

Spain sets the example

● Spain has considerable challenges to overcome in order to meet the needs of its drought-prone areas.

LLUÍS SALA, RAFAEL MUJERIEGO, MANEL SERRA and TAKASHI ASANO look at water reuse developments in Catalonia that promise a sustainable future.



The vineyard plantation in Colera, Northern Costa Brava, is irrigated with reclaimed water.

Spain's future water policy issues have been the subject of heated and controversial debate over the last few years. After a brief but intense social and parliamentary debate, the long-awaited National Hydrological Plan (PHN) was finally passed on July 5, 2001. Since then, there has been continued criticism of the legal text by a considerable number of scientists and environmental NGOs.

The PHN encompasses 11 wastewater reclamation and reuse projects, mostly in southern Spain and the Canary Islands, and also a highly controversial project that proposes the diversion of 1.050 million Ml/year from the Ebro river delta to the southeastern regions of Spain, where water is scarce and in high demand for agricultural irrigation and urban supply to coastal resort areas. Critics of the plan consider the intended diversion as unsustainable for the Ebro Delta ecosystem.

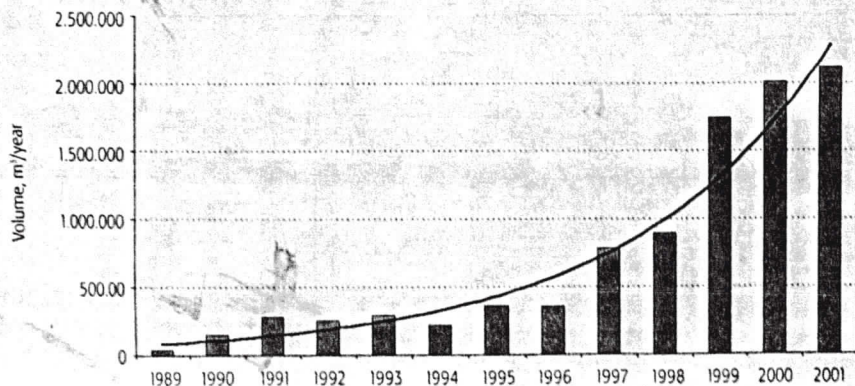
A survey conducted in 1999 by the Spanish Institute of Statistics (INE) indicates that 17.681 million Ml/year, or 78% of a total of 22.771 million Ml/year, was used for agricultural irrigation, followed by urban supply at 3.536 million Ml/year (16%). One of the main objectives of the PHN is to redistribute water resources across Spain, bringing them from water-rich regions to those with water scarcity, where the agricultural and tourist potential are greatest. However, a large number of social groups have expressed fears that implementing the plan might seriously threaten the lower Ebro basin and its delta, with likely impacts on the geography, hydrogeology, ecology, agronomy and economy of the area (Friends of the Earth, 2000; WWF, 2001).

Critics of the main proposals of the

PHN claim there is a need to promote and enforce a 'new water culture' based on water conservation, ecosystem preservation, and improvement of natural water quality, as well as wastewater reclamation and reuse, among other measures, as a more sustainable option for water resources management. Although water reclamation and reuse are recognised as a contributing element within this new approach, most of the reports issued by the scientific community mention the need to promote water reclamation and reuse of the large summer flows in coastal areas for non-potable uses.

In this context, the experience gained by the Consorci de la Costa Brava (CCB, Costa Brava Water Agency) over the last 12 years has provided a sound base for the rapid development of planned water reuse projects in several coastal areas of Catalonia, in the north east of Spain. The merger of the two former governmental agencies in Catalonia that were responsible for water resources development and water pollution control resulted in the creation of the Agència Catalana de l'Aigua (ACA, Catalan Water Agency) in 2000. This provided a suitable institutional framework for promoting water reuse development. The ACA has also presented several objections to the Ebro river diversion project and has taken the first step towards a new,

Figure 1 Reclaimed water flows produced annually in the Costa Brava from 1989 to 2001.

