JENNIFER PITT, DANIEL F. LUECKE*, MICHAEL J. COHEN**, EDWARD P. GLENN***, & CARLOS VALDÉS-CASILLAS****

Two Nations, One River: Managing Ecosystem Conservation in the Colorado River Delta

ABSTRACT

The Colorado River delta historically consisted of riparian, freshwater, brackish, and tidal wetlands that covered 1,930,000 acres and supported a legendary richness of plant, bird, and marine life. Dam construction and water diversions in the United States and Mexico in the twentieth century reduced the Delta to small areas of wetlands and brackish mudflats. The Delta is no longer a system that can be understood solely in terms of biology and hydrology; human actions, embedded within a complex institutional framework, have significantly altered and modified the Delta. In the last two decades, flood releases from reservoirs in the United States and agricultural return flows from both the United States and Mexico have begun to restore Delta ecosystems on about 150,000 acres. Deliberate management of existing water resources can significantly improve conditions in this region. This article reviews the numerous institutions that can play a role in conservation of the Colorado River delta and discusses options to protect the Delta's ecosystems, including changing international institutions and agreements to support Delta ecosystems; using U.S. federal law to find legal remedies; asserting Delta ecosystem requirements in ongoing, related management issues; establishing market mechanisms and funding sources for Delta preservation; and increasing public participation in Colorado River decisions that affect the Delta.

* Jennifer Pitt is a Senior Resource Analyst and Daniel F. Luecke is a Senior Scientist; both are with Environmental Defense, 2334 Broadway, Boulder, CO 80302.

** Michael J. Cohen is a Research Associate with the Pacific Institute for Studies in Development, Environment, and Security, 654 13th Street, Preservation Park, Oakland, CA, 94612.

*** Edward P. Glenn is Director of the Environmental Research Laboratory, University of Arizona, 2601 E. Airport Drive, Tucson, AZ, 85706.

**** Carlos Valdés-Casillas is Director of the Center for Conservation and Use of Natural Resources and Head of Research at the Instituto Tecnológico y de Estudios Superiores de Monterrey, Campus Guaymas, Bahía Bacochibampo S/N, Apdo. P. 484, Guaymas, Sonora, 85450, Mexico.

I. INTRODUCTION

Prior to the construction of major dams[1] along its route, the Colorado River fed a great delta in the midst of the Sonoran desert. Spread across the northernmost end of the Gulf of California,[2] the Colorado River delta's (Delta) vast riparian, freshwater, brackish, and tidal wetlands once covered 1,930,000 acres (475 square miles) and supported a wealth of plant, bird, and marine life. As most of the river's flow reached the Delta, freshwater, silt, and nutrients helped create a complex system of wetlands that provided feeding and nesting grounds for birds, and spawning habitat for fish and crustaceans.[3] The legendary richness of the Gulf of California can be attributed to the Delta's productivity as well as its capacity to support marine and bird life. In contrast to the aridity of the surrounding Sonoran Desert, the Colorado River delta's abundance was striking. In *A Sand County Almanac*, Aldo Leopold recalled a visit:

> I have never gone back to the Delta of the Colorado since my brother and I explored it, by canoe, in 1922....For all we could tell, the Delta had lain forgotten since Hernando de Alarcón landed here in 1540....On the map the Delta was bisected by the river, but in fact the river was nowhere and everywhere, for we could not decide which of a hundred green lagoons offered the most pleasant and speedy path to the Gulf.[4]

Today, conditions in the Delta have changed. Like other desert river deltas, such as the Nile[5] and the Indus,[6] human activity has greatly altered the Colorado River delta. Decades of dam construction and water diversions in the United States and Mexico have reduced the Delta to a remnant system of small wetlands and brackish mudflats. During the years

1. There are more than 20 storage reservoirs with capacities greater than 20,000 acre-feet in the Colorado River basin (an acre-foot is 325,851 gallons of water, roughly the amount two families of four use in one year). Total storage capacity in these reservoirs exceeds 60 million acre-feet, four times the river's average annual flow. The two largest reservoirs in the basin are Lake Mead (25.88 million acre-feet) and Lake Powell (24.32 million acre-feet). *See* DALE PONTIUS, SWCA, INC., COLORADO RIVER BASIN STUDY: REPORT TO THE WESTERN WATER POLICY REVIEW ADVISORY COMMISSION 9 (1997).

2. The Gulf of California is also known as the Sea of Cortez.

3. *See* Edward P. Glenn et al., *Effects of Water Management on the Wetlands of the Colorado River Delta, Mexico*, 10 CONSERVATION BIOLOGY 1175, 1176 (1996).

4. ALDO LEOPOLD, A SAND COUNTY ALMANAC 141-42 (1968).

5. *See generally* Daniel Jean Stanley & Andrew G. Warne, *Nile Delta: Recent Geological Evolution and Human Impact*, 260 SCIENCE 628 (1993).

6. *See generally* Robin M. Leichenko & James L. Wescoat Jr., *Environmental Impacts of Climatic Change and Water Development in the Indus Delta Region*, 9 WATER RESOURCE DEV. 247 (1993).

that reservoirs filled behind upstream dams and captured floodwaters, almost no freshwater flows reached the Delta.

Once Lake Mead filled behind Glen Canyon Dam in 1981, flood flows began periodically to reach the Delta, and the Delta's ecosystems began to make a slow comeback.[7] From 1980 to 1998, total water releases to the Delta have amounted to an estimated 20 percent of the Colorado's total flows over the same period, most of it either floodwater or wastewater from agricultural and municipal sources. Despite the irregularity of flood flows and the high salinity and pollutant content of wastewater, these sources of water have begun to revive some areas of the Delta. Recent hydrologic and institutional conditions have unintentionally and inadvertently caused wetlands and riparian vegetation to flourish on about 150,000 acres, an important restoration of habitat.

As long as these conditions prevail, the Delta's existing ecosystems should continue to thrive. Large, established demand for water by irrigators, cities, and other important constituencies makes it extremely unlikely that substantial pre-development-like flows can be restored to the Delta in the short term. Nevertheless, the habitat gains of recent years should be acknowledged and protected, as a run of dry years or additional water consumption upstream along the river could jeopardize existing Delta ecosystems.

Even in its present state, the Delta is the largest remaining wetland system in the southwest region of North America and supports a very productive estuary. As ongoing field studies document the ecological, social, and economic values of the Delta's ecosystems, it is increasingly likely that these values will be recognized in deliberations over the allocation of surplus waters, and that instream flows may be dedicated to sustain them.[8] At the same time, increasing population throughout the region and growing pressures on water, land, and other resources will intensify the strain on the Delta. Water users both north and south of the border may be forced to make difficult choices about Colorado River allocations.

7. For the purposes of this article, a flood is any volume of Colorado River water that crosses the U.S.–Mexico international border and is delivered at a rate that exceeds Mexico's diversion capacity and inundates land (either within the levees or beyond) that is normally dry. These floods occur as a result of releases from U.S. reservoirs for flood control purposes (or other reasons), or directly as a result of flooding in the United States (e.g., flooding in the Gila basin).

8. Department of Interior Secretary Bruce Babbitt noted that there should be "no net loss to environmental resources" in the Colorado River delta, in extemporaneous remarks during his 1999 speech to the Colorado River Water Users Association. Department of the Interior Secretary Bruce Babbitt, Remarks at the Meeting of the Colorado River Water Users Association Annual Meeting (Dec. 17, 1999) (tape available at the Colorado River Water Users Association, Coachella, CA).

If the U.S. federal government and the Colorado River basin states[9] in the United States were to recognize the Delta's ecosystems in the allocation of Colorado River water, the current regime of flows reaching the Delta could be protected.[10] Furthermore, key additional areas of the Delta could be restored through more efficient use of the water that now flows into the Delta, by purposefully managing existing water resources such as agricultural drainage, wastewater, and floodwater, without adverse effects on other Colorado basin water users. Although the Delta's ecosystems deserve greater consideration in the allocation of Colorado River water, the Delta's minimum requirements are surprisingly modest.

This article reviews the Colorado River delta's natural history, the institutions and policies that shape river management, and explores opportunities for conservation of the Delta's ecosystems. Because the Colorado River is so tightly controlled and regulated, the problem of protecting the Delta's ecosystems is ultimately one of institutional and social change. Options to protect the Delta's ecosystems include changing international institutions and agreements to support Delta ecosystems; using U.S. federal law to apply legal remedies; asserting Delta ecosystem requirements in ongoing, related management issues; establishing market mechanisms and funding sources for Delta preservation; and increasing public participation in Colorado River decisions that affect the Delta.

II. THE DELTA

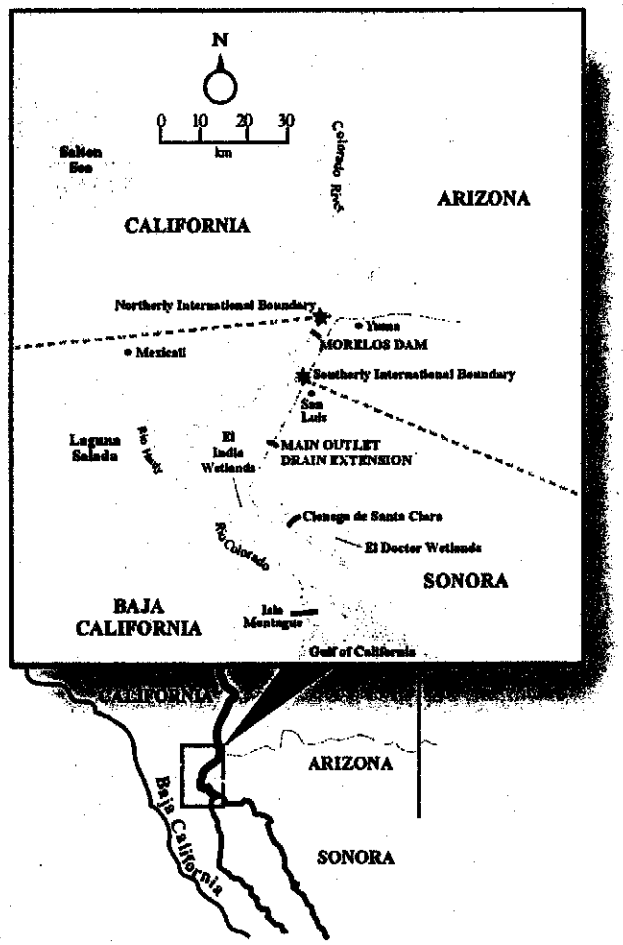
A. Contemporary Geography

The Colorado River flows through nine states in two countries. Its headwaters lie in the Rocky Mountains of the United States in the high peaks of Wyoming and Colorado, more than 1000 miles north of the Delta. The Colorado River watershed encompasses 244,000 square miles, 2000 of which are in Mexico. The current extent of the Delta lies completely within the borders of Mexico (see figure 1).

9. The U.S. Colorado River basin states are Colorado, New Mexico, Utah, and Wyoming in the Upper Basin, and Arizona, California, and Nevada in the Lower Basin.

10. Significantly, the Law of the River effectively ignored ecological considerations in the basin until the passage, in 1992, of the Grand Canyon Protection Act of 1992, Pub. L. 102-575 § 1801-1809, 106 Stat. 4600, 4669-73.

Figure 1: The Colorado River Delta, 2000



The U.S.–Mexico border follows the Colorado River for about 24 miles between southwestern Arizona and northeastern Baja California. The Morelos Dam in Mexico stands as the last major structure on the river's mainstem. The point at which the international boundary diverges from the river and continues southeast is known as the Southerly International Boundary (SIB).

In Mexico, below the SIB, the river's alluvial plain forms a broad delta. The Delta is presently confined by levees and encompasses

approximately 150,000 acres, within which the river periodically floods. In the center of the Delta, about 50 river miles south of the SIB, the Río Hardy joins the Colorado River from the northwest. A local tributary, the Río Hardy is about 16 miles long and drains about 135 square miles below the nearby Cucapá Mountains. Most of the Río Hardy's flow is brackish water that drains from surrounding agricultural fields.[11] East of the Colorado's mainstem, the Main Outlet Drain Extension canal delivers additional agricultural wastewater to the Delta from southern Arizona in the United States. At the end of its course, the Colorado River empties into the northern end of the Gulf of California.

Outside of the levees, the Delta is surrounded by the agricultural valleys of Mexicali and San Luis Río Colorado and the Sonoran Desert. These farmlands comprise some 500,000 acres irrigated with a portion of Mexico's share of Colorado River water delivered from Morelos Dam via the Central Canal.[12] Beyond the irrigated landscape lies the Sonoran Desert ecosystem, dominated by arid soils and low shrubs.

During the twentieth century, river flows into the Delta have been reduced nearly 75 percent;[13] in 24 of the past 40 years, less than two percent of the Colorado River's estimated undepleted flow reached the Delta. This reduction in water brought less silt, fewer nutrients, higher salinity, and higher concentrations of pollutants, resulting in major changes to the Delta.[14] Erosion—rather than accretion—is now the dominant physical process in the Delta, a highly unusual condition for a river delta.[15] Like other river deltas at risk, such as the Nile's, the Colorado's delta has actually decreased in size.[16]

The loss of freshwater flows to the Delta over the past century, combined with land use changes, has reduced Delta wetlands and riparian areas to about five percent of their original extent.[17] Non-native species, better adapted to high-saline, low-flow conditions, have further compromised the ecological value of the region. Native forests of cottonwood and willow, which supported greater species richness and

11. Total dissolved solids in the water of the Río Hardy have been documented at 4,000-5,000 parts per million. *See* Edward P. Glenn et al., *Status of Wetlands Supported by Agricultural Drainage Water in the Colorado River Delta, Mexico*, 34 HORTSCIENCE 16, 18-19 (1999).

12. *See* CARLOS VALDÉS-CASILLAS ET AL., INFORMATION DATABASE AND LOCAL OUTREACH PROGRAM FOR THE RESTORATION OF THE HARDY RIVER WETLANDS, LOWER COLORADO RIVER DELTA, BAJA CALIFORNIA AND SONORA, MEXICO 10 (1998).

13. *See* Glenn et al., *supra* note 11, at 16.

14. The natural ecology of most of the world's large river systems has been disrupted by dams, flow diversions, channelization of riverbeds, and alteration of riparian zones by agricultural activities that in turn reduce flows, silt accretion, and nutrient loads to their deltas.

15. *See* Glenn et al., *supra* note 3, at 1177.

16. *See* Stanley & Warne, *supra* note 5, at 628.

17. *See* Glenn et al., *supra* note 3, at 1181.

density than any other desert habitat,[18] have yielded to non-native salt cedar and iodinebush, decreasing the habitat value of the riparian corridor.[19]

B. The Undisturbed Delta: Before Upstream Development

The Colorado River delta ecosystem's pre-development conditions provide a context for understanding the current ecosystem, as well as for understanding the goals for ecological restoration. Undisturbed river deltas tend to be highly productive and diverse ecosystems,[20] and the Colorado River delta was no exception. Until the 1930s, highly variable flood cycles on the Colorado created a dynamic delta nearly twice the size of Rhode Island, populated by a rich array of adaptable and resilient plant and animal species, as well as human communities that lived off this bounty. Historically, as much as 70 percent of the Colorado River's silt load was carried to the Delta,[21] importing nutrients and extending the Delta ever wider into the upper Gulf of California. These sediments and nutrients created a fertile delta that once supported an estimated 200 to 400 species of vascular plants.[22] The Delta's richness was further increased by the action of tides typically ten feet or more in amplitude, an unusually high ebb and flow that extended the tidal estuary 35 miles upriver.[23] The interaction of these tidal flows with freshwater from the Colorado River created a rich breeding ground for the marine life of the Gulf of California.

The Delta was also home to a local people known as the *Cucapá*, or "the people of the river."[24] Descendants of Yuman-speaking Native Americans, the *Cucapá* have inhabited the Delta for nearly a thousand years and used the Delta floodplain extensively, harvesting Palmer's saltgrass (a wild grain), and cultivating corn, beans, and squash. Other foods included

18. *See* Jake Rice et al., *Comparison of the Importance of Different Habitat Attributes to Avian Community Organization*, 48 J. WILDLIFE MGMT. 895, 905-09 (1984).

19. *See* MARK K. BRIGGS & STEVE CORNELIUS, DEFENDERS OF WILDLIFE, OPPORTUNITIES FOR ECOLOGICAL IMPROVEMENT ALONG THE LOWER COLORADO RIVER AND DELTA: FINAL REPORT 4 (1997).

20. *See* EDWARD J. KOMONDY, CONCEPTS OF ECOLOGY 378 (4th ed. 1996).

21. Between 45 million and 455 million metric tons of silt per year were transported through the Grand Canyon between 1922 and 1935. *See* W. L. Minckley, *Native Fishes of the Grand Canyon Region: An Obituary?*, *in* COLORADO RIVER ECOLOGY AND DAM MANAGEMENT 124, 126 (National Research Council ed.,1991).

22. *See* Exequiel Ezcurra et al., *Freshwater Islands in a Desert Sand Sea: The Hydrology, Flora, and Phytogeography of the Gran Desierto Oases of Northwestern Mexico*, 9 DESERT PLANTS 35 (1988).

23. *See* JACK M. PAYNE ET AL., DUCKS UNLIMITED, INC., FEASIBILITY STUDY FOR THE POSSIBLE ENHANCEMENT OF THE COLORADO DELTA WETLANDS, BAJA CALIFORNIA NORTE, MEXICO 8 (1992).

24. *See* Sandra Postel et al., *Allocating Fresh Water to Aquatic Ecosystems: The Case of the Colorado River Delta*, 23 WATER INT'L 119, 121 (1998).

mesquite, deer and wild boar, wild geese and ducks, doves, quail, and fish, providing a subsistence lifestyle that required a healthy Delta ecosystem.[25]

C. The Delta Transformed

The physical transformation of the Colorado River delta is the result of numerous local and basin-wide developments. By the nineteenth century, the Delta was open for navigation, and steamboats consuming riverside cottonwoods for fuel traveled from Yuma, Arizona, through the Delta to the Gulf of California, in an active river trade.[26] By the early 1900s, farmers in the Mexicali Valley had begun to clear the land and irrigate their fields. Irrigators in the United States, subjected to the river's annual cycle of spring floods and low summer flows, demanded that the federal government control the Colorado River to provide a consistent and reliable supply of water.[27] Water's power to transform the dry desert landscape, and its power to generate electricity, would make Colorado River water an irresistibly valuable resource throughout the twentieth century.

As the West's population and need for water have grown, the Colorado River has been tapped through a system of dams and diversions. Over its 1400-mile course, the Colorado is interrupted by more than 10 major dams. More than 80 major diversions carry water away from the river for agriculture and other uses.

The construction of Hoover Dam in Nevada in the 1930s marks the beginning of the modern era for the Colorado delta. For six years, as Lake Mead filled behind the dam, virtually no freshwater reached the Delta. Even spring flooding was captured, and the riparian zone of the river from Morelos Dam to the junction with the Río Hardy was a dry ecosystem, dominated by widely spaced mesquite trees.[28] As Lake Mead filled, the river flow was perennial below the junction of the two rivers due to the discharge of agricultural wastewater from the Mexicali Valley and tidewater entering from the Gulf of California. The marked decrease of water in the mainstem from Morelos Dam to the confluence with the Río Hardy recurred from

25. *See* Anita Alvarez de Williams, *Cocopá*, *in* 10 HANDBOOK OF NORTH AMERICAN INDIANS 99 (Alfonso Ortiz ed., 1983).

26. *See id.*; GODFREY SYKES, THE COLORADO DELTA 30-34 (1937). *See generally* MARK K. BRIGGS, RIPARIAN ECOSYSTEM RECOVERY IN ARID LANDS (1996).

27. *See* NORRIS HUNDLEY, JR., WATER AND THE WEST: THE COLORADO RIVER COMPACT AND THE POLITICS OF WATER IN THE AMERICAN WEST 5-10 (1975).

28. These observations are based on inspection of 1972 aerial photographs and interviews with residents. *See* VALDÉS-CASILLAS ET AL., *supra* note 12, at 5.

1963 to 1981 as Lake Powell filled behind the newly-constructed Glen Canyon Dam in Arizona (see figure 2).[29]

Today, with these reservoirs near capacity, the dams are used to regulate flows so that water can be reliably apportioned among users. Most flood flows can be contained, regulated, and added to the river's capacity to supply agriculture and urban centers. Floodwaters, known as "space-building" or "spill" flows, are released from Lake Mead, the largest reservoir on the river, only when the U.S. Bureau of Reclamation (BOR), the agency managing the dams, predicts flows that exceed the system's capacity for use and storage.

The Colorado River is now one of the most highly regulated and diverted rivers in North America. Virtually every drop is accounted for in the allocation of water among nine states (seven in the United States and two in Mexico) and the 27 native tribes that have rights to use it.[30] The river irrigates more than 3.7 million acres of farmland in the southwestern United States and Mexico, and supplies water to nearly 30 million people. While irrigated agriculture tops the list of Colorado River water uses in the United States and Mexico, the second largest consumption of water is evaporation from reservoirs.[31] Diversions out of the Colorado basin, such as water delivered to Los Angeles, are the third largest use, followed by municipal and industrial uses. In addition to providing water for consumptive use, the dams along the Colorado River in the United States provide hydroelectric power to the states in the U.S. Southwest, with a total generating capacity of about 4425 megawatts.[32]

In years without flooding, the only Colorado River water to cross the border is the 1.5 million acre-feet allotted by treaty to Mexico,[33] slightly more than 10 percent of current estimates of the river's average annual

29. *See* INT'L BOUNDARY & WATER COMM'N, WESTERN WATER BULLETIN: FLOW OF THE COLORADO RIVER AND OTHER WESTERN BOUNDARY STREAMS AND RELATED DATA (1960-1998); U.S. GEOLOGICAL SURVEY, GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1313, COMPILATION OF RECORDS OF SURFACE WATERS OF THE UNITED STATES THROUGH SEPTEMBER 1950, PART 9: COLORADO RIVER BASIN 709-29 (1954).

30. There are 34 tribes in the Colorado River basin, of which 27 claim rights to Colorado River water. *See* PONTIUS, *supra* note 1, at 72.

31. Allocations made under the laws and compacts that make up the Law of the River do not account for 1.5 million acre-feet in annual evaporative losses from mainstem reservoirs. *See* PONTIUS, *supra* note 1, at 10.

32. *See* Larry MacDonnell & Bruce Driver, *Rethinking Colorado River Governance*, 1996 PROCEEDINGS REPORT FROM THE COLORADO RIVER WORKSHOP 181, 190.

33. *See* 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.

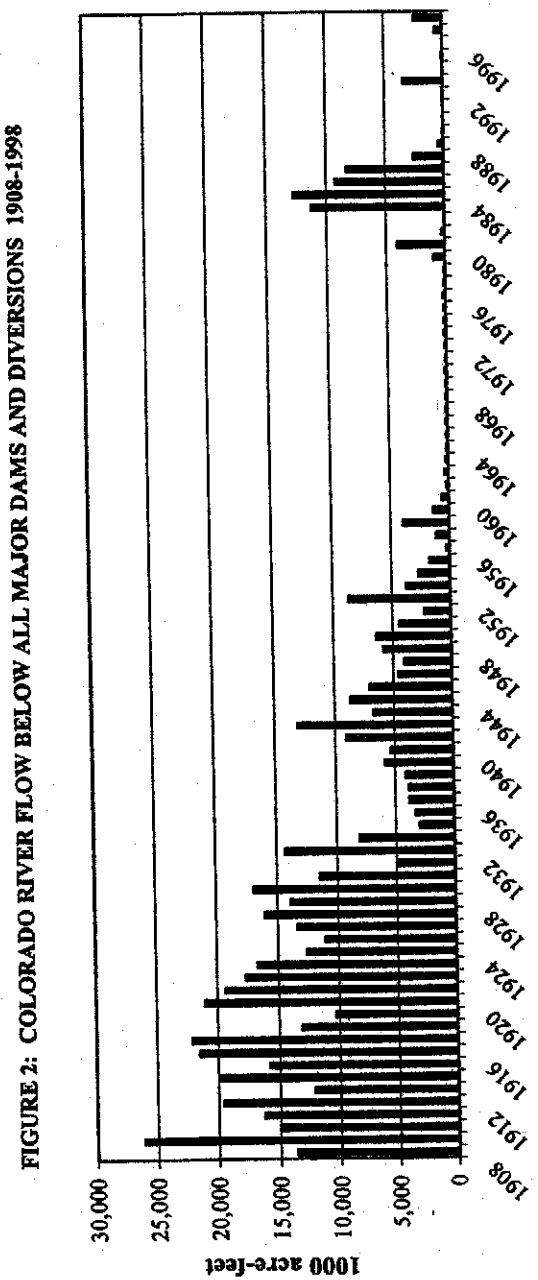


FIGURE 2: COLORADO RIVER FLOW BELOW ALL MAJOR DAMS AND DIVERSIONS 1908-1998

flow.[34] The United States delivers 90 percent of Mexico's water allotment to the Northerly International Border (NIB) at Morelos Dam. Mexico diverts this water to the Mexicali and San Luis Río Colorado irrigation districts by way of the Central Canal,[35] which has a capacity sufficient to divert Mexico's entire allocation. Water in the Central Canal not used for irrigation is routed to Mexicali and Tijuana for municipal use.[36] The ten percent of Mexico's allocation delivered at the SIB in the San Luis Río Colorado valley is diverted for irrigation. In years without flood releases, no Colorado River water reaches the remnant Delta wetlands below the diversion points; the only water reaching the Delta comes from groundwater seeps, agricultural drainage, and tidewater.[37]

D. Colorado River Delta: Endangered Species, Habitat, and Water Requirements

Despite its diminished state, the Delta plays a significant ecological role extending far beyond the bounds of its 150,000 acres. The Delta supports a variety of wildlife, including several threatened and endangered species listed in both the United States and Mexico.[38] The Delta is a key

---

34. The average flow (over the 90 year historic record) of the Colorado River is 15 million acre-feet. Flows as low as 6 million acre-feet and as high as 24 million acre-feet have been recorded. *See* PONTIUS, *supra* note 1, at 6. In 1976 researchers estimated the long-term annual flows of the Colorado River, based on extensive tree-ring sampling for the years 1520-1961, at approximately 13.5 million acre-feet. *See* David Tarboton, *Hydrologic Scenarios for Severe Sustained Drought in the Southwestern United States*, 31 WATER RESOURCES BULL. 803 (1995).

