

## 10. State of Mexico

Mexico's total surface area is slightly less than 2 million km<sup>2</sup>. Annual runoff from its rivers is 399 km<sup>3</sup>, of which 87 percent comes from the thirty-nine main rivers of the country, whose basins occupy 58 percent of the country's total surface area. Average annual per capita water availability is 4,547 m<sup>3</sup>, with great variation between the southeast (13,566 m<sup>3</sup>) and the north, centre and northeast of the country (1,897 m<sup>3</sup>) (CNA, 2004). This uneven distribution of water resources causes water shortages in densely populated areas. The north, centre and west of the country, where only 32 percent of the runoff takes place, is home to 77 percent of the country's population and 85 percent of Mexico's GDP (CNA, 2004).

In so far as water stress is concerned, one of the country's most critical cases is the State of Mexico, with a population of almost 15 million inhabitants corresponding to approximately 14 percent of the nation's total population but only 1 percent of the country's total surface area. The State of Mexico is an industrial centre with a wide range of economic activities; it is ranked second in the nation in terms of its GDP contribution, about 9.5 percent.

### Water and land resources

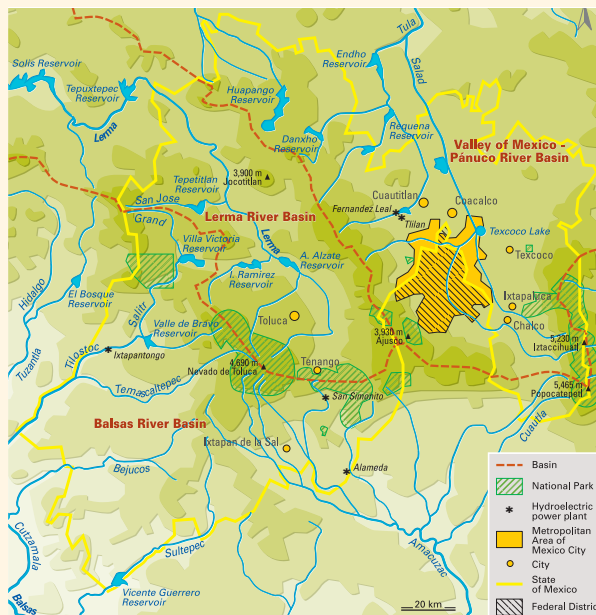
The State of Mexico is located within the geographical area of three main basins, namely the Valley of Mexico, the Lerma River and the Balsas River basins. The Valley of Mexico Basin lies in the north and northeast of the State and includes the Federal District<sup>6</sup> and parts of the states of Hidalgo and Tlaxcala. There are 22 million inhabitants living in these states, 10 million of which reside in the State of Mexico's part of the basin (CAEM, 2004). Combined, they represent 20 percent of the national population and contribute 31.5 percent of the total GDP. Conversely, the amount of available water resources in the basin is only 3.9 km<sup>3</sup>, or only 0.9 percent of the country's total water availability (CNA, 2004).

The Lerma River Basin is the lifeline of the city of Toluca, the capital of the State of Mexico, with approximately 1.5 million inhabitants living in the metropolitan area and 2.5 million living throughout the basin (CAEM, 2004). This region is also a centre of heavy economic activity. The high water demand in this basin has necessitated the implementation of water transfer schemes from the Balsas River Basin, located 130 km from Mexico City.

As for groundwater resources, there are nine aquifers in the State of Mexico, six of which are shared with Mexico City<sup>7</sup> (CAEM, 2004). Since these aquifers are the main source of water supply for the State of Mexico and Mexico City, they are exploited well beyond their renewal capacity. In general, it is estimated that underground water resources are overexploited at a rate of 100 percent or more, with the Texcoco aquifer in the Basin of the Valley of Mexico being overexploited at a rate of more than 850 percent (CAEM, 2004). As a direct consequence, in many aquifers the hydrostatic pressure has been lost, some springs have dried, and the ground is sinking up to 40 cm per year in some areas

6. The capital of Mexico.

7. The Metropolitan Area of Mexico City (henceforth Mexico City) includes the Federal District and some boroughs of the States of Mexico and Hidalgo.



**Map 14.11: Overview of the river basins in the State of Mexico**

Source: Prepared for the World Water Assessment Programme by AFDEC, 2006.

of the Valley of Mexico. The intense overexploitation is further aggravated by the fact that the clayey topsoil in both the Valley of Mexico and the Lerma Valley enhances the runoff of rainwater and substantially reduces the natural recharge of aquifers. In order to curb the destruction of aquifers, the Federal Government has forbidden further development. However, unauthorized usage remains a problem.