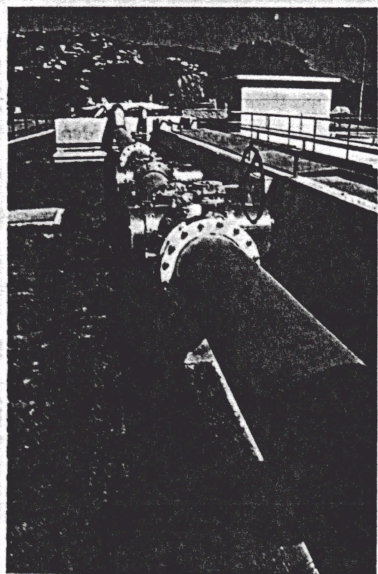




alternative approach to water resource management by including non-conventional sources such as water reclamation and seawater desalination as a means of reducing the proposed diversions.

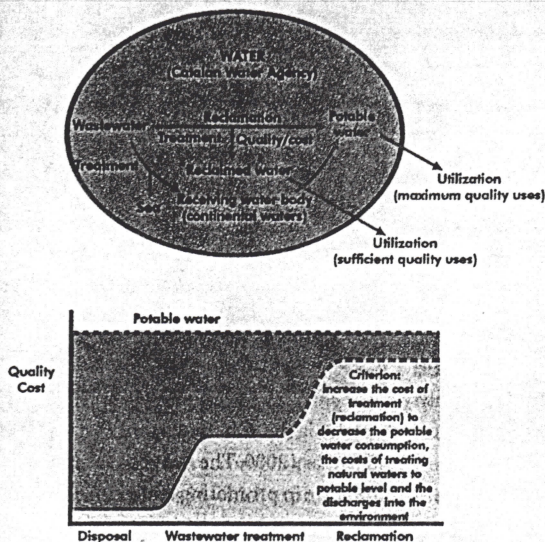
Water reuse in the Costa Brava

The amount of reclaimed water available for use on the Costa Brava has steadily and significantly increased over the last few years. Since the three water reclamation projects sponsored by the European Union Cohesion Fund became operational in 1998, water reclamation and reuse has had considerable publicity, and they have also served as demonstration



UV equipment for water reclamation, Central Costa Brava

CURRENT MANAGEMENT SCHEME



PAST MANAGEMENT SCHEME

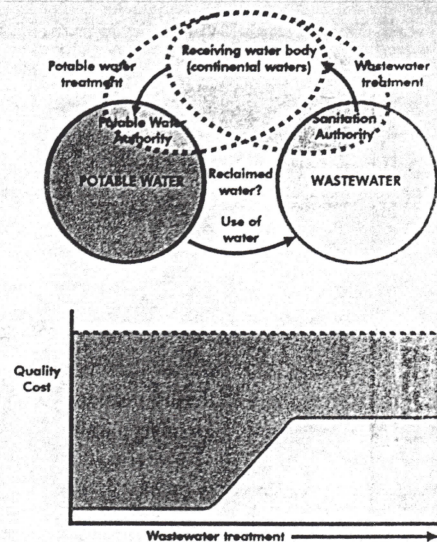


Figure 2 Past and present water management agencies in Catalonia.

projects for further applications in other parts of the Costa Brava and the rest of Catalonia. Implementing those projects has resulted in a tenfold increase in the volume of water reclaimed over the last 12 years, as shown in Figure 1. While the total flow of secondary treated wastewater has remained reasonably stable, at approximately 30,000 Ml/year, reclaimed water flows have steadily increased from virtually zero in 1989 to 2300Ml/year by the end of 2001.

The type and level of water reclamation varies depending on CCB's wastewater treatment plants, the quality required for the intended use and the budgetary resources available. Reclaimed water intended for golf courses and landscape irrigation is, as a minimum, disinfected secondary effluent, although in some facilities secondary effluent undergoes direct filtration and disinfection before being supplied to users. Water for urban non-potable uses is always filtered and disinfected secondary effluent, while the effluent used for environmental enhancement at the Aiguamolls de l'Emporda wildlife sanctuary is reclaimed water from a constructed wetland system designed to achieve nutrient removal.

