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PROJECT

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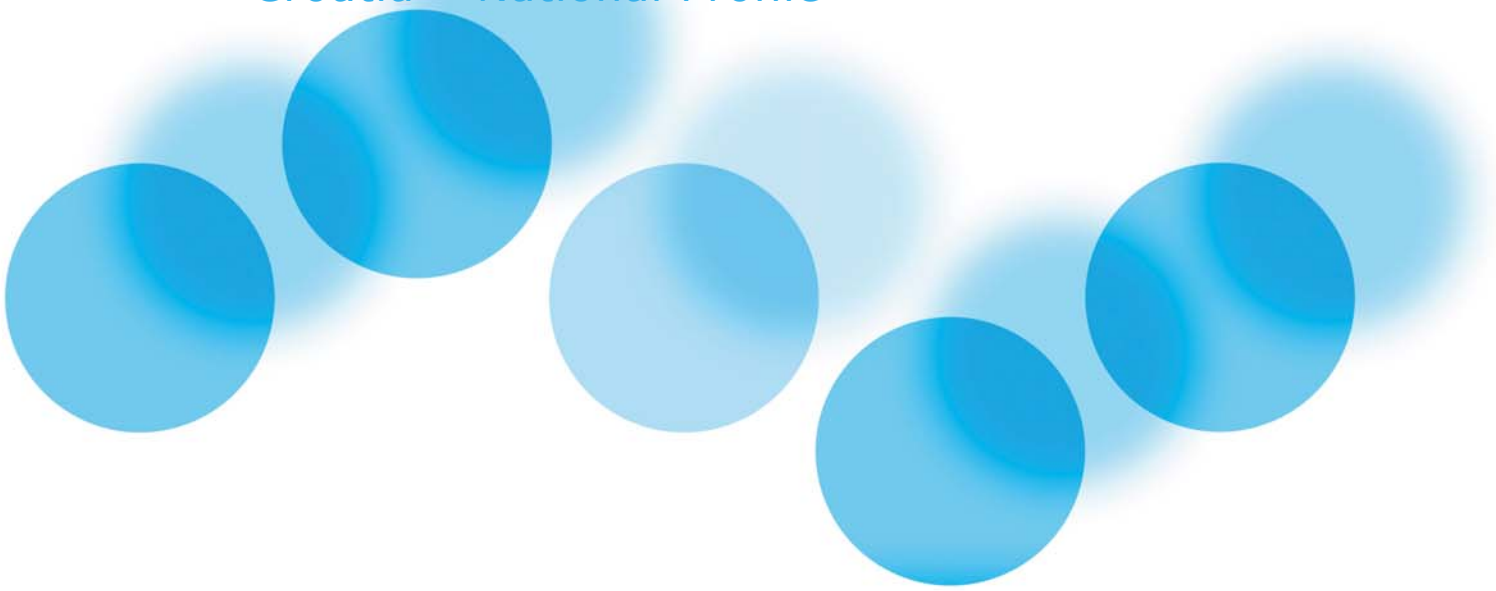
ASSESSMENT AND DEVELOPMENT OF MUNICIPAL WATER AND WASTEWATER TARIFFS AND EFFLUENT CHARGES IN THE DANUBE RIVER BASIN.

Volume 2: Country-Specific Issues and Proposed Tariff and Charge Reforms: Croatia – National Profile



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WORKING FOR THE DANUBE AND ITS PEOPLE

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PROJECT

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PREFACE

The Danube Regional Project (DRP) consists of several components and numerous activities, one of which was "Assessment and Development of Municipal Water and Wastewater Tariffs and Effluent Charges in the Danube River Basin" (A grouping of activities 1.6 and 1.7 of Project Component 1). This work often took the shorthand name "Tariffs and Effluent Charges Project" and Phase I of this work was undertaken by a team of country, regional, and international consultants. Phase I of the UNDP/GEF DRP ended in mid-2004 and many of the results of Phase I the Tariffs and Effluent Charges Project are reported in two volumes.

Volume 1 is entitled *An Overview of Tariff and Effluent Charge Reform Issues and Proposals*. Volume 1 builds on all other project outputs. It reviews the methodology and tools developed and applied by the Project team; introduces some of the economic theory and international experience germane to design and performance of tariffs and charges; describes general conditions, tariff regimes, and effluent charges currently applicable to municipal water and wastewater systems in the region; and describes and develops in a structured way a initial series of tariff, effluent charge and related institutional reform proposals.

Volume 2 is entitled *Country-Specific Issues and Proposed Tariff and Charge Reforms*. It consists of country reports for each of the seven countries examined most extensively by our project. Each country report, in turn, consists of three documents: a case study, a national profile, and a brief introduction and summary document. The principle author(s) of the seven country reports were the country consultants of the Project Team.

The authors of the Volume 2 components prepared these documents in 2003 and early 2004. The documents are as up to date as the authors could make them, usually including some discussion of anticipated changes or legislation under development. Still, the reader should be advised that an extended review process may have meant that new data are now available and some of the institutional detail pertaining to a specific country or case study community may now be out of date.

All documents in electronic version – Volume 1 and Volume 2 - may be read or printed from the DRP web site (www.undp-drp.org), from the page Activities / Policies / Tariffs and Charges / Final Reports Phase 1.

We want to thank the authors of these country-specific documents for their professional care and personal devotion to the Tariffs and Effluent Charges Project. It has been a pleasure to work with, and learn from, them throughout the course of the Project.

One purpose of the Tariffs and Effluent Charges Project was to promote a structured discussion that would encourage further consideration, testing, and adoption of various tariff and effluent charge reform proposals. As leaders and coordinators of the Project, the interested reader is welcome to contact either of us with questions or suggestions regarding the discussion and proposals included in either volume of the Project reports. We will forward questions or issues better addressed by the authors of these country-specific documents directly to them.

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1 INTRODUCTION

1.1 General Scope of the Report

This report is, first of all, a compilation of information and data that describing the institutions and conditions that shape and characterize the provision of municipal water and wastewater service in Croatia. The purpose of this compilation is to provide background and inspiration for proposals to reform both the current system of water and wastewater tariffs and effluent charges and coincident proposals to adjust or modify the legal and regulatory system within which the these tariffs and effluent charges function in Croatia. Indeed, some chapters include brief analyses suggesting such reforms and Chapter 9 concludes this report with preliminary proposals for reforms in the institutional setting and design of these tariffs and charges. The aim of the these proposals is to improve the management of water and wastewater resources used in the municipalities of Croatia generally and, including protection of water resources from nutrient loading and toxic substance originating from municipal systems.

1.2 General Information on the Republic of Croatia

The Republic of Croatia is one of the youngest Europian countries and democratic parlamentary republic. The total area of the country is 87,609 sq.km (land area is 56,542 sq.km and surface area at teritorial sea and interior sea waters is 31,067 sq.km).

It consists of two geographic parts: Danube basin (Black Sea catchment area - 60%), and the Mediterranean part (40%). Today's total population of Croatia is 4,437 milion inhabitans according to the 2001 census (population density 78.5 inhabitants per sq.km). In the territorial and administrative sense Croatia is divided into 20 counties and the capital Zagreb (which also enjoys the status of the county. The counties are further divided into towns (122) and municipalities (424).

Croatian GDP was 19,536 million USD (at current prices) in 2001 (4,403 USD per capita). The end year inflation rate (for the same year) was 3.8%, while the average net monthly salary amounted to 3,541 HRK (425 USD).

With respect to its natural resources and the existing economic potential, Croatia is an export-oriented country. The major features of the Croatian economy are the geographic strategic position, the potential of agriculture and food-processing industry, tourism and educated and qualified population. The gross national product is realised 55 percent in tertiary, service sector, 32 percent in industry, and less than 13 percent in agriculture.

Traffic and communications contribute 8 percent of gross national product, which is the result of the exceptional position of Croatia in the centre of the European communication area and on the crossroad of routes leading to various directions - northern Europe, south-eastern Europe, Middle East and the Adriatic Sea. The power production in Croatia is based on coal, oil, natural gas and water. Croatian agricultural land covers a large area, out of which 48.0 percent are ploughland and gardens, 33.0 percent are pastures, and 19.0 percent are meadows, orchards and vineyards. The major industrial branches are textile, food-processing, chemical industry, shipyards, wood processing, metal-processing industry, tobacco production and processing.

The Danube basin is rather urbanised, with developed industry and valuable agricultural land. International communications also pass through this area.

The Mediterranean region includes the Adriatic coast (islands, coast and hinterland). In addition to transport and industry, tourism and service activities are developed in this area. The mountain area separates the Mediterranean from the Danube basin catchment area. Through this area important

transport communications pass towards the North and South, and the area is also covered with valuable forests and with corresponding industry.

1.3 Purpose of the National Profile for Municipal Water and Wastewater

On the state level, depend on size and type of project, main role in the decision making process for investments in water sector and water pricing have:

State Water Directorate is in charge of all the activities related to water management. It plans, monitors and co-ordinates development of the water management system, while accommodating for the needs of the overall economic development.

Within its legal powers, Croatian Waters, a Government agency for water management, passes administrative and other acts and makes decisions on issues important to water management. These include preparing of basic plans for water management, maintenance of water-related structures, protection from detrimental effects of water, water use, water pollution control, etc.

There are more about 130 water utilities in Croatia, that a usually organised as public companies, as far the ownership structure 99% of these are companies with limited liability where local government units hold at least 51% of the shares.

These 130 companies, mainly located in larger urban areas, provide water supply and wastewater treatment services. They were either founded by local government units, or have emerged in the process of transformation of former public enterprises under the Municipal Services Act of 1995., all of these activities provide by the Ministry of Zoning, Construction and Housing.

Participation of private capital in these companies may ot exceed 49% of the shares, and there are still no examples of fully privatised companies providing municipal services in the water sector.

Very often, specially in smaller municipalities water supply and sewerage are only one among many other responsibilities of the utilities, but in bigger cities of which Croatia have eleven there are dedicated companies for water and wastewater management.

Table 1 Population of the Largest Cities in Croatia

Cities	Inhabitants
Zagreb	770,085
Split	173,692
Rijeka	143,395
Osijek	91,046
Zadar	69,239
Pula	58,342
Slavonski Brod	57,199
Karlovac	49,228
Varazdin	41,252
Sisak	37,491
Sibenik	36,886
Total	**1,527,855**

The City political bodies are

- City assembly
- Mayor
- City government

The assembly of the city yields the statute, general acts, resolutions, and elects and relieves of the mayor and the members of the city government. The city assembly established the public institutions and other legal institutions for performing economic, social and other activities in the interest of the city.

City government conducts the executive works of the city. City government manages the properties in the city ownership, as well as the city incomes and expenses, and also prepares the prepositions of the general acts. City government executes or insures the exectuion of the city assembly's general acts. The City assembly on the Mayor's preposition elects City government. The members of the City government are, as a rule, also principals of the City government's administrative departments.

The incomes and expenses of the City are defined by the annual budget.

The quality of life of every citizens, first of all, depends on the communal services. For that reason, there are several corporations fulfilling the communal needs citizens.

Corporation low defines the work of those corporations.

One of the corporations in the City ownerships is Water Supply and Sewerage. Water supply and sewerage is working according to corporations low, and the only member of that corporation is City.

The highest level of the conducting the corporation is:

Assembly, which, by authorization of the Assembly of City makes all relevant business decisions, from future investments to the nomination of the management.

In addition to the assembly, other management organs are: Supervisory board, which is appointed by the Corporation Assembly, as an organ of the Corporation's transactions control and the Director, which is also appointed and revoked by the Corporation Assembly. The Director represents the Corporation and preforms other activities according to the Corporation low. Director of water company suggest changing the prize of water but City government must accept it.

State plan for water protection requires building of Treatment plants for wastewater for cities bigger than 50 000 inhabitants.

Croatian lows allowed concession and BOT public - private partnership models, but there is one pilot project known till now - Treatment plant of Zagreb.

A strategy from the government could be to combine and organisations engaged in utility water supply, wastewater collection and treatment. This can be done either by laws or setting conditions, which can only be fulfilled by large organisations.

1.4 Future Direction

Starting from the above, it will be necessary to review all legislation related to water management, adjust it to EU requirements and define the possible deadlines for fulfilment of commitments towards EU, because the Republic of Croatia is oriented towards joining the EU. At present, the major problem in meeting these objectives is lack of funds.

The most important objective of water management system in Croatia is to provide adequate quantity of water of required quality for the needs of population and the economy. The development plan developed to meet this objective included: defining of objectives, analysis of technical and technological issues included implementation of effective systems of water polution charges, the method of managing of water supply systems, application of market principles with policy reform and legislation measures for the development of cost covery concepts for water and wastewater tariffs,

environment protection, implementation schedule and investment requirements.

The general water supply development program for the period up to 2015 was based on the elements and objectives of the social and economic development plan. The objective of this program is to achieve the level of 95 percent of population supplied from public water supply systems, and to meet the requirements of industry.

2 LEGAL AND INSTITUTIONAL SETTING

2.1 National Laws and Regulations Governing Provisions of Municipal Water and Wastewater Service

The orientation of the Government of the Republic of Croatia is adjusting of all the regulations with EU legislation, including regulations related to water management. In line with this strategic goal, the Republic of Croatia has ratified numerous international conventions, and taken part in the implementation of the EU Water Framework Directive which is adopted by the EU Parliament

In this context, the documents of particular importance for water management are Convention on the Protection of Trans-boundary Watercourses and International Lakes, and Convention on Cooperation for the Protection and Sustainable use of the Danube River. In connection with these documents, Water Act and Water Management Financing Act have been amended accordingly. In addition to the two laws, over 40 by-laws from the field of water management have been passed. These by-laws regulate numerous issues such as preparing of water management plans, defining of water related structures, determining the areas of water management activities, issuing of water management documents (conditions, consents, and permits), determining of the water estate, issuing of concessions on water and water estate, organising water management and water management inspection.

Water management plans both at the national (Water Master Plan of Croatia) and at the local level (catchment area master plans or water management plans) are under preparation. These are long-term plans containing the data on distribution, resources and properties of water, water requirements, provision of adequate quantities of water, water protection from pollution, regulation of watercourses and flood protection. They also determine other measures and activities for establishing the integrated water regime in the given planning area. The plans are being developed based on the water management documentation kept by Croatian Waters, and on the annual plans of Croatian Waters. They include the use of revenues from the charges transferred to the account of Croatian Waters.

From the collected charges, construction of water use and water pollution prevention facilities is partially financed. These funds are used either in the form of loans, or as participation in the costs of construction, in which case Croatian Waters also obtains property rights. Since such funds are, in principal, insufficient, construction of such facilities is also planned at the local level, where the loans from foreign financial institutions (World Bank and others) are sought.

At present, priority is given to ensuring adequate water supply for population, while investments aimed to reduce water pollution are given less attention, mainly due to lack of available funds. The objective of water supply planning is to provide sufficient water quantities and adequate quality for all uses. Water Master Plan of Croatia and the water supply plan as a part there for, are elements of the wider physical planning and protection of aquatic environment, and thus of the environment as a whole.

2.1.1 Common Provision

Funding for the activities of municipal service companies is provided from various sources, but in the case of water supply and wastewater disposal and treatment, the funds are provided through the price of the service.

The price and the method of payment for the provision of water supply and sewerage services are determined by the service providers, i.e. municipal service companies, and there are no administrative or legal limitations regarding the level of the price. In practice, however, the price set by the municipal service companies is under control of the company’s founders - local government units.

The Municipal Service Act allows privatisation of water supply and wastewater sector, through its provisions that any legal entity or private person can get a concession for performing municipal services.

2.1.1.1 Service Area

The *territory* of Croatia is divided into 4 major water management areas which makes specific units: Sava water area, water area of the rivers Drava and Danube, water area of the Primorje and Istria and the water area of the Dalmatia area.

River Sava is used as a water resource for drinking for thousands of people living along the river or nearby, as well as rivers Drava and Danube.

It is estimated that 12% of the total water reserves in Croatia belongs to the underground waters but the significance of that source is very important which can be shown by the fact that more then 90% of all cities (settlements) use underground water for drinking purposes. Generally, the quality of underground waters is rather good, especially in comparasion with other European countries which means that this is a very important resource for Croatia.

The biggest consumers of *surface waters* for drinking purposes are Osijek (partly - Drava river), Vukovar (Danube) and Sisak (Kupa river).

Some 73% of the population of Croatia is supplied from public water supply systems. Out of the total wastewater - municipal and industrial - only 20% is treated before being discharged into watercourses. The water supply penetration through public networks increased from 53% in 1991 to 68% in 1995 and to 73% in 2000 and should reach 95% in 2015.

In spite of slow development during recent years, there is still a considerable back in sewerage services. Only half ot he country's households are connected to a sewerage network - 51%.

Wastewater production in cu.m. (total) are 287.803,000, and treated only 88,000,000 cu.m.

Percentage of treated wastewater with

- a mechanical treatment stage 85%
- a biological treatment stage 4%
- a mechanical-biological treatment stage 11%

Major problems facing water management and water demand in the Slavonia region of Sava catchment area is that only c/a 25% of the inhabitants are connected to the public supply system of drinking water and that the demand for water is high and water resources are limited. It means that more investigation for more water resources must be organized. In the middle and western part of Sava catchment area, especially in Zagreb and in its vicinity, there is heavy water demand. On average, c/a 75% of the demand is satisfied by the public water supply, even the ratio range between 40% to 90%. Problems related to the water supply must be solved in the combination of regional and central public water systems with the limited use of local water systems as transitory solution.

Major problems facing water supply in the catchment areas of Drava and Danube rivers are that only (on average) 53% of the population is supplied with public water supply system which means that the rest of population use water from its own wells as well as industry.

2.1.1.2 Conditions of Service

Companies with limited liabilities where local government units (one or several) are founders and owners of the company are still the predominant form of the organisation of service providers. Participation of private capital in these companies may not exceed 49% of the shares, and there are still no examples of fully privatised companies providing municipal services in the water sector.

In case when there is more than one founder of the company, their share in the company's property is determined based on:

- corresponding part of company property in a particular local government unit (municipality);
- share of services provided to a particular municipality;
- population.

Municipal activities are carried out as a public service.

Pursuant to Municipal Services Act and special regulations, local self-government units and legal and physical persons who carry out municipal activities are obligated to:

- ensure permanent and quality conducting of municipal activities,
- ensure the maintaining of municipal facilities and installations in a functional state,
- take measures to conserve and protect environment.

Pursuant, municipal activities are the following:

- drinking water supply,
- collection and wastewater treatment,

Drinking water supply includes the activities of abstraction, purification and delivery of drinking water.

Sewerage and wastewater treatment include collection and wastewater treatment, drainage of atmospheric water, and pumping, removal and disposal of faecal matter from septic tanks, sump pits and black pits.

Apart from the activities stated, the representative body of the local self-government unit can by decision determine the activities of local interest which are considered municipal activities pursuant to the provisions.

2.1.1.3 Reporting Requirements

The price of the municipal service is paid to the service provider on the basis of monthly bills and of the act proposed by the company performing the service and approved by the company founder.

The water user charge is determined by the decree of Croatian Waters based on level of tarrif approved by the Government of the Republic of Croatia, and on the Regulations on calculation and payment of the water user charge, determined annually (or for the shorter periods of time) by the State Water Directorate. Croatian Waters determines the user charge for all the entities abstracting or drawing water directly from its natural sources. Companies supplying water to the consumers through public water supply systems collect the charge (part of the monthly water bills), and transfer the revenues to the account of Croatian Waters.

The water protection (pollution) charge is determined by a decree of Croatian Waters vode, based on level of tarrif approved by the Government of the Republic of Croatia, for the period of one year or less. In the case of direct discharge, Croatian Waters collects water protection charge, based on the measurements of pollution levels. Water supply companies collect the water protection charge from the users that discharge wastewater through the public sewage systems, and transfer it to the account of Croatian Waters.

The concession charge is determined by the concession contract. In the cases when the decision on awarding the concession is made by Parliament, Government or the State Water Directorate, the contracting authority is State Water Directorate. If the decision on awarding concession is made by county authorities, the contracting authority is Croatian Waters. The agreed amount of the concession charge is paid in favour of the Government budget, if the concession contract is signed by the State Water Directorate, and in favour of the county budget if the concession contract is signed by Croatian Waters.

2.1.1.4 Ownership of Infrastructure

Public ownership of the water supply and wastewater treatment facilities prevails in Croatia. Since local government units are the majority owners of all the existing service providers, Municipal Assemblies have the key role in the management of infrastructure. In the case of new investments, Croatian Waters may acquire property rights, provided that it participates in financing the given development.

2.1.2 Self Service

For the purpose of conducting of activities Municipal Services Act, local self-government units can establish self-services.

Self-services do not have characteristics of a legal person.

Self-services can also conduct municipal activities for other local self-government units in the area of the same or other counties, on the basis of a written contract.

In case the contracts of entrusting the conducting of municipal activities are made by the administration of local self-government units.

Self-services are independent in conducting of municipal activities pursuant, regulations based on foundation forms.

A local self-government unit establishes self-services by the decision of its representative body in the manner and following the procedure stipulated, and regulations.

The decision to establish self-services contains, in particular, the provisions related to:

- municipal activities to be conducted by the self-services,
- the area in which municipal activities shall be conducted,
- internal structure, business organization and management of the self-services,
- funds necessary to start the operation of the self-services, and the manner of their obtaining or securing,
- business acts of the self-services,
- reporting about business efficiency,
- limitations related to acquiring, burdening and alienation of real estate and other forms of special property of the local self-government unit, in which the business of the self-services is conducted,
- manner of supervision of the self-services' business by the local self-government unit,
- appointing and relieving of the manager of the self-services,
- termination of the self-services.

Internal structure of the self-services is regulated by the decision on the establishment of the self-services, and elaborated in more detail in the business statute of the self-services

The self-services are managed by the manager.

The manager is appointed and relieved by the administration of the local self-government unit.

The manager organizes and manages the business of the self-services, is accountable to the administration of the local self-government unit for material and financial business of the self-services, and lawfulness of the business of the self-services.

Based on the authorization by the administration of the local self-government unit, the manager enters into contracts with other physical or legal persons.

The Water Act, the Water Management Financing Act and the Municipal Services Act define the payers of municipal services, water user charge and water protection charge.

Table 2 Charges Paid for Water Use and Wastewater Discharge

1. Price of municipal service	Paid by the end users.
2. Water use charge	Paid by legal entities and persons that abstract or pump water from watercourses, lakes, storage reservoirs ground aquifers and other natural sources.
3. Water protection charge	Paid by legal entities and persons that discharge wastewater or other substances that pollute water.
4. Concessions on water and water-related estate	Paid by concession holder for: • water abstraction for public water supply; • use of water power for electricity generation of electric energy; • water abstraction for technological purposes in industrial and similar activities; • pumping of mineral and thermal waters - water abstraction for irrigation; • fish farming in enclosed water bodies.

2.1.2.1 Limitations on Self Service

The sanctions related to non-payment of the water user charge, water protection charge or concession charge are defined by the Water Management Financing Act, including fines ranging from HRK 10,000 to HRK 500,000 (EURO 1,300 to EURO 65,000) in the following cases:

- if the water supply company fails to account and remit in due time the funds of the water user charge,
- if the company using water power for electricity generation fails to account and to remit in due time the water user charge,
- if the liable company fails to account and to remit water protection charge.

In the above cases, the law envisages fines for the responsible person in the company, ranging from HRK 1,000 to 10,000 (130 EURO to 1,300 EURO).

2.2 Management Units

The conducting of municipal activities can be jointly organized by several local self-government units in a manner stipulated.

The local self-government unit incapable of independently providing the conducting of municipal activities can by the decision of its representative body entrust the conducting of such activities to another local self-government unit in the area of the same or other county, on the basis of a written contract.

If the municipal infrastructure system covers the area of more local self-government units within one or more counties, and forms a unitary, indivisible functional unit, the local self-government units are obligated to organize joint conducting of municipal activities by means of jointly-owned companies.

If the local self-government unit has not organized a permanent, quality conducting of certain municipal activities, or maintaining of individual facilities and installations of municipal infrastructure in the functional state pursuant to provisions, the county in whose area the local self-government unit is located shall organize the conducting of certain or all municipal activities, i.e. the maintenance of facilities and installations of municipal infrastructure in the functional state, at the cost of the local self-government unit.

Any disputes that may arise from the implementation are resolved by arbitration, which consists of representatives of the ministry responsible for municipal services, the county and the local self-government unit.

