REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE NATURAL RESOURCES AND ENVIRONMENT

WATER FRAMEWORK DIRECTIVE

(2000/60/EC)

Reporting Sheets on Economics

Nicosia, February 2010

ΚΥΠΡΙΑΚΗ ΔΗΜΟΚΡΑΤΙΑ ΕΥΡΩΠΑΪΚΗ ΕΝΩΣΗ ΔΙΑΡΘΡΩΤΙΚΑ ΤΑΜΕΙΑ της Ευρωπαϊκής Ένωσης στην Κύπρο οι ιδέες μας, πράξη και ανάπτυξη

«Προγραμματική Περίοδος 2007-2013 - Το Έργο δύναται να συγχρηματοδοτηθεί από το Ταμείο Συνοχής της ΕΕ»

Republic of Cyprus

Reporting Sheets on Economics

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- Vlasis Partasides, SWE, Head of Division of Management Operation and Maintenance of Government Irrigation Works, WDD (ret.)
- Ermioni Chrysostomou, SWE, Head of Design Division, WDD
- Costas Katsavras, SWE, Head of Division of Management Operation and Maintenance of Government Irrigation Works, WDD
- Spyros Stefanou – SWE, Head of Planning Division, WDD
- Charis Omorfos – EE I, Coordinating Committee of European Union, WDD
- Panagiota Hadjigeorgiou TE I., Telemetry Division, WDD
- Evripides Kyriakides – El. E. Electromechanical Workshop , WDD
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- Andreas Karaolis – FO, Ministry of Finance
- Gianna Nicolaou – EE I, Division of Management Oper. and Maint. of Government Drinking Water Works, WDD
- Angela Larkou – SE, Division of Sewerage and Recycling, WDD
- Zoe Hadjivassiliou, SWE, Head Division of Management Oper. and Maint. of Government Drinking Water Works, WDD
- Kyriakos Spanos SWE, Pafos District Engineer Pafos, WDD
- Soteris Paschalides SWE, Limassol District Engineer, WDD
- Nicos Neokleous, SWE, Larnaka District Engineer, WDD
- Andreas manoli El. E. Head Electromechanical Workshop, WDD
- Fedros Roussis, ST, Division of Management Operation and Maintenance of Government Irrigation Works, WDD
- Lia Georgiou – SE I, Division of Sewerage and Recycling, WDD
- Ioanna Stylianou SE, Division of Sewerage and Recycling, WDD
- Giorgoulla Chrysostomou EE I, Pafos District Office, WDD
- Michalis Televantos EE Limassol District Office, WDD

- Michalis Karaiskakis Technician I, Limassol District Office, WDD
- Elena Phinikaridou EE, Larnaka District Office, WDD
- Demetris Andronikou EE, Larnaka District Office, WDD
- Demos Antoniou, SWE, Nicosia District Engineer, WDD
- Antoulla Shiamma EE, Nicosia District Office, WDD

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Contents

1 Introduction

This summary report comprises all information related to the economic analyses - as required by Articles 5 and 9 of the Water Framework Directive (WFD) for the Republic of Cyprus - and has been prepared using as a template the "Updated reporting sheets on economics" (final version 4 - February 2009) that have been developed by the Commission, discussed at the relevant SCG meetings and agreed by Water Directors.

More specifically, the 2004-2005 reporting sheets were agreed for the purpose of the electronic reporting in WISE linked to obligations under article 3 and article 5 of the WFD. At the time they were endorsed, the reporting sheets identified some elements that would need a review in view of the fact that subsequent reporting of the characterisation and pressure and impact analysis will be made in the context of the river basin management plan reporting. The updated reporting sheets were agreed by Water Directors in June 2008. The reporting sheet on economics is the only one pending an update from the 2004-2005 guidance.

The enclosed reporting sheets have been developed by the Commission and were discussed at the SCG meeting in November 2008. Written comments were received from UK, NL, SL, FI, DK, SI, FR, DE, BE, ES, CZ, EEB and Eureau. A second version of the reporting sheets were circulated to SCG, copied to Working Group D, prior to the Water Directors meeting in Paris on 24-25th Nov 2008. Water Directors discussed the reporting sheets and identified two open points. Water Directors mandated the SCG to solve the open issues and finalise the sheets at the March 2009 meeting. A third version of the reporting sheets was circulated on 17 December 2008 for comment by 16 January 2009. Comments were received from ES, DE, SK, NL, UK and EEB. This version (v.4) of the sheets reflects the comments received.

The Economic Analysis of water use under Article 5 of the WFD has already been reported by the Republic of Cyprus in the context of WFD Article 5 implementation in 2004 – 2005 (Republic of Cyprus, EU-summary report Articles 5 & 6, March 2005). However, since the economic analysis in 2005, the republic of Cyprus has collected more updated and relevant to the economic analysis data through the development of an Information Protocol (IP) for the River Basin District of Cyprus, in order to support the reassessment and updating of the Economic Analysis of water use and the implementation of water pricing policies under WFD Article 9. The information protocol aimed at identifying and processing all possible data that might be needed in cost assessment analysis, pricing policies, programmes of measures etc. In addition, in 2009 the elaboration of an integrated data processing system was completed, which includes an extensive database as prescribed in the above mentioned information protocol, as well as data processing -through appropriate algorithms- and reporting capabilities. This integrated data processing system supports and provides comprehensive reports for all stages of cost assessment of water services/uses.

Therefore, the prescribed 'Reporting Sheets' cover: 1) the update and reassessment of the Economic Analysis of water use under Article 5 based on the above and 2) the reporting of the steps taken for the implementation of the WFD Article 9 provisions.

The following 'Reporting Sheets' have been prepared and included in this report:

Sheet Code	Reporting Sheet Title	WFD Reference	Reporting dates
ECO 1	Economic analysis of water use	Article 5, 15 and Annex III	2009
ECO 2	Economic analysis of water use Summary of steps and measures taken to meet the requirements of Article 9	Article 9, 11 15 and Annex III	2009

This report covers and presents all the information that is required in the above reporting sheets.

As described in the information supplied to the Commission in 2004 under WFD Article 3, Cyprus has been identified as one River Basin District. The competent authority is the Minister of Agriculture, Natural Resources and Environment of the Government of the Republic of Cyprus. The above-mentioned competent authority has responsibility over the entire River Basin District. It has to be noted, however, that according to the provisions of Article 1 of Protocol No. 10 on Cyprus, attached to the Treaty of Accession to the EU, the application of the acquis is suspended in those areas of the Republic of Cyprus in which the Government of the Republic of Cyprus does not exercise effective control. Furthermore, the Memorandum of Understanding between the Government of the Republic of Cyprus and the Government of the United Kingdom of Great Britain and Northern Ireland concerning responsibility for the implementation of the Protocol on the Sovereign Base Areas of Akrotiri and Dhekelia in Cyprus, provides for the application of the WFD in the Sovereign Base Areas of Akrotiri and Dhekelia in Cyprus.

This Reporting Sheets on Economics have been prepared by the team-members of a Consortium consisting of ENVECO A.E., Kosmides A.E. – Symeonides P. O.E. (Draxis Environmental Technology), I.A.CO Environmental and Water Consultants LTD, D. Argyropoulos.

2 General Information about Cyprus – Definitions of basic terms/ principles

2.1 General Information on Cyprus

River basin area

Cyprus has been identified as one River Basin District (11015 km^2). Hydrographically, the island of Cyprus is subdivided into 9 hydrological regions made up of 70 watersheds (Figure 2.1-1). According to the provisions of Article 1 of Protocol No 10 on Cyprus, the application of the acquis is suspended in those areas of the Republic of Cyprus in which the Government of the Republic of Cyprus does not exercise effective control. The area under government control contains 47 watersheds. Cyprus falls within ecoregion 6: the Mediterranean Sea, on System A, 'Ecoregions for transitional and coastal waters', and in ecoregion 26: Cyprus on System A, 'Ecoregions for rivers and lakes' (Republic of Cyprus Law N, 13(1)/2004).

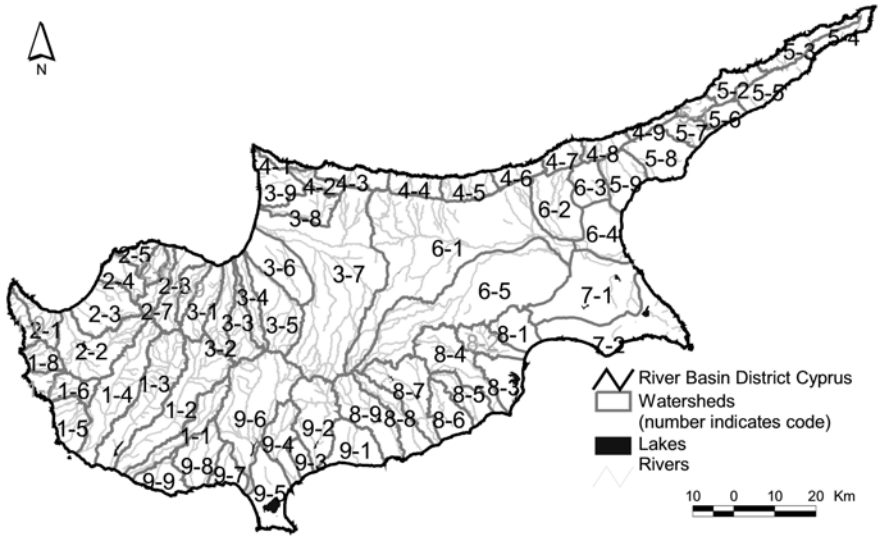

Figure 2.1-1 River basin district Cyprus with its watersheds and rivers. Numbers present watershed number.

Topography

In the middle of the south-western part of Cyprus the Troodos massif arises, which consists of mostly volcanic rock (Figure 2.1-2). The highest elevation can be found in this area and is 1953 meters. On the North coast is the Kyrenia Range, a narrow mounting range reaching elevation of 1000 meters. Plain areas can be found along the southern coast as well as in the centre of island, the Mesaoria plains. Most rivers originate in the Troodos area.

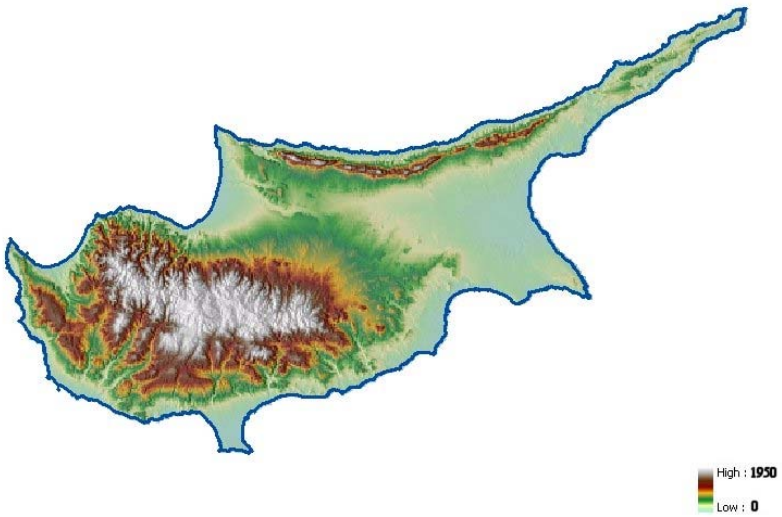

Figure 2.1-2 Topography of Cyprus (geological map based on the Geological Survey Department of the Ministry of Agriculture, Natural Resources and Environment, 1995)

Climate

Cyprus has an intense Mediterranean climate with the typical seasonal variation strongly marked with respect to temperature, precipitation and weather in general. The mean annual precipitation is about 460 mm. Most rain falls in the winter months (December - February), with snow in the Troodos Mountains. During the past 100 years, the average annual rainfall has decreased by 14%, with significant over annual deviations and triannual periods of drought.

Drought is a matter of great importance for Cyprus. Cyprus and Malta are classified as the EU member states with the highest levels of water shortage, with drought being the most important problem. Cyprus has always had a problem of water shortage, affecting both its drinking and irrigation needs. Nowadays, and despite the development of most of the water resources of the island, the problem of drought remains acute. This is due to the population increase (locals and immigrants), the increase of tourists, the high seasonal demand for water, the improvement of living standards, the increase of water demand for irrigation, but also due to the drought conditions, which have increased in the last years.

In conjunction with the aforementioned phenomena, the island has an unequal distribution of water resources due to physical parameters. The presence of the Troodos mountain range (with an altitude of almost 2.000 m) has resulted in the unequal distribution of rainfall (ranges from 280 mm in the southeastern regions to more than 1000 mm on the high altitudes of Troodos) (Figure 2.1-3).

Land Uses

According to the land cover mapping report for Cyprus published in 2000, (Corine Land Cover, 2000), the total area of arable land and permanent crops was 443.043 ha and equaled 47,89% of the total island area. Forested land covered 407.858 ha, which equaled 44,12% of the island area, while other land use classes covered much smaller proportions of the island area. The artificial surfaces covered 70.233 ha (7,63%), wetlands 1955 ha (0,21%) and water bodies covered 1401 ha (0,15%) (Figure 2.1-4).

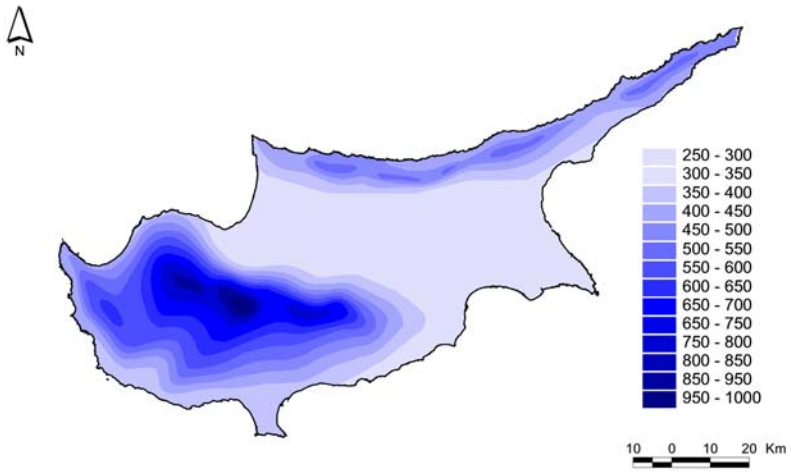

Figure 2.1-3 Mean annual rainfall in Cyprus in mm (period 1991-2000).

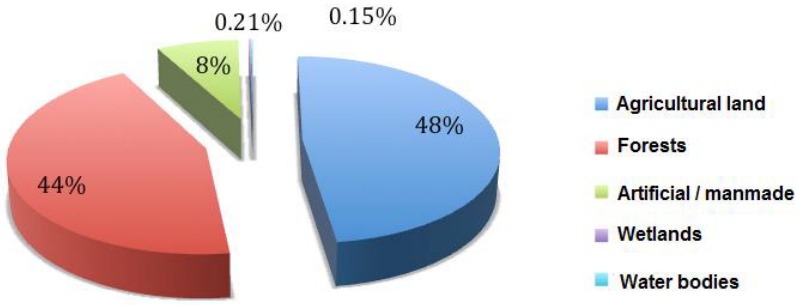

Figure 2.1-4 Land Uses (Corine land cover, 2000).

Socioeconomic Data

The economy of Cyprus (judging by the trends of GDP growth – Figure 2.1-5) has been growing since 1996 (GDP: 18%) to 2000 (GDP: 5,0%). However, the economic growth slowed down in 2001, with this trend worsening in 2002 and 2003. In 2004-2007, the national GDP remained relatively stable, while in 2008, the economy of Cyprus had a GDP growth of 3,7%, which was the smallest of the past four years. This noticeable slowing down of the GDP growth rate during 2008 is attributed to the adverse international economic conditions.

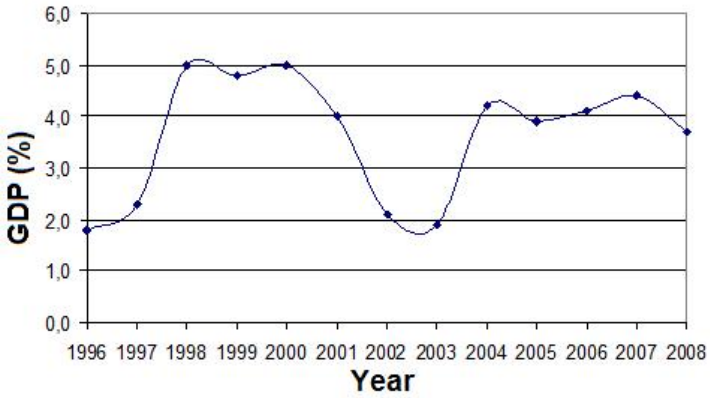

Figure 2.1-5 Annual GDP growth rate in constant prices from 1996 to 2008 (National Accounts, Statistical Service, 2008).

Inflation has increased in 2008. This is attributed, according to the Statistical Service, to increases in the prices of several fresh fruits, petroleum products, several clothing items and water charges. Decreases were recorded in the prices of several fresh vegetables, the car retail market, electricity services and potatoes (Figure 2.1-6).