CCB currently operates 18 wastewater treatment plants. Eleven of them have some type of water reclamation facility, the latest one being a Title-22 treatment system (i.e. complying with California's stringent water recycling criteria, often regarded as the strictest in the world,

which set quality levels for unrestricted non-potable reuse) at the Blanes plant, which has a treatment capacity of 800m³/h. The reclaimed water production is intended for use in agricultural irrigation and aquifer recharge to control seawater intrusion. Two additional wastewater treatment plants (Torroella de Montgrí and Tossa de Mar) are currently being remodeled, under the sponsorship of the ACA, to provide them with a reclamation process. The process at the Torroella de Montgrí works will have a Title-22 treatment system with a capacity of 1300m³/hour, and the reclamation process at the Tossa de Mar plant will have a direct filtration stage as well as a disinfection stage. In the first project, water will be used mainly to supplement flows to agricultural irrigation in the area, while in the second project, the reclaimed water will mostly be used for urban non-potable uses. Drought conditions and a lack of other viable alternatives are also fostering the implementation of an aquifer recharge project to aid drinking water production in Port de la Selva (northern Costa Brava), the first of this kind in the area.

But the amount of reclaimed water being produced is not the only thing that has changed on the Costa Brava. Treatment technologies, both biological and reclamation processes, have also been considerably improved. While water reclamation in the late 1980s was undertaken simply by disinfecting the secondary effluent, more recently designed and constructed projects use full reclamation processes (Title-22 or

Orchards irrigated with reclaimed water around the Castell-Plaja d'Aro treatment plant, Central Costa Brava

similar) to achieve higher treatment efficiency and reliability and to produce water of a quality comparable to that specified by Californian regulations (State of California, 2001). In recent years, disinfection has been upgraded from simple chlorination to the more sophisticated combinations of UV and chlorine. Considering the high capital costs of UV systems, and the comparatively lower operational costs of sodium hypochlorite, this coupled disinfection process, in which UV undertakes most of the disinfection and chlorine is used only for final polishing, has several advantages:

- a high disinfection level can be achieved with a lower capital cost than if UV alone was used
- an alternative, single low-cost disinfection system is available whenever the UV system has to undergo maintenance or fails, or when key quality parameters such as water transmittance at 254nm falls below design limits.
- the chlorine contact tank can be smaller, or even totally eliminated, since the UV system provides the main log removal of microorganisms, and final microbial inactivation can be achieved by residual chlorine during the reclaimed water's residence in the final storage tank.
- a chlorine residual concentration can be maintained throughout the distribution system, ensuring the required microbiological quality for the reclaimed water is met at the point of use

The Catalan Water Agency (ACA)

The experience gained by CCB in water reclamation and reuse for the Costa Brava has helped the ACA to strongly promote water reclamation and reuse in



Catalonia since the new agency's creation in January 2000. The ACA has taken the initiative in promoting and financing tertiary treatment systems at several wastewater treatment plants. Figure 2 shows the past and present water management systems in Catalonia.

New water reuse initiatives

The ACA has already devoted several million Euros to building water reclamation facilities and promoting water reuse, particularly to golf courses that are forced to rely on reclaimed water as their sole source of irrigation. The following initiatives should be given further consideration:

- expanding the scope, objectives, and regulations for source pollution control programmes
- improving the design and operation of wastewater treatment plants, using the new approach of providing a good quality product. A coordinated effort in designing and operating wastewater treatment plants and water reclamation facilities, together with effective source control programmes, should result in stable reclaimed water quality.
- building and operating safe and reliable tertiary treatment plants. There are abundant scientific and technical references detailing how to design, build, and operate a reliable reclamation process, and also on the reclaimed water quality criteria applicable to various water uses.
- establishing detailed agreements with users of reclaimed water. Reclaimed water supply conditions (flows, quality, cost, use restrictions) need to be identified and established in a formal agreement or contract between the reclaimed water supplier and the user.
- focusing on realistic and objective

water quality criteria. Incorporating reclaimed water into the water management framework also means bringing water quality into the spotlight.

By recognising and promoting these new water reuse initiatives, reclaimed water can become a valuable new resource for the water-scarce areas of Catalonia. In addition, Spanish coastal resorts, which are experiencing record summer populations, could have a reliable and complementary source of water for agricultural and landscape irrigation if they redirected their distribution pipelines inland instead of towards the sea, where treated effluents are currently disposed of through sea outfalls to the Mediterranean. ●

References

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The Golf d'Aro, Central Costa Brava, has been irrigated with reclaimed water since 1989.