35. Approximately 2 million acre-feet per year are used for irrigation in the Mexicali and San Luis Río Colorado valleys, with Colorado River water making up the majority of this supply. *See* VALDÉS-CASILLAS ET AL., *supra* note 12, at 22.

36. Telephone Interview with Robert Ybarra, Foreign Affairs Officer, International Boundary and Water Commission (Jan. 29, 1999).

37. *See* Glenn et al., *supra* note 3, at 1178. The Colorado River provides considerable value in terms of recreational and fish and wildlife benefits. However, the ecological needs of the Colorado River have only recently gained legal recognition and protection. *See* David H. Getches, *Colorado River Governance: Sharing Federal Authority as an Incentive to Create a New Institution*, 56 U. COLO. L. REV. 573, 573-74 (1997).

38. Listed species include the desert pupfish, listed in the United States and Mexico (the largest remaining population anywhere is in the Ciénega de Santa Clara); the Yuma clapper rail, listed as an endangered species in the United States and Mexico; the bobcat, listed only in Mexico; the vaquita porpoise, the world's smallest marine mammal, listed in Mexico, and in the United States as a species of special concern by the Marine Mammal Commission; and the totoaba, listed in both the United States and Mexico, now virtually extinct, a steel-blue fish that grows up to seven feet and 300 pounds, and once supported a commercial fishery that closed in 1975. In addition, Mexico lists five threatened species: the yellow-footed gull, Heermann's gull, elegant tern, reddish egret, and peregrine falcon; three species for special protection: the brant, house finch, and mockingbird; and one rare species: the great blue heron. *See* 50 C.F.R. § 17.11 (listing endangered or threatened species under the U.S. Endangered Species Act).

stopover along the Pacific Flyway and supports large numbers of wintering waterfowl.[39] Although resident and migratory bird densities have not been studied extensively, the Delta is considered a key element of the Flyway, and the only significant freshwater wetland among the Mexican Pacific Coast marshes.[40] In the United States, the total acreage of habitat in the lower basin of the Colorado River is estimated to support fewer than half as many birds.[41]

Agricultural wastewater, tides, a small amount of naturally occurring run-off, and artesian springs provide perennial water to the Delta. Seventeen agricultural drains from the Mexicali Valley flow into the Colorado River delta. The Ciénega de Santa Clara[42] receives agricultural wastewater from both Mexico and the United States. The U.S. agricultural wastewater flows from southern Arizona's Wellton-Mohawk Irrigation and Drainage District via a canal built by the U.S. BOR in 1977, the Main Outlet Drain Extension (MODE) canal.[43] In sum, agricultural drain flows contribute an average annual volume of 200,000 acre-feet of water to the Delta.[44]

Flood flows along the river's mainstem sustain the increasingly rare, and ecologically valuable, native riparian vegetation in the upper reaches of the Delta. Since 1980, Colorado River flood flows have again reached the Delta intermittently due to near capacity storage at Lake Mead and a series of years with above average precipitation. From 1980 to 1993,

Listings are found in Mexico's endangered species act as well, *see* "Norma Oficial Mexicana que Determina las Especies y Subespecies de Flora y Fauna Silvestres Terrestres y Acuáticas en Peligro de Extinción Amenazades, Raras y las Sujetas para su Protección," D.O., 16 de mayo de 1994 (NOM-059-ECOL-1994).

39. *See* PAYNE ET AL., *supra* note 23, at 3.

40. Delta habitat is estimated to support 68,000 resident and 49,000 nonresident summer birds. *See* DANIEL F. LUECKE ET AL., ENVIRONMENTAL DEFENSE FUND, A DELTA ONCE MORE: RESTORING RIPARIAN AND WETLAND HABITAT IN THE COLORADO RIVER DELTA 24 (1999) (citing the calculations found in B.W. Anderson & Robert D. Ohmart, *Vegetation*, *in* INVENTORY AND MONITORING OF WILDLIFE HABITAT 639 (Allen Y. Cooperrider et al. eds., 1986)).

41. *See id.* The comparison between river reaches in the United States and Mexico is made to emphasize the importance of the Delta region to the overall lower Colorado River ecosystem.

42. A marsh created and sustained by the irrigation drainage delivered by the Main Outlet Drain Extension canal. *See* Glenn et al., *supra* note 11.

43. The water in the MODE is too saline to be included in Mexico's allocation of Colorado River water. The U.S. BOR at one time planned to remove the salt from this water, and the MODE was built as a temporary drain for Wellton-Mohawk agricultural wastewater while the Yuma Desalting Plant was under construction. Completed in 1992, the Yuma Desalting Plant has never been operated due to high costs (estimated to be $25 million annually) and availability of lower-salinity water from other sources. A decision to operate the plant could result in the cessation of flows in the MODE, with devastating consequences for the Ciénega de Santa Clara. *See* LEUCKE ET AL., *supra* note 40, at 31.

44. *See* Glenn et al., *supra* note 11, at 17.

average annual flood flows across the border (cross-border flows minus Mexico's allotment) were 3.9 million acre-feet, nearly three times Mexico's treaty allotment, and 25 percent of the average flow before dams blocked the river.[45] In addition to freshwater flood flows, large tides flood some 81,500 acres in the Delta on a daily basis.[46]

In recent years, researchers inventoried the vegetative response to floods, and concluded that the reestablishment of native forest species in the riparian corridor has been a direct consequence of overbank flooding below Morelos Dam since the filling of Lake Powell.[47] Specifically, modest annual flows (below Morelos Dam) of 32,000 acre-feet have been estimated to be sufficient to maintain, even improve, cottonwood-willow habitat in the upper reaches of the Delta.[48] Annual flood events are not necessary for survival of these native tree species: they are capable of surviving at least a three-to-four-year interval between major flow events in the Delta floodplain.[49] Pulse flows of 260,000 acre-feet, released at a rate of 3,500–7,000 cubic-feet per second, are sufficient to inundate the Delta's floodplain within the levees, sustain riparian corridor vegetation, and stimulate seed germination.[50] This flood volume and release rate is on a par with recent flood releases and is likely to occur on average every four years under the present Colorado River management regime unless there is an extended drought.[51]

E. Water Dedicated to the Delta

A coalition of environmental organizations and research scientists are calling for conservation of the Delta's existing habitat and sufficient

45. *See id.* at 19.

46. *See id.* at 16.

47. More field research is needed to quantify with certainty the required volume and frequency of these floods. In addition, freshwater flow needs of Delta fisheries and Gulf near-shore marine species have not been quantified. The flows needed for restoration cited in this article do not include the needs of aquatic species. *See generally* LUECKE ET AL., *supra* note 40, at 17-32.

48. *See id.* at 42.

49. It is not clear whether the survival of the Delta's riparian vegetation depends on local agricultural return flows or other sources that may recharge the riparian zone during periods in which water does not flow from the United States. *See id.* at 20.

50. Fieldwork conducted after the 1997 floods documented high-intensity riparian vegetation in approximately 30 percent of the floodplain, with evidence of widespread seed germination of native trees as well as salt cedar. Peak flows of 3,500–7,000 cubic feet per second (cfs) inundated nearly the entire floodplain between the levees below Morelos Dam, and diluted significantly the salinity of ocean water in the tidal zone. *See id.*

51. The 260,000 acre-foot pulse flow represents less than two percent of the Colorado's average annual flow.

water to sustain it, by establishing dedicated flows to the region.[52] These water requirements are currently met through inadvertent and unprotected flood flows and agricultural wastewater. More field research is needed to quantify with certainty the volume and frequency of floods necessary to conserve existing habitat. Significantly, freshwater flow needs of Delta fisheries and the Gulf's near-shore marine species have not been quantified. Because the water that currently sustains the Delta arrives there inadvertently and is unprotected, it is vulnerable to further upstream development as well as to reductions due to drought. Dedication of instream flows in the quantity presently reaching the Delta is necessary to preserve existing habitat. In addition, ecosystem health could be enhanced through changes that do not require additional dedicated flows, such as the timing of water deliveries and improvements in water quality. One short-term improvement would be to provide regular flood releases every few years to inundate riparian and wetland areas, study the vegetative response, and further adapt the timing of these releases to maximize benefits to the Delta ecosystem.

If agricultural wastewater can be deliberately managed, many areas of the Delta can be sustained without any additional dedicated flows. Water quality problems in some wetlands supported by agricultural wastewater require mitigation to protect humans who come into contact with the water or eat the local wildlife and fish. The brackish water pumped from the Wellton-Mohawk Irrigation and Drainage District in Arizona currently bypasses the Yuma Desalting Plant[53] and is discharged via the MODE canal into the Ciénega de Santa Clara, where it sustains some 50,000 acres of wetlands.[54] Agricultural wastewater may not be an ideal source of water,

52. The coalition remains informal, but has in the past included representatives from the American Humane Association, American Rivers, Amigos Bravos, Animal Protection Institute, Asociación Ecológica de Usuarios de los Ríos Hardy y Colorado (AEURHYC), Audubon Council of Utah, Biodiversity Legal Foundation, Border Ecology Project, Bosques de las Californias, A.C., Bradshaw Mountain Wildlife Association, Center for Biological Diversity, Center for Environmental Connections, Centro de Derecho Ambiental e Integración Económica del Sur A.C. (DASSUR), Centro de Estudios de los Océanos y Desiertos (CEDO), Centro Regional de Estudios Ambientales y Socioeconómicas (CREAS), Defenders of Wildlife, Ducks Unlimited, Earth Island Institute, Environmental Defense, Friends of Pronatura, Forest Guardians, Fund for Animals, Glen Canyon Institute, Great Salt Lake Audubon, The Humane Society of the United States, In Defense of Animals, International Rivers Network, International Sonoran Desert Alliance, ITESM–Campus Guaymas, National Audubon Society, Northwest Ecosystem Alliance, Pacific Institute, Pro Esturos, Pronatura Sonora, Sierra Club, Sonoran Institute, Southwest Rivers, Southwest Toxic Watch, and Wetlands Action Network. These organizations represent over eight million United States and Mexican citizens.

53. *See supra* note 43.

54. *See* Edward P. Glenn et al., *Ciénega de Santa Clara: Endangered Wetland in the Colorado River Delta, Sonora, Mexico* 32 Nat. Resources J. 817, 817 (1992).

yet its benefits may—for the present—outweigh its liabilities, particularly since there are few other potential sources for restoring Delta ecosystems.

II. COLORADO RIVER MANAGEMENT

Defining ecological needs is an important component of preserving the Delta, but good science alone will not suffice. The Delta is no longer a system that can be understood solely in terms of biology and hydrology: human actions, embedded within a complex institutional framework, have significantly altered and modified the Delta. Any program to restore the Colorado River delta will necessarily engage the array of arrangements and institutions that govern the management of the Colorado River.

A. The Law of the River

A complex set of legal and administrative agreements, known as the Law of the River,[55] governs use of Colorado River water. The Law of the River is not explicitly defined or codified in any single location; it is a dynamic bundle of rules subject to frequent dispute, re-interpretation, revision, and expansion. The Law of the River allocates Colorado River water according to a three-tiered set of priorities. At the top is the United States' international obligation to deliver 1.5 million acre-feet of water within a prescribed salinity range to Mexico each year. The second tier allocates water within the upper and lower basins in the United States, and to the states within each basin. The lowest tier allocates water within each state.

The Law of the River allocates more water than actually flows down the river in most years. Over the historic long term, the average annual flow of the Colorado is 13.5 million acre-feet.[56] Yet when the river was apportioned, first by the Colorado River Compact of 1922,[57] and subsequently by the Upper Colorado River Basin Compact of 1948,[58] court

55. A considerable literature exists on the Law of the River. *See generally* David Getches, *Competing Demands for the Colorado River*, 56 U. COLO. L. REV. 413 (1985); Charles Meyers, *The Colorado River* 19 STAN. L. REV. 1 (1966); Charles Meyers & Richard Noble, *The Colorado River: The Treaty with Mexico* 19 STAN. L. REV. 367 (1967); NEW COURSES FOR THE COLORADO RIVER: MAJOR ISSUES FOR THE NEXT CENTURY (Gary D. Weatherford & F. Lee Brown eds., 1986); Larry MacDonnell et al., *The Law of the Colorado River: Coping with Severe Sustained Drought*, 31 WATER RESOURCES BULL. 825 (1995).

56. *See supra* note 34.

57. The full text of the Compact can be found in RAY LYMAN WILBUR & NORTHCUTT ELY, THE HOOVER DAM DOCUMENTS, H.R. Doc. No. 80-717, at A17 (1948). The Compact can be found on-line at <http://www.glencanyon.org/CRC.HTM>. The Compact was ratified by Congress in the Boulder Canyon Project Act 43 U.S.C. § 617(l) (1994).

58. 63 Stat. 31 (1949).

decisions, federal law, and international treaty, the river was overallocated because allocations were based on erroneously high estimates of average annual flow.[59] Compounding the problems of overallocation are numerous different interpretations of the definition of consumptive use, treatment of evaporation from reservoir surfaces, and water delivery obligations of the Upper Basin states (Colorado, New Mexico, Utah, and Wyoming) under the treaty to Mexico.[60] To date, none of the Upper Basin states has used its full annual apportionment, enabling reservoirs to maintain storage near capacity, in turn prompting flood flow releases in the recent, above-average flow years.

Implementation of the Law of the River has been subject to considerable litigation and discussion. It is generally accepted that the Law of the River gives priority to

> (1) the delivery of water to Mexico;
> (2) "present perfected rights" (water rights exercised prior to 1922, including the rights of Indian tribes);
> (3) delivery of water to the Lower Basin for consumptive uses;
> (4) consumptive uses in the Upper Basin;
> (5) economic, nonconsumptive uses (e.g., power generation); and
> (6) non-economic, nonconsumptive uses (e.g., environmental protection).[61]

To date, the Law of the River contains no provision for allocating water to support the ecological health of the Colorado's delta. In 1973, the 1944 Treaty with Mexico[62] was amended with Minute 242, which established salinity standards for water delivered at the NIB.[63] The impact of Minute 242 on the Delta is indirect: because some agricultural wastewater from southern Arizona is too saline to meet the standard, it is channeled into Mexico in a canal and drains into the Ciénega de Santa Clara, where it sustains the Delta's largest wetlands.[64]

59. The river's annual average flow for the period 1911-1960 was 13 million acre-feet, yet 16.5 million acre-feet are allocated among Mexico and the U.S. states. *See* Meyers, *supra* note 55, at 2, 15; Meyers & Noble *supra* note 55, at 388.

60. *See generally* Getches, *supra* note 55.

61. *See generally* Meyers, *supra* note 55.

62. Treaty with Mexico Respecting Utilization of the Waters of the Colorado and Tijuana Rivers and of the Río Grande, Feb. 3, 1944, U.S.–Mex., 59 Stat. 1219, 1265.

63. *See Agreement on the Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River* Resolution 1, IBWC Minute 242 (Aug. 30, 1973), *reprinted at* 12 I.L.M. 1105, 1105 [hereinafter Minute 242].

64. *See supra* note 43.

Despite stiff institutional resistance, resource managers have slowly begun to recognize the need to manage for ecological values in the Delta. The Law of the River developed under the premise that water left instream was "wasted," a norm challenged over the past generation by a society increasingly sensitive to environmental considerations. In the United States, under the mandate of the Endangered Species Act, the federal government and the states are working towards restoration and protection of habitat and endangered species protection in both the Upper and Lower Basins. In 1987, the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin[65] was developed to protect and improve in-stream flows, restore habitat, and reduce the adverse effects of non-native fish species. In the Lower Basin states (Arizona, California, and Nevada), water users representing irrigation, municipal, and power interests launched the Lower Colorado River Multi-Species Conservation Program (MSCP)[66] in 1994 to mitigate water development impacts on threatened and endangered species while at the same time optimizing water diversions and hydroelectric power production. The Grand Canyon Protection Act of 1992[67] established an important precedent for the Colorado River, prioritizing environmental concerns regarding power generation at Glen Canyon Dam.[68] In 1996, as required by the Act, the BOR released a flood of stored water from behind Glen Canyon Dam in an effort to redistribute sediments in the Grand Canyon and re-create eroded

65. The Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (RIP) is a cooperative effort involving the U.S. FWS; BOR; Western Area Power Administration; the states of Utah, Colorado, and Wyoming; water users; and environmentalists. The recovery program, which is expected to require 15 years, contains five major elements: (1) habitat management, designed to identify and acquire in-stream flows and changes in operation of federal reservoirs in the basin; (2) habitat development based on the development of research methods for creating, protecting, and improving habitat; (3) stocking native fish based on a genetic management plan; (4) non-native species control; and (5) research, monitoring, and data management programs designed to study various means of recovering fish, monitor long-term population trends, recommend flows, evaluate genetic differences between populations, recommend "refugia" (facilities to hold and protect rare fish), evaluate differences between hatchery and wild fish, establish brood stock, and develop and manage a centralized database. *See* FISH AND WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR, RECOVERY IMPLEMENTATION PROGRAM FOR ENDANGERED FISH SPECIES IN THE UPPER COLORADO RIVER BASIN (2000).

66. *See* Multi-Species Conservation Program (MSCP) for the Lower Colorado River, Arizona, Nevada, and California, 64 Fed. Reg. 27,000, 27,000-27,002 (1999).

67. Pub. L. 102-575 § 1801-1809, 106 Stat. 4600, 4669-73.

68. *See* JASON J. MORRISON ET AL., PACIFIC INSTITUTE, THE SUSTAINABLE USE OF WATER IN THE LOWER COLORADO RIVER BASIN 4 (1996).

beaches.[69] These efforts suggest a growing awareness of the importance of the river's ecological health and the flexibility to address new concerns.

Of particular relevance to the magnitude and frequency of flood flows are the "Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs,"[70] which invest the Secretary of the Interior with the authority to determine surplus and shortage conditions and guide the allocation of surplus water among users. The U.S. Department of the Interior (DOI) must prepare a yearly plan for managing reservoirs in the system and must declare whether a surplus or shortage exists. In early 2000, the DOI began drafting a set of criteria to standardize the process by which these surplus determinations are made (see Section IV infra, Surplus and Shortage Criteria).

One unresolved aspect of Colorado River water allocation is the extent of Indian reserved water rights in the United States.[71] These rights are defined in a series of court decisions that set a basis for quantifying them. The quantity of unadjudicated rights is large, particularly those rights associated with Navajo reservation lands.[72]

B. Governing Institutions

The number of agencies with jurisdictional authority over the Delta, Colorado River water, and border-related environmental issues, is daunting. Successful, long-term preservation of the Delta will require cooperation between Mexico and the United States, among states and resource agencies and tribes, and the active involvement of nongovernmental organizations, communities, and citizens. A review of the likely players and several long-standing, related resource management issues suggests the involvement of many.

1. International Boundary and Water Commission

The only institution with binational authority over surface water resources in the border region is the International Boundary and Water Commission (IBWC), known as *Comisión Internacional de Límites y Aguas* (CILA) in Mexico. Created in 1889,[73] the IBWC/CILA is charged with applying provisions of various boundary and water treaties. The scope of its work includes boundary maintenance, reclamation projects, allocation of transboundary water resources, construction and maintenance of sewage and sanitation works, and the resolution of treaty and water quality disputes.[74] Today, the IBWC/CILA 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 responsive to public concerns."[75] For the most part, the IBWC/CILA has limited its focus to problems of water supply and quality along the border, leaving issues of environmental protection to the jurisdiction of other Mexican and U.S. agencies. In late 1997, IBWC/CILA established a binational workgroup to bring together agency managers from both countries to discuss a research agenda.[76] At present the workgroup is considering several proposals, but has yet to act.[77]

2. NAFTA Institutions

Several international organizations were established with the 1993 signing of the North American Free Trade Agreement (NAFTA). The North American Commission for Environmental Cooperation (CEC) was created with a broad mandate to promote regional cooperation, prevent environmental disputes, and promote effective enforcement of environmental laws. The CEC facilitates cooperation between the three NAFTA nations (Mexico, Canada, and the United States)—through exchange of information, promotion of scientific research, and access to

69. The 1996 flood helped increase the sandbar volume of 50 percent of the camping beaches measured between Glen Canyon and Hoover dams. The flood bypassed the dam's turbines, and cost approximately $2.5 million in lost hydropower revenues. *See* DAVID A. HARPMAN, AMERICAN GEOPHYSICAL UNION, THE ECONOMIC COST OF THE 1996 CONTROLLED FLOOD (Geophysical Monograph No. 110, 1999).

70. *See* Arizona v. California, 373 U.S. 546 (1963) (opinion). *See also* Arizona v. California, 376 U.S. 340 (1964) (decree).

71. *See* Allen V. Kneese & Gilbert Bonem, *Hypothetical Shocks to Water Allocation Institutions in the Colorado River Basin*, *in* NEW COURSES FOR THE COLORADO RIVER: MAJOR ISSUES FOR THE NEXT CENTURY 94, 94-98 (Gary D. Weatherford & F. Lee Brown eds., 1986).

72. *See id.* at 97.

73. The International Boundary Commission was formed in 1889, and renamed the IBWC following the Treaty with Mexico Respecting Utilization of the Waters of the Colorado and Tijuana Rivers and of the Río Grande, Feb. 3, 1944, U.S.–Mex., 59 Stat. 1219. *See* STEPHEN P. MUMME, COMISSION ON ENVIRONMENTAL COOPERATION, THE INSTITUTIONAL FRAMEWORK FOR TRANSBOUNDARY INLAND WATER MANAGEMENT IN NORTH AMERICA: MEXICO, CANADA, THE UNITED STATES, AND THEIR BINATIONAL AGENCIES, at IV.3 (1996).

74. *See generally* Meyers & Noble, *supra* note 55.

75. *See International Boundary and Water Commission Web Site* (visited Sept. 5, 2000) <http://www.ibwc.state.gov/>.

76. *See* International Boundary and Water Commission, IBWC-34-97, Meeting of the Commission to Form a Fourth Colorado River Matters Task Force Regarding the Colorado River Data (Oct. 28, 1997) (unpublished document, on file with author).

77. The workgroup met for a short time in 1997, and then was inactive until late 1999 when it was reconvened. At that time the workgroup members from the United States agreed to propose several collaborative research initiatives. Telephone Interview with Sam Spiller, Lower Colorado River Coordinator, U.S. Fish and Wildlife Service (May 22, 2000); International Boundary and Water Commission, *supra* note 76.

information and public participation at a regional level—on priority projects of their environmental agencies.[78]

The Border Environmental Cooperation Commission (BECC) was established at the same time as NAFTA, although not formally as a component of NAFTA or its related environmental side accord.[79] BECC is designed to promote and certify "environmental infrastructure" projects in the U.S.–Mexican border region, and while it neither develops nor manages the projects, it aids local communities in their efforts to improve environmental conditions, including developing their water-supply, wastewater-treatment, and solid-waste management infrastructures.[80]

3. *National Agencies*

Both the United States and Mexico acknowledge the importance of Delta ecosystems in domestic and international policy arenas. In 1993, parts of the Delta and the upper Gulf of California were declared a Biosphere Reserve[81] by the Mexican government. Natural resource agencies from both nations cooperate on projects in the Delta, including revegetation in the Delta riparian area and technical support for local ecotourism efforts.[82] National agencies with programs in the border region include several U.S. agencies, the Environmental Protection Agency (EPA) and Department of the Interior (DOI); and Mexico's Secretariat of the Environment, Natural Resources, and Fisheries (SEMARNAP).

In Mexico, SEMARNAP has jurisdiction over environmental protection, natural resource management, and the management of marine resources, and it helps develop and implement the nation's Ecology Law.[83] SEMARNAP's National Institute of Ecology (INE) carries out environmental research and development, evaluates Mexico's environmental policies, and implements its natural resource programs. INE administers the "National System of Protected Natural Areas" and is

78. The CEC funds projects through the North American Fund for Environmental Cooperation. *See* Stephen P. Mumme & Pam Duncan, *The Commission on Environmental Cooperation and the U.S.–Mexican Border Environment*, 5 J. ENV'T & DEV. 197, 197-215 (1996).

79. The commission was conceived as a mechanism to win support for the trade pact among U.S. border states, the rationale being that environmental infrastructure improvements could mitigate any potential environmental degradation associated with NAFTA's promised economic development. *See id.* at 5.

80. *See* MUMME, *supra* note 73, at IV.4.

81. *See* CENTRO DE INVESTIGACIONES CIENTÍFICAS Y TECHNOLÓGICAS DE LA UNIVERSIDAD DE SONORA ET AL., PROGRAMA DE MANEJO DE LA BIOSFERA DEL ALTO GOLFO DE CALIFORNIA Y DELTA DEL RÍO COLORADO 4 (1995).

82. *See* U.S. Dep't of the Interior, U.S.–Mexico Sonoran and Chihuahuan Desert Initiatives, (Feb. 9, 2000) (unpublished activities report, on file with author).

