plans. Both plans involve environmental NGOs and others working with the Mexican water agency (the *Comisión Nacional de Aguas* or the National Water Commission) to identify and purchase marginal agricultural lands in the Mexicali Valley of Mexico. If the lands are suitable for a wetland habitat, they would be transformed using the property's water rights.²¹² In the first proposal, lands that are not suitable to become wetlands would have their water rights retired, and the water designated for the land would be re-routed to the Delta through drainage systems.²¹³ In the second proposal, the water retired in Mexico would be subtracted from the total that the United States has to deliver to Mexico as part of the Mexico-U.S. Water Treaty of 1944. An identical volume of agricultural wastewater, which has higher salinity, would be released upstream and diverted through the MODE canal to the Cienega de Santa Clara for delivery to the Delta.²¹⁴ The second proposal would decrease the water flowing through the main portion of the Colorado River, but the water delivered would be of higher quality (lower salinity). Mexico would still receive the 1.5 maf dedicated to it per the Treaty.

One feasible solution would be a combination of the two proposals outlined above. Water could be purchased according to the voluntary purchase-and-transfer system as outlined by the Sonoran Institute and then delivered to the Delta via the means described by the MCE proposal. This solution is a politically, economically, and legally practical way to resolve the problems plaguing the region and restore water to the Delta. Because the system is voluntary, only those interested in selling their water rights would be involved, and those parties would be compensated for the lost water. If sellers could be found, this system would provide a politically sensitive means of securing water for the Delta.²¹⁵

The program could also reduce the salinity of the river at a lower cost than operating the Yuma Desalting Plant or other available methods.²¹⁶ Water with lower salinity would greatly benefit both the United States and Mexico. Agricultural interests in Mexico would not have to use as much water due to the lower salinity. It would also decrease the expenses due to damage to water delivery systems in Mexicali and Tijuana.²¹⁷ The United States government would save money in its desalinization efforts as well. Between 1994 and 1997, the United States Congress distributed more than \$77 million to control salinity.²¹⁸ These costs could be greatly reduced. In addition, the government would not have to spend money to plan and implement new salinity control projects if a plan, like the one outlined above, is in place to reduce salinity.²¹⁹

The United States and Mexico would also realize additional benefits. In the United States, because less land would be used to irrigate crops, the maintenance and transportation costs involved with delivering the water to the land would be avoided.²²⁰ Additional water flows would also increase hydropower production at certain dams.²²¹ In Mexico, additional water flowing to the Delta would increase the population of shrimp and other marine life.²²² This would support the local fish and shrimp industries. A 1988 study regarding a transfer of 40,000 af of water from the Upper to the Lower Basin concluded that water can be more valuable when left in the river. This conclusion was reached by comparing the cost savings from reduced salinity and the increased hydropower production with the return from the water when it is used for agriculture.²²³

There are some difficulties associated with this proposal, however. First, transfers of water for any purpose are still difficult to obtain. Even if farmers that are willing to sell their water are found, an agreement must still be made with the irrigation district they are a part of before the transfer can go through. In Arizona, the Wellton-Mohawk Irrigation and Drainage District (MWIDD) "has publicly stated that it is not willing to sell or lease water."²²⁴ According to Arizona law, the MWIDD can veto any farmer's decision to sell his or her water rights by forcing the farmer to acquire written consent from the irrigation district.²²⁵ Because of this resistance, NGOs and others involved must search for supplies in many different regions to find an irrigation district that will not object to the sale.

This proposal would also require a binational agreement. Otherwise, the United States may fear that the extra water it releases to Mexico could be used for irrigation instead of environmental protection.²²⁶ Acquiring this agreement would not be a difficult task, as the framework is already in place through the IBWC. The IBWC could create a Minute that obligates Mexico to deliver the additional water flows created by the purchase-and-transfer agreements to the Delta. Mexico would be required by international law to abide by this Minute. Mexico would likely not be opposed to such an agreement because the economic benefits of allowing the water to reach the Delta are greater than those gained by diverting the water for municipal or agricultural uses.²²⁷

Overall, a market-based transfer system is the best means to acquire water for the Colorado River Delta without upsetting the ingrained system of priorities and historical water rights found in the Law of the River. The market-based system would provide great economic benefits to both the United States and Mexico. The additional water flow down the river would reduce costs and increase revenues on both sides of the border. Although there would be some difficulties in implementing this plan, it is a realistic solution to the intensifying problems of the Colorado River Delta.

