



Integrated river basin Management

From Concepts to Good Practice

Case Study 5

The Lerma-Chapala River Basin,
Mexico



Acknowledgments

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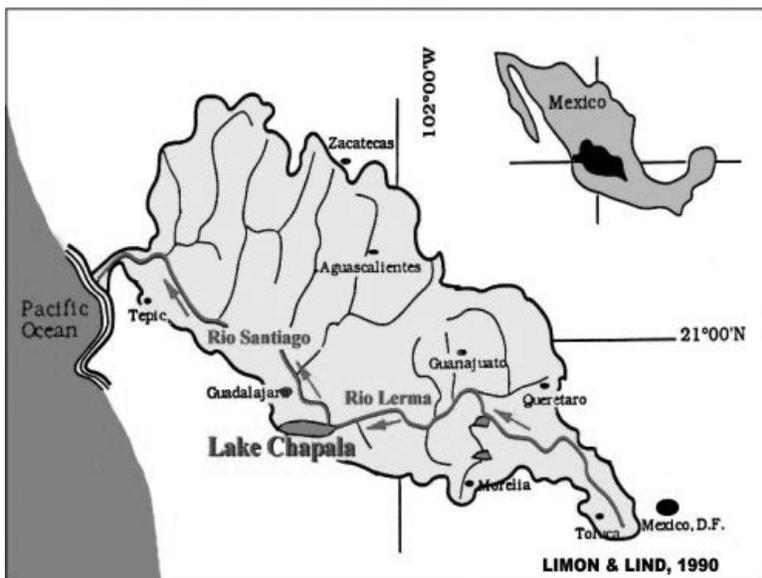
Name of Organization:
Lerma-Chapala
River Basin Council

History of Establishment:

In April 1989, the federal government and the governments of the five states that share the basin formally agreed to coordinate their efforts to carry out a Program for Water Allocation among Users. Government agencies then installed a Consultative Council for evaluation and follow-up of all sub-programs and activities derived from the basin program. This Council was a predecessor of the current River Basin Council. Three years later, in December 1992, the National Water Act, LAN (Ley de Aguas Nacionales), was approved. The Act enforced the creation of basin councils throughout Mexico to improve institutional coordination and enhance relationships among users and water institutions. The Lerma-Chapala Basin Council was the first to be established, and was launched in 1993.



Figure 5.1. Lerma-Chapala-Santiago River Basin



Basin Characteristics

Area: The Lerma-Chapala Basin includes parts of the states of Mexico, Querétaro, Guanajuato, Jalisco, and Michoacán. The basin is a tropical region with an area of 54,421km². The 750 km-long River Lerma originates in Mexico's central high plateau at an altitude above 3,000 m above sea level (masl). The river ends in Lake Chapala (1,510 masl), which is the largest natural lake in Mexico, 77 km long and 23 km wide. The maximum storage capacity of the lake is 8.13 km³ and the surface area is about 110,000 ha (1,110 km²). The lake is also rather shallow; its average depth is 7.2 m, with a maximum of just 16m. The 547km-long River Santiago arises from Lake Chapala and flows westward, finally reaching the Pacific Ocean (see figure 5.1).

River Basin Flow: The total discharge of the River Lerma from its drainage basin into Lake Chapala fluctuates around 1.5 billion m³/yr. The discharge from this lake into the River Santiago is about 1 billion m³/yr. Approximately 5,135 million m³/year are extracted for consumptive uses (including evaporation from the lake). Mean annual run-off is 4,740 million m³.

Population: 11,300,000

Economy: The Gross Regional Product is approximately US\$192 million.

Main Economic Activities: Agriculture (maize, sorghum, wheat, barley, and garbanzo); industries relating to agricultural and dairy produce, beverages, pulp and paper, leather goods, petrochemical and chemical products.

Main Water Management Concerns:

1. Water Scarcity

In the 1980s, demand for water in the river basin outstripped replenishment capacity and the river basin reached a condition known as closure. Conditions remain critical. The water deficit is particularly severe in the sub-regions of the Lerma system. Current estimates for the aggregated deficit between available water and water demand are between 1.6 and 1.8 billion m³/yr. The situation is further aggravated by low efficiencies in water use. The average estimated efficiency rate for the primary water-using sector – agriculture – is only 45 percent, although the great majority of the “losses” are recycled and therefore not “real” losses to the basin. The water deficit is being compensated through over-exploitation of groundwater aquifers and lakes, which in turn leads to further degradation of the water resources base and the ecosystems.

2. Pollution

The degradation of water quality occurs throughout the basin, causing public health problems and limiting water availability, primarily due to eutrophication in the case of the main water bodies. The Lerma-Chapala Basin is the major recipient of municipal wastewater in Mexico, receiving approximately 48,000 tons of BOD per year. Currently only about 30 percent of the municipal wastewater is being treated. Based on data from the National Water Commission (CNA), 52 percent of the surface water resources are considered to be highly contaminated, 39 percent are moderately contaminated, and only 9 percent are of acceptable water quality. In the upper and middle Lerma sub-basins, where industry is the major water polluter, the highest levels of pollution are reported.