83. Ley General de Equilibrio y la Protección al Ambiente. *See* MUMME, *supra* note 73, at I.2.

responsible for establishing and managing all natural areas, including the Biosphere Reserve in the upper Gulf of California and the Colorado River delta.[84] The Biosphere Reserve's management team includes law enforcement, as well as staff for the research station in the Golfo de Santa Clara. Although none have been established in the Delta as yet, INE also oversees the System of Wildlife Management Units, which establishes small wildlife refuges that can be managed for the economic benefit of local communities.[85]

Also within SEMARNAP is the National Water Commission (CNA), which has nearly complete jurisdiction over water resources and planning in Mexico. CNA builds potable water, sanitation, wastewater-treatment, irrigation, drainage, and flood control systems. It administers Mexico's system of water rights and pumping permits, and shares (with INE) responsibility for the nation's water quality. CNA has recently attempted to decentralize its decision making by establishing local watershed councils. State and municipal governments have little local control over water resources.[86]

In the United States, several federal agencies have some jurisdiction over activities in, or impacting, the Delta. The EPA regulates water quality, and has supported research on selenium in Delta waters.[87] In addition, two DOI agencies play critical roles. The Fish and Wildlife Service (FWS) administers the Endangered Species Act[88] and is mandated to review federal actions for adverse impacts to endangered species.[89] The BOR operates the dams on the Colorado River in the United States and has stated it is planning to conduct a needs assessment of the Colorado River delta in cooperation with Mexican agencies under the auspices of the IBWC/CILA, although no action has yet been taken.[90]

84. Other protected areas include national parks, national marine parks, areas for protection of vegetation and wildlife, and natural monuments.

85. Land protected by regulation under the Wildlife Management Units (known as UMAs) includes public, private, and common holding (i.e., *ejido*) lands. *See* VALDÉS-CASILLAS ET AL., *supra* note 12, at 72.

86. In an attempt to enhance the influence of user groups and allow some local control of water resources, Mexico has established District Water Committees (*Comités Hidráulicos*) composed of water users. In addition, River Basin Councils were created in 1992 to help decentralize water management. CNA sits on both the irrigation district committees and the river basin councils. *See* MUMME, *supra* note 73, at I.1.3

87. Jaqueline Garcia-Hernandez, Bioaccumulation of Selenium in the Ciénega de Santa Clara, Colorado River Delta, Sonora, Mexico (Feb. 26, 1999) (unpublished manuscript, on file with author).

88. 16 U.S.C. §§ 1531-1543 (1994) (amended in 1978 by Pub. L. No. 95-632, 92 Stat. 3751).

89. *See* MUMME, *supra* note 73, at III.2.8.2.

90. Telephone interview with Robert Johnson, Regional Director, Lower Colorado Region Office, U.S. Bureau of Reclamation (Feb. 1999).

4. Tribes, Basin States, and Local Communities

Beyond the national government agencies, numerous authorities play a role in Colorado River management. In the United States, 34 Indian reservations are located in the Colorado basin. Twenty-seven tribes have undeveloped Colorado River water rights that date to the establishment of their reservations or to more recent court decisions.[91] Together these tribes assert rights to more than two million acre-feet of water,[92] but little has been developed. Many tribes are looking for ways to secure economic benefits from their entitlements other than traditional water supply development. For example, the ten tribes of the Colorado River Tribal Partnership formed a coalition to secure, develop, and market their water rights.[93]

State and local governments also play a role in Colorado River management. The seven Colorado River basin states in the United States (Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming) wield considerable decision-making power over water allocations, flows, storage, management of endangered species concerns, and environmental restoration. The two Mexican states (Baja California and Sonora) play a more limited role, with most decision-making authority resting with the CNA.[94] Local communities in the Delta region as yet have a limited voice.

5. Non-Governmental Organizations

Non-governmental organizations (NGOs) in the United States and Mexico have worked to conserve the Delta's ecosystem by advocating for management improvements within both federal governments, gathering baseline ecological data, and educating the public. A significant number of U.S. and Mexican NGOs have advocated for conservation of the Colorado River delta, including PRONATURA Sonora; the Intercultural Center for the Study of Deserts and Oceans; the *Centro Regional de Estudios Ambientales y Socioeconómicos*; Environmental Defense;[95] the Sonoran Institute; the Pacific Institute for Studies in Development, Environment, and Security; Defenders of Wildlife; the Center for Biological Biodiversity; the Sierra Club; Southwest Rivers; and others. Also of note, two university-based research centers have been the source of important studies documenting current Delta conditions. Faculty at The University of Arizona and at the

91. *See* Pontius, *supra* note 1, at 72-74.

92. This figure represents rights asserted by the tribes rather than adjudicated rights. *See* Kneese & Bonem, *supra* note 71, at 97.

93. *See* Colorado River Tribal Partnership, Position Paper of the Ten Indian Tribes with Water Rights in the Colorado River Basin, *reprinted in* PONTIUS, *supra* note 1, at app. D.

94. *See* MUMME, *supra* note 73, at I.1.

95. Environmental Defense was formerly known as the Environmental Defense Fund (EDF).

Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) have made appreciable efforts to increase the body of knowledge concerning Delta ecosystems, economies, and communities. Governments and NGOs alike depend on the work of these individuals and institutions to provide credible, scientific data.

6. Institutional Challenges

Despite, or perhaps because of, the long list of institutions with some role to play in determining the fate of the Colorado River delta, the ecosystem remains threatened. The institutions governing the management and use of the Colorado River are often at odds, hindering efforts to develop solutions to pressing problems. The early failure of the Law of the River to address tribal and ecological concerns, as well as its foundation upon erroneous hydrologic assumptions, has generated decades of disputes, negotiations, and litigation that appear likely to continue into the foreseeable future. Agencies with conflicting missions resist cooperation and groundwater and surface water and water quantity and water quality are all independently monitored and regulated. The institutional heterogeneity[96] that characterizes the agencies listed previously further challenges efforts to address Delta restoration. To date, no one organization or agency has emerged as the forum for a binational effort to protect the Delta, and there is little systematic programming of long-term commitments by either nation.[97] The establishment of the IBWC/CILA workgroup is an important first step, but it is limited to technical discussions.[98]

To be successful, an international effort will need to be funded, and will need to operate with a transparency that allows stakeholders in both countries to understand and participate in decisions. Furthermore, the efforts of federal agencies in the United States and Mexico should integrate existing Colorado River delta research and restoration plans, the plans formulated by academics and NGOs from the United States and Mexico, and should expand planning to include economic and cultural preservation concerns. Local communities in the Delta region as yet have a limited voice,

96. *See generally* Gerald D. Bowden et al., *Institutions: Customs, Laws and Organization*, *in* WATER: COMPETITION FOR CALIFORNIA ALTERNATIVE RESOLUTIONS 163 (Ernest A. Engelbert ed., 1982).

97. *See* MUMME, *supra* note 73, at IV.6.1. *See also* Stephen Mumme, *NAFTA's Environmental Side Agreement: Almost Green?*, BORDERLINES, Oct. 1999, at 1.

98. Possibly, the United States and Mexico will establish a new binational forum under the auspices of the 2000 Joint Declaration to enhance cooperation on the Colorado River delta. *See* Bruce Babbitt & Julia Carabias, Joint Declaration between the Department of the Interior of the United States of America and the Secretariat of the Environment, Natural Resources, and Fisheries (SEMARNAP) of the United Mexican States to Enhance Cooperation in the Colorado River Delta (May 18, 2000) (unpublished document, on file with author).

but the formation of new groups such as the *Asociación Ecológica de Usarios de los Ríos Hardy y Colorado* (Ecological Association for the Users of the Hardy and Colorado Rivers) demonstrates local commitment to promoting their interest in Delta restoration.

IV. CONSERVATION CONSIDERATIONS AND OPPORTUNITIES

Although the basic objective—keep sufficient water in the river—seems simple, it will require the alignment of numerous institutions, agreements, and organizations. Public attention needs to be focused on Delta ecosystems. The significant institutional commitments required to ensure the Delta's future necessitate that both international stakeholders and local communities develop strong and vigilant voices demanding that attention be paid to the Colorado River delta.

A successful conservation strategy for the Delta's ecosystem is likely to include some or all of the following: an international agreement, legal action, the inclusion of the Delta as a priority in related management decisions, new funding for conservation, and increased public participation in decisions that affect the Delta and related ecosystems. The best conservation strategy will treat the Delta and the river upstream as one ecological whole, overcoming the obstacles presented by the international boundary.

A. International Agreement

Deliveries of Colorado River water from the United States into Mexico have been characterized by a lack of binational cooperation and considerations, necessitating the negotiation of binding international agreements.[99] After a lengthy series of binational negotiations, the U.S.–Mexico Treaty governing the Colorado River was amended with Minute 242 in 1973 to mitigate the impacts of pronounced increases in the salinity of the Colorado River as it crossed into Mexico.[100] Domestic interests in the United States continue to preclude discussion of transboundary impacts and cooperation. In December 1998, the Colorado River Board of

99. *See generally* NORRIS HUNDLEY, JR. DIVIDING THE WATERS: A CENTURY OF CONTROVERSY BETWEEN THE UNITED STATES AND MEXICO (1966).

100. Mexico complained that water deliveries on the Colorado River were too saline to support agriculture. The river's increased salinity was due in part to the reduction of freshening flows because of storage in new upstream reservoirs and to the release of brackish drainage water from the Wellton-Mohawk Canal. *See* PONTIUS, *supra* note 1, at 62.

California adopted a resolution[101] stating that the MSCP study area should not extend into Mexico, bisecting the river along a political, rather than a hydrologic, boundary.

This history, as well as continuing disregard for the impacts of U.S. actions on habitat downstream of the international boundary, strongly suggests that the restoration of the Colorado River delta will require a binational agreement between the United States and Mexico. Although diplomacy alone cannot restore ecosystems, a binational commitment would serve as a framework under which all other changes take place. Until conservation of the Delta is a priority for both nations, sufficiently important to merit discussion, negotiation, and most importantly commitment, its welfare will remain an afterthought in management decisions. Once the United States and Mexico recognize that the Delta is a natural resource worthy of a conservation commitment, they will be obliged to codify their intentions in a binational treaty that dedicates water, land, and institutional support. Short of such formality, the Delta's future remains uncertain.

1. *Need for Binational Commitment*

Conservation of the Delta's ecosystems will require binational commitment. Mexico lacks sufficient water both to ensure the ecological viability of the Delta and to sustain a burgeoning human population at its border.[102] Additionally, it is not clear that Mexico should unilaterally shoulder responsibility for Delta restoration when the United States diverts some 90 percent of the Colorado's flows. Water that sustains the Delta is a transboundary resource, and it will take commitment from both Mexico and the United States to reserve sufficient waters for environmental purposes. The minimum volume required to sustain the Delta is a significant portion of Mexico's entire Colorado River entitlement. Not only does the United States capture 90 percent of the river's allocated waters, but as a nation of considerably greater wealth it has greater capacity to fund the protection of natural resources.[103] Finally, all Colorado River water storage capacity, and nearly all control, rests in the United States. Without the cooperation of the U.S. agencies that manage the Colorado's hydraulic systems, Delta ecosystem conservation will not be achieved.

101. Colorado River Board of California, Resolution Regarding the Planning Area for the Lower Colorado River Multi-Species Conservation Program (Mar. 11, 1998) (unpublished document, on file with author).

102. Population in the Delta (entirely in Mexico) grew more than 3% annually from 1990-1995. *See* Paul Ganster, *Environmental Issues of the California-Baja California Region*, (visited Sept. 6, 2000) <http://www.scerp.org/scerp/docs/berr1.html>.

103. *See* Jessica Mathews, *The Implications for U.S. Policy*, *in* PRESERVING THE GLOBAL ENVIRONMENT: THE CHALLENGE OF SHARED LEADERSHIP 309, 320 (Jessica Mathews ed., 1991).

At the same time, Delta conservation cannot be implemented by the United States acting alone. The Delta's welfare is subject to local land management as well as the availability of water from the north. In establishing the Biosphere Reserve of the Upper Gulf of California and Colorado River Delta, Mexico demonstrated commitment to Delta ecosystem preservation.[104] Nevertheless, it is unlikely that the United States would be willing to send water across the border without a corollary commitment from Mexico to insure that these waters reach Delta ecosystems and to improve natural resource management and protection in the Delta.

A binational agreement will allow Mexico and the United States to establish a goal for conservation of the Delta, commit resources to this goal, and define a process to achieve it. Each of these three objectives poses a challenge. Straightforward commitments of water, land, and institutional support for environmental purposes should go far to sustain the Delta's ecosystems, but these alone will not suffice. Like all ecosystems, the Delta is dynamic. Indicators of ecological stability such as the presence of keystone species are useful for monitoring the efficacy of restoration efforts, but do not clearly translate into management prescriptions. Optimally, an agreement will recognize this and allow flexibility in management without forgoing measurable commitments such as quantified instream flows, area of protected lands, and management resources.

2. A Binational Institution

This need for flexibility suggests that a binational agreement should establish an institution with the responsibility to monitor the health of the Delta and the contributions of Mexico and the United States to sustaining the Delta. Whether a new or newly identified organization, it should have a mandate to monitor and study Delta ecosystems, manage transboundary water movement, promote the sustainable use of water in the Delta, and encourage greater public participation in decisions that affect the Delta. Numerous international environmental agreements have been signed in recent decades, and in virtually every case they are intended to solve well-defined problems by creating institutions to define social practices, assign roles to participants in these institutions, and govern interactions.[105] For example, the Great Lakes ecosystems benefit from a binational agreement that established the International Joint Commission of the United States and

104. The Biosphere Reserve is among the minority of Mexico's protected areas that receive regular funding from the federal government. *See* Michelle Nijhuis, *HIGH COUNTRY NEWS*, July 3, 1986, at 1.

105. *See generally* Oran R. Young, *Hitting the Mark*, ENVIRONMENT, Oct. 1999, at 20.

Canada.[106] The Commission is charged with assisting and monitoring both nations' progress towards prohibiting the discharge of toxic substances, providing financial assistance for the construction of publicly owned waste treatment works, coordinating planning processes, and developing best management practices.[107]

3. National Mandates for Conservation

A binational agreement will also provide a mandate for conservation of Delta ecosystems to myriad institutions within each nation. Commitment at the national level to an international agreement will affect the behavior of sub-national and non-state actors by influencing unfolding political processes.[108] Absent a mandate, sub-national actors that manage water storage and flow, protect species, manage floodplain and watershed lands, and use water for consumptive purposes have little incentive to consider the Delta in the numerous decisions they make that bear on its health. Because the power of water users is presently greater than that of conservation interests, sub-national actors do not consider impacts to Delta ecosystems in their decision processes.

In the United States, managers at the BOR have not recognized the Colorado River delta as a legitimate conservation priority. Specifically, the BOR has consistently excluded Delta species from environmental planning processes such as the 1996 biological assessment for operations on the lower Colorado River[109] and the more recent Lower Colorado River Multi-Species Conservation Program.[110] In both cases, the agency denies responsibility for the environmental health of the river beyond the U.S. border by excluding the Delta from its planning areas and excluding the health of the Delta's people, animals, and plants from its objectives. The FWS has concurred with BOR and has not considered the impacts of BOR actions on listed species in Mexico.[111]

106. *See* Agreement on Great Lakes Water Quality, Nov. 22, 1978, U.S.-Can., art. 7, 30 U.S.T. 1383.

107. *See id.*

108. *See* Young, *supra* note 105, at 25-27.

109. *See* U.S. BUREAU OF RECLAMATION, DESCRIPTION AND ASSESSMENT OF OPERATIONS, MAINTENANCE, AND SENSITIVE SPECIES OF THE LOWER COLORADO RIVER, at I(A) (1996), <http://www.lc.usbr.gov/~g2000/assess/titlepg.htm>.

110. *See* Notice of Intent to prepare an Environmental Impact Statement (EIS) /Environmental Impact Report (EIR) and notice of public scoping meetings, 64 Fed. Reg. 27,000, 27,001 (1999).

111. *See* U.S. FISH AND WILDLIFE SERVICE, FINAL BIOLOGICAL AND CONFERENCE OPINION ON LOWER COLORADO RIVER OPERATIONS AND MAINTENANCE—LAKE MEAD TO SOUTHERLY INTERNATIONAL BOUNDARY 1 (1997). For availability of this document, see Notice of availability of Biological Opinion and notice of public meetings on Bureau of Reclamation's lower Colorado River operations and maintenance, 62 Fed. Reg. 28,894 (1997).

With a binational, environmental agreement in place that included a quantified commitment to deliver water to the Delta for environmental purposes, U.S. agencies could identify water to meet its terms. Precedent exists for the reallocation of water for environmental purposes. The Recovery Implementation Plan in the Upper Colorado River basin has water users, states, federal agencies, and environmentalists negotiating over the establishment of mechanisms, some of which have already been implemented, that will ensure protection of flow releases from federal reservoirs.[112] On the Green River, changes in the operation of Flaming Gorge Dam in Utah have enhanced peak flows and reduced and stabilized winter flows to improve habitat for several endangered fishes.[113]

Colorado River stakeholders in the United States have not yet engaged in a process to address the ecological health of the Delta, but the need to mitigate the impacts of upstream development on Delta species may force these stakeholders to action.[114] Such a process might include quantification of water needed to preserve the Delta's ecosystems, identification of the entity that would hold these allocations and manage the rights, logistics of storing and releasing the water, and the level of priority that ecosystem resources would enjoy.

In Mexico, the lack of a national mandate to protect the Delta presents additional problems. In the summer of 1999, the National Water Commission (CNA) began a program of vegetation clearing in the Delta. The apparent purpose for such activity was to prevent damage to the levee system in the Delta by blocking secondary river channels, and to prevent floodwaters from reaching nearby farmlands.[115] A clearly articulated national position could have underscored the importance of this habitat and discouraged CNA from clearing the vegetation, suggesting the need for greater communication and cooperation among resource agencies in Mexico.

112. *See supra* note 65.

113. *See* Robert T. Muth et al., U.S. Fish and Wildlife Service et al., Flow Recommendations for Endangered Fish in the Green River Downstream of Flaming Gorge Dam 5-1 to 5-28 (May, 1999) (unpublished draft final report, on file with author).

114. On June 28, 2000, eight plaintiffs, led by the Defenders of Wildlife and the Center for Biological Diversity, filed a complaint for declaratory and injunctive relief with the U.S. District Court for the District of Columbia contending that the Departments of Interior and Commerce and related agencies responsible for river management and marine protection have violated the Endangered Species Act, its implementing regulations, and the Administrative Procedure Act. *See* Defenders of Wildlife v. Babbitt, No. 1:00CV01544 (D.D.C. filed Jun. 28, 2000). For further discussion, see *infra* Section IV(B).

115. Electronic Memoranda from Carlos Valdés-Casillas, Professor, Instituto Tecnológico y de Estudios Superiores de Monterrey to Colorado River Delta listserve (Aug. 23, 1999) (on file with author).

4. Coordination and Cooperation

A binational agreement is needed as well to facilitate coordination of management and research between the United States and Mexico. Improved coordination could maximize the benefit of flood flows to Delta ecosystems. Mexico is presently given little notice of impending flood releases and has no formal vehicle for recommending release schedules to benefit the Delta. With a binational commitment, management authorities on both sides of the border could look for opportunities to divert and store floodwaters for conservation purposes.

With binational cooperation, research could be broadened to a program of adaptive management that might include a determination of the Delta's water needs through experimental variation of the flow rates through Morelos Dam. At present, the lack of a formal program between the United States and Mexico limits the kind of research that can be conducted. To date, the Delta's water requirements have been determined deductively, through snapshot observations of existing conditions. Experimental research would help shed light on the timing and extent of floods in the Delta, evaporative processes, and other dynamics. IBWC/CILA has recently established an international task force on research, but it has yet to act.[116] Independent researchers and non-governmental organizations, however, have coordinated research activities, and published baseline ecological information and analyses with contributions of experts from both countries.[117] Only a formal mechanism to coordinate the research programs of both countries will harness the research resources of the U.S. and Mexican governments in collaboration.

5. Precedent for a Binational Agreement

Fortunately, a considerable and relevant history of agreements between the United States and Mexico sets the precedent for a binational Delta conservation agreement. Migrating birds have long been identified as a transnational resource worthy of dedicated protection efforts, and as early as 1936 Mexico and the United States signed the Convention for the Protection of Migratory Birds and Game Mammals, committing to protection for birds that live in the United States and Mexico.[118] This was soon followed by an agreement of western hemisphere nations to protect species and their habitats, which included specific mention of several Delta species, including the jaguar, the Colorado River pikeminnow, and the

116. *See* International Boundary and Water Commission, *supra* note 76.

117. *See* LUECKE ET AL., *supra* note 40, at iii.

118. Convention for the Protection of Migratory Birds and Game Mammals, Feb. 7, 1936, U.S.-Mex., art. 1, 50 Stat. 1311.

Yuma clapper rail.[119] In 1971, nations of the world protected designated wetlands, including the Colorado River delta, in an agreement commonly known as the Ramsar Convention.[120] In 1986, both Mexico and the United States established a mandate and process for the protection of wetlands in the North American Waterfowl Management Plan,[121] and listed the Delta as a continentally important habitat. And as recently as 1994, the United States, Mexico, and Canada together formed the Trilateral Committee for Wildlife and Ecosystem Conservation and Management.

In 1983, the United States and Mexico negotiated the U.S.–Mexico Border Environmental Cooperation Agreement,[122] commonly known as the La Paz Agreement, creating workgroups that bring together environmental authorities from both countries to address environmental issues in the border region.[123] These workgroups were reinvented as Border XXI[124] under the Integrated Border Environmental Plan (IBEP),[125] created in 1992 and revised in 1996.[126]

In 1997, Secretary Babbitt of the U.S. Department of Interior and Secretary Carabias of Mexico's Department of Environment, Natural Resources, and Fisheries signed a joint Letter of Intent announcing the following plans:

> to expand cooperation in the protection of contiguous, natural protected areas,...to harmonize activities directed at the conservation of biological diversity,...beginning with...pilot projects...in Mexico, the Biosphere Reserves of the *Alto Golfo de California y Delta del Río Colorado*...[including] harmonization and coordination of policies leading to the conservation of natural and cultural resources.[127]

Pursuant to this letter, the agencies have collaborated on several projects in the Delta.[128] These activities are also reported under the Natural Resources Workgroup of Border XXI.[129] Most recently, in the spring of 2000, the Secretaries of each country's natural resource agency (DOI and SEMARNAP) signed a Joint Declaration to enhance cooperation in the Colorado River delta,[130] committing to coordinate research on transboundary species, establish compatible information systems, and develop strategies for environmental sustainability. While promising, the good intentions expressed in the Letter and the Declaration are not sufficient to protect the Delta until formalized in a treaty that, at a minimum, dedicates water to the Delta ecosystem.

One possibility for creating an effective binational agreement to dedicate Colorado River water to the Delta is to construct an environmental minute to the Treaty[131] that allocates Colorado River water between Mexico and the United States. This treaty has already been amended to address Mexico's water quality concerns.[132]

B. United States Federal Law and Legal Remedies

Independent of any binational effort to restore and protect the Colorado River delta, U.S. law could be used to require U.S. river managers to define and provide minimum instream flows for the purpose of preventing further harm to the endangered species that live in the Delta's habitats. The Endangered Species Act (ESA)[133] prevents federal agencies

119. *See* Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, Oct. 12, 1940–Dec. 16, 1965, 56 Stat. 1354, 161 U.N.T.S. 193.

120. Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Feb. 2, 1971, T.I.A.S. No. 11,084, 996 U.N.T.S. 245 [hereinafter Ramsar Convention].

121. U.S. FISH AND WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR & CANADIAN WILDLIFE SERV., ENV'T CAN., NORTH AMERICAN WATERFOWL MANAGEMENT PLAN (1986).

122. Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area, Aug. 14, 1983, U.S.–Mex., T.I.A.S. No. 10,827.

123. The La Paz Agreement created six binational workgroups to deal with border environmental issues of air, hazardous waste, water, pollution prevention, contingency planning, and emergency response. *See* MUMME, *supra* note 73, at IV.5.

124. The Border XXI Program builds on the efforts of the Integrated Border Environmental Plan and increases its scope to include environmental health and natural resource issues. *See* U.S.–Mexico Border Program, *Border XXI Program Framework Document Executive Summary*, (visited Aug. 9, 2000) <http://www.epa.gov/usmexicoborder/ef.htm>.

125. U.S. ENVTL PROTECTION AGENCY, EPA NO. 160-R-96-003, U.S.–MEXICO BORDER XXI PROGRAM: FRAMEWORK DOCUMENT (1996).

126. Released in 1992, the IBEP identifies priority environmental issues in the border area and projects aimed at addressing those issues.

127. Bruce Babbitt & Julia Carabias, Letter of Intent between the Department of the Interior of the United States and the Secretariat of Environment, Natural Resources, and Fisheries of the United Mexican States for Joint Work in Natural Protected Areas on the U.S.–Mexico Border 1-3 (May 5, 1997) (unpublished document, on file with author).

128. For further information contact agency representatives in the United States or Mexico (Javier De La Masa, Coordinador de Areas Naturales Protegidas, INE-SEMARNAP, Ave. Revolución 1425, Nivel 25, Colonia Tlacopac, San Angel Delegación Alvaro Obregon, Mexico Df, 01040 MEXICO; or Susan Lieberman Goodwin, U.S.–Mexico Coordinator, U.S. Department of the Interior, 1849 C St. N.W. (ms4426), Washington D.C. 20240).