In accordance with the Municipal Services Act (NN 36(95) which defines the municipal activities, these services include among others water supply and wastewater treatment and disposal. municipal services may be performed by:

1. a company founded by one or several local government units
2. a public institution founded by a local government unit
3. a service - plant, established by one or several local government units
4. a legal entity or a person, subject to concession agreement

Regulations influencing the price of water and the application of economic instruments in water sector are, as follows:

Municipal Services Act (NN 36/95).

Decree on municipal service price determined by the Assembly of the municipal company, and other decisions of the company regarding development of municipal infrastructure and loan obligations.

- Water Management Financing Act (NN 107/95, 19/96 and 88/98) .
- Ordinance on the level of water user charge (NN 62/00).
- Regulations on calculation and payment of water use charge (NN 94/98).
- Ordinance on the level of water protection charge (NN 58/00).
- Regulations on calculation and payment of the water protection charge (NN 62/00).
- Decree on conditions and procedures for awarding of concessions on water and public water-related estate (NN 99/96).

2.2.1 Administrative Units

The management bodies of the municipal companies are the Assembly, Supervising Committee and the management. The company founder, which is at the same time majority owner (city council or city authorities), passes regulations governing the activity of the company.

Based on the required financial resources and the way of financing the municipal infrastructure, the municipal services company has the right to decide what will be the level of the investment costs to be covered by the end users through the water price.

In theory, there are no limitations on the level of the prices municipal companies charge for their services. However, since the company's founders i.e. local government units decide the pricing policy, strong economic and social concerns are often incorporated in it. Although the information indicating regional variations in the collection efficiency exists, there is no data on the impact of municipal service prices on the rate of the payment of water bills in Croatia.

2.2.2 Operating Units

The price and the method of payment for the provision of water supply and sewage services are determined by the service providers, i.e. municipal service companies, and there are no administrative or legal limitations regarding the level of the price. In practice, however, the price set by the municipal service companies is under control of the company's founders - local government units.

2.2.3 Ownership of Facilities

Full privatisation of municipal service companies in Croatia is a desired direction, although the awareness that there are positive and negative sides of the process exists. Participants pointed out that

the positive effects of privatisation of municipal services would not be an automatic result, but would require numerous preconditions, such as:

- adhering to the rules of competition;
- market prices of water, i.e. elimination of the mechanisms that keep the water prices low in order to safeguard the living standard of the users, practice that is currently achieved through the right of the company's founder to control the prices;
- clear contractual relations on the quality of services between the user and the provider of the services (private partner);
- the contract with the private partner must include a time limit in order to provide the possibility of competition in case the provider of the service does not fulfil contractual obligations;
- in case of bankruptcy of the private partner, the service user must be able to protect assets given to the private partner for use;
- the control over the private partner's cost and the possibility of their reduction must be permanent and efficient.

Only professional application of the above-mentioned conditions and of the international experience of more developed societies (including privatisation of municipal companies in transition countries) may give the desired results.

2.3 Service Users

2.3.1 Classification of Users

In accordance with the Municipal Services Act defines the principles, manner of conducting and financing of municipal services and other issues aimed at the efficient carrying out of municipal activities.

Pursuant to this Act, municipal services include the conducting of municipal activities, in particular the providing of municipal services of interest to physical and legal persons, and financing of the construction and maintenance of facilities and installations of the municipal infrastructure as a complete system in the areas of municipalities, towns and the City of Zagreb (hereinafter: local self-government units) as well as in the counties, provided that it is so stipulated.

The funds for conducting of the following municipal activities are secured from the price of the municipal service, as follows:

1. drinking water supply,
2. collection and wastewater treatment, excluding atmospheric water,

The price amount and method of payment of the municipal service are determined by the service provider.

The price of the municipal service for provided municipal service is paid to the service provider.

The payer of the price for provided municipal service is the owner of the real estate, or the user when the owner has transferred it by contract to the user.

If the reasons occur to introduce direct supervision of prices of municipal services, pursuant to a special Act, the measure of direct supervision of prices is introduced by the competent body of the local self-government unit in whose area the seat of the service provider is located.

The construction of facilities and installations of municipal infrastructure for:

1. drinking water supply,
2. sewerage and wastewater treatment

is financed from:

1. municipal contributions,
2. budgets of the local self-government unit,
3. grants, and
4. other sources determined by special regulations.

The decision which determines the amount of the municipal tax is made by the administrative department of the local self-government unit competent for municipal services.

The decision contains, in particular:

1. the amount of funds which the owner of the building site is obligated to pay at one time, or in installments,
2. deadline for the construction of the municipal facility or installations,
3. fine and a reimbursement of paid funds, if the local self-government unit does not fulfill its obligation.

The decision which does not contain the obligatory elements prescribed is null and void.

The decision is made after the determination of the amount of municipal taxes, at the latest by the issuing of the building permit.

The municipal tax is paid per [M1] m^2 gross of the developed surface of the building which can be built on the building lot.

A municipal tax payer who demolishes or restores the existing facility already connected to the municipal infrastructure is obligated to participate in construction financing of facilities and installations of municipal infrastructure proportionally to the increase in the surface of the building in comparison to the previous structure.

The owner of the building is obligated to connect his building to the municipal infrastructure under the conditions prescribed by the decision of the representative body of the local self-government unit.

The owner of the building site pays the costs of the connection of the building site to the facilities and installations of municipal infrastructure directly to the connection provider.

The representative body of the local self-government unit can by decision determine the areas in which the owner of the building can be exempt from the obligation to connect to municipal infrastructure, if the person has in a satisfactory manner individually fulfilled his needs.

The buildings built without a building permit cannot be connected to municipal infrastructure.

2.3.2 Classification of Waters

In the Republic of Croatia, water is classified according to the quality into categories from I to V, on the basis of criteria defined in the Ordinance on Water Classification (NN 77/98). Category I refers to drinking quality waters, and surface waters suitable for trout farming. Bathing and waters suitable for recreation and growing of lower quality fish fall into the second category, Water suitable for the use in industry and agriculture are classified as category III, while waters that can be used only after the purification and in the areas with severe water shortages are classified as category IV. Finally, category V refers to waters that cannot be used for any purposes.

2.4 Regulatory Units

The water sector has linkages with other Ministries, and State Directorates in such matters as organization and scope, public health, improvements in municipal services and general policy on protection of the environment etc.

The Government of Croatia (GOC), through its House of Representatives, has established a National Water Council for the purpose of discussing essential issues of water management, coordination of

various needs and interests, and proposing measures for the development and improvement of the water system in the Republic of Croatia.

The National Water Council consists of the Chairman and ten members appointed for the period of four years by the House of Representatives of the Parliament of the Republic of Croatia. The Chairman and members are nominated from among the representatives in Parliament, eminent scientists and professionals in the field of water management and related fields.

The administrative supervision of the Water Act and its regulations is carried out by the State Water Directorate, which also carries out inspection over the implementation of the provisions of the Water Act and its Regulations, in collaboration with county offices.

"Croatian Waters" is the government agency for water management. The task of Croatian Waters is to ensure permanent and unimpeded carrying out of public services and other tasks in water management in the scope defined by plans and in accordance with the available funds provided for the purpose under corresponding legislation.

The government bodies are organised in accordance with the Act on Organisation and Scope of Ministries and other Government Administration Bodies (NN 48/99 and 15/00). The Act defines their scope of work and competencies. The Ministries, State Directorates, and other bodies having direct influence on water sector policies through regulations proposed to the government of the Republic of Croatia are, as follows:

2.4.1 The State Water Directorate

The State Water Directorate is in charge of all the activities related to water management. The State Water Directorate monitors and co-ordinates development of the water management system, while allowing for the needs of the overall economic development. It is also in charge of the measures for regulation of watercourses and other water bodies, protection from floods and ice, erosion and torrents, irrigation and drainage. Other competencies of the State Water Directorate include management and use of water-related estate, protection of water and sea from pollution, provision of adequate water supplies for population and industry, use of water power, planning and co-ordination of development and construction of public water supply and sewage systems, and inspection in the field of water pollution control. The State Water Directorate proposes to the Government of the Republic of Croatia the level of water use charge and water protection charge (tariff), which are the constituent parts of the total price of water delivered.

(1) Organization

As a Directorate, the SWD is headed by a Director and does not have a seat in the Cabinet of Ministers, but may participate if requested to do so.

SWD has four divisions and its prime responsibility is directing the long-term development of water resources, management of water resources, and supervision over implementation of the provisions of the Water Act (NN 107/95).

The SWD carries out administrative supervision over Croatian Waters regarding its performance of administrative tasks entrusted to it under the Water Act, carries out inspection over the implementation of the provisions of the Water Act, and its organization is structured accordingly.

(2) Jurisdiction

The Water Act defines the responsible bodies and the sharing of responsibilities and water inspection. The SWD develops laws and regulations and ensures the administrative supervision of the implementation of the legislation on water.

In particular, it exercises control over water quality standards and pollution levels, and is the principal International Alert Centre for early warning in the case of accidents on Trans National waters.

SWD controls Croatian Waters and arbitrates on any problems between it and the county offices in charge of water management.

SWD through its State Water Inspectorate is responsible for inspection of national waters (12 inspectors) and acts together with county water management inspectors (40 inspectors located at county offices) who are responsible for local waters. The State Inspectorate is responsible for the monitoring of water quality.

The State Water Inspectorate is also responsible for international commitments, the preparation and implementation of the National Plan for the Defense Against Floods, and other sub-plans under the National Water Management Master Plan of Croatia (yet to be issued).

2.4.2 The Ministry of Public Works

The Ministry of Public Works is in charge of the activities related to the application of instruments and measures of the economic policy in construction, housing and housing policy, and implementation of special programs for improvement of the situation in municipal services.

2.4.3 The Ministry of Environment and Physical Development

The Ministry of Environment and Physical Development carries out administrative and other tasks related to the general policy of environmental protection, providing of conditions for sustainable development, protection of air, water, sea, flora and fauna in integrated interaction.

2.4.4 Counties

In addition to the above-mentioned Ministries, at the local level, there are 21 counties and the metropolitan administration of the City of Zagreb, which influence the price of water by their respective decisions.

2.4.5 Croatia Waters

"Croatian Waters" is a Government agency for water management. The task of Croatian Waters is to ensure permanent and unimpeded carrying out of public services and other tasks in water management in the scope defined by plans and in accordance with the available funds provided for the purpose under corresponding legislation. Within its legal powers, Croatian Waters passes administrative and other acts and makes decisions on issues important to water management. These include preparing of basic plans for water management, maintenance of water-related structures, protection from detrimental effects of water, water use, water pollution control, managing of public water estate, professional supervision and engineering in construction of water-related structures, and collection of funds for financing of such works and activities.

(1) Organization

The governing body of Croatian Waters is the Management Council. The Management Council has seven members, appointed (and dismissed) by the government. The members are nominated primarily from among public officials and professionals in the field of water management, economy and public finance.

The leader of operations of Croatian Waters is the General Manager. He is appointed (and dismissed) by the government (GOC) upon proposal by the Director of the State Water Directorate, for a period of five years.

The internal organization of Croatian Waters for the purpose of operative management has established five Water Management Departments as follows:

1. Sava Basin, with the seat in Zagreb
2. City of Zagreb, with the seat in Zagreb
3. Drava Basin, with the seat in Osijek
4. Littoral and Istrial Basin, with the seat in Rijeka
5. Dalmation Basin, with the seat in Split

Water management branch offices of catchment areas are formed within the departments.

The internal organization of Croatian Waters is defined by a separate general document passed by the management council with the consent of the Director of SWD. The internal organization is determined in accordance with the principles of internal organization defined by the Statute. There is an Act on Organization and Scope of Ministries and other Government Administration Bodies (NN 48/99 and 15/00).

Operational management of the water system is carried out by four Water Management Departments for each of the main basin catchment areas, and one special department for the City of Zagreb catchment area. Each department has sections dealing with the basic components of water management (water use, water protection, and protection from water). The main four water management departments also control the branch offices for the 31 individual river catchment areas.

Water management activities as defined by the Water Act are carried out by a number of separate sectors responsible for:

- Preparing studies and development plans
- Pollution control
- Ensuring of water resources
- Protection from the harmful effects of water
- Operation of public authority in the water sector

The main office of Croatian Waters is located in Zagreb, and includes the water management departments of the Sava river basin and the City of Zagreb basin (other basin departments are located elsewhere).

Croatian Waters has a staff of about 700, with approximately 60% being the holders of University Degrees.

(2) Jurisdiction

Croatian Water has responsibility for State and local water management. Its principle duties are to manage Croatia's waters according to the adopted water management plans and schemes, issue administrative and other orders and make decisions on matters of importance. In terms of water management, it has jurisdiction over the following:

- Preparation of water management plans, water management schemes of catchment areas and other plans for water management
- Regulation of watercourses and other water bodies and protection from the adverse effects of water - monitoring of the situation and control of watercourses and other water bodies, organization of protection from floods and ice, protection from erosion and torrents, organization of construction, technical and economic maintenance of watercourses and water works
- Water protection-monitoring and determination of water quality, organizing of implementation of the National Water Protection Master Plan, coordination of water protection plans of the local

administrative units and other plans for investment in water protection, and control over their implementation, measures for prevention and elimination of water pollution

- Supervision over implementation of terms and conditions of water management acts and concession agreements (water management supervision)
- Tasks related to implementation of plans for water management

2.4.6 Local Governments

(1) Organization

Most but not all of the companies providing water supply and sewerage system services are joint stock companies owned by the municipalities they serve. In some places the services are operated by municipal departments.

In general terms, the organization of these private (municipal) companies is similar, with an Assembly, a Supervising Committee and a Manager (or Director). The organization beyond this level depends on the total municipal services provided (some companies provide solid waste disposal, cemetery maintenance etc.), the size of the population and industries served, and the level of facilities to be operated and maintained. Hence, all companies have different departments and sections to suit their particular needs.

Regulations governing the activities of the company are passed by the company founder and majority stockholder who are usually a city council, town council or municipality.

The Assembly is the highest authority of the company like Board through which the founder makes decisions on the following matters:

- Tariff setting
- Contents of the contract with the company
- Election (and dismissal) of the members of the supervising committee
- Appointment (and dismissal) of the manager
- Appointment of members of the arbitration committee
- Acceptance of new members into the company
- Awarding of concessions for municipal activities following the previous decision of the city, town or municipal council - (the founder of the company) for water source
- Adopting regulation on financing of development of municipal activities
- Development program of water supply and wastewater disposal

The Supervising Committee supervises the operation of the company and acts on behalf of the company towards the management. The Supervising Committee in particular:

- Supervises the use of company funds, the operation of the company, the implementation of contracts and decisions of the Assembly
- Discusses the reports on Operations and Finance
- Submits to the Assembly the reports on supervision etc.

(2) Jurisdiction

With regard to water quality management, Municipal and Town Councils, and the City of Zagreb, are responsible for the drawing up and issuing of the following regulations under the Water Act:

- Sanitary protection zones around sources of water used for public supply

- Use of the public water estate for rest and recreation
- The method of wastewater disposal, the obligation to connect to the public sewerage system, the conditions and manner of wastewater disposal in areas where such systems do not exist, particular measures for the disposal and elimination of hazardous and other substances, and the obligation to maintain the public sewerage system
- Maintenance of the amelioration drainage system

The municipal companies have jurisdiction over the operation and maintenance of the water supply, wastewater treatment and disposal.

2.5 Environmental Regulation

Pursuant to the Croatia's foreign policy objectives, the process of European integration has been recognized as one of the top priorities. In order to decrease differences between Croatia and the EU member states in the field of environmental monitoring and reporting, it will be necessary to adopt the EU/European Environmental Agency (EEA) standards and guidelines in the process of association. Without a doubt, the harmonization of indicator sets and environmental reporting with the EU accepted norms and standards is one of the most important steps in achieving the sound environmental management. The implementation of these standards will make the data comparable and ready for exchange on both, the national and international level. This in turn, will allow the EU and the international community in general, to provide a better assistance to Croatia both in terms of consultancy and technology transfer.

In Croatia today, the collection of environmental data is carried out on different levels and it is most financed from the State budget. Various governmental bodies, research and academic institutions as well as other organizations/companies have competence to gather information and meta-data of a vital enviromental importance.

According to the provisions of the Law on Environmental Protection of the Ministry of Environmental Protection and Physical Planning has the obligation to prepare the State of the Environment Report every four years. The preparation of the State of the Environment Report heavily relies on the data available while its quality depends on the quality of the data used.

The Ministry of Environmental Protection, and Physical Planning, is responsible for water bodies inside protected areas, and deals with environmental protection information. It is responsible for the maintenance of the Environmental Pollution/Emission Cadastre created in 1997, which includes emissions into waters. The Ministry of Health looks at the health impact of water (drinking water) and water uses.

2.6 Economic Regulation

The basic economic regulators influencing the price of water, and corresponding legislation are the following.

Table 3 Basic Economic Regulations Influencing the Price of Water

1. Price of municipal service	Source of revenue for municipal service determined by the Municipal Services Act (includes the service, repayment of loans for construction of facilities and municipal infrastructure). It is determined by the provider of the municipal service, with the consent of the founder of the municipal company.
2. Water use tariff	Source of revenue for financing of water management defined by the Water Management Financing Act (NN 107/95). The charge (tariff) is determined by the Government of the Republic of Croatia
3. Water protection tariff	Source of revenue for financing of water management defined by the Water Management Financing Act (NN 107/95). The charge level (tariff) is determined by the Government of the Republic of Croatia.
4. Concessions on water and water estate	Concession provides the right of use of water and water-related estate, i.e. the right to perform economic and other activities on water and water-related estate.

Other important laws that may directly influence the price of water are:

- Islands Act (NN 34/99)
- Investment Promotion Act (NN 73/00)

The above laws provide certain alleviations in financing of infrastructure works, which results in lower loan repayment instalments and directly affects the price of water.

In accordance with the Islands Act, the Program of Sustainable Development is prepared. On the basis of this Program, it is possible to obtain loans at more favourable terms than those at the market. In addition, the Government prepares national development programs for the islands, which among other things include water supply and disposal of island wastewater.

The Investments Promotion Act provides the possibility of using tax and customs privileges for newly established companies carrying out specific activities (such as new companies holding the concession rights for municipal service activities, for example).

Also, in the areas of particular national concern, in accordance with the program of reconstruction of such areas, it is possible to implement more favourable investments in infrastructure, which may influence the final price of water in such areas.

2.6.1 The Water Protection Charge

The Water Protection Charge is fully defined in the Water Management Finance Act (NN 107/95, as amended by NN 19/96 and NN 88/98), and summarized below:

Payments for water protection are made for contamination and pollution of water resources. The funds collected by these payments are used for financing of protection of water resources, as follows:

- Preparation of Water Protection Plans and their implementation
- Recording and establishing the quality of water resources and undertakingmeasures for their protection
- Building of water protection facilities

In addition, the funds are used for proportional participation in financing the expert, administrative and other activities in water system management, considered as public service.

Payments for water protection are made by legal and physical persons discharging wastewater or other substances contaminating water or deteriorating their quality and usability. The water protection payments are accounted by legal persons performing water supply activities as per the quantity of distributed water, and these payments are made by the owners and users of apartments and business premises with a connection to the water supply system, except by those discharging contaminated industrial wastewater. These legal persons keep the collected payments on an internal transfer account and remit them to Croatian Waters as determined by the State Water Directorate. The legal persons collecting payments for transfer to Croatian Waters are entitled to a fee in the amount not exceeding 5% of the payment collected in accordance with a contract entered into with Croatian Waters.

The payments for water protection are made as per the quantity of discharged wastewater and by the degree of impact on deterioration of quality and usability of the water (quantity of discharged dangerous substances, impact on the deterioration of quality, etc.).

The amount of payment for water protection is determined by the government of Republic of Croatia. The unit charge in principle cannot be less than the price of wastewater purification (except for the payments made by the users purifying the water with their own purifiers), but in practice this principle is rarely applied.

The water protection payments from the persons discharging contaminated (polluted) industrial wastewater and from the users of apartments and business premises without a connection to the water supply system are accounted by and made to Croatian Waters.

Water Protection charge payments made to Croatian Waters in year 2000 were as follows:

Table 4 Payments of Water Protection Charge in Croatia

Source	Billed HRK	Collected HRK	Balance HRK
W & S Companies	161,442,448	139,252,758	22,189,690
Industrial & Other Users	95,282,849	46,311,536	48,971,313
Total	**256,725,297**	**185,564,294**	**71,161,003**

As can be seen from the foregoing, the collection efficiency for payments through the W & S Companies was 86%, that of the industrial and other users paying directly to Croatian Waters was only 49 %, giving an overall collection efficiency of 72%.

Contributions of W & S Companies amounted to about 60% of the total billed and 75% of the amount collected. Although the balances are, in theory, collectable and subject to penalties for late payment, the Croatian Waters recorded the amount outstanding at the end of year 2000 to be HRK 448,083,966.

However, the figures given are running totals and do not necessarily reflect the true collection efficiency, although the figures may be considered indicative since the debt to Croatian Waters is increasing on year.

Figures for the Sava Basin, excluding Zagreb for year 2000 were as follows:

Table 5 Payments of Water Protection Charge in the Sava River Basin

Source	Billed HRK	Collected HRK	Balance HRK
W & S Companies	20,886,471	18,872,089	2,014,382
Industrial & Other Users	25,443,999	12,832,465	12,611,533
Total	**46,330,470**	**31,704,554**	**14,625,915**

2.6.2 Central Financing of Infrastructure Development

The users of sewerage collector mains, wastewater treatment plants, submarine collectors with corresponding facilities, retention basins, collector overflows, pumping stations, etc. may use

preferential loans (with a lower interest rate than commercial loans) from Croatian Waters provided for water pollution control and included in the annual Water Management Plan, under the conditions that that they provide their own contribution of minimum:

(i) 25% in areas of particular national concern
(ii) 30% on Adriatic Islands
(iii) 35% in towns and municipalities where the development of public sewerage is less than 30%
(iv) 50% in other towns and municipalities

The burden of the local cost contribution is shared between the local government and the company providing water and sewerage services, in accordance with the affordability of the parties. The amount of contribution from the town and municipal companies must be considered separately for each individual case in accordance with the ability of each municipal authority to obtain a long-term loan. Since the companies are wholly owned by the local authorities, there is no distinction between local government and the municipal company when considering the percentage of the local budget contribution to project financing.