3. Alterations to Lake Chapala

Lake Chapala has suffered severe degradation and significant changes over the last three decades. The lake level has been decreasing progressively because of the high water

deficit, which endangers the very existence of the lake. According to environmental NGOs, the lake currently stands at only 37 percent of its total volume. Water pollution in the lake is also large and increasing due to discharges of industrial wastewater, untreated domestic sewage, and agricultural chemicals, mainly from the Lerma River, which receives wastewaters along large sections of its course. The erosion caused by deforestation and by changes in land use across the Lerma Basin has led to an increased flow of sediments into the lake. This, in turn, has increased water turbidity, affecting the lake's biological production. It has also contributed to the loss of depth, which is already quite serious due to the decreases in the amount of water supplied by the Lerma River. The shallowness of the lake has increased its water temperature, leading to higher evaporation rates. Increasingly, large areas of the lake's surface are being invaded by water hyacinth. The water hyacinth limits light penetration into the water and constrains the free movement of boats, thus affecting fishing and recreational activities. Although different studies catalogue the pollution of the lake's waters differently, it is acknowledged that the presence of organic matter, detergents, heavy metals, and pesticides has decreased fish stocks. (Some endemic species, such as the popocha, are about to become extinct.) The lake's pollution also poses a threat to human health through the consumption of contaminated fish and is an economic challenge for the more than 2,000 local residents who still depend on fishing for their livelihoods. Because of the large accumulation of contaminants in the lake sediments, improving the lake's water quality is a much bigger challenge than just reducing the pollution inflow.

4. Alterations to the Basin Ecosystem

Land-based activities, urbanization, land degradation including deforestation, the expansion of irrigated agriculture together with unsustainable use of the basin's water resources and heavy pollution discharges have negatively impacted the ecosystem's health by altering the hydrological balance of the basin.



An integrated approach to management of the basin and the coastal zone is called for to solve these problems. There are two major challenges. The first is to incorporate land-based environmental concerns into development policies, plans, and programs for the Lerma-Chapala-Santiago Basin for the protection of the lake, the freshwater courses, and its coastal zone. The second is to restore a balance between resource utilization and protection by removing significant amounts of water from productive use and returning these to the river systems and by reducing pollution loads.

Type of Organization:

Under the 1992 National Water Act (LAN, or Ley de Aguas Nacionales), river basin councils are fora where different federal, state, and private interests can get together and discuss water-related issues. These councils do not have execution or operational responsibilities and are not responsible for financial resource allocation. The different state and federal agencies, particularly CNA, are supposed to gear their programs to be in line with the deliberations of the councils. In practice, this has not worked very well, and the new 2003 LAN purports to strengthen these councils and to better align work programs of the different agencies with the council deliberations. The new law establishes basin organizations under CNA that have a degree of autonomy from the central administration and that are to directly carry out the decisions of the councils. A new water financing system authorized under the law intends to align financing with council decisions. The provisions of the new LAN have yet to be implemented.

The Lerma-Chapala River Basin Council is a participative organization with one voting member from each of the states and one voting representative from each of the different types of water users. The federal agencies involved do not have a vote.



1. Conceptual and Institutional Issues

The Lerma-Chapala River Basin Council is a relatively new basin organization; it has existed for only 11 years. It was integrated by the Ministers of Agriculture and Hydraulic Resources, Social Development, Health, Fisheries, Treasury and Public Credit, Energy, Mines and State-owned Industry, the Federation Comptroller General, the Directors of Federal Electricity Commission, Mexican Oil (Pemex, the state-owned oil company), and CNA, as well as all five state governors and six representatives of different water user sectors. It continues to ratify the technical working group of the Consultative Council; within it, specialty support groups were created. Water users have a General Regional Assembly, work committees, and subcommittees arranged by water use and state. Its structure is very complex, as are the interests that drive each water use. In every case, each committee elects its representatives. In turn, the general assembly elects six water users who will become council official members. Aquifer committees have also been created where groundwater users participate and actions are undertaken to achieve rational and efficient water use.

2. Systems for Water-related Data

A river basin inter-institutional information system has been created. All members share costs and information. Data on the hydrological cycle, water availability, water costs, and water users is managed by the Lerma-Chapala Information Center. Different systems engineering tools such as simulation and optimization models are available to help analyze different scenarios and to support decision making. The Council reaches the general public by means of several periodicals.

The enforcement of water quality regulations in the basin has been notably unsuccessful. This is largely attributed to one major cause: the lack of reliable data. In addition, the effects of floods - which are recurrent events in the basin - could be substantially reduced by improving

the quality of facilities and equipment used to provide hydrological and meteorological data and to model and analyze data.

3. Basin-wide Policies and Strategies

A River Basin Hydraulic Program, which defines the objectives, strategies, and action lines for improving the basin's water sector, has been agreed upon with CNA. Since 1991, a surface water distribution agreement has been in force. It established mathematical rules for water distribution and reservoir operation, in accordance with users. Through extensive discussions, an umbrella regulation has been agreed upon for each state in the basin area with respect to groundwater allocation and reduction of aquifer overexploitation. There is also a River Basin Water Quality Program that specifies the introduction of treatment facilities. This has required significant time, participation, and investment from all related parties, including the private sector, as well as domestic and international credits.