129. *See Report from the Workgroup on Natural Resources to the U.S.–Mexico Border XXI National Coordinators Ensenada, Baja California*, (last modified Aug. 22, 2000) <http://www.epa.gov/usmexicoborder/ef-nr.htm>.

130. Babbitt & Carabias, *supra* note 98.

131. Treaty with Mexico Respecting Utilization of the Waters of the Colorado and Tijuana Rivers and of the Río Grande, *supra* note 62.

132. *See* Minute 242, supra note 63, at 1105.

133. 16 U.S.C. §§ 1531-1544 (1994).

from taking actions that harm[134] threatened or endangered species. Whether the ESA restricts agency actions when impacts are created across an international boundary is unresolved.[135] The National Environmental Policy Act (NEPA)[136] requires federal agencies to consider the environmental impacts of their actions, and Executive Order 12114[137] directs federal agencies to consider the environmental effects abroad of major federal actions. In 1997, the Council on Environmental Quality issued a memorandum directing all U.S. federal agencies to consider the environmental impacts of their actions, regardless of where those impacts might occur.[138] Even the BOR has implementing regulations that require analysis of the affected foreign environment in environmental reviews.[139] In the MSCP, the BOR and FWS, along with Arizona, Nevada, and California, are committed to a mandated planning exercise that will result in an application by the states to "take" endangered species in exchange for mitigation measures.[140] The MSCP is also intended to serve as a long-term compliance vehicle under the Endangered Species Act[141] for federal agencies that must consult with the FWS concerning the impact of Colorado River dam operations on threatened and endangered species. Significantly, MSCP participants have excluded the Delta from the MSCP planning area,[142]

134. Implementing regulations define harm to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." 50 C.F.R. § 17.3 (1999).

135. The Supreme Court heard a case on this subject but declined to rule on the matter. *See* Lujan v. Defenders of Wildlife, 504 U.S. 555, 582 (1992).

136. 42 U.S.C. § 4321-4370 (1994).

137. Executive Order No. 12,114, 3 C.F.R. 356 (1980), *reprinted in* 42 U.S.C. 4321 (1994).

138. *See* Memorandum from Kathleen A. McGinty, Chair, White House Council on Environmental Quality et al., to Rosario Green, Minister of Foreign Affairs, Mexico et al. (July 1, 1997) (on file with author).

139. *See* Bureau of Reclamation, *Policy ENV-P03, National Environmental Policy Act policy*, (last updated Feb. 10, 1998) <http://www.usbr.gov/recman/env/env-p03.html>.

140. *See* Multi-Species Conservation Program (MSCP) for the Lower Colorado River, Arizona, Nevada, and California, 64 Fed. Reg. 27,000, 27,000-27,002 (1999). "Take" is defined in the Environmental Species Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. § 1532(19) (1994); *see supra* note 134.

141. 16 U.S.C. § 1536 (a)(2)(1994).

142. "It is proposed that the MSCP will serve as a coordinated, comprehensive conservation approach for the lower Colorado River basin within the 100-year floodplain from below Glen Canyon Dam to the Southerly International Boundary with Mexico for a period of 50 years." Multi-Species Conservation Program (MSCP) for the Lower Colorado River, Arizona, Nevada, and California, 64 Fed. Reg. 27,000, 27,000-27,002 (1999).

despite the connection between the river's ecosystem both north and south of the international border.[143]

Several environmental groups contend that the MSCP is not only biologically flawed, but also illegal.[144] The exclusion of the Delta prevents federal agencies from considering within the MSCP process the impacts of their actions on endangered species that depend on Delta habitat. It also prevents agencies from evaluating the possible benefits of mitigation in the Delta. Of the five MSCP priority species, three (the American peregrine falcon, the razorback sucker, and the Southwestern willow flycatcher) are listed by the FWS with reference to critical habitat in Mexico.[145] Another endangered bird on the lower Colorado River, the Yuma clapper rail, has been reported in the Delta at the Ciénega de Santa Clara.[146] United States conservation obligations under the ESA must be applied to endangered species found in the Delta even if these species are not found in the lower Colorado River in the United States, such as the desert pupfish, totoaba, and vaquita.[147] However, conservation goals of the MSCP do not include these species.[148] In the long run, FWS and other federal agencies may be forced to end the MSCP, reclaim the process, and complete a full examination of the effects of federal river operations on the viability of endangered species in the Delta.

Mexican law offers fewer possibilities for enhancing Delta habitat and preserving threatened and endangered species. The Mexican Constitution includes the Colorado River in the definition of national waters, but sets no policy for instream flows.[149] The National Water Law of 1992 clearly gives CNA authority over national waters, and 1994 regulations that implement the law provide for the use of national waters for ecological

143. When first established in 1995, the MSCP included representatives from environmental groups. In 1998, when MSCP participants voted not to include the Colorado River delta in the scope of the planning area, the environmental representatives withdrew.

144. *See* Defenders of Wildlife v. Babbitt, No. 1:00CV01544 (D.D.C. filed Jun. 28, 2000). *See also* Defenders of Wildlife, *Groups Sue U.S. to Protect Mexican Wetlands and U.S. Endangered Species* (visited Oct. 12, 2000) <http://www.defenders.org/releases/pr2000/pr062800.html>.

145. *See* 50 C.F.R. § 17.11 (1999).

146. *See* Erik Mellink et al., *Non-Breeding Waterbirds of the Delta of the Río Colorado, Mexico*, 68 J. FIELD ORNITHOLOGY 113, 114 (1997).

147. ESA consultation requirements apply to all agency actions affecting listed species, whether within United States or abroad. *See* Defenders of Wildlife v. Lujan, 911 F.2d 117, 123 (8th Cir.1990), *rev'd on other grounds*, 504 U.S. 555 (1992).

148. *See generally* Ogden Envtl. and Energy Services Co., Inc., Lower Colorado River Multi-Species Conservation Program: Preliminary Species Conservation Goals (August 28, 1998) (unpublished presentation to Lower Colorado River Multi-Species Conservation Program Biology Subcommittee), *available in pieces at* <http://www.lcrmscp.org/files.html>).

149. *See* Constitución Política de los Estados Unidos Mexicanos [Constitution], Art. 27.

conservation purposes.[150] The General Law of Ecological Equilibrium and Environmental Protection[151] authorizes Mexico's biosphere reserves to protect areas of great biological diversity and unique ecological characteristics.[152] To the extent that the ecological value of the Biosphere Reserve in the Delta is found in its wetlands, this law might serve as a tool to secure or protect adequate flows.

C. Related Issues and Opportunities

Given the many competing demands for water in the Colorado River basin, prospects for improving water management to benefit the Delta may be found in conjunction with other, related efforts. Several resource management issues related to management of the Colorado River or other water resources on the border may offer strategic opportunities for improving management of the Delta.

1. *Colorado River Entitlements and the California Colorado River Water Use Plan*

Collectively, states in the Upper Basin (Colorado, New Mexico, Utah, and Wyoming) do not presently use their full allotment of water, and (with the exception of New Mexico) are unlikely to develop their entire Colorado River water apportionments in the foreseeable future.[153] California currently uses just over 5.1 million acre-feet a year, including surplus water and a diminishing quantity of unused Lower Basin entitlements.[154] In an ongoing planning process for the California Plan, California has committed to reduce its use of Colorado River water by 2015.[155] One component of the California Plan is an agreement in 1999 between municipal water users in

150. Ley de Aguas Nacionales, su Reglamento y Ley Federal del Mar (1992, amended 1994).

151. The Ley General del Equilibrio Ecológico y Protección al Ambiente can be accessed at <http://www.ine.gob.mx/uaj/lgeepa/index.html>.

152. *See* VALDÉS-CASILLAS ET AL., *supra* note 12, at 56.

153. Development of Upper Basin water will be regulated under the Endangered Species Act. The most optimistic projections for development in the Upper Basin forecast full development for New Mexico by 2030, and Colorado and Wyoming in some year beyond the 60-year projection timeframe. Utah is not projected to develop its entire apportionment under these projections. *See* Memorandum from Wayne E. Cook, Executive Director, Upper Colorado River Commission, to Interested Agencies/Parties (Dec. 19, 1999) (on file with author).

154. Under the Supreme Court decree in *Arizona v. California*, 376 U.S. 340 (1964), California has the right to use 4.4 million acre-feet in normal years, plus the unused portions of Arizona and Nevada. In years when the Secretary of the Interior declares a surplus condition, California is entitled to use an additional 500,000 acre-feet (50% of a one-million acre-foot surplus), plus the unused surplus entitlement of Arizona and Nevada.

155. The Draft California Colorado River Water Use Plan may be accessed at <http://crb.water.ca.gov/reports.htm>. A final plan is expected in early 2001.

San Diego and irrigators in the Imperial Irrigation District to implement water conservation measures.[156]

2. *Surplus and Shortage Criteria*

The Secretary of the U.S. Department of Interior has discretion to declare a surplus on the Colorado River, and has the subsequent responsibility to allocate surplus water among the states.[157] The Colorado River Compact[158] protects the Lower Basin states from shortage by requiring the Upper Basin states not to deplete flows to the Lower Basin based on an aggregate flow over a period of 10 consecutive years.[159] In compliance with the Compact, BOR managers keep Lake Mead, the reservoir behind Hoover Dam, near capacity, and in wet years must spill water to create space for spring floods—the releases that create flood flows to the Delta. Viewing these releases as "wasted" water, the Lower Basin states have proposed various off-stream storage opportunities to capture it.[160] Surplus declarations are presently made on an annual basis, but the Department of Interior, in early 2000, solicited comments on a 15-year plan that would allocate surplus based on a list of criteria.[161] The Department of Interior's initial surplus proposal will allow Lower Basin states to divert additional Colorado River water in years when Lake Mead exceeds prescribed elevations, thereby reducing the frequency and magnitude of flows to the Delta. A coalition of organizations has proposed interim criteria reflecting a tiered strategy that guarantees deliveries to satisfy the baseline needs of the Delta before any surplus flows for municipal and industrial uses, agriculture, or off-stream storage (including groundwater banking) could be allocated in the United States or Mexico.[162] Under these criteria, flood flows for the Delta would be allocated before agricultural users could claim

156. *See Key Terms for Quantification Settlement among the State of California, Imperial Irrigation District, Coachella Valley Water District, and Metropolitan Water District* (last modified Oct. 15, 1999) <http://www.cvwd.org/wateriss/Key_Terms.htm> [hereinafter *Key Terms for Quantification*].

157. The Supreme Court established DOI's authority to declare surplus in *Arizona v. California*, 376 U.S. 340 (1964).

158. *See supra* note 57.

159. *See id.* at art. III(d).

160. *See* PONTIUS *supra* note 1, at 32.

161. *See* Notice of availability of a draft environmental impact statement and public hearings for the proposed adoption of Colorado River Interim Surplus Criteria: INT-DES 00-25, 65 Fed. Reg. 42,028, 42,029 (2000).

162. *See* Letter from Mindy Schlimgen-Wilson, Associate Director, Southwest Regional Office, American Rivers et al., to David Hayes, Acting Deputy Secretary, U.S. Department of Interior, & Robert Johnson, Regional Director, Lower Colorado Region Office, U.S. Bureau of Reclamation (discussing Colorado River Interim Surplus Criteria) (Feb. 15, 2000) *available at* <http://www.pacinst.org/coriver.html>.

any surplus, as well as before any off-stream storage uses. If and when the Department of Interior formalizes shortage criteria, environmental groups will demand that baseline flows for the Delta receive priority as well.

3. Salton Sea

Several proposals to improve the ecological conditions of California's Salton Sea, a large inland saline lake fed by agricultural drainage and lying in a former arm of the Colorado delta, would link the Sea to the current limit of the Delta and its estuary. To reduce and stabilize the salinity and elevation of the Salton Sea, resource managers have proposed several alternatives, including pumping Salton Sea water to the Gulf of California.[163] Any consideration of management options involving discharge of Salton Sea water to the Delta or Gulf of California will require Mexican involvement, and thus may present an opportunity for Mexico and the United States to consider binational measures for enhancing Delta ecosystems.[164] Another Salton Sea restoration proposal would have diverted up to 300,000 acre-feet of Colorado River flood flows from the mainstem at Imperial Dam in Arizona to the Salton Sea, significantly diminishing the quantity of water that would otherwise reach the Delta.[165]

Were the effluent and wastewater now flowing into the Salton Sea managed with care in the Delta, they might bring some benefit to wetland ecosystems. For example, flood flows could flush away any buildup of pollutants or salinity. A new wastewater treatment plant in Mexicali–to be completed in 2001–will improve the quality of some of the effluent now sent via the New River to the Salton Sea. The plant is presently designed to discharge treated effluent into the New River and eventually empty into the Salton Sea. If instead this treated effluent is discharged into the Río Hardy basin, the Río Hardy wetlands might serve as part of the wastewater treatment process. Both the Mexican government and the U.S. EPA have indicated an interest in exploring options for using treated water to enhance Delta environments.[166]

163. *See* Tetra Tech, Inc., *Salton Sea Restoration Project Environmental Impact Statement/ Environmental Impact Report* at 2-43, 6-27 to 6-34 (2000) (unpublished draft prepared for Salton Sea Restoration Authority & U.S. Bureau of Reclamation), *available at* <http://www.lc.usbr.gov/~saltnsea/deistoc.html>.

164. The transfer of Salton Sea water to Delta wetlands may increase pollutants and salinity in the Delta and adversely affect Delta wildlife.

165. *See* Tetra Tech, Inc., *supra* note 163 at 2-27, 4-27 to 4-29.

166. Telephone interview with Doug Eberhardt, Environmental Engineer, Water Management Division, U.S. Environmental Protection Agency Region IX (Jul. 1999); Telephone interview with Carlos Peña, Division Engineer, International Boundary and Water Commission (Apr. 1999).

4. Yuma Desalting Plant

A proposal by the BOR to operate the Yuma Desalting Plant[167] and market the resulting water would divert agricultural wastewater flows from the Ciénega de Santa Clara and replace the wastewater with concentrated brine.[168] The basin states are likely to increase pressure on the BOR to operate the plant in order to treat the MODE canal water to Minute 242 salinity standards. In this way agricultural wastewater could be counted as treaty water, freeing a like amount of upstream water for use by the basin states.[169] Operating the Desalting Plant would markedly reduce the area of the Delta wetlands and negatively impact wildlife and local residents who generate income as wildlife guides. A decision to operate the Desalting Plant will require an environmental assessment. In order to prevent damage to the Delta ecosystem, water supplemental to Mexico's Colorado River entitlements must be dedicated to support the Ciénega de Santa Clara.

5. All-American Canal and Delivery of Water to Mexico

Mexico relies on groundwater pumped from border region aquifers to augment its supplies,[170] but plans by California and Nevada to line the nearby All-American Canal will lower the water table in these aquifers.[171] Mexico opposes these plans on the grounds that the seepage from the canal is "grandfathered"[172]—in other words, a known condition that existed at the time the original treaty was negotiated, and, therefore, water to which Mexico is entitled. In addition, Mexico has requested that its entire allocation of water from the Colorado River be delivered at the Northerly

167. *See supra* note 43.

168. Telephone interview with Robert Johnson, Regional Director, Lower Colorado Region Office, U.S. Bureau of Reclamation (Jan. 2000).

169. At present, 110,000 acre-feet of saline agricultural wastewater flows to the Ciénega de Santa Clara annually, sustaining 50,000 acres of wetland habitat. *See* discussion *infra* Section II. Despite the inadvertent nature of the Ciénega's creation, any proposal that results in its destruction or degradation is certain to be challenged by environmental groups in both Mexico and the United States.

170. Mexico pumps approximately 100,000 acre-feet of groundwater per year that is directly attributable to seepage loss from the All-American Canal. *See* Douglas L. Hayes, *The All-American Canal Lining Project: A Catalyst for Rational and Comprehensive Groundwater Management on the United States–Mexico Border* 31 NAT. RESOURCES. J. 803, 805 (1991).

171. The Bureau of Reclamation estimates that the 29.9 mile reach of the All-American Canal from Pilot Knob to Drop 4 loses 91,600 acre-feet per year, most of which recharges the shallow aquifer in the northeast section of the Mexicali Valley. When the Canal is lined, groundwater depths are projected to drop from one to 30 feet in a 70 square mile region over 50 years. *See* U.S. Bureau of Reclamation, U.S. Dep't of the Interior, All American Canal Lining Project: Imperial County California: Final Environmental Impact Statement/Final Environmental Impact Report, at III-4, III-5 (1994).

172. *See* Hayes, *supra* note 170, at 806.

International Boundary,[173] one of two sites where water is currently delivered.[174] Resolution of these issues will require negotiations between the two countries, creating another opportunity to discuss water for the Delta.

D. Market Opportunities

The Law of the River, established historically and based on a system of equitable apportionment, creates entitlements to Colorado River water. Dedicating water to the environment after these rights have been established presents a challenge: how to secure water for instream flows while respecting existing entitlements? A potential solution is to compensate possessors of water rights.

The direct cost of water required for conservation of the Delta is considerable, although impediments to water transfers imposed by the Law of the River make it difficult to put a price on Colorado River water. Based on recent transactions between consumptive users of Colorado River water, it is possible to estimate the cost of an acre-foot of water between $144 and $233.[175] The cost of a permanent water right is greater by at least an order of magnitude, so securing permanent rights to a minimum annual baseflow of 32,000 acre-feet could cost at least $46 to $75 million. Securing the larger pulse flows needed on average every four years is a matter of policy and management changes rather than the acquisition of additional water rights, as Army Corps of Engineers Flood Release Guidelines[176] dictate the release of floodwaters. Additional direct costs will include on-site management and operation of a binational institution.

Market transactions offer several possibilities for conservation of the Delta's ecosystems, resulting in either water or funds that could be used to purchase water. Mechanisms have been established in recent years to allow for the market transfer of water rights, including water banking and

173. *See* PONTIUS, *supra* note 1, at 69.

174. Mexico's interest in receiving its entire allocation at the Northerly International Boundary (NIB) is twofold: (1) water delivered at the NIB can be diverted into the Central Canal, while water delivered at the SIB bypasses this diversion point; and (2) Minute 242 to the 1944 Treaty holds that water delivered at the SIB is not subject to salinity control. *See* Minute 242, *supra* note 63, at 1105.

175. In 1992, the Metropolitan Water District in southern California paid $26.7 million to the Palo Verde Irrigation District to fallow 20,000 acres for two years, in order to bank 186,000 acre-feet in Lake Mead. *See* PONTIUS, *supra* note 1, at 31-32. In 1998, the San Diego Water Authority contracted with the Imperial Irrigation District for water purchased at a rate of $233 per acre-foot. *See Agreement for Transfer of Conserved Water by and between Imperial Irrigation District and San Diego County Water Authority* (visited Sept. 8, 2000) <http://www.iid.com/water/agmt/> [hereinafter *Conserved Water Transfer Agreement*].

176. *See generally* U.S. ARMY CORPS OF ENGINEERS, WATER CONTROL MANUAL FOR FLOOD CONTROL: HOOVER DAM AND LAKE MEAD, COLORADO RIVER, NEVADA AND ARIZONA (1982).

water transfer agreements. Off-stream water banking in the United States has been established in several states as a means to move water between consumptive users.[177] To date, environmental resource agencies and private groups have not used these banks,[178] so changes may be needed in water banking provisions to allow a market-based approach to Delta preservation to succeed. Any such program will need to designate entities eligible to bank water for the environment, implement water transfer and purchasing programs, and support prospective water-banking regulations that allow timed releases to meet environmental needs.

1. *Water Transfer Agreements*

Two recent water conservation and transfer agreements in California set a precedent for future transfers. In 1989, the Metropolitan Water District of Southern California (MWD) and the Imperial Irrigation District (IID), located in southeastern California, signed a water conservation agreement enabling MWD to divert up to 106,000 acre-feet per year of conserved agricultural water through MWD's Colorado River Aqueduct.[179] A 1998 agreement between IID and the San Diego County Water Authority would allow the transfer of as much as 200,000 acre-feet of conserved water from agricultural users to the Authority.[180] These two agreements are driven by urban users' desire to increase the reliability of their supply of water. Each year since 1986, MWD, which supplies water to 16 million people in Southern California, has diverted more than 1.18 million acre-feet of Colorado River water through the Colorado River

177. For example, the Arizona Water Banking Authority has proposed to contract with California and Nevada to allow these states to store unused Colorado River water. The contracting state would pay to store water in Arizona, helping to replenish Arizona's aquifers, and in the future would be able to draw a similar quantity directly from the Colorado River. The program does not involve the sale of any future rights to water, only a specified quantity of unused water. *See* ARIZ. REV. STAT. ANN. § 45-2471 (West Supp. 1999).

178. Telephone Interview with Tim Henley, Manager, Arizona Water Bank (Jul. 10, 2000).

179. See NATIONAL RESEARCH COUNCIL, WATER TRANSFERS IN THE WEST: EFFICIENCY, EQUITY, AND THE ENVIRONMENT, 234-48 (1992) for a discussion of the water conservation agreement, and ROBERT STAVINS, ENVIRONMENTAL DEFENSE FUND, TRADING CONSERVATION INVESTMENTS FOR WATER (1983) for an appraisal of the conditions leading to the agreement. In 1984, the California State Water Resources Control Board held that IID was wasting water and ordered IID to implement water conservation programs. *See* California's State Water Resources Control Board's Decision 1600 of June 21, 1984, *aff'd*, Imperial Irrigation District v. State Water Resources Control Board, No. 58706 (Super. Ct. Cal. 1985), *rev'd in part* 231 Cal.Rptr. 283 (1986), *cited in* Hayes, *supra* note 170, at 813. IID's own Draft Water Conservation Plan (date January 31, 1985) identified potential conservation of 325,000 acre-feet annually. *See* Hayes, *supra* note 170, at 813. IID has rights to 3.1 million acre-feet, making it the largest single user on the Colorado River and an obvious party to water transfer agreements. *See Key Terms for Quantification*, *supra* note 156.

180. *See Conserved Water Transfer Agreement*, *supra* note 175.

Aqueduct to meet its customers' demand.[181] Yet, of California's annual entitlement to 4.4 million acre-feet of Colorado River water, only 0.55 million acre-feet are apportioned to MWD.[182] With the exception of the conserved water transferred from IID, MWD's diversion of Colorado River water in excess of its rights to 0.55 million acre-feet has come from Arizona and Nevada's unused Colorado River entitlements and, since 1996, from additional water released from Hoover Dam as "surplus" at the discretion of the Secretary of Interior.[183]

These new agreements set powerful examples of water transfers, although they do not include environmental goals. Nevertheless, the agreements demonstrate that despite the tangle of rules embodied by the Law of the River, flexibility remains in the system. New provisions for interstate and interbasin water transfers can allow reallocation of developed water supplies to meet environmental demands. States in the Lower Basin already have proposed several approaches for marketing water among themselves. In the Upper Basin, Utah has expressed an interest in marketing its undeveloped Central Utah Project water to downstream users.[184] At least one holder of a senior water right in the Lower Basin has expressed an interest in marketing water to an entity that would deliver water to the Delta.[185] The prospect of claims by U.S. tribes opens the possibility that large, senior priority water rights might be available for purchase for instream flows. New provisions in U.S. and state law would have to address how water could be transferred across the international boundary, and open the market to allow participation by entities representing non-consumptive environmental and recreational uses. New legal provisions

181. Data derived from U.S. BUREAU OF RECLAMATION, COMPILATION OF RECORDS IN ACCORDANCE WITH ARTICLE V OF THE DECREE OF THE SUPREME COURT OF THE UNITED STATES IN ARIZONA V. CALIFORNIA: CALENDAR YEAR 1998, at 16-17 (1999), combining the record of MWD's consumptive use and "IID/MWD Water Conservation Program Phase 1 conserved water made available by IID for diversion in current year by MWD." *Id.*

182. Although California's Seven-Party Agreement of August 18, 1931, apportions 5.362 million acre-feet annually among California's water users, the 1929 California Limitation Act of March 4, 1929, 1929 Cal. Stat. ch. 16, and the 1964 decree, *see* U.S. BUREAU OF RECLAMATION, *supra* note 181, at 16-17, limit California's use of Colorado River water to 4.4 million acre-feet per year, of which the first three priority rights to a combined 3.85 million acre-feet belong to agricultural users in southeastern California and the fourth priority right to 0.55 million acre-feet belongs to MWD.

183. *See* U.S. BUREAU OF RECLAMATION, #DES 00-25, COLORADO RIVER INTERIM SURPLUS CRITERIA DRAFT ENVIRONMENTAL IMPACT STATEMENT 1-3 (July 7, 2000).

184. *See* Rodney T. Smith, *Water Marketing: Building Flexibility into Water Allocations*, 1996 PROCEEDINGS FROM THE COLORADO RIVER WORKSHOP 113, 139.

185. The Cibola Irrigation District in Arizona has offered to sell 22,560 acre-feet of marketable Colorado River water. *See* Letter from Dan Israel, Attorney for the Cibola Irrigation District, to Chelsea Congdon, then Senior Research Analyst, Environmental Defense (June 6, 1997) (on file with author).

would also have to define parameters for the price of water for environmental uses and for the duration of the transferred water right.