C. Reducing Water Usage

Another important part of increasing water flows to the Delta and protecting future water supplies throughout the Colorado River Basin is decreasing water use per capita in the United States and Mexico. Water use per capita has been increasing in some Southwestern states, increasing pressure on the Colorado River water.²²⁸ The United States also uses significantly more water than other industrialized countries.²²⁹ Through education, this trend can be reversed, and demand on the river from both sides of the border can decrease. This will require changing how water is used for industrial, residential, and agricultural purposes.

Industrial water use accounts for eight percent of total consumptive water use in the United States.²³⁰ There are many ways that industry can reduce its water use. Business can reduce their overall consumption of water by fixing leaks and identifying processes that are wasteful of water. Educating employees on the importance of saving water can also make a substantial difference in the amount of water used. All employees should be aware of how they can reduce the company's water use. In addition, water should be recycled within a company whenever possible. Many processes do not require freshwater; these processes can be fed wastewater from other parts of the factory.²³¹ Factories can also use automatic shut-off devices for processes that use water. This will insure that water use is limited to what is really needed and that water is not being wasted.²³²

Individual water users also must be more responsible about water use in their homes. Domestic and commercial uses of water account for ten percent of the total water used in the United States.²³³ Forty-one percent of this water is used for toilet flushing and an additional thirty-three percent is used for bathing.²³⁴ Residences and small businesses can reduce their water use by investing in appliances that are more efficient. There are now efficient toilets, showerheads, faucets, washing machines, and dishwashers available.²³⁵ People may also preserve water by being conscious of their water use. Shorter showers, turning off the faucet whenever possible, and only running appliances such as the dishwasher when they are full will substantially reduce overall water use. Residential users also need to be more selective in their use of water outdoors. Water should not be used in the place of a broom to clean outdoor areas. Watering of plants and grass should only be done in the morning and only when necessary, and sprinkler systems should be checked frequently for leaks.²³⁶

By far, the most significant water use in the United States is for irrigation. Irrigation accounts for eighty-one percent of total water use.²³⁷ In the Colorado River Basin, irrigators use more water than elsewhere in the country.²³⁸ This is due, in large part, to the crops they plant. Crops such as alfalfa and cotton are popular in the Colorado River Basin even though they require large amounts of water and are of a relatively low value.²³⁹ Farmers must switch to higher value crops that require less water. "There is still going to be a lot of agriculture, but it is going to get by with less water used more efficiently and probably on higher value crops," Thomas J. Graff, regional director of the advocacy group Environmental Defense and former member of the Colorado River Board of California, explained. "Just throwing water on fields to grow grass or to grow cotton is increasingly inefficient and uneconomic."²⁴⁰ Farmers need to update their irrigation systems so less water can be used to produce more crops. Irrigation systems can also use recycled water, reducing demand for freshwater flows.²⁴¹

There are many means to improve the environment of the Colorado River Delta, including those outlined above. None of these solutions will work in isolation, however. Each tactic used to improve the environment must be agreed upon by both countries. The Delta itself is entirely in Mexico, and, therefore, it is under Mexican legal control. Its welfare is directly subject to local management. However, the United States uses ninety percent of the water that feeds it. The United States also has greater economic resources, the ability to store water, and more political control over the Colorado River water.²⁴² Without agreement between the two sides, the Delta will surely deteriorate even further.

VI. Conclusion

The Colorado River Delta is an important ecosystem that is beautiful, diverse, and endangered. Without a guaranteed permanent flow of water, the ecosystem will decrease until it can no longer support the endangered and threatened species, migrating birds, marine animals, and villages that currently call it home. Recent developments in the United States, such as the increasing population and use of water per capita, the implementation of water banking, increasing water salinity, and the new surplus criteria, put the Delta in even greater danger because they further reduce the flow of fresh water down the Colorado River.

The Law of the River, the set of laws that govern this vast ecosystem, creates a system of water management that is damaging to the ecosystem. It gives highest priority to historical water rights, allocates most river water to agriculture, and places environmental protection below all other non-economic uses of water. Thus, under the current system, leaving water in the river is akin to wasting it, despite evidence that proves the economic benefits of maintaining instream flows. Water

interests on the river are also hesitant to change; they do not wish to reduce their use of the water out of fear that they will not have enough water when they need it.

