

URBAN WATER QUALITY MANAGEMENT

Policies to implement wastewater reuse in Israel

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The water scarcity in the Mediterranean region leads the Israeli government to develop a comprehensive precise and unique policy regarding integrated water resource management (IWRM). As such, it was essential to modify the whole water sector in order to address the increasing demand for water, the need for improved water quality and the desire to ensure cheap and easy access to water.

The Water Law of Israel, enacted in the late 50's, defines Israel's water sources as public property and this unique characterization strongly influences the principles of the Israeli water management and the whole water sector.

As a result, water management in Israel is highly centralized. An important modification of the Law was made in 2006, when the Parliament approved the establishment of a national Water Authority (under the Ministry of National Infrastructures, Energy and Water Resources) with overall responsibility for water, sewage and water resources management policy. Furthermore, one of the main principles introduced was that water tariffs should enable full cost recovery in the water sector including costs of water conveyance, piping systems and wastewater treatment.

This "close market principle", together with construction of desalination plants along the Mediterranean coast, dramatically increased the prices of water in Israel for all the sectors. Today, the domestic sector is paying ~ 2.5 Euro per cubic meter of potable water, while farmers pay only 0.4 Euro per cubic metre of effluents.

The power of the Water Authority under the Water Law, together with numerous regulations that have been promulgated pursuant to this law, establishes the framework for the control and protection of Israel's water resources. It allows for the application of a wide range of efficient instruments for sustainable water management, such as water supply and demand strategies, a water tariff system etc.

To balance the centralized management by the Water Authority, at the regulatory level, two other ministries were left with their responsibilities regarding water management: the Ministry of Health, which controls potable water quality and manages the effluent irrigation permitting system, and the Ministry for Environmental Protection with responsibility for water pollution prevention.

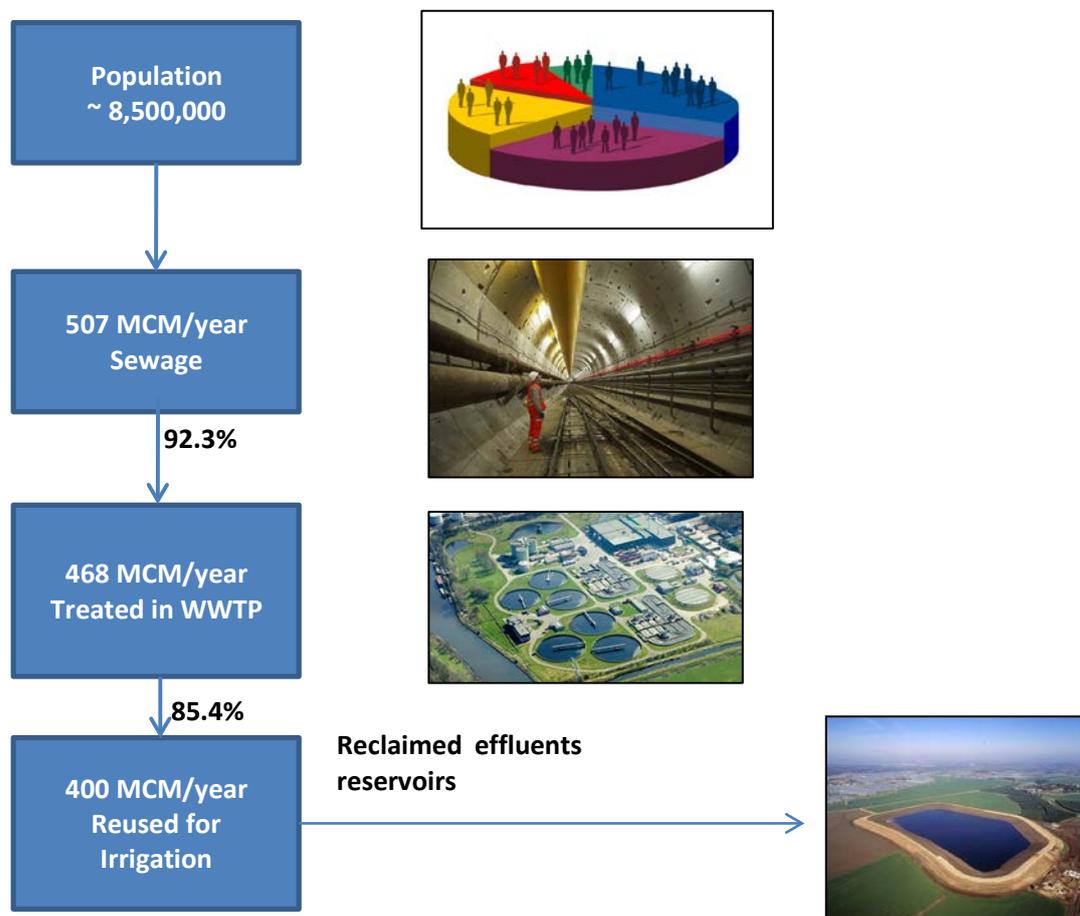
Wastewater management is an integral part of the overall water management, as sewage and treated wastewater (effluents) are considered as a legitimate water resource which constitutes a significant part of all water uses. National policy calls for the gradual replacement of freshwater allocations to agriculture by reclaimed effluents.