3 PRODUCT QUANTITY AND QUALITY

Table 6 Water Use in Croatia

Average annual water use in Croatia from 1990-1999	635 million m^3
- public water supply	278 million m^3
- industrial purposes - company executed abstraction	75 million m^3
- cooling water	205 million m^3
- other	77 million m^3
Population connected to public water supply	3,286 million m^3
Specific water consumption from public water supply systems	232l/per capita/day
Total leakages in water supply systems	46%
Percentage of groundwater in water quantities abstracted for water supply	86 %
Percentage of surface waters in water quantities abstracted for water supply	14 %
Population supplied from public water supply systems	
- in 1990	62 %
- in 1992 (decrease due to war-related destruction)	51 %
- in 2000	75 %
Amelioration areas	
- with favourable natural conditions for amelioration	620,000 ha
- with constructed amelioration systems	13,290 ha
Surface of freshwater fisheries in the Sava, Drava and Danube catchment areas	13.110 ha
Available, technically usable hydropower potential of the Republic of Croatia	12.00 TWh/year
- used hydropower potential in 17 conventional hydropower plants	5.5 TWh/year
- economically and ecologically profitable portion of unused hydropower potential	3.50 TWh/year
- hydropower potential without economical or ecological profitability	3.00 TWh/year

Table 7 Protection of Water and Sea from Pollution and Contamination

Total number of locations for monitoring the quality of sufrace waters, groundwater and the sea	704
- surface waters	239
- groundwater	183
- sediment	8

- coastal waters	68
- special programs	206

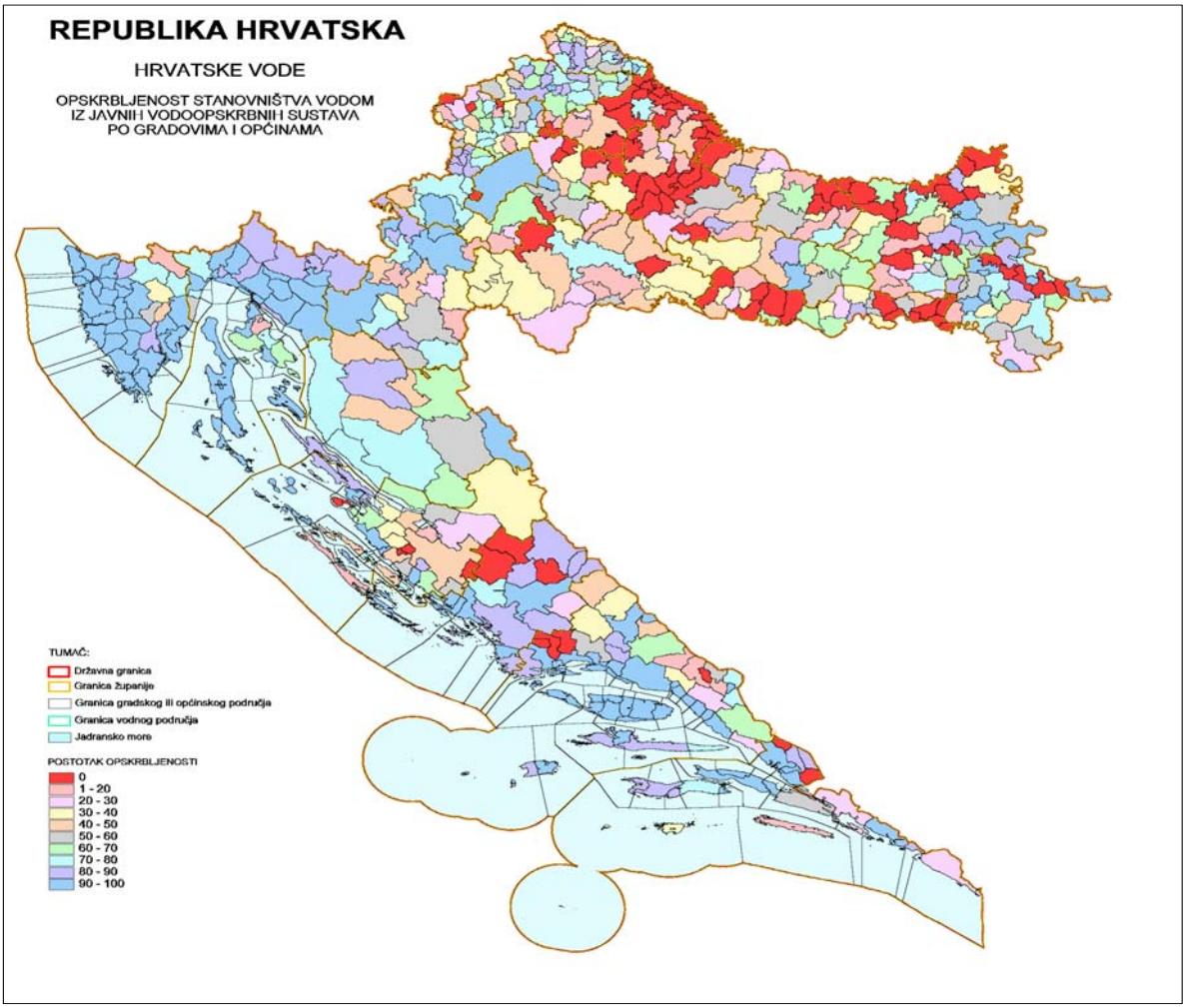
Surface waters and sea water quality trends

Due to the reduced industrial production since 1999 a trend of quality improvement of surface waters has become evident. Water quality of large watercourses complies with the majority of key parameters prescribed for the category, with the exception of segments downstream of largest sources of pollution. Small local watercourses in their upstream segments are mostly satisfactory with regards to prescribed category, which is not the case with lowland watercourse sections.

In karst regions water quality in spring areas is satisfactory for prescribed category, except in unfavourable hydrologic conditions. Sea water quality is mostly satisfactory for prescribed water categories I and II, except for areas along wastewater discharges of large polluters. Measured average values of BOD_5 are mostly satisfactory for water quality categories II and III.

Table 8 Monitoring and Level of Wastewater Treatment

Total number of locations for monitoring wastewater and point source pollution	1730
- municipal wastewater	201
- industrial wastewater	1529
Constructed municipal wastewater treatmet plants (2.230.820 PE)	67
- mechanical treatment	17
- mechanical - biological treatment	27
- mechanical treatment with long submarine outfall	22
- constructed wetlands	1
Households connected to public sewerage systems	40-50%
- percentage of mechanically treated wastewater	10.5%
- percentage of mechanically-biologically treated wastewater	3.8 %
Some importat ecosystems in water basins	
- Plitvice Lakes National Park	
- Krka River National Park	
- Lonjsko Polje and Mokro Polje	
- Kopački Rit	
- Lower Neretva River	
- Crna Mlaka Fish Ponds	


REPUBLIKA HRVATSKA
HRVATSKE VODE
OPSKRBLJENOST STANOVNIŠTVA VODOM
IZ JAVNIH VODOOPSKRBNIH SUSTAVA
PO GRADOVIMA I OPĆINAMA
TUMAČ:
Državna granica
Granica županije
Granica gradskog ili općinskog područja
Granica vodnog područja
Jadransko more
POSTOTAK OPSKRBLJENOSTI
0
1 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100

4 ECONOMIC DATA

4.1 Prices at Various Points in the Production

Water use charges are calculated based on the tariffs (No) set by the Government of the Republic of Croatia, quantity of water used, and a series of correction factors that reflect the intended use of water.

Charges (No) per 1 m^3 of water (depending on category) are given below:

- Category I HRK 0.80, EURO 0.10
- Category II HRK 0.72, EURO 0.09
- Category III HRK 0.56, EURO 0.07
- Category IV and V HRK 0.32, EURO 0.04
- Mineral and thermal waters HRK 1.60, EURO 0.21

Since it's introduction in 1990 until recently, basic tariff of water use charges was linked to Deutsche Mark, so the currency change (from former Yugoslav dinars into Croatian kunas) and inflation did not affect the relative amount of the tariff. Water Management Financing Act from 1995 confirmed previous regulations on the basic charge tariffs, so they in fact did not change during the past 10 years. With the low inflation rates in the recent years (since the tariff is no longer linked to German currency), and due to generally low purchasing power and weak economy, there were no attempts to raise the level of the tariff.

4.2 Water Price Structure - Tariffs

Based on the above data, the following table illustrates structure of water prices paid by consumers connected to the public water supply and sewerage system in several Croatian cities.

Table 9 Water Price Structure in Selected Cities in Croatia (2000)

Water price component	1	2	3	4	5	6	7
municipal service for water supply	2.41	1.15	1.10	2.04	2.90	1.81	1.17
VAT 22%	0.53	0.26	0.24	0.45	0.63	0.40	0.26
municipal service for sewerage	0.61	0.50	0.33	0.68	0.30	0.61	0.46
VAT 22%	0.13	0.11	0.07	0.15	0.07	0.13	0.10
development of infrastructure	0.57	0.42	0.94	3.44	-	0.16	1.70
water user charge	0.80	0.80	0.80	0.80	0.80	0.80	0.80
water protection charge	0.90	0.90	0.90	0.90	0.90	0.90	0.90
water use concession charge	0.08	0.08	0.08	0.08	0.08	0.08	0.08
TOTAL per 1 cu.m. HRK	**6.03**	**4.22**	**4.46**	**8.54**	**5.68**	**4.89**	**5.47**
TOTAL per 1 cu.m. EURO	**0.78**	**0.55**	**0.58**	**1.11**	**0.74**	**0.64**	**0.71**

Cities: 1 Rijeka, 2 Zagreb, 3 Varaždin, 4. Osijek, 5 Gospić, 6 Đakovo, 7 Split.

(1 EURO =7.7 HRK)

Source: Survey of the State Water Directorate

4.3 Water Protection Charge

The basic tariff (T) for 1 m^3 of discharged wastewater is 0.90 HRK (0.12 EURO). The amount of water protection charge for discharged water is calculated according to the following formulae:

a) For wastewater discharged into public sewerage system (communal and/or industrial wastewater), or into natural recipient:

$$N = T \times V \times k_1 \times k_2 \quad (1)$$

b) For discharged wastewater, which was used in the cooling process, into natural recipient:

$$N = T_{\Delta t} \times V_t \times \Delta t \quad (2)$$

c) For wastewater discharged into natural recipient when communal and industrial wastewater is mixed with wastewater used in the cooling process:

$$N = (T \times V \times k_1 \times k_2) + (T_{\Delta t} \times V_t \times \Delta_t) \quad (3)$$

The factors in equations (1), (2) and (3) mean:

N = amount of charge

T = charge level or tariff per cu.m. of discharged wastewater, set by the Ordinance of the Government of Republic of Croatia (0,9 HRK, EURO 0.12)

$T_{\Delta t}$= charge level or tariff per cu.m. of wastewater used for cooling, as determined by the Ordinance of the Government of Croatia (0,0009 HRK, EURO 0.00012)

V = annual quantity of discharged wastewater in cu.m.

V_t = annual quantity of discharged wastewater used for cooling, in cu.m.

k_1 = coefficient reflecting the level of deterioration of water quality and suitability for use, calculated according to the formula:

$$k_1 = \left(\frac{B}{B_d} \times R + \sum_{i=1}^{n} \frac{OT_i}{OT_{di}}\right)^{0,5}$$

Where:

B = annual arithmetic mean of all measured values of five-day biochemical oxygen demand in mg O_2 /l in discharged wastewater

B_d = permissible value of five-day biochemical oxygen demand in mg O_2/l, determined by the water management permit

R = factor of biodegradability of released wastewater, calculated according to the formula COD_{cr}/ (2.5 x B), which is introduced only if higher than 1, and when wastewater is discharged into the public sewerage system. Exceptionally, it may be introduced in the case when wastewater is discharged into the natural recipient, and in accounting of the charge B = 250.

COD_{cr} = the annual arithmetic mean of all measured values of chemical oxygen demand in released wastewater, in mg O_2/l,

OT_i = annual arithmetic mean of all measured concentrations of i-th dangerous substance in mg/l in discharged wastewater

OT_{di} = permissible concentration of i-th dangerous substance in discharged wastewater, determined by the water management permit

k_2 = coefficient applied only when wastewater is discharged through the wastewater treatment plants into the natural recipient, which is:

0.70 - For wastewaters discharged through a wastewater treatment plant with the first stage of treatment, or through plants with a corresponding level of treatment with a submarine outfall

0.30 - For wastewaters discharged through a second stage treatment plant with sludge processing and disposal, or through a first stage treatment plant with submarine outfall and disposal of sludge

0.20 - For wastewaters discharged through a third stage treatment plant, with sludge treatment and disposal

Δt = Difference of arithmetic means of measured values of wastewater temperature at discharge and measured values of temperature at the intake, during one year.

Coefficient k_1 is a cost-recovery instrument, and its value is proportional to the actual level of pollution of the discharged wastewater. K_1 is equal to 1 for communal wastewater and other effluents that are not subject to wastewater permits. The coefficient is calculated based on the actual (measured) values of water pollutants against their values given in the effluent permit[1].

Coefficient k_2 on the other hand is an incentive instrument, aimed to stimulate polluters to discharge wastewater thorough the plants with full-scale treatment - mechanical, biological and chemical. However, incentive function of the coefficient may be fulfilled only if the basic water protection tariff (currently 0,9 HRK/m^3) is set on a realistic level and if it represents the actual costs of necessary water treatment.

By being the subject to the same regulations as water use charge, the relative amount of the water protection charge has not changed during the last decade.

Following formulas are used in calculating water user charges:

For water delivered through water supply system, for technological purposes with user's own abstraction, and for abstraction of water for cooling processes

$$N = N_o \times V_1$$

Where:

N = the amount of charge

N_o = tariff depending on water category

V_1= quantity of water in cu.m. used in the accounting period

a) For water abstraction or pumping by the user's plant, when water is used for fish-farming

$$N = 0.05 \times N_o \times V_2$$

Where:

N = amount of charge

N_o = tariff depending on water category

V_2 = quantity of water used expressed as the volume of fishpond, in cu.m.

b) For irrigation:

$$N = N_1 \times V_3 \times k$$

Where:

N = amount of charge

[1] The permissible concentrations of dangerous substances are defined in the effluent permit, which is issued by either county authorities or Hrvatske vode, with the consent of State Water Directorate.

N_1 = tariff determined, in this case, by the municipal assembly

V_3 = quantity of water used in the accounting period

k = correction coefficient determined by the county assembly;

Correction factor k is designed in such a way as to reflect the level of development of the irrigation system. Its rationale is to stimulate the application of more efficient irrigation systems, and thus the more efficient use of water. However, due to bad conditions in the agricultural sector, and low collection efficiency, a number of municipal assemblies decided not to implement this charge.

c) For water used for electricity generation

$$N = N_2 \times E$$

Where:

N = amount of charge

N_2 = level of charge per 1 KW h (7.5% of the price of KWh at plant gate)

E = quantity of electric energy produced in the accounting period

d) For water which is used as plant driving power

$$N = N_2 \times S$$

Where:

N = amount of charge

N_2 = level of charge per 1 KWh

S = total plant power in KW

4.4 Concession charge

The annual charge paid for concession is:

1. for water abstraction for public water supply - 10 percent of the water user charge, which is 0.08 HRK (EURO 0.01) per cu.m. of water;
2. for water abstraction for selling on the market - 2.5 percent of revenues from water sale;
3. for pumping of mineral and thermal waters, 10 percent of charge for use of such waters which is 0.16 HRK (EURO 0.02) per cu.m;
4. for pumping of mineral waters for the market, 2.5 percent of revenues from the sales;
5. for irrigation, 10 percent of the water user charge;
6. for the use of water power for generating of electric energy, the annual charge is 1 percent of actual average price of energy at plant gate;
7. for the use of water power for plant driving, 1 percent of revenues from the activity for which the plant is used;
8. for fish-farming, 15 percent of estimated value of total fish catch in one year.

Concession charges described above were set in 1996, and have not changed since.

5 INFRASTRUCTURE

Data referring to water consumption in Croatia exists within official data of Croatian Waters. These data are collected for the purpose of calculating the water management charges (water protection, water use and concession charges). The second source of the data related to the water consumption is official statistical data of the National Statistical institute.

Prior to 1998, municipalities were not obliged to report data on total abstracted water, so water supply statistics were kept in a different way. Since two years ago, municipalities report data related to abstracted water (volume of water metered on the actual place of the water intake, or volume of water which enters water supply system), but the data collection is still not entirely smooth and efficient.

According to the present calculations, leakages from the public water supply system were estimated at 46% in 1998, and at 43% in 1999. The figures represent difference between abstracted and delivered water, and are mainly attributed to the old age of the water supply pipelines and equipment. Another factor influencing high leakages is a considerable number of illegal connections to the water supply network. War damages of the water supply facilities, poor maintenance and low-quality materials also play a role in the water losses accounting to nearly half of the abstracted water.

When all the categories of water supply are taken into account (PWS, industry's own abstraction, cooling water and others), leakages are estimated at 25%.

The percentage of population with the access to PWS was 62% in 1991. Over the last 10 years, Percentage of population with the access to PWS rose steadily and reached 73% in 2000. However the level of water supply is still not satisfactory. The reasons for this can be found in water supply constraints such as inadequate capacity of water sources, and incomplete or non-satisfactory development of water supply system. Damages caused by the war additionally worsened the existing problems in water supply.

When the data on the water delivered through the PWS is compared with the share of population with access to PWS, two opposite trends are observed: decrease in the consumption of water delivered through PWS (311 mill m^3 in 1991, 276 mill m^3 in 1999), and an increase in the percentage of population with the access to PWS (62% in 1991, 73% now). The main explanation for this is drastically reduced water consumption of the industrial sector, due to reduced level of industrial operations in the country. At the same time, a slight trend in the reduction of per capita domestic water consumption is observed. Both of these two factors are offsetting the effects of the increased share of population connected to PWS, and resulting in decreased total water consumption during the last 10 years.

Equipment for metering of the water delivered to households exist in 59 out of 130 Croatian municipalities that have registered service companies dealing with water supply and wastewater (data from 1998).

Water consumption is mainly metered by block of flats, or by single-family houses. The bill paid by block of flats is divided by number of persons in the block, and does not reflect the actual water use of the individual household. In the case of the single-family houses the bill is paid by the house and in the some cases can reflect the actual water use of the individual household.

In the last few years, municipalities in larger cities allow installation of meters in each flat. There is no particular official standpoint related to this issue, and if there are specific requests for installation of individual metering equipment, there are usually approved. Generally speaking, individual metering equipment in the big apartment building is still rare. The metering system is volumetric.

Some of the municipalities where there is no metering equipment, for example, determine minimal volume of water per inhabitant, which is used for further calculations (for example 5 m^3/inh/month).

The following table presents the share of population with access to sewerage and public wastewater treatment facilities. It also gives share of population (in different regions) with access to primary and secondary wastewater treatment for 1996 and 1999.

Table 10 Share of Population with Access to Sewerage and Public Wastewater Treatment Facilities

River basin	Number of inhabitants (rough figures)	Year	Connected to public sewer network		Connected to primary treatment plants		Connected to secondary treatment plants	
			No. inh.	%	No. inh.	%	No. inh.	%
Sava	2,340,000	1996.	1,169,700	50.0	20,700	0.9	80,300	3.4
		1999.	1,239,900	53.0	20,700	0.9	80,300	3.4
Drava and Danube	910,000	1996.	425,000	46.7	25,000	2.7	49,300	5.4
		1999.	427,000	46.9	25,000	2.7	65,300	7.2
Littoral and Istrian	599,000	1996.	320,000	53.4	230,000	38.4	13,500	2.3
		1999.	344,900	57.6	252,000	42.1	22,000	3.7
Dalmatian	937,000	1996.	380,000	40.6	180,000	19.2	9,500	1.0
		1999.	468,500	50.0	205,600	21.9	12,000	1.3
Total Croatia	**4,786,000**	**1996.**	**2,294,700**	**47.9**	**455,700**	**9.5**	**152,600**	**3.2**
		1999.	**2,480,300**	**51.8**	**503,300**	**10.5**	**179,600**	**3.8**

Source: Croatian Waters

The typical sewage system is combined. Only a few smaller cities and residential districts of bigger towns have separate systems. Industrial wastewater is often discharged into the sewerage system, in many cases without adequate pre-treatment. In terms of treatment facilities, Croatia is under-equipped. The bulk of the wastewater undergoes primary treatment only. Since construction of wastewater treatment plants was made priority a few years ago, many municipal facilities have been or are being built.

As shown in Table 10, the share of population connected to public sewerage and wastewater treatment plants is considerably higher in Littoral and Istrian river basin, than in any other region of Croatia. This is due to the fact that boundaries of this river basin coincide with the most developed part of Croatia, which has long developed a systematic approach in dealing with wastewater. At the same time, the price of water paid in the counties of this river basin is significantly higher than the average price of Croatia, i.e. more funds are available for the investment in wastewater treatment plants/sewage system.

Due to the already mentioned weaknesses in keeping water statistics in Croatia, and relatively low penetration of metering equipment, data on per capita (or household) water consumption is not readily available. This report therefore looks into couple of different methods for calculating average water consumption

As already explained, water consumption has a decreasing trend due to the large decrease of water consumption by the industrial sector. Based on the above calculation method, this in fact means that the total quantity of consumed/abstracted water fell from 232 m^3 per person per year in 1985, to 170 m^3 in 1995. The downward trend continued in the second half of the 90's, with the following average consumption figures: 1996 - 167 m^3 per person; 1997 - 165 m^3 per person; 1998 - 166 m^3 per person.

Another method takes into account domestic water consumption, and divides the quantity of invoiced water with the number of users. The average consumption calculated in this way is 60 m^3 per user per year, where user is not a single person, but the holder of the water bill.

6 MANAGEMENT UNITS

6.1 Types of Management Units

The Municipal Services Act (NN No. 36/95), which defines the municipal activities, includes, among others, water supply and wastewater disposal services. Municipal services may be carried out by either or among the following entities:

1) A company founded by one or several local administration units
2) A public institution founded by a local administrative unit
3) A service plant, established by one or several local administration units
4) A legal entity or a person subject to concession agreement

Presently, private companies provide most of the municipal services (wastewater disposal). There are about 130 such companies located in the larger urban areas. Privatization of municipal service companies has been carried out under the Municipal Services Act.

When municipal companies are formed, they are usually established as limited liability companies (d.o.o.), with local administration unit(s) as founders and owners.

Local Administration Units must hold at least 51% of the shares, with the remaining shares available for other private entities. No one from the private sector has yet bought into these companies since their financial situations are unattractive to investors.

The municipal companies are the owners of the assets, and if others buy in, their ownership would be in proportion to their shareholdings.

It is essential to ensure that the water and sewerage companies have the institutional as well as the financial capacity for the operation and maintenance of the enhanced sewerage systems.

The formation of private municipal companies has lead to many municipal services,in addition to water supply and sewerage, being transferred to the new limited liability companies (d.o.o.) There are some comapnies that provide water, and sewerage services only. The remaining companies are communal service companies that provide a range of other services from gas supply and solid waste disposal to open air markets and cementery maintenance.

In the interest of economy, there is logic to the sharing of financial and management services, and to group together environmental and other services, which can share both labor and transport. However, as the sewerage network expands and the treatment plants come on stream, there will be need for a dedicated management team and labor force for the water supply and sewerage services.

It is recommended that the whole policy regarding the services to be provided by a municipal company be re-assessed nationally, particularly where large sewerage (and water supply) projects are planned.

6.2 Management Unit Services Areas

Due to the increasing standard of living and the reflashing of tourism we see and expect a further increasing water demand. The water supply penetration through public networks increased from 53% in 1991 to 68% in 1995 and to 73% in 1999 and should reach 95% in 2015. The network length in 1998 was 24,596 km.

Table 11 Basic Data of Water Supply (2000)

Indicator	Unit	Value
Population supplied with piped water	Thousand	3,125
Population supply penetration 1999 (% of total population)	%	73
Specific water demand	L / capita, day	205
Total water consumption household	Mil m^3 / y	190.317
Total water consumption industry	Mil m^3/ y	139.006
Length of water supply networks	km	24,596
Water losses	%	43

It is recommended that the municipal companies that provide a variety of services, form a separate water supply and sewerage department to cope with the proposed expansion to the sewerage system and the construction of treatment plants. Water and sewerage form and integral system and their operation, maintenance and development must be compatible.

Such a department should have one (1) manager for the technical and financial operations of both the water supply and sewerage sections, sharing the services of plant and vehicles, the laboratory, etc. The sewerage section should have units for drainage, the sewerage network, and the treatment plant.

There must be a Management/Finance/Administration structure to support the technical services of the water supply and sewerage units within the new combined department. Whereas it is desirable for the department to have its own finance and administration section, this may not always be possible, particularly in the smaller companies.

However, it is essential that any finance department providing services to a number of departments has a separate cost center for water supply and sewerage accounts, a sound billing system and be able to provide essential statistical information.

6.3 Population Served

It is important to point out that the war (1991-1995) had a tremendous impact on the population distribution and the number of inhabitants (forced migrations, refugees, displaced persons, ethnic cleansing, etc). Population movements particularly affected Eastern part of the country, but the demographic situation changed for the whole country as well. For example, mid-year population estimate of the Statistical Information 2001 gives a figure of 4,437,000 inhabitants.

Share of agricultural population in 1991 was 8.,56% (409,647 inhabitants), while there is no precise data on the ratio of rural/urban population. A 1997 estimate stated that rural population in Croatia accounted for 20-30 % of the country's population.

Data referring to water consumption in Croatia exists within official data of Croatian Waters. These data are collected for the purpose of calculating the water management charges (water protection, water use and concession charges). The second source of the data related to the water consumption is official statistical data of the National Statistical institute.

Although the data on water consumption is fairly well kept, some estimates are still necessary. These estimates are included in Table 12, presenting total water supply in Croatia for the year 1985, and the period 1990-1999.

Table 12 Total Water Supply in Croatia (in mill m^3)

Type of consumption	Years										
	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Public water supply system	368	338	311	319	315	276	272	296	292	289	276
Industry (not connected to public supply system)	129	111	87	79	69	97	86	56	54	55	52
Cooling water	310	251	127	203	205	210	215	210	210	212	211
Other	80	79	75	77	77	78	78	77	77	78	77
Total	**887**	**779**	**600**	**678**	**666**	**661**	**651**	**639**	**633**	**634**	**616**

Source: Gradjevinski godisnjak; dr.sc. Dragutin Geres + Croatian Waters data

Figures given for *public water supply (PWS) system* refer to delivered (i.e. invoiced) water, both for domestic consumption and industry. Leakages (estimated as a difference between abstracted and delivered water) are not included.