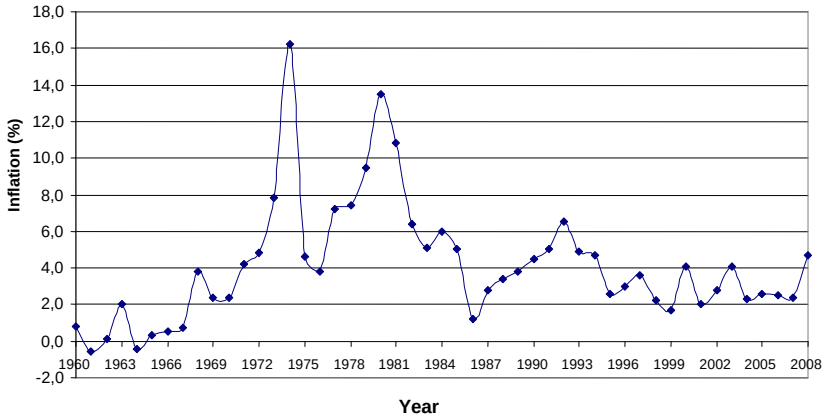

Figure 2.1-6 Inflation in Cyprus for years 1960-2008 (Inflation, Statistical Service, 2008).

2.2 Definitions of basic terms/ principles

In the current section of this report, it is described how the basic terms – principles concerning the economic analyses have been implemented in practice. These basic terms/ principles consist the "foundation" based on which the economic analyses have been structured and concern the following:

- Spatial Scale of Analysis
- Timeframe of Analysis
- Identification of Water Services and Water Service Providers
- Identification of Water Uses

2.2.1 Identification of water Services, Uses & Water Service Providers

According to Article 2 of the WFD the **Water Services** are defined as: «*all services which provide, for households, public institutions or any economic activity: a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater, b) waste-water collection and treatment facilities which subsequently discharge into surface water*».

As it is mentioned in the Guidance Document No 1 – WATECO, overall a water service represents an intermediary between the natural environment and the water use itself. The main purpose of the water service is to ensure that: 1) Key characteristics of natural waters are modified (i.e. the service offered is this modification) so as to ensure it fits with the requirements of well-identified users (e.g. provision of drinking water); or 2) Key characteristics of water 'discharged' by users are modified (i.e. the service offered is also this modification, e.g. waste water treatment) so that it can go back to the natural environment without damaging it. Overall, a water service per se does not consume water

nor produce pollution, although it can directly lead to morphological changes to the water ecosystem (e.g. dams, pipelines, etc.).

Concerning private water services, usually there is limited available information (private wells, private desalination plants, septic tanks, etc.). In these cases, estimates of the extent / volumes that these services are used were made (e.g. percentage of homes with septic tanks or private wells). However, for the cost analysis of these private services, it was considered that the financial costs are covered by the private individuals and thus they were not included in the calculations and only the associated resource and environmental cost were taken into account.

The Water Services in Cyprus were further subdivided in sub-services for the purposes of the economic analyses and calculation of total cost, so as to link the water services to the water uses. Thus the water services and subservices that we identified in the case of Cyprus were the following:

1. Supply of drinking water
   This service is further divided in the following "sub-services":
   - 1.1. Supply of drinking water to households
   - 1.2. Supply of drinking water to tourism
   - 1.3. Supply of drinking water to industry
   - 1.4. Supply of drinking water to other uses
2. Supply of irrigation water
   This service is further divided in the following "sub-services":
   - 2.1. Supply of irrigation water to agriculture
   - 2.2. Supply of irrigation water to livestock
   - 2.3. Supply of irrigation water to industry
   - 2.4. Supply of irrigation water to other uses
3. Supply of recycled water
   This service is further divided in the following "sub-services":
   - 3.1. Supply of recycled water to agriculture
   - 3.2. Supply of recycled water to tourism
   - 3.3. Supply of recycled water to other uses
4. Sewerage and urban wastewater treatment (up to secondary treatment)

In each water service, there are several **Service Providers** that are involved in the supply of the water service to the users. These Service Providers were identified and recorded mainly because their costs are the basis for the calculation of the financial cost of water services.

According to Article 2 of the WFD **Water Uses** are defined as «*water services together with any other activity identified under Article 5 and Annex II having a significant impact on the status of water*».

Water Uses are all activities that have a significant impact on water status, according to the analysis of pressures and impacts (Art. 5 of the WFD). Economic analysis should be carried out for all these uses and ensure that these uses - which should be separated into at least industry, households and agriculture - contribute to the cost recovery of water Services. The activities which do not have significant negative impacts on water bodies are not defined as

water uses. This will be reassessed in every 6-year WFD management cycle, taking into account the dynamic evolution of the state of water uses.

In Cyprus, based on the implementation of WFD Article 5, the main water uses identified are the following:

- Drinking water – household use
- Agriculture
- Tourism
- Livestock
- Industry

Based on all the above, the following table 2.2.1-1 depicts all the Water Services, sub Services, Service Providers, Water Uses and Water Sources as identified in Cyprus River Basin District.

Table 2.2.1-1 Water services, sub-services, water uses, water sources and water providers in Cyprus River Basin District

Water Services	Water Sub Services	Water Providers	Water Uses	Water Sources
Supply of Drinking Water	Drinking water Supply to households	Water Development Department, Water Boards, Municipalities/ Communities	households	Surface Water (Dams/Reservoirs), Groundwater, Desalination
	Drinking water Supply to tourism	Water Development Department, Water Boards	tourism	Surface Water (Dams/Reservoirs), Groundwater, Desalination
	Drinking water Supply to industry	Water Development Department, Water Boards	industry	Surface Water (Dams/Reservoirs), Groundwater, Desalination
	Drinking water Supply to other uses	Water Development Department, Water Boards	other uses	Surface Water (Dams/Reservoirs), Groundwater, Desalination
Supply of Water for Irrigation	Supply of Water for Irrigation to agriculture	Water Development Department, Agricultural Associations	agriculture	Surface Water (Dams/Reservoirs), Groundwater
	Supply of Water for Irrigation to animal husbandry	Water Development Department, Agricultural Associations	livestock	Surface Water (Dams/Reservoirs), Groundwater
	Supply of Water for Irrigation to industry	Water Development Department, Agricultural Associations	industry	Surface Water (Dams/Reservoirs), Groundwater
	Supply of Water for Irrigation to other uses	Water Development Department, Agricultural Associations	other uses	Surface Water (Dams/Reservoirs), Groundwater
Sewerage (up to 2ndary treatment)	-	Sewerage Boards	households, tourism, industry	Sewerage from households, Touristic and Industrial Units
Supply of recycled water (tertiary treatment and supply)	Supply of recycled water to agriculture	Water Development Department, Local Sewerage Boards	agriculture	2ndary treated sewerage that undergo 3ary treatment
	Supply of recycled water to tourism	Water Development Department, Local Sewerage Boards	tourism	2ndary treated sewerage that undergo 3ary treatment

Water Services	Water Sub Services	Water Providers	Water Uses	Water Sources
	Supply of recycled water to other uses	Water Development Department, Local Sewerage Boards	other uses	2ndary treated sewerage that undergo 3ary treatment

2.2.2 Spatial Scale of Analysis

For the WFD cost analyses implementation, it is important to perform the analyses at the level of water uses and services, so as to enable the application of the "the polluter - user pays" principle. So, at first stage the spatial scale of analysis is at the level of services and users.

In addition, the Water Services of Drinking Water and Water for Irrigation are provided either a) through Governmental Water Projects or b) other Non-Governmental Water Projects. The cost analyses took into account this distinction and it was considered more appropriate for the case of Cyprus, to carry out all the analyses initially at the scale of the major Governmental Water Projects (GWP) - large scale projects operated by the Water Development Department - and for the areas and users that are not served by major GWP, the analysis to be carried out at the spatial scale of the seven (7) major hydrological areas (Paphos, Tilliria, Morphou, Central Mesaoria, Southeastern Mesaoria, Larnaca and Limassol).

The reason for the distinction between the areas served by GWP and those not served by GWP is mainly due to differences in institutional and legislative structure and organisation and in the form of the available data.

The Governmental Water Projects (GWP) which operate almost as autonomous systems - complexes as regards the supply for drinking and irrigation water, are divided as follows:
A. Southern Conveyor Governmental Water Project
B. Paphos Governmental Water Project
C. Chrysochou Governmental Water Project
D. Other Minor Governmental Water Project

Thus, the water consumption analysis, as well as the subsequent cost analysis is carried out at the scale of water services and uses and then at the scale of major GWP or major hydrological areas.

2.2.3 Timeframe of Analysis

The timeframe of the analysis was selected in order:

1) To take into account the most recent data related to a) recorded available costs and revenues (financial cost data, prices of water), in relation to the structure of water projects and the management of water resources.
2) For the economic analyses to be the least possible affected by distortions in water availability and supply, that are caused by intense water shortage phenomena which characterize Cyprus during the recent years (2008-2009). This aims in the

determination of the representative average water cost conditions in Cyprus, avoiding extreme conditions.

3) Take into account data from older time series that relate to water uses (e.g. crop types and areas), as well as the amount of permanent and renewable volumes in the ground water bodies.
4) Be in accordance to the form and the type of available records kept by Governmental Services.

Based on the above, the time frame that was used in the economic analysis was:

- The average of the last three years (2005-2007) for which data were available. This scale of analysis was used: 1) for determining water consumption for each use and service, 2) for estimating financial parameters and costs, 3) for the prices of water and for the revenues of the water service providers.
- In cases of water supply from ground water bodies as well as in estimates of groundwater abstractions, the data used included also older time series in order to have a more representative estimate, not affected by extreme phenomena.

Considering all the above, the analysis for the determination of the volumes, costs and prices associated with the water services was made in the scale/matrix of water sources, water providers, water sub-services and main hydrological regions or Governmental Water Projects, using various sources of data. The results of this analysis were aggregated to the level of Water Services according to the structure of Table 2.2.1-1.

More specifically, the scale of analysis per task was the following:

Table 2.2.3-1 Scale of analysis (special and timeframe) per task

Analysis Task	Scale of analysis	Time scale of analysis
Water Volumes	water service provider, water subservice, Governmental Water Project and then aggregation to Water Service	average 2005-2007
Financial Cost	water service provider, water subservice, Governmental Water Project and then aggregation to Water Service	average 2005-2007 (in 2007 rates)
Environmental Cost	water body, water subservice (use), Governmental Water Project and then aggregation to Water Service	older time series and average 2005-2007
Resource Cost	water body, water subservice (use), Governmental Water Project and then aggregation to Water Service	older time series and average 2005-2007
Water Prices	water service provider, water use, Governmental Water Project and then aggregation to Water Service	average 2005-2007

3 Analysis of the main water uses

This chapter includes a brief presentation of the main characteristics of the most important water uses, as they were defined in the context of the implementation of Article 5 of WFD in Cyprus and mentioned in the chapter 2.2.1 of this report. The water uses are analysed both on the basis of socioeconomic data - trends and of water consumption. The most important water uses that were identified are:

- households/services,
- agriculture
- livestock
- tourism
- industry

With regards to the economic sectors of Cyprus the most important one is the **tertiary**, both in terms of economic output and employment (66,7% of GDP, 71,6% of total employment for 2007), showing a constant upwards trend. However, the associated water consumption (household and tourism) has only been 35% of the total. The **agricultural sector** (crops and livestock), on the contrary, has experienced a downwards trend, both in terms of its economic output and employment (3,2% of GDP, 7,9% of total employment for 2007). However, agriculture has remained one of the greatest water consumers in Cyprus, accounting for 62% of total water consumption. The **wider industrial sector**, which covers activities associated with light manufacturing industry, mining and quarrying, production and distribution of electricity, water and natural gas, has been steadily on a rise in the last six years, contributing 30,1% to national GDP and having a share of 20,7% of total employment for 2007. Water demand for the industrial sector is 3% of the total water consumption.

More analytically, in total, the **GDP** has been growing, with 2008 being the year with the maximum growth (9.750 million €). According to the Statistical Service of the Republic of Cyprus, during the past 6 years, the primary sector peaked in 2003 with a GDP of 363 million € and reached 312 million € in 2008. The secondary sector reached a maximum GDP of 2.934 million € in 2008 and has been constantly growing during the past six years. The GDP of the tertiary sector ranges in similar levels during the past 6 years with the maximum annual value having been recorded in 2008 (6.504 million €). The tertiary sector accounts for 66,7% of the National GDP, the secondary sector has a significantly smaller share with 30,1%, and the primary has 3.2%. Tourism is the economic activity of the tertiary sector, which contributes the most revenues to the national economy. Touristic development has experienced a general positive trend, with the recorded reductions being characterised as temporary phenomena. For instance, the reduction during the period 2001-2003 is attributed to the international concurrences (Iraq war, SARS epidemic, fear of terrorist attacks, etc). The distribution of GDP in millions € for the years 1995-2008 per financial sector is depicted in the following Figure 3-1.

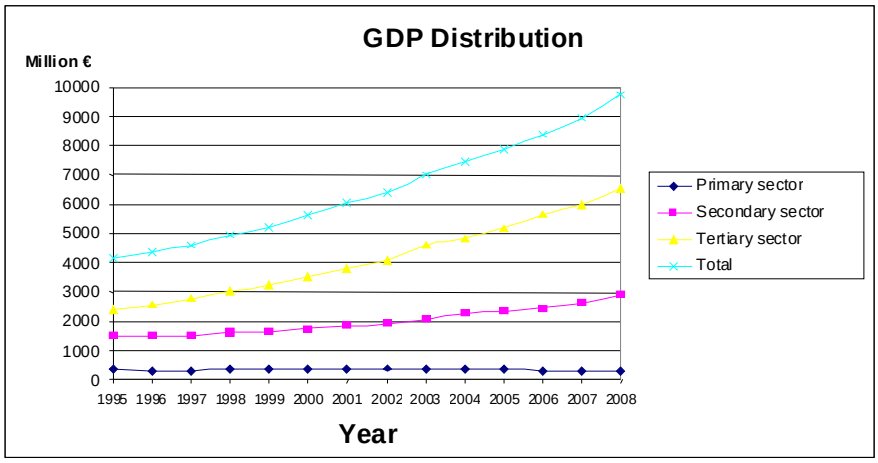

Figure 3 -1 Distribution of GDP in millions € for the years 1995-2008 per financial sector (National Accounts, Statistical Service, 2008).

Employment in the primary sector has experienced a relative decrease from 32,500 in 2000 to 32,200 in 2004 and reached 29,600 in 2007. This decrease is mainly the result of the decrease of population employed in agriculture, since 31,100 were employed (in the agricultural sector) in 2000, while in 2007 it was decreased to 28,300. The secondary sector has been steadily growing. From an employed population of 65,300 in 2000, in 2007 it reached 76,300 (growth rate of 16.85%). Finally, the employment of the tertiary sector has increased from 214,300 in 2000 to 266,700 in 2007 (growth rate of 24.5%) (Labour force statistics for 2007, Statistical Service). The employment in the three main economic sectors for years 1995-2007 is depicted in the following Figure 3-2.

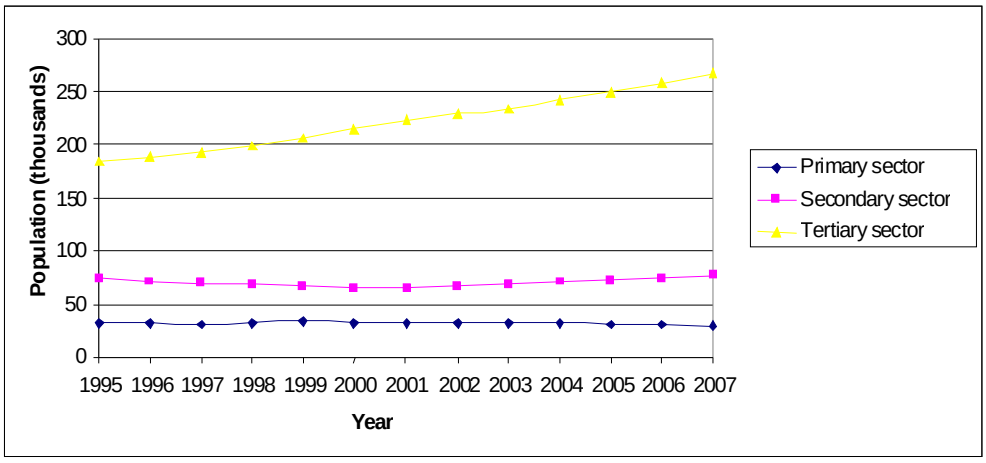

Figure 3 -2 Employment in 3 main economic sectors for years 1995-2007 (Employment, Statistical Service, 2007).

The distribution of the water consumption per main use indicates clearly that agriculture is the sector which consumes the greatest volume of water, in comparison with the other uses. Agriculture consumes 59.1% of the total water consumption, households 29.6%, tourism 4.9%, industry 3% and livestock 3.3% (Figure 3-3).

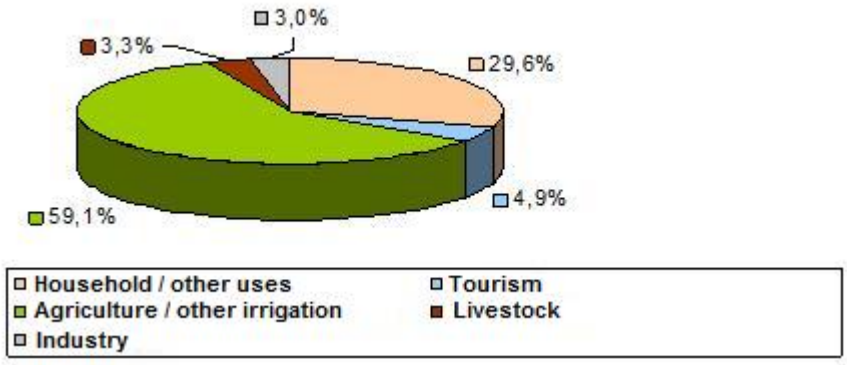

Figure 3 -3 Water consumption (%) per water use.