All of these problems can be overcome, however, through the cooperation of the citizens and governments of the United States and Mexico. Through education, a renewed focus on the environment in international decision-making, a market system of water allocations, and reduced water usage on both sides of the border, the environment of the Delta can improve. These improvements will benefit not only the Delta ecosystem, but also the people of the Colorado River Basin. Salinity will decrease, water flows will increase, and communities on both sides of the river will save money due to the reduced water usage and the lower levels of salinity in the water.

The benefits of the restoration of the Delta ecosystem cannot be underestimated. It will provide environmental, economic, and cultural benefits for generations to come. Losing this habitat would have long-reaching devastating effects on the economy and the environment. The United States and Mexico must take action to protect this region and provide it with the additional water resources it needs. Every year the amount of water flowing down the Colorado River decreases and the Delta grows closer to extinction. Without joint action by the United States and Mexico soon, the Delta will surely be lost. In 1922, Aldo Leopold wrote, "On the map the Delta was bisected by the river, but in fact the river was nowhere and everywhere..."²⁴³ With prompt bilateral action by the United States and Mexico, the Delta can again thrive and offer the next generation the same scenes that Leopold enjoyed.

Footnotes

¹ Jennifer Pitt et al., *Two Nations, One River: Managing Ecosystem Conservation in the Colorado River Delta*, 40 NAT. RES. J. 819, 820 (2000).

² ALDO LEOPOLD, A SAND COUNTY ALMANAC 142-8 (1948).

³ Robert Jerome Glennon & Peter W. Culp, *The Last Green Lagoon: How and Why the Bush Administration Should Save the Colorado River Delta*, 28 ECOLOGY L.Q. 903, 905 (2002).

⁴ MARC REISNER, CADILLAC DESERT 12 (1986).

⁵ Glennon & Culp, *supra* note 3, at 906.

⁶ Pitt et al., *supra* note 1, at 821.

⁷ *Id.*

⁸ *Id.*

⁹ Glennon & Culp, *supra* note 3, at 907.

¹⁰ *Defenders of Wildlife v. Norton*, No. 00-1544, 2003 U.S. Dist. LEXIS 5031, at *11 (D.D.C. Mar. 31, 2003). *See also* Pitt et al., *supra* note 1, at 829.

¹¹ Glennon & Culp, *supra* note 3, at 909.

¹² Pitt et al., *supra* note 1, at 825.

¹³ In El Golfo de Santa Clara, a small village in the Delta, the resurgence of the Delta has meant new ways to make a living: commercial fishing and tourism. *See* Wesley Marx, *Border Waters, The Surprise Return of the Colorado River Delta*, 17 CAL. COAST & OCEAN (2002), at www.coastalconservancy.ca.gov/coast&ocean/winter2002/pages/six.htm.

¹⁴ Glennon & Culp, *supra* note 3, at 909.

¹⁵ An acre-foot (af) is the amount of water it takes to cover an acre of land one foot deep. It equals 325,821 gallons and it is roughly the amount that two families of four use in one year. Measurements along the Colorado River are often in million acre-feet (maf).

¹⁶ Pitt et al., *supra* note 1, at 831; Glennon & Culp, *supra* note 3, at 964.

¹⁷ Annual flows of the Colorado River over the last 400 years average approximately 13.5 maf. Glennon & Culp, *supra* note 3, at 916. The annual necessary flows to sustain the Delta compromise 0.24% of the annual flow. The larger periodic pulse flow represents less than two percent of the annual flow and would not have to be administered every year. Pitt et al., *supra* note 1, at 831.

¹⁸ This refers to the Colorado River Surplus Criteria, which will be discussed in depth later in this paper. Glennon & Culp, *supra* note 3, at 910.

¹⁹ *See* *Defenders of Wildlife v. Norton*, *supra* note 10.

²⁰ Glennon & Culp, *supra* note 3, at 911 (stating that any program to provide water for the Delta will require support from both the United States and Mexico).

²¹ The United States' states include Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The Mexican states include Sonora and Baja California. Pitt et al., *supra* note 1, at 822.