### Water and land uses

Of the available water resources in the State of Mexico, 48 percent is utilized for domestic purposes, 34 percent for irrigation and 5 percent for industry. The remaining 13 percent is transferred to the Federal District for consumption.

Agriculture is the main economic activity in the state, practised over approximately 50 percent of the overall surface area. Irrigation for agriculture is practised on a smaller scale, covering only 7 percent of the State's land surface. Almost 80 percent of the water used for irrigation is pumped from aquifers.

### Water transfer

Water shortage in the State of Mexico is already at an alarmingly critical level. The situation is expected to worsen due to increasing domestic, industrial and agricultural water demands. Although the state government is constantly pursuing new mechanisms to slow down urban growth and promote efficient water use, water transfer from other water basins remains necessary to meet growing demand. Currently, water is transferred from both surface and groundwater resources to meet the demands of Mexico City and, to a lesser degree, the State of Mexico itself. For example, water is transferred from the Balsas River Basin to the Lerma River Basin and the Valley of Mexico, mainly to provide the Federal District's potable water supply. Underground water resources of the Alto Lerma System are also channelled to the Mexico City, causing their overexploitation. The extent of these transfer schemes (i.e. the distance from which the water is diverted), is also likely to grow, which could trigger disputes over water resources.

### Water and health

In 1990, a cholera outbreak initiated in Peru and expanded throughout the continent. The first sign of cholera was seen in the State of Mexico in June 1991, signalling deficiencies in proper chlorination. Since then, the Government of the State of Mexico has assumed responsibility for the production of the chlorine supply and the maintenance of chlorination equipment. As a result, chlorination effectiveness has increased by 300 percent in the past decade.

The coverage of water and sanitation services in the State of Mexico is above the national average. Over 90 percent of the population has access to safe water and approximately 80 percent to sanitation services. However, water scarcity is still the major factor behind water-borne diseases. Through state social programmes, public awareness is being raised concerning preventive health measures, such as handwashing and cleaning water storage tanks.

Since underground water resources are exploited on a regular basis, the water wells are sealed to protect the naturally high quality of groundwater by preventing direct contamination by pollutant leakage. However, human activities pose a constant threat to groundwater quality. For example, in the State, wastewater is generated approximately at the rate of 30 m<sup>3</sup> per second (m<sup>3</sup>/s), about 19 percent of which is directly discharged without any kind of treatment. Solid wastes are disposed of into open pits or partially controlled waste disposal sites. In addition to this is agricultural pollution, caused by the utilization of wastewater for irrigation and the use of fertilizers and insecticides. There is no exact data concerning the health consequences of such activities.

### Water management

The water policies adopted in the State of Mexico (see **Box 14.7**) complement the National Development Plan for 2001-2006, which correctly identifies water as a scarce resource and puts forward the

common policy of integrated management for the sustainable utilization of water resources. In the State of Mexico, the Water Commission of the State of Mexico (CAEM, Comisión del Agua del Estado de Mexico) is an independent decentralized government institution authorized to manage the country's water resources, as well as to formulate national water policy. The Secretariat of Water, Public Works and Infrastructure for Development (SAOPID, Secretaría de Agua, Obra Pública e Infraestructura para el Desarrollo), the Water Consulting Council and the Water Commission of the State of Mexico are the coordinating bodies for the planning and programming of the state's water sector and for the surveillance of compliance with policies, strategies, plans and programmes. Laws, standards and regulations have been issued at federal, state and municipal levels. However, the full enforcement of such regulations is missing. Furthermore, a lack of consolidation of the bodies in charge of providing and maintaining the water and sanitation services has led to the inefficient use of water supply. In order to minimize this problem, in 2004, the Federal government started PROMAGUA, a programme aimed at modernizing the water operating bodies, and established an independent body for the regulation of the supply of potable water, sewer systems and wastewater treatment utilities. In addition to national funds allocated for the modernization and extension of utility services, the collaboration of the private sector is also being sought through public-private partnerships. Unfortunately, low levels of revenue collection coupled with a lack of respect for efficient water use might pose a problem for private sector involvement.

### Water and ecosystems

The State of Mexico is ranked fourth in the world in terms of diversity of flora and fauna, after Brazil, Indonesia and Colombia (CNA, 2004). However, as a consequence of human activities, many species have become extinct, and wetlands and forests have either decreased in size or have been completely destroyed. Early records from the seventeenth century show that more than 58 percent of the State of Mexico's territory was forest, covering more than 1.3 million ha, and wetlands of the Lerma Swamp and the lakes of the Basin of the Valley of Mexico extended over 88,000 ha. Today, in the valleys of Mexico and Alto Lerma, the natural water bodies have been reduced by more than 80 percent overall; some of them having totally disappeared with their ecosystems. It is estimated that the forest area was reduced to one-third of its original area. The main causes of deforestation are stockbreeding, human settlements, road systems and firewood production for domestic use. Deforestation causes the surface run off to carry greater amount of debris, silting up dams, rivers and channels, reducing the capacity of storage and evacuation of storm water. The loss of vegetal cover also enhances surface run off, thus reducing the amount of water of infiltration and severely affecting the recharge of aquifers.

