

# Water demand management in the Mediterranean, progress and policies

ZARAGOZA, 19-21/03/2007

**PAPER**

**Working group "Factoring WDM into drinking  
and industrial water management"**

*Recycling of grey water in Cyprus*

*C. A. Kambanellas*

**3<sup>RD</sup> REGIONAL WORKSHOP ON WATER AND  
SUSTAINABLE DEVELOPMENT IN THE  
MEDITERRANEAN**

**Zaragoza (Spain)**  
**19 – 21 March 2007**

**RECYCLING OF GREY WATER  
IN CYPRUS**

C. A. KAMBANELLAS, BSc, PhD,  
Executive Engineer I,  
Water Development Department,  
Ministry of Agriculture, Natural Resources and Environment,  
P.O. Box: 23699  
CY-1685, Nicosia, Cyprus.  
Phone: +35799578719  
Fax: +35722803141  
Email: [kambanel@cytanet.com.cy](mailto:kambanel@cytanet.com.cy)

**Abstract**

From 1997 onwards, the Government has decided, in parallel with new projects, the implementation of water conservation measures at household level (Onsite wastewater treatment and recycling). Over 50% of the domestic water demand could be met by water of a lower grade quality, such as processed water. Saving water from the existing domestic water supply systems has exactly the same results as water supplied from new water supply schemes. As a practical measure, to save drinking water, a scheme has been put into practice, for subsidizing the recycling of "grey water" for irrigation and/or for operating the WC's in households or buildings. With this practical measure there is a conservation of drinking water from 35% - 40% of the per capita water consumption. Recycling of grey water started on an experimental basis in 1997 and continued right through 1998. To date the Recycling of grey water has become part of the Integrated Water Demand Management of the country. The advantage of recycling grey water, in comparison with recycling treated sewage effluents, is that this done in the building/household itself. Hence, this water is used again, either for the irrigation of the garden or for the flushing of the toilets of the same building/household. The introduction of a consumer-based sustainable Water Demand Management has accomplished true saving of drinking water, at residential level.

## **Context**

The Recycling of Grey Water at household level is a decentralised process which introduced a consumer-based sustainable water demand management. Its use can decrease the need for new water supply or water treatment projects.

Additionally this is beneficial for the environment and has significant positive impacts on people's quality of life.

## **Methodology and Process Used**

### **Limited Freshwater**

Freshwater is one of man's most valuable commodities. Without it there can be no life. Only the estimated 1% or less of the world's water supports the world's population and this is unequally distributed around the world. In arid or semi-arid regions of the world like Cyprus, the need for a satisfactory water supply poses a constant problem because of low or uneven distribution of precipitation and high evapotranspiration.

Water conservation and water reuse are becoming increasingly important, particularly in these regions. The reuse of grey water is one of the means which would help to meet present and future demands. It has the additional benefits of conserving valuable drinking water resources

### **About Cyprus**

Cyprus is situated in the north eastern part of the Mediterranean Sea. It is one of the ten countries that have joined the European Union in May 2004, as part of the EU expansion. Cyprus is one of the 35 countries which are members of the Euro-Mediterranean Water Information System.

Cyprus is the third largest island in the Mediterranean Sea with an area of 9250Km<sup>2</sup>. Approximately 40% of the area of Cyprus, is under Turkish occupation.

The population in the government controlled area of Cyprus is about 700000. Every year the island is visited by more than 2.5 million tourists

### **Water Resources Situation**

Throughout its long history Cyprus has always been confronted with the problem of water shortage. Droughts are a very usual phenomenon and many times in the past Cyprus came close to desertion as a result. Cyprus has no rivers with perennial flow while rainfall is highly variable and droughts occur frequently.

In order for this situation to improve, as from 1997 onwards, the Government of Cyprus has decided in parallel with new projects using non-conventional sources such as desalination, and the implementation of water conservation measures at household level.

## **Conservation of Drinking Water**

Potable water used in households and industry is normally taken directly from the drinking water system and discharged into a central sewerage system or into an onsite wastewater system, like a septic tank/absorption pit. Water suitable for potable use is therefore taken from the supply system and used for other purposes. It is quite obvious that water of this quality is not needed from many domestic and industrial applications.

In Cyprus over 50% of the demand for water could be met by water of a lower grade quality. To meet these non-potable water demands with an appropriate quality of water the cheapest solution is the decentralized recycling of at least a suitable part of the discharge water i.e grey water for reuse for garden irrigation/watering and toilet flushing of the same household.