²² This water is not considered part of Mexico's allocation of water because it is too saline. DANIEL F. LEUCKE ET AL., ENVIRONMENTAL DEFENSE FUND, A DELTA ONCE MORE: RESTORING RIPARIAN AND WETLAND HABITAT IN THE COLORADO RIVER DELTA 31 (1999).

²³ Glennon & Culp, *supra* note 3, at 905-6.

²⁴ Pitt et al., *supra* note 1, at 825.

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- ²⁵ In this paper, I use the adjective “United States” instead of “American.” In my travels in Mexico, the Mexican citizens have reminded me that they are Americans too. Therefore, out of respect to Mexicans, I will use the term “United States” instead of “American.”
- ²⁶ Pitt et al., *supra* note 1, at 826.
- ²⁷ “As the river was dammed and its water diverted, the riverside forests, green lagoons, and cattail wetlands receded. Waterfowl, fish, and beavers disappeared. Mudflats dried to barren salt flats, and dust blew where Leopold had canoed. With the loss of delta habitat, migratory waterfowl and shorebirds on the Pacific Flyway were forced to compete for stopover space along the California coast, the Salton Sea, and other stressed areas.” Marx, *supra* note 13.
- ²⁸ Pitt et al., *supra* note 1, at 826.
- ²⁹ Bureau of Reclamation, at <http://www.usbr.gov/> (last visited April 24, 2003).
- ³⁰ El Niño is a disruption in the ocean-atmosphere system that causes strange weather patterns worldwide. National Oceanic and Atmospheric Administration (NOAA), *El Niño Theme Page*, at <http://www.pmel.noaa.gov/tao/elnino/nino-home.html> (last visited April 24, 2003).
- ³¹ Glennon & Culp, *supra* note 3, at 906.
- ³² Dean E. Murphy, *In a First, U.S. Officials Put Limits on California’s Thirst*, NY TIMES, Jan. 5, 2003, at A1.
- ³³ James Sterngold, *WATER PRESSURE: Year-end deadline in Southern California Could Affect North*, SAN FRANCISCO CHRONICLE, Sept. 24, 2002, at A1.
- ³⁴ For information on the increasing demands on Colorado River water, see *infra* text accompanying notes 142-158.
- ³⁵ Pitt et al., *supra* note 1, at 824.
- ³⁶ All of the water from these sources is extremely brackish. *Id.* at 829.
- ³⁷ Glennon & Culp, *supra* note 3, at 909.
- ³⁸ Pitt et al., *supra* note 1, at 824.
- ³⁹ *Id.* at 825.
- ⁴⁰ Glennon & Culp, *supra* note 3, at 933.
- ⁴¹ In 2002, the Sea was thirty-five miles long and between nine and fifteen miles wide. *Id.*
- ⁴² For discussion of why and how to increase water-use efficiency in irrigation for food products, see generally Jim S. Wallace & Peter J. Gregory, *Water resources and their use in food production systems*, 64 AQUATIC SCIENCES 363 (2002).
- ⁴³ Salton Sea Reclamation Act, 112 Stat. 3377 (1998).
- ⁴⁴ Glennon & Culp, *supra* note 3, at 935.
- ⁴⁵ *Id.* at 935-6.
- ⁴⁶ Jennifer Pitt, Chris W. Fitzer & Lisa Force, *New Water for the Colorado River: Economic and Environmental Considerations for Replacing the Bypass Flow*, 6 U. DENV. WATER L. REV. 68, 72 (Fall 2002).
- ⁴⁷ Glennon & Culp, *supra* note 3, at 908.
- ⁴⁸ Pitt, Fitzer & Force, *supra* note 46, at 72.
- ⁴⁹ The organization was renamed in 2000 when responsibility over fisheries was moved to another department. The organization is now known as the Secretary of the Environment and Natural Resources (SEMARNAT – *Secretaría del Medio Ambiente y Recursos Naturales*). SEMARNAT, at <http://www.semarnat.gob.mx/> (last visited April 24, 2003).
- ⁵⁰ Marx, *supra* note 13.
- ⁵¹ For information about the salinity standards of the Mexico-U.S. Water Treaty of 1944, see *infra* text accompanying notes 97-102.
- ⁵² Pitt, Fitzer & Force, *supra* note 46, at 69-70.
- ⁵³ See generally *id.*
- ⁵⁴ *Id.*
- ⁵⁵ Pitt et al., *supra* note 1, at 824.
- ⁵⁶ Glennon & Culp, *supra* note 3, at 912.
- ⁵⁷ *Id.*
- ⁵⁸ *Id.*
- ⁵⁹ *Id.* at 916.
- ⁶⁰ *Id.*
- ⁶¹ Pitt et al., *supra* note 1, at 827.
- ⁶² *Id.* at 834.
- ⁶³ *Id.*; Stephen P. Mumme, *Water Use Symposium: The Case for Adding an Ecology Minute to the 1944 United States-Mexico Water Treaty*, 15 TUL. ENVTL. L.J. 239, 241 (2002).
- ⁶⁴ Pitt et al., *supra* note 1, at 835.
- ⁶⁵ Glennon & Culp, *supra* note 3, at 912.
- ⁶⁶ The Colorado River Compact, 70 Cong. Rec. 324 (1928); ratified by Congress as the Boulder Canyon Project Act 43 U.S.C. § 617(l) (1994).