4 Volumes consumed per Water Service

Based on the scale of analyses that was described in Chapter 2.2 of this report, -that concerns the definitions of water services, water uses, special scale and timeframe of analysis-, the volumes of water that are provided by the water services to each water use have been estimated.

In most cases, there were data available from various sources. In few cases, where there were no available data, estimates were made (e.g. for the water consumption of the industrial sector) according to sound assumptions (e.g. number/type of industries and related water consumption).

The water consumption analysis was considered as a base for the water services cost calculations, which greatly rely on the analysis of water supply-consumption per source, service, service provider and water use. More specifically, the water consumption analysis was used in order to support the cost analysis, in the following aspects:

- Financial cost:
  - Definition of water providers and water development infrastructure/works per water service.
  - Allocation of financial cost to each service (either for "mixed" projects, i.e. projects that are involved in more than one service e.g. drinking water supply and water for irrigation or for general operational costs) according to the consumed volumes.
- Resource cost:
  - Extend of water deficit per area and water body, taking into account the involvement of non-renewable ground water resources in the mass balance, i.e. over-pumping of groundwater.
- Environmental cost:
  - Consumed volumes from lake water bodies (all of them reservoirs created by dams) and their allocation to the drinking and irrigation water services, in order to calculate and distribute the environmental cost due to the lack of ecological flow downstream of the dams.
- Allocation of the total cost (financial, environmental, resource) per GWP/ Main Hydrologic Region and Service according to the final consumed volumes.
- Evaluation of the degree of cost recovery.

Furthermore, the determination of the total available quantity of water per water service is necessary for its volumetric pricing.

Thus, the analysis for the determination of the volumes abstracted/ discharged per water service was carried out at multiple levels, -those of water sources, water providers, water sub-services, main hydrological regions or Governmental Water Project-, using various sources of data. The results of this analysis were aggregated to the level of Water Services.

In the following Table 4-1, the volumes of water used per water Service (aggregated results) are presented:

Table 4 -1 Water Volumes used per water service (average of years 2005-2007).

Water Service	Through Governmental Water Projects	NOT through Governmental Water Projects	Total
Supply of Drinking Water	68,682,697	11,216,357	79,899,054
Supply of Irrigational Water	38,236,251	105,014,715	143,250,966
Sewerage (up to 2ndary treatment)	20,637,536		20,637,536
Supply of recycled water (tertiary treatment and supply)	9,907,924		9,907,924

5 Total Cost of Water Services

In this Chapter, the main principles of the methodology and the results of the calculation of the total cost for each water service are presented. WFD Article 9 (1) refers to the cost recovery of Water Services and defines the cost parameters, which must be taken into account for the total cost assessment of Water Services. Thus, according to the WFD, total cost assessment of Water Services should take into consideration three types of costs:

- Financial cost, which includes operational cost, maintenance cost, capital cost, management cost and other costs
- Resource cost, which is defined according to Guidance Document 1 (WATECO) as the opportunity cost of alternative water uses, in cases where a water body is used over its natural recharge rate.
- Environmental cost, which is defined as the environmental damage, expressed as the financial opportunity cost (prosperity loss). Environmental damage is defined as the deviation of the quality status of water bodies from the good status.

In the following paragraphs, the basic principles of the methodology and the results of the cost estimation of water services in Cyprus water River Basin District are presented for all the three types of costs: financial cost, resource cost and environmental cost.

5.1 Financial Cost

The financial cost is being calculated for the infrastructures, procedures and providers that are included in each water service in order for the supply of water/ service to the final consumer. The accurate calculation of the financial cost relies on the good mapping of infrastructures and providers -both technically and hierarchically- that are involved in each water service. The financial cost consists of the following parameters:

1. Capital cost
2. Operational cost
3. Maintenance cost
4. Management and other costs

For every water service, the above four different elements of financial cost were taken into consideration. In the following paragraphs, the basic methodological principles for the assessment and calculation of each financial cost element are described.

5.1.1 Calculation of Capital Cost

Capital cost consists of two elements:

1. Fixed capital cost per year corresponding to the water production and water supply procedures: This equals to the annual depreciations calculated based on the replacement cost of the infrastructure in use and not on the historical cost. It is common practice for the organisations which manage and provide the water services to include the replacement cost in the annual operational cost and more specifically to the maintenance cost. As a result, the lifetime of the fixed cost increases significantly and it is equal to 60 years for sewage infrastructure, 70 years for drinking water infrastructure and 80 years for irrigation infrastructure. Therefore, the depreciation coefficients are 0.017 (1/60) for sewage infrastructure, 0.014 (1/70) for drinking water infrastructure and 0.013 (1/80) for irrigation infrastructure.

2. Opportunity cost of invested capital, which means the capital cost return in alternative investments: Practically, it is equal to the return of Cyprus' long term trust funds. The nominal return of Cyprus trust funds is based on the mean European Interest rates, plus the spreads which are in use in Cyprus. This return in deflated terms does not exceed 1%, while during many years this value can be negative, depending on Cyprus inflation and the mean European inflation. Practically, it is considered to take zero value (Figure 5.1.1-1).

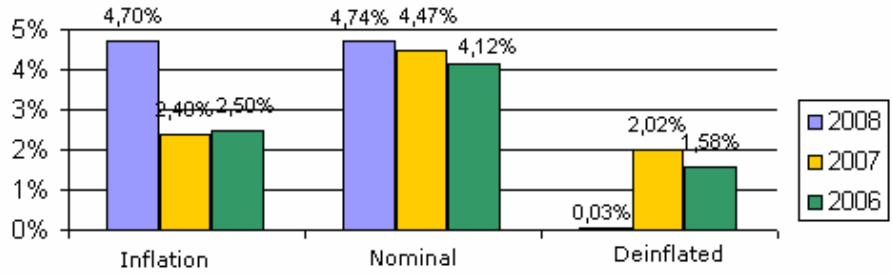

Figure 5.1.1-1 Inflation, Nominal and de-inflated interest of state nominal development stock, 2006-2008

Prerequisite for the calculation of the two elements of the capital cost is the estimation of the present value for all fixed infrastructures that are used. Investments for this type of infrastructure are made by governmental services, local providers and individuals. For each category, the estimation varies according to the data availability.

- *Current value of investments of Central Government Services*

In central government services, there is a database with includes the annual investments for each infrastructure in prices at the time the infrastructure was built. Each infrastructure is assigned to the water service(s) and to the GWP which it belongs. The estimation of cost was made for the 2005-2007 average.

In order to express the primary data in current values (2007) and to be assigned to water services and GWP, the following three steps are necessary:

a) Adjustment of the historical investment cost in current values (2007), based on inflation index by the Statistical Service of the Republic of Cyprus.
b) Distribution of the investments for infrastructure projects that are related to more that one water service according to the relevant water volumes (i.e. dams and reservoirs for supply drinking water and irrigation water).

c) Currency exchange from CY pounds to Euro when necessary. The fixed exchange rate is 1 € = 0.585274 CY £.

- *Current value of investments by local providers*

Local providers' investments refer to infrastructure for local networks or other infrastructure which are built and managed by them. Service Providers which carry out these kinds of infrastructure are: Water Boards (W.B.), Sewage Boards (S.B.), Agricultural Organisations (A.O.) and Municipalities and Communities (M/C). The estimation of the local investments varies for each region and each Board/ Organisation according to the data availability.

Some providers (e.g. WBs and SBs) issue a balance sheet every year. From the corresponding balance sheets for the year 2007, data for annual and cumulative depreciation are collected. Dividing the cumulative depreciations by the annual ones, the outcome is the estimation of the mean weighted average age of the fixed costs and therefore of the mean weighted year of construction. By multiplying the fixed cost at the acquisition value with the coefficient corresponding to each specific year, the outcome is a satisfactory assessment of the value of fixed cost at 2007 values.

In some providers (e.g. M/C), only the annual depreciations are available. By applying an average percentage of annual depreciation, the total fixed costs in acquisition values were estimated. In order to convert this cost in 2007 values, it was necessary to make an adjustment with a coefficient, accustomed to the estimated average year of fixed cost acquisition. .

5.1.2 Calculation of Operational Cost, Maintenance and Management Cost

- *Cost of infrastructure managed by Central Service Providers*

The operational cost (mainly wages, energy etc) and the maintenance cost of infrastructure managed by Water Development Department's Central or Local Service Providers is monitored and recorded by them. The cost data are derived from these Providers.

The management cost is not recorded. Management support of Central Providers refers to:

a) Supply of management services to the decentralized Providers, i.e. necessary decision of management units, accounting, credit's insurance. The cost of these management services is estimated as 10% of the direct operation and maintenance cost for each region of Governmental Projects.

b) Supply of general services not distributed in sub regions. These services include general water policy, study of the hydrological processes, monitoring projects and infrastructure for water saving.

For the estimation of the cost of the supply of general services (part b), it was decided that the water cost should not be taken into account. Firstly, the civil servants' wages that provide these services and constitute the major cost of the services, are recovered through

the general taxation. If these costs were charged and distributed in the water's price, then this would lead to double counting. However, from one point of view, the general taxation can be assumed to have distortional impacts in the economy's functions. According to this, a possible change to the Cyprus national financial policy, over which -especially these kind of wages- cease to be recovered from the general taxation, but they are recovered from the water pricing policy, will result in a double benefit: both these costs would be recovered and the impact of taxation would be less distortional. But these kinds of reviews can be decided through the general national fiscal policies and not based on water pricing criteria. As a result, these kinds of costs are not part of the water cost.

- *Cost of services managed by Local Providers*

Some providers (mainly Sewerage Boards and Water Council Boards) compose either annual billing results or financial statements, from which one can obtain the parameters of the annual operation and maintenance cost. When the management cost is not identified separately, then it is part of the total operational cost.

Other Providers (e.g. Municipalities/ Communities) provided their data for the operation and maintenance cost for their water supply services. For those, the management cost is assumed to equal to the 10% of the direct operational cost. Only the unit cost (m^3 of water or sewage, depending on the Service) is calculated. Based on the unit cost, the necessary assessments were carried out for the rest Municipality Boards, for which there were no available data.

The summary results of the calculation of financial cost are presented in chapter 5.5 of this report.

5.1.3 Estimated Investments for Water Services

Estimates of relevant investments including forecasts of such investments for the period 2009-2015 were included in the economic analysis, as far as planned desalination plants are concerned. These investments affect directly the water volumes, water costs and water prices and it was considered necessary to include these investments both in the cost analyses as well as in the pricing policies analysis.

As far as other investments are concerned, these will be taken into account as soon as they start operating and will be examined and included in the next economic analysis to be carried out before 2015 for the second WFD river basin management cycle (2015-2021).

During 2008, Cyprus experienced heavy drought conditions and water shortage, which was the result of consecutive years of drought. This resulted in serious retrenchments both in drinking water supply and definitely in irrigation water supply. Water was imported from Greece, in order to meet the drinking water demand. In that context, the Republic of Cyprus planned the desalination plants, in order to be able to cover the drinking water needs and to ensure independency from the weather conditions.

It must be noted that the demand of irrigation water for agriculture is rarely satisfied, with the exemption of the 'wet' years 2004-2005, when the dams were over spilling. Apart from that, as it has already mentioned, the country usually suffers from severe drought conditions

and the impact of water scarcity affects to a great extent the agricultural sector, since the water quantities to agriculture are often well below the minimum quantity needed for production.

The desalination plants are scheduled to start operating during 2012 and they will be constructed and operated by private investors contracted by the Water Development Department. The desalinated water will be bought by the Water Development Department following the contract terms and it will be used only for the Water Service of Drinking Water Supply. In the analysis that was carried out, the cost that was associated with the desalination plants was the cost of the desalinated water to be bought by the Water Development Department. This cost will be "transferred" to the consumers. The price is estimated to be 0.85 €/m^3.

The capacity of the planned desalination units is depicted in the following Table 5.1.3-1.

Table 5.1.3-1: Capacity of Planned desalination units

Desalination Unit	Maximum Capacity		Estimated maximum Cost
	(m^3/day)	(m^3/year)	(€/year)
Dekelia	60,000	21,900,000	18,615,000
Larnaka	62,000	22,630,000	19,235,500
Episkopi	40,000	14,600,000	12,410,000
Vasilikos	50,000	18,250,000	15,512,500
Pafos	40,000	14,600,000	12,410,000

The Scenario for the operation of the planned desalination plants (hereinafter referred to as desalination scenario) was examined in order to investigate the impact of the introduction of the planned desalination plants to the water volumes for different water services (drinking water supply and irrigational water supply) as well as to the unit cost of drinking and irrigational water.

The basic assumptions that were made are the following:

- Temporary small scale Desalination Plants will operate only until the Permanent Desalination Plants will start operating. Since these temporary Desalination Plants constitute a transitional phase, which was urgently introduced to the water supply system after the water crisis in 2008 only the Permanent Plants were taken into account. It is scheduled, that all permanent units will be in operation by 2012.
- The impact of the introduction of planned permanent desalination plants in the unit cost of drinking and irrigational water was estimated and was compared to the present situation (as was estimated for the years 2005-2007).
- The additional volumes of water through desalination are to be supplied for drinking water purposes and they will replace groundwater, as well as surface water from reservoirs. The volumes replaced can be either used to cover irrigation needs or for groundwater recharge. They will also have a positive impact towards the reduction of the groundwater abstraction for irrigation or domestic use. Thus, the water quantities in the Drinking Water Service will remain the same, whereas the water quantities in the Irrigation Water Service might be increased.

Therefore, the unit cost of drinking water is expected to increase, since the more expensive desalination water will replace water quantities from other sources and the unit cost of irrigation water is expected to decrease mainly because more water will be available for irrigation.

For the estimation of the impact of the planned desalination plants to the unit cost of the drinking water and irrigation water, the following steps were followed:

1. The available data is analysed in great detail in order to differentiate the cost of water production and supply to fixed and variable cost.
2. As a start point, the estimation of the average real cost for the years 2005-2007 is used.
3. The fixed cost 2005-2007 is estimated and remains the same in the desalination scenario.
4. The variable cost 2005-2007 is estimated according to the water volumes that have been forecasted under this scenario, taking into account the cost of desalination water.
5. The sum of variable and fixed cost that results from the above stages is divided by the forecasted water consumption in this scenario the unit cost for the services of drinking water supply and irrigational water supply is estimated.

5.2 Environmental Cost

In the frame of WFD Article 9 implementation, the following are defined:

- *Environmental damage:* the deviation from water bodies' quantity and quality status, from a predetermined target ('good status').
- *Environmental cost:* the expression of environmental damage in terms of opportunity cost (prosperity loss). The term "environmental cost" is directly related to the term of environmental externality.

5.2.1 Identification and assessment of environmental damage

For the examination of the existence (or not) of environmental damage, it is necessary to know: 1) the quality status of water bodies and 2) the predetermined target. In order to assess the quality status of water bodies and the possible deviation from the good status, all the available data (monitoring results, assessments of pollution loads etc) were used.

Concerning the pollution loads, they were separated in the following three categories and they were assigned to corresponding water uses:

- Nutrient pollution derived from either urban or agricultural/livestock pollution
- Organic pollution derived from either urban or livestock pollution
- Dangerous substances/ priority substances derived either from agricultural (pesticides) or from industrial/mine pollution.

Based on the above, the following different categories of environmental cost - referring to surface inland water bodies - were defined:

1- Environmental cost due to pollution

1.1.1 Pollution due to organic load which originates from urban wastewater (households and tourism) and livestock.
1.1.2 Pollution due to nutrient load which originates from agriculture, livestock and urban wastewater (households and tourism).
1.1.3 Pollution due to priority substances which originates from industry and agriculture (pesticides).

2- Environmental cost due to lack of ecological flow downstream of dams

As far as it concerns the coastal water bodies, from the available data there was no sign of environmental damage, since all coastal water bodies are in or higher good status.

Regarding the groundwater bodies, problems in their quality status exist either due to sea intrusion (salinisation) or due to the presence of nitrates. Concerning the pollution due to nitrates, no environmental cost was calculated, as it was considered that the cost of implementing the Directive 91/676/EEC already covers that. In the case of salinisation, only the recourse cost is being taken into account, in order to prevent double counting (environmental and resource cost) for the same purpose (over abstraction).

Concerning the environmental 'benefit' which can be derived from situations such as ground waters' enrichment with recycled water, this is taken into account in the calculation of the resource cost (reduction of resource cost).

Finally, as far as it concerns the calculation of the environmental cost from the operation of a desalination plant, mainly due to air pollutants emissions, it was taken into account that the cost of these emissions is expressed by the increase of energy consumption, resulting in the increase of the financial cost. More specifically, the increased emissions of the desalination plants lead to the need of more greenhouse gas permissions. This leads to an increased electricity cost which in turn results in higher prices for the production of desalinated water. Thus the environmental cost from the operation of desalination plants is not included in the environmental cost calculation, as it is expressed in the financial cost and thus avoiding double counting.

5.2.2 Expression of environmental damage to cost

For the expression of environmental damage to cost, the most appropriate method in the case of Cyprus RBD, was considered to be the restoration method.

A) Thus as far as it concerns the environmental cost due to pollution from organic or nutrient loads the following are applied:

The restoration method was applied to water bodies that show pollutants concentrations above the set limits. The restoration cost equals the recycled water cost (tertiary treatment and supply) for the following reasons: Based on the implementation of Directive 91/271/EC in Cyprus, wastewater treatment plants have been established and planned in many cities/agglomerations. So taking into account the implementation of Directive 91/271/EC and despite that, there are still problems in the water bodies, then the restoration method would require tertiary treatment. In addition, through the implementation of Directive 91/271/EC, the cost of secondary treatment is or will be covered and therefore the estimation of environmental cost will applied based on the cost difference between tertiary

and secondary treatment, i.e. cost of recycled water, for the total volume of the water body. This unit average cost in the case of Cyprus was estimated as **0,15 €/m^3**.

