DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
CROATIA

TECHNICAL REPORTS

Part A: Social and Economic Analysis

Part B: Financing Mechanisms

State Water Directorate
State Directorate for the Protection of Nature and Environment

in cooperation with the

Programme Coordination Unit
UNDP/GEF Assistance

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Preface

The National Reviews were designed to produce basic data and information for the elaboration of the Pollution Reduction Programme (PRP), the Transboundary Analysis and the revision of the Strategic Action Plan of the International Commission for the Protection of the Danube River (ICPDR). Particular attention was also given to collect data and information for specific purposes concerning the development of the Danube Water Quality Model, the identification and evaluation of hot spots, the analysis of social and economic factors, the preparation of an investment portfolio and the development of financing mechanisms for the implementation of the ICPDR Action Plan.

For the elaboration of the National Reviews, a team of national experts was recruited in each of the participating countries for a period of one to four months covering the following positions:

- Socio-economist with knowledge in population studies,
- Financial expert (preferably from the Ministry of Finance),
- Water Quality Data expert/information specialist,
- Water Engineering expert with knowledge in project development.

Each of the experts had to organize his or her work under the supervision of the respective Country Programme Coordinator and with the guidance of a team of International Consultants. The tasks were laid out in specific Terms of Reference.

At a Regional Workshop in Budapest from 27 to 29 January 1998, the national teams and the group of international consultants discussed in detail the methodological approach and the content of the National Reviews to assure coherence of results. Practical work at the national level started in March/April 1998 and results where submitted between May and October 1998. After revision by the international expert team, the different reports have been finalized and are now presented in the following volumes:

Volume 1:	Summary Report
Volume 2:	Project Files
Volume 3 and 4:	Technical reports containing:
	- Part A : Social and Economic Analysis
	- Part B : Financing Mechanisms
	- Part C : Water Quality
	- Part D : Water Environmental Engineering

In the frame of national planning activities of the Pollution Reduction Programme, the results of the National Reviews provided adequate documentation for the conducting of National Planning Workshops and actually constitute a base of information for the national planning and decision making process.

Further, the basic data, as collected and analyzed in the frame of the National Reviews, will be compiled and integrated into the ICPDR Information System, which should be operational by the end of 1999. This will improve the ability to further update and access National Review data which is expected to be collected periodically by the participating countries, thereby constituting a consistently updated planning and decision making tool for the ICPDR.

UNDP/GEF provided technical and financial support to elaborate the National Reviews. Governments of participating Countries in the Danube River Basin have actively participated with professional expertise, compiling and analyzing essential data and information, and by providing financial contributions to reach the achieved results.

The National Review Reports were prepared under the guidance of the UNDP/GEF team of experts and consultants of the Danube Programme Coordination Unit (DPCU) in Vienna, Austria. The conceptual preparation and organization of activities was carried out by **Mr. Joachim Bendow**, UNDP/GEF Project Manager, and special tasks were assigned to the following staff members:

- Social and Economic Analysis and Financing Mechanisms: **Reinhard Wanninger**, Consultant
- Water Quality Data: **Donald Graybill**, Consultant,
- Water Engineering and Project Files: **Rolf Niemeyer**, Consultant
- Coordination and follow up: **Andy Garner**, UNDP/GEF Environmental Specialist

The **Croatian National Review** was prepared under the supervision of the Head of Delegation to the Danube River Protection Commission, **Mr. Zeljko Ostojic**, with the support of the Country Programme Coordinator, **Mr. Predrag Sibalic**. The authors of the respective parts of the report are:

- Part A : Social and Economic Analysis: **Mr. Ognjen Caldarovic**
- Part B : Financing Mechanisms: **Ms. Dubravka Mokos**
- Part C : Water Quality: **Ms. Marija Marijanovic**
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The findings, interpretation and conclusions expressed in this publication are entirely those of the authors and should not be attributed in any manner to the UNDP/GEF and its affiliated organizations.

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Vienna – Austria, November 1998

Part A

Social and Economic Analysis in Relation to Impact of Water Pollution

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List of Abbreviations

BPK (BOD)	biochemical consumption of oxygen
ES	P.E. (population equivalent)
GWh	Gigawatts per hour
Km	kilometer
km^2	square kilometer
KPK (COD)	chemical consumption of oxygen
l/s	liters of water per second
M l/d	million of liters per day
m^3	cubic meter
m^3/s	cubic meters per second
MW	megawatts
p.e.	population equivalent

1. Summary

Today (1998), Croatia is divided into 20 counties and the major city of Zagreb, which also holds a position of a county. The counties are divided into 69 cities and 432 municipalities. Today's total population is 4.784.265 inhabitants (1991), country area is 56.542 km^2 and an average density is 85 inhabitants per km^2. Ratio of *agricultural* population for the country is 409.647 or 8,56 % and estimation on the ratio of urban and rural population is that in 1997 there was c/a 20-30% of rural population in the country. The Danube catchment area consists of catchment areas of *relevant tributaries* - of the river Drava with 6.888 km^2, of the river Sava with 25.100 km^2 and of the immediate catchment area of the river Danube with 2.416 km^2. Due to specific situation in the country (war damages after 1991), only tentative projections of future population had been made till now. One of the estimations predicts the total number of 4,500.000 inhabitants in the year 2015. However, it means that Croatia can expect only very modest increase in its population in the next 20 years which can have as a consequence lower level of water and soil degradation due to the stabilized number of population, low level of new production units construction as well as generally better results due to the increase of the implementation of higher measures for water and environmental protection in the country.