Industry (not connected to public supply system) gives data on the water consumption of the industrial sector through own abstraction of groundwater and surface water). Once again, leakages are not included.

Volume of the *cooling water* is derived form the data used for calculation of water management charges.

Finally, category *others* gives an estimated volume of water used for domestic or industrial purposes that does not fall under any of the previous categories.

As presented in the next table, domestic consumption accounted for 56 (59)% of the PWS in 1998 and 1999 respectively. The share of the domestic consumption has risen significantly in comparison with the early '90s, when it accounted for some 40% of the PWS.

Table 13 Domestic Water Consumption in the Total Public Water Supply (mill m^3)

	1998	**1999**
Total public water supply	289	276
Domestic consumption	162	162
Share of domestic consumption in PWS (in %)	56.06	58.7

Source: Gradjevinski godisnjak, Croatian Waters, dr.sc. Dragutin Geres

Prior to 1998, municipalities were not obliged to report data on total abstracted water, so water supply statistics were kept in a different way. Since two years ago, municipalities report data related to abstracted water (volume of water metered on the actual place of the water intake, or volume of water which enters water supply system), but the data collection is still not entirely smooth and efficient.

Due to the already mentioned weaknesses in keeping water statistics in Croatia, and relatively low penetration of metering equipment, data on per capita (or household) water consumption is not readily available. This report therefore looks into couple of different methods for calculating average water consumption

Household water price consists from the following items: basic price of water - price of municipal service, water use charge, water protection charge, concession charge, and tax. Both basic price of water and water management charges (water use, water protection and concession charges) are based on volume rates.

VAT rate of 22% is only applied to the basic price of water (price of municipal services).

Structure of the average price for household for $1m^3$ of delivered water is presented in the following table:

Table 14 Average Price for Household for $1m^3$ of Delivered Water (incl. Sewerage)

Price component	Charge
Municipal service for water supply	A
VAT 22%	22% A
Development of infrastructure	B
Municipal service for sewerage	C
VAT 22%	22% C
Water user tariff	D
Water protection tariff	E
Water use concession charge	F
TOTAL per 1 cu.m.	**A+22%A+B+C+22%C+D+E+F**

The above scheme applies to consumers connected to the public water supply and sewerage system.

Decreasing or increasing block schedule does not exist at the moment, and is not planned in the near future.

The exact data on the relation between the average water expanses paid by Croatian households and their income and other expenditures does not exist. Nevertheless, some comparison of water prices and household income can be made, based on the figures presented in this report so far, and official statistic.

If the annual consumption of $60m^3$ per user and the price of water are taken into account, an average domestic user in Croatia paid 293 HRK (or 38 EURO) water bill in the year 2000. According to the National Statistics Institute, the average net monthly salary for the same year was 3,055 HRK (397 EURO).

Data on the annual water consumption for industrial use is given below.

Table 15 Industrial Water Consumption in the Total Water Supply (mill m^3)

	1998	1999
Total water supply	634	616
Industry*	181	162
Share of industry (%)	28.55	26.3

Source: Construction Yearbook, Croatian Waters, dr.sc. Dragutin Geres

Figures refer both to the industrial water supplied through the public supply system, and own abstraction

6.4 Special Obligations

The State Water Directorate, Croatian Waters, and the Counties have the responsibility for the organization of physical and financial planning with respect to the detailed plans within their areas of jurisdiction. The operation and maintenance of water and sewerage facilities, and the setting of tariffs rest with the municipal companies under the jurisdiction of the local governments.

In order to avail themselves of the loans provided by Croatian Waters, the municipal companies should have both the institutional and financial capacity to operate and maintain the facilities. Further, they should have the financial resources to contribute to the project finance and service the loans from Croatian Waters.

For the success of the project, there is a need to amend the regulations in order to ensure that Loan Agreements between SWD/Croatian Waters and the Local governments/W&S Companies will contains conditions to ensure due performance of sewerage development contracts by the municipal companies.

6.5 Financial Conditions

The water supply and sewerage companies (W&S companies) collect water pollution charges from customers and remit the amount collected to (Croatian Waters) Croatian Waters is required to return 50% of this amount to the W&S companies for the construction of pollution control facilities (sewer networks and treatment plant). This is given in the form of an interest free loan over 50 years. Generally, the Local Government (LG) and the W&S company must match this amount with funds from their own budget. If the loan is not repaid, Croatian Waters becomes the owner of that proportion of the assets financed.

Since the National Water Master Plan is still under preparation, and the counties have not yet completed their Water Pollution Control Plans, there is no national financing strategy at present.

7 NATIONAL AND LOCAL REGULATION

7.1 National and Local Planning and Permitting

Water Management Master Plan

Medium and long term planning of sewerage facilities is difficult without a corresponding master plan fot he development of water supply systems. The Water Management Master Plan of Croatia is scheduled for completion by the end of 2004., and it should provide the basis for planning of all water related facilities. It is recommended that the Water Management Master Plan be completed as soon as possible.

County Water Polution Control Plan

The National Pollution Control Plan has been completed, and it introduces measures to ensure that Croatia's natural water bodies are protected from polution by both municipal and industrial wastewaters. The plan sets time horizons for the building of facilities and plant for wastewater treatment. However, the plan only sets the framework for general policy.

County plans for the construction of wastewater treatment plants are incomplete and it is recommended that the State Water Directorate and Croatian Waters take action to assist the counties with this task, on a basin-by-basin framework. This should include a strategy for the drawing upo of master plans with implementation schedules and financing mechanisms.

7.1.1 Data Collection

Each municipality periodically monitors sewage effluent and each industry periodically monitors industrial wastewater according to the government regulations, including frequency and parameters of analysis. Licensed laboratories perform the laboratory analyses and the results are submitted to Croatian Waters.

7.1.2 Activity Permitting

The permissible limits of major parameters of industrial wastewater discharged into natural receiving waters and public sewerage systems one prescribed in NN No 40/99 as amended by NN No 6/01

7.2 Economic Regulations or Limitations

Water Management Financing Act

This Act defines the source of funds and purposes for which they may be used and funds from each source may only be used for specific purposes. For example, the water protection tariff may only be used for the protection of water resources (including construction of sewerage system), and the water use tariff, on exploitation of water resources (including construction of water supply system).

Water Management Fund

The Water Management Fund forms part of the consolidated central government budget, and the financial plan is drawn up annualy by Croatian Waters (Croatian Waters) in consultation with the municipal companies providing water and sewerage services. The financial plan for the year 2000 shows the following major features:

Table 16 Income of the Water Management Fund (2000)

Income		Amount (10^3 HRK)	Rate (%)
1. Income From Fees	Water Use Tariff	210,000	14.5
	Water Protection Tariff	235,000	16.3
	Extraction of Sand & Gravel	3,000	0.2
	River Basin Fee	310,000	21.5
	Power Generation Charges	40,000	2.8
	Sub-total	798,000	55.3
2. Income from Government Budget		390,794	27.1
3. Income from Towns & Municipalities		27,000	1.9
4. Min. of Public Works Reconstruction & Development		33,500	2.3
5. Income from Power Generation		15,000	1.0
6. Sale of Croatian Privatization Fund Stock		85,000	5.9
7. Other Income		94,910	6.6
Total Income		**1,444,204**	**100.00**

Source: Croatian Waters

Table 17 Expenditures of the Water Management Fund (2000)

Expenditure		Amount (10^3 HRK)	Rate (%)
1. Running Costs	Operating Expenditure	203,000	13.5
	Carrying out of Obligations	545,650	36.2
	Sub-total	748,650	49.6
2. Capital Expenditures & Transfers	Investment for Tangible/Intangible Assets	25,000	1.7
	Investment for Pollution Control Facilities	77,600	5.1
	- National Waters		
	Investment for Water Supply Reconstruction & Development	357,694	23.7
	Investment for Water & Sea Pollution Control Facilities	238,265	15.8
	Investment for Water Management Design	61,000	50.4
	Sub-total	759,559	50.4
Total Expenditure		**1,508,209**	**100.00**

Source: Croatian Waters

Source of funds for government is the 22% VAT paid on the amount billed for water supply and sewerage services. This government source would not be enhaned by an increase in collection efficency. However, the municipal companies would benefit as they currently pay the tax on uncollected bills.

Source of funds for Croatian Waters is the Water Protection Tariff, which would be increased by improved collection efficiency. In addition, the level of the water pollution tariff should not be lower than the cost of wastewater treatment in accordance with the Water Management Financing Act. This tariff should be determined annually and enforced within the limitations of affordability.

Source of funds for the municipal companies is the chare, which should be set to cover the cost of operation, maintenance and development. Realistic charges should be set, again within the limitations of affordability. The sources of funds to the companies could be increased immediately by improved collection efficiencies, which would increase revenue for water supply as well as sewerage and also, increase the amount of water use tariff payable to Croatian Waters.

In order to improve collection, it is necessary for all municipalities to have by-laws to enforce disconnection for none payment. It also appears to be necessary to simplify the legal process to reduce time and costs for any neccessary court action.

To ensure the financial viability of projects, it is recommended that Croatian Waters should review its policy on the percentage of loans made available to municipal companies for development projects to minimize the loan charges to the municipal companies.

In addition, loan agreements between Croatian Waters and the municipal companies should include provisions for the attainment of collection efficiency targets for the setting of tariff levels necessary to meet financial obligations, and for the achievement of the appropriate wastewater effluent quality, etc.

The owners of the companies are the LG authorities, which decide policy and approve the charges proosed by the company. Hence, the companies are responsible to the LG and not Croatian Waters,with development being in line with LG aims and objectives.

Profit and Loss accounts usually show that income and expenditure is balanced, except when loan-financing charges are included which usually leads to a loss situation. O&M is generally limited to the amount of finance available rather than to a rational plan.

7.3 Environmental Regulations and Restrictions

National Water Protection Plan

The National Water Protection Plan issued in January 1999 (NN No. 8/99) includes definitions, plans, measures and others; namely, (i) Necessary research and monitoring of water quality; (ii) Categorization of water; (iii) Measures for water conservation; (iv) Measures for contamination emergencies of water; (iv) Plan to build sewerage facilities and sewage treatment plant; (b) Source and manner of financing the plan; and (vi) A list of legal and natural persons charged with carrying out the plan.

(a) Water Quality Monitoring

Water quality monitoring programs for national waters (national monitoring program) are drawn up and carried out by Croatian Waters. National waters are as listed in NN No. 8/99 and local waters are all other waters. A county water protection plan lays down the program for monitoring the quality of local water. The results of the monitoring are delivered to Croatian Waters and published together with the report on monitoring of the national water.

(b) Categorization of Water

The Plan contains the categorization of national waters, while categorization of local waters are contained in the county water protection plan.

The receiving waters for effluent are categorized in the Decree on Water Classification (NN No. 77/98) whose prescribed conditions have to be met. Water is clasified into five (5) types according to its quality that corresponds to the established conditions of its general ecological function and to the conditions of water use. The categorization of national waters has been completed, and that for local waters will be contained in the county water protection plans when issued.

(c) Limit Values of Wastewater Effluent Quality

For the protection of water quality and the environment, limit values of hazardous and other substances in the effluents of industrial wastewater and sewage tratment plant are prescribed by the Decrees issued by the State Water Directorate (NN No. 40/99, as amended by NN No. 6/01 for industrial wastewater and NN No. 40/99 for effluent from sewage treatment plant).

(d) Measures for Contamination Emergencies

The Plan contains measures for cases of exstraordinary water contamination and contamination emergencies. For Threat Level 1 (minor quantities of dangerous substance) and Level 2 (major quantities of dangerous substance), measures laid down in the county water protection plan are applied. In the case of Threat Level 3 (quantities of dangerous substances with possible cross-border consequence), the provisions of the National Water Protection Plan are applied.

(e) Sewerage Development Plan

The Plan sets up the implementation program in three (3) stages for the construction of public sewerage system and wastewater treatment plant; namely, short-term program up to 2005, medium term program up to 2010 and long term program up to 2025.

(f) International Agreements

Trans-boundary water issues are very important to Croatia. The National Water Protection plan includes water quality monitoring programs for cross-border watercourses, and these are subjet to treaties between the Republic of Croatia and neighboring states in connection with water industry relationships.

The national monitoring program on the Trans-National Monitoring Network (TNMN) for the Danube Drainage Basin is the program of the Permanent Commission f the Danube Protection Convention.

8 SOURCE USERS

The water of water supply system and the wastewater of sewerage system includes domestic, institutional and industrial (including commercial) wastewater, and groundwater infiltration. The wastewater of large industries is estimated individually. The wastewater of the remaining small industries is dealt as part of the municipal wastewater, as well as domestic and institutional wastewater.

(1) Design Unit Municipal Wastewater Quantity

(a) Unit Municipal Water Consumption

The existing domestic water consumption (household use only) ranges from 80 l/capita/day (lcd) to 170 lcd, mostly less than 150 lcd. It is nearly constant irrespective of the population size of town. However, domestic water consumption in the urban centers is larger than the above average value. Hence, the existing domestic water consumption in the objective sewerage development areas is assumed to be 170 lcd.

On the other hand, the unit municipal water consumption (including domestic, institutional and small industry uses) increases according to the population size of town. The unit municipal water consuption is classified into 190 lcd for towns with less than 10,000 inhabitants and 230 lcd for towns with 10,000 population or more.

The future unit municipal water consumption will increase according to the improvement of living standards. The annual growth rate is assumed at 2%.

(b) Unit Municipal Wastewater

Most of the consumed municipal water returns to the sewerage system. The unit municipal wastewater is estimated from the unit municipal water consumption on the assumption that the return rate is 80%.

(c) Municipal Wastewater Fluctuation

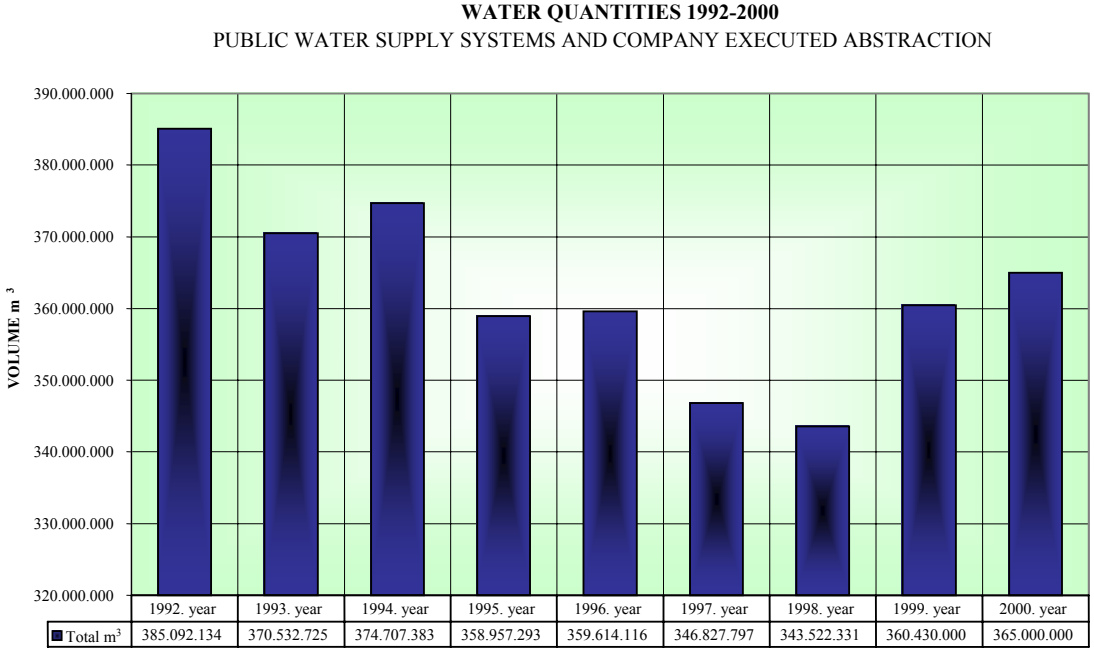
The wastewater flow seasonally fluctuates throughout the year. Therefore, the capacity of treatment plant is usually designed to meet the daily maximum wastewater flow in the month when the largest water consumption occurs. The daily maximum ratio (ratio of the daily maximum in the largest consumption month to the daily average) in the towns is in the range of 1.10 and 1.30. The daily maximum ratio is assumed at 1.30 for safety. The wastewater flow also hourly varies. Therefore, the capacity of sewer and pump is designed to meet the maximum hourly wastewater flow.

(d) Groundwater Infiltration

Groundwater infiltration is usually expressed as a ratio of the infiltrated groundwater to the municipal wastewater quantity.

Table 18 Public Water Supply

	Unit of measure	1998.	1999.	2000.
Volume of water used	'000 m^3	356,664	323,701	314,089
Length of watermains	km	7,312	7,335	7,335
Length of distribution network	km	24,596	24,689	24,792
Water connections	number	874,703	877,668	878,499



Source: Croatian Waters

Table 19 Public Sewage System

	Unit of measure	1998.	1999.	2000.
Wastewater - total	'000 m^3	287,803	258,608	257,901
Purified wastewater	'000 m^3	87,796	88,785	86,579
Unpurified wastewater	'000 m^3	200,007	169,823	171,322
Total length of sewage network	km	5,093	5,236	5,368
Length of main sewer	km	1,121	1,201	1,069
Sewage connections	number	294,210	303,532	318,658

Source: Statistical Yearbook of Republic of Croatia

Systematic control of water quality in all well fields, inflow area and water supply structures guarantee quality portable water supply in compilance with appplicable regulations in the future.

9 POLICY ISSUES

9.1 Policies

The economic and political processes in the country were also reflected on municipal water management, in particular in the field of water pollution control. Stopping on reduction of operation of some industrial plants resulted in reduced pollution in temporary improvement of surface water quality. At present the main problem in water pollution control is the insufficient number of treatment plants for municipal wastewater from public sewerage systems. Such problems are at present the priority in solving of water pollution control issues in the Republic of Croatia, and for this purpose it is necessary to provide large financial means to cover the requirements from its own sources but before that it will be to look for funds through International loans, will be necessary to prepare *tariff reforms* and *effluent charge reforms* which we use in case study with spread sheet modul.

The strategy of water and water protection from pollution is defined by document State Water Protection Plan (NN8/99). The Plan contains:

- required research and analysis to water quality;
- water categorisation (planned water quality in a given area - sensitivity of the area);
- water protection measures;
- emergency measures for cases of sudden and accidental pollution;
- plan of construction of wastewater treatment plants larger than 50,000 population equivalent (PE);
- sources of financing;
- list of persons and entities in charge of enforcement of the Plan, their rights and responsibilities.

At the county level, water protection plans are also prepared. The county plans have the same contents, and are adjusted with the state plan, elaborating in detail parts of procedures in cases of emergency or accidental pollution, as well as provision of financial resources for construction of water protection facilities. While State Water Protection Plan is a strategic document, county plan is an implementation document for the territory of the particular County.

The funds for water protection and, consequently, for the implementation of the above plans, come exclusively from the water pollution charges which are, with respect to the problems of water pollution in Croatia, insufficient.

For the purpose of water protection against pollution, the law provides that the charge (tariff) for water protection should not be lower than the costs of wastewater treatment. However, a recent assessment carried out by Croatian Waters experts indicated that the presently paid tariff is four times lower than the actual costs of wastewater treatment. Yet the existing level of basic tariff (and resultant water protection charge) is maintained, mainly due to the general status of the national economy.

The underrated and unrealistic level of water protection charge is also the cause of the prevailing attitudes towards the wastewater treatment. Given the fact that levied charges are several times lower then full economic and environmental costs of water pollution, everybody is motivated to maintain the status quo, rather then to invest into new wastewater treatment plants. In addition, small number of existing wastewater treatment plants considerably increases the water price for those connected to them. The other users who have not built any treatment plants enjoy considerably lower price of water, and it is more convenient for them to pay the unrealistically low charge.

9.2 Policy Evaluation

Starting from the above, it will be necessary to review all legislation related to water management, adjust it to EU requirements and define the possible deadlines for fulfilment of commitments towards

EU, because the Republic of Croatia is oriented towards joining the EU. At present, the major problem in meeting these objectives is lack of funds. Also, it will be necessary, through international workshops, to educate young professionals for working in accordance with EU requirements, and to adjust water management to new approaches, in particular with regard to the environment and sustainable economic development.

In the EU, economic principles and the use of economic instruments have been gradually but clearly embedded into environmental policies. The Treaty now integrates the Polluter Pays Principle as a foundation of all European environmental policies. The Fifth Environmental Action Programme of the European Commission ending in 2000 has the broadening of the range of policy instruments as one of its top priorities. However, progress in the actual appliciation of economis instruments remains limited so far.

The Commission has advocated an increased role for pricing in enhancing the sustainability of water resources in the context of the proposed Directive establishing a framework for Community action in the field of water policy (or Water Framework Directive).

(1) Efficient water pricing acts as an incentive to reduce pollution and improve the efficiency of water use. Thus, it reduces the pressure on water resources and the environment, and it ensures available resources are efficiently allocated between water uses.

(2) As a result, water supply and treatment infrastructure can be more adequately sized. This means providing water services and protecting the environment more cost-effectively.

(3) It mobilises financial resources to ensure the financial sustainability of water infrastructure and service suppliers, and to pay for environmental protection.

It is argued that the lack of importance given to economic and environmental issues in designing existing water pricing policies, as opposed to more general social or development objectives, has led to current situations of inefficent use, over-exploitation and degradation of surface and groundwater resources.

Over the last few years, Croatia has put a lot of effort into enacting laws and regulations in the area of water management a special for these strategis:

Strategy name	Srategy Description	Comments/Concerns
Economic regulation	1. Price of municipal service Source of revenue for municipal service determined by the Municipal Services Act (includes the service, repayment of loans for construction of facilities and municipal infrastructure). It is determined by the provider of the municipal service, with the consent of the founder of the municipal company. 2. Water use tariff Source of revenue for financing of water management defined by the Water Management Financing Act (NN 107/95). The charge (tariff) is determined by the Government of the Republic of Croatia 3. Water protection tariff Source of revenue for financing of water management defined by the Water Management Financing Act (NN 107/95). The charge level (tariff) is determined by the Government of the Republic of Croatia. 4. Concessions on water and water estate Concession provides the right of use of water and water-related estate, i.e. the right to perform economic and other activities on water and water-related estate.	The economic analisys should be undertaken to aid decision-making in selecting programmes of measures for achieving the environmental objectives as well as to ensure transparency and informed decisions on the recovery of costs. Economics has to provide enough information to make assesment and justification of objective derogation, because of sustainable socio-economic activities and restrictions. In the case of Croatia, such derogations could be of special importance, due to less developed water uses and watere services, that need to be improved.
Environmental regulation	The strategy of water and water protection from pollution is defined by document State Water Protection Plan (NN8/99) which contains: - required research and analysis to water quality - water categorisation (planned water quality in a given area – sensitivity of the area) - water protection measures - emergency measures for cases of sudden and accidental pollution - plan of construction of wastewater treatment plants larger than 50,000 population equivalent (PE) - sources of financing - list of persons and entities in charge of enforcement of the Plan, their rights and responsibilities	Reduction of water consumption by increase in use efficency and reduction in quantity of wastewater leads to the protection of water rscources.

Strategy name	Srategy Description	Comments/Concerns
Policy regulation	The Ministries and State Directorates having direct influence on water sector policies through regulations proposed to the government of the Republic of Croatia are: The State Water Directorate In charge of all the activities related to water management Monitors and co-ordinates development of the water management system, while allowing for the needs of the overall economic development In charge of the measures for regulation of watercourses and other water bodies, protection from floods and ice, erosion and torrents, irrigation and drainage Other competencies include management and use of water-related estate, protection of water and sea from pollution, provision of adequate water supplies for population and industry, use of water power, planning and co-ordination of development and construction of public water supply and sewage systems, and inspection in the field of water pollution control Proposes to the Government of the Republic of Croatia the level of water use charge and water protection charge (tariff), which are the constituent parts of the total price of water delivered The Ministry of Environment and Physical Development The Ministry carries out administrative and other tasks related to the general policy of environmental protection, providing of conditions for sustainable development, protection of air, water, sea, flora and fauna in integrated interaction Agency for water management "Hrvatske vode" is a Government agency for water management The task of Hrvatske vode is to ensure permanent and unimpeded carrying out of public services and other tasks in water management in the scope defined by plans and in accordance with the available funds provided for the purpose under corresponding legislation	The integratedwater resources management ensures sustainable management of the water demand and development of water resources.