4. Communication and Participation

The establishment of the Lerma-Chapala River Basin Council has led to progress in building consensus for the management of common water resources. However, decision making is still very centralized at the national level (CNA). The new LAN includes provisions to strengthen decision making at the river basin level, but this is yet to be implemented. Participation in the Council's activities has been reasonably good and has included water users (irrigation, municipal, industrial, recreation), state governments, and federal entities, in addition to CNA.

5. Monitoring and Assessing Sustainability

Efforts are being made by CNA and the Lerma-Chapala Basin Council to introduce effective systems for performance evaluation and monitoring of the organization's activities.

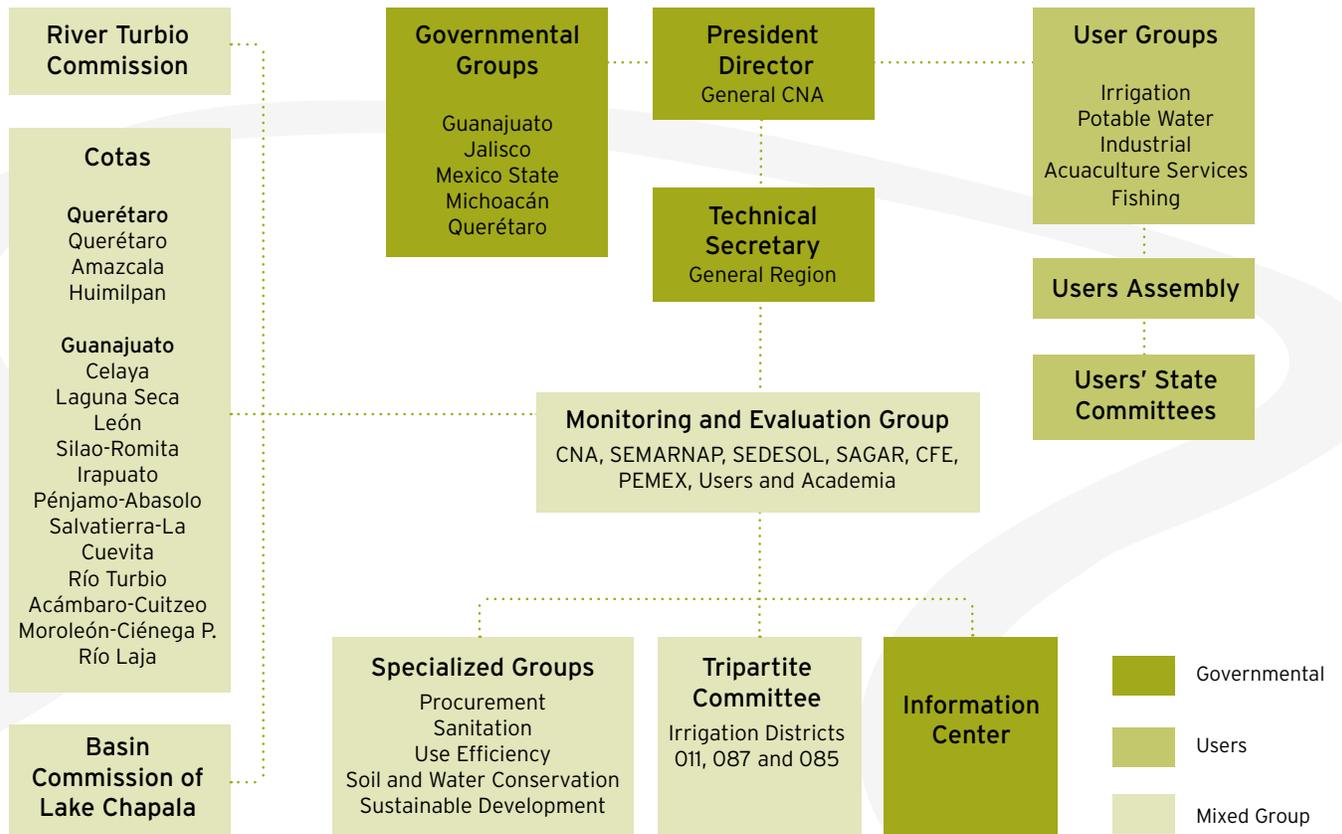
Tasks of the Organization and Staff Complement:

According to the LAN, which states the legal basis for the creation of the river basin councils, the tasks of the organization are: "instances of coordination and orchestration between the three levels of government (federal, state and municipal) and the representatives of water users, better management of water bodies, the development of hydraulic infrastructure and of the respective services, and the preservation of the basin's resources." Essentially, the four main objectives of the Council are:

- Distribution of water among users according to the water allocation policy
- Improvement of water quality by treating municipal raw effluents
- Increasing water-use efficiency
- Conserving the river basin system.

The organization of the Lerma-Chapala River Basin Council is presented in figure 5.2.

Figure 5.2. Organization of the Lerma-Chapala River Basin Council





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