⁶⁷ *Id.* at Art. I.

⁶⁸ *See id.* at Art III(e).

⁶⁹ The Upper Basin is required to release 75 maf of water to the Lower Basin over 10 year periods. *Id.* at Art. III, (d).

⁷⁰ This interpretation, vague in the original Compact, was clarified by the *Arizona v. California* ruling. *See id.* Art. III, (b); *Arizona v. California*, 373 U.S. 546 (1963).

⁷¹ Glennon & Culp, *supra* note 3, at 917.

⁷² *Id.*

⁷³ For a detailed description of the prior appropriation system, *see* Heather R. Brinton, *Casenote: Arizona v. California: Riding the Wave of Federal Riparianism*, 13 VILL. ENVTL. L.J. 59, 64 (2002).

⁷⁴ United States Department of the Interior, Final Environmental Impact Statement, Colorado River Surplus Criteria Table K-1, Attachment K (2000), available at http://www.lc.usbr.gov/g4000/surplus/pdf/Attachments/Attachment_K.pdf [hereinafter “Final Surplus EIS”].

⁷⁵ *Id.*

⁷⁶ Colorado River Operating Criteria, 35 Fed. Reg. 8,951 (Dep’t Interior, June 4, 1970).

⁷⁷ Glennon & Culp, *supra* note 3, at 918.

⁷⁸ Boulder Canyon Project Act, 45 Stat. 1057 (1928), 43 U.S.C. 617 (1928).

⁷⁹ Glennon & Culp, *supra* note 3, at 919.

⁸⁰ Boulder Canyon Project Act, *supra* note 78, at 10, 14.

⁸¹ Glennon & Culp, *supra* note 3, at 919.

⁸² *Arizona v. California*, 373 U.S. 546, 562 (1963).

⁸³ *Id.* at 587.

⁸⁴ *Id.* at 588.

⁸⁵ *See id.* at 573. In the event of a surplus, California is allocated fifty percent, Arizona is allocated forty-six percent, and Nevada is given four percent. *Arizona v. California*, 376 U.S. 340, 342 (1964).

⁸⁶ *Id.* at 341.

⁸⁷ Thus, the CAP has low priority in water allocation. It is, however, guaranteed 1 maf of water by the Metropolitan Water District (MWD) of California in shortage years. Nonetheless, the CAP will likely not be able to sustain its inflows of 1.2 maf per year for long. This is just one example of the future strain on Colorado River resources. Colorado River Basin Project Act of 1968 (CRBPA), 43 U.S.C. 1501-56 (1968).

⁸⁸ A discussion of all three rivers is beyond the scope of this paper. Treaty on the Utilization of Waters of the Colorado and Tijuana rivers and of the Río Grande, Feb. 3, 1944, U.S.-Mex., 59 Stat. 1219.

⁸⁹ Pitt et al., *supra* note 1, at 828-9. The United States is not required to deliver 1.5 maf only in years with “extraordinary drought or serious accident.” Glennon & Culp, *supra* note 3, at 914-5.

⁹⁰ Pitt et al., *supra* note 1, at 829.

⁹¹ The IBWC is known as the *Comisión Internacional de Límites y Aguas (CILA)* in Mexico. The International Boundary and Water Commission, at <http://www.ibwc.state.gov/> (last visited May 8, 2003).