In Cyprus lightly polluted or Grey Water from baths, showers, hand or wash basins and washing machines is kept separate from heavily polluted or Black Water from WC's and kitchens. As a result it is relatively easy to intercept each type of wastewater at household level for subsequent treatment and reuse. This reuse is novel in Cyprus.

A study that was conducted on the water resources situation in Cyprus from 1950 to 1984 had shown that each water project that was built for the solution of the water problem was always bigger than the previous one. At the same time, the water problem not only did it not get better, but it grew larger each year, especially in terms of the drinking water. The main causes for that were: the environmental changes, the prolonged droughts, the increase of the local population, tourism, etc. It was also concluded that in parallel to the construction of new projects, water conservation measures should also be implemented. It is believed that the recycling of grey water can be used as a practical water conservation measure in an integrated water demand management policy.

Initially the research was aimed to identify the real per capita water consumption in urban and rural areas. The water consumption was categorized in grey water, black water and water for irrigation and other uses.

It was concluded that more than 35% of the per capita drinking water consumption is discharged as Grey Water and more than 50% of the water used in a household is not necessary to be of drinking quality. These facts showed that recycling could provide a substantial tool not only in the conservation of drinking water but also in the water demand management, since 35% of the drinking water can be reused for garden watering and/or toilet flushing at the household that the Grey Water was produced from. In this way the recycling of grey water at household level i.e. decentralisation has an advantage over the recycling of treated effluents from the central sewage systems, because this is done in the establishment from which, the grey water comes from. Hence, real saving of drinking water is accomplished at residential areas where there is water shortage.

As a result of this research the “**Grey Water Treatment Plant**” (GWTP) was developed and tested. This is a treatment process for grey water, using physical and chemical methods. The GWTP can easily be installed at every household because almost all existing buildings in Cyprus have 3 discharge pipes. One pipe for the grey water, one pipe for the black water from toilets and one pipe for the waste water from the kitchen. Tests have shown that the quality of the treated grey water is suitable for garden watering and/or the flushing of toilets.

### **Types of Tools for Water Demand Management and for Integrated Water Resources Management Used**

After five years (1985 – 1991) research and two years (1997-1998) experimental work on a pilot scale the Government of Cyprus decided to subsidize, as from the beginning of 1999, the installation of a Grey Water Treatment Plant (GWTP).

During these two years the Government of Cyprus funded with €12.500 the Water Development Department (WDD) for the evaluation of the GWTP as a water conservation measure, in build-up areas.

Since January 1999 the Government of Cyprus has adopted the Recycling of Grey Water as one of the main water conservation measures in built-up areas (The Decisions of the Council of Ministers of the Republic of Cyprus are: 48.226 of 7/8/1998, 49.512 of 21/4/1999 and 51.567 of 12/4/2000). At the same time, the Government, through the Ministry of Agriculture, Natural Resources and Environment decided, in an attempt to encourage the consumers to install the GWTP, started to subsidize the installation with €350 for each household. From January 2003 onwards, the subsidy was doubled to €700 for each system. Since April 2006, after the decision of the Council of Ministers of the Republic of Cyprus No.: 37 of April 5<sup>th</sup> 2006, this subsidy has been increased further to €1050. In this way, 75% of the cost of the purchase and installation of a GWTP which is around €400 is covered.

Each interested consumer who wishes to install such a system fills-in an application form and sends it to the WDD. When the installation is completed the system is tested and checked. If the installation is successful and everything works satisfactorily, the commissioning is completed, the subsidy application is forwarded and the subsidy is sent to the applicant by the Accountant General of the Government of Cyprus.

Since 1999 the installation of GWTP was applied not only to households but also to schools, army camps, football fields and nursing homes. The costs of the installation and operation of the systems in public establishments were undertaken by the Government. The costs for the systems of the nursing homes, was undertaken by non-profit organisations such as the Rotary Club, etc.

Up to August 2005, 25 GWTP have been installed at primary and secondary schools. The waste water from the drinking fountains that the students drink and wash their hands, is collected, treated and reused to irrigate the school gardens. For 2006, after the approval of the Council of Ministers of the Republic of Cyprus for the amount of €22,000 (Decision No.: 37 of April 5<sup>th</sup> 2006) there are under construction 80 more systems for the Ecological and other schools.

Visits to schools and lectures to the teachers and students are organised for the importance of recycling, of water conservation and of the importance of water-saving consciousness. As a result, the teachers every year introduce in their curriculum the subject of grey water recycling and the students conduct a series of measurements and observe the amount of the recycled water used for garden watering and discuss their findings at the “Ecological Schools” meetings.