B) As far as it concerns the environmental cost due to priority substances, the following are applied:

The restoration method was applied in the total volume of water bodies that show priority substances concentrations above the set limits determined by the Directive 2008/106/EK. The restoration cost equals the cost of applying the multiple membrane treatment method. This cost equals to an average unit cost of **0,37 €/m^3**. This cost includes also the cost for treatment from conventional pollutants (N, P και BOD).

C) As far as it concerns the environmental cost due to no ecological flow below the dams, the following are applied:

Regarding, the restoration cost due to no ecological flow downstream the dams, the following are apllied:

a. When a dam is used for drinking water supply, then the restoration cost is estimated based on the desalination cost. The desalination cost is the marginal cost for building a new desalination plant at the given time and under the local circumstances. In Cyprus a new desalination plant of 40.000 m^3/day, with 20 years time as the investment's depreciation, including electricity and pumping, costs **0,72 €/m^3** (excluding the 15% profit).
b. When a dam is used for irrigation water supply, then the restoration cost is estimated based on the recycled water cost (tertiary treatment). This cost only refers to the cost of production of recycled water by secondary treatment. This is due to the fact that every Member State is obliged to apply secondary treatment even if recycled water is not necessary. The mean unit cost of production of recycled water is **0,15€/m^3** in Cyprus.
c. When a dam is used both for drinking water supply and for irrigation water supply, then the restoration cost is estimated based on the above and according to the percentage of each use.

The above costs are multiplied with the volumes of 1/3 of the average summer inflow of each dam (June – October) and then multiplied by 12 months (volume per year).

5.2.3 Distribution of the Environmental Cost

Based on the above, environmental cost per water body was calculated and then total environmental costs were determined for river and lake water bodies that are due to pollution loads. These costs are allocated to the following water uses based on the share of its use in the pollution (as determined during the implementation of WFD Art. 5):

1. Urban use (household and tourism)
2. Agriculture
3. Livestock
4. Industry

Then, the environmental cost of the water uses is allocated to the Water Services of Drinking Water, Irrigation Water and Recycled Water according to the volumes consumed (water mass balance). For example the environmental cost due to industry, is distributed in the sub-

services of 1) Drinking Water Supply Service for Industry and 2) Irrigation Water Supply Service for Industry.

Concerning the environmental cost due to no ecological flow downstream the dams, it is allocated to the Services of Drinking Water Supply and Irrigation Water Supply according to the water volumes consumed. These environmental costs are distributed only in the Governmental Water Projects.

The summary results of the calculation of environmental cost are presented in chapter 5.5 of this report.

5.3 Resource Cost

The resource cost was applied to groundwater bodies in the cases where the volume of the annual abstraction is greater than the mean annual recharge. Concerning the restoration method, in the case of Cyprus due to water scarcity, there are no alternative water resources than desalinated and recycled water. Thus, the following are applied:

1. When a groundwater body, in which the mean annual abstraction is greater than the mean annual recharge and it is being used for drinking water supply, the restoration cost is estimated based on the desalination cost, which as mentioned in section 5.2.2 of this report equals to 0.72 €/m^3.
2. When a groundwater body, in which the mean annual abstraction is greater than the mean annual recharge and it is being used for irrigation purposes the restoration cost is estimated based on the cost of production of recycled water (tertiary treatment cost), which as mentioned in section 5.2.2 of this report equals to 0.15 €/m^3.
3. When a groundwater body, in which the mean annual abstraction is greater than the mean annual recharge and it is used both for drinking and irrigation purposes, the restoration cost is estimated according to the above mentioned and multiplied with the percentage of the volume abstracted for each use.

Resource cost is estimated according to all the above and then distributed to each water service (Drinking Water Supply and Irrigation Water Supply) according to the consumed water volumes.

The summary results of the calculation of resource cost are presented in the chapter 5.5 of this report.

5.4 Dealing of cross-subsidies

The issue of cross-subsidies was dealt very cautiously in order mainly to avoid "double counting" of costs. Cross-subsidies were present in various cases of the cost analysis and they were dealt as listed below:

Environmental/ Resource Cost:
In some cases of environmental and resource costs, indirect cross subsidies were present, as for example the over-exploitation of groundwater bodies and the resulting sea intrusion.

These two problems are interconnected. As far as the over-exploitation of groundwater bodies is concerned, only resource cost is estimated where abstraction is more than recharge and no environmental cost is calculated in the cases of sea intrusion, making the assumption that if the good quantity status is recovered, then the good quality status will recover as well. In that way, double counting (estimating both environmental and resource cost) is avoided in cases of the same causes (over pumping).

In addition, in cases of environmental indirect 'advantage', as for example in case of groundwater recharge from recycled water, this is taken into account in the estimation of the resource cost, where the over exploitation is reduced (due to higher level of recharge) and this in turn leads to reduced resource cost.

The estimated future increase of surface water available to irrigation after the introduction of desalinated water volumes in the drinking water supply was not considered as a cross-subsidy as it does not exceed the specified quota of irrigation water set in the feasibility studies and business plans of Governmental Projects when constructed. In fact, with the exception of the wet year 2004, irrigation water supply was significantly lower that the quota originally specified. In addition, the new permanent desalination plants relate solely with drinking water supply and are part of the of the Governmental Policy of safeguarding drinking water supply to big urban centres irrespective of the weather and hydrological conditions of the year.

Concerning the issue of subsidies, which are present in some cases mainly in the financial cost, these were included and counted as 'normal' costs in the financial cost analysis. For example, in some cases the government finances the construction of the drinking water infrastructures in Municipalities and Communities. In the cost assessment, these subsidies were included as capital cost in the financial cost analysis.

5.5 Summary Results of Cost Assessment

In the following Tables (Tables 5.4-1 – 5.4-4), the unit costs (€/m^3) (financial, environmental, resource) of water services are presented. For the Water Services of Drinking and Irrigation Water Supply, the distinction of costs is made between the supply of water through Governmental Water Projects (GWP), large scale projects operated by the Water Development Department and other non Governmental small scale projects operated mainly by Local Authorities and Irrigation Organisations.

Table 5.4-1 Unit Costs for the Supply of Drinking Water

Cost	through GWP (€/m^3)	Other (€/m^3)
Financial	1.17 (96%)	1.00 (89%)
Environmental	0.04 (3%)	0.03 (3%)
Resource	0.01 (1%)	0.09 (8%)
Total	**1.22 (100%)**	**1.12 (100%)**

Table 5.4-2 Unit Costs for the Supply of Irrigational Water

Cost	through GWP (€/m^3)	Other (€/m^3)
Financial	0.34 (76%)	0.30 (61%)
Environmental	0.10 (22%)	0.16 (33%)

Resource	0.01 (2%)	0.03 (6%)
Total	**0.45 (100%)**	**0.49 (100%)**

Table 5.4-3 Unit Costs for the Sewerage (up to 2ndary treatment)

Cost	Unit Cost (€/m^3)
Financial	1.21 (100%)
Environmental	-
Resource	-
Total	**1.21 (100%)**

Table 5.4-4 Unit Costs for the Supply of recycled water (tertiary treatment of effluent of 2ndary treatment and supply)

Cost	Unit Cost (€/m^3)
Financial	0.15 (65%)
Environmental	0.08(35%)
Resource	-
Total	**0.23 (100%)**

6 Cost recovery levels of Water Services

In this chapter the results of the estimation of current levels of cost recovery per water service are presented. The Water Services are:

- Drinking Water Supply Service
- Irrigation Water Supply Service
- Sewerage Service Supply (up to secondary treatment)
- Recycled Water Service Supply (tertiary treatment and supply)

The cost recovery rate (2005-2007) was estimated for each water service up to the final consumer level based on the general formula:

$$\frac{\text{REVENUES}}{\text{COST (Financial + Environmental + Resource)}}$$

As it is mentioned in previous paragraphs, the scale of analysis was more detailed and then the results were aggregated to the Water Service level by weighted (according to water volumes) averages. The cost recovery rates were estimated according to water service providers (and in the case of Water Development Department also according to Governmental Water Projects) and then aggregated to water service level.

In cases of water supply through private organisations or individuals (e.g. Irrigation Organisations), it is assumed that full recovery of the financial cost is made, i.e. the financial cost equals the revenues.

In the following Tables (Tables 6-1 – 6-4), the level of cost recovery (%, average for years 2005-2007) per water service is presented. For the Water Services of Drinking and Irrigation Water Supply, the distinction of cost recovery between the supply of water through Governmental Water Projects (GWP) and not through GWP is made.

Table 6-1 Recovery levels for the Supply of Drinking Water

Supply of Drinking water (to the consumer level)	**95%**
through GWP	99%
other	72%

Table 6-2 Recovery levels for the Supply of Irrigational Water

Supply of Irrigational water (to the consumer level)	**56%**
through GWP	41%
other	61%

Table 6-3 Recovery levels for the Sewerage (up to 2ndary treatment)

Sewerage (up to 2ndary treatment)	**227% ***

** The high level of cost recovery is due to specific financial arrangements made for funding new required infrastructure, which include early payments by the service users.*

Table 6-4 Recovery levels for the Supply of recycled water (tertiary treatment and supply)

Supply of recycled water	**38%**

7 Existing Water Pricing Policies

The pricing policy, which is applied in Cyprus today, varies according to water service, water provider, use, area etc and focuses, in essence, on the recovery of the financial cost (partly or as a whole) of the given water supply service.

The supply of **Drinking and Irrigation Water Services** can be initially divided into two categories: supply of water through Governmental Water Projects (GWP) and supply of water in areas not covered by Governmental Water Projects.

The supply of water **through Governmental Water Projects (GWP)** is controlled by the Water Development Department (WDD). In some cases, the consumer of the water services provided by the WDD, may not be the end user but an intermediary organisation, which receives water on wholesale basis from the WDD and distributes it to its own end users.

Regarding the supply of **drinking water** through GWP, the intermediary organisations who buy water on wholesale basis from the WDD can be either the Water Council Boards of cities or Municipal - Community Boards. Regarding the supply of **irrigation water** through GWP, the WDD supplies water, either directly to private individuals (farmers, livestock installations etc), or to Agricultural Organisations.

The supply of water to the users-consumers in **areas not served by Governmental Water Projects** takes place mainly through private groundwater abstractions primarily for irrigation purposes (either on a private individual level or local Irrigational Organisations), as well as from water abstractions or springs that are managed by Local Authorities.

The **Sewerage Service** (collection and secondary treatment of sewerage) is responsibility of the Sewerage Boards. Six big (Urban) Sewerage Boards (SB) operate in Cyprus: Nicosia, Limassol-Amathounda, Larnaca, Agia Napa, Paralimni and Pafos. Also, eleven smaller (rural) Boards operate on the island: Agrou, Aska, Palaeochoriou, Idaliou-Pera Choriou-Nisou, Platron, Kyperoundas, Pelentriou, Alassas, Lythrodonta, Solea, Athienou, Polis Chrysochou, Astromeritis - Peristerona – Akaki, while the construction and operation of a further 3 rural SA's is currently in the programming stage.

Finally, WDD is responsible for the **Service of Supply of recycled water**, which includes tertiary treatment and supply of water from the urban SB's to the consumers, while the rural SB's which produce recycled water from tertiary treatment, are solely responsible for its utilization and management.

The following paragraphs include a brief description of the current status of the pricing policies in Cyprus per Water Service. It must be noted that the references to prices and costs in the next paragraphs are in euros (€), unless otherwise stated.

7.1 Service of Drinking Water Supply

The supply of water to households through Governmental Water Projects (GWP) - including the supply of water from desalination plants- is controlled by the WDD. As mentioned above, in most cases, the end user of water services offered by the WDD is not the end consumer, but an intermediary organization, which receives water on wholesale from the WDD and distributes it to its own end consumers. These cases, which cover drinking water supply, are classified as follows:

- The WDD supplies drinking water directly to big tourism establishments and industrial plants. In this case, the WDD is the supplier of drinking water directly to the end consumers.
- The WDD supplies drinking water on wholesale to Municipalities / Communities. In this case, the WDD functions as the supplier of drinking water, who gives water on wholesale to individual water suppliers (Municipalities / Communities), which in their turn, distribute drinking water to households, tourism establishments and industrial plants.
- The WDD supplies drinking water on wholesale to Water Council Boards of cities. In this case, the receptor of the service supplied by the WDD are the Water Council Boards, who continue the supply of drinking water on retail level to the end users (households, tourism establishments or industrial plants).

The supply of drinking water to various users-consumers in areas not served by GWP mainly comes from groundwater abstractions and community water sources managed by Local Authorities.

7.1.1 Water Development Department (WDD)

The prices for the supply of drinking water though GWP (Water Development Department) to local authorities are proposed by the Ministry of Agriculture, Natural Resources and Environment after a proposal prepared by the WDD and approved by the Council of Ministers. The Ministry of Finance also contributes to the formulation of the proposal for the price, by specifying the price adjustments, which are dependent on the general increase of the cost of living.

The price of drinking water supplied by the Governmental Drinking Water Supply Systems (GDWSS) of Limassol, Nicosia, Larnaca-Famagusta was 0,57 €/m^3 (0,335 C£/m^3) in 1994 and increased to 0,77 €/m^3 (0,45 C£/m^3) in 2004, which is the price that stands today. In the GDWSS of Pafos, the price of drinking water increased to 56 €/m^3 (0,33 C£/m^3) in 2004 from 0,27 €/m^3 (0,16 C£/m^3) in 1994, which is the price that stands today. Table 7.1.1-1 includes the various prices of drinking water by WDD, which were approved by the Council of Ministers.

Table 7.1.1-1 Price of Drinking water from Governmental Drinking Water Supply Systems

Period of validity / Price of Water (per c.m.)	1984 - 1985	1986 – 1989 (from 1/11/1985)	1990 – 1993 (from 1/01/1990)	1994 – 2004 (from 1/1/1994)	2004 – today (from 1/1/2004)
GWCB of Limassol, Nicossia, Larnaca-Famagusta	0,1812 C£ 0,31 €	0,217 C£ 0,37 €	0,27 C£ 0,46 € *	0,335 C£ 0,57 €	0,45 C£ 0,77 €
GWCB of Pafos				0,16 C£ 0,27 €	0,33 C£ 0,56 €

** This price is valid since 01/01/1994 for the GWCB of Nicosia and Larnaca-Famagusta and since 01/01/1994 for the GWCB of Limassol, which is the date of start of operations for the Water Distillery of Limassol.*

The increase of the price of water is expected, when the constantly increasing cost for the purchase of water by the WDD from desalination plants is taken into account. The inclusion of desalinated water in the water balance was done in 1997, with its use as a source for GWPs being constantly on an increase (Figure 7.1.1-1). Apart from 2008, due to the long lasting drought of the last years and with the aim to reinforce the water balance and the independence of water supply of urban and tourism centers from weather conditions, the WDD has proceeded with the expansion of the two existing Plants and the construction of new Desalination Plants.

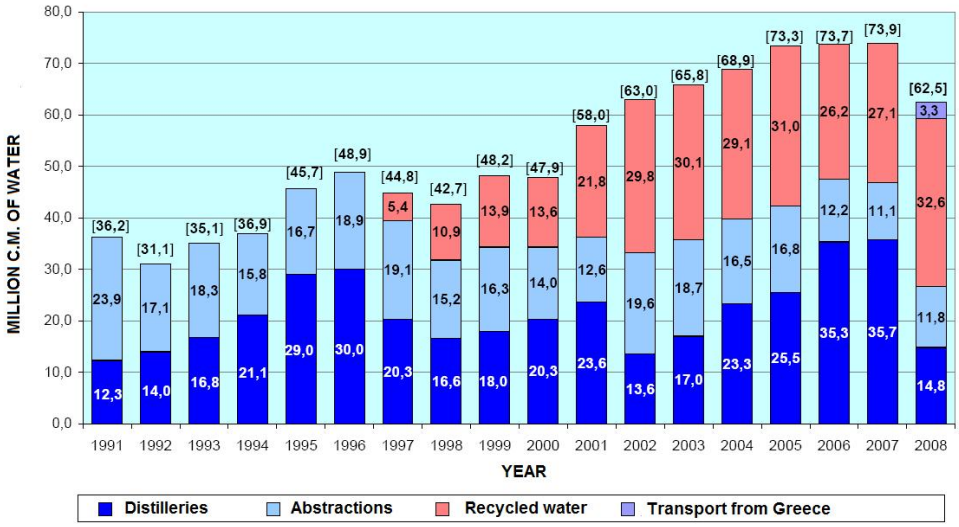

Figure 7.1.1-1 Governmental Water Projects – Water Sources (1991-2008) (source: WDD)

7.1.2 Water Council Boards & Municipalities / Communities

The rights and charges which are exercised by the Water Council Boards and Municipalities or Communities Boards, in relation to the supply or use of water, are specified by the National Legislation through relevant Regulations and Laws. Under recent legislation, the rights and charges exercised by the Water Council Boards and Municipalities and Communities Boards are specified by themselves without the requirement of Parliamentary approval. The following Tables 7.1.2-1 and 7.1.2-2 indicatively depict the current water prices of Water Council Boards and Municipalities and Communities Boards, respectively.