2. *Environmental Damage Taxes*

Charging the costs of ecosystem damages to Colorado River water users is another potential use of the market to secure water for environmental purposes. An accounting system that established mitigation and restoration surcharges on all water and power used in the basin, internalizing ecosystem damage costs, would provide a reliable and broad-based source of funds for Delta restoration. An alternative version of this idea is to levy a surcharge (in water or money) against all U.S. transfers of Colorado River water, with revenues going to restore critical habitat in the United States and Mexico or to purchase water for the Delta. Water purchased or leased for environmental purposes should not be subject to these surcharges. Any fees would be earmarked to protect the "public-good" values of the river, such as habitat, wildlife, and recreation, including protection and restoration of the Delta and upper Gulf of California. Revenues could be collected by an entity authorized to represent environmental uses in the water market, such as buying or leasing water for the environment, and to spend monies for habitat restoration projects. The eligible entity could be established in a binational agreement. This entity could then administer funds to organizations that undertake conservation activities.

3. *Mitigation Banking*

Finally, the United States could revise environmental regulations to allow mitigation transfers and mitigation banking programs to support Delta habitats. Healthy Delta habitats could offset damage to threatened species and habitat components elsewhere in the lower Colorado basin. In some instances, it may be easy to demonstrate that greater benefits would accrue from conservation measures in the Delta than in other areas of the basin.

B. Public Participation and Environmental Advocacy

The success of any effort to preserve Delta ecosystems, whether administrative, legal, or based on markets, hinges upon its ability to identify and include the interests and concerns of local people—the community of place. Many daily decisions that affect the health of Delta ecosystems, such as the treatment of riparian vegetation, are made at the local level. Communities in the Delta are most directly harmed by degraded ecosystem conditions. If local communities benefit from a conservation strategy, their

stewardship is likely to enhance the Delta's health.[186] Support from the broader conservation community—the community of interest—is also essential, for without pressure from broad constituencies, decision makers in the United States and Mexico are unlikely to put Delta conservation ahead of the demands of consumptive water users. Like many natural resource management institutions, those responsible for the Colorado River operate on a mechanistic, reductionist worldview.[187] The inertia of these institutions will require that NGOs press them to adopt a paradigm shift to a perspective that provides products and services within a broader social and ecological context.

1. Local Communities and Advocacy

People living in the Delta region continue to depend on the ecosystem, from fishermen in the Gulf of California to burgeoning ecotourism operators.[188] To the extent that conservation plans include these economic interests, local communities will advocate for them, and will have the incentive to be good ecosystem stewards.

The Delta generates significant economic activity in addition to irrigated agriculture. Three communities—El Golfo de Santa Clara, San Felipe, and Puerto Peñasco—continue to rely on fishing as the basis for their culture and economy.[189] Sixteen tourist camps located near the confluence of the Río Hardy and the Río Colorado are used by visitors from Mexicali and the United States for fishing, hunting, and other water-based recreation, and local residents work as guides for these visitors.[190] Many communities in the Delta rely on riparian forests for fuel wood. One community produces catfish in an aquaculture facility.[191]

Approximately 600 Native Americans live in the Delta region, some 200 of whom are *Cucapá*.[192] No longer able to engage in their traditional subsistence practice of harvesting Palmer's salt grass, which has limited reproductive capability without regular flooding to disperse seeds, the *Cucapá* have looked to other harvests that the Delta supports. Members of several *Cucapá* settlements (*ejidos*) hunt and fish in the Delta,[193] but diminished river flows have forced many to truck their boats miles to reach the nearest waterways, and many travel farther to find work in the agricultural fields of the Mexicali Valley.[194] The *Cucapá* people have the only licensed commercial fishing operation in the Delta, with tribal rights to fish for Gulf corvina and shrimp.[195] However, subsistence fishing, hunting, and gathering are no longer common, and many *Cucapá* work as hunting and fishing guides and sell arts and crafts to tourists.[196]

Current debates over the Delta's future assume the support of Delta residents for ecosystem conservation. U.S. environmental groups act as if the benefits of conservation that would accrue to local communities outweigh the costs to the local communities. Yet human-induced threats to Delta ecosystems include local activities, not just damage from the absence of water. Overfishing has depleted Totoaba stocks.[197] Agricultural activities can result in the loss of native vegetation. People living in the Delta rely on local natural resources, and unless their subsistence needs are met, local pressures on the resource will continue. Successful examples of ecosystem protection in inhabited landscapes, such as Chitwan National Park in Nepal and Matobo National Park in Zimbabwe, demonstrate that protected area management can be structured to allow direct harvest of resources.[198] There are also ways to reduce locals' demand on ecosystem resources by developing alternative income sources. Although some ecotourism exists in the Delta, the potential for its expansion has not been well researched. The management plan for the Delta's Biosphere Reserve[199] recognizes that local communities have subsistence needs, but need greater incentives to shift from patterns of resource use to other income-generating activities.

Several agencies and organizations working on Delta restoration have sought input from communities in the Delta concerning strategies to improve Delta ecosystems. Two Mexican organizations, PRONATURA Sonora and the Intercultural Center for the Study of Deserts and Oceans

186. *See* BOB DOPPELT ET AL., ENTERING THE WATERSHED: A NEW APPROACH TO SAVE AMERICA'S RIVER ECOSYSTEMS 62 (1993).

187. *See generally* Winifred B. Kessler et al., *New Perspectives for Sustainable Natural Resources Management*, 2 ECOLOGICAL APPLICATIONS 221 (1992).

188. *See* VALDÉS-CASILLAS ET AL., *supra* note 12, at vi-vii.

189. *See id.* at 50.

190. *See id.* at 51.

191. *See id.*

192. *See id.* at 48.

193. In 1937, Lazaro Cardenas, Mexico's forceful and popular president, ordered the creation of the first 67 *ejidos* in an effort to reform land tenure. The Cardenas reforms triggered the first wave of migration to the upper Delta. *See* WILLIAM DEBUYS & JOAN MYERS, SALT DREAMS 141-44 (1999).

194. *See* Peggy Boyer, *Colorado River Water*, CENTRO INTERCULTURAL DE ESTUDIOS DE DESIERTOS Y OCÉANOS NEWS, Spring/Summer 1998, at 25.

195. *See* CARLOS VALDÉS-CASILLAS ET AL., WETLAND MANAGEMENT AND RESTORATION IN THE COLORADO RIVER DELTA: THE FIRST STEPS 17 (1998).

196. *See* VALDÉS-CASILLAS ET AL., *supra* note 12, at 50.

197. *See* Tom Knudson, *Sea of Cortez Teeming with Greed*, SACRAMENTO BEE, Dec. 10, 1995, at A1.

198. *See* JOHN A. DIXON & PAUL B. SHERMAN, ECONOMICS OF PROTECTED AREAS 65 (1990).

199. *See generally* CENTRO DE INVESTIGACIONES CIENTÍFICAS Y TECHNOLÓGICAS DE LA UNIVERSIDAD DE SONORA ET AL., *supra* note 81.

(CEDO), have been effective in soliciting local involvement,[200] but no established community or environmental organization has yet emerged as the primary facilitator of local involvement and advocate for local interests. One important development is the recent grassroots organization of local interests in the Delta. During the summer of 1999, Delta residents formed the *Asociación Ecológica de Usarios de los Ríos Hardy y Colorado* to share information and seek consensus on the issues affecting the area, to promote ideas to improve the management of the Delta's natural resources, and to develop sustainable development projects.[201] The Association's membership includes broad representation, including individuals who work in the fishing industry, tourism, and agriculture, as well as other stakeholders with an interest in the use and management of the resources of the Río Hardy–Colorado River region. As restoration of the Delta ecosystem progresses, this group and others may take on additional stewardship activities best conducted by local communities, such as monitoring habitats.[202]

3. NGOs and International Advocacy

People from all over the world—the community of interest—would like to see Delta ecosystems restored and have a role to play in Delta conservation as well. Absent legal action, public resources are not likely to be dedicated to Delta restoration unless a large and vocal constituency insists that it be made a conservation priority. Institutions presently controlling use of Colorado River water have historically protected the interests of water consumers, a dynamic not likely to change without significant pressure from people who want a healthy Colorado River delta ecosystem. The National Environmental Policy Act of 1969[203] obligates U.S. agencies to consider all interests as they make resource management decisions in the lower Colorado basin, but to date the BOR has not considered the full range of stakeholders. In Mexico, no legal mandate requires CNA to consider environmental interests.

Given that Mexico and the United States have historically been slow to advance Delta conservation, NGOs have an important role to play in assuring that alternatives to consumptive water use are considered. Public interest groups on both sides of the border have worked to coordinate their response to Delta threats. Groups from both countries have worked

200. *See generally* Elena Chavarria, Public Involvement in the Management and Restoration of the Colorado River Delta (unpublished manuscript, on file with author).

201. *See* Nijhuis, *supra* note 42, at 1. For more information, contact the Ecological Association for the Users of the Hardy-Colorado River via Jose Luis Blanco Argil <jlblanco@campus.gym.itesm.mx>.

202. *See* DOPPELT ET AL., *supra* note 186, at 66-67.

203. 42 U.S.C. § 4321–4370 (1994).

together to establish the Delta as a conservation priority, conduct research, educate, forge coalitions, encourage dialogue, and address the needs of people who live near the Delta and depend on its resources.[204] A small portion of these activities has been supported by U.S. agency dollars, but the majority has been funded by the philanthropy of foundations and individuals.

NGO advocacy efforts are increasing as NGOs accumulate a growing understanding and appreciation of Delta ecosystems as well as the mounting list of evidence that U.S. government agencies are not establishing Delta conservation and restoration as a priority. A number of NGOs and individuals concerned about the Delta have formed an informal caucus[205] to

- facilitate recognition of currently unheard voices for conservation;
- halt degradation and restore ecological and sustainable social conditions;
- identify alternative water sources;
- seek specific water allocation for Delta conservation;
- demand that U.S. water managers consider the effects of U.S. actions on Mexican Delta resources;
- monitor species dependent on flows;
- increase scientific understanding of conservation needs including an inventory of Delta resources and collection of information relevant to adaptive conservation management;
- stop toxic threats;
- relate economic health to ecosystem health;
- enhance local cultures; and
- recognize the importance of recreation and fisheries.

The significance of this caucus cannot be overstated; together the member organizations represent Delta residents, more than a dozen scientific organizations, and hundreds of thousands of voters. If this group coordinates its activities, it has the potential to become a formidable voice in the politics of Delta conservation.

204. *See supra* note 52. *See also* Pacific Institute, *Workshop Proceedings, Water Issues in the Colorado River Basin Border Region* (Nov. 18-19, 1999) (visited Sept. 8, 2000) <http://www.pacinst.org/coloradopro.pdf>.

205. *See supra* note 52. For more information on this informal caucus, contact the author at Environmental Defense (jennifer_pitt@environmentaldefense.org).

V. CONCLUSION

Saving the Delta from further decline and shoring up resources to improve the quality of its habitats will require substantial long-term commitments by numerous stakeholders. The challenges are many, including the arbitrary obstacle of a political border that severs the Delta from its watershed; the distrust across an international border; the heterogeneity of institutions implicated in the Delta's conservation; the archaic Law of the River that focuses on offstream water developments and consumptive use instead of a more modern interest in instream flows, environmental restoration, and the ecological values of the Delta; the need for specific, codified water deliveries to the Delta; and the need for a binational agreement between Mexico and the United States that requires the commitment of governments and local communities to manage for the Delta ecosystem's health.

These challenges are considerable, yet surely less imposing than the cumulative cost and complexity of the construction of storage and diversion projects on the Colorado River. The cost of dessication and loss of remaining emergent wetland and riparian habitat in the Colorado River delta, and the loss of myriad terrestrial and aquatic species these habitats support, cannot be calculated. Clearly these costs would be unacceptably high. The value society places on nature today is reflected in environmental laws such as the U.S. Endangered Species Act and the billions of dollars in voluntary contributions given each year to environmental organizations. Mexico has made a significant commitment to the Delta in declaring it a biosphere reserve, and both the United States and Mexico have laid the foundation for substantive conservation management in their Letter of Intent and Joint Declaration. Both nations are ruled by democracies that ostensibly represent their citizenry and govern for their benefit. The Colorado River was developed in the twentieth century by a society determined to tap natural resources for economic gain; surely the river's Delta can be preserved in the twenty-first century by a society determined to conserve natural ecosystems.

SUZANNE M. MICHEL*

Defining Hydrocommons Governance along the Border of the Californias: A Case Study of Transbasin Diversions and Water Quality in the Tijuana–San Diego Metropolitan Region

ABSTRACT

The geography of water resources along the border between California and Baja California represents a network of manmade aqueduct and storage facilities utilized for water transfers. This network of water transport and storage facilities, known as a hydrocommons, delivers Colorado River water for agricultural uses in the eastern part of the Californias' border region and to western urban centers on the Pacific Coast. As with other urban regions in Baja California and Southern California, the Tijuana-San Diego metropolitan region depends upon water imports for the region's rapidly growing economic and residential needs. Today, water agencies in San Diego and Tijuana are investigating the possibility of constructing a binational aqueduct to import greater amounts of Colorado River water. This article defines the hydrocommons that connects the Tijuana–San Diego metropolitan region to the Colorado River and the consequent border water quality and ecosystem degradation problems caused by Colorado River transbasin diversions. After a review of the environmental problems caused by the border hydrocommons, the article turns to an analysis of hydrocommons based governance. In Northern California, a hydrocommons based governance program is evolving to address the water quality and wetlands ecosystem degradation associated with transbasin diversions from Northern California's Bay-Delta estuary region. This hydrocommons project, known as the CALFED process, links the politics and management of water supply, water quality, and wetlands restoration for Northern California's Bay-Delta estuary. Governance lessons learned from the CALFED process are detailed. Hydrocommons governance along the border of the Californias could be utilized to not only restore the Colorado River Delta but also to protect river, estuarine, and coastal water quality in the Tijuana–San Diego metropolitan region.[1]

---

* Ph.D. Water Resources Geography, Institute for Regional Studies of the Californias and the Department of Political Science, San Diego State University.

1. The article is based upon the author's dissertation research of water quality politics in the Tijuana–San Diego metropolitan region. The author spent three years using participant observation, document analysis, and intensive interviews for collecting data. Due to the

INTRODUCTION

Within the past decade, water resources scholars, government agencies, and water supply agencies have started to examine the links between long distance transbasin water transfers, water quality, and watershed ecosystem degradation. Water resources policy makers and scholars who stress the connections between water quality and watershed ecosystem health with transbasin diversions support a hydrocommons based approach.[2] Hydrocommons based water quality management is a regional approach towards water quality management and governance.[3] What differentiates the hydrocommons approach from watershed based approaches to water quality management is that hydrocommons governance recognizes the environmental links between the region that sends or exports water and the region that receives water imports.[4] In addition, a hydrocommons approach recognizes the environmental links between water transfers, water pollution of surface and ground waters, and aquatic ecosystems degradation.[5]

In California and Baja California, two major transbasin diversions from the Sacramento and Colorado Rivers provide water to the Tijuana–San Diego metropolitan region. San Diego imports between 75 to 90 percent of its water supply from the Sacramento River Basin, 600 miles north of San Diego, and from the Colorado River, which is approximately 240 miles east of San Diego.[6] The City is negotiating to increase its current supply of water through agriculture to urban transbasin water transfers from Imperial Valley, California. During times of drought, Tijuana imports up to 90 percent of its water supply from the Colorado River and is seeking to

political sensitivity of the topic and the human subjects requirements of the University of Colorado, Boulder (the university granting the Ph.D. degree), the author cannot reveal the identity of informants in this research. The author apprised all informants of the research project contents and the risks associated with the research participation. A copy of the informant consent form for interviews is provided at the end of the article.

2. *See generally* Gary D. Weatherford, From Basin to "Hydrocommons": Integrated Water Management without Regional Governance 1 (Western Water Policy Project Discussion Series Paper No. 5, 1990) (unpublished paper, on file with Natural Resources Law Center, University of Colorado School of Law).

3. *See id.*

4. *See id.*

5. *See* Suzanne M. Michel, Place, Politics and Water Pollution in the Californias: A Geographical Analysis of Water Quality Politics in the Tijuana–San Diego Metropolitan Region 285 (2000) (unpublished Ph.D. Dissertation, University of Colorado (Boulder)) (on file at University of Colorado (Boulder) Library).

6. *See id.* at 287.

increase its allocation of Colorado River water.[7] At present, both cities are working together to investigate the possibility of constructing a binational aqueduct to transport increasing amounts of Colorado River water to the Tijuana–San Diego Metropolitan region.[8]

This article delineates the hydrocommons that connects the Tijuana–San Diego metropolitan region to the Colorado River and the consequent border water quality and ecosystem degradation problems caused in part by Colorado River transbasin diversions. After a review of environmental problems caused by these transbasin diversions, the article turns to an analysis of hydrocommons based governance and the applicability of such governance to improve water quality and supply problems caused in part by Colorado River transbasin diversions. In California, a hydrocommons based governance program is underway to address the water quality degradation associated with transbasin diversions from Northern California's Bay-Delta estuary region. This hydrocommons project, known as the CALFED process, links governance of water supply, water quality, and restoration of the Bay-Delta estuary ecosystem.

A hydrocommons based governance entity connecting the lower Colorado River Basin with expanding urban regions in Southern California and Tijuana has not been implemented, but certain organizations have initiated work groups and conferences to examine this governance option. For these organizations, hydrocommons based management makes sense because in this western part of the U.S.–Mexico border region, the primary waterways are not large river basins (such as the Río Grande in the eastern borderlands). Instead, Southern California's and Northern Baja California's primary waterways are a network of manmade canals and aqueducts that divert Colorado River water to agricultural fields in the Mexicali and Imperial Valleys, and west to expanding urban regions such as Los Angeles, Tijuana, and San Diego.

WHAT IS A HYDROCOMMONS?

Before discussing the hydrocommons that exists along the border between California and Baja California, it is important to understand water transfers. Water transfers are defined in the United States as the process of moving water supplies through a complex of water storage and distribution systems from areas of lesser need to areas of greater need.[9] Water transfers may occur either within a watershed (intrabasin), or beyond the natural

7. *See id.*

8. *See id.*

9. *See* WATER EDUCATION FOUNDATION, LAYPERSON'S GUIDE TO WATER MARKETING & TRANSFERS 1-4 (1996).

watershed boundaries (transbasin diversions).[10] Water transfers can occur between agricultural interests or firms, or between agricultural and urban users. Water supply agencies and politicians in Tijuana and San Diego cite transbasin water transfers as advantageous because the transfers assure a long term, reliable water supply that meets the demands of the growing urban binational economy and population.[11]

According to Gary D. Weatherford, once a transbasin water diversion or transfer is made, the sending and receiving basins/watersheds are linked.[12] This linkage, made via the transfer, erases the natural boundaries of both sending and receiving basins.[13] When transbasin water transfers are established by conveyance systems such as storage reservoirs and aqueducts, the receiving basin becomes dependent upon the sending basin for water.[14] In addition, the sending basin is no longer self-contained because water is diverted beyond its natural basin boundaries. Areas downstream of the diversion now receive less water. Consequently, the sending region's water quality and aquatic ecosystems downstream of the diversion are altered.[15] In essence, transbasin diversions "cause hydrologic basins to be reshaped, breached and bonded by hydraulics resulting in hybrid basins."[16] These hybrid basins, which are tied together by man-made plumbing, are known as hydrocommons.[17] What is important to understand is that the creation of the hydrocommons results in altered hydrology, water quality, ecosystems, economies, and even land use patterns in both the sending and receiving watersheds/basins.[18] Consequently, in regions that rely on transbasin diversions such as the Tijuana–San Diego metropolitan region, Weatherford and other hydrocommons proponents argue that watershed or river basin management should be viewed actually as hydrocommons management.[19]

Figure One details the hydrocommons that provides water to urban regions in Southern California and Northern Baja California. The total amount of Colorado River transbasin diversions for Southern California and Northern Baja California (agriculture and urban) range between six to eight million acre-feet each year.[20] These transbasin diversions, along with

10. *See id.* at 4-5.
11. *See* Michel, *supra* note 5, at 286.
12. *See* Weatherford, *supra* note 2, at 5-6.
13. *See id.*
14. *See id.*
15. *See* Michel, *supra* note 5, at 287-88.
16. *See* Weatherford, *supra* note 2, at 3.
17. *See id.*
18. *See* Michel, *supra* note 5, at 288.
19. *See id.*
20. *See id.* at 290.

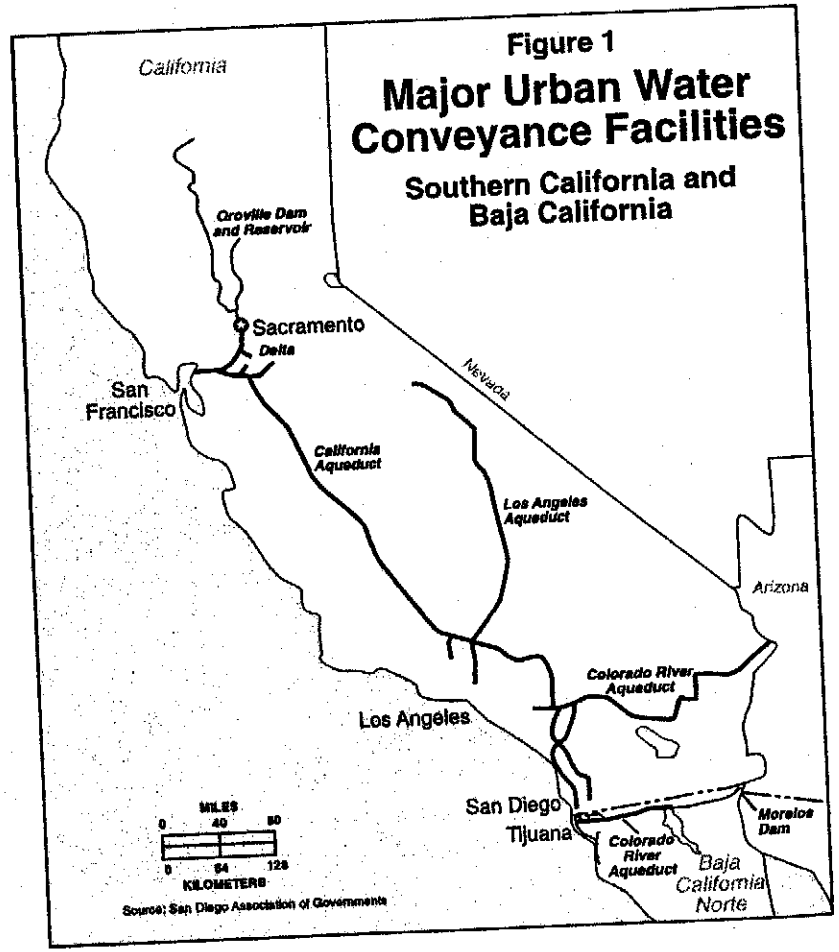
other diversions from the Colorado River Basin, are the primary cause of numerous water and land based environmental degradation problems along the California and Baja California border.[21] Currently, laws and governmental organizations in the United States do not adequately address the links between transbasin diversions, water quality, and habitat destruction. In Mexico, government water resources organizations at the federal and state levels govern water supply in conjunction with water quality. Laws and infrastructure planning, however, rarely address the connections between transbasin diversions, water quality, and wetlands habitat destruction.

ESTABLISHING HYDROCOMMONS CONNECTIONS BETWEEN THE LOWER COLORADO RIVER BASIN AND THE TIJUANA–SAN DIEGO METROPOLITAN REGION

Colorado River Transbasin Diversions for San Diego

As shown in figure one, San Diego's source of Colorado River water comes from the Colorado River aqueduct, an aqueduct owned and operated by Metropolitan Water District of Southern California (MWD).[22] [23] San Diego County Water Authority is the water supply organization that buys water from MWD, and subsequently sells this imported water to various water districts and cities in the San Diego region.[24] In 1998, San Diego County Water Authority imported 490,000 acre-feet of water from MWD.[25] This imported water is a blend of State Water Project water from the Northern California Bay-Delta estuary and the Colorado River. According to the City of San Diego Manager's Report, dated March 24, 1999, the city of San Diego has received several unsolicited offers for water transfers from Central Valley, Northern California, and the Colorado River basin.[26] One

21. *See id.*
22. *See id.* at 330.
23. Metropolitan Water District of Southern California (MWD) was formed in 1928, pursuant to California's Metropolitan Water District Act. *See* CAL. WATER CODE (APP.) §§ 109-1 to 109-551 (West 1995). MWD represents 240 cities and unincorporated areas and serves 17 million people in six counties of Southern California. *See* ARTHUR L. LITTLEWORTH & ERIC L. GARNER, CALIFORNIA WATER 13-15 (1995); Metropolitan Water District of Southern California, *Fact Sheet* (visited Oct. 20, 2000) <http://www.mwd.dst.ca.us/Docs/AboutMWD/FactSheet/factsheet.htm>.
24. *See* Michel, *supra* note 5, at 331.
25. *See id.*
26. *See id.*



main issue for San Diego is conveyance of imported water supplies. How can San Diego transport and store the imported water? How will conveyance be financed?

San Diego actively supports an increase in water supplies because local government officials cite that San Diego's population will increase from 2.8 million in 1999 to 3.6 million in 2015.[27] In addition, water supplies

27. *See id.*

need to be long term and reliable to support San Diego's 87 billion dollar economy.[28] By 2015, San Diego County Water Authority officials estimate that San Diego's growing economy and population will nearly double the region's demand for water supplies to 868,700 acre-feet per year.[29] One key provision of San Diego's plan to increase its water supply is for Imperial Irrigation District (IID) to transfer or sell Colorado River water directly to the San Diego County Water Authority.[30] [31] This water transfer agreement was approved by the San Diego County Water Authority Board of Directors in 1998. The agreement proposes to transfer 200,000 acre-feet per year for an initial term of 45 years.[32] San Diego County Water Authority may increase the water transfer amounts to a total of 300,000 acre-feet, and renew the water transfer agreement for an additional 30 years.[33]

The San Diego County Water Authority–Imperial Irrigation District water transfer represents San Diego's move to obtain its own water imports in addition to those it now receives from Metropolitan Water District of Southern California (MWD).[34] At present, all of San Diego's imported water is supplied by MWD.[35] By 2015, San Diego County Water Authority proposes to reduce MWD imports by 25 percent.[36] However, even with its own water supplies from IID, San Diego is still dependent upon MWD to transport the water from the Colorado River.[37] At present, the only way for San Diego County Water Authority to transport IID water is through the

28. *See id.*

29. San Diego County Water Authority, Presentation: Future Water Supply Reliability for San Diego County, at the Smart Growth Water Resources Specialty Group, San Diego, Cal. (Mar. 31, 1999) (copies of slides on file with author).