As a result, Israel holds a world record of 85% reclaimed effluents reuse in agriculture and is a world leader in the development and the production of efficient water saving irrigation systems. A unique and

important part of Israeli water management refers to sewage and wastewater treatment, and this part will be described in detail at this case-study.

Currently, treated wastewater constitutes about 21% of total water consumption in Israel and ~45% of agricultural consumption. Out of a total of ~ 510 million cubic meters (MCM) of sewage produced in Israel yearly, 97% of the sewage is collected and about 85% of it is reused. Local authorities, regional councils and private water corporations are responsible for the treatment of municipal sewage. In recent years, new or upgraded intensive treatment plants were set up in municipalities throughout the country. The ultimate objective is to treat 100% of Israel's wastewater to a level enabling unrestricted irrigation in accordance with soil sensitivity and without risk to soil and water sources.

Figure 1 Sewage and wastewater in Israel



As part of the overall perception of sewage as an important source of water, and if treated wastewater is to be used for agricultural irrigation, sewage treatment must be done according to strict standards so that the effluent quality is safe for irrigation of all agricultural crops and for discharge in to water sources (rivers and aquifers).

Until the early 1990's, wastewater treatment was very poor, with only primary treatment applied. In 1992, new regulations set secondary quality standards for BOD and TSS. As a result, municipalities built intensive wastewater treatment plants (WWTP) with national loans of ~ 1.5 billion USD. Nevertheless, the