Table 7.1.2-1 Current prices of drinking water from the 3 Water Council Boards (€/m^3)

Nicosia Water Board				Limassol Water Board				Larnaca Water Board			
Pricing Categories	**Pricing Scale (m^3)**	**Prices (€/m^3)**	**Pricing Period**	**Pricing Categories**	**Pricing Scale (m^3)**	**Prices (€/m^3)**	**Pricing Period**	**Pricing Categories**	**Pricing Scale (m^3)**	**Prices (€/m^3)**	**Pricing Period**
A- Households	Fixed rate *	5.69	2 months	A- Households	Fixed rate *	9.55	4 months	A – Households	Fixed rate *	10.50	3 months
	1 - 10	0.79			Fixed Maintenance price	4.78			1 – 30	0.42	
	11 – 20	0.91			1 – 40	0.24			31 – 60	0.97	
	21 – 30	1.13			41 – 80	0.43			61 – 75	1.54	
	31 – 40	1.24			81 – 120	0.83			76 – 90	2.11	
	41 – 50	1.93			121 - above	4.78			91 - above	2.54	
	51 – 60	2.51									
	61 - above	3.18									
B – Commercial	Fixed rate*	56.86	2 months	B – Commercial / Industrial	Fixed rate *	95.52	4 months	B – Commercial / Industrial	Fixed rate *	54.57	3 months
	1 - 100	1.24			Fixed Maintenance price	4.78			1- 300	0.97	
	101 – 200	1.24			1 – 400	0.46			301 – 600	1.13	
	201 – 300	1.82			401 - above	0.70			601 - above	1.67	
	301 – 400	1.82									
	401 – 500	2.16									
	501 – 600	2.16									
	601 - above	2.16									
Γ – Industrial	Fixed rate*	568.55	2 months					Γ – Local Institutions	Fixed rate *	274.92	3 months
	1 – 1000	1.24							1 – 1500	1.13	
	1001 – 2000	1.24							1501 – above	1.54	
	2001 – 3000	1.82									
	3001 – 4000	1.82									
	4001 – 5000	2.16									
	5001 – 6000	2.16									
	6001 – above	2.16		• *Fixed charge is paid on flat price per meter for each correspondent period of pricing*							

Table 7.1.2-2 Pricing (€) per Municipality (a) and Community Council (b) for supply of drinking water for household consumption (source: Letter of General Controller to Minister of Interior on 14.10.2008 regarding current water pricing)

(a) Municipalities

		Pegeia	Dali	Aradippou	Paralimni	Chrysochous town	Pafos	Germasogeia	Lakatamia	Geroskipou
Fixed charge per trimester		13,67	5,13	6,83	13,67	20,5	11,96	10,88	8,17	11,96
Consumption	**1-5 c.m.**	0,9	0,85	0,94	0	0	0,25	0	0,8	0,34
	6-10 c.m.	0,9	0,85	0,94	0	0	0,25	0	0,8	0,34
	11-15 c.m.	0,9	0,85	0,94	0	0	0,25	0	0,8	0,34
	16-20 c.m.	0,9	0,85	0,94	1,11	0	0,37	0	0,9	0,34
	21-25 c.m.	0,9	0,85	0,94	1,11	0	0,37	0	0,9	0,34
	26-30 c.m.	0,9	0,85	0,94	1,11	0	0,37	0	0,9	0,34
	31-35 c.m.	0,34	1,11	0,94	1,28	0	0,46	0,53	1,1	0,77
	36-40 c.m.	0,34	1,11	0,94	1,28	0	0,46	0,53	1,1	0,77
	41-45 c.m.	0,34	1,11	0,94	1,28	0	0,46	0,53	1,1	0,77
	46-50 c.m.	0,34	1,11	0,94	1,54	0	0,6	0,53	1,25	0,77
	51-55 c.m.	0,34	1,11	0,94	1,54	0,68	0,6	0,53	1,25	0,77
	56-60 c.m.	0,34	1,11	0,94	1,54	0,68	0,6	0,53	1,25	0,77
	61-65 c.m.	1,03	1,54	0,94	1,88	1,28	1,45	1,23	1,95	1,45
	66-70 c.m.	1,03	1,54	0,94	1,88	1,28	1,45	1,23	1,95	1,45
	71-75 c.m.	1,03	1,54	0,94	1,88	1,28	1,45	1,23	1,95	2,14
	76-80 c.m.	1,37	1,54	0,94	2,56	1,71	2,13	1,23	2,55	2,14
	81-85 c.m.	1,37	1,54	0,94	2,56	1,71	2,13	1,23	2,55	2,14
	86-90 c.m.	1,37	1,54	0,94	2,56	1,71	2,13	1,23	2,55	2,14
	91-95 c.m.	1,71	1,88	1,71	2,56	1,71	2,39	1,53	3,25	2,39
	96-100 c.m.	1,71	1,88	1,71	2,56	1,71	2,39	1,53	3,25	2,39
	101-110 c.m.	1,71	1,88	1,71	2,56	2,39	2,39	1,53	3,25	2,39
	111-120 c.m.	1,71	1,88	3,42	2,56	2,39	2,39	1,53	3,25	2,39
	121 c.m. +	1,71	1,88	3,42	2,56	2,39	2,39	1,96	3,25	2,39

(b) Communities

		Pera Choriou-Nisou	Zygi	Paliometocho	Kokkinotrimithia	Kakopetria	Pissouri
Fixed charge per trimester		3,42	13,7	3,42	1,5	1,71	5
Consumption	**1-5 c.m.**	0,77	0	0,68	0,68	0,26	0,7
	6-10 c.m.	0,77	0	0,68	0,68	0,26	0,7
	11-15 c.m.	0,77	0,85	0,68	0,68	0,26	0,7
	16-20 c.m.	0,77	0,85	0,68	0,68	0,26	0,7
	21-25 c.m.	0,77	0,85	0,77	0,94	0,34	0,7
	26-30 c.m.	0,77	0,85	0,77	0,94	0,34	0,7
	31-35 c.m.	0,77	1,03	0,77	0,94	0,43	5
	36-40 c.m.	0,77	1,03	0,77	0,94	0,43	5
	41-45 c.m.	0,85	1,03	0,94	1,36	0,51	5
	46-50 c.m.	0,85	1,03	0,94	1,36	0,51	5
	51-55 c.m.	1,03	1,03	1,36	1,36	1,03	10
	56-60 c.m.	1,03	1,03	1,36	1,36	1,03	10
	61-65 c.m.	1,37	1,2	1,71	2,13	1,03	10
	66-70 c.m.	1,37	1,2	1,71	2,13	1,03	10
	71-75 c.m.	1,71	1,2	1,71	2,13	1,03	10
	76-80 c.m.	1,71	1,2	1,71	2,13	1,03	10
	81-85 c.m.	1,71	1,2	2,56	2,56	1,03	10
	86-90 c.m.	1,71	1,2	2,56	2,56	1,03	10
	91-95 c.m.	1,71	1,37	2,56	2,56	1,03	10
	96-100 c.m.	1,71	1,37	2,56	2,56	1,03	10
	101-110 c.m.	1,71	1,37	2,56	2,56	1,03	10
	111-120 c.m.	1,71	1,37	2,56	2,56	1,03	10
	121 c.m. +	1,71	1,37	2,56	2,56	1,03	10

As it is clear from the tables above, currently there is no uniformity between the Boards, neither regarding the types of charged services nor the way of forming the charges. The charges for the water sold by the Water Council Boards to the end consumers vary significantly, despite the fact that the Boards are supplied with water from WDD at the same price. Also, the pricing period varies per Board, since the one for Nicosia has been set to be bimonthly, for Larnaca every three months and for Limassol every four months. The comparison between household charges indicates that the WCB of Limassol sets the lowest charges for household consumption, while the WCB of Nicosia sets the highest. Concerning the Municipalities and Communities Boards, which are either located within or outside areas served by GWP, significant variations are also observed both in the pricing categories which are applied and, within each category, in the relevant charges. A similar variation is observed on the level of charges to hotels, clinics, schools, factories and industrial plants.

7.2 Service of Irrigation Water Supply

As it has already mentioned, the supply of irrigation water through GWP is the responsibility of the Water Development Department. The WDD supplies water either directly to private individuals such as farmers and livestock farms, or on wholesale, to Agricultural Organisations. The supply of water to various users/consumers not served by GWP is mainly based on private abstraction of ground waters and mainly for irrigation purposes.

7.2.1 Water Development Department (WDD)

The price of irrigation water is initially proposed by the Water Development Department. Then, this proposal is discussed in the Ministry of Agriculture, Natural Resources and Environment by an advisory committee chaired by the Minister. Based on the recommendations made by this committee, the Minister can suggest changes in the proposal made by the WDD, and, thus, formulate the final proposal. This final proposal is approved by the Council of Ministers.

After the operation of the Southern Conveyor Project, charges for the supply of irrigational water from Governmental Water Projects (GWP) were imposed by the State, according to the terms included in the Agreements for loans from the International Bank for Reconstruction and Development (IBRD) to fund this project. This aforementioned agreement included references both for the calculation methodology of the cost of irrigation water and for the level of charges. The charges had to be less than 40% of the Weighted Average Cost of Capital (WACC) and only under special circumstances could this percentage rise to 65%. Therefore, from 1991 to 2003, irrigation water from GWP was supplied in a subsidized price (from 5 to 7 cent C£/c.m.) covering 38% of the financial cost. However, due to the nature of this methodology, the non-recovered cost continued to affect the estimate of the average weighed unit financial cost in the following years.

In March 2002, with the final payment of the loans to the International Bank and after the adoption of the Directive 2000/60/EC, the Ministry of Agriculture, Natural Resources and Environment reviewed the issue of irrigation water pricing through a specialist technical

committee consisting of the Department of Agriculture, the Water Development Department and the Bureau for Programming, which calculated the unit cost for water for all GWPs.

Considering that it would be unfair for the future farmers to bare all the cost which was not recovered in the past, this Committee decided that the proportion of the capital cost, which was not charged in the previous years, should be considered as sunk cost, so as not to affect the future charges. Thus, for the new calculation of financial cost, only the remaining value of works deflated in 2001 prices was taken into account. Also, in order to "disassociate" the price of irrigational water from the frequent water shortages, it was considered that the GWPs should be capable of supplying at least 60 million c.m. per annum of water for irrigation in the future, with the unit cost being accordingly adjusted. Based on the assumptions above, the Committee calculated the financial cost of irrigational water from GWP at 11 cent C£/c.m.

After 12 years of validity of the previous charges, in 2003 there was a review of the charges of fresh-non distilled and recycled water supplied from GWP (Council of Ministers Decision Nr 59.156, date 17/12/2003). The Decision aimed at a) the adjustment of the charges to the new cost conditions, where in time the new investments had dramatically risen, b) the preparation for adaptation to the requirements of the -new then- Water Framework Directive and c) the regulation and posing of a single charge with the aim of equal treatment for farmers across all regions of GWPs.

In order to adjust progressively, a specific timetable was applied on the new charge, according to which on the 1st day of each year 1 cent/c.m. would be added to the charge. Thus, the price for selling fresh non-distilled water for agriculture would reach 11 cent C£/c.m. In parallel, the charge for water for livestock farming was reduced from 13 cent C£/c.m. to 11 and became equal with the charge for agriculture, while the charge for irrigation of green spaces, parks and golf courses remained at 20 cent C£/c.m. The same decision also required the reduction in the charge of supply of recycled water (see section 7.4 of this report), with the aim to encourage the use of recycled water and the substitution of the use of fresh water, wherever that was feasible.

Moreover, this decision retained the imposing of a over-consumption charge, associated with the quantity of water which exceeds the approved threshold by 10%. The over-consumption charge is considered as a measure that provides motive for water saving.

Every farmer with crops located in an area served by GWP must submit an application for irrigation water on an annual basis (at the beginning of every irrigational period, March-April). This application must contain the type of crop and the area, which will be farmed. By processing these applications and examining the irrigation needs for the crops which are already or about to be farmed and the available water stocks for each year, the WDD grants each farmer the annual quantity of water that they are entitled to. This approval is communicated in writing, with the note that in case that the over-consumption threshold is exceeded, a penalty will be imposed for the consumed quantity exceeding 110% of the approved one.

Table 7.2.1-1 includes the charges which have been valid from 2004 up to today for the supply of irrigation water (fresh, not distilled) though GWP for each different use and pricing category.

Table 7.2.1-1 Prices of irrigational water from the Water Development Department (€/m^3)

Description / Use	Unit	Unit Price
To Agricultural Organisations for agricultural production	€ /m^3	0.15
To individuals for agricultural production	€ / m^3	0.17
For industrial consumption	€ / m^3	0.19
For animal husbandry consumption	€ / m^3	0.17
For consumption after overflow	€ / m^3	0.05
For irrigation of football and golf courses	€ / m^3	0.34
For irrigation of other sports places, hotels and house gardens	€ / m^3	0.34
For fish breeding	€ / m^3	0.17
For over consumption	€ / m^3	0.56
Other prices/ rates		
Fixed yearly rate	€/hectare	1.71
For connection (once)		
(α) Water meter	€ /meter	68.00
(β) Filter	€/ hectare	5.00
For reconnection	€	25.50

7.2.2 Areas not Served by GWP

Water for irrigation in areas not served by GWP from private groundwater abstractions either on private level or by local Agricultural Organisations /Associations is not charged. The expenses for the supply of water (construction, operation, maintenance of abstraction and relevant utilities) are covered by the private individual/organisation.

7.3 Sewerage Service (up to 2ndary treatment)

The National Implementation Program (NIP-2005) for Cyprus is the first report relevant with Directive 91/721/EC, which was submitted in early 2006 to the European Commission and was aimed to produce the list of settlements, which are pursuant to the requirements of the Directive. In the beginning of 2009, Cyprus submitted to the European Commission the Reviewed National Implementation Program for 2008 (IP-2008), which includes the reviewed list of settlements with a population equivalent greater than 2.000.

The IP-2008 included a total of 57 settlements, 7 Urban Settlements (630.000 population equivalent) and 50 Rural Settlements (230.000 population equivalent) with a total population equivalent equaling 860.000 and IP-2008 experiencing an increase of 21,5% in population equivalent from IP-2005.

The Sewerage Service (collection and secondary treatment of sewerage) is a duty of Sewerage Boards. Six big (Urban) Sewerage Boards (SA) operate in Cyprus: Nicosia, Limassol-Amathounda, Larnaca, Agia Napa, Paralimni and Pafos. Also, eleven smaller

(rural) Boards operate on the island: Agrou, Aska, Palaeochoriou, Idaliou-Pera Choriou-Nisou, Platron, Kyperoundas, Pelentriou, Alassas, Lythrodonta, Solea, Athienou, Polis Chrysochou, Astromeritis - Peristerona – Akaki, while the construction and operation of a further 3 rural SA's is currently in the programming stage.

It must be noted that for several rural agglomerations of the NIP 2008, their inclusion in the relevant urban SA is scheduled. The urban SA will be responsible for the construction of waste water treatment plants and thus for the charges.

Sewerage rights and charges are specified and imposed every year with a relevant Notification in the Official Gazette of the Republic of Cyprus, according to the Law on Sewerage Systems of 1971 (Article 30) and its amendments up to 2007, including the Sewerage Regulations of each Sewerage Board.

Usually, Sewerage Boards impose two charges as follows:

1. The first charge is calculated with the estimated value of households - as they are determined by the Cadastre and Land Surveying Department - and it is a percentage of the estimated value. This charge is imposed for the payment of capital costs of the projects, meaning the construction of the sewerage system and the payment of several loans and interest.

2. The second charge which is usually imposed, is the charge for use of the system, which starts being paid with the connection of each individual household to the sewerage system. This charge is imposed to cover the operation and maintenance costs and is based on the water consumption, which is recorded on the water meter of each household (€/c.m. consumed water). This charge is usually imposed and collected through the Water Council Boards in urban areas or other authorities responsible for water supply in each area.

Also, some Sewerage Boards of urban areas impose a charge for storm water collection. Table 7.3-1 outlines the charges for each Sewerage Board, as they were published in the Official Gazette of the Republic of Cyprus.

Table 7.2-1 Charges imposed by Sewerage Boards for Sewerage Service

Sewerage Board	Charge based on household value	Charge based on water consumption	Reference year
Urban Sewerage Boards			
Nicosia	- 5 $^{o}/_{oo}$	0.41 € /c.m.	2009
Larnaca	- 4 $^{o}/_{oo}$ - charges set for storm-water sewerage	0.38 € /c.m.	2009
Limassol	- 2.76 $^{o}/_{oo}$ - charges set for storm-water sewerage - other charges set for tourism and industrial uses	0.41 € /c.m.	2009
Pafos	- 2,75 $^{o}/_{oo}$ - other charges set for tourism uses - charges set for storm-water sewerage		2009
Agia Napa	- 3 $^{o}/_{oo}$		2008

Sewerage Board	Charge based on household value	Charge based on water consumption	Reference year
	- other charges set for tourism uses, properties etc		
Paralimni	- 6 $^{o}/_{oo}$, when within touristic area - 3,50 $^{o}/_{oo}$ within limits of SB and outside touristic area - other charges set for tourism uses, properties etc		2008
Rural Sewerage Boards			
Pera Choriou-Nisou	- 4,7 $^{o}/_{oo}$ within area of SB & 2 $^{o}/_{oo}$ outside area of SB - other charges set for farms and holdings	0.38 € /c.m.	2009
Palechoriou	- Different pricing based on household value (ranges from 2 $^{o}/_{oo}$ up to 13 $^{o}/_{oo}$)		2008
Lithrodonta	- 10 $^{o}/_{oo}$ within area of SB & 4 $^{o}/_{oo}$ outside area of SB		2008
Kyperoundas	- 6 $^{o}/_{oo}$ within area of SB & 3 $^{o}/_{oo}$ outside area of SB	0.05 € /c.m.	2008
Agrou	- 7 $^{o}/_{oo}$ within area of A' phase of SB & 4 $^{o}/_{oo}$ outside area of B' phase of SB	0.10 € /c.m.	2008

7.4 Service of Recycled Water Supply

As regards to the use of recycled water, efforts are being made for its inclusion in the water balance - where this is possible - with the substitution of fresh water used for agriculture. Also, recycled water is used for the enrichment of groundwater aquifers.