Strategy name	Srategy Description	Comments/Concerns
	Within its legal powers, Hrvatske vode passes administrative and other acts and makes decisions on issues important to water management: preparing of basic plans for water management, maintenance of water-related structures, protection from detrimental effects of water, water use, water pollution control, managing of public water estate, professional supervision and engineering in construction of water-related structures collection of funds for financing of such works and activities The seat of Hrvatske vode is in Zagreb - there are five water management departments: in Zagreb, for the Sava river basin, in Osijek for the Drava and Danube river basin, in Rijeka for the Istrian and Littoral basin, in Split for the Dalmatian basin and a further department in Zagreb for the catchment area of the City of Zagreb	

According to the strategy acts and the ensuing regulations, every municipality is responsible for provide tariff and charges effluents reforms with next evaluations:

Strategy name	Advantages		Disadvantages	
	Advantages	Evaluation	Disadvantages	Evaluation
Economic regulation	• large revenues • new investment • determined purpose	SUFFICIENT	• economic analsys • unpaid tariff • large water consume	
Environmental regulation	• data (quality, quantity) • save resource • transbounders effect	PROPORTIONATE	• lack of monitoring • lack of project documentation • pollution	
Policy regulation	• water management • the integrated water resource managament • planing	PRACTICAL	• political decisions • EU water framework • determine priority	

Recommendation:

There are enough resources all over the country, but there are lot of problems with water losses and old water network.

Due to this, big investments are needed and increase of tariffs and charges is necessary in the next years. However, they will not cover all investments so other founds will have to be included.

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7. Regulations on special conditions to be met by legal entities performing the wastewater disposal activity (NN 93/96)
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September 2004

ASSESSMENT AND DEVELOPMENT OF MUNICIPAL WATER AND WASTEWATER TARIFFS AND EFFLUENT CHARGES IN THE DANUBE RIVER BASIN.

Volume 2: Country-Specific Issues and Proposed Tariff and Charge Reforms: Croatia – Case Study

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WORKING FOR THE DANUBE AND ITS PEOPLE

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REGIONAL
PROJECT

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PREFACE

The Danube Regional Project (DRP) consists of several components and numerous activities, one of which was "Assessment and Development of Municipal Water and Wastewater Tariffs and Effluent Charges in the Danube River Basin" (A grouping of activities 1.6 and 1.7 of Project Component 1). This work often took the shorthand name "Tariffs and Effluent Charges Project" and Phase I of this work was undertaken by a team of country, regional, and international consultants. Phase I of the UNDP/GEF DRP ended in mid-2004 and many of the results of Phase I the Tariffs and Effluent Charges Project are reported in two volumes.

Volume 1 is entitled *An Overview of Tariff and Effluent Charge Reform Issues and Proposals*. Volume 1 builds on all other project outputs. It reviews the methodology and tools developed and applied by the Project team; introduces some of the economic theory and international experience germane to design and performance of tariffs and charges; describes general conditions, tariff regimes, and effluent charges currently applicable to municipal water and wastewater systems in the region; and describes and develops in a structured way a initial series of tariff, effluent charge and related institutional reform proposals.

Volume 2 is entitled *Country-Specific Issues and Proposed Tariff and Charge Reforms*. It consists of country reports for each of the seven countries examined most extensively by our project. Each country report, in turn, consists of three documents: a case study, a national profile, and a brief introduction and summary document. The principle author(s) of the seven country reports were the country consultants of the Project Team.

The authors of the Volume 2 components prepared these documents in 2003 and early 2004. The documents are as up to date as the authors could make them, usually including some discussion of anticipated changes or legislation under development. Still, the reader should be advised that an extended review process may have meant that new data are now available and some of the institutional detail pertaining to a specific country or case study community may now be out of date.

All documents in electronic version – Volume 1 and Volume 2 - may be read or printed from the DRP web site (www.undp-drp.org), from the page Activities / Policies / Tariffs and Charges / Final Reports Phase 1.

We want to thank the authors of these country-specific documents for their professional care and personal devotion to the Tariffs and Effluent Charges Project. It has been a pleasure to work with, and learn from, them throughout the course of the Project.

One purpose of the Tariffs and Effluent Charges Project was to promote a structured discussion that would encourage further consideration, testing, and adoption of various tariff and effluent charge reform proposals. As leaders and coordinators of the Project, the interested reader is welcome to contact either of us with questions or suggestions regarding the discussion and proposals included in either volume of the Project reports. We will forward questions or issues better addressed by the authors of these country-specific documents directly to them.

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Acronyms

AO - Anaerobic-Oxic Activated Sludge
AS - Activated Sludge
BOD - Biochemical Oxygen Demand
BOT - Build, Operate and Transfer
CW - Croatian Waters
DRB - Danube River Basin
GDP - Gross Domestic Product
GOC - Government of Croatia
HH - Households
HRK - Croatian Kuna (Kn)
ICPDR - International Commission for the Protection of the Danube River
KDR - Municipal Company Duga Resa (Komunalno Duga Resa)
LG - Local Government
MEPP - Ministry of Environmental Protection and Physical Planning
MU - Municipal Units
MWWU - Municipal Water and Wastewater Utility
NN - Official Gazette (Narodne novine)
O&M - Operation and Maintenance
RU - Regulatory Units
SU - Services Units
SWD - State Water Directorate
T-N - Total Nitrogen
T-P - Total Phosphorous
TSS - Total Suspended Solids
VAT - Value Added Tax (PDV)
VKK - Water Supply and Sewerage Company Karlovac (Vodovod i Kanalizacija d.o.o. Karlovac)

Exchange rate

The currency exchange rates used in this Case study are:
Local currency: HRK or Kn (Kuna)
HRK/EUR: 7.50
HRK/USD: 6.80

1 Introduction

1.1 Purpose of the Pilot Case Study

This report describes the recent history, current conditions, and planned development of the Karlovac and Duga Resa municipal water and wastewater utilities (MWWUs) in Croatia. This examination includes development of several sets of financial "accounts" that are used to make a broad examination of both the current balance sheet of Karlovac and Duga Resa MWWUs and the future financial implication of various investment programs and, of course, changes in the tariffs levied and effluent charges paid by the MWWUs and their customers. The purpose of this examination is to provide a more concrete background and specific insight for use in identifying and evaluating selected institutional and policy reforms connected to water and wastewater tariffs and effluent charges in Croatia. This is meant to complement the identification and discussion of some of these same institutional and policy reforms as contained in the accompanying National Profile Report.

Additionally, it was our purpose to illustrate availability of data for modelling of MWWU operations. In general, Croatian Waters compiles various water documents into a water book, a "Water Cadastre" and data on concessionaries. The Water Cadastre includes a cadastre of waters, a water building infrastructure cadastre, a cadastre of water abstraction and a cadastre on water protection. The last is an additional tool for water management in Croatian Waters and is not transparent for other users.

There is also a register of emissions into waters. All entities which have a water permit must provide Croatian Waters via the county offices with recorded information/data on the pollution they discharge.

Statistical data alone, however, would not be sufficient for case study development. Good cooperation with the case study municipal companies "Vodovod i kanalizacija" from Karlovac (VKK) and "Komunalno" from Duga Resa (KDS) has been imperative in securing proper data and information.

1.2 The Case Selected

As part of the activities of the ICPDR the Emission Inventory was prepared on the basis of commonly agreed criteria on the level of the Danube basin. All point sources of pollution in the Emission Inventory have thus become regionally important municipal point sources of pollution and the first priority on the national level.

Also, the Joint Action Programme (January 2001) as a basic document for the implementation of the "Convention on the Protection and Sustainable use of the Danube River" refers in part 3 to "... objectives and actions of the Joint Action Programme for the Danube River Basin include Karlovac as one of the projects in Croatia which should be completed by 2007.

In August 2001 the Study for Water Pollution Reduction on the Sava River Basin in the Republic of Croatia was completed by the Japan International Cooperation Agency (JICA), together with the State Water Directorate and Croatian Waters. As a result of this study, the Master Plan for Pollution Reduction was prepared as well as five feasibility studies for five cities. These five cities were selected on the basis of the Master plan as the most important municipal point sources of pollution. One of the five selected cities is the City of Karlovac.

The water and wastewater systems in Karlovac and Duga Resa were selected for the case study. The community of City Karlovac belongs to the five the most important municipal point sources of pollution. The community Duga Resa is located in the vicinity of Karlovac and there is a investment plan to connect wastewater services to Karlovac.

The sewerage systems of Karlovac and Duga Resa are independent at present. However, the two systems are planned to be integrated into one for the purpose of treating the wastewater of both towns at the central treatment plant proposed on the right bank of the Kupa River, immediately downstream

of Karlovac. Since the transport collector between Duga Resa and the treatment site is mostly completed, the existing systems of the two towns are described as one.

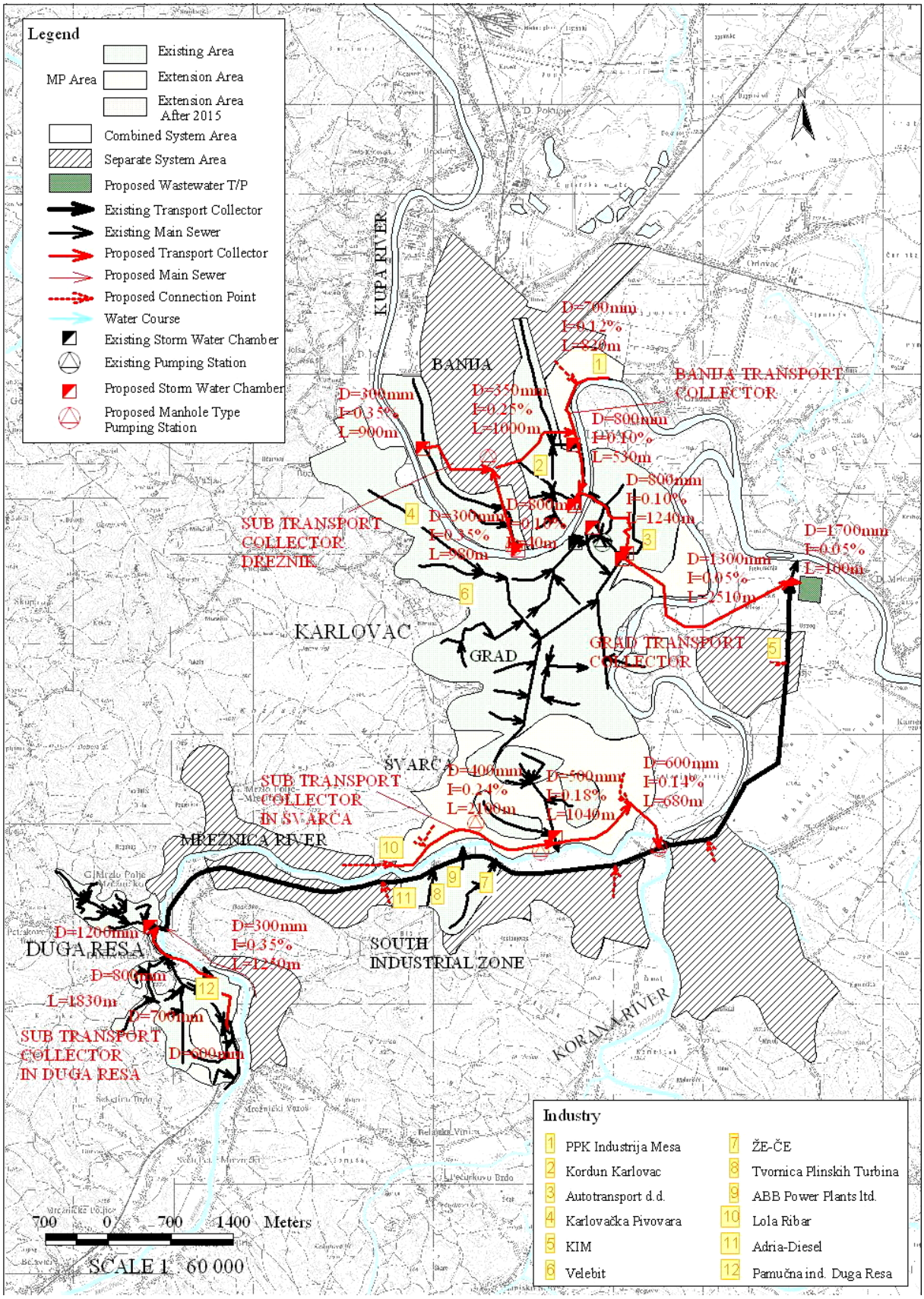
Regardless of the final restructuring, in order to achieve the most efficient conditions for investment financing, both municipal organizations cooperate very well with all institutions which featured in the National Profile. This is especially true for adoption of new strategies and implementation of the reform during calculation of water tariffs and charges.

2 Case Setting

2.1 Service Areas of the Case

Figure 1 Location of the Case Study within Croatia

Figure 2 Present and Proposed Wastewater Infrastructure of the Case Study Area



2.1.1 Karlovac

The town of Karlovac, consisting of 56 settlements, has developed on the flood plains of the Kupa, Dobra, Korana and Mrežnica rivers. It links with Zagreb City through the superhighway and railway, and this resulted in the intensive urbanization and development of industries.

The existing and future administrative areas and population are estimated as follows.

Table 1. Area and Population in Karlovac

Item		Urban Center	Rural Area	Total	Household
Area (ha)		952	39,203	40,155	
Population	(1999-2001)	52,000	8,000	60,000	16,900
	(2007)	52,000	8,000	60,000	16,900
	(2015)	53,000	7,000	60,000	16,900

Of the total of 16,900 households in Karlovac, 7,250 are connected to the public water supply and sewerage, whereas 6,250 households are connected to the water supply system only, but with no public sewerage. The rest of the households (3,400) have neither service.

2.1.1.1 Sewerage System of Karlovac

The existing sewerage system serves 966 ha covering the central urban area (Grad Area: 952 ha) and some surrounding areas. The served settlements are industrial zone area Grad, Banija, Svarca and the South Industrial Zone. The served is 43% with sewerage, and 81% with water supply.

There are 12 large industries in the whole town area and seven (7) of them are served by the sewerage system while the remaining five (5) discharge wastewater into the rivers/canals, as shown below.

- Served by Sewerage: Karlovacka Pivovara, Kordun Karlovac, Ze-Ce, Tvornica Plinskih Turbina, Adria-Diesel, ABB Alstom Power, Autotransport
- Discharge to River: PPK Karlovacka Mesna Industrija, Velebit, Lola Ribar, Karlovacka Industrija Mlijeka, Linde Plin

The existing sewerage system is combined, i.e. sewerage includes surface water. Even after the new WWTP will be operational (see Chapter 4) and new network elements will be added, there will be a mixed system. No cost-benefit analysis of constructing a separate storm water network has been carried out, but it is suspected that the savings in costs related to treating the storm water, the volume of which is about 10% of the wastewater handled by the network, would likely be lower than the costs of building a parallel network for storm water.

2.1.1.2 Water Supply of Karlovac

Some of the wells supplying water to Karlovac are located at the banks of Korana River. There is a strong possibility that polluted river water will contaminate these wells.

- Main Features of Existing Water Works
  - Total Intake Volume: 6,210,707 m^3/y
  - Treatment System

    Water from the wells is simply pumped up, from wells use storage tanks, disinfected by adding chlorine, and

    then distributed to the town.
  - Direct Water Production Cost: 2.9 HRK/m^3

For the determination of water consumption water meters are used for households. Only in older buildings (30% of households), total consumption is measured by one water meter and then calculated per number of users. In these buildings installing meters for households is costly, because water pipelines are vertically crossing the apartments at several points, and meters would need to be installed at each of these (no actual cost estimates are available, however).

Altogether in Karlovac and Duga Resa annually about 3.3 million m^3 of water is lost through distribution, mostly through leakage. The majority of this leakage is related to service in Karlovac.

2.1.2 Duga Resa

The town of Duga Resa, consisting of 28 settlements, is located immediately upstream of Karlovac along the Mrežnica River.

The existing and future administrative areas and population are estimated as follows.

Table 2. Area and Population in Duga Resa

Item		Urban Center	Rural Area	Total	Household
Area (ha)		185	5,979	6,164	
Population	(1999)	8,266	7,234	15,500	4,600
	(2007)	8,106	6,980	15,086	4,600
	(2015)	8,425	7,075	15,500	4,600

From total 4,600 households in Duga Resa, 1,130 which were connection on water supply and sewerage system and 3,362 households were having only water supply system.

2.1.2.1 Sewerage System of Duga Resa

The sewerage system serves not only parts of the densely populated central urban area (185 ha) but also some surrounding areas at present. The existing sewerage service area and population are estimated to be approximately 133 ha and 3,800 people respectively.

There is only one (1) large industry (Pamučna industrija Duga Resa), which discharges wastewater into the Mrežnica River at present. This company, however, is in a bad financial situation and may stop production in the near future.

The proposed sewerage development will cover the existing service area of 133 ha, and serve the population of 5,600 within the service area in 2007. Pamučna Industrija, which is currently discharging wastewater into the river, will also be served by the sewerage system if it stays in operation.

The largest transport collector serving both towns is the completed South Transport Collector, which connects with Duga Resa. Midway, the transport collector joins the collectors of Švarča and the South Industrial Zone in Karlovac. The collector will be connected to the central treatment plant proposed at the right bank of the Kupa River east of Karlovac.

2.1.2.2 Water Supply of Duga Resa

At present, Duga Resa is supplied with water taken from the Dobra River.

- Main Features of Existing Water Works
  - Intake Volume: 1,095,000 m^3/y
  - Treatment System

    Water from the river is simply pumped up, disinfected by adding chlorine, and

then distributed to the town.

- Direct Water Production Cost: 2.2 HRK/m^3

❖ Economic Benefit

The present water supply system of Duga Resa will benefit from the proposed wastewater treatment plant at Ogulin which is located on the Dobra River. In this case, benefit cannot be expressed in monetary term.

❖ Treatment plant

The treatment plant is proposed on the right bank of Kupa River to discharge into the Kupa River. The treatment site is a private wasteland (bush) with an average ground elevation of 107.8 m. Since the flood water level of the Sava River is estimated at 111.10 m for a 100-year return period, some flood protection works are necessary.

Inlet pumps lift up the wastewater transported to the plant and then the treated water is discharged into the Kupa River by gravity.

2.2 History and Evolution of the Current Organization

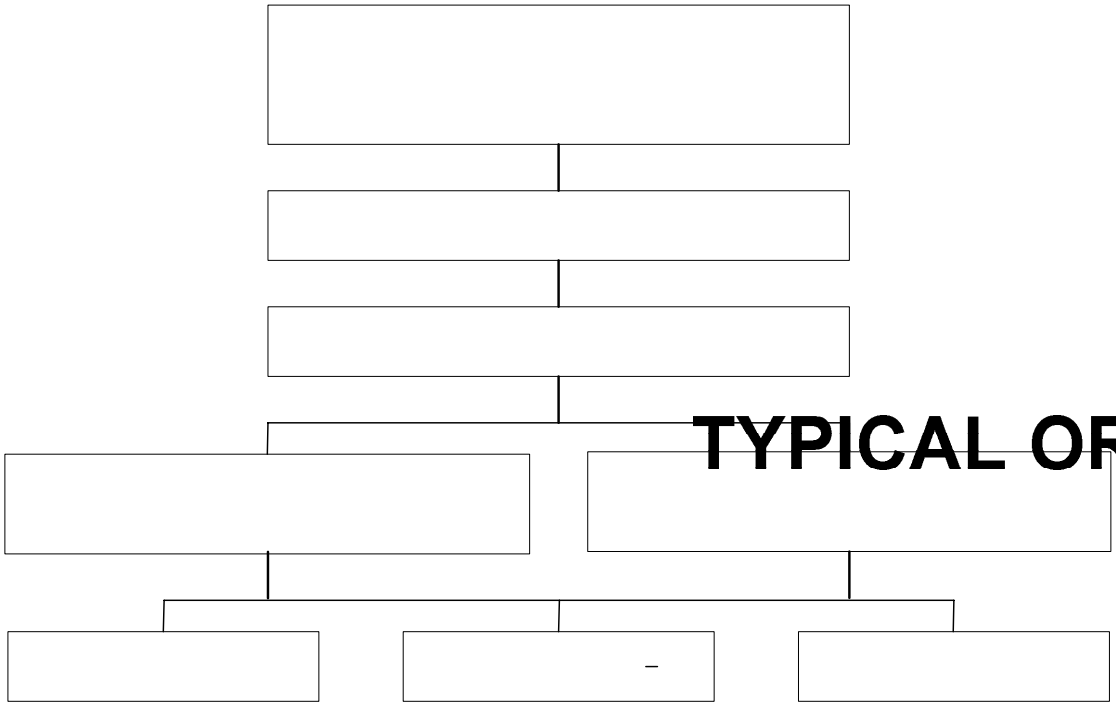
The beginning of the first public sewerage system of the city of Karlovac fell back in 1917 when Valerijan Rieszner, B.C.E. made a project for the need of a city of 13.800 inhabitants. It encompassed mainly drainage from the narrower city area, so called "Star"/Zvijezda on the right bank of the Kupa with several sides. Main part of Rieszner's project was put to work in the period from 1930 until 1932, including the first and so far the only pumping station.

A sewerage system from the Yugoslav period was built according to the requirements of a particular part of the city or the buildings without the existence of a ground plan or the plan for the bigger area which would encompass all these new, partial sewer systems.

Firm "Vodovod i kanalizacija" d.o.o. Karlovac (VKK) is located at Gaza - Gazanski trg 8. Sphere of work is water supply (distribution of drinking water to households and industries), wastewater disposal and treatment. This linkage is down in Figure 3.

Most MWWUs in Croatia are owned by the municipalities. This used to be true for VKK as well, until 30% of the shares were taken over by Croatia Waters in exchange for helping to repay some of the World Bank loans of VKK.

Figure 3 Organization Structure of Municipal Companies



Based on Municipal Utilities Act (NN 36/95) public municipal utilities through transformation have become the property of local administration units, mostly in the form of limited liability companies. The specific feature of such utilities is that the local administration units must be the majority owner, and 49 percent may be private property. Out of all registered utilities, 99 percent belong to this model. The law allows privatisation through establishing of concessions for municipal activities.

Department for wastewater is in charge of wastewater disposal and has management over public about 100 km long sewerage system net.

Department for water supply is in charge of providing and distributing water from 6 pumping plant (capacity about 500 l/second) to the households and industries in town Karlovac. Most of wells are close to the rivers Korana, and Kupa where wastewater from most industries finishes without pre-treatment, what is potential dangerous. Ground water is pumping from thin alluvial deposit of gravel and putting into water tanks placed on surrounding hills total capacity 13.000 m^3. By gravitation and pumping from them water is distributed to a consumers in the town Karlovac and nearby settlement. Water supply net is about 400 km long. All water plant and the most of consumers are connected in net shaped in ring with about 1.200 hydrants and 13.000 water meters. Average ages of water supply net is about 30 years, and in "Zvijezda"- old part of town water supply pipes are even from 1914. year.

2.3 The Current Organization of Water and Wastewater Services - the MUs, RUs and SUs

2.3.1 Overview of Regulatory Units

The national regulatory units, especially the State Water Directorate, Croatia Waters, the National Water Council, are described in detail in the National Profile. The general role municipalities, local governments play in water management is also described there. In this section specific information

related to the case study sites will be presented, supplementing the more general descriptions of the National Profile.

County Assemblies and the Assembly of the City of Karlovac play an important role in water management. With the enactment of the new Water Act, the Assemblies were given the responsibility of drawing up planning documents for the County Water Protection Plan and Water Management Plan, limit values of hazardous and other substances, method of wastewater disposal, and limits of sanitary protection zones. County offices in charge of water management play a continuous role in the water sector and carry out inspection at county level.

The City of Karlovac, Municipal and Town Councils carry out municipal services including water supply and wastewater treatment and disposal. Most of these services are performed by municipal service companies.

Croatia Water provides loans directly or indirectly to MWWUs. If the MWWU is not able to repay its loan to Croatia Waters, then the debt will be converted to ownership by Croatia Waters. A variation of this arrangement is when Croatia Waters repay a loan of instead of the MWWU. The latter happened in the case of the World Bank loan of VKK, and as a result Croatia Waters now has 70% ownership in VKK, while 30% is owned by the municipality.