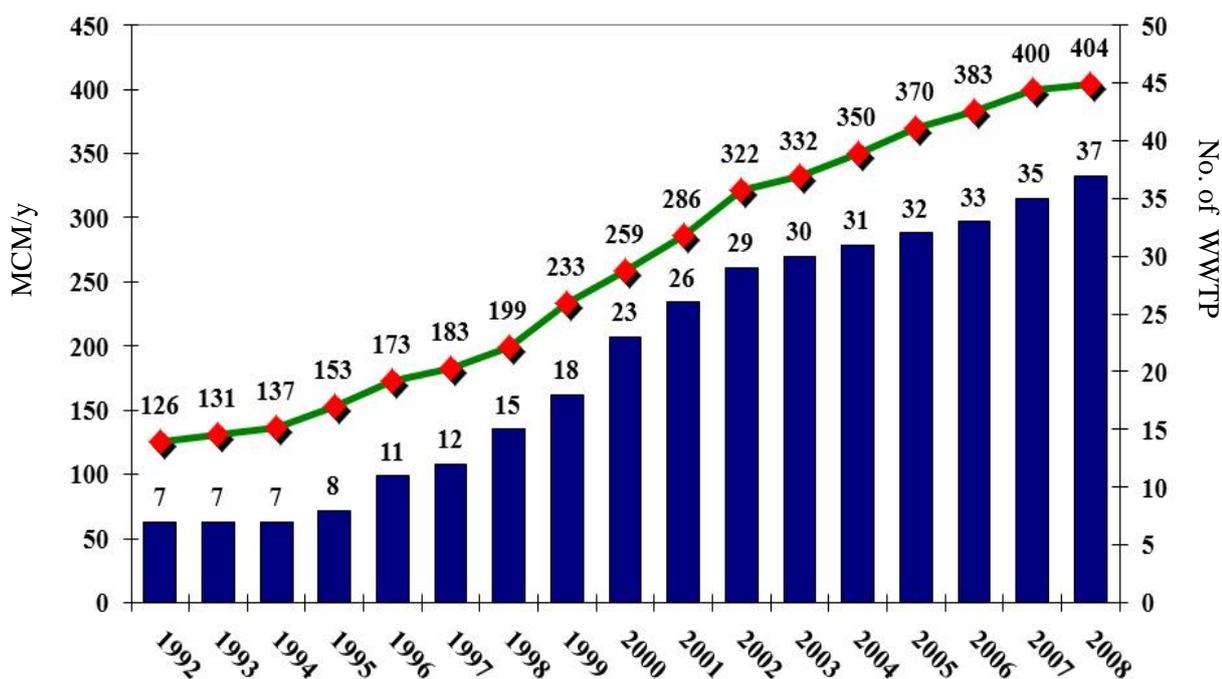
effluent quality was still not good enough for unlimited irrigation, and stricter legislation (tertiary standards) was needed to make sure that WWTP's treat wastewater to a level appropriate for unlimited uses.

Tertiary standards came into force in 2010 and advanced treatment technologies began being implemented at WWTP's, carrying out Nitrogen and Phosphorus reduction, filtration and disinfection.

The additional cost to attain the improved standard (from secondary (20/30) level) is approximately $10\text{¢} / \text{m}^3$ (Capital + O&M). However, the benefits of tertiary treatment and unlimited effluent irrigation are much higher than the costs. On top of that, the entire ecosystem is flourishing due to a permanent and steady flow of high quality effluents that can be used for various purposes.

With regard to the pricing of the effluents, as long as the treatment was secondary the farmers and their water associations got the effluents at no charge at the WWTP gate. They had the responsibility to build up the piping system and the reservoirs to collect the water and use it for their needs. Since effluent quality was upgraded to tertiary level, the farmers pay an amount of $\sim 3\text{¢} / \text{m}^3$.

Figure 2 Major Intensive WWTP (Over 1,400 m³/d)



1. Red diamonds: Volume of treated wastewater (MCM/yr)
2. Blue bars: Intensive wastewater treatment plants (WWTPs) (Over 1,400 m³/d)

Since 2000, two major processes have enhanced the wastewater and wastewater reuse sectors in Israel and although they were unrelated, they both had a dramatic influence and improved the ability of Israel to use the sewage in a better and more advanced way.