Today, roughly 14,6 million c.m. of recycled water are produced annually, which cover needs for irrigation of crops and green areas. From this quantity, about 10 million c.m. cover needs of the water balance, about 2,5 million c.m. are used for enrichment of groundwater aquifers and the remaining 2 million c.m. (winter production) end up in the sea.

With the future expansion of the urban Sewerage Boards, effort is being made for the inclusion of additional quantities of recycled water in the water balance in order to cover existing needs, including the enrichment of groundwater aquifers, with the aim to contribute to their long term recovery. Also, the use of recycled water for irrigational purposes is being promoted in all sewerage projects in rural communities.

In the case of recycled water originating from Governmental Water Projects (GWP) – which is by far the largest proportion of the total quantity of recycled water for the island – and with the aim to provide incentives for its use, the prices do not take into account its production cost. The retail price of recycled water to individual farmers equals, nowadays, to 7 cent €/m^3 , while for Agricultural Organisations is 5 cent €/m^3.

The following table depicts the current prices for recycled water sold by the WDD per use.

Table 7.4-1 Current prices of recycled water supply by the Water Development Department

Recycled water from Sewerage Boards (tertiary treatment and supply)	Retail price € cent/c.m.
To Agricultural Organisations for agricultural production	**5.00**
To private individuals for agricultural production	**7.00**

Recycled water from Sewerage Boards (tertiary treatment and supply)	**Retail price € cent/c.m.**
For sports activities	**15.00**
For irrigation of green spaces, parks and hotel gardens	**15.00**
For irrigation of golf courses	**21.00**
For abstraction from groundwater aquifers, which have been enriched with recycled water	**8.00**

8 Steps and Measures to meet the Requirements of Article 9

8.1 Formation of the water pricing policies and cost recovery mechanisms according to the WFD requirements

8.1.1 Introduction to the main analysis principles

The new suggested water pricing policies in Cyprus aim to implement the provisions of Article 9 of WFD and at the same time to implement a feasible pricing policy that does not cause great disruptions in the production and social conditions.

Initially, the policy to ensure adequate quantities of water in Cyprus included the construction of dams in order to exploit the surface waters and the promotion of groundwater abstractions. However, under the conditions of severe drought during the past few years, a new policy was formed that aims at the introduction of desalinated water, in order to fully cover the needs for drinking water and to be able to be independent from the weather conditions. Thus, the current planning includes the construction of five desalination plants, until 2013, which will fully cover the need of drinking water in the main urban areas of Cyprus.

Based on the above, the planning for the new water pricing policies in Cyprus aims to cover both a) the current circumstances, where the greatest part of water needs for drinking and irrigation water are covered by dams, groundwater abstractions and small desalinated plans and b) the future condition, from year 2013 and on, where the capacity of the **desalination plants** will increase significantly, in order to cover the drinking water needs.

An **analysis model** was implemented, which examined on one hand the impacts of the new prices in the water demand and on the other hand the cost assessment methodology and results that were described in previous chapters of this report.

From the cost assessment and recovery levels that were described in chapters 5 and 6 of this report, the following conclusions are derived:

- The current pricing policies ensure the full cost recovery (financial, environmental and resource) of drinking water supply.
- On the other hand, the current pricing policies leave a significant percentage of cost uncovered for the irrigation water supply through GWP.

- When the planned infrastructure for the new desalinated plants will be part of Cyprus water balance (2013 at the latest), then the cost of drinking water will significantly increase and consequently this will affect water pricing.
- At the same time, the availability and the cost of irrigation water will change, as well. Volumes of water derived from groundwater abstraction and dams, which will not be used anymore for drinking purposes, could possibly be used for irrigation purposes at a lower cost. This will result to a higher cost recovery level for irrigation water supply.

Therefore, it is very likely that the supply and consumption conditions will change significantly. In addition to that, the cost and the prices both for drinking and irrigation water will change. The system will strike a new balance and in this new balance, the assessment of the implementation of cost recovery was conducted. In the following figure 8.1-1, the steps of the analysis model are depicted, based on the above.

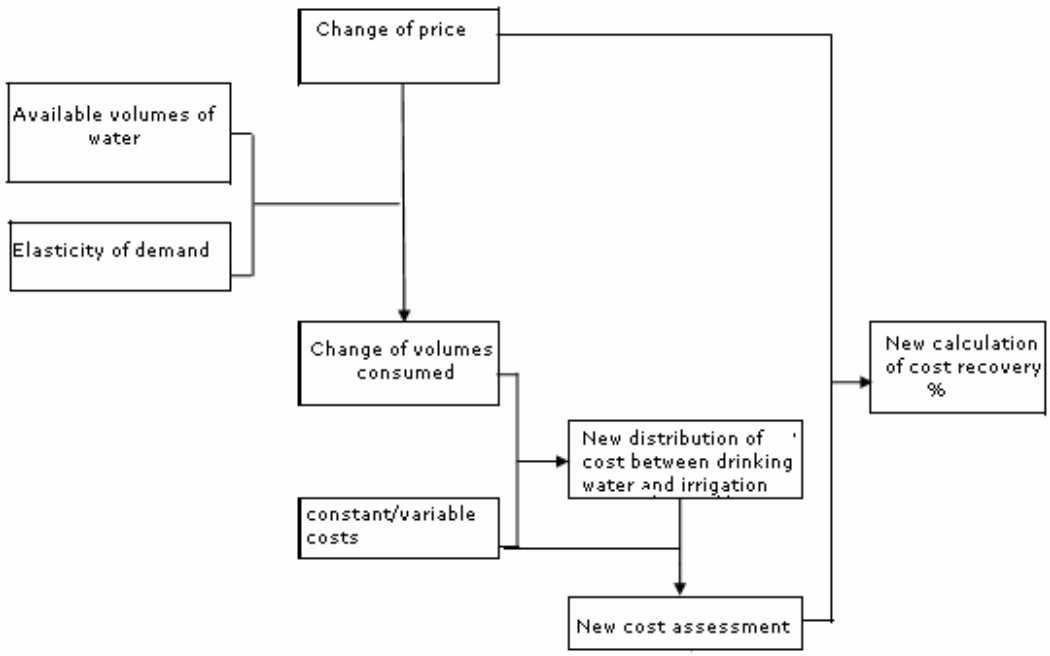

Figure 8.1-1 Stages of the analysis model

The elements which influence this new balance and were examined in the analysis model are the following:

1. The available volumes of water. The volumes of desalinated water which are currently produced and those that will be produced by the planned plants are used, as well as the average of the available water volumes from dams and groundwater abstraction for the period 2005 – 2007.
2. New cost assessment data. The costs that have been taken into account are the new costs for buying desalinated water from the planned plants as well as the current costs assessed as described in chapter 5 of this report.
3. New pricing data. Alternative water prices for drinking and irrigation water were examined and their impacts in water demand and in the cost recovery levels were assessed.

4. Different quantities of consumed water, which will arise from the new conditions of water availability and cost, are incorporated into this analysis.

In order to investigate further the above points 3 and 4, relevant factors were assessed, such as elasticity of demand and affordability.

The **price elasticity of demand** measures the rate of consumer response to water quantity demand due to a price change.

Concerning the **Drinking Water Supply Service**, according to Hadjispyrou et al. (2002), the **range of elasticity of water demand** in Cyprus is given by the table 8.1-1 below.

Table 8.1-1 Values of elasticity demand in Cyprus (Hadjispyrou et al., 2002)

Income brackets	Elasticity of demand	
	Income	Value
0%–10%	0.25	-0.79
11%–25%	0.22	-0.69
26%–50%	0.23	-0.6
51%–75%	0.30	-0.56
75%–90%	0.35	-0.5
Top–10%	0.48	-0.39

Thus, for the drinking water supply service, the analysis for elasticity of demand in Cyprus led to the examination of a range of values of price elasticity of demand between -0.5 and -0.7. The chosen range of elasticity of demand for drinking water supply also agrees with the literature. A recent literature review by Worthington and Hoffman (2008), in which 40 empirical estimations of elasticity of demand are examined globally, concludes that short-term the expected values of elasticity of demand range between -0.5 and 1. According to this study, the major parameters that affect that are: the seasonality (water demand is greater during the summer months), the household composition (number of members and age) and the imposing of restrictions in the available quantities of drinking water.

Concerning the **affordability to pay for the drinking water** cost in Cyprus, the available studies show that one person or household can afford to pay the total cost for drinking water supply (excluding the sewerage supply cost) up to a level which not greater than the 2.5% of its annual income. The average per capita household water consumption does not exceed 50 m^3 per year. The average per capita national income is 10.312 CY £ or 17.620 € in current prices of 2009. Based on these data, the margin of the affordability to pay for the water cost is 440 € per person, which is much higher from the cost of 50 m^3, with any way of charging the consumer.

In conclusion, in the drinking water supply service in Cyprus, if there is an increase in price of drinking water and if this change is not greater than the level at which the consumer can afford to pay (i.e. less than 50%), the calculated values of elasticity of demand for drinking water could have a short term impact. In the long term, the consumers will revert to their previous consumption levels. This conclusion is reinforced by the fact that the current water

consumption levels have not been formed as a result of the current water prices, but they were formed based on imposed restrictions on the available water quantity in the form of retrenchments in water supply or other relevant administrative measures.

As far as it concerns the **Irrigation Water Supply Service**, there has not been any estimation for the **elasticity of demand** in Cyprus, since due to the severe scarcity of water, the available water for irrigation is always restricted. However, it is assumed that rational increases in the irrigation water prices, - up to the level that this does not affect the economic value of the main crops -, will not seriously affect the water demand. In other countries, the elasticity of demand for irrigation water supply is between -0.4 and -0.6. An average value of elasticity of demand for irrigation water supply is -0.5 (Scheierling et al., 2006).

However, the above mentioned elasticities for both drinking and irrigation water supply, only apply if a balance between demand and supply exists in a market, which due to water scarcity does not exist in Cyprus. In order to address this issue, the following approach has been adopted:

- In irrigation, the main scenario that was examined, is based on the assumption that the observed water consumptions are a result of significant restrictions in irrigation water supply and that the irrigation water demand will increase according to water availability, even if the price is increased. It is however also assumed that the price increases will occur only up to the point that they do not jeopardise the economic value of the main crops of Cyprus.
- In drinking water supply, the main scenario examined, corresponds to zero elasticity of demand that agrees to the fact that the observed consumed water quantities were greatly affected by the significant restrictions in water availability.

Therefore, both in drinking and irrigation water the most probable scenarios are those with zero elasticity of demand and although other elasticities were examined in the analyses, the water pricing policies that are described in this chapter are based on zero elasticities for these two water services, for the reasons described above.

As far as it concerns the **affordability to pay for irrigation water** in the agricultural sector, the cost data of the main crops in Cyprus was assessed through the net-back analysis (NBA). The net-back analysis might be used in order to examine the economic change of a crop when the water price is changing.

The *NBA* could be used in the study of change of economy of a crop when the price of water is changed. Thus the NBA (net-back) could be written:

$$N_w = (P_j * Q_j) - (FC_j - VC_j - C_w) \quad (1)$$

where,

N_w represents the net back and represents the profit if the product j plus the irrigation expenditure of the holding. The profit of the product j is the difference between the gross return of the product j and the total of the productive expenditure, fixed FC_j and

variable VC_j. The gross returns of the product j includes the value of the total product j (value of the final product + value of intermediary products + value of self-consumption + value of self-consumption + compensations + value of stock + subsidies).

If we consider that the subsidies are transfer expenditure and that the whole quantity of the produced product is disposed in the market, then the net back could be written as:

$$N_w^{-s} = (P_j * Q_j) - (FC_j - VC_j - C_w) - S \qquad (2)$$

where,

S represents the subsidies.

To study whether the use of water for the production of the product j is socially " excellent" the following should be valid:

$$N_w^{-s} - P_w w_j \geq 0 \qquad (3)$$

where,

P_w represents the price of water which arises from effective pricing as required by the Directive 2000/60/EC and w_j water consumption for the production of the product j.

Occasionally though, it is preferred to use the gross profit (or mixed profit) instead of the (business) profit for the evaluation of the net back analysis. Some reasons that support this are the following:

a) Profit is an accounting concept with little practical significance since the producers do not disburse or draw the imputed costs (fixed costs).
b) The profit can be negative marking a long irrational use of resources. However, the small or few alternative uses of capital tied in the primary sector and the socially rather than economically determined mobility of labour in agriculture, make the concept of profit in the least functional.

Instead, the concept of gross profit is what determines the sustainability of crops and the supply curve of products ($P_j \geq AVC$) and therefore it is often used in the agricultural planning and the policy analysis (Hazell and Norton, 1986). The use of gross profit is obtained by subtracting the variable costs from the gross return, $(P_j * Q_j) - VC_j$ and therefore, the modified net back analysis can be written as:

$$N_w^* = (P_j * Q_j) - (VC_j - C_w) - S \qquad (4)$$

and hence, for the use of water for the production of the product j in the medium term to be social 'effective' the following should apply:

$$N_w^* - P_w w_j \geq 0 \qquad (5)$$

The data for net-back analysis for the main crops in Cyprus, that is described in the following tables, is derived from the Statistical Service of Cyprus and the Agricultural Research Institute of Cyprus.

Tables 8.1-3 to 8.1-6 present the net back analysis to the main crops (Table 8.1-2), when the price of water changes from 0.17 to 0.39 €/m^3. The Tables 8.1-7 and 8.1-8 present the contribution of irrigation cost in the crops' variable expenses and total expenses, respectively for the aforementioned price range. The crops assessed consist 73.78% of the total irrigational areas of Cyprus.

Table 8.1-2 Major Irrigation Crops

	Area (Ha)	**%**
Citrus		
Oranges	2984	7.38%
Lemons	857	2.12%
Deciduous		
Apples	1274	3.15%
Peaches	714	1.77%
Bananas	250	0.62%
Table Olives	13740	33.97%
Table Grapes	900	2.23%
Potatoes (Spring)	6190	15.30%
Potatoes (Intermediate)		
Potatoes (Autumn)		
Vegetables		
Tomatoes (open)	360	0.89%
Tomatoes (greenhouse)		
Cucumbers (open)	237	0.59%
Cucumbers (greenhouse)		
Water Melons (open)	542	1.34%
Haricot bean (open)	250	0.62%
Colocasia	110	0.27%
subtotal	**28408**	**70.23%**
Total Irrigated Land	**40449.08**	**28%**
Total Agricultural Land	**144461.00**	

Table 8.1-3 Net-back analysis €/ha

	Water Prices €/μ³												
	0	**0.17**	**0.19** (11.8%)	**0.21** (23.5%)	**0.23** (35.3%)	**0.25** (47.1%)	**0.27** (58.8%)	**0.29** (70.6%)	**0.31** (82.4%)	**0.33** (94.1%)	**0.35** (105.9%)	**0.37** (117.6%)	**0.39** (129.4%)
Oranges	2222.0	862.0	702.0	542.0	382.0	222.0	62.0	-98.0	-258.0	-418.0	-578.0	-738.0	-898.0
Lemons	-1559.0	-2919.0	-3079.0	-3239.0	-3399.0	-3559.0	-3719.0	-3879.0	-4039.0	-4199.0	-4359.0	-4519.0	-4679.0
Apples	10050.2	8656.2	8492.2	8328.2	8164.2	8000.2	7836.2	7672.2	7508.2	7344.2	7180.2	7016.2	6852.2
Peaches	17351.3	15957.3	15793.3	15629.3	15465.3	15301.3	15137.3	14973.3	14809.3	14645.3	14481.3	14317.3	14153.3
Bananas	13987.9	11859.5	11609.1	11358.7	11108.3	10857.9	10607.5	10357.1	10106.7	9856.3	9605.9	9355.5	9105.1
Table Olives	201.8	-529.2	-615.2	-701.2	-787.2	-873.2	-959.2	-1045.2	-1131.2	-1217.2	-1303.2	-1389.2	-1475.2
Table Grapes	-3361.7	-3881.9	-3943.1	-4004.3	-4065.5	-4126.7	-4187.9	-4249.1	-4310.3	-4371.5	-4432.7	-4493.9	-4555.1
Potatoes (Spring)	4343.0	3833.0	3773.0	3713.0	3653.0	3593.0	3533.0	3473.0	3413.0	3353.0	3293.0	3233.0	3173.0
Potatoes (Intermediate)	3048.5	2538.5	2478.5	2418.5	2358.5	2298.5	2238.5	2178.5	2118.5	2058.5	1998.5	1938.5	1878.5
Potatoes (Autumn)	1807.9	1297.9	1237.9	1177.9	1117.9	1057.9	997.9	937.9	877.9	817.9	757.9	697.9	637.9
Tomatoes (open)	1158.8	47.0	-83.8	-214.6	-345.4	-476.2	-607.0	-737.8	-868.6	-999.4	-1130.2	-1261.0	-1391.8
Tomatoes (greenhouse)	34542.5	33279.4	33130.8	32982.2	32833.6	32685.0	32536.4	32387.8	32239.2	32090.6	31942.0	31793.4	31644.8
Cucumbers (open)	7894.4	7085.2	6990.0	6894.8	6799.6	6704.4	6609.2	6514.0	6418.8	6323.6	6228.4	6133.2	6038.0
Cucumbers (greenhouse)	11879.0	10896.4	10780.8	10665.2	10549.6	10434.0	10318.4	10202.8	10087.2	9971.6	9856.0	9740.4	9624.8
Water Melons (open)	897.8	30.8	-71.2	-173.2	-275.2	-377.2	-479.2	-581.2	-683.2	-785.2	-887.2	-989.2	-1091.2
Haricot bean (open)	2197.6	1160.6	1038.6	916.6	794.6	672.6	550.6	428.6	306.6	184.6	62.6	-59.4	-181.4
Colocasia	19642.9	15562.9	15082.9	14602.9	14122.9	13642.9	13162.9	12682.9	12202.9	11722.9	11242.9	10762.9	10282.9