⁹² Glennon & Culp, *supra* note 3, at 915.

⁹³ *Id.* at 916.

⁹⁴ Pitt et al., *supra* note 1, at 837.

⁹⁵ The International Boundary and Water Commission, *supra* note 91.

⁹⁶ Pitt et al., *supra* note 1, at 837.

⁹⁷ Resolution on the Permanent and Definitive Solution to the International Problem on the Salinity of the Colorado River, Aug. 30, 1973, U.S.-Mex., 24 U.S.T. 1971, available at <http://www.lc.usbr.gov/g1000/pdfiles/min242.pdf> (last visited May 9, 2003).

⁹⁸ Pitt, Fitzer & Force, *supra* note 46, at 70.

⁹⁹ *Id.* at 71.

¹⁰⁰ *Id.*

¹⁰¹ This is the water that created the Cienega de Santa Clara. Recommendations on the Colorado River Salinity Problem, Mar. 22, 1965, U.S.-Mex., 24 U.S.T. 1965.

¹⁰² Clean Water Act, 33 U.S.C. §§ 9601 – 9675 (1972).

¹⁰³ Glennon & Culp, *supra* note 3, at 932.

¹⁰⁴ United States-Mexico Studies for Future Recommendations Concerning the Estuarine Ecology of the Limitrophe Section of the Colorado River and its Associated Delta (Minute 306), Dec. 12, 2000, at <http://www.ibwc.state.gov//Files/Minutes/Min306.pdf>.

¹⁰⁵ *Id.*

¹⁰⁶ Proceedings from the United States – Mexico Colorado River Delta Symposium, Sept. 11-12, 2001, at <http://www.ibwc.state.gov/FAO/CRDS0901/EnglishSymposium.pdf>.

¹⁰⁷ Glennon & Culp, *supra* note 3, at 937.

¹⁰⁸ *Id.*

¹⁰⁹ *Id.*

¹¹⁰ See generally Offstream Storage of Colorado River Water and Development and Release of Intentionally Created Unused Apportionment in the Lower Division States, 43 C.F.R. 414 (1999).

¹¹¹ *Id.*

¹¹² Glennon & Culp, *supra* note 3, at 939.

¹¹³ U.S. Census, Population, Housing Units, Area Measurement, and Population Density Table, at <http://www.census.gov/population/censusdata/table-2.pdf> (last visited May 9, 2003).

¹¹⁴ Glennon & Culp, *supra* note 3, at 936.

¹¹⁵ *Id.*

¹¹⁶ Boulder Canyon Project, Agreement Requesting Apportionment of California's Share of the Colorado River Among the Applicants in the State (the "Seven Party Agreement"), Aug. 18, 1931.

¹¹⁷ *Id.*

¹¹⁸ See Glennon & Culp, *supra* note 3, at 940.

¹¹⁹ *Id.* at 941.

¹²⁰ *Id.*

¹²¹ *Id.*

¹²² *Id.* at 942.

¹²³ Douglas Jehl, *Thirsty Cities of Southern California Covet the Full Glass Held by Farmers*, NY TIMES, Sept. 24, 2002, at A22.

¹²⁴ Key Terms of the Quantification Settlement Among the State of California, IID, CVWD and MWD, available at http://www.cvwd.org/wateriss/Key_Terms.htm (Oct. 15, 1999) [hereinafter "Key Terms of Quantification Settlement"].

¹²⁵ *Id.*

¹²⁶ Nancy Vogel, *Milestone Water Accord Ok'd*, LA TIMES, Oct. 17, 2002, at 1.

¹²⁷ Glennon & Culp, *supra* note 3, at 945.

¹²⁸ Key Terms of Quantification Settlement, *supra* note 123, Appendix A.

¹²⁹ Glennon & Culp, *supra* note 3, at 946.

¹³⁰ The Basin States Alternative, 65 Fed. Reg. 48,531 (Aug. 8, 2000). Modifications were published at 65 Fed. Reg. 57,371 (Sept. 22, 2000).

¹³¹ Record of Decision, Colorado River Interior Surplus Guidelines, 66 Fed. Reg. 7,772 (Dep't Interior, Jan. 25, 2001).