The National Profile provides details on the water protection tariff. The unit tariff paid by the case study MWWUs is 0.90 HRK/m^3, adding up to more than 3 million HRK/year, which is over 40% of all wastewater related expenditures.

2.3.2 Service users

Table 3 below reviews the categories of service users as we characterized them for modelling purposes. SUs are distinguished from each other based upon their location (Karlovac or Duga Resa), their legal status (households or legal entities – due to different tariff levels) and the service they use (water, wastewater). The number of accounts as well as the annual water consumption and wastewater discharge is also included in the table. The numerical data in the table is estimate – actual statistics was not available at the MUs.

Table 3. Characteristics of Service User Categories

Name of the Service User category	Number of accounts	The service	Annual water use per account (m^3/year)	Annual wastewater discharge per account (m^3/year)	Comment
Households of Karlovac A	7 250	Water and wastewater	244	244	Some of these households (about 30%) do not have water meters.
Households of Karlovac B	1 345	Water only	244		While these households do not have wastewater service now, they are planned to be connected to the network from 2007
Households of Karlovac C	4 905	Water only	244		No plans for connection to the wastewater network
Households of Duga Resa A	1 130	Water and wastewater	113	113	Some of these households do not have water meters.
Households of Duga Resa B	493	Water	113		While these households do not have wastewater service now, they will be connected to the network from 2007
Households of Duga Resa C	2 869	Water	113		No plans for connection to the wastewater network
Big ind. facilities in Karlovac A	50	Water and wastewater	41 077	29 575	It is assumed that these water and wastewater services can be decoupled from each other, i.e. these two services are not composite (as opposed to household SUs)
Big ind. facilities in Karlovac B	10	Water	41 077		Some of these facilities will be connected to the sewer from 2007
Big ind. facilities in Duga Resa	3	Water and wastewater	36 528	32 875	It is assumed that these water and wastewater services can be decoupled from each other, i.e. these two services are not composite (as opposed to household SUs)

3 Current Accounts for Management Units

3.1 General Background Information

The companies have their own accounting systems separate from the local government, and their finance and accounts departments produce annual Profit and Loss Accounts and Balance Sheets on standard government forms. The forms are usually handwritten and signed and stamped by the company executives. No independent audit is carried out.

The accounts do not separate the income from water supply and sewerage (and gas and others in the case of multi-discipline companies). The financial results are highly variable, most companies planning to break even, but often failing to do so when financial charges due to capital development projects are high. Clearly there are no reserves for future expansions of the system.

The Law on Municipal Services (NN 36/95) sets out the principles and methods of carrying out and financing of municipal services. The income for municipal companies is derived from:

- Price of Municipal Services
- Municipal Levies
- Budgets of Local Administration Units
- Other Sources subject to Special Regulations

In accordance with Article 18 of the Law, the price for municipal services is determined by the service provider. Accordingly, each municipal company decides on the price for water and sewerage services and such pricing has to be agreed with local government (the owners and shareholders of the company).

The price for water supply and sewerage services should, in principle, be set at such a level as to meet the full cost recovery for both operating and maintenance costs and capital investment. Whereas the intention is to use actual financial resources from revenues generated to avoid pressure on the country's balance of payments, the current economic situation has not allowed for a realistic level of charge to be set for wastewater management. Large amounts of capital are required to expand sewerage systems and construct wastewater treatment plants. Companies may add a development charge as a contribution to capital projects – but this usually does not happen.

Having set the tariffs for water and sewerage services, the companies are obliged to collect the water use tariffs and the water pollution tariffs from their customers, generally, on a monthly metering basis. VAT at the current rate of 22% is charged on the price of municipal services only, and not on the water use and water protection charges which are remitted to Croatian Waters. In any particular period, the companies are obliged to pay VAT to the government on the basis of the billed amount and not the amount collected. At the same time, the VAT payment obligation of MWWUs can be lowered with the amount of VAT that was billed in earlier periods, but never actually collected. Therefore the MWWUs only temporarily pay uncollected VAT to the state; in essence, they provide an interest-free loan to the state budget.

Companies in the Study Area have an overall collection efficiency rate of about 70% (MU-Karlovac 80% and MU-Duga Resa 60%) within 30 days after the arrival of bill, the period set by the contracts of the MWWUs for paying bills. Together with late payments, however, collection ratios reach 85-90% in both MWWUs. Late payments and non-payment is mainly due to the current economic circumstances, causing unemployed persons and uneconomical commercial and industrial enterprises to default on payment.

For technical reasons (vertically running water pipelines through apartments above each other), disconnection of non-paying apartments is not possible without also disconnecting other, paying apartments. In the case of apartment buildings, however, the contractual relation is between the building itself (building associate) and not the individual apartments, therefore the MWWU does not have to deal with the apartments directly.

The water and sewerage monthly bill for Karlovac and Duga Resa with Components of price is given below. As in many other locations within Croatia and throughout the region, legal entities pay a higher, most often unjustified tariff, than households. This practice is usually guided by local political agendas.

Table 4. Price Component for Water Supply and Sewerage

		Karlovac		Duga Resa	
Item No.	Price Component	Charge (HRK/m^3)	Charge (HRK/m^3)	Charge (HRK/m^3)	Charge (HRK/m^3)
		Other Users	Households	Other Users	Households
1.	Municipal Service for Water supply	6.50	2.00	5.30	2.00
2.	VAT (22%) on Item 1	1.43	0.44	1.17	0.44
3.	Municipal Service for Sewerage	1.75	0.95	0.30	0.30
4.	VAT (22%) on Item 3	0.39	0.21	0.07	0.07
5.	Water Use Tariff	0.80	0.80	0.80	0.80
6.	Water Protection Tariff	0.90	0.90	0.90	0.90
7.	Concessions Fee			0.09	0.09
	Total per m^3	11.77	5.30	8.63	4.32

The household tariff is usually for domestic premises only, and other users are generally institutional, commercial and small industrial customers.

3.2 Current Account Balance for Karlovac (VKK)

"Vodovod i kanalizacija d.o.o." Karlovac (VKK) is one of two water supply and sewerage companies in the study area. The company is headed by a director under the control and direction of the Assembly and the Supervising Committee. Water plan is recommended that Duga Resa join the company when two sewerage systems are connected and the new treatment plant serves both systems.

The company's annual accounts show the profit and loss situation for the combined services of water and wastewater, cleaned of all other activities carried out by VKK. The results for 1998 and 1999 were as follows:

Table 5. Current Account Balance of VKK in 1998-1999 (HRK)

Profit and Loss Account (HRK)	**1998.**	**1999.**
Revenue		
1. For Water and Sewerage	24,588,880	27,816,228
2. Financial Revenue	390,144	389,016
3. Extra Revenue	515,528	430,562
4. Total Revenue (1+2+3)	25,494,552	28,635,806
Expenditure		
5. For Water and Sewerage	26,241,508	26,111,670
6. Financial Expenses	2,483,256	3,012,043
7. Extra Expenses	1,055,377	253,528
8. Total Expenditure (5+6+7)	29,780,141	29,377,241
Profit/(Loss) before Financial Items (1−5)	(1,652,628)	1,704,558
Profit/(Loss) after Financial Items (4−8)	**(4,285,589)**	**(741,435)**

The loss situation was caused by depreciation of the Kuna on repayment of loans in foreign currency, as VKK used IBRD-Loan until 2002.

The collection efficiency (85-90% if late payments are also included) is reasonably high in comparison with other towns, and should improve even more as industry recovers and employment increases.

A more detailed breakdown of the cost side of VKK is also available for 2002. Compared to 1999 costs have slightly decreased.

Table 6. Breakdown of Costs at VKK in 2002 (thousand HRK)

Material	2 341
Energy	1 896
Office supply	302
Postal service	217
Office equipment	553
Rental	16
Services	710
Amortization	6 801
Employees (salary, insurance, tax)	11 787
Representation	71
Donations	224
Bank charges	52
Other non-product services	1 924
Total	**26 894**

According to the management of the company, the potential for considerable cost savings exists at VKK. Two examples for savings are provided below:

- At present, a municipal company is in charge of the billing process, charging 6% on the amount billed as a collection fee. This is equivalent to 7.5% of the amount collected, and on the basis of the calculated wastewater discharge, the fee is about HRK 130.000 excluding the fee on the water charge. It could be more economical for the company to handle its own billing system or to contract a private company for this activity after a competitive bidding process.
- According to an earlier feasibility study, investment into reduction of the leakage of the water supply network would result in positive returns within 7 years. No specific information on these investments was available for our analysis, however.

3.3 Current Account Balance for Duga Resa (KDS)

"Komunalno" Duga Resa (KDS) provides communal municipal services for gas, solid waste disposal, parks, open-air markets and the cemetery, in addition to those for water supply and sewerage. The company is headed by a director under the control and direction of the Assembly and the Supervising Committee.

Since a mechanical wastewater treatment is to be provided jointly for Karlovac and Duga Resa and the two sewerage systems are to be joined, the national water plan recommends that the Duga Resa water supply and sewerage facilities be added to the "Vodovod i kanalizacija" Karlovac (VKK) company. It will be necessary for the Assembly and Supervising Committee at both locations to agree to this amendment. There are, of course, other forms of cooperation too, e.g. long term contract for wastewater treatment collection and treatment; common company for sewerage, but separate for water services. These alternatives, as we understand them, have not yet been investigated in detail.

The company's annual accounts show the profit and loss situation for the *combined* services provided. The results for 1998 and 1999 were as follows:

Table 7. Current Account Balance of KDS in 1998-1999 (HRK)

Profit and Loss Account (HRK)	**1998.**	**1999.**
Revenue		
1. For Water, Sewerage	9.615.551	7.496.349
2. Financial Revenue	304.842	81.472
3. Extra Revenue	0	23.432
4. Total Revenue (1+2+3)	9.920.394	7.601.254
Expenditure		
5. For Water, Sewerage	8.050.415	7.172.095
6. Financial Expenses	1.676.542	243.213
7. Extra Expenses	0	71.505
8. Total Expenditure (5+6+7)	9.726.957	7.486.813
Profit/(Loss) before Financial Items (1−5)	1.565.136	324.254
Profit/(Loss) after Financial Items (4−8)	**193.437**	**114.440**

Source: Komunalno Duga Resa d.o.o., Annual Accounts

The above figures also include revenues and costs related to other activities beside water and wastewater services, e.g. the company has a construction unit with 30 employees.

Actual W&WW costs and revenues are much lower than the range of 7-7.5 million HRK/year above. The KDS management provided water and wastewater related cost and revenue data on several occasions. Table 8 includes the most detail on water and wastewater related costs at Duga Resa, with a total of about 2.6 million HRK/year. Based on tariffs and consumed amounts we computed the W&WW revenues to be slightly above 2 million HRK/year. The management of the company, on other occasions, indicated that both costs and revenues of W&WW services are at around 3.5 million HRK/year. No detailed breakdown was supporting these latter figures, however. Eventually we decided to use the cost data from Table 8 and revenue data based on tariffs in use and consumption data provided by the company.

Table 8. Breakdown of Costs at KDS in 2002 (thousand HRK)

Material, energy	1 426
Employees	514
Amortization	286
Non-material, e.g. insurance	57
Interest	70
Repayment of loan	251
Total	2 604

The above tables and discussion clearly indicate that reliable and coherent accounting information is difficult to obtain from Duga Resa, and this makes it difficult to carry out good quality analysis in support of tariff reforms. The main reason for poor data quality, in our view, is that several activities are pursued by KDS without their treatment as separate cost centers.

From the calculated wastewater figures, sewerage revenue at KDS is only a few percent of total revenue (incl. non-W&WW services, too) and would probably not cause any financial upset if the sewerage system were to come under the control of Karlovac. The actual outcome, of course, depends on the specific arrangement between the two companies for provision of wastewater services by VKK to KDS. If tariffs increase, then a good public relations campaign will be required for the Duga Resa customers to accept them. Increase in tariffs may have to be done over a period of time. It is important to point out, however, that increase of wastewater tariffs in Duga Resa will be inevitable once an upgrade takes place, regardless of the actual type of cooperation between the two companies (e.g. merger, service contract, joint wastewater company).

4 Future Conditions

4.1 Planning Basis

4.1.1 Permissible Quality of Treatment Plant Effluent

The permissible limits of effluent (TSS, BOD, COD-Cr, T-N, T-P) discharged from the sewage treatment plant into the receiving water vary according to the size of the treatment plant and the category of the receiving water as follows.

Table 9. Permissible Quality

Category	Plant Size	TSS (mg/l)	BOD (mg/l)	COD-Cr (mg/l)	T-P (mg/l)	T-N (mg/l)
Watercourse II	<10,000 PE	60	40	150	-	-
	10,000 PE - 100,000 PE	35	25	125	2	15
	>100,000 PE	35	25	125	1	10
Watercourse III	<10,000 PE	120 – 150	-	-	-	-
	>10,000 PE	35	25	125	-	-

4.1.2 Wastewater Flow

The wastewater in sewerage systems includes domestic, institutional and industrial wastewater, and groundwater infiltration. As mentioned before, wastewaters of 51 large industries in the Study Area are estimated individually; whereas, wastewaters of the other smaller industries are dealt as part of the municipal wastewater, as well as domestic and institutional wastewater.

4.1.2.1 Design Unit Municipal Wastewater Quantity

The existing average unit municipal wastewater quantity (domestic, institutional and small industries: l/capita/day) is estimated from the water consumption data. It varies depending on the population size of town. In this Study, it is classified into two (2) categories: less than 10,000 people and larger than 10,000 people, based on the existing water consumption data in the Study Area. Return rate of the consumed water to the sewerage is assumed as 80 %.

On the other hand, the municipal wastewater varies throughout the year. Hence, the treatment plant is designed to meet the daily maximum wastewater. The ratio of daily maximum to daily average is estimated to be 1.30 based on the actual variation data in the water plan study.

The unit municipal wastewater quantity will increase according to the improvement of living standards in the future. The design unit municipal wastewater quantity for the master plan study (target year: 2015) is summarized below.

Table 10. Design Unit Municipal Wastewater Quantity

Population Size		<10,000 (l/capita/day)	>10,000 (l/capita/day)
Daily Average	Domestic	190	190
	Institutional/Small Industry	30	70
	Groundwater Infiltration	70	70
	Total	290	330
Daily Maximum	Domestic	240	240
	Institutional/Small Industry	30	90
	Groundwater Infiltration	70	70
	Total	340	400

4.1.2.2 Design Unit Pollution Load of Municipal Wastewater

The design unit pollution load of domestic wastewater is set at BOD: 60 g/capita/day by employing the widely used one in Croatia. The design unit BOD loads of institutional and small industrial wastewater are determined by assuming the BOD concentration as 200 mg/l.

4.1.2.3 Design Total Sewerage Wastewater

The wastewater quantity and quality in the large industries are estimated individually. The total wastewater quantity and pollution loads into public sewerage are estimated by adding those of large industries to the municipal ones.

4.2 Proposed Sewerage Development

4.2.1 Design Bases for Sewerage System and Treatment Plant

The design bases of the sewerage systems and treatment plants are summarized below.

Table 11. Design Base for Sewerage System and Treatment Plant

Item	Karlovac Duga Resa
Service Area (ha)	1.142
Served Population	43.800
Served Large Industry (No.)	10
Daily Maximum Wastewater Quantity (m^3/d)	23.285
Municipal Wastewater (m^3/d)	15.430
Industrial Wastewater (m^3/d)	7.855
Influent BOD Concentration (mg/l)	193
Pollution Load (PE)	74.800
Effluent BOD Concentration (mg/l)	116

4.2.2 Proposed Sewer

The main features of the proposed collectors are summarized below.

Table 12. Proposed Collector

Urban Center	Transport Collector		Secondary/Tertiary		Total	
	∅ (mm)	L (m)	∅ (mm)	L (m)	∅ (mm)	L (m)
Karlovac - Duga Resa	300-1.700	11.670	400	1.000	300-1.700	12.670
Total		**11.670**		**1.000**		**12.670**

4.2.3 Proposed Treatment Plant

According to the government regulations, the treatment plant with a size of more than 10,000 PE shall treat both T-P and T-N when the effluent is to be discharged into a Category II river. The normal biological treatment process (Activated Sludge: AS) can coincidentally treat nutrients to some extent; however, some advanced treatment processes must be introduced to meet the regulation level. Usually, Anaerobic-Oxic Activated Sludge (AO) is applied for the treatment of T-P and Anaerobic-Anoxic-Oxic Activated Sludge (A_2O) is applied for the treatment of both T-P and T-N. The required costs of the three (3) processes are compared in index as follows.

Table 13. Compared Treatment Process

Treatment Process	AS	AO	A_2O
Required Land Space	100	111	199
Construction Cost	100	108	172
O&M Cost	100	104	218

As shown in the above table, the treatment of T-N requires a large cost. Hence, the treatment of T-N is left as a future target after 2015. The proposed master plan will treat only T-P by the Anaerobic-Oxic Activated Sludge (AO).

4.2.4 Construction and Annual O&M Costs

The construction and annual O&M costs are estimated as follows at the prices of 2001. The cost of the treatment plant correspond to mechanical treatment only. The costs related to biological treatment have not been estimated.

Table 14. Construction and O&M Costs

Item	Karlovac Duga Resa
Construction Cost (million HRK)	129.76
Collector	61.43
Treatment Plant	68.33
Annual O&M Cost (million HRK/year)	2.33

4.3 Implementation Schedule

The proposed projects will start in 2006 and be completed by 2010. The proposed implementation schedules are shown below.

Table 15. Implementation Schedule

Item	Construction Works	Karlovac-Duga Resa
Detailed Design and Land Acquisition		2006
Stage I Construction	Collector, Primary Treatment, Sludge Treatment, etc.	2007 - 2009
Monitoring		-
Stage II Construction	Biological Treatment (A_2O)	-

5 Scenario Descriptions

Scenarios have been constructed around the notion of "progression" – a development from baseline conditions through medium term sustainability to upgrade of the infrastructure. In this chapter we provide a description of the scenarios as well as the data used in the scenarios, especially if a given piece of data did not appear in earlier chapters.

Each scenario received a code for easier identification, such as B1- which is the Simple Baseline scenario. Modelling results will be presented in Chapter 6.

5.1 Baseline Scenarios

B1 – Simple Baseline. In this scenario only *actual expenditures* are included on the cost side, namely variable (operating) costs, fixed costs (e.g. management costs, maintenance costs), payment obligations for past investments, water tariffs, effluent charges. Amortization costs are excluded, since they do not represent an actual short-term payment obligation for the company. Costs are distributed in proportion to water consumption and wastewater discharge of SUs. Tariffs, however, are not required to cover costs, present day tariffs (see Table 4) are used.

B2 – Cost Recovering Baseline I. Same as Scenario B1, but cost recovering tariffs are applied. Cost recovery takes place individually for each service user entity, for instance each household pays exactly as much as the cost behind its consumption. The MUs will, nevertheless, not reach real cost recovery as they are not able to collect all of the bills, their revenue shortfall will be equal to non-payment. Similarly to B1, there is a one component variable tariff.

B3 – Cost Recovering Baseline II. Same as Scenario B2, except that missing payments from non-payers are also recovered by payers. Payers, in effect, have to carry a larger burden than what is justified by their consumption, so that the company can break even.

B4 – Cost Recovering Baseline with Marginal Cost Pricing. Same as Scenario B3, except that marginal cost pricing is applied through an economically more attractive two part tariff (for description of tariff designs and their features see Volume 1 of the project report)

5.2 Medium Term Financial Requirements Scenarios

M1 – Medium Term Cost Recovery I. In addition to actual expenditures, as described in the baseline scenarios, medium term investment requirements for replacement of infrastructure are also included. These are investments that will simply replace part of the existing infrastructure, so that the system will stay operational for the next 5-10 years, but will not expand/upgrade the system. Since the MUs were unable to provide the requested investment data, it has been assumed that spending the amount of amortization on replacement each year would be sufficient for medium term sustainability. The operating costs are not changed. Moreover, cost recovering tariffs are applied the same way as in B2; cost recovery takes place individually for each service user entity, but the MUs will not reach real cost recovery due to 15% of non-payment.

M2 - Medium Term Cost Recovery II. Same as Scenario B1, except that missing payments from non-payers are also recovered by payers through increased charges. The company breaks even in this scenario.

M3 - Medium Term Cost Recovery with Marginal Cost Pricing. The cost structure and level is the same as in M2, but there is a two part tariff, just like in B4.

5.3 Upgrade Scenarios

Upgrade scenarios include an upgrade of the wastewater infrastructure on top of medium term financial requirements. Details of the upgrade are described in Chapter 4. Some of the upgrade features would be logical to couple with long term financial requirements (as opposed to medium term financial requirements), but data on financial requirements for the long term was not available from the case study MWWUs. The upgrade of the infrastructure has several implications:

- The sewerage network is extended, with new SUs connecting to it.
- Mechanical treatment of wastewater introduced (as opposed to the earlier lack of treatment)
- There are new fixed (investment) and variable costs related to upgrade of service
- The MUs will have to pay lower water protection tariffs as a result of improved effluent control (0.63 HRK/m^3 instead of 0.9 HRK/m^3). Since this cost item is valid for every cubic meter of wastewater, it is passed on to newly connected SUs as well as already connected SUs.

In addition to the variations introduced among baseline and medium term scenarios (cost recovery, tariff design), in case of upgrade scenarios the way the investments are financed is yet another modelling feature. Investments can be financed through loan, through savings, through grants and combinations of these. As the number of scenario variations could quickly multiply, we decided to reduce the number of scenarios through keeping some other variables constant. Therefore, we only modelled upgrade scenarios in which missing payments from non-payers are recovered through increased tariffs paid by those who do pay. Upgrade scenarios should, therefore, primarily be compared to scenarios B3, B4, M2 and M3, in which non-payment is also recovered by increased tariffs of those who do pay.

An important feature of the upgrade scenarios is that the costs of the WWTP upgrade are shared among all consumers of wastewater service based on their consumption levels - we have not been able to determine any better way of cost distribution among SUs. The costs related to wastewater network extension are distributed only to newly connected users. These costs are, again, distributed based on consumption levels. This concept, however, may distort modelling results to some degree, since newly connected SUs face all the costs of wastewater infrastructure, while existing SUs do not face long term replacement costs, as those have not been identified. For this reason, we ran some of the upgrade scenarios with uniform household tariffs – in these scenarios new households are not at a "disadvantage" compared to old households.

U1 – Upgrade from Grant and Loan. Cost recovery is assumed, 75% of the upgrade cost is financed from grant (according to EU schemes) and 25% from preferential loan, possibly provided by Croatia Waters. The loan must be repaid through the lifetime of the investments: 30 years[1].

U2 – Upgrade from Grant and Loan with Marginal Cost Pricing. Same as U1, but with marginal cost pricing (like B4 and M3)

U3 – Upgrade from Loans. Like U1, but all of the investment is financed from loans, without any grant from the EU or the government. The real interest rate is set at 4.5%.

U3H – Upgrade from Loans with Uniform Household Tariffs. Same as U3, but with uniform tariffs for all households, whether newly connected or connected in the past, and whether in Duga Resa or Karlovac. The tariffs of commercial customers are not made uniform, they recover costs for each SU separately.

[1] There is ambiguous conflicting information on the conditions of the loans provided by Croatia Waters, and the rules may change from year to year. It is not certain that a loan from Croatia Waters would be accessible by the case study MWWUs, and likewise the terms, e.g. duration and interest, are not known. For modelling purposes we chose a 30 year duration to match the lifetime of the equipment.

U4 – Upgrade from Loans II. Like U3, but with a higher interest rate of 10%. 4.5% of interest rate belongs to a preferential loan, but commercial banks are not likely to provide loans at below 10% of interest rate.

U4H - Upgrade from Loans II, with Uniform Household Tariffs. Same as U4, but with uniform tariffs for all households (like in U3H).

There are two additional scenarios, which will not be presented in detail: U1C and U3C. In these scenarios newly connected users will have to repay their fixed connection costs through a connect charge. In any other respect, these scenarios are identical to scenarios U1 and U3. Only the modelled wastewater tariffs for these scenarios will be presented in the next chapter.

5.4 Overview of Scenario Features

To help review and determine which scenario is directly comparable with which one, Table 16 describes the most important scenario characteristics.