Table 8.1-4 Changes in net-back analysis %

	Water Prices €/μ³										
	0.19 (11.8%)	**0.21** (23.5%)	**0.23** (35.3%)	**0.25** (47.1%)	**0.27** (58.8%)	**0.29** (70.6%)	**0.31** (82.4%)	**0.33** (94.1%)	**0.35** (105.9%)	**0.37** (117.6%)	**0.39** (129.4%)
Oranges	-18.6%	-37.1%	-55.7%	-74.2%	-92.8%	-111.4%	-129.9%	-148.5%	-167.1%	-185.6%	-204.2%
Lemons	-5.5%	-11.0%	-16.4%	-21.9%	-27.4%	-32.9%	-38.4%	-43.9%	-49.3%	-54.8%	-60.3%
Apples	-1.9%	-3.8%	-5.7%	-7.6%	-9.5%	-11.4%	-13.3%	-15.2%	-17.1%	-18.9%	-20.8%
Peaches	-1.0%	-2.1%	-3.1%	-4.1%	-5.1%	-6.2%	-7.2%	-8.2%	-9.2%	-10.3%	-11.3%
Bananas	-2.1%	-4.2%	-6.3%	-8.4%	-10.6%	-12.7%	-14.8%	-16.9%	-19.0%	-21.1%	-23.2%
Table Olives	-16.3%	-32.5%	-48.8%	-65.0%	-81.3%	-97.5%	-113.8%	-130.0%	-146.3%	-162.5%	-178.8%
Table Grapes	-1.6%	-3.2%	-4.7%	-6.3%	-7.9%	-9.5%	-11.0%	-12.6%	-14.2%	-15.8%	-17.3%
Potatoes (Spring)	-1.6%	-3.1%	-4.7%	-6.3%	-7.8%	-9.4%	-11.0%	-12.5%	-14.1%	-15.7%	-17.2%
Potatoes (Intermediate)	-2.4%	-4.7%	-7.1%	-9.5%	-11.8%	-14.2%	-16.5%	-18.9%	-21.3%	-23.6%	-26.0%
Potatoes (Autumn)	-4.6%	-9.2%	-13.9%	-18.5%	-23.1%	-27.7%	-32.4%	-37.0%	-41.6%	-46.2%	-50.9%
Tomatoes (open)	-278.1%	-556.1%	-834.2%	-1112.2%	-1390.3%	-1668.4%	-1946.4%	-2224.5%	-2502.6%	-2780.6%	-3058.7%
Tomatoes (greenhouse)	-0.4%	-0.9%	-1.3%	-1.8%	-2.2%	-2.7%	-3.1%	-3.6%	-4.0%	-4.5%	-4.9%
Cucumbers (open)	-1.3%	-2.7%	-4.0%	-5.4%	-6.7%	-8.1%	-9.4%	-10.7%	-12.1%	-13.4%	-14.8%
Cucumbers (greenhouse)	-1.1%	-2.1%	-3.2%	-4.2%	-5.3%	-6.4%	-7.4%	-8.5%	-9.5%	-10.6%	-11.7%
Water Melons (open)	-330.7%	-661.5%	-992.2%	-1323.0%	-1653.7%	-1984.4%	-2315.2%	-2645.9%	-2976.7%	-3307.4%	-3638.1%
Haricot bean (open)	-10.5%	-21.0%	-31.5%	-42.0%	-52.6%	-63.1%	-73.6%	-84.1%	-94.6%	-105.1%	-115.6%
Colocasia	-3.1%	-6.2%	-9.3%	-12.3%	-15.4%	-18.5%	-21.6%	-24.7%	-27.8%	-30.8%	-33.9%

Table 8.1-5 Modified net-back analysis €/ha

	Water Prices €/μ³												
	0	**0.17**	**0.19** (11.8%)	**0.21** (23.5%)	**0.23** (35.3%)	**0.25** (47.1%)	**0.27** (58.8%)	**0.29** (70.6%)	**0.31** (82.4%)	**0.33** (94.1%)	**0.35** (105.9%)	**0.37** (117.6%)	**0.39** (129.4%)
Oranges	5463.6	4103.6	3943.6	3783.6	3623.6	3463.6	3303.6	3143.6	2983.6	2823.6	2663.6	2503.6	2343.6
Lemons	1961.0	601.0	441.0	281.0	121.0	-39.0	-199.0	-359.0	-519.0	-679.0	-839.0	-999.0	-1159.0
Apples	17605.3	16211.3	16047.3	15883.3	15719.3	15555.3	15391.3	15227.3	15063.3	14899.3	14735.3	14571.3	14407.3
Peaches	23667.5	22273.5	22109.5	21945.5	21781.5	21617.5	21453.5	21289.5	21125.5	20961.5	20797.5	20633.5	20469.5
Bananas	19468.9	17340.5	17090.1	16839.7	16589.3	16338.9	16088.5	15838.1	15587.7	15337.3	15086.9	14836.5	14586.1
Table Olives	5032.1	4301.1	4215.1	4129.1	4043.1	3957.1	3871.1	3785.1	3699.1	3613.1	3527.1	3441.1	3355.1
Table Grapes	2135.0	1614.8	1553.6	1492.4	1431.2	1370.0	1308.8	1247.6	1186.4	1125.2	1064.0	1002.8	941.6
Potatoes (Spring)	7629.9	7119.9	7059.9	6999.9	6939.9	6879.9	6819.9	6759.9	6699.9	6639.9	6579.9	6519.9	6459.9
Potatoes (Intermediate)	6208.3	5698.3	5638.3	5578.3	5518.3	5458.3	5398.3	5338.3	5278.3	5218.3	5158.3	5098.3	5038.3
Potatoes (Autumn)	4430.0	3920.0	3860.0	3800.0	3740.0	3680.0	3620.0	3560.0	3500.0	3440.0	3380.0	3320.0	3260.0
Tomatoes (open)	8682.6	7570.8	7440.0	7309.2	7178.4	7047.6	6916.8	6786.0	6655.2	6524.4	6393.6	6262.8	6132.0
Tomatoes (greenhouse)	98118.6	96855.5	96706.9	96558.3	96409.7	96261.1	96112.5	95963.9	95815.3	95666.7	95518.1	95369.5	95220.9
Cucumbers (open)	13899.1	13089.9	12994.7	12899.5	12804.3	12709.1	12613.9	12518.7	12423.5	12328.3	12233.1	12137.9	12042.7
Cucumbers (greenhouse)	81512.0	80529.4	80413.8	80298.2	80182.6	80067.0	79951.4	79835.8	79720.2	79604.6	79489.0	79373.4	79257.8
Water Melons (open)	4344.8	3477.8	3375.8	3273.8	3171.8	3069.8	2967.8	2865.8	2763.8	2661.8	2559.8	2457.8	2355.8
Haricot bean (open)	18103.0	17066.0	16944.0	16822.0	16700.0	16578.0	16456.0	16334.0	16212.0	16090.0	15968.0	15846.0	15724.0
Colocasia	30020.2	25940.2	25460.2	24980.2	24500.2	24020.2	23540.2	23060.2	22580.2	22100.2	21620.2	21140.2	20660.2

Table 8.1-6 Changes in the modified net-back analysis %

	Water Prices €/μ³										
	0.19 (11.8%)	**0.21** (23.5%)	**0.23** (35.3%)	**0.25** (47.1%)	**0.27** (58.8%)	**0.29** (70.6%)	**0.31** (82.4%)	**0.33** (94.1%)	**0.35** (105.9%)	**0.37** (117.6%)	**0.39** (129.4%)
Oranges	-3.9%	-7.8%	-11.7%	-15.6%	-19.5%	-23.4%	-27.3%	-31.2%	-35.1%	-39.0%	-42.9%
Lemons	-26.6%	-53.2%	-79.9%	-106.5%	-133.1%	-159.7%	-186.4%	-213.0%	-239.6%	-266.2%	-292.9%
Apples	-1.0%	-2.0%	-3.0%	-4.0%	-5.1%	-6.1%	-7.1%	-8.1%	-9.1%	-10.1%	-11.1%
Peaches	-0.7%	-1.5%	-2.2%	-2.9%	-3.7%	-4.4%	-5.2%	-5.9%	-6.6%	-7.4%	-8.1%
Bananas	-1.4%	-2.9%	-4.3%	-5.8%	-7.2%	-8.7%	-10.1%	-11.6%	-13.0%	-14.4%	-15.9%
Table Olives	-2.0%	-4.0%	-6.0%	-8.0%	-10.0%	-12.0%	-14.0%	-16.0%	-18.0%	-20.0%	-22.0%
Table Grapes	-3.8%	-7.6%	-11.4%	-15.2%	-18.9%	-22.7%	-26.5%	-30.3%	-34.1%	-37.9%	-41.7%
Potatoes (Spring)	-0.8%	-1.7%	-2.5%	-3.4%	-4.2%	-5.1%	-5.9%	-6.7%	-7.6%	-8.4%	-9.3%
Potatoes (Intermediate)	-1.1%	-2.1%	-3.2%	-4.2%	-5.3%	-6.3%	-7.4%	-8.4%	-9.5%	-10.5%	-11.6%
Potatoes (Autumn)	-1.5%	-3.1%	-4.6%	-6.1%	-7.7%	-9.2%	-10.7%	-12.2%	-13.8%	-15.3%	-16.8%
Tomatoes (open)	-1.7%	-3.5%	-5.2%	-6.9%	-8.6%	-10.4%	-12.1%	-13.8%	-15.5%	-17.3%	-19.0%
Tomatoes (greenhouse)	-0.2%	-0.3%	-0.5%	-0.6%	-0.8%	-0.9%	-1.1%	-1.2%	-1.4%	-1.5%	-1.7%
Cucumbers (open)	-0.7%	-1.5%	-2.2%	-2.9%	-3.6%	-4.4%	-5.1%	-5.8%	-6.5%	-7.3%	-8.0%
Cucumbers (greenhouse)	-0.1%	-0.3%	-0.4%	-0.6%	-0.7%	-0.9%	-1.0%	-1.1%	-1.3%	-1.4%	-1.6%
Water Melons (open)	-2.9%	-5.9%	-8.8%	-11.7%	-14.7%	-17.6%	-20.5%	-23.5%	-26.4%	-29.3%	-32.3%
Haricot bean (open)	-0.7%	-1.4%	-2.1%	-2.9%	-3.6%	-4.3%	-5.0%	-5.7%	-6.4%	-7.1%	-7.9%
Colocasia	-1.9%	-3.7%	-5.6%	-7.4%	-9.3%	-11.1%	-13.0%	-14.8%	-16.7%	-18.5%	-20.4%

Table 8.1-7 Contribution of irrigation cost in variable expenses

	Water Prices €/μ³											
	0.17	**0.19** (11.8%)	**0.21** (23.5%)	**0.23** (35.3%)	**0.25** (47.1%)	**0.27** (58.8%)	**0.29** (70.6%)	**0.31** (82.4%)	**0.33** (94.1%)	**0.35** (105.9%)	**0.37** (117.6%)	**0.39** (129.4%)
Oranges	17.80%	19.48%	21.10%	22.66%	24.15%	25.59%	26.97%	28.31%	29.59%	30.83%	32.03%	33.19%
Lemons	13.24%	14.57%	15.86%	17.11%	18.33%	19.51%	20.65%	21.77%	22.85%	23.90%	24.93%	25.93%
Apples	20.63%	22.51%	24.31%	26.02%	27.66%	29.22%	30.72%	32.16%	33.54%	34.86%	36.13%	37.36%
Peaches	26.36%	28.58%	30.66%	32.63%	34.49%	36.25%	37.91%	39.50%	41.00%	42.43%	43.79%	45.09%
Bananas	21.15%	23.06%	24.89%	26.62%	28.28%	29.87%	31.39%	32.84%	34.24%	35.57%	36.86%	38.09%
Table Olives	6.44%	7.14%	7.83%	8.51%	9.19%	9.85%	10.50%	11.14%	11.78%	12.40%	13.02%	13.63%
Table Grapes	9.73%	10.75%	11.75%	12.73%	13.69%	14.62%	15.53%	16.43%	17.31%	18.16%	19.01%	19.83%
Potatoes (Spring)	8.60%	9.52%	10.41%	11.29%	12.16%	13.00%	13.83%	14.65%	15.44%	16.23%	17.00%	17.75%
Potatoes (Intermediate)	9.69%	10.71%	11.70%	12.68%	13.63%	14.56%	15.47%	16.36%	17.24%	18.09%	18.93%	19.75%
Potatoes (Autumn)	10.29%	11.37%	12.42%	13.44%	14.44%	15.42%	16.37%	17.31%	18.22%	19.11%	19.99%	20.84%
Tomatoes (open)	12.53%	13.80%	15.04%	16.24%	17.40%	18.54%	19.64%	20.71%	21.76%	22.78%	23.77%	24.74%
Tomatoes (greenhouse)	2.87%	3.19%	3.52%	3.84%	4.16%	4.48%	4.79%	5.10%	5.42%	5.73%	6.03%	6.34%
Cucumbers (open)	13.00%	14.31%	15.58%	16.82%	18.02%	19.18%	20.31%	21.42%	22.49%	23.53%	24.54%	25.53%
Cucumbers (greenhouse)	1.26%	1.41%	1.56%	1.70%	1.85%	1.99%	2.14%	2.28%	2.42%	2.57%	2.71%	2.85%
Water Melons (open)	9.58%	10.59%	11.57%	12.54%	13.48%	14.40%	15.31%	16.19%	17.06%	17.91%	18.74%	19.55%
Haricot bean (open)	11.25%	12.41%	13.54%	14.64%	15.71%	16.75%	17.77%	18.77%	19.74%	20.69%	21.62%	22.52%
Colocasia	33.27%	35.78%	38.11%	40.28%	42.30%	44.19%	45.96%	47.62%	49.18%	50.65%	52.04%	53.35%

Table 8.1-8 Contribution of irrigation cost in total expenses

	Water Prices €/μ³											
	0.17	**0.19** (11.8%)	**0.21** (23.5%)	**0.23** (35.3%)	**0.25** (47.1%)	**0.27** (58.8%)	**0.29** (70.6%)	**0.31** (82.4%)	**0.33** (94.1%)	**0.35** (105.9%)	**0.37** (117.6%)	**0.39** (129.4%)
Oranges	11.98%	13.20%	14.39%	15.55%	16.68%	17.77%	18.84%	19.88%	20.90%	21.89%	22.85%	23.79%
Lemons	9.86%	10.89%	11.90%	12.89%	13.86%	14.80%	15.72%	16.63%	17.51%	18.38%	19.23%	20.06%
Apples	9.74%	10.76%	11.76%	12.74%	13.70%	14.63%	15.55%	16.44%	17.32%	18.18%	19.02%	19.84%
Peaches	12.01%	13.24%	14.43%	15.59%	16.72%	17.82%	18.89%	19.93%	20.95%	21.94%	22.91%	23.85%
Bananas	13.69%	15.06%	16.39%	17.67%	18.92%	20.12%	21.30%	22.44%	23.54%	24.62%	25.66%	26.68%
Table Olives	4.60%	5.12%	5.63%	6.13%	6.63%	7.12%	7.61%	8.09%	8.57%	9.04%	9.51%	9.97%
Table Grapes	4.80%	5.33%	5.86%	6.38%	6.90%	7.41%	7.92%	8.42%	8.91%	9.40%	9.88%	10.36%
Potatoes (Spring)	5.53%	6.14%	6.75%	7.34%	7.93%	8.51%	9.08%	9.65%	10.21%	10.76%	11.31%	11.85%
Potatoes (Intermediate)	6.05%	6.72%	7.37%	8.02%	8.66%	9.29%	9.90%	10.52%	11.12%	11.71%	12.30%	12.88%
Potatoes (Autumn)	6.73%	7.46%	8.19%	8.90%	9.60%	10.28%	10.96%	11.63%	12.29%	12.94%	13.58%	14.21%
Tomatoes (open)	6.78%	7.52%	8.24%	8.96%	9.66%	10.36%	11.04%	11.71%	12.37%	13.03%	13.67%	14.30%
Tomatoes (greenhouse)	1.99%	2.22%	2.44%	2.67%	2.90%	3.12%	3.34%	3.57%	3.79%	4.01%	4.23%	4.45%
Cucumbers (open)	6.62%	7.34%	8.05%	8.75%	9.44%	10.12%	10.78%	11.44%	12.09%	12.73%	13.36%	13.98%
Cucumbers (greenhouse)	0.67%	0.74%	0.82%	0.90%	0.98%	1.05%	1.13%	1.21%	1.29%	1.36%	1.44%	1.52%
Water Melons (open)	6.94%	7.69%	8.43%	9.16%	9.88%	10.59%	11.28%	11.97%	12.64%	13.31%	13.96%	14.60%
Haricot bean (open)	8.19%	9.06%	9.92%	10.76%	11.59%	12.40%	13.20%	13.99%	14.75%	15.51%	16.25%	16.98%
Colocasia	25.97%	28.17%	30.23%	32.19%	34.03%	35.78%	37.44%	39.01%	40.51%	41.94%	43.30%	44.59%

According to table 8.1-3, the cultivation of lemons and grapes is not profitable even with zero irrigation cost. The current charge of irrigation water (0.17 €/m^3) is not profitable for the olives. Tomatoes crops and water melon (out of greenhouses) are not profitable with a water cost of 0.19 €/m^3. Finally, when the water price increases by 70,6%, i.e. 0.29 €/m^3, the orange crops become non-profitable.