¹³² National Environmental Policy Act of 1969, Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970.

¹³³ Final Environmental Impact Statement, *supra* note 74, at 2-10.

¹³⁴ See Lower Colorado Multi-Species Conservation Program, available at <http://www.lcrmscp.org> (last visited May 10, 2003).

¹³⁵ See *Defenders of Wildlife v. Norton*, *supra* note 10. The suit's name was changed to the *Defenders of Wildlife v. Norton* when Gale Norton became Secretary of the Department of the Interior.

¹³⁶ *Id.* at *3.

¹³⁷ *Id.* at *18.

¹³⁸ See Glennon & Culp, *supra* note 3, at 959-960.

¹³⁹ *Defenders of Wildlife v. Norton*, *supra* note 10, at *13.

¹⁴⁰ See *id.*

¹⁴¹ The Endangered Species Act, 50 C.F.R. § 402.03 (1986).

¹⁴² Glennon & Culp, *supra* note 3, at 940.

¹⁴³ Susan Lieberman Goodwin, *Conservation Connections in a Fragmented Desert Environment: The U.S.-Mexico Border*, 40 NAT. RES. J. 989, 994 (2000).

¹⁴⁴ *Id.*

¹⁴⁵ Glennon & Culp, *supra* note 3, at 926.

¹⁴⁶ *Id.*

¹⁴⁷ *Id.*

¹⁴⁸ Final Environmental Impact Statement, *supra* note 74.

¹⁴⁹ Goodwin, *supra* note 143, at 995.

¹⁵⁰ Glennon & Culp, *supra* note 3, at 926.

¹⁵¹ To remedy this, the SNWA requested that the state bring in 80,000 af of water from Southern Nevada. *Id.* at 927.

¹⁵² Goodwin, *supra* note 143, at 995.

¹⁵³ *Id.*

¹⁵⁴ Jehl, *supra* note 123.

¹⁵⁵ Vogel, *supra* note 126.

¹⁵⁶ Dean E. Murphy, *supra* note 32.

¹⁵⁷ T. R. Reid, *Troubled Waters: Fight Brews Over Mighty Colorado River*, WASH. POST, Jan. 19, 2003, at A03.

¹⁵⁸ *Id.*

¹⁵⁹ Murphy, *supra* note 32.

¹⁶⁰ Glennon & Culp, *supra* note 3, at 930.

¹⁶¹ *Id.*

¹⁶² *Id.*

¹⁶³ *Id.*

¹⁶⁴ *Id.* at 931.

¹⁶⁵ *Id.*

¹⁶⁶ *Id.*

¹⁶⁷ *Id.*

¹⁶⁸ *Id.*

¹⁶⁹ *Id.* at 932.

¹⁷⁰ *Id.*

¹⁷¹ *Id.*

¹⁷² *Id.* at 933.

¹⁷³ Pitt, Fetzer & Force, *supra* note 46, at 83.

¹⁷⁴ *Id.*

¹⁷⁵ *Id.* at 84.

¹⁷⁶ *Id.*

¹⁷⁷ *See id.* at 75.

¹⁷⁸ *Winters v. United States*, 207 U.S. 564 (1908).

¹⁷⁹ Glennon & Culp, *supra* note 3, at 928.

¹⁸⁰ *Id.*

¹⁸¹ *Id.*

¹⁸² *Id.* at 929.

¹⁸³ *Id.* at 928.

¹⁸⁴ *Id.* at 929.

¹⁸⁵ *Id.*

¹⁸⁶ *Id.* at 951.

¹⁸⁷ Christopher P. Brown & Stephen Mumme, *Applied and Theoretical Aspects of Binational Watershed Councils (Consejos de Cuencas) in the U.S.-Mexico Borderlands*, 40 NAT. RES. J. 895, 917 (2000).

¹⁸⁸ Goodwin, *supra* note 143, at 1000.

¹⁸⁹ Pitt et al., *supra* note 1, at 843.

¹⁹⁰ The Morelos Dam was created as a diversion dam and was not designed as a storage reservoir. Glennon & Culp, *supra* note 3, at 955-6.

¹⁹¹ Pitt et al., *supra* note 1, at 843.

¹⁹² *Id.* at 842.