Table 16. Review of the Most Important Scenario Features

					In Case of *Upgrade* Scenarios			
Scenario	Cost Basis	Cost Recovery	Non-Payment Covered by Payers	Marginal Cost Pricing (Two Part Tariff)	Uniform Tariffs Required for All Households	Real Interest Rate on Loans	75% Investment Grant, 25% Loan	100% Loan, no Grant
B1	Short term							
B2	Short term	✓						
B3	Short term	✓	✓					
B4	Short term	✓	✓	✓				
M1	Medium term	✓						
M2	Medium term	✓	✓					
M3	Medium term	✓	✓	✓				
U1 (C)	Upgrade	✓	✓			4.5%	✓	
U2	Upgrade	✓	✓	✓		4.5%	✓	
U3 (C)	Upgrade	✓	✓			4.5%		✓
U3H	Upgrade	✓	✓		✓	4.5%		✓
U4	Upgrade	✓	✓			10%		✓
U4H	Upgrade	✓	✓		✓	10%		✓

U1C and U3C are alterations of U1 and U3, respectively, including a connect charge for service users newly connected to the sewer.

5.5 Data Used in Modelling

As the companies were unable to provide an exact breakdown of costs to water and wastewater services, a general estimate was used: 80% of costs related to water service, and 20% of costs related to wastewater service. However, since this estimate does not have a sound basis, specifically water and wastewater related modelling results are not considered to be dependable either.

The expenditure data provided by the MUs were separated into variable and fixed cost components. Material and energy costs were assumed to vary with consumption, while all other costs (see Table 6 and Table 8) were assumed to be fixed costs. If we had more detailed data, we would be able to fine-tune the above distinction of variable and fixed costs. Variable costs were entered into the model as HRK/m^3, while fixed costs were entered as HRK/year.

We had ambiguous information on non-payment of bills. After some investigation it became clear, however, that the problem of non-payment is twofold: there is a problem with delayed payment, and with actual non-payment, i.e. bills that are never paid. The latter category is around 10-15%. In the model we used a non-payment ratio of 15% uniformly (lacking SU specific breakdown).

Moreover, the data provided by the MUs have not always been consistent or unambiguous. We tried to improve the detail and consistency of some of the data (especially cost data), but this effort was only partially successful, partly because of lack of proper breakdown of data at the MUs, and partly because of lack of time at the MUs to fulfill our data requests. We are certain, however, that the quality of the modelling data can be greatly improved if more time is available for the MUs for this purpose and if outside expertise can be deployed as assistance. One example for the potential to improve data is elasticity of demand. The management of Karlovac will be able to provide consumption and price time series in order to make computations of elasticity. Since this was not possible within the time frame of the project, we simply used an elasticity value of –0.2 for all SUs and both services. This value is probably not too far away from reality, but this assumption needs validation through examination of actual price and quantity data.

Due to problems with data availability, only certain scenario features have been tested. As data improves or gets systematically collected from the books and other documents (for which there is a promise from the case study MWWUs), the scope of modelling can be extended to cover, among others, the following areas:

- Impact of investments which reduce leakage
- Differentiated application of demand elasticities based on time series of tariffs and consumption in given SU categories
- Upgrade of the proposed WWTP to biological treatment
- Alternative methods of cost distribution among SUs
- Strategies for reduction of non-payment
- Estimates on long term financial requirements, and improved estimates on medium term financial requirements
- Breakdown of water and wastewater related costs

6 Scenario Results

In this chapter the most important scenario variables are described and analyzed.

6.1 Tariffs

Table 17 and Table 19 include tariffs of those scenarios in which one component variable tariffs were used (for water and wastewater, respectively), while Table 18 and Table 21 contain the results of scenarios with two component tariffs.

By comparing scenarios B1 and B2 it becomes evident that households are cross-financed by non-household users in both services and both locations. The exact degree of cross-financing is not certain, however, due to arbitrary methods of cost distribution among SUs. The biggest tariff increase will take place for wastewater service for the households of Duga Resa since, at this moment, they cover less than 40% of their costs.

Progression from baseline through medium term financial requirements to upgrade results, quite naturally, in increased tariffs in case of cost recovering scenarios (all scenarios except for B1). The increase in average tariffs is especially dramatic for wastewater services, especially if investment grants do not support the upgrade investments (scenario U3, for instance, in Table 19). Existing wastewater users will face increased tariffs due to the requirement to cover costs related to wastewater treatment. Newly connected service users will face even higher tariffs, since they also need to cover the costs related to network development. Therefore we also ran scenarios with uniform tariffs for all households. In this case the wastewater tariffs of already connected households will further increase, since they compensate the lowered tariffs of newly connected households (compare U3 with U3H, and U4 with U4H in Table 19).

Another policy option is to make newly connected service users pay for the costs of their connections through a connect charge. This charge may be a one-time up-front payment, but it may also be repaid through several years like a loan. This way the variable tariffs of different household users will not be very much different from each other, and there will be no need for equalizing tariffs among households SUs. For demonstration purposes, we ran two scenarios in which newly connected users will repay their particular connection costs through 5 years in the form of a connect charge. The resulting wastewater tariffs are presented in Table 20. The two modelled scenarios are modifications of scenarios U1 and U3, and they are called U1C and U3C respectively, C referring to “Connect charge”. These scenarios can be compared with the wastewater tariffs of Table 19 for scenarios U1, U3, and U3H. Essentially, in exchange for paying a connect charge, the service users pay a lower variable tariff, equal to the tariffs of already connected service users. Since there is no need for equalizing tariffs in case of scenario U3, already connected users do not have to face increased charges.

Since the upgrade of the wastewater infrastructure is an expensive investment, the cost of capital is an important factor in determining the annual costs, which also include the loan repayment obligations of the MUs. As an illustration, scenario U4 was created, in which the real interest rate paid after the investment was increased from 4.5% to 10%. As a consequence, wastewater tariffs of already connected households increased by around 20% on average, while wastewater tariffs of newly connected households went up by over 50%.

Without presenting it, we also ran scenarios in which the MUs save revenues for future investments, instead of taking on a loan. One drawback of this approach is that the investment will only be possible in the future, after enough capital has been accumulated, and until that time consumers may show disillusionment with high tariffs without corresponding improvements of service. A distinct advantage, however, is that financing the investment this way will increase the tariffs to a lower degree than investing from loans. For instance, investing with use of a loan with 10% interest rate and paying back the loan for 30 years has the same annual cost as saving for 8.5 years at an interest rates of 5% (it is assumed that the interest rate of a bank deposit or a state bond is lower than the interest

paid after the loan) and then investing the accumulated capital. If the MU is able to delay the investment for more than 8.5 years, then the annual burden will be even lower.

Switching from a one component variable tariff to a two component tariff results in lower variable tariff, while fixed tariff is introduced. Progression from baseline to medium term financing needs in case of a two part tariff scheme (B4 to M3) leaves the variable tariffs unchanged for both water and wastewater services, while the fixed tariffs increase – since the sole change from baseline to medium term is that part of the infrastructure needs to be replaced, and the related cost is assumed to be fixed cost, independent of consumption. When we progress from medium term scenario to upgrade, then water tariffs are mostly unchanged, while fixed sewage tariffs increase substantially due to increases in fixed costs, but variable tariffs actually decrease, as the new WWTP will be subject to lower water protection charges due to improved pollution reduction.

The reason for the decrease in the wastewater tariff of "Big Industrial Facilities in Karlovac B" (newly connected as part of the upgrade) from scenario U4 to U4H is that newly connected households in Duga Resa and Karlovac will now be paying a lower wastewater tariff, therefore their water and wastewater consumption will slightly increase, and since wastewater costs are distributed among SUs based upon wastewater discharge, these households will now be responsible for a higher portion of the investment costs of wastewater network upgrade, while industrial facilities will have to cover a lower share of these costs.

Table 17. Water Tariffs in Scenarios with Simple Variable Tariff (HRK/m^3)

Service Users	B1	B2	B3	M1	M2	U1	U3	U3H	U4	U4H
Households of Karlovac A	2.80	3.50	4.21	4.56	5.51	5.53	5.59	5.53	5.62	5.58
Households of Karlovac B	2.80	3.50	4.21	4.56	5.51	5.53	5.59	5.53	5.62	5.58
Households of Karlovac C	2.80	3.50	4.21	4.56	5.51	5.53	5.59	5.53	5.62	5.58
Households of Duga Resa A	2.87	3.85	4.58	4.27	5.10	5.12	5.14	5.53	5.16	5.58
Households of Duga Resa B	2.87	3.85	4.58	4.27	5.10	5.12	5.14	5.53	5.16	5.58
Households of Duga Resa C	2.87	3.85	4.58	4.27	5.10	5.12	5.14	5.53	5.16	5.58
Big ind. facilities in Karlovac A	7.30	3.50	4.21	4.56	5.51	5.53	5.59	5.59	5.62	5.64
Big ind. facilities in Karlovac B	7.30	3.50	4.21	4.56	5.51	5.53	5.59	5.59	5.62	5.64
Big ind. facilities in Duga Resa	6.17	3.85	4.58	4.27	5.10	5.12	5.14	5.15	5.16	5.17

Table 18. Water Tariffs in Scenarios with Two Component Tariff

	B4		M3		U2	
Service Users	Fixed Tariff (HRK/entity/ year)	Variable (HRK/m^3)	Fixed Tariff (HRK/entity/ year)	Variable (HRK/m^3)	Fixed Tariff (HRK/entity/ year)	Variable (HRK/m^3)
Households of Karlovac A	571	1.63	816	1.63	829	1.63
Households of Karlovac B	583	1.63	833	1.63	829	1.63
Households of Karlovac C	583	1.63	833	1.63	827	1.63
Households of Duga Resa A	143	3.12	189	3.12	192	3.12
Households of Duga Resa B	150	3.12	199	3.12	192	3.12
Households of Duga Resa C	150	3.12	199	3.12	199	3.12
Big ind. facilities in Karlovac A	118 908	1.63	169 910	1.63	168 826	1.63
Big ind. facilities in Karlovac B	118 908	1.63	169 910	1.63	168 826	1.63
Big ind. facilities in Duga Resa	56 836	3.12	75 049	3.12	75 127	3.12

Table 19. Wastewater Tariffs in Scenarios with Simple Variable Tariff (HRK/m^3)

Service Users	B1	B2	B3	M1	M2	U1	U3	U3H	U4	U4H
Households of Karlovac A	1.85	2.14	2.56	2.62	3.15	3.64	4.80	6.22	5.83	8.24
Households of Karlovac B						5.47	13.18	6.22	20.68	8.24
Households of Karlovac C										
Households of Duga Resa A	1.20	3.28	3.91	3.68	4.39	4.72	5.86	6.22	6.88	8.24
Households of Duga Resa B						6.55	14.23	6.22	21.73	8.24
Households of Duga Resa C										
Big ind. facilities in Karlovac A	2.65	2.14	2.56	2.62	3.15	3.64	4.80	4.81	5.83	5.86
Big ind. facilities in Karlovac B						5.47	13.18	12.71	20.69	19.56
Big ind. facilities in Duga Resa	1.20	2.09	2.48	2.29	2.72	3.26	4.36	4.36	5.36	5.37

Table 20. Wastewater Tariffs in Scenarios with Connect Charge

	U1C		U3C	
Service Users	Connect Charge (HRK/entity/ year)	Variable Tariff (HRK/m^3)	Connect Charge (HRK/entity/ year)	Variable Tariff (HRK/m^3)
Households of Karlovac A		3.62		4.70
Households of Karlovac B	1 194	3.62	4 777	4.70
Households of Karlovac C				
Households of Duga Resa A		4.70		5.76
Households of Duga Resa B	553	4.70	2 212	5.76
Households of Duga Resa C				
Big ind. facilities in Karlovac A		3.62		4.70
Big ind. facilities in Karlovac B	146 853	3.62	587 413	4.70
Big ind. facilities in Duga Resa		3.24		4.29

The connect charge in the table needs to be paid annually for a period of 5 years.

Table 21. Wastewater Tariffs in Scenarios with Two Component Tariff

	B4		M3		U2	
Service Users	Fixed Tariff (HRK/entity/ year)	Variable (HRK/m^3)	Fixed Tariff (HRK/entity/ year)	Variable (HRK/m^3)	Fixed Tariff (HRK/entity/ year)	Variable (HRK/m^3)
Households of Karlovac A	274	1.36	392	1.36	548	1.05
Households of Karlovac B					919	1.05
Households of Karlovac C						
Households of Duga Resa A	134	2.54	177	2.54	222	2.22
Households of Duga Resa B					367	2.22
Households of Duga Resa C						
Big ind. facilities in Karlovac A	34 807	1.36	49 738	1.36	71 741	1.05
Big ind. facilities in Karlovac B					121 907	1.05
Big ind. facilities in Duga Resa	19 234	1.80	25 416	1.80	45 746	1.48

6.2 MU Current Accounts

Table 22 describes the current account balances and revenues of management units under different scenarios. In most scenarios the current account balance is zero, since cost recovery, including recovery of non-payment, has been required. In B1, where present tariffs are applied, Karlovac has a slight positive balance, equivalent to 6% of revenues, while Duga Resa faces losses equivalent to 45% of revenues. Since these scenarios do not include amortization among the costs, actual reported financial balance may be worse. Together the two MUs just break even.

In B1 cross-financing between household and non-household users is present, although in Duga Resa surplus revenues from non-household consumers do not compensate the loss associated with service provision to households.

In B2 and M1 cost recovery is attained for individual service users, but if some service users do not pay, then the MUs themselves will not break even financially. Our results show that if "fair", cost recovering tariffs are applied then the two management units together would still incur losses of about 5 million HRK/year, depending on the scenario.

Finally, let us note that since cost allocation among SUs is somewhat arbitrary, the figures in Table 22 must be used with some care, and revisited after alternative strategies of cost distribution are also applied. For the same reason, water and wastewater specific results are not presented below, as we think that allocation of costs between the two services is less defendable than allocation of costs among SUs based on levels of service use.

Table 22. Current Account Balance and Revenues of Management Units

Current account balance (thousand HRK/year)	**B1**	**B2**	**M1**	**All other scenarios**
Karlovac, household consumers	-4 992	-2 206	-2 694	0
Karlovac, non-household consumers	6 610	-1 995	-2 437	0
Total for Karlovac	*1 617*	*-4 200*	*-5 131*	*0*
Duga Resa, household consumers	-968	-330	-359	0
Duga Resa, non-household consumers	58	-97	-106	0
Total for Duga Resa	*-910*	*-427*	*-464*	*0*
Total for both MUs	*707*	*-4 627*	*-5 595*	*0*
Revenues (thousand HRK/year)	**B1**	**B2**	**M1**	**All other scenarios**
Karlovac, household consumers	10 621	12 490	15 265	varies
Karlovac, non-household consumers	18 624	11 294	13 801	varies
Total for Karlovac	*29 245*	*23 784*	*29 066*	*varies*
Duga Resa, household consumers	1 369	1 865	2 029	varies
Duga Resa, non-household consumers	675	551	597	varies
Total for Duga Resa	*2 044*	*2 417*	*2 626*	*varies*
Total for both MUs	*31 289*	*26 201*	*31 692*	*varies*
Ratio of Balance and Revenue	**B1**	**B2**	**M1**	**All other scenarios**
Karlovac, household consumers	-47%	-18%	-18%	0%
Karlovac, non-household consumers	35%	-18%	-18%	0%
Total for Karlovac	*6%*	*-18%*	*-18%*	*0%*
Duga Resa, household consumers	-71%	-18%	-18%	0%
Duga Resa, non-household consumers	9%	-18%	-18%	0%
Total for Duga Resa	*-45%*	*-18%*	*-18%*	*0%*
Total for both MUs	*2%*	*-18%*	*-18%*	*0%*

6.3 Consumption

Figure 4 and Figure 5 depict water consumption and wastewater discharge by major customer groups for each scenario. Consumption is primarily determined by changes in two factors:

- Tariffs. Usually increase of tariffs will reduce consumption, within the model this relationship takes effect through the elasticity of demand. The elasticity values, however, are only rough estimates, therefore more dependable estimates of changes in water consumption and wastewater discharge require better estimates of elasticities.
- Number of service users. Within the upgrade scenarios discharge of wastewater goes up, due to increased number of connections (the decrease in volume due to higher tariffs is counterbalanced by the discharge from new connections)

When households make a decision about water consumption, they consider this combined tariff, since the water they consume will be released as wastewater, subject to charge as well – except for those households, which are not on the sewer.

Industry, however, makes water and wastewater related decisions separately within the model, and therefore responds separately to water and wastewater tariff changes. The underlying assumption is

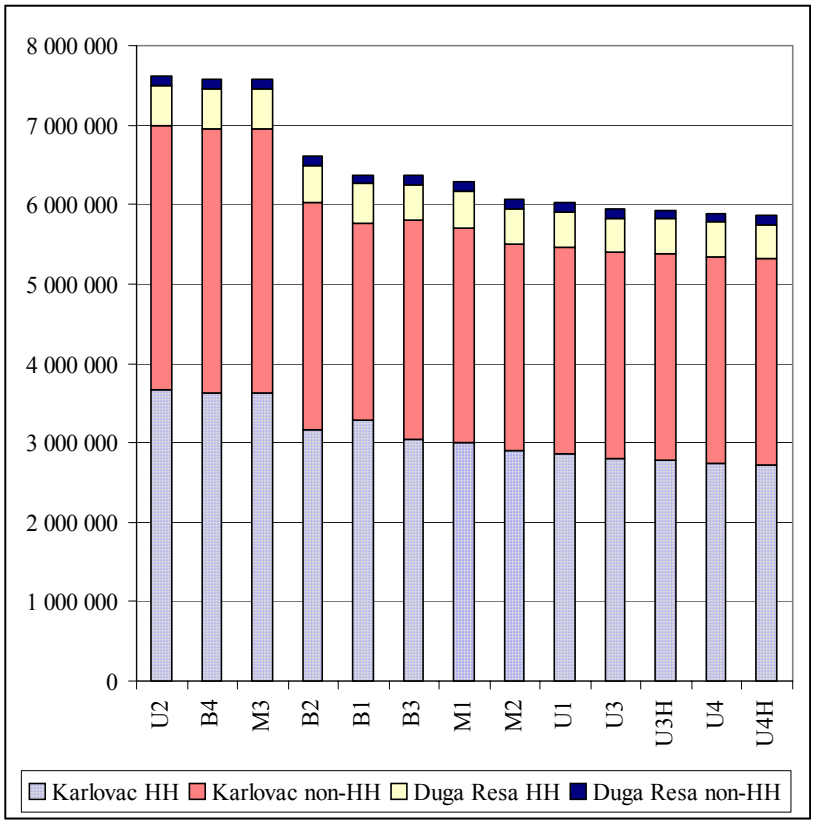
that when an industrial consumer faces increases in the tariff of only one service, then it may decide on self-supply of that particular service – if it has the freedom to do so from a contractual and regulatory perspective.

Water consumption is lowest for upgrade scenarios, since the combined price of water and wastewater services steeply rise, and as a result, households will reduce their consumption. Consumption is highest for scenarios in which marginal cost pricing has been introduced, since the variable tariff is low (see section 6.1 on tariffs), and consumption decisions are based on the variable tariff, and not on the fixed monthly charge. In the case of scenario U2 the impact of marginal cost pricing outweighs the effect of the increase in costs due to upgrade, mainly because much of the investment costs is paid for by grant.

The lowest wastewater discharge takes place in those baseline and medium term financing need scenarios in which variable tariffs for households increase to the greatest extent; M1, M2 and B3. Wastewater discharge, quite naturally, is highest in those scenarios with marginal cost pricing and/or upgrade of wastewater services with new connections.

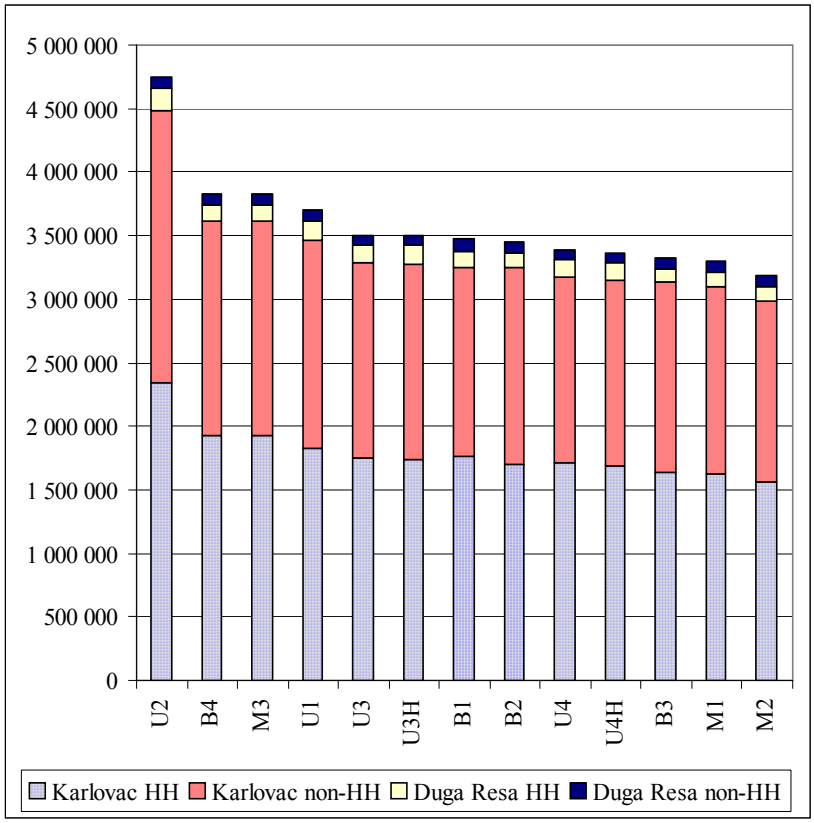
It is worthwhile to note that compared to present consumption levels (scenario B1) consumption of both services can increase as well as decrease, as a side effect of tariff reforms.

Figure 4 Water Consumption of Service User Groups (m^3/year)



HH=household

Figure 5 Wastewater Discharge of Service User Groups (m^3/year)



HH=household

6.4 Household Water and Wastewater Expenditure

Water and wastewater expenditures of households are computed by multiplying unit consumption with variable tariff, and then adding the fixed tariff per entity. This way we receive a uniform figure for all scenarios, which makes comparison of one and two component tariff scenarios easier and provides the basis for calculation of burden indices in Chapter 7.

Table 23 contains actual expenditures, while Table 24 includes the ratio of expenditures in a scenario compared to present, baseline expenditures.

The water and wastewater expenditures of households increase substantially for certain households as medium term financial sustainable is reached, and then the wastewater infrastructure is upgraded. Most of this increase is related to the upgrade of wastewater services. For households, which are newly connected to the sewer, expenditures may rise more than 6 times compared to present levels, and 2-3 times higher than expenditures of already connected households or households which will not be connected during the modelled time horizon. Such a difference in expenditures between different households is a politically very sensitive issue, which requires some remedy. One possibility is the investment grant specifically dedicated to the extension of the sewer. Another possibility is the application of uniform tariffs across all households with wastewater services. A connect charge, as described in Chapter 6.1 will equalize variable tariffs, but does not really alter the level of total expenditures.