Further to the lectures at schools, the “Students’ Drawing Competitions”, under the subject “Water Conservation was also introduced”. There have been 600 winners so far and the prizes totalled €52,000. It was also decided to collect and publish as a 2005 Calendar, some of the winning drawings. 3000 of these calendars were distributed to schools island-wide. For 2006, the Council of Ministers approved €70,000 (Decision No.: 37 of April 5<sup>th</sup> 2006) for the continuation of the “Students’ Drawing Competition “, as was done in 2005.

Furthermore, GWTP were installed at 15 army camps of the National Guard. At these camps, further to the conservation of drinking water, the problem of overflowing sewage from the absorption pits was also solved. The treated effluent is used for the toilet flushing of the Barracks Restrooms and for the irrigation of the camp’s garden. For 2006, there is an approval from the Council of Ministers for €28,000 (Decision No.: 37 of April 5<sup>th</sup> 2006) for the continuation of another 3 recycling systems for the army camps. Regular visits to the barracks are made and lectures to the soldiers on the importance of water recycling and the need to develop water-saving consciousness are conducted.

Grey water recycling at football fields was also promoted. Twenty GWTP, were installed at football fields. Grey water collected from the shower-rooms is being treated. This treated effluent is reused for the irrigation of the lawns. All of the above systems were installed by a team of technicians from the WDD.

The quality of the treated effluent from the above-mentioned treatment plants is monitored regularly. A monitoring/ sampling schedule was drawn up in cooperation with the State General Laboratory and the Laboratory of the WDD. Samples are collected twice a month and are sent to the laboratory for testing.

The operation of the GWTP is simple and does not present any special problems. The cost of the treated effluent is about €0.35 per cubic meter. All of the above measures have been introduced as part of the long-term integrated water demand management of the country.

## **Results of the Experience and Lessons to be Learned**

Conservation of drinking water has been initiated as a practical means of assisting water demand management where, for instance, capital expenditure on water resources development (new dams, main conveyors, water treatment plants, etc) might be reduced or deferred.

"Water saved is exactly the same as water supplied" and "One person's reduction in water use makes water available for someone else to use".

In addition, the advantage of recycling of grey water, in comparison with the recycling of treated sewage effluents from the central sewage systems, is that this is done in the building or household itself from which the grey water comes from. Hence, this water is used again, either for the irrigation of the garden or for the flushing of the toilets of the same building or household. In this way, true saving of drinking water is accomplished, at residential areas where there is shortage of water.

With this scheme there is a conservation of drinking water from 35% to 40% of the per capita water consumption. This means that the conservation of drinking water from every two persons covers the needs of the third person. With this practical measure there is at the moment a saving of 2 million cubic meters per year of drinking water.

The quality of the treated effluent is suitable for garden irrigation and for toilet flushing. Cyprus does not have National Standards for the reuse of the treated grey water effluent. Cyprus follows the strictest of the standards for the reuse of treated sewage effluent.

The installation of GWTP not only saves drinking water, but it also saves electricity that is used either for the production of desalinated water or for its pumping to build-up areas. Additionally, the reduction in the electricity demand saves fuel oil and reduces the CO<sub>2</sub> release and pollution from the power stations.

## **Justification of the Importance of the Paper**

The use of the GWTP introduced a consumer-based sustainable water demand management. Its use has moved from the initial experimentation and has evolved into an integral part of the country's Integrated Water Demand Management.

With GWTP, at least 35% of the wastewater of each household is being reused; therefore, capital expenditure on water resources development may be reduced or deferred. The water saved is exactly the same as the water supplied. The cost of the drinking water saved from the GWTP installation is at least 4 times cheaper than the same amount of drinking water supplied to the same town from new projects. Additionally, the need for central sewerage system is diminished, as well as the reactions of citizens against the construction of central sewage treatment plants close to their properties.

## **Discussion**

The water resources of the Island of Cyprus are limited, and they are almost fully developed. Water conservation and reuse are the main water demand management tools in Cyprus.

The recycling of Grey Water is a consumer-based sustainable water demand management tool.

The consumers can take active part in the water demand management and also develop a greater water conscious.

The recycling of Grey Water is a practical, decentralised method and can give substantial economy on drinking water in residential areas.

The cost for installing and operating the grey water treatment plant is quite low compared to other methods of treating wastewater, such as the biological treatment therefore it is easier for the consumers to be encouraged for its use.

The amount of subsidy that is provided by the Government shows its recognition to the beneficial effects of the GWTP in its water demand management policy.

## **Key Words**

Grey Water  
Recycling  
Household  
Decentralisation  
Consumer-based  
Sustainable  
Integrated  
WDM