

# Distribution

The integrated water cycle





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## 1. Water distribution throughout history

A drinking water supply network is a system that allows water to travel from the point of collection to the point of consumption under the correct conditions of quality and quantity.

The storage and distribution of water was a concern in all major ancient cultures.

Water transport systems began to be developed in Jericho (Israel) over 7,000 years ago with the distribution of water from wells initially using simple canals excavated into the rock or sand and later using hollow pipes. The remains of water distribution facilities have also been found in the city of Mohenjo-Daro, Pakistan.

The Greek cities had storage facilities and water distribution networks, but the biggest and best builders of hydraulic works of all the ancient civilisations were the Romans. During the time of the Roman Empire dams were constructed for the storage and impoundment of water, it was purified using aeration treatments, water sources were protected from external pollutants and a supply system was developed that consisted of large conduits such as aqueducts and piping systems using concrete, rock, bronze, silver, wood and lead.

After the fall of the Roman Empire the development of water supply systems suffered a hiatus with even the aqueducts falling from use. During the Middle Ages wastes were thrown directly into surface waters, which lead to severe health problems.

Water carriers were used at this time to transport the water arising from uncontaminated sources as they were relatively distant from population centres such as cities.

The first drinking water supply system to serve an entire city was built in Paisley, Scotland in the early nineteenth century by John Gibb. Three years later it began to carry filtered water to the city of Glasgow.





## 1.1 The situation in Spain

In the early twentieth century Spain was an agrarian society, which directly influenced water policy. Hydrographic confederations were created that were responsible for managing water in the river basins and for promoting all the works necessary to increase the area under irrigation. The urban supply networks were born out of this context, where they were initially given less importance than the construction of major works or irrigation canals. However, the citizens soon became used to these advances to such an extent that it was quickly considered essential to have running water in homes.

## 1.2 The water within the Community of Madrid

### Antecedents: Water channels

The extraction of groundwater and the supply to the population through channels was the only system used in Madrid from its foundation in the ninth century up to the mid-nineteenth century. The system consisted on a series of wells and galleries that terminated in public sources used by farmers and inhabitants, or private sources in places such as hospitals, monasteries, etc. The sources were the responsibility of a body called Source Board (Junta de Fuentes), chaired by the mayor, who reported directly to the Crown.

By 1850 there were nearly 50 channels with a length of around 124 km. The water from the flowing sources was collected by the inhabitants or by water carriers, with the latter responsible for transporting water to private homes when requested.



## 2. The need for a supply system

The shortage of water in the city was becoming ever more acute. While prior to the mid-nineteenth century several ways to supply water to the capital were studied, it was not until 1851 when approval was granted for a water supply system to Madrid from the River Lozoya, located 77 km from the city, based on a study by engineers Juan Rafo and Juan de Ribera.

The works bringing water from the Lozoya were completed in 1858, through a canal of the same name. The water fed into the First Drinking Water Tank, located in Calle Bravo Murillo. At that time, the city of Madrid had around 250,000 inhabitants to supply. Two main arteries left the First Drinking Water Tank; one of them followed Calle Ancha de San Bernardo to the Puerta de Toledo, the other followed Calle Fuencarral to Calle Atocha.

The network was slowly extended and all the houses started to have piped water, although in the most humble the water was distributed through sources located in their courtyards. Hydrants also began to be installed in the streets that were used for street washing and sanitation.

The years between 1860 and 1900, after running water arrived in the capital, saw the launch of the main projects of the urban water supply network. The first activity was to construct the triangle of streets San Bernardo-Fuencarral-Sol. The Second Drinking Water Tank also entered into service at this time (1881) and the supply and distribution projects continued unabated. The increase in demand for water led to the planning of canals, hydroelectric power stations, pumping stations and new drinking water reservoirs, as well as the construction of distribution arteries within the urban area.

Significant facilities entered into service in the first half of the twentieth century that were essential to the water supply and that slowly managed to get tap water to all homes.

The most important were: the first central pumping station and the first elevated drinking water tank, Torrelaguna hydroelectric power station, the Third Drinking Water Tank, the Alto Canal, an elevated drinking water reservoir in Plaza de Castilla and the Eastern Canal. A new plan of water supply projects was developed between 1946 and 1954 that were needed to deal with the expected increase in demand.

The Jarama Canal entered into service in the second half of the twentieth century and in 1965 plans were approved that would give rise to the region's current supply system. Canal de Isabel II undertook more projects between 1968 and 1976 than throughout the rest of its history: reservoirs, treatment plants, supply networks and drinking water reservoirs. During the following years, the constant investment in new infrastructure and the maintenance of existing facilities allowed the expansion of the distribution network from a baseline of 233 km that existed in the early twentieth century and which supplied 600,000 inhabitants. This system increased in the early twenty-first century to over 17,300 km of distribution network and large conduits, more than 320 forebays and 160 drinking water pumping stations that gave permanent supply to more than 6 million people.



### 3. Management of the distribution system

To provide this service from the treatment plants to the user's tap the company has available many different types of infrastructure that ensures the distribution of water in quantity and with good quality, such as: large conduits, forebays, drinking water pumping stations and finally the distribution network.

 [Watch a video about distribution](#)

#### 3.1 Large conduits

These are a fundamental element in guaranteeing the optimal distribution of water. They are linked in a ring that connects the major canals leading from the Rivers Lozoya and Jarama with those that lead from the Rivers Guadarrama and Alberche.

 [See table of the large conduits](#)

#### 3.2 Forebays

These are waterproof enclosures where drinking water is stored to supply the population. The Community of Madrid supply system has 33 large forebays, the first of which was constructed in 1879, as well as 288 with a smaller capacity.

 [See a table on forebays](#)



### 3.3 Drinking water pumping stations

Pumping stations take the water from the corresponding drinking water tanks and elevate it to a height sufficient to supply the water, with adequate pressure, to the highest areas in the Community of Madrid. The company has 160 of these installations.

 See table on pumping stations



### 3.4 The distribution network

The managed distribution network, which started to be constructed in 1851, now exceeds 17,300 km. Its care requires an exhaustive policy of renovation and improvement, aimed at increasing its efficiency.