30. *Id.*

31. The California legislature supported this transfer by setting aside $235 million for use on a number of farm water conservation measures in IID. These measures should save agricultural water so that IID may transfer or sell conserved water to the San Diego County Water Authority. *See* Michel, *supra* note 5, at 332.

32. *See id.*

33. See San Diego County Water Authority, *supra* note 29.

34. Critics cite that San Diego's need for independence from MWD is resulting in water transfer deals that force San Diego county water users to pay more for water. The IID water transfers indeed support this assertion. IID pays the U.S. Bureau of Reclamation $12.50 per acre-foot of Colorado River water. If the IID–San Diego County Water Authority transfers are approved, IID will sell water to San Diego County Water Authority for $200 per acre-foot of water, which may increase to around $306 per acre-foot of water. Based upon other agriculture to urban water transfers in California (Central Valley Project water, for example), critics state that San Diego should pay between $165 to $185 per acre-foot of water. One critic estimates that for the initial 45 year, 200,000 acre-foot contract, San Diego ratepayers will spend $1.1 billion more than they should be paying for water. *See* Steven P. Erie, *San Diego/Imperial Valley Water Deal: Who Stands to Gain? Who to Lose?*, METRO INVESTMENT REPORT, June 1997, at 1, 1-2.

35. *See* Michel, *supra* note 5, at 333.

36. San Diego County Water Authority, *supra* note 29.

37. *See* Michel, *supra* note 5, at 334.

Colorado River aqueduct, an aqueduct owned and operated by MWD.[38] Negotiations for the wheeling rate (transport fees) of IID water with MWD have been problematic at best. San Diego wants to keep costs down on the transportation fees and claims that MWD's wheeling rate is yet another example of MWD overcharging their customers.[39] On the other hand, MWD, which has built, financed, and continues to maintain the aqueduct and water treatment facilities, asserts that San Diego should pay for these services in the wheeling or transportation rates. As a result of these tense negotiations concerning the use of MWD's aqueduct, San Diego is looking to the south to work with Tijuana to build a second aqueduct. This aqueduct would transport IID water transfers and Tijuana's increasing Colorado River water allocations to the San Diego–Tijuana metropolitan region.[40]

Colorado River Transbasin Diversions for Baja California and Tijuana

According to water laws throughout the United States, individual states are empowered to appropriate water. In Mexico, however, all waters are owned and appropriated by the nation.[41] States, irrigation districts, and municipalities cannot own water and appropriation cannot be done without federal government supervision and approval.[42] In addition, Mexican water law and appropriation decisions encompass not only water supply but water quality, including regulation of diverted waters once they are utilized and discharged.[43] The federal organization that has jurisdiction over planning, permitting, and enforcement of water resources (quality and quantity) is the *Comisión Nacional del Agua* (CNA), or the National Water Commission.[44]

Tijuana's current allocation of Colorado River water is 2,537 liters per second.[45] This water is delivered by the Río Colorado–Tijuana Aqueduct, an aqueduct operated and maintained by the State Water Service Commission or the *Comisión de Servicios de Agua del Estado* (COSAE).[46] The

38. *See id.*
39. *See id.*
40. *See id.*
41. *See id.* at 336.
42. *See id.*
43. *See id.* Given the recent election of opposition party Vicente Fox (PAN) as Mexico's president, however, administration of water rights may change.
44. *See id.*
45. Comisión Nacional del Agua, Presentation: Panoramica de los Recursos Hídraulicos en Baja California, at the Border of the Californias Water Recycling Plan Workshop, International and Boundary Water Commission, San Diego, Cal. (Aug. 12, 1999) (handout on file with author).
46. *See* Michel, *supra* note 5, at 339.

water organization that delivers water to Tijuana's water users (imported and locally developed water supplies) is a state agency, the *Comisión Estatal de Servicios Públicos de Tijuana* (CESPT). This agency provides both water and wastewater services to Tijuana and Rosarito Beach, a community approximately 16 miles south of Tijuana.[47] Table one[48] provides a breakdown of sources of potable water for Tijuana as of July 1999.

TABLE ONE: Water Production in Tijuana, July 1999

Source of Water Supply	Liters per Second	Acre-feet per year
Surface Water: Presa Rodriguez (Rodriguez Dam)	2,250	56,612
Surface Water: Presa Carrizo (Carrizo Dam)	789	19,852
Tijuana-Alamar River Aquifer	40 (capacity: 200)	1,006 (capacity 5032)
Colorado River-Tijuana Aqueduct*	0 (capacity: 4000)	0 (capacity: 100,645)
Water Supplies Sent to Rosarito Beach	- 144	- 3,623
Total	**2, 935**	**73,847**

*Tijuana's allocation of Colorado River Water is 2,537 liters per second or 63,834 AF/year

As shown in table one, during the month of July 1999, Tijuana did not use its allocation of transbasin diversions from the Colorado River. CESPT can obtain water from the Colorado River Aqueduct, but the state agency in charge of the aqueduct, COSAE, does not operate the aqueduct until Tijuana runs out of local surface and groundwater supplies, usually in years with drought conditions.[49] This action saves the state from paying high energy costs to pump water over the mountains between Tijuana and the Colorado River.[50] In addition, the current aqueduct is in poor structural condition, and there is significant water loss as water is delivered from the Colorado River to Tijuana.[51]

Like San Diego, Tijuana seeks to increase its water supplies to support a growing economy and population.[52] By 1999, Tijuana's popula-

47. *See id.*
48. *See id.*
49. *See id.* at 340.
50. *See id.*
51. *See id.*
52. *See id.*

tion was 1.2 million people, and by 2010 the *Comisión Estatal del Agua* (CEA) estimates the population will be well over two million.[53] Tijuana's rapid population growth rate poses for CESPT a tremendous challenge to provide potable water for all city residents. This is an especially difficult task since state and municipal agencies receive little or no financial income from the federal government.[54] It is estimated that by 2004 water rationing will start for Tijuana.[55] According to a local newspaper, Tijuana has four options to solve its water shortage problem.[56] First, Tijuana may retrofit and modernize the existing aqueduct.[57] Second, the city may construct a second aqueduct.[58] Third, it may construct desalinization plants, and fourth the city may use wastewater reclamation as a supplemental source of water.[59]

The Tijuana–San Diego Binational Aqueduct

The government-sponsored proposal to build a binational aqueduct for the Tijuana–San Diego metropolitan region has its roots in the Border Water Council. The Border Water Council was formed in 1998 and was designed as a forum for water agencies in Tijuana and San Diego to discuss binational solutions to water resources management in the Tijuana–San Diego metropolitan region.[60] As of May 2000, the primary mission of the Border Water Council is to investigate the possibility of constructing a binational aqueduct to deliver water from the Colorado River to the Tijuana–San Diego metropolitan region.[61] During the summer of 1999, Border Water Council representatives completed a technical report and submitted a draft memorandum of agreement (MOU) to the International Boundary and Water Commission (IBWC).[62] On October 14, 1999, IBWC signed Minute 301.[63] The Minute established the scope, the plan and

53. Comisión Estatal del Agua, Presentation: Baja California–Programa de Infrastructura Hidráulica para el Saneamiento Ambiental y Suministro de Agua Potable in Tijuana, B.C., Mex. (Aug. 5, 1999) (handout on file with author).
54. *See* Michel, *supra* note 5, at 340.
55. *See Cross-Border Proposal Aims at Region's Water Shortage*, SAN DIEGO DIALOGUE, Aug. 1999, at 1, 8-9.
56. *See* Héctor Javier González Delgado, *2004: Sin Agua*, ZETA, Aug. 13-19, 1999, at 16A.
57. *See id.*
58. *See id.*
59. *See id.*
60. *See* Michel, *supra* note 5, at 342.
61. *See id.*
62. *See id.*
63. *Joint Colorado River Water Conveyance Planning Level Study For The San Diego, California –Tijuana, Baja California Region*, IBWC Minute 301 (Oct. 14, 1999), *available at* <http://www.ibwc.state.gov/FORAFFAI/MINUTES/min301.htm>.

responsibilities of the binational aqueduct investigation.[64] Funding for this investigation is $3 million.[65] San Diego County Water Authority will provide $500 thousand and the California Department of Water Resources will provide $2.5 million.[66]

There is a second, private proposal by two Mexican businessmen for a Tijuana–San Diego binational aqueduct. Francisco Molina, director of the Mexican development company EMTEC, and Gastón Luken Aguilar, chairman of the board of Proxima Gas, propose building a binational aqueduct and power plant in Mexico.[67] This aqueduct would have a capacity of 525,230 acre-feet per year, with up to 300,000 acre-feet of IID water for San Diego, and 225,230 acre-feet of water for Tijuana.[68] The total cost of the aqueduct power plant project is estimated at $800 million.[69]

Despite the two proposals, a binational aqueduct faces political and legal challenges in both Mexico and the United States. On the U.S. side, the funding source will determine what laws will apply to such a project.[70] If federal funding is provided, then the National Environmental Policy Act (NEPA)[71] requires an Environmental Impact Study (EIS). In addition, if project funding is drawn from the North American Development Bank (NADBank),[72] the project must receive certification from the Border Environmental Cooperation Commission (BECC).[73] Both the NEPA EIS and BECC certification processes entail extensive public review and participation. In addition to federal legal requirements, it is unclear as to how other Colorado River Basin states will react to yet another aqueduct or "straw" that will draw water from an already over-allocated Colorado River.[74] At the 1997 Public Officials for Water and Environmental Reform Conference on California Water Policy, the "second" aqueduct for Southern California question was posed to water agency representatives from Nevada and Arizona. Both representatives stated an emphatic "no" to a second aqueduct.[75]

64. *See id.*
65. *See* Steve La Rue, *U.S., Mexico Set Aqueduct Study*, SAN DIEGO UNION–TRIB., Sept. 7, 1999, at B1.
66. *See id.*
67. *See Cross-Border Proposal Aims at Region's Water Shortage*, *supra* note 55, at 1, 8-9.
68. *See id.*
69. *See id.*
70. *See* Michel, *supra* note 5, at 344.
71. 42 U.S.C. §§ 4321- 4370 (1994).
72. The 1994 NAFTA Environmental Accord created NADBank to assist communities and potential buyers in the financial design and structure of environmental infrastructure projects.
73. *See* Michel, *supra* note 5, at 344.
74. *See id.*
75. *See id.*

Concerning the IID water transfers, San Diego County Water Authority faces two legal hurdles. The first is the completion of an Environmental Impact Report and public review process, as required by the California Environmental Quality Act.[76] In addition, the transfers must be approved by the State Water Resources Control Board (SWRCB).[77] For this approval, the SWRCB will examine the type of transfer or the mechanism used to free up water for the transfer (fallowing, crop shifting, substitution of ground water for surface irrigation, or conserved water, for example).[78] Also, the State Board must examine third-party impacts or economic consequences to rural communities sending water to San Diego.[79] Farmers and other local business owners in Imperial Valley fear that the IID water transfers could result in fallowing of farmlands and a subsequent decline of Imperial County's local economy, which is dependent upon agriculture.[80] Finally, California prohibits water transfers that would unreasonably affect fish and wildlife.[81] The SWRCB will evaluate environmental impacts, and if significant environmental impacts are determined, the SWRCB may require an environmental water allocation, or a transfer tax to fund environmental water transfers.[82] [83]

Concerning agricultural to urban water transfers from the Mexicali Valley to Tijuana, it is unclear if and how these transfers will occur. Since water use in the Mexicali Valley accounts for 81 percent of Mexico's Colorado River water supplies, the CNA plans to examine techniques that may increase agriculture water use efficiency in the irrigation districts.[84] These techniques include more precise measurement of consumptive water

76. CAL. PUB. RES. CODE §§ 21000–21178.1 (West 1996).
77. *See id.*
78. *See id.* at 345.
79. *See id.*
80. *See* WATER EDUCATION FOUNDATION, *supra* note 9, at 2-3, 18.
81. *See* Michel, *supra* note 5, at 345.
82. *See id.*
83. The IID–San Diego water transfers also incur a possible international water conflict. One method to free up water for the transfer is to line the All-American Canal in Imperial Valley. This conservation method has been approved by IBWC and is funded by the state of California. The lining will save IID an estimated 100,000 acre-feet per year. However, water from the All-American Canal has seeped into an aquifer, and most of this aquifer is located in Mexico. For decades, farmers in the Mexicali Valley have used this groundwater for irrigation agriculture. The lining will reduce a significant amount of recharge for the aquifer, an estimated 80,000 acre-feet each year. Farmers in the Mexicali Valley strongly oppose this lining and continue to bring up the topic in binational forums and conferences. *See* Roman J. Calleros, *The Impact on Mexico of the Lining of the All-American Canal*, 31 NAT. RESOURCES J. 829, 829-38 (1991); Douglas L. Hayes, *The All-American Canal Lining Project: A Catalyst for Rational and Comprehensive Groundwater Management on the United States–Mexican Border* 31 NAT. RESOURCES J. 803, 803-27 (1991).
84. Mexicali Valley is one of Mexico's most productive agricultural regions. *See* Hayes, *supra* note 83, at 803.

use, water conservation, and water reclamation, resulting in more Colorado River water for Tijuana.[85] CNA, however, does not support water transfers from Mexicali Valley as the only source of water to fulfill Tijuana's growing water demands.[86] CNA plans to examine the feasibility of desalinization plants to supply water for the expanding urban regions on the west coast of Baja California.[87]

At the state level, the State Water Commission (CEA) and the State Commission of Water Services (COSAE) are the two state agencies that are the strongest supporters of a second aqueduct for Tijuana.[88] According to the COSAE State Hydraulic Plan, the 1992 National Water Law allows for the sale of irrigation water rights.[89] The water rights' acquisitions may occur in three ways. First, Tijuana or the State could rent agricultural land in Mexicali and thus obtain water rights attached to the land.[90] Second, the land and the water rights could be sold to Tijuana or the state.[91] In these two cases it seems that the agricultural land may be fallowed for the water transfers. The third strategy is to substitute reclaimed water for irrigation uses in the Mexicali Valley.[92] The unused Colorado River water would then be transported to Tijuana.[93] In COSAE's discussion of water transfers neither third party nor environmental impacts are addressed.[94] CEA officials, however, support the water transfers but remain quiet on how the transfers will occur.[95]

In this section, the status of Colorado River transbasin diversions and the status of the binational aqueduct proposal have been detailed. In the next section, environmental consequences of increased diversions from the Colorado River to the Tijuana–San Diego metropolitan region will be discussed. Since this study is focused upon water quality in the Tijuana–San Diego metropolitan region, this section will focus upon the environmental impacts of increased Colorado River transbasin diversions to the receiving region of the hydrocommons, the Tijuana–San Diego metropolitan region. Environmental consequences of transbasin diversions in receiving regions are an aspect of hydrocommons governance ignored by most water resources policy makers and scholars.

85. *See* Michel, *supra* note 5, at 346.
86. *See id.*
87. *See id.* at 347.
88. *See id.*
89. COMISIÓN DE SERVICIOS DE AGUA DEL ESTADO (COSAE), PLAN ESTATAL HIDRÁULICO 1994-2015, at 77-78 (1994).
90. *See id.*
91. *See id.*
92. *See id.*
93. *See id.*
94. *See* Michel, *supra* note 5, at 347.
95. *See id.*

COLORADO RIVER HYDROCOMMONS CONNECTIONS AND ENVIRONMENTAL CONSEQUENCES

The Sending Region: The Colorado River Delta and Upper Gulf of California

According to Professor Daniel W. Anderson, Professor of Wildlife Biology at the University of California, Davis, four linked areas in Baja California and California need immediate wetland restoration attention. These are the Klamath Basin, the San Francisco Bay–Delta estuary, the San Joaquin Valley, and the Río Colorado (Colorado River) Delta region.[96] The latter delta, often referred to as California's "Other" Delta (the preeminent delta being the San Francisco Bay–Delta estuary), is a wetland ecosystem that, to date, has largely been ignored by policy makers in California and Baja California. Like the Bay-Delta estuary, the Río Colorado Delta has been dramatically altered by transbasin diversions from the Colorado River.[97]

At the turn of the century, the Río Colorado Delta was the largest and most diverse desert wetland system in North America.[98] This delta spanned an enormous area, more than 150 miles long and 100 miles across.[99] The Delta supported between 200–400 plant species in various habitats from forests, to grasslands, to tidal wetland marshes and estuaries.[100] Aldo Leopold, a highly esteemed U.S. environmentalist, described the region as one of hundreds of green lagoons, awesome jungles, and lovely groves.[101] In addition, nutrients, sediment loads, and fresh water from the Colorado River supported not only the Delta wetland habitat but also the diverse and productive Upper Gulf of California marine ecosystem.[102] Mexico's Upper Gulf of California, also known as the Sea of Cortez, was once a place of biological richness and a seemingly limitless source of fish for food, for commerce, and for sport.[103] In this marine

96. *See* Daniel W. Anderson, *Saving More than the Salton Sea*, UC MEXUS NEWS, Summer 1999, at 2, 2-3.

97. *See* JASON I. MORRISON ET AL., SUSTAINABLE USE OF WATER IN THE LOWER COLORADO RIVER BASIN 21-26 (1996).

98. *See id.*

99. *See* SARAH F. BATES ET AL., SEARCHING OUT THE HEADWATERS: CHANGE AND REDISCOVERY IN WESTERN WATER POLICY 115 (1993).

100. *See* MORRISON ET AL., *supra* note 97, at 21-26.

101. *See* BATES ET AL., *supra* note 99, at 115.

102. *See* Michel, *supra* note 5, at 350.

103. *See* Kathyrn Vincent, *Science and Policy in "The Hollow of God's Hand,"* UC MEXUS NEWS, Summer 1999, at 1, 4-5.

ecosystem, a gulf shrimp fishery and commercial sports fishing industry once thrived.[104]

In 1999, Colorado River transbasin diversions in the United States and Mexico dramatically reduced the natural flow of water, silt, and nutrients to the Colorado River Delta and the Upper Gulf of California.[105] Except for rare high flood years (for example, 1983 and 1998), the entire flow of the river is diverted and used.[106] The reduced Colorado River flow has desiccated the Delta and the Upper Gulf estuaries. Today, wetland habitat exists but only where agriculture drainage water is discharged or where there is groundwater flow.[107] Estuary habitat in the Upper Gulf of California is probably the most endangered habitat because the estuaries no longer contain adequate amounts of freshwater flow to support estuary ecosystems.[108]

Due to the amount of wetland habitat that has been lost, a number of species that depend upon the Colorado River Delta and the Upper Gulf ecosystem are threatened or endangered. One group of threatened species is migratory birds (brown pelicans, white pelicans, Virginia rails, least bitterns, white-face ibis, green-backed heron, and black-crowned heron) that use the Delta wetlands and the Sea of Cortez as a place for resting and breeding within the Pacific Flyway system.[109] In addition, marine ecosystems in the Upper Gulf of California have degraded due to diminished Colorado River flows.[110] Local fishermen and biologists in the Gulf of California area assert that the decline in Gulf shrimp and commercial fish catches such as the totoaba is due to the lack of nutrient-rich water inflow from the Colorado River into the Gulf of California.[111] [112]

104. *See* Michel, *supra* note 5, at 350. *See generally* M.F. Lavin & Salvador Sánchez, *On How the Colorado River Affected the Hydrography of the Upper Gulf of California*, 19 CONTINENTAL SHELF RES. 1545, 1545-47 (1999) (describing how the marine ecosystem was before alteration of the Colorado River by dams).

105. *See* Michel, *supra* note 5, at 350.

106. *See* MORRISON ET AL., *supra* note 97, at 22; Edward P. Glenn et al., *Effects of Water Management of the Wetlands of the Colorado River Delta*, 10 CONSERVATION BIOLOGY 1175, 1175-86 (1996).

107. *See* Glenn et al., *supra* note 106, at 1175-86.

108. *See id.*

109. *See* Anderson, *supra* note 96, at 2. The Pacific Flyway system consists of wetlands that host migrating waterfowl as they travel north or south along the west coast of North and South America.

110. *See* Michel, *supra* note 5, at 353.

111. *See id.*; Manual S. Galindo-Bect et al., Analysis of the Penaeid Shrimp Catch in the Northern Gulf of California in Relation to Colorado River Discharges (n.d.) (unpublished manuscript, on file with author).

112. Today, due to transbasin diversions, wetlands exist in California that are part of the Delta wetland ecosystem. The largest and most biodiverse wetland/marine ecosystem is the Salton Sea, a terminal saline lake located 35 miles north of the U.S.–Mexico border and 90 miles

Given that the United States is diverting most of the Colorado River water (15 million or more acre feet) and the 1944 treaty[113] grants Mexico only 1.5 million acre-feet of Colorado River water, Mexican responses to save the Río Colorado Delta and Upper Gulf ecosystem are localized and limited at best.[114] One response by universities in Baja California is to document the hydrological and geomorphological (i.e., sediment flows) effects of reduced Colorado River flows in the Upper Gulf of California.[115] In addition, university researchers have created artificial fisheries for the endangered totoaba, which needs Delta estuary habitat for spawning.[116] In 1993, the Mexican government set aside 2.3 million acres of water and land within the Delta and the Upper Gulf as a United Nations Biosphere Reserve.[117] Over 400,000 acres are designated as a core zone, limiting activities to research, small-scale shell harvesting, and limited ecotourism.[118] For the manager of the Delta Biosphere Reserve and wetlands advocates in the United States and Mexico, the major goal of the reserve is obtaining fresh water flows from the Colorado River.[119]

COLORADO RIVER HYDROCOMMONS CONNECTIONS AND ENVIRONMENTAL IMPACTS

The Receiving Region—The Tijuana–San Diego Metropolitan Region

> A San Diego-Baja aqueduct study is a good idea. But dare we hope that the worthies studying the idea will plan what to do

east of San Diego. Ironically, the Salton Sea receives agricultural wastewater (IID water diverted from the Colorado River), which in turn creates wetland habitat, while the Colorado River Delta wetlands are drying up due to lack of water. The Salton Sea now supports a rich aquatic ecosystem and high levels of avian biodiversity. This ecosystem, however, is experiencing increasingly largescale mortality events for both fish and waterfowl species. IID–San Diego County Water Authority water transfers could endanger this ecosystem because less water inflow into the Salton Sea will increase salinity and pollutant levels. For a detailed study of the Salton Sea and its links to the Colorado River Delta, see MICHAEL J. COHEN ET AL., PACIFIC INSTITUTE, HAVEN OR HAZARD: THE ECOLOGY AND FUTURE OF THE SALTON SEA (1999).

113. Treaty Regarding the Utilization of Waters of Colorado and Tijuana Rivers and of the Rio Grande, Feb. 3, 1944, U.S.–Mex., 59 Stat. 1219.

114. *See* Michel, *supra* note 5, at 354.

115. *See id.* at 355.

116. *See id.*

117. *See* Vincent, *supra* note 103, at 4; Water Education Foundation, *Deciding About the Colorado River Delta*, RIVER REPORT, Spring 1999, at 4.

118. *See* Vincent, *supra* note 103, at 4; Water Education Foundation, *supra* note 117, at 4.

119. *See id.* at 4-5. How much flow is the question. Because the Delta is located within an arid desert region with intermittent precipitation and hence river flow patterns, Dr. Edward Glenn from the University of Arizona asserts that around 500,000 acre-feet every three to four years would support riparian habitat in the Delta. However, the amount needed for marine and estuary ecosystem restoration has not been determined.

> with the water after it has been flushed into Baja's sewers? And ours too, for that matter. This year for the first time in decades, I have not needed medical attention for infected sinuses and ears. Because this year, for the first time in decades, I have not gone into our ocean. Cleaning up the water we already have should be of first importance.[120]

The above editorial sums up a concern not thought of in the construction and management of hydrocommons. What are the land use and subsequent water quality impacts of the diversion to the region that receives the transbasin diversions? In addition, if there are environmental impacts in the receiving region caused in part by transbasin diversions, should not these impacts in the receiving region be a consideration in proposals that seek to increase water imports from the Colorado River?

As demonstrated by the above editorial, an increase in water imports and water quality is directly proportional to increases in water supply and wastewater flows.[121] In Mexico, because state and federal level hydraulic plans evaluate both water supply use and wastewater discharges, the correlation between developed water supply and wastewater discharges is easy to plot. Saul Guzman reviewed the water supply and wastewater discharge data in CNA and CEA hydraulic plans.[122] His analysis revealed that between 1984 and 1999 Tijuana's developed water supply has nearly doubled.[123] The increase of water supply resulted in a threefold increase in wastewater discharges and a threefold increase in uncontained wastewater flows.[124] What is not evident from Guzman's analysis of the state and federal documents is an analysis of the quality of wastewater effluent.