¹⁹³ Paulette L. Stenzel, *The U.S. and Mexico Sin Fronteras—Without Borders: Sustainable Development from a Local Perspective*, *in press* (2003).

¹⁹⁴ This, in economics, is called an externality because something external to the market transaction must bear additional costs. For an explanation of externalities as they relate to the environment, *see* Externality, at <http://library.thinkquest.org/26026/Economics/externality.html> (1999).

¹⁹⁵ For information on Environmental Education, *see* EPA, Environmental Education, at <http://www.epa.gov/enviroed/index.html> (last updated Feb. 12, 2003); The Global Development Research Center, Environmental Education Objectives, at <http://www.gdrc.org/uem/ee/2-1.html> (last visited May 11, 2003).

¹⁹⁶ Stenzel, *supra* note 193.

¹⁹⁷ Mumme, *supra* note 63, at 241.

¹⁹⁸ *Id.* at 246.

¹⁹⁹ Environmental protection became a major concern in the United States in the 1970s, and environmental groups began to express their views during this time to the IBWC. In Mexico, environmental concerns developed later, in the mid-1990s, and are still developing. *Id.* at 242.

²⁰⁰ This paragraph based on *id.* at 253-4.

²⁰¹ Pitt et al., *supra* note 1, at 844.

²⁰² *Id.* at 247.

²⁰³ *Id.* at 248.

²⁰⁴ *Id.* at 249.

²⁰⁵ *Id.*

²⁰⁶ Comisión Nacional de Aguas, Ley de Aguas Nacionales Ch. 5, Art. 38 (1992).

²⁰⁷ Mumme, *supra* note 63, at 251.

²⁰⁸ *Id.* at 253.

²⁰⁹ Glennon & Culp, *supra* note 3, at 964; The Sonoran Institute, at <http://www.sonoran.org/> (last visited May 11, 2003).

²¹⁰ Glennon & Culp, *supra* note 3, at 964.

²¹¹ Michael Clinton Engineering, Proposal for Packard Foundation: Water Augmentation for the Colorado River Delta, Sept. 14, 2000 (unpublished proposal).

²¹² *Id.*

²¹³ *Id.*

²¹⁴ *Id.*

²¹⁵ Glennon & Culp, *supra* note 3, at 972.

²¹⁶ *Id.* at 974.

²¹⁷ *Id.* at 975.

²¹⁸ *Id.* at 976.

²¹⁹ *Id.*

²²⁰ *Id.*

²²¹ *Id.*

²²² *Id.* at 977.

²²³ *Id.* at 976.

²²⁴ *Id.* at 972.

²²⁵ *Id.*

²²⁶ Because of conditions in Mexico, it is unlikely that the water would be used for anything other than restoring the Delta. Mexico does not have infrastructure to store significant amounts of water; it would have no choice but to let the water flow down the river. *Id.* at 977.

²²⁷ *Id.*; for a more complete description of the difficulties that may be encountered while implementing this agreement, *see generally id.*

²²⁸ *Id.* at 926.

²²⁹ EPA, *Water on Tap: A Consumer's Guide to the Nation's Drinking Water*, at <http://www.epa.gov/ogwdw/wot/howmuch.html> (last visited May 11, 2003) [hereinafter "Water on Tap"].

²³⁰ EPA, *How We Use Water in These United States*, at <http://www.epa.gov/water/you/chap1.html> (last updated Mar. 18, 2003).

²³¹ These tactics taken from *Water on Tap*, *supra* note 229.

²³² Colorado Office of Water Conservation, *Water Saving Tips!*, at <http://cwcb.state.co.us/owc/freefa.htm> (last visited May 11, 2003).

²³³ *How We Use Water in These United States*, *supra* note 230.

²³⁴ *Id.*

²³⁵ *Water on Tap*, *supra* note 229.

²³⁶ Information in this paragraph taken from *Water Saving Tips!*, *supra* note 232.

²³⁷ *How We Use Water in These United States*, *supra* note 230.

²³⁸ Jehl, *supra* note 123.

²³⁹ Murphy, *supra* note 32.

²⁴⁰ *Id.*

²⁴¹ For more information about how to make irrigation more efficient, *see generally* Wallace & Gregory, *supra* note 42.

²⁴² Pitt et al., *supra* note 1, at 843.

²⁴³ LEOPOLD, *supra* note 2, at 141-2.