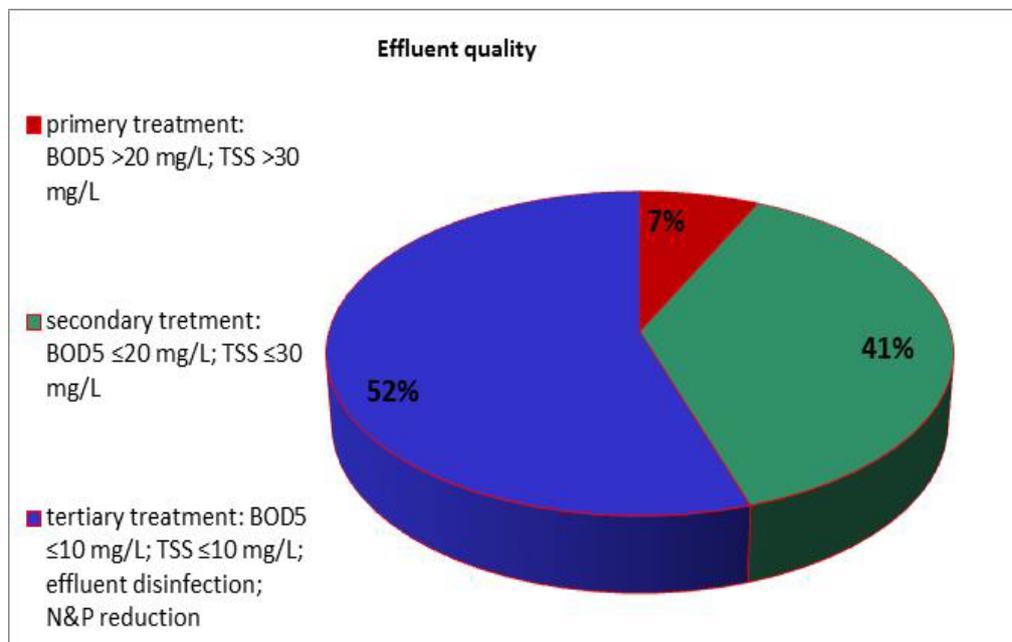
1. The budgets that were allocated in the 1990's to build WWTP's created the appropriate conditions for wastewater treatment but were not enough by themselves. Along with the funding there was a need for **stricter enforcement**.

The ultimate aim of environmental legislation is to prevent pollution and promote environmental quality. In this context, enforcement is an essential means of assuring compliance with the country's environmental laws and regulations.

Israel's environmental legislation is enforced by the Ministry of Environmental Protection through administrative, civil and criminal measures. Although major emphasis is placed on administrative enforcement, criminal prosecution is often an effective deterrent tool, especially because of the personal responsibility imposed on directors of economic and public corporations.

As mentioned above, in 2010 new and strict quality standards for effluents were legislated with 37 different quality parameters including for heavy metals, nutrients and oxygen demand. The standards enable to use the effluents without any limits for all purposes and thus the Ministry of Health allocates permits for unlimited cultivation of crops.

Figure 3 Effluent quality according to regulations



2. The second process with significant importance for the water management was the legislation of the Water and Sewerage Corporations Law in 2001. The law transfer water and sewerage services from the municipalities to corporate entities. This was the first step in the transformation of the administratively managed water sector to a more commercially orientation. It ensures that income from water and sewerage services will finance infrastructure investments, enabling of private sector investments for infrastructure and the assurance of a high quality services.

The second process with significant importance for water management was the legislation of the Water and Sewerage Corporations Law in 2001. The law transferred water and sewerage services from the municipalities to corporate entities. This was the first step in the transformation of the water sector from administrative management to a more commercial orientation. It ensures that revenues from the

supply of water and sewerage services is used to finance infrastructure investments, enabling private sector investments in infrastructure and the assurance of a high quality services.

The process was initially a voluntary one, and since 2008 state loans in the water sector are given only to water and sewerage corporations. The Corporations may serve the area of one or more municipalities, although in the latter case all municipalities in the service coverage area have to agree thereto. The tariffs and service charges applied by each of the Corporations are subject to review and approval by the Water Authority as part of the Corporations' obligation to meet certain service criteria.

There are currently 55 corporations serving 6.6 million people in 155 municipalities (out of 183). Their investments dramatically improved the environmental parameters in terms of maintenance and pollution prevention and the service level provided is today higher, and so is the percentage of water and wastewater fee collection. The regional councils are not obliged to join a Corporation although it is optional for them.

In the process of establishing the Corporations, they received the ownership of all the municipalities' infrastructure including piping systems and WWTP's.

Summary: the combination of economic tools such as tariffs and close market principle along with economic orientation of the water and sewerage corporations, and strict environmental regulations with relentless and uncompromising enforcement, lead to development of an advanced wastewater reuse system in Israel. This remarkable process is still ongoing and there is a lot more to achieve, but the water sector has changed and improved drastically in the last 20 years.

The use of economic tools is essential to improve the water sector and there is a need to do so in combination with other legislative and administrative tools.