In San Diego, there is much discussion as to the cumulative amount of water imported to the city. Unlike Mexican agencies, which integrate water and wastewater management and regulation, there is little discussion by California's wastewater and water agencies concerning the cumulative loads of wastewater discharged into Southern California's coastal waters. In 1998, the Southern California Coastal Water Research Project (SCCWRP) completed an analysis of the four largest municipal wastewater treatment

120. *See* John Herman, Letter to Editor, *The Second-Pipe Plan is Just a Pipe Dream*, SAN DIEGO UNION–TRIB., Sept. 17, 1999, at B11.

121. *See* EDWARD R. OSANN & JOHN E. YOUNG, SAVING WATER SAVING DOLLARS: EFFICIENT PLUMBING PRODUCTS AND THE PROTECTION OF AMERICA'S WATERS 13 (1998). *See generally* Charles Gunnarson, *Costs of Water Supply and Wastewater Disposal: Forging the Missing Link*, *in* WATER AND THE CITY: THE NEXT CENTURY 185 (Howard Rosen & Ann Durkin Keating ed., 1991).

122. *See* Saul Guzman Garcia, La Contaminación del Aquifero del Río Tijuana 99-100 (Aug. 25, 1998) (unpublished Masters thesis, El Colegio de La Frontera Norte) (on file with author).

123. *See id.*

124. *See id.*

facilities discharging effluent into Southern California's coastal waters. One noticeable trend is the 99 percent wastewater flow increase for San Diego's Point Loma Wastewater Treatment Plant between 1971 and 1995.[125] The study cites that population growth patterns, regional industry types and numbers, presence or absence of water reclamation programs, and inland discharge sources account for the differences among the plants.[126] In addition, the study states that even though wastewater flow volumes have increased in Southern California, the amount of certain pollutants discharged has decreased.[127] For example, in 1971 the four plants discharged nearly 600 metric tons each of copper and chromium.[128] By 1996, approximately 6.5 metric tons of chromium and 49 metric tons of copper were discharged by the plants.[129] Between 1971 and 1996, oil and grease discharges decreased by 76 percent.[130] However, this and other wastewater discharge studies have not analyzed trends in bacterial and viral pathogen discharges because scientific research has yet to produce cost effective and accurate tests to monitor these biological contaminants.

An increase of wastewater flows entails a need for more and larger pipelines to collect and convey the wastewater to municipal wastewater treatment plants.[131] Given the increased water supply and urban population growth in the San Diego–Tijuana metropolitan region, environmentalists in San Diego and Tijuana claim that the city planning process does not address the resultant need to increase daily sewage capacity and sewage maintenance.[132] In essence, more pipelines entail more inspections, cleaning, and replacement of pipes. In addition, environmentalists assert that both cities fail to address sewage spills before they occur.[133] Instead, elected officials

125. *See* Valerie Raco-Rands, *Characteristics of Effluents from Large Municipal Wastewater Treatment Facilities in 1996* (visited Oct. 20, 2000) <http://www.sccwrp.org/pubs/annrpt/97/ar01.htm>. The Orange County Sanitation District wastewater flow increased 82 percent and the Hyperion Treatment Plant, 7 percent. However, the Joint Water Pollution Control Plant volumes decreased by 11 percent. According to the 1998 NPDES permit, Point Loma discharged an average of 194 million gallons per day of advance primary treated effluent. *See* Michel, *supra* note 5, at 370.

126. The study did not cite an increase in developed water supply as a possible cause of increased wastewater discharges. In 1972, San Diego County Water Authority imported 339,852 acre-feet; in 1998 imported water amounts totaled to 433,490 acre-feet. *See* Michel, *supra* note 5, at 370.

127. *See* Raco-Rands, *supra* note 125.

128. *See id.*

129. *See id.*

130. *See id.*

131. *See* Michel, *supra* note 5, at 371.

132. *See id.*

133. *See id.*

spend money on an emergency basis to fix sewage spills.[134] According to the lead water quality activist Donna Frye,

> You can only fit so much stuff into a pipe. San Diego is building projects and adding users. Where you had a single family home, you now have a twelve unit condo building; where you had a mom and pop store, you now have a mini-mall. We are dealing with the problems after the fact. When looking at a pipe that is 50 years old, the answer to the question: Should we have repaired our pipes earlier? is self evident.[135]

The problems surrounding wastewater infrastructure and urban growth lead us to a controversial yet necessary topic that must be addressed before considering the cumulative impacts of nonpoint source pollution to California's and Baja California's watersheds and coastal waters. In essence, what is the relationship between imported water and urban growth? According to water resources scholars Mark Reisner, Bob Gottlieb, and Donald Worster, from a historical perspective, Los Angeles' and San Diego's urban population numbers could not increase without an increase of imported water.[136] Tijuana's rapid population growth rate (5.8 percent per year) also has been accompanied by a two-fold increase of developed water supplies between 1984 and 1999.[137] However, Southern California Metropolitan Water District cites that its aggressive conservation measures have resulted in the District's population increasing by 2.8 million between 1987 and 1997, without an increase of water supplies.[138]

Given these conflicting points of view on the links between imported water and urban growth, probably the more appropriate question is whether an increase of water imports encourages expansion of urbanized land use. In both cities, urban centers are not only growing in population numbers but also in square miles of urbanized region. The amount of urban expansion, however, does differ. According to Lina Ojeda's historical analysis of native habitat acreage in the Tijuana River watershed, in 1938, Tijuana, which occupies the lower part of the watershed, covered less than

134. *See id.*

135. Bradley Weaver, *Road Congestion in the Pipeline for Point Loma*, THE PENINSULA BEACON, July 22, 1999, at 1.

136. *See generally* MARK REISNER, CADILLAC DESERT: THE AMERICAN WEST AND ITS DISAPPEARING WATER (1986); ROBERT GOTTLIEB, A LIFE OF IT'S OWN: THE POLITICS AND POWER OF WATER (1988); DONALD WORSTER, RIVERS OF EMPIRE: WATER, ARIDITY AND THE GROWTH OF THE AMERICAN WEST (1985).

137. *See* Michel, *supra* note 5, at 373.

138. Interviews with Annette Hubbell, Senior Government Relations Representative, Southern California Metropolitan Water District, in San Diego, Cal. (Jan.-June 1999).

one percent of the watershed, or 17.35 square miles.[139] By 1994, Tijuana's urbanized region had extended to over seven percent of the watershed or 121.45 square miles for 1,035,415 residents.[140] San Diego's urbanized region can best be estimated by the total square miles of urban services, such as sewerage service, that are provided.[141] San Diego's Metropolitan Wastewater Department's (MWWD) sewerage service area, which encompasses the city of San Diego and 15 cities and districts, is 450 square miles.[142] Within this service area, MWWD serves approximately 2,000,000 residents. Given these numbers, Tijuana's urban population density is approximately 8,500 persons per square mile, and San Diego's is 4,444 persons per square mile.

Since both cities import water supplies and urbanized regions are increasing, it seems that for this binational region water imports encourage urban consumption of land. However, one can clarify the imported water–urban expansion link controversy by asking a simple question: What is the intended use of the imported water? If the use of the imported water is to build more residential and industrial units in regions that were previously not urbanized, then imported water supports urban consumption of land. For the Tijuana–San Diego metropolitan region, local politicians' and water agencies' rhetoric supports increasing imported water supplies to build more homes and high tech and tourism based economies.[143] In terms of the Imperial Irrigation District–San Diego County Water Authority transfers, a staff member of the State Water Resources Control Board believes that San Diego's developers intend to use the IID water to build new homes. This use of water is problematic to this staff member as she/he asks, "What happens after the transfer contract expires in 75 years, and IID decides to sell this water to another water user?"[144] In

139. *See* Lina Ojeda Rivah, *Land Use and the Conservation of Natural Resources in the Tijuana River Basin, in* SHARED SPACE: RETHINKING THE U.S.–MEXICO BORDER ENVIRONMENT 211, 227 (Lawrence A. Herzog ed., 1999).

140. *See id. See also* Paul Ganster, Sustainable Development in the San Diego Tijuana Region: A View from San Diego 6 (May 15, 1998) (unpublished discussion paper prepared for the University of California, San Diego, Center for U.S. Mexican Studies Binational Community Forum) (on file with author).

141. *See* Michel, *supra* note 5, at 374. The extent of sewerage and piped water service can be considered the urban limit line for the San Diego region. Environmentalists in the region assert that this urban limit line is constantly being extended, and never enforced.

142. *See id.* MWWD does not service urban regions in the north part of San Diego County, a region that is rapidly growing in terms of urban growth and sprawl, especially for cities such as Oceanside.

143. *See id.* at 375.

144. Representative of the State Water Resources Control Board, Comment at the Public Officials for Water And Environmental Reform Conference in Los Angeles, Cal. (Oct. 14-15, 1999).

Tijuana, land use planners are also preparing for tremendous growth along major highways between Tijuana and Tecate to the east, and Tijuana and Rosarito Beach to the south.[145] One planner in Tijuana relayed to me that he would like to see more centralized urban development.[146] However, landowners along these highway corridors are lobbying local politicians to allow for Tijuana's urban expansion.[147]

Urban growth and expansion are critical in terms of the region's water quality. The U.S. Environmental Protection Agency, coastal water pollution non-governmental organizations such as the American Oceans Campaign, Heal the Bay, and San Diego BayKeeper, and other experts assert that urban growth and its consequent land cover change are the primary cause of the ever-increasing amounts of nonpoint source pollution present in Southern California's and Baja California's coastal waters.[148] A recent Los Angeles Times report articulates how polluted runoff travels and enters coastal waters:

> A drop of rain plunks onto a sidewalk in downtown Los Angeles. Spilling over the curb, it whirls down the drain. Five hours later, after coursing 18 miles through the heart of the city, the storm water—carrying every germ and chemical it encountered along the way—splashes into the ocean at Playa del Rey.
>
> Everyday rain or shine, enormous quantities of potentially toxic wastes, from human sewage to garden pesticides to metals that flake off roofs and car brake pads, are washed from streets and yards onto the beaches Southern Californians cherish.[149]

Urban expansion and increasing population growth exacerbate urban polluted runoff in two ways. First, increasing populations generate more contaminants. [150] Second, when regions urbanize there is an increase

145. *See* Michel, *supra* note 5, at 375.

146. Anonymous interview. *See supra* note 1.

147. Interview with Carlos B. Graizbord, Director of Instituto Municipal de Planeación, in Tijuana, B.C., Mex. (Aug. 19, 1999).

148. *See* Michel, *supra* note 5, at 376. *See also* Ted Morton, American Oceans Campaign, *Draining to the Ocean: The Effects of Storm Water Pollution on Coastal Waters* (visited Oct. 20, 2000) <http://www.americanoceans.org/runoff/draining.htm>. Nonpoint source pollution does not originate from a single source. Instead, it is human/animal waste, chemicals, oil, and other substances that have collected on the ground, are washed off by water flows, and eventually enter and pollute watersheds and coastal waters. Nonpoint source pollution includes urban polluted runoff and storm water runoff as well as pollution from other diffuse sources. *See* Michel, *supra* note 5, at 376.

149. Marla Cone, *Runoff Remedies Will Be Complex, Costly*, L.A. TIMES, Sept. 6, 1999, at A1.

150. *See* Morton, *supra* note 148.

of impervious surface area.[151] These impervious surfaces do not allow rainwater to be absorbed by vegetation or soils, and, hence, storm water runoff flows in greater velocities and volumes to surface waters.[152] Pollutants such as oil, copper, fertilizers, bacteria, and viruses are picked up by runoff and discharged untreated into surface waters via the storm water conveyance system. Furthermore, impervious areas such as asphalt or concrete greatly impede the natural pollutant filtration system that allows rainwater to percolate into the soil or accumulate in wetland regions.[153]

In essence, as the surface area of impervious surfaces expands, there will be a concomitant increase of urban runoff flows.[154] As urban populations grow there is a greater concentration of nonpoint source contaminants that enter urbanized regions' storm drains, rivers, and coastal waters.[155] Between 1972 and 1995 Southern California's urban runoff and its toxic compounds have increased over 1100 percent.[156] In 1995, almost 800 billion gallons of polluted runoff flowed into the 13 largest rivers between Ventura County and the U.S.–Mexico border.[157] Table two[158] summarizes

TABLE TWO: Southern California Runoff Pollutants Historical Increases

Pollutant (in metric tons)	1972	1995	% Change
Copper	18	88	+389
Zinc	101	316	+213
Lead	90	39	-57
Nitrate	980	8,800	+798
Phosphorous	410	2,900	+607
Total Runoff (gallons)	**63.9 billion**	**771 billion**	**+1,106%**

151. *See id.*; Michel, *supra* note 5, at 376.
152. *See* Morton, *supra* note 148; Michel, *supra* note 5, at 376-78.
153. *See* Morton, *supra* note 148; Michel, *supra* note 5, at 376-78.
154. *See* Michel, *supra* note 5, at 378; Bay Steven & Kenneth Schiff, *Impacts of Stormwater Discharges on the Nearshore Environment of the Santa Monica Bay* (visited Oct. 20, 2000) <http://www.sccwrp.org/pubs/annrpt/96/ar-11.htm >.
155. *See* Morton, *supra* note 148.
156. *See* Cone, *supra* note 149.
157. *See id.* The amount of polluted runoff reflects urban runoff flows that occur during the region's wet season (November through April), and the region's dry season (May through October). Due to water imports to the region, rivers (including the Tijuana River) that should be dry during the region's dry season, now flow year round.
158. *See* Cone, *supra* note 149 (source: Southern California Coastal Water Research Project).

the major pollutants found in Southern California's polluted runoff and the amounts in metric tons deposited in coastal waters.[159]

Along with the increase of urban polluted runoff, for the past 30 years Southern California's surfing community and Baja California's beach community residents have noticed an increase in infections and illnesses in swimmers and surfers who spend long periods of time in ocean water—especially after a storm event. This concern for the health consequences of urban-based water pollution is reflected in the quote from the San Diego Union Tribune editorial at the beginning of this section. Viral and bacterial pathogens are present in polluted runoff.[160]

Pathogens can afflict swimmers and surfers when polluted ocean water enters their ears, nose, or mouth.[161] Surfers exposed to pathogens risk contracting gastroenteritis, hepatitis, ear nose and throat infections, respiratory ailments, diarrhea, rashes, and other illnesses.[162] In 1995, the Santa Monica Bay Restoration Project and University of Southern California researchers conducted an epidemiological study to examine the health effects of swimming near storm drain outfalls in the Santa Monica Bay. The study

> compar[ed] individuals swimming at the outfall location with those swimming 400 yards away, [and] found substantial increases in experiencing fever, chills, ear discharges, vomiting, coughing with phlegm, respiratory diseases and gastrointestinal illness among those swimming directly in front of the outfalls.[163]

The study confirmed what surfers had been claiming for decades. There is an increased risk of illness associated with swimming near storm drain outfalls (the discharge outlets for polluted runoff).[164]

Given the above discussed environmental impacts in both the sending and receiving regions of the hydrocommons serving Southern California and Baja California, certain organizations are calling for hydrocommons governance along the border of the Californias.[165] These

159. *See id.* For the San Diego–Tijuana region, urban runoff is identified as a primary source of pollution for semi-enclosed water bodies such as the San Diego Bay, Mission Bay, and the Tijuana River Estuary.
160. *See* Morton, *supra* note 148, at ch.3.
161. *See id.*
162. *See id.*
163. *See id.*
164. *See id.*
165. *See generally* MORRISON ET AL., *supra* note 97. Organizations such as the Southwest Center for Biodiversity and the Southern California Watershed Alliance work to protect migratory waterfowl and aquatic habitat in the Salton Sea and the Lower Colorado River Basin.

organizations support hydrocommons based management because Southern California and Northern Baja California's primary waterways are not large river basins but a web of manmade canals and aqueducts, a hydrocommons that facilitates Colorado River transbasin diversions. In California, a hydrocommons based management program known as CALFED is currently underway to address water quality and wetlands degradation of Northern California's Bay-Delta estuary.

CALFED: LINKING WATER RESOURCES GOVERNANCE FOR NORTHERN AND SOUTHERN CALIFORNIA

The Scope of Hydrocommons Governance

According to the California Department of Water Resources, Northern California's San Francisco Bay/Sacramento/San Joaquin River Delta-Estuary is a "unique and valuable resource, and an integral part of California's water system."[166] Like the Río Colorado Delta, Northern California's Bay-Delta region supports a vast estuary (the largest on the west coasts of North and South America), and its blend of fresh and salt water supports a wide diversity of plant and animal life, including chinook salmon, steelhead trout, and Pacific herring.[167] Transbasin diversions from the Bay-Delta estuary establish probably the most wide ranging and complex hydrocommons in North America. The Bay-Delta estuary provides water to California's two largest transbasin water transfer projects: the California Department of Water Resources State Water Project (SWP) and the U.S. Bureau of Reclamation Central Valley Project (CVP). Water from these projects supports agriculture in the San Joaquin Valley.[168] In addition, Bay-Delta estuary hydrocommons provides water to cities in Northern California and to over 22 million people in Central and Southern California, including San Diego.[169]

166. *See* CAL. DEP'T OF WATER RESOURCES, SACRAMENTO–SAN JOAQUIN DELTA ATLAS 1 (1995).

167. *See* CALFED, CALIFORNIA'S BAY-DELTA: THE PROBLEM, THE PROCESS AND THE POTENTIAL 3 (1998); WATER EDUCATION FOUNDATION, LAYPERSON'S GUIDE TO THE DELTA 10 (1998).

168. *See* CALFED, *supra* note 167 at 3; WATER EDUCATION FOUNDATION, *supra* note 167 at 2.

169. *See* CALFED, *supra* note 167 at 3; WATER EDUCATION FOUNDATION, *supra* note 167 at 2.

As with the Río Colorado Delta, interbasin transfers have altered the Bay-Delta estuary's water quality and wetland ecosystems.[170] In addition, regions receiving water from the Bay-Delta are now dependent upon these imported water supplies for agriculture and burgeoning urban populations. In certain cases such as San Diego, politicians from the Bay-Delta estuary hydrocommons receiving regions are lobbying for increased Bay-Delta water diversions.[171] After years of conflict between federal agencies, state agencies, and Bay-Delta water users, in May 1995 Governor Pete Wilson established CALFED as a consortium of 15 state and federal agencies.[172] CALFED is a regional water organization whose primary goal is to develop a consensus based hydrocommons governance with the purpose of restoring the Bay-Delta estuary.[173]

According to water resources scholar and practitioner Elizabeth Rieke, before any solutions can be determined by CALFED, the scope of this new regional water organization must be defined.[174] Elizabeth Rieke's definition of the scope of a regional water organization encompasses three dimensions: substantive, geographic, and temporal.[175] Substantive scope entails what resource problems will be integrated and hence addressed by a new regional water governance entity. In California, numerous water organizations confine their scope to a single resource sector integration (such as water supply or wastewater treatment only).[176] However, CALFED's substantive scope has moved beyond focusing on a single resource sector. The substantive scope of CALFED integrates four general resource areas—ecosystem restoration, water quality, water supply reliability, and levee system integrity.[177] In addition, CALFED differentiates itself from previous basin management projects because it recognizes that

170. *See* Michel, *supra* note 5, at 297-300. Bay-Delta estuary water quality is not only important for Delta wildlife, but for California residents who use the water for drinking water purposes. According to water supply agencies, as water travels through the Delta the water quality degrades as it mixes with drainage water from cities and farms and with seawater intrusion from the San Francisco Bay. In addition, as detailed above, transbasin diversions also result in higher concentrations of salts and pollutants in Bay-Delta water downstream of the diversions. *See id.*

171. *See id.* at 293.

172. *See* CALFED, *supra* note 167, at 4.

173. *See id.*

174. *See* ELIZABETH RIEKE, DESIGN OF A NEW REGIONAL CALFED ENVIRONMENTAL RESTORATION IMPLEMENTATION ORGANIZATION: PRELIMINARY CONSIDERATIONS 12 (1998).

175. *See id.*

176. *See id.* at 12-13. The exception to this generalization would be certain U.S. watershed organizations, such as the Los Angeles & San Gabriel Rivers Watershed Council and Mexico's national watershed council (*consejo de cuenca*) program. *See generally* Michel, *supra* note 5, at 205-84.

177. *See* Michel, *supra* note 5, at 307.

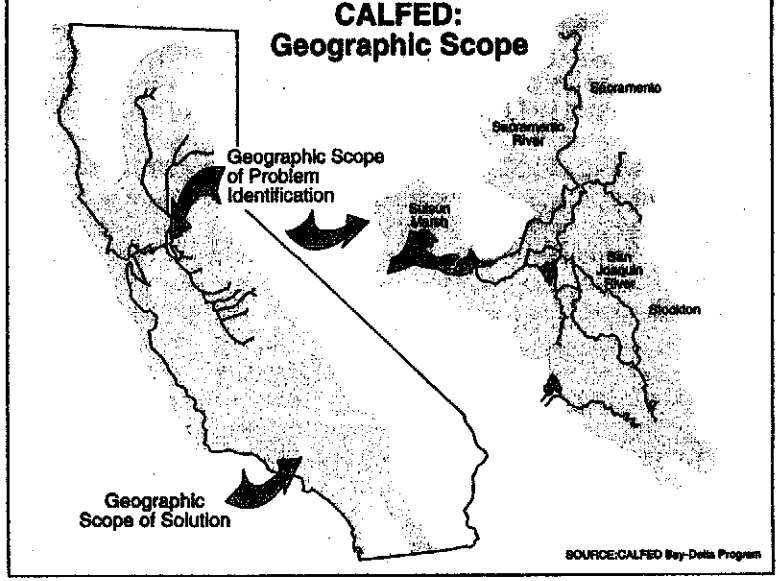
problems in one resource area (such as ecosystem restoration) cannot be solved effectively without addressing problems in all four areas at once.[178]

There are numerous ways to define the geographic scope of a regional water organization. Some regional water resources entities are defined spatially by the boundaries of political regions (nations, states or municipalities), while others are defined by natural boundaries such as a watershed.[179] Yet, the Bay-Delta estuary hydrocommons does not adhere to political nor natural boundaries. Figure Two demonstrates CALFED's geographic scope. Its scope divides the hydrocommons into two regions. The first is the problem region, which is defined as the region experiencing degrading levels of water quality and subsequent aquatic/land based habitat destruction.[180] According to CALFED, the problem region is defined as the Bay-Delta estuary area.[181] Since the hydrocommons involves transbasin diversions, the geographic scope for developing solutions includes a much broader area. The second region, the solution region, encompasses the regions or places within and beyond the boundaries of the problem region that may contribute to identified resource problems, and thus be integral to solving resource problems.[182]

The third component of Rieke's scope for regional water organizations, temporal scope, defines whether the entity will resolve short or long term solution. CALFED was formed to provide a long-term 30-year plan or solution. [183] CALFED's timeline is divided into three phases. The first phase is an identification of the appropriate range of solution alternatives.[184] During the second phase, CALFED will develop an environmental assessment of solution alternatives.[185] The third phase is project implementation and governance.[186] On July 27, 2000, CALFED released its final environmental impact statement/environmental impact report for public review. It is believed that CALFED will enter the third phase of project implementation and governance within the following year.[187]

178. *See* CALFED, CALFED BAY-DELTA PROGRAM: PROGRAM SUMMARY 6 (1999).
179. *See* Michel, *supra* note 5, at 307.
180. *See id.*
181. *See id.* at 310.
182. *See id.* In addition to the hydrocommons geographic scope, CALFED incorporates a problemshed geographic scope. A problemshed geographic scope is defined by problem and solution regions.
183. *See id.*
184. *See id.*
185. *See id.*
186. *See id.*
187. Interview with Francis Spivey-Weber, Executive Director, Policy Mono Lake Committee, in Los Angeles, Cal. (July 28, 2000).

Figure 2
CALFED: Geographic Scope



There are two reasons why CALFED participants cite CALFED's substantive and geographic scope as advantageous. First, CALFED's defined scope, which integrates the four resource areas and the geographic range of the hydrocommons, has resulted in an expanded range of choice among technical solutions to resource problems within the Bay-Delta estuary.[188] Such an integration recognizes that problems in one resource area can create problems in the other three resource areas. For example, degraded water quality in the Bay-Delta estuary can result in aquatic species mortality events.[189] Subsequently, the range of choice among

188. *See generally* Michel, *supra* note 5, at 285-413. The concept "range of choice" is one formulated by geographer Gilbert White. According to White the range of choice principle is significant because unwise water resources decisions often result from misperception or unawareness of potentially good alternatives. Essentially, the range of choice principle is similar to the alternatives analysis required by the National Environmental Policy Act (NEPA) or the California Environmental Quality Act (CEQA). *See* James L. Wescoat Jr., *The 'Practical Range of Choice' in Water Resources Geography* 11 PROGRESS HUM. GEOGRAPHY 41, 41-59 (1987). *See generally* Michel, *supra* note 5, at 1-46 & 285-413.
189. *See* Michel, *supra* note 5, at 297.

solutions for CALFED is expanded from one resource area to four. In addition, the resource problems in the Delta are not limited to the geographic boundary of the Bay-Delta estuary itself or to its watershed but to the entire hydrocommons. Hence, CALFED's expanded substantive and geographic scope allows for solutions that improve "not just the part that seems to be the problem [the Bay-Delta estuary in this case] but all parts of the system that contains it."[190]

Second, CALFED's broad substantive and geographic scope is perceived as advantageous because, in part, it corrects "existing institutional deficiencies associated with an inappropriately narrow or fragmented management regime."[191] In the United States, resource management organizations usually are limited to one sector resource management. Such a fragmented resource management strategy does not recognize the relationships between various resource areas (such as water supply and quality, for example). Moreover, the fragmentation could limit the range of choice among solutions available to decision makers. Finally, agency fragmentation creates barriers for public and/or stakeholder participation in the water quality governance process, as explained by a Southern California Metropolitan Water District official and CALFED participant:

> CALFED brings all the players under one regional authority. Before, everything was so fragmented. You would go to many meetings, have your ten minutes in the spotlight then move on to the next meeting. It was time consuming and it took up too much energy. Now you can concentrate all your energy on one project with the main stakeholders.[192]

TABLE THREE: Scope of Regional Water Organization–CALFED

Substantive: What Resource Problems Integrated?	Geographic: Geographic Range of Defined Problem and Solutions	Temporal: Short or Long term	Scope of Conflict: Expanded or Limited
Ecosystem Restoration, Water Quality, Water Supply Reliability, Levee System Integrity	Hydrocommons Problemshed	Short term: Complete EIR/EIS Long term: 30 year management plan	Expanded via: Public Participation, Bay Delta Advisory Committee, Work groups

190. PAUL HAWKEN ET AL., NATURAL CAPITALISM: CREATING THE NEXT INDUSTRIAL REVOLUTION 123 (1995).

191. *See* RIEKE, *supra* note 174, at 13.