Table 23. Water and Wastewater Expenditures of Case Study Households (HRK/household/year)

Service Users	B1	B2	B3	B4	M1	M2	M3	U1	U2	U3	U3H	U4	U4H
WATER TARIFFS													
Households of Karlovac A	683	821	953	1 007	1 021	1 188	1 252	1 179	1 275	1 161	1 122	1 146	1 094
Households of Karlovac B	683	816	947	1 027	1 010	1 174	1 277	1 136	1 275	1 031	1 122	970	1 094
Households of Karlovac C	683	816	947	1 027	1 010	1 174	1 277	1 178	1 272	1 187	1 178	1 194	1 185
Households of Duga Resa A	324	389	447	473	422	486	519	485	526	476	506	469	493
Households of Duga Resa B	324	411	472	497	446	513	546	468	526	425	506	400	493
Households of Duga Resa C	324	411	472	497	446	513	546	515	546	517	548	519	552
WASTEWATER TARIFFS													
Households of Karlovac A	451	502	579	638	586	678	756	776	834	997	1 261	1 187	1 617
Households of Karlovac B	0	0	0	0	0	0	0	1 124	1 204	2 432	1 261	3 568	1 617
Households of Karlovac C	0	0	0	0	0	0	0	0	0	0	0	0	0
Households of Duga Resa A	136	332	381	403	363	419	446	447	460	543	568	626	729
Households of Duga Resa B	0	0	0	0	0	0	0	599	606	1 177	568	1 683	729
Households of Duga Resa C	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL TARIFFS													
Households of Karlovac A	1 135	1 323	1 531	1 645	1 607	1 866	2 008	1 955	2 109	2 158	2 383	2 333	2 711
Households of Karlovac B	683	816	947	1 027	1 010	1 174	1 277	2 260	2 479	3 463	2 383	4 538	2 711
Households of Karlovac C	683	816	947	1 027	1 010	1 174	1 277	1 178	1 272	1 187	1 178	1 194	1 185
Households of Duga Resa A	460	721	828	876	786	905	965	932	986	1 019	1 074	1 095	1 223
Households of Duga Resa B	324	411	472	497	446	513	546	1 068	1 131	1 603	1 074	2 083	1 223
Households of Duga Resa C	324	411	472	497	446	513	546	515	546	517	548	519	552

Table 24. Index of Total Water and Wastewater Expenditures of Case Study Households Compared to Scenario B1

Service Users	B1	B2	B3	B4	M1	M2	M3	U1	U2	U3	U3H	U4	U4H
Households of Karlovac A	1.00	1.17	1.35	1.45	1.42	1.64	1.77	1.72	1.86	1.90	2.10	2.06	2.39
Households of Karlovac B	1.00	1.19	1.39	1.50	1.48	1.72	1.87	3.31	3.63	5.07	3.49	6.64	3.97
Households of Karlovac C	1.00	1.19	1.39	1.50	1.48	1.72	1.87	1.72	1.86	1.74	1.72	1.75	1.73
Households of Duga Resa A	1.00	1.57	1.80	1.90	1.71	1.97	2.10	2.03	2.14	2.22	2.33	2.38	2.66
Households of Duga Resa B	1.00	1.27	1.46	1.53	1.38	1.58	1.69	3.30	3.49	4.95	3.31	6.43	3.77
Households of Duga Resa C	1.00	1.27	1.46	1.53	1.38	1.58	1.69	1.59	1.69	1.60	1.69	1.60	1.70

7 Burden Indices

The average household income in 2000 in Karlovac and Duga Resa was about 4,000 HRK/month, with a median of about 3,000 HRK/month. The annual income of households is therefore 36,000 HRK/year (median) and 48,000 HRK/year (average). The ratio of water and wastewater expenditures and household incomes is shown by Table 25 below.

In our view the baseline scenarios will not create excessive burden for most households. Some households with low incomes may face difficulties paying their water and wastewater bills, especially those households which have both services (Karlovac A, Duga Resa A households).

The number of households with difficulty paying for the services increases in medium term sustainability scenarios, but households with average income would still find tariffs affordable.

Upgrade scenarios will considerably increase the burden falling on households, and the number of households connected to both services will also increase; Karlovac B and Duga Resa B households will connect to the sewer, and therefore must face much higher expenditures than before. These households will also have to pay more for the service than already connected households, since their connect costs will need to be covered through tariff payments, except if tariffs are set uniformly for all households, as in U3H and U4H. Investment grants (U1 and U2) would certainly make the upgrade projects more acceptable for households.

Table 25. Water and Wastewater Expenditures of Case Study Households (HRK/household/year)

	B1	B2	B3	B4	M1	M2	M3	U1	U2	U3	U3H	U4	U4H
MEDIAN INCOME HOUSEHOLDS													
Households of Karlovac A	3.2%	3.7%	4.3%	4.6%	4.5%	5.2%	5.6%	5.4%	5.9%	6.0%	6.6%	6.5%	7.5%
Households of Karlovac B	1.9%	2.3%	2.6%	2.9%	2.8%	3.3%	3.5%	6.3%	6.9%	9.6%	6.6%	12.6%	7.5%
Households of Karlovac C	1.9%	2.3%	2.6%	2.9%	2.8%	3.3%	3.5%	3.3%	3.5%	3.3%	3.3%	3.3%	3.3%
Households of Duga Resa A	1.3%	2.0%	2.3%	2.4%	2.2%	2.5%	2.7%	2.6%	2.7%	2.8%	3.0%	3.0%	3.4%
Households of Duga Resa B	0.9%	1.1%	1.3%	1.4%	1.2%	1.4%	1.5%	3.0%	3.1%	4.5%	3.0%	5.8%	3.4%
Households of Duga Resa C	0.9%	1.1%	1.3%	1.4%	1.2%	1.4%	1.5%	1.4%	1.5%	1.4%	1.5%	1.4%	1.5%
AVERAGE INCOME HOUSEHOLDS													
Households of Karlovac A	2.4%	2.8%	3.2%	3.4%	3.3%	3.9%	4.2%	4.1%	4.4%	4.5%	5.0%	4.9%	5.6%
Households of Karlovac B	1.4%	1.7%	2.0%	2.1%	2.1%	2.4%	2.7%	4.7%	5.2%	7.2%	5.0%	9.5%	5.6%
Households of Karlovac C	1.4%	1.7%	2.0%	2.1%	2.1%	2.4%	2.7%	2.5%	2.7%	2.5%	2.5%	2.5%	2.5%
Households of Duga Resa A	1.0%	1.5%	1.7%	1.8%	1.6%	1.9%	2.0%	1.9%	2.1%	2.1%	2.2%	2.3%	2.5%
Households of Duga Resa B	0.7%	0.9%	1.0%	1.0%	0.9%	1.1%	1.1%	2.2%	2.4%	3.3%	2.2%	4.3%	2.5%
Households of Duga Resa C	0.7%	0.9%	1.0%	1.0%	0.9%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.2%

8 Recommendations

We list our recommendations by themes under several headings. Many of these recommendations reinforce each other and work most effectively in a package. If, for example, a tariff reform is accompanied by cost saving measures, then reserves for future investments are easier to build up and subsequent tariff increases do not need to be so severe.

8.1 Management Practice

Reliable, coherent and appropriately detailed accounting and financial information is difficult to obtain from the case study communities, and this makes it difficult to carry out good quality analysis in support of reforms, including tariff reforms. This is partly caused by outdated accounting practices, partly by the fact that several activities are pursued by KDS without their treatment as separate cost centers. Our suggestion is to reform accounting practices through:

- Creation of cost centers (including cost centers based on service, consumer groups and/or geographical location)
- New data requirements and reporting templates to assist financial analysis

The case study utilities, according to our knowledge, have ample room for improving operating efficiency. The management should systematically investigate opportunities for cost control, and introduce reasonable measures and investments with attractive repayment periods. If the skills for streamlining operations are not present within the company, then appropriate experts need to be hired or consultants need to be contracted for this purpose. Appearance of a private (minority) stakeholder would certainly speed up this process.

Some of the opportunities for cost reduction that we are aware of are listed below. Screening of the company would most likely identify a fair number of other options to reduce costs.

- According to an earlier feasibility study there are leakage reduction investment opportunities with repayment periods of less than 7 years.
- Billing is carried out by a municipal company for a substantial fee. If the same service was subcontracted through a competitive bid, the cost of billing could likely be reduced substantially.

8.2 Tariff Designs and Levels

Our recommendations are the following:

- In the short run the companies are in a financially stable situation. The infrastructure, however, is being depreciated not only in terms of accounting, but also physically, and major investments will be needed to maintain and/or replace pieces of it. Tariffs will need to be increased in order to generate appropriate revenues for this purpose.
- At present household consumers are cross-financed by industrial consumers. Tariff increase, therefore, should primarily take place at households. This is also a step towards sustainable tariffs and economic efficiency.
- Economic efficiency can also be improved through the introduction of fixed tariffs. Fixed tariffs generate revenues regardless of actual consumption, therefore they make the revenue stream more dependable, and they are also more equitable, as all consumers will have to contribute towards the fixed costs of the company (the majority of the costs of water and wastewater services are fixed costs, which need to be covered even if consumption is very low for certain users)

- There are, however, some vulnerable consumer groups, especially low income households, where a dramatic increase in tariffs, especially fixed tariffs, can create problems. Fixed tariffs, should therefore, be introduced slowly and cautiously.
- Upgrade of the wastewater network and construction of the WWTP may not be feasible entirely from revenues, as tariffs would grow excessively. Outside help, in the form of grants or preferential loans, is needed, or these investments need to be delayed until the economic status of consumers considerably improves.

8.3 Ownership and Organization

There are two issues here that need to be addressed in the near future, but based on the information that we have now, we cannot provide any definite recommendation.

Issue 1: Is there a need for private investors? Private partners, whether owners or through concessions, would offer the potential for great improvements through:

- Bringing skills to the utilities that are presently missing
- Capital contribution from which attractive investments can be carried out, e.g. leakage reduction with short payback periods, eventually contributing to the financial stability of the companies
- The investment contract would open up new management possibilities through more autonomy from the municipality, such as streamlining operations, improved collection of bills.

A badly formulated privatization or operation contract can, however, also have miserable consequences for the municipality and service users. Therefore, again, great caution is required and the municipality should receive legal, economic, and technical assistance as a preparation for any form of a private public partnership.

Issue 2: Cooperation between Karlovac and Duga Resa. We have come across suggestions that the two companies should be merged in order to implement the wastewater investments together. While there are certainly advantage to a merger, much depends on actual execution. Furthermore, we would like to emphasize that there are many other ways of cooperation, which should be investigated before a decision on merger is made. Such possibilities are, for instance, long term contract for wastewater treatment collection and treatment; common company for sewerage, but separate for water services.

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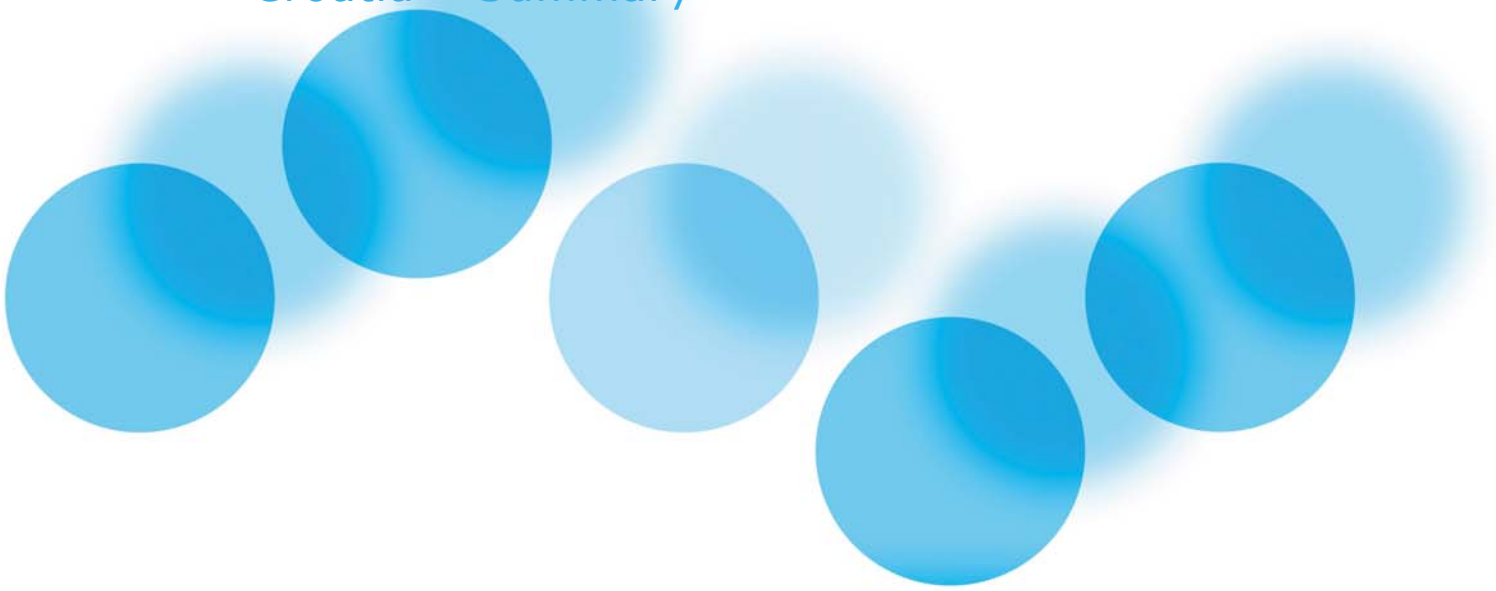
ASSESSMENT AND DEVELOPMENT OF MUNICIPAL WATER AND WASTEWATER TARIFFS AND EFFLUENT CHARGES IN THE DANUBE RIVER BASIN.

Volume 2: Country-Specific Issues and Proposed Tariff and Charge Reforms: Croatia – Summary



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PREFACE

The Danube Regional Project (DRP) consists of several components and numerous activities, one of which was "Assessment and Development of Municipal Water and Wastewater Tariffs and Effluent Charges in the Danube River Basin" (A grouping of activities 1.6 and 1.7 of Project Component 1). This work often took the shorthand name "Tariffs and Effluent Charges Project" and Phase I of this work was undertaken by a team of country, regional, and international consultants. Phase I of the UNDP/GEF DRP ended in mid-2004 and many of the results of Phase I the Tariffs and Effluent Charges Project are reported in two volumes.

Volume 1 is entitled *An Overview of Tariff and Effluent Charge Reform Issues and Proposals*. Volume 1 builds on all other project outputs. It reviews the methodology and tools developed and applied by the Project team; introduces some of the economic theory and international experience germane to design and performance of tariffs and charges; describes general conditions, tariff regimes, and effluent charges currently applicable to municipal water and wastewater systems in the region; and describes and develops in a structured way a initial series of tariff, effluent charge and related institutional reform proposals.

Volume 2 is entitled *Country-Specific Issues and Proposed Tariff and Charge Reforms*. It consists of country reports for each of the seven countries examined most extensively by our project. Each country report, in turn, consists of three documents: a case study, a national profile, and a brief introduction and summary document. The principle author(s) of the seven country reports were the country consultants of the Project Team.

The authors of the Volume 2 components prepared these documents in 2003 and early 2004. The documents are as up to date as the authors could make them, usually including some discussion of anticipated changes or legislation under development. Still, the reader should be advised that an extended review process may have meant that new data are now available and some of the institutional detail pertaining to a specific country or case study community may now be out of date.

All documents in electronic version – Volume 1 and Volume 2 - may be read or printed from the DRP web site (www.undp-drp.org), from the page Activities / Policies / Tariffs and Charges / Final Reports Phase 1.

We want to thank the authors of these country-specific documents for their professional care and personal devotion to the Tariffs and Effluent Charges Project. It has been a pleasure to work with, and learn from, them throughout the course of the Project.

One purpose of the Tariffs and Effluent Charges Project was to promote a structured discussion that would encourage further consideration, testing, and adoption of various tariff and effluent charge reform proposals. As leaders and coordinators of the Project, the interested reader is welcome to contact either of us with questions or suggestions regarding the discussion and proposals included in either volume of the Project reports. We will forward questions or issues better addressed by the authors of these country-specific documents directly to them.

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Overview of Issues and Proposed Tariff and Charge Reforms in Croatia

Croatia has a fairly well developed water and wastewater (W&WW) infrastructure, providing good quality water to most of its citizens, and collecting wastewater from over 50% of the population. The quality of supplied water is generally good, the service is reliable, most municipal water and wastewater utilities (MWWUs) operate without major difficulties – at least in the short run. The water sector, however, is not without challenges, and the number and magnitude of problems is likely to rise with time, if reforms are not implemented in due course.

The purpose of the present document is to describe those issues identified by Project Components 1.6 and 1.7 of the UNDP/GEF Danube Regional Project, which, in our view, require immediate attention from policy makers and utility managers. Together with these issues, related reform proposals will also be described. Interested readers should turn to the Croatian National Profile and Croatian Case Study documents for more detail on the portrayed issues and reforms, or Volume 1 of the project report for more information on methodology of the project and background for reform proposals.

We list the issues and recommendations by themes under several headings. Not all of them relate directly to tariff and charge designs and levels, but they reinforce and increase the effectiveness of tariff and charge reforms. If, for example, a tariff reform is accompanied by cost saving measures, then reserves for future investments are easier to build up and subsequent tariff increases do not need to be so severe.

1 Accounting

Reliable, coherent and appropriately detailed accounting and financial information is difficult to obtain at many MWWUs, and this makes it difficult to carry out good quality financial analysis in support of reforms, including tariff reforms. The costs related to service provision to any given service user are difficult or not possible to calculate. This is partly caused by outdated accounting practices, partly by the fact that several activities are pursued by municipal utilities without their treatment as separate cost centers. Our suggestion is to reform accounting practices through:

- ***Creation of cost centers*** (including cost centers based on service, consumer groups and/or geographical location)
- ***New data requirements and reporting templates*** to assist financial analysis

2 Operating Efficiency

Most MWWUs have ample room for improving operating efficiency. The management should systematically ***investigate opportunities for cost control***, and introduce reasonable ***measures and investments with attractive repayment periods***. If the skills for streamlining operations are not present within the company, then well trained experts need to be hired or consultants need to be contracted for this purpose. Appearance of private (minority) stakeholders would speed up this process.

Some of the opportunities for cost reduction that we are aware of are listed below. Screening of the MWWUs would most likely identify a fair number of other options to reduce costs.

- Leakage reduction investment with short repayment periods
- Energy saving measures with short repayment periods
- Optimization of the billing process
- Laying off redundant workforce

3 Tariff Designs, Levels and Collection

While there are water companies with negative current financial accounts, most Croatian MWWUs have zero or slightly positive balance. Although the current account balance is a key indicator of MWWU performance, this figure alone does not tell the whole story. There are companies with zero balance which, by properly and regularly maintaining the infrastructure, are on a sustainable path of operation. Some other companies also break even financially, while they cannot maintain their infrastructure and therefore constantly experience a deterioration of system conditions and quality of service. Many MWWUs in Croatia belong to the latter category. Present tariffs at these utilities will not ensure safe long term operation, and the MWWUs need to increase revenues (often together with a decrease of costs). Higher revenues will be especially important when pieces of the existing infrastructure are worn out and need replacement, or the service is upgraded, for instance by building a wastewater treatment plant.

Even though collection of bills is not a problem for many MWWUs, some utilities are not able to collect a portion of their bills (up to 20%) or receive payments only with a delay. For these MWWUs setting proper tariffs must go together with efforts or strategies at improved and more timely collection.

On top of the problems with current and future financial balance, tariff designs are often distorted and household users are cross-subsidized by industrial and other users. Cross-subsidies not only result in a loss of economic efficiency, but they also pose a risk of disconnection on the part of industrial clients of the MWWUs, losing a major source of revenue. Since fixed costs make up the majority of all costs for most MWWUs, stable revenues are high priority, and the self-supply of industrial consumers is a threat to the stability of revenues.

Another threat to the revenue stream is that present tariff designs include only a variable component, and not a fixed one. As tariffs increase, demand for the services will go down, and this will have an impact on total revenues. By introducing a fixed tariff component, the stability of revenues can be improved.

Lastly, a large portion of the collected revenues is paid as a tax or charge to the government, reducing the possibility of building up reserves locally for future investments.

In this context, our reform proposals are listed below. Needless to say, not all proposals apply to all MWWUs in Croatia, but for many MWWUs they are worth considering.

- In the short run most municipal water and wastewater companies are in a financially stable situation. The infrastructure, however, is being depreciated not only in terms of accounting, but also physically, and major investments will be needed to maintain and/or replace assets. ***Tariffs will need to be increased*** in order to generate appropriate revenues for this purpose.
- At present household consumers are cross-financed by industrial consumers. ***Tariff increase, therefore, should primarily take place at households***. This is also a step towards sustainable and economically efficient tariffs.
- In MWWUs with problems with non-payment, ***strategies to improve collection and timely payment of bills*** need to be implemented.
- Economic efficiency can also be improved through the ***introduction of fixed tariffs***. Fixed tariffs generate revenues regardless of actual consumption, therefore they make the revenue stream more dependable, and they are also more equitable, as all consumers will have to contribute towards the fixed costs of the company, which need to be covered even if consumption is very low for certain users.
- There are, however, some vulnerable consumer groups, especially low income households, where a dramatic increase in tariffs, especially fixed tariffs, can create problems. Fixed tariffs, should therefore, be introduced slowly and cautiously, or ***special arrangements*** need to be made ***for low income households***.

- Some of the large investments, especially into ***sewage collection and wastewater treatment***, will dramatically increase costs, and subsequently, tariffs. If outside help, such as grants or preferential loans from the European Union is not available, then ***these investments need to be delayed*** until the economic status of consumers considerably improves.

4 Ownership and Autonomy

The majority stakes in MWWUs are owned by the Municipalities. While minority private ownership is made possible by law, this is still very rare in Croatia, in fact, most MWWUs have full municipal ownership. Municipalities nominate the management, and therefore key decisions reflect the goals and interests of municipal decision makers. These goals and interests, however, often do not coincide with the interests of the MWWU itself. Increase of households tariffs, as proposed in section 3 above, for instance, is rarely supported by municipal decision makers, as households are their constituency through local elections.

Real reforms can only be expected to take place if the autonomy of the MWWU from the municipality increases. This can be attained in several ways, from legal stipulation, through contractual guarantees to privatization. Involvement of a ***carefully selected private partner***, either for operation, or as an investor, accompanied with proper incentives for improved operations, and guarantees for autonomous decision making seems like a wise alternative. Such a reform, if well implemented, is advantageous to the local community, and can also serve the interests of the municipal decision makers, as the MWWU becomes better managed, more efficient, providing service of improved value to the constituency of local politicians. Private investors can also contribute capital needed for investments, if they raise equity in the MWWU – as opposed to buying a portion of the existing stake, in which case the revenues would arrive at the owners, the Municipality or Croatia Waters, and not the MWWU itself.

Regarding the above we cannot suggest any specific reform, other than ***educating local decision makers on how private-public partnerships operate*** (including both drawbacks and advantages) and training municipal decision makers so that they can manage contracts with private partners in the best interest of the municipalities.

Another issue of ownership is the role of Croatia Waters in the W&WW sector of Croatia. Croatia Waters, as a government agency, provides loans, and preferential loans to MWWUs through the Water Management Fund. If an MWWU is unable to repay its loan, then the loan will be converted into a stake in the MWWU. Through this arrangement, Croatia Water has acquired considerable stakes in a number of poorly performing MWWUs. While "convertible bond" is an important tool in private capital markets, the use of the same concept for financing badly managed or ill-situated utilities is questionable for at least two reasons. First, the MWWUs do not face serious consequences upon non-payment, in essence, we are talking about a soft-loan with a convertible feature. Second, we do not see why Croatia Waters, a government agency, should be the minority owner of financially unstable MWWUs.

As a reform proposal, we suggest that the present practice is abandoned, and instead

- ***MWWUs with a chance for stabilized finances do not receive any sort of assistance***, even loan from the government, instead they should get loans from commercial banks or capital from equity markets. By introducing such a rule, MWWUs will have an incentive to improve operations instead of waiting for outside help.
- ***Only MWWUs which inherited a destroyed or badly functioning infrastructure, or operate under overly unfavorable conditions, should receive assistance***, without the prospect being owned by the government again. Together with the provision of financial assistance, the MWWUs should be required to ***agree to improvements in their operations***, such as tariff designs and operating efficiency, in order to enhance the stability of operations.

5 The Design of Charges, and Use of the Revenues

The purpose of the charges and the value added tax is primarily revenue generation – the incentive for change in polluting behavior is quite limited. Our reform proposal is the following:

- ***Redesign the water protection charge*** so that MWWUs would have a real incentive to invest into reduction of water pollution. The initial level of the charge should be low and should gradually increase so that MWWUs have sufficient time to carry out infrastructural investments in reaction to the charges.

The revenues from charges and taxes serve a variety purposes. Revenue from VAT is of course a general budget revenue, while charges arrive at the Water Management Fund operated by Croatia Waters and are earmarked for water purposes, such as planning and water administration. The Water Management Fund has other sources of revenue as well. A share of the budget of the Fund is used for supporting investments at MWWUs, as described in section 5. In line with the recommendations in section 4, we propose that

- The central investment support schemes should be redesigned so that ***only a restricted circle of MWWUs*** (those which are most disadvantaged and have limited potential to access other sources, such as EU investment funds) ***would be eligible for financial assistance***, in harmony with lower revenues collected for this purpose.