On the other hand, according to the table 8.1-5 (the modified version of the net-back analysis), the only non profitable crop at a 35,3% price increase, i.e. 0.23 €/m^3, is lemons.

Thus, from the net back analysis - as described in the above paragraphs and tables – it is concluded that the examined water prices range, from 0.17 €/m^3 to 0.39 €/m^3, differently influence the gross profit of the irrigated crops, due to the differences in the participation of the irrigation cost to the variable expenses (Table 8.1-7). This results in the alteration of the relative competitiveness of the irrigated crops. From the results of this analysis, a rational range of increased water prices for irrigation water was chosen to be further examined, that ranges from 0.21 to 0.25 €/m^3 can be implemented without causing negative serious impacts in the Cyprus agriculture.

Therefore, the proposed pricing scenarios were examined through the implementation of the analysis model which took into consideration the impacts of new pricing in water demand and utilizes the water cost model which has been developed and presented in chapter 5 of this report. Through consecutive, interactive specifications of all parameters under study (prices, elasticity, demanded volumes, water costs and revenues), the result was an overall picture of the WFD's applicability regarding cost recovery.

Based on all the above, various scenarios were examined that included different availability of water quantities (based on the introduction of the planned scheduled desalination plants), various price ranges, different elasticities of demand and adjusted costs.

The new prices and cost recovery mechanisms for the water services of drinking and irrigation water supply aim on the smooth transition of prices from the current situation – before the introduction of the new desalination plants – towards the higher cost conditions that will result from the introduction of the planned desalination plants to the water mass balance. Thus, water prices are proposed for:

- year 2010 based on the current situation and cost analysis without the introduction of the new desalination plants
- year 2013 based on a price that consists a smooth transition from the 2010 to 2015
- year 2015 based on the introduction of the planned desalination plants to the water mass balance

In the following sections, the different water pricing policies for each water service according to the provisions of WFD Article 9 are described and the targets, the cost recovery mechanisms and the resulting prices are presented.

8.1.2 Service of Drinking Water Supply

Regarding drinking water, the aim is full cost recovery. According to this aim, the following are proposed.

The proposed cost recovery mechanism for the end consumers is the Increasing Block Rated (IBR) pricing. In summary, this gradual pricing refers to a standard fixed charge X_{α} (to cover fixed costs) and two at least blocks (volumetric charge – prices $P_{1\alpha}$ and $P_{2\alpha}$).

As it has already mentioned, there are different drinking water providers in Cyprus. The supply of water through Governmental Water Projects (GWP) is controlled by the Water Development Department (WDD) and the consumer of the water services provided by the WDD, may not be the end user but an intermediary organisation, which receives water on wholesale basis from the WDD and distributes it to its own end users. The intermediary organisations who buy water on wholesale basis from the WDD, can be either the Water Council Boards of cities or Municipal - Community Boards.

Regarding the new drinking water charge from the Water Development Department to the local water providers, this charge will include WDD's total financial cost and the environmental and resource cost, so as to ensure that the environmental and the resource cost are collected from WDD's central mechanism. Since the Republic of Cyprus has been identified as one River Water Basin District (RWBD), it has been proposed that one drinking water price is set by the WDD, uniform for all the governmental water projects. Based on this, the following table 8.1.2-1 depicts the proposed prices for the drinking water charged by WDD.

Table 8.1.2-1 Proposed Drinking Water price €/m^3 (Water Development Department), uniform for all governmental water projects (in estimated current prices per year)

Year	Prices (€/m^3)
2010	0.82
2013	1.09
2015	1.32

For the years 2010 and 2015, prices fully (100%) cover the WDD's cost. Year 2013 is an exception, as the proposed price is set so as to ensure a smooth transition from 2010 prices (no desalination projects) to 2015 prices (with new desalination projects). In this way, a smoother transition from the current conditions prior to the introduction of new desalination plants towards higher cost conditions caused by the introduction of extensive new desalination plants to the drinking water mass balance.

The uniform pricing at WDD's level for all GWP has the following advantages: The Republic of Cyprus, through the Water Development Department, has undertaken responsibility for the production and distribution of water – which is considered a public good - to providers and end consumers and has made significant investments for decades, giving priority to areas of higher demand and/or financial importance. Therefore, the development of two governmental water project systems (Southern Conveyor and Paphos Projects) and the respective formation of water costs is a planning outcome, which did not necessarily follow the principles of the Water Framework Directive. In this context, the

uniform drinking water price is considered as fair treatment of all citizens. In this way, the main message coming across to citizens is that water is a public property, treated as such at a political, legislative and administrative level. In order to facilitate the implementation of measures under the WFD, which require a change in the perception of water as either private property or belonging to a certain Municipality or area, it is considered extremely important for citizens to comprehend this message.

Concerning the end providers (Water Council Boards, Municipalities / Communities), the drinking water costs vary in different areas. Thus, the implementation of differentiated prices is proposed according to the variations in water production and water distribution costs per area and per provider, so as to ensure full cost recovery for each area. According to the above, indicative prices per provider / provider group to the end users are as follows:

Table 8.1.2-2 Indicative Drinking Water prices €/m^3 per provider / provider group to the end users (in estimated current prices per year)

Governmental Water Supply System	Indicative proposed prices (€/m^3)		
	2010	2013	2015
South Conveyor Project	1,11	1,26	1,38
Governmental Water Projects through Municipalities, Communities (and groups)	1,13	1,27	1,38
Governmental Water Projects through Water Council Board	1,09	1,26	1,38
Pafos Governmental Water Project	1,46	1,63	1,76
Governmental Water Projects through Pafos Municipality	1,38	1,57	1,71
Governmental Water Projects through other Municipalities, Communities (and groups)	1,52	1,67	1,79

The above *differentiated* water price scenario from the different local service providers to the end users has the following advantages:

a. More accurate reflection of the final water providers' financial cost (after the Water Development Department level) into the final water prices. In this context, infrastructure costs, maintenance and management costs undertaken by the end provider (Water Council Boards, Municipalities and Communities) are accurately identified. Obviously, these costs vary according to the providers.

b. No obvious distortions are caused in the water market, through the integration of indirect subsidies and/or discounts from one water service provider to another. This would be inevitable in the case of a uniform price to the end users, where resources from lower cost providers would have to be transferred to higher cost providers. In this case, the end users of a Water Council Board or a Municipality / Community, for example, would have to undertake the greater cost of another Board or Municipality / Community, thus resulting into a state, where price would not reflect the actual cost, which is not compatible with the principles of the Water Framework Directive.

c. Compatibility with the existing legislative and administrative water pricing framework, according to which end providers are responsible for their pricing

proposals, taking into consideration the particularities of their total financial cost. Should a uniform water price be enforced, providers may lose motivation for better services to end users, through the reduction of operational costs or their preservation at low levels, due to the loss of their accountability towards end users.

d. Full accordance to the spirit and the letter of WFD's Article 9, as the environmental cost and resource cost are covered centrally by the provider to the Water Development Department and are integrated in its financial cost and, on the other hand, the implementation of the 'user pays' principle is more accurately implemented, especially regarding end user costs. In this context, water saving conditions are promoted in a simple manner, thus reducing to minimum any indirect subsidies between water providers for the same uses.

According to the above, each Water Council Board and/or Municipality/Community may (and would be desirable to) introduce higher prices for large consumption blocks, so as to discourage excessive consumption. Exceptions for certain social groups may also be introduced, according to each area's specific characteristics. However, the critical elements are price p_1 and the fixed cost, which will be defined so as to cover the large majority of consumers and to the above, which will ensure full cost recovery. According to the above, there will be a gradual transition to the prices from the current situation to the point where the new desalination projects will be introduced.

Regarding any exemptions to the drinking water supply according to the provisions of Article 9(4), an analysis was made that examined the macro-economical affordability indicators, which have been estimated for Cyprus. According to this analysis, the average household in Cyprus does not face an affordability issue regarding water bills. However, according to each area's specific characteristics, the local authorities may set special regulations for water charges, without, however, having an impact on the Water Development Department's selling price, on WDD's revenues from local authorities, or on the local authority's total final cost recovery.

In the areas not served by governmental water projects, Municipalities and Communities cover and therefore should fully recover their financial cost (construction, operation – maintenance of boreholes and relevant infrastructure) for water supply to the end user. However, they will also charge, on top of the financial cost, the respective environmental and resource cost, based on each end user's consumption. The environmental cost and the resource cost will be collected at a first stage from Municipalities and Communities and will be reimbursed to the Water Development Department's central mechanism.

8.1.3 Service of Irrigation Water Supply

Regarding the irrigation water supply, in relation to the formation of pricing proposals, a thorough analysis was undertaken, taking into consideration the social importance of the primary sector. The approach for the definition of a reasonable range of increased irrigation water price was not only based on the principle of full cost recovery, but mainly on consideration of affordability.

Affordability for agriculture was assessed through an analysis of the cost elements for the main crops in Cyprus, based on net-back analysis. As mentioned in chapter 8.1 of this report, net-back analysis may be used in the identification of a crop's affordability according to water price variation. According to the analysis results, the increased irrigational water price is from 0,21 to 0,25 €/m^3, which may be implemented without causing short or medium term disruption to the Cypriot agricultural production model, has been used as a basis for the pricing proposals for irrigation.

The irrigation water pricing method is a two part tariff, where a fixed cost is charged for covering fixed expenses and a variable cost (per volume) is charged for covering variable expenses. However, it was estimated that large part of charges is covered by fixed cost, thus not discouraging excessive irrigation water consumption. Therefore, the fixed and volumetric prices were adapted, by reducing the fixed cost to 15% of its theoretical price and increasing the volumetric price at a point which allows same levels of cost recovery. According to the above, the following prices are set:

- Annual Fixed Charge: 10.20 € per decare ή 44.01 € per water meter ή 30.61 € per plot

- Volumetric Charge:

Proposed per volume price €/m^3 - *In estimated current prices for each year*	
2010	0.24
2013	0.26
2015	0.28

The above lead to cost recovery of irrigation water from 53.7% in 2010 to 71.6% in 2015.

The prices of irrigation water for other uses apart from agriculture are formed taking into consideration the principle of full cost recovery. Thus, the water uses that concern the irrigation of golf and football courses, green areas hotel's and houses' gardens as well as industrial uses, are charged with a price that corresponds to 100% cost recovery (0,45 €/m^3). For several uses, as for example industry and tourism, a detailed analysis of affordability was made and based on that the proposed changes of the irrigation water prices for those uses are affordable. Concerning the livestock and the cultivation of ornamental fishes, these are considered to be included in the agricultural sector and thus the charges will be the same as those for agricultural production.

For areas not served by governmental water projects, where private boreholes supply irrigational water to individuals or irrigational organizations, it is estimated that the financial cost for water supply (construction, operation – maintenance of borehole and related infrastructure) is fully covered by the private individual. Therefore, any charge imposed by the Water Development Department will exclude the financial cost and will only include the environmental cost and the resource cost. However, because in the provision of water for irrigation through the GWP, the full recovery cost is not fully applied, the same principle must stand for the water supply for the areas not served by Governmental Projects. Therefore, the environmental and resource cost for the areas not served by governmental projects will be recovered in 54% which corresponds to the percent through GWP. Based on

the above, for the areas not served by governmental projects, the environmental and resource cost that will be charged equals to is 0.11 €/m^3.

8.1.4 Sewerage Service (up to 2ndary treatment)

Regarding the Sewerage Service's pricing policy, the existing planning according to the implementation framework of Directive 91/271/EEC will be adopted for the reasons below:

- The planning for the implementation of the urban wastewater Directive – in the case of Cyprus, which is a new member state - is posterior to the implementation of pricing policies according to the WFD.
- A series of technical reports for the implementation of the urban wastewater Directive has been completed.
- In the implementation framework of the urban wastewater Directive, Cyprus has already submitted reports – National Implementation Programme – to the EC for approval.
- In the context of the above-mentioned reports, a detailed cost-analysis of investments has been conducted and the financial programming includes the collection of revenues prior to project operation, through fixed charges to consumers before the use of sewerage projects. Any intervention in the already existing programming would lead to modifications in existing financial agreements and is therefore not considered advisable.

Therefore, for the Sewerage Service according to the WFD, pricing policy will be based upon and will adopt existing pricing mechanisms, as these have been established in the framework of the urban wastewater Directive and in the next WFD management cycle (2015 - 2021) to revisit the issue based on an overall picture of the implementation of both Directives.

8.1.5 Service of Recycled Water Supply

Cyprus always faced water scarcity issues regarding drinking and irrigational needs, which derive from its traditional tendency towards agriculture and constantly growing tourism. Today, and since most of the island's water resources have been developed, the water scarcity issue still remains. This is due to constantly growing population numbers, tourism growth, high seasonal water demand, improved living standards, increase in irrigation water demand and droughts which have prevailed in recent years.

The issue of groundwater over-exploitation and its subsequent impacts is one of the most significant problems for Cyprus. The large majority of groundwater bodies in Cyprus (15 out of 19 groundwater bodies), due to the island's particular geography and the pressures which are caused by human activities, have been characterized as being at risk from over-exploitation and most coastal groundwater bodies are characterized by salination (from sea intrusion).

Based on the aboved, governmental water policy focuses on maximum exploitation of non-conventional water sources, such as recycled water, the use of which releases equal volumes of good quality water.

The use of recycled water according the Code of Good Agricultural Practice is performed by farmers and started in 1995, initially for farming plants (clover, corn etc). The use of recycled water later expanded in crops such as citrus fruits, olives, potatoes as well as vegetables such as aubergines, peppers and tomatoes.

The use of recycled water has immediate environmental benefits, regarding the level of further sewage treatment required, as well as the reduction of groundwater body overexploitation and therefore promotes the WFD's environmental targets. This results in the adoption of a reasonable encouragement policy for recycled water use.

The recycled water encouragement policy was adopted since its early use and has led to a standard pricing in all of Cyprus (through Water Development Departments) at a charge much lower to the financial cost, which does not even cover the environmental cost.

However, circumstances are mature for the transition from the recycled water encouragement period to a new phase, where it will be possible to cover a significant part of the water recycling cost.

For the above-mentioned reasons, the proposed pricing policies, which were presented in the following paragraphs, consider recycled water as an exception from full cost recovery, so as to promote its use, but to also cover significant part of its cost.

It must be taken into account, that the recycled water will always have a strong opponent: the fresh distilled water for irrigation purposes. Consequently, the pricing policy cannot be formed by the cost of the recycled water, but by the price of its substitute which is the fresh distilled water. Recycled water has to be less expensive compared to the fresh water. Based on the aforementioned, the prices of the recycled water are formed to be 75% of the price of the fresh distilled irrigation water (i.e. 0,18 €/m^3 in 2010, 0,20 €/m^3 in 2013 and 0.21€/m^3 in 2015). Based on this price, the percentage of cost recovery of recycled water can be up to 88%.

8.2 Steps towards the implementation of the pricing policies

The way that the future water pricing policies have been investigated and proposed to be applied, satisfies both the WFD criteria, as described in the above paragraphs. They provide adequate incentives for users to use water resources more efficiently through appropriate volumetric pricing, both by Increasing Block Rate Pricing for Drinking water and by two part tariff pricing for Irrigational and Recycled Water. In addition, the provision of high price rates for over consumption is included. Also the adequate contribution of the different water uses to the recovery of the costs of water services, through the provision of sub-services which combine water services and water uses, in order to estimate the environmental and resource costs for each use and then "transfer" these costs to the level of water service. This analysis takes into account the polluter pays principle.

Concerning their implementation, already a draft **regulation** has been prepared that can form the basis for the necessary institutional and legal arrangements for the implementation

of pricing policies. The contents of the draft regulations are in effect the codification of the conclusions of the pricing policies / cost recovery mechanisms, as mentioned in the previous chapter, in the form of a legal document. The structure of the regulations was formulated so as to include an introductory section which refers to the objective of the regulations, on key definitions and general provisions, and followed by three (3) parts-one for each Water Service (Drinking water, Irrigation and Recycled Water) - and the relevant annexes, where the charges for each Service are mentioned in the form of tables.

In addition, **consultation procedures** with the public and stakeholders have been programmed for implementation. These include 1) the preparation and publication of a report that describes in simple form the cost analyses and pricing policies under the WFD, 2) conferences local and national to present and discuss the above, 3) as well as other publication and consultation actions.

Finally, **the organization of the available relevant data and the way of recording new data** is promoted. Since the first economic analysis in 2005 (implementation of WFD Article 5), an information protocol was implemented that aimed at recording of all possible data that might be needed in cost assessment analysis, pricing policies, programmes of measures etc. In 2009 the elaboration of an integrated data processing system was completed, which includes an extensive database, as prescribed in the above mentioned information protocol, as well as data processing -through appropriate algorithms- and reporting capabilities. This integrated data processing system supports and provides comprehensive reports for all stages of cost assessment of water services/uses.

The Water Development Department is currently in the process of reorganising its own recording system. Additionally, specific directions were given to other authorities and bodies involved in water services so as to achieve the same recording level. Finally, new projects are in the process concerning the exact recording of existing boreholes, as well as drinking water networks.

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