192. Anonymous Author interview of CALFED participant. *See supra* note 1.

Hence, according to this water district official, CALFED's broad substantive and geographic scope essentially makes the participation in the water governance process easier. The question remains, what is CALFED's governance structure? A brief summary of this topic is provided below.

CALFED Governance

In July 2000, CALFED's federal/state agency representatives and consultants completed the final draft of the environmental impact statement (EIS)/environmental impact report (EIR) as required by the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The EIS/EIR identifies the range of general resource management strategies to address the four resource problems. The general resource management strategies are ecosystem restoration; a longterm levee protection plan; water quality improvement; water use efficiency; water transfers, storage, and conveyance; and watershed management.[193] In addition to a delineation of strategies, both the EIS and EIR analyze three alternative solutions with the recommendation of a preferred alternative.[194] However, state and federal agency generation of the EIS/EIR is one part of CALFED's governance. Besides defining the substantive, geographic, and temporal scope, CALFED has devoted time and resources to define or restate the scope of conflict and to identify those government agencies and other stakeholders that potentially merit formal representation during the CALFED decision making process.[195] The "scope" of an environmental conflict is defined as the extent to which the audience (the public and other stakeholders) is involved in the conflict. According to this theory, powerful organizations assert their power by limiting the scope (such as limiting public or outside participation) of a conflict.[196] Conversely, weaker organizations hope to change the balance of power by expanding the scope (i.e. inviting public or outside participation) of an environmental conflict.[197] The defined scope of conflict could be added as a fourth element of Rieke's defined scope, as portrayed in table three. As stated in a CALFED information booklet, "Ultimately, it is the active participation of the entire public that will help fix the Bay-Delta."[198]

193. Interview with Francis Spivey-Weber, *supra* note 187.

194. *Id.*

195. *See generally* E.E. SCHATTSCHNEIDER, THE SEMISOVEREIGN PEOPLE: A REALIST'S VIEW OF DEMOCRACY IN AMERICA (1960).

196. *See generally id.*

197. *See generally id.*

198. *See* CALFED, *Commonly Asked Questions About the CALFED Bay-Delta* Program, (visited Oct. 20, 2000) < http://calfed.ca.gov/general/new_q&a.html>.

There are two mechanisms in CALFED that support an expanded scope of conflict. The first is done via a public citizen outreach participation process.[199] The second is the Bay-Delta Advisory Council (BDAC).[200] BDAC is a federally chartered advisory council of more than thirty representatives from the Native American tribes and the state's leading urban, agricultural, business, environmental and fisheries interests.[201] BDAC's primary function is to review documents and/or presentations of work groups sponsored by CALFED and make policy recommendations during the EIR/EIS process.[202] CALFED created the work groups to evaluate and obtain consensus on solutions for particular resource problems. Membership in work groups is open to anyone who attends work group sessions. There are numerous work groups addressing resource challenges. One work group addresses ecosystem restoration, for example, and within the past year a watershed work group was formed. Every two months, BDAC meets and reviews documents and/or presentations produced by the workgroups. Below are reflections of one BDAC representative interviewed. Although this representative viewed the BDAC process as one with flaws, this person believes that public participation via BDAC and the work group process has expanded the range of choice among water resources management solutions in the CALFED decision making process.

What is BDAC and what are its functions?

> BDAC is an advisory body and it does give opinions pretty freely; it doesn't reach consensus. It is not like a watershed group that targets those things on which it can agree and leaves those things on which it can't agree on the side. BDAC goes straight to those things on which it can't agree and it stays there.
>
> BDAC meets about every two months for a day, day and a half. For example, they get a presentation from the ecosystem restoration work group for two hours, and they comment on it. BDAC representatives comment from their own perspective, which often has more to do with fear of what might happen rather than a real understanding of what is happening. Overall I would say the comments are not taken very seriously. The biggest problem with BDAC is that it is not taken very seriously because the people in BDAC are more political than technical. They say what they are expected to say, or what their group sponsor would like to say. If your group is not appointed to BDAC, that perspective is not represented. That is true of inner city groups and U.S.–Mexico border groups. Only one indigenous representative is appointed to BDAC.[203]

199. *See* Michel, *supra* note 5, at 316.
200. *See id.*
201. *See id.*
202. *See id.*

If there are problems with BDAC, then why are you an advocate of expanding stakeholder and citizen participation in the CALFED process?

> There were CALFED staff members [government agency staff] who were absolutely confident they knew how to fix the Bay-Delta—add a peripheral canal,[204] and add more storage, which meant building dams. It was the old 1950s way of water resources management. They were sure they were doing it right. By opening it up to the public via BDAC and the work groups, numerous other alternatives came in—doing watershed management in the Sierra Nevadas and Southern California; doing more with conservation; [and] bringing groundwater management agencies in on the process. That's what has come from public participation: looking at a much broader menu of alternatives. It is messier, but it is more likely to be useful in the future. The messiness of public participation has resulted in having CALFED's options enlarged.[205]

One alternative or critique that has entered into the CALFED process via public participation is a rethinking of the geographic range of problems and solutions, or the geographic scope of the CALFED organization. Two broad coalitions, watershed groups in the Sierra Nevadas and urban watershed groups in northern and southern California, assert that CALFED's geographic scope of problem identification needs to be expanded.[206] Watershed groups in the Sierra Nevadas, a region where snowpack provides most of the water to the Bay-Delta estuary, believe that CALFED-proposed solutions (especially the proposals supporting building

203. How does one get appointed to BDAC? The author does not know for all stakeholders, but for environmental representation CALFED asked the Environmental Water Caucus to choose BDAC representatives. The Environmental Water Caucus is the largest coalition of environmental organizations working on California's water problems.
204. The peripheral canal is labeled as the open channel isolated facility in CALFED documents. The peripheral canal is not a new concept, it was proposed in the 1960s and signed into law by California governor Jerry Brown in 1980. In 1982, a successful petition drive to recall Governor Brown's decision put the peripheral canal on the ballot for a vote. In June 1982, California voters repealed Brown's peripheral canal legislation. *See generally* NORRIS HUNDLEY, JR., THE GREAT THIRST: CALIFORNIANS AND WATER, 1770s-1990s, at 299-349 (1992).
205. Anonymous author interview. *See supra* note 1.
206. *See* Michel, *supra* note 5, at 319.

a peripheral canal and dams) would take water away from the mountain watersheds, thus causing resource problems such as the destruction of montane meadow ecosystems in the Sierra Nevadas.[207]

Urban-based watershed groups argue that the geographic scope of problem definition should be expanded because, as argued above for the San Diego–Tijuana metropolitan region, increased amounts of transbasin diversions result in expanding urbanized regions, which in turn exacerbate the problem of nonpoint source pollution or polluted runoff in urban regions that receive the water.[208] Subsequently, watershed movements involved in the CALFED process call for watershed protection in not only the sending region of the hydrocommons, but also for the receiving region as demonstrated by the statement below taken from a letter to CALFED from urban watershed/environmental justice groups:

> Water management decisions (especially those made without a connection to land use) can promote sprawl and can result in increased infrastructure costs to urban residents as well as increased concentrations of non-point source pollution in urban streams and waterways....Our communities already suffer from deteriorating infrastructure and polluting industries, and we want to ensure that CALFED programs do not add to these burdens.[209]

In essence, both the Sierra Nevada and urban watershed groups claim that the Bay-Delta estuary is not the only problem region in the Bay-Delta hydrocommons. These mountain and urban watershed groups view transbasin diversions as causing problems in mountain (sending regions) and urban watersheds (receiving regions) of the Bay-Delta estuary hydrocommons.[210] The narrative below details the evolution of watershed activism within the CALFED hydrocommons governance and new governance ideas presented by the Sierra Nevada–urban watershed group alliance:

> When the watershed work group got set up in CALFED, they started meeting monthly. In June 1999, the Draft EIR/EIS was released and there was finally a document to show saying, here is a document that will be managing water and will affect your watershed. We wanted to asked watershed groups throughout California, where are you in this document? So a community development organization in the Sierra Nevada got funding to hire a consultant to go and work with Southern California watershed groups. The goal was to develop statements in the response to the EIR/EIS. The consultant found fifty-seven groups organized in Southern California. Some are quite large, like the Los Angeles and San Gabriel Rivers Watershed Council; some are quite small and organized around a lagoon. These groups have been identified; some have been spoken to; some are commenting. Where we will go next is to create more of a sense of identity among watershed groups in Southern and Northern California.
>
> During the summer of 1999, a presentation was made by the CALFED watershed work group to the BDAC. What we saw were very professional, very knowledgeable people who had organized their local areas. They knew the players; they knew the experts and the political powers; they knew the problems. They had already sorted through issues that would be very hard to work on, and issues which would be easy to work on. What they were saying to CALFED, if you will work with and through us at the local level—we are not trying to replace you at the state level—but if you will use us as your outlet at the local level, we will be able make sure that the various programs you are trying to put together are integrated. That was the key message, if you want to integrate these large CALFED programs, and they have to be integrated to work, and be cost effective, work through the watershed groups and where you don't have watershed groups, then you should be trying to get one organized.
>
> If I were setting up a new BDAC, I would make sure that watershed representatives were at the core of the BDAC. Because they can see the connection between the issues of ecosystem restoration, water quality, and various issues dealt with. They can see the connection between the big CALFED issues and local implementation. Watershed groups are not going to cover everything that needs to be covered, but it would give a much stronger basis of practical discussion.[211]

Critics of CALFED cite that CALFED has spent so much time listening to numerous stakeholders and trying to accommodate all stakeholders that a decision will never be made.[212] In Spring 2000, California Governor Gray Davis' administration and the Department of Interior stopped the dialogue and put together a draft record of decision. It is not

207. *See id.* at 319-20.
208. *See id.* at 320
209. *See id.* at 397.
210. *See id.*

211. Anonymous author interview. *See supra* note 1.
212. Interview with Francis Spivey-Weber, *supra* note 187.

clear if CALFED's decision will be the best option to restore the Bay-Delta estuary ecosystem, and there is a possibility that certain stakeholders who do not agree with the conclusions of the draft EIR/EIS may stall the CALFED process even further by filing a lawsuit.[213]

This analysis demonstrates that CALFED, although problematic, is a success story in terms of advancing democracy in water resources governance in California. CALFED is the first attempt to recognize the geographic range of hydrocommons-caused resource problems. In addition, CALFED's commitment to public participation or an expanded scope of conflict has resulted in an expanded range of choice among alternatives not only for dealing with resource problems in the Bay-Delta estuary, but resource problems in mountain watersheds and receiving regions such as urban watersheds in Southern California as well. Finally, as demonstrated by the above narrative on the watershed work group, CALFED participants are experimenting with multi-scale integration and governance of hydrocommons. In other words, besides an overall hydrocommons governance structure, CALFED could implement its broad substantive and geographic scope solutions at the local level via community based watershed organizations.[214]

LINKING CALFED AND THE COLORADO RIVER

Hydrocommons Along the Border of the Californias

As indicated above, the watershed groups participating in CALFED are concerned with not only environmental impacts in the sending region, but also with the problem of urban expansion, urban polluted runoff, and subsequent degraded surface and ground water quality of urban regions that receive water imports. Subsequently, in Southern California, watershed groups recognize the importance of the north-south hydrocommons alliances and discussions fostered by CALFED governance. Yet, what about the Colorado River hydrocommons, or, to restate, the east-west connections

213. *Id.*

214. However, CALFED's governance advances towards democracy in water must continue throughout the implementation phase that will follow the EIR/EIS process. All stakeholders interviewed agreed that CALFED needs to make difficult decisions—decisions that will not please all stakeholders. Moreover, CALFED must be committed to long term Bay-Delta estuary restoration. In essence, it must provide regulatory, financial, and personnel resources that will effectively restore the Bay-Delta estuary ecosystem. Yet, the actual governance of CALFED's implementation is unclear as the governance is one facet of CALFED the public has to review and comment upon. As demonstrated by the above narrative, CALFED's watershed work group and BDAC are discussing governance alternatives. However, it is unclear if the CALFED staff is listening to these discussions.

along the border of California–Baja California that need to be made? Unfortunately for the Colorado River hydrocommons along the border of the Californias, there is neither CALFED nor hydrocommons governance, and, hence, little to no forum to inform the general public of the environmental impacts of transbasin diversions. Furthermore, there is little opportunity for watershed groups to work with government officials to expand the range of choice among alternatives to include watershed protection of both sending and receiving regions of the hydrocommons.

At present, in negotiations for Baja California and California's Colorado River allocations, watershed advocates and numerous stakeholders are excluded from Colorado River negotiations of water transfers and allocations.[215] In addition, the Tijuana–San Diego Border Water Council negotiations concerning the Binational Aqueduct involve only water supply agency staff members from the Tijuana–San Diego region, representatives from the International Boundary and Water Commission, and water resources staff members from the states of California and Baja California.[216] In fact, the general public has not been invited to any Border Water Council meetings with the exception of one meeting in January 1998.[217] San Diego County Water Authority, the lead agency for the Border Water Council, states that Border Water Council meetings and focus groups are kept small at the request of the Mexican government.[218] Additionally, county water authority representatives assert that keeping focus groups small has allowed the groups to obtain consensus and formulate recommendations without much delay. Public input will be asked once recommendations are formulated. Because meetings are closed to the public, critics of the Council are concerned that water users and voters will be unable to hold government entities such as the Border Water Council accountable for their actions.[219] Or more specifically, should not the public be involved in the decision to investigate a binational aqueduct? Should not the public be informed of environmental consequences of increased water imports?

Critics perceive limiting the scope of conflict in the Border Water Council negotiations and the creation of IBWC Minute 301 as a strategy being utilized by San Diego and Tijuana's political leaders to assert their power over other water agencies and stakeholders who seek to use

215. *See* Michael Gardner, *Colorado River Water Deal Sealed*, SAN DIEGO UNION–TRIB., Oct. 19, 1999, at A1. (addressing negotiation proceedings for limiting California's allocation of Colorado River to 4.4 million acre-feet (4.4 plan), and noting that many stakeholders, including environmentalists, were locked out of the negotiations).

216. *See* Michel, *supra* note 5, at 398.

217. *See* Michel, *supra* note 5, at 402-03.

218. Anonymous author interview. *See supra* note 1.

219. *Id.*

Colorado River water. One San Diego water official stated that the primary reason for Border Water Council's "closed focus group meetings" is that San Diego County Water Authority does not desire participation of other Colorado River water users, especially Metropolitan Water District. In essence, the perception is that MWD's participation would slow the Minute process down, or, worse even, prevent any progress on a binational aqueduct. [220] If San Diego and Tijuana are not successful in constructing the binational aqueduct, San Diego remains dependent upon MWD to transport IID water through MWD's Colorado River aqueduct. Hence, San Diego will not be able to secure its own water imports from IID without the approval or cooperation of MWD. Indeed, it seems that the Border Water Council's limited scope of conflict mentality is one that may very well be rooted in the assertion of power over other Colorado River water users such as MWD. In addition, Border Water Council's limited scope of conflict has resulted in the exclusion of numerous stakeholders, including those who cannot afford expensive water imports, those who wish to restore the Colorado River Delta, and those who desire to protect water quality of the region's coastal watersheds and the Pacific Ocean.

CONCLUSION: HYDROCOMMONS GOVERNANCE ALONG THE BORDER OF THE CALIFORNIAS

The geography of water resources along the border between California and Baja California demonstrates a network of manmade aqueducts and storage facilities utilized for water transfers. This hydrocommons transports Colorado River water for agricultural uses in the eastern part of the Californias border region, and ultimately west to urban centers on the Pacific Coast. As with other urban regions in Baja California and Southern California, the Tijuana–San Diego metropolitan region is dependent upon water imports for the region's rapidly growing industrial and residential needs. Both San Diego and Tijuana seek to increase Colorado River water imports, and both cities are investigating the possibility of constructing a binational aqueduct to transport imported Colorado River water.

The hydrocommons that supplies water to the Tijuana–San Diego metropolitan region, along with other transbasin diversions within the Colorado River Basin, has resulted in greatly diminished fresh water flows entering the Río Colorado Delta. The diminished freshwater flows have desiccated wetlands in the Delta and threatened migratory waterfowl populations that visit the Delta to breed and rest. In addition, marine

220. *See* Michel, *supra* note 5, at 403.

species in the Upper Gulf of California (Gulf shrimp, vaquita, and totoaba) are endangered, in part, by diminished Colorado River flows.

However, transbasin diversions not only adversely impact sending regions such as the Delta, but receiving regions also. In the Tijuana–San Diego metropolitan region, a region which imports up to 90 percent of its water supply, water imports contribute to increasing urban populations and urban consumption of land. This urban expansion results in more contaminants, and an increase of paved surfaces. As with any urbanized region, polluted runoff flows pick up chemicals and germs and then discharge concentrated amounts of bacterial and chemical pollutants into rivers and coastal waters. In both Tijuana and San Diego, polluted runoff is the primary public health risk for surfers and swimmers in the region's surface waters.

Given these environmental impacts in both sending and receiving regions of the hydrocommons that supports Southern California and Baja California, organizations are calling for hydrocommons governance along the border of the Californias. CALFED, a hydrocommons based water quality management program, is currently underway to address the water quality and wetland ecosystem degradation in Northern California's Bay-Delta estuary. The CALFED process has resulted in a restructuring of the scope of regional water resources governance. CALFED's substantive scope integrates four general resource areas—ecosystem restoration, water quality, water supply reliability, and levee system integrity. This expanded substantive scope is significant because CALFED has recognized that problems in one resource sector may cause problems in other resource sectors. Subsequently, the range of choice among solutions is now expanded from one resource sector to four. In addition, even though the Bay-Delta estuary is defined as the problem region, CALFED's geographic scope is expanded beyond the Bay-Delta estuary watershed. Under CALFED, the entire Bay-Delta hydrocommons, including San Diego, is defined as the region in which solutions for the Bay-Delta estuary restoration may be found.

Finally, CALFED has expanded the scope of conflict resulting in an extended public participation process, including open work groups that redefine Bay-Delta hydrocommons problems and propose new solutions. The expanded substantive scope, geographic scope, and scope of conflict have resulted in an expansion of the range of choice among alternatives that not only improve water quality in the Bay-Delta estuary but also CALFED's governance. One innovative suggestion provided by urban watershed groups is that receiving regions must also be considered problem regions because water imports do result in increased wastewater discharges and polluted runoff that contaminates local rivers, estuaries, coastal waters, even local water supplies.

CALFED negotiations, as problematic as they are, have fostered discussion within watershed-based environmental groups in Southern California and Baja California that addresses environmental problems within the Colorado River hydrocommons. Certain water resources scholars and groups would like to apply CALFED as a template to implement hydrocommons based governance for hydrocommons problem regions, such as the Río Colorado Delta and the Salton Sea.[221] In addition, as indicated by the above section on water quality problems in the Tijuana–San Diego metropolitan region, Border Water Council's negotiations to increase water imports and to construct a binational aqueduct have resulted in a public discussion on the links between water imports, urban growth, and coastal water quality. Essentially, at the true end of the pipeline—the ocean outfalls that discharge municipal wastewater and the storm drain outlets that drain onto Southern California and Baja California beaches—another problem, coastal water contamination, is emerging due to increased water transfers along the border of Baja California and California.

By way of conclusion, I suggest that along with a feasibility study of a binational aqueduct for the Tijuana–San Diego metropolitan region (IBWC Minute 301), IBWC should conduct a second feasibility study and learn from the CALFED experience. IBWC and border water resources stakeholders could learn from CALFED's failures and successes and consider the possibility of creating a hydrocommons based binational water council for the Californias border region. This council, as CALFED attempts to do, should be committed to extensive public participation and conduct work groups on hydrocommons problem and solution definitions associated with increased Colorado River water transfers to the Tijuana–San Diego metropolitan region.[222] As evidenced by CALFED's watershed work groups and BDAC, expanded public participation by all stakeholders in hydrocommons governance could result in an expanded range of choice among technical and governance solutions for the numerous water quality and supply problems caused by transbasin diversions along the California–Baja California border.

221. *See generally* DALE PONTIUS, COLORADO RIVER BASIN STUDY: REPORT TO THE WESTERN WATER POLICY REVIEW ADVISORY 101 (1996); MORRISON ET AL., *supra* note 97, at 77; COHEN ET AL., *supra* note 112, at 48; Anderson, *supra* note 96, at 3.

222. The author understands that the entire Colorado River hydrocommons is quite large and complex, including water resources management of upper basin states and municipalities such as Denver, Colorado. Certain water resources scholars have asked for a council to manage and govern the entire Colorado River Basin or hydrocommons. *See* PONTIUS, *supra* note 221, at 101. To address the problems within the entire Colorado River Basin is beyond the scope of this article. This paper provides evidence that a binational council for the U.S.–Mexico Border Colorado River hydrocommons should be considered, especially given the binational aqueduct negotiations. The International Boundary and Water Commission is one agency that has the legal international authority to be the lead agency for this Council. For more details concerning the governance of this proposed binational council, see generally Michel, *supra* note 5, at 285-413.

Introduction Letter
(Prepared in English and Spanish)

Dear Sir or Madam,

Thank you so much for taking some time out to assist me in my research on the water quality governance process within the Tijuana-San Diego metropolitan region. I believe the study will assist all participants in the water quality political process in better understanding the complex, and often confusing process of water quality governance.

Part of my research methodology entails interviewing governmental and non-governmental representatives involved in improving the region's water quality. You will participate in one interview that should last between 45-60 minutes. You may choose any site for your interview—home, office, restaurant etc. Please understand that your participation is voluntary, and you have the right to withdraw your consent or discontinue participation at any time.

I have enclosed an interviewee information form and a listing of my four place based case studies. These enclosures should answer most questions you may have about our interview. Once again many thanks, and if you have any questions, you may reach me by email at:XXXX. I look forward to our interview in the near future.

Sincerely,

Suzanne M. Michel

HUMAN SUBJECTS CONSENT FORM

Tijuana-San Diego Water Quality Governance Study
Interviewee Information Form
(Prepared in English and Spanish)

You are invited to participate in a study of water quality governance within the Tijuana-San Diego metropolitan region. The research is being conducted by Suzanne M. Michel, Doctorate Degree Candidate in the University of Colorado, Boulder Department of Geography, Boulder CO 80309-0260. Local phone: (619)534-6042. The project is under direction of Professor James Wescoat, Department of Geography, University of Colorado, Boulder, Campus Box 260, Boulder, CO 80309-0260. Phone #: (303) 492-4877. We believe the study will yield new insights concerning water quality governance and citizen participation. These insights will assist all participants involved in improving the region's water quality, and in better understanding the complex, often confusing process of water quality governance.

If you decide to participate, you will be asked to provide information about your participation concerning the region's water quality. You will participate in one interview that should last between 45-60 minutes, and you may be asked to participate in a follow up interview. The topics covered will be your own perception of the water quality, your opinions of current policies/programs concerning water quality within the region, and binational cooperation in water quality management. A benefit from your participation in this study is that you will have access to information concerning your organization's and other organization's participation in water quality politics. The information will be available upon completion of the dissertation, and includes a listing of organizations involved in water quality politics, and an analysis of different place -based approaches of water quality governance (point source vs. watershed approaches for example).

You may choose any site for your interview -- home, office, restaurant etc. Please understand that your participation is voluntary, and you have the right to withdraw your consent or discontinue participation at any time. You have the right to refuse to answer any question(s) for any reason.

One risk concerning your participation could be an untimely release of information. However, we are taking the following precautions to prevent any release of information. All your responses will be kept confidential. Your identity, organizational affiliation will be kept confidential. No information will be shared with other individuals and organizations until completion of the dissertation. Your interview will be identified by code number and the data (including tape recordings) will be available only to the myself and my faculty advisor, Dr. James Wescoat. If anecdotal data is recorded, all identifying material will be modified to maintain confidentiality. All interview tapes and files will remain locked and secure in my home in Santee, California, USA. Upon request, I will destroy interview tapes and files associated with your interview, five years after completion of the study.

If you have any questions regarding your rights as a subject, any concerns regarding this project or any dissatisfaction with any aspect of this study, you may report them—confidentially, if you wish—to the Executive Secretary, Human Research Committee, Graduate School, Campus Box 26, Regent 308, University of Colorado, Boulder, Boulder CO 80309-0026, USA or by telephone: (303) 492-7401. Copies of the University of Colorado Assurance of Compliance to the federal government regarding human subject research are available upon request from the Graduate School address listed above.

_____

Signature of the Investigator