The National Development Plan of Environment and Natural Resources for 2001-2006 (PND, Plan Nacional de Desarrollo) was formulated to pursue economic development while reversing environmental degradation as

**BOX 14.7: WATER RESOURCES DEVELOPMENT IN THE STATE OF MEXICO**

In the State of Mexico, the following criteria set the main framework of water resources development:

- Implementation of IWRM throughout the State
- Giving priority to enhancing the quality and the extent of water utilities for raising the quality of life of citizens
- Assisting in the consolidation and efficiency of bodies in charge of rendering services
- Establishing a 'water culture' that prioritizes the efficient and sustainable utilization of water resources
- Involving the private sector in the financing, construction, operation, maintenance and administration of infrastructure
- Promoting modernization of the legal framework

much as possible. In this regard, the State of Mexico's Secretariat of Ecology is responsible for executing state policy and evaluating its effectiveness.

**Risk management**

Urban settlements in the state have experienced high growth rates accompanied by the rapid expansion of informal settlements. Consequently, people living on settlements that are constructed on slopes, old lacustrine areas, river and stream banks and beds are highly vulnerable to water and mud floods. Furthermore, the overexploitation of aquifers has caused differential ground sinkage and impeded the surface run off of storm water. Water and sewer services have also been either interrupted or completely disconnected due to ground sinkage.

Flood risk is especially high in the plains of the Valley of Mexico and Alto Lerma. Due to the lacustrine origin of the land, the natural drainage is very limited. The situation is worsened by the fact that the largest percentage of the State's population lives within this area. In order to reduce the risk of catastrophic floods, large-scale drainage systems have been implemented. However, as mentioned previously, the sinking of the ground and the extreme siltation caused by the loss of vegetal cover lower the discharge capacity of the drainage systems.

During the last eleven years, the State Government has compiled a flood atlas that gathers information on the social and economic impacts of water-related extreme events. The latest flood event in 2004 affected over 35,000 people in diverse municipalities of the State of Mexico.

The National Development Plan of 2001-2006 defined water-related risk reduction as a priority. In this context, the structural measures against flood prevention will continue to be financed at the federal and state levels.

**Conclusion**

Although Mexico has sufficient water resources, the State of Mexico is under severe water shortage stemming from a very dense population coupled with an accelerated growth of approximately 380,000 thousand inhabitants per year. The situation is even more critical in the Valley of Mexico, where the Metropolitan Area of Mexico City contains

approximately 20 million inhabitants. The increasing water demands of various sectors have led to 100 percent or more overexploitation of underground water resources. The effects of the overuse of aquifers are striking: ground has been sinking up to 40 cm per year; piezometric levels have dropped significantly; aquifers have lost their hydrostatic pressure; and some springs have dried up. Water and sewer infrastructure has been either disconnected or become unusable due to sinking ground. This further complicates the challenge of providing the public with safe water and sanitation services. Although further abstraction of underground water resources is forbidden, illegal utilization continues to grow. Population growth has also had a toll on the vegetation cover and ecosystems. Forests have decreased by one-third and natural water bodies have been reduced by more than 80 percent in area; the associated ecosystems have shrunk dramatically or disappeared altogether. Because of deforestation, topsoil has lost its ability to retard surface run off, which in turn has reduced the infiltration rate and recharge of aquifers. Intra-basin water transfer schemes have been implemented to cope with the growing demand for water, but this unfortunately caused disputes between user groups. The quality of surface and groundwater resources is decreasing due to domestic, industrial and agricultural pollution. Although the construction of treatment plants is underway, financial problems have hindered their full realization. The capacity of existing wastewater treatment facilities cannot cope with the sheer volume of discharge.

The National Development Plan has underlined the importance of water resources as well as the necessity for integrated basin-wide management and stakeholder participation in decision-making. This plan is further backed by specialized agencies and coordinating bodies that are responsible for implementing projects and surveying the compliance with rules and regulations. However, the enforcement of such regulations has not been effective.

Hydrological and economic difficulties are unfortunately compounded by the lack of social awareness towards efficient use of water resources. Raising public awareness will facilitate the sustainable utilization of water resources in an environmentally sound fashion.