Many problems affecting the quality of the Danube River water are listed in the Strategic Action Plan and are also relevant for Croatia as well: *changes of patterns of river flow, pollution of rivers with dangerous substances, municipal and industrial waste, uncontrolled dumping of waste into the river or close to it, many possibilities of pollution of underground waters, agricultural pollution by different farms, irrigation, uses of pesticides and fertilizers as well as by untreated municipal, industrial and individually produced wastewater*.

Trying to develop a sound environmental policy, Croatia has signed till 1997 several *international conventions* regulating the duties of each country to comply to the rules and regulations adopted (for example, The Ramsar Convention, Convention on the Biological Diversity and a Convention on the Protection of the River Danube). It has also a very elaborated legal and formal basis for water management regulation on different levels; many institutions and state offices are responsible for water quality and the system of monitoring is in constant improvement. Danube as well as its main tributaries are not used at the moment very much by the population for tourist purposes.

It is estimated that 12% of *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.

Major elements of *human impact* on the Danube River and its tributaries in Croatia can be summarized as follows: the uncontrolled dumping of waste into rivers or on irregular dumping places, discharge of sewage water into rivers, use of river water for irrigation, discharge of partially treated or not treated at all wastewater from agricultural farms to the rivers, transport of crude or refined oil or other dangerous substances, increase of number of population living in the catchment areas which means the increase in the production of waste and wastewater. Many problems of great importance to the environmental degradation of soil and water are connected with lack of systematic monitoring of water quality.

The system of *public water pipelines* was used by 63,0 % of the inhabitants of Croatia in 1991. Water consumption was approximately, in the days of maximum consumption - c/a 22 m^3 per second. 55,0 % of the quantity of water was used by the economy (production), and 45% by the population. It is estimated that in Sava catchment area 62,0 % of population is supplied with public pipeline water systems, in Danube and Drava areas 61,0 % and in Croatia 68,4 % in 1997. It is also estimated that total water consumption with all loses for 1997 are c/a 190 liters of water per day and without loses 140 liters per day. *Wastewater* production in 1996 in Croatia by the type of producers was 127.176.000 m^3 by households, 137.126.000 m^3 by activities (production, services,

etc.) and 6.641.000 m^3 by public utilities services which makes a total of 270.943.000 m^3 of wastewater. Total domestic wastewater production *per capita* was in Croatia in 1996 c/a 56.566 m^3 of water. If we take only households' wastewater production then we get the data that per capita total wastewater production in Croatia in 1996 was 26.588 m^3. In major cities in Croatia with a total number of 1.639.7272 inhabitants a yearly total wastewater production is 187.360.059 m^3 or 114,3 m^3 per inhabitant per year. The analysis of data in different cities has shown that there is no necessary correspondence between the size of a settlement and the quantity of wastewater production per one inhabitant in a given time span (a year).

Total *discharge of wastewater* from public sewage system in 1996 for Croatia was: I. *Unpurified water* 212.934.000 m^3 and out of it into the Black Sea watershed (catchment areas of Danube, Sava and Drava) 148.122.000 m^3; II. *Purified water* 58.009.000 m^3 and out of it into Black Sea watershed 1.594.000 m^3 which makes a total of 270.943.000 m^3. It means that 78,5% of total sewage waters had been discharged into the catchment river systems without purification, and only 21,5% had been purified. Wastewater centralized systems had been built mostly in major cities, centers of municipalities as well as for the supply of bigger enterprises, companies or administrative, cultural or tourist centers. Smaller, especially rural settlements and villages had not been supplied with centralized sewage systems. The existing systems are taking c/a 35,0 % of the total quantity of sewage waters which means that a reduction of the equivalent sewage load is for c/a 25,0 %.

Generally, it could be said that *underground water* in Northern Croatia is of a good quality, even on this territory the biggest number of potential sources of pollution are located. The area is densely populated along big rivers, the settlements are connected with major roads, the biggest industrial capacities are built in this area, and that is the most advanced agricultural area in Croatia. Due to these reasons, the quality of underground water is partially and only on some spots degraded by the higher concentrations of nitrites or by the temporarily increase of the concentration of organic dilutes. Also, taking into account the recent trends it could be concluded that a certain *improvement* had been gained in the qualities of Drava, Sava and Danube waters. Major reasons are: in the upper streams of the rivers Sava and Drava, in Slovenia and in Austria there has been an improvement in the construction of water protection facilities, and in the countries of Central Europe, and in Croatia, economic recession had been registered.

Surface waters for public pipeline water demand are used the most in the immediate Danube catchment area (85,2%), much less in the Drava catchment area (6,6%) and the least in the Sava catchment area (2,3%).

In general, total quantities of water demand from underground waters are realized with 95,8% in the catchment Sava area, 97,3% in the Drava catchment area and only with 4,6% in the immediate Danube catchment area. Water in need for *industry and mining* is taken usually in two ways: directly by the industries (direct use - surface waters or underground waters) or from public pipeline water systems. *Irrigation* areas are located along all three major rivers in Croatia. Along the Sava River they are the biggest and they cover a total area of 25.100 km^2. *Agricultural* areas are covering 12.052 km^2. which makes 48,0 % of the total areas. In the catchment areas of Drava and Danube a total of 9.304 km^2 is classified as irrigation areas, and 61,0 % or 5.709 km^2 is classified as agricultural areas.

A *projection* of *water demand* for the year 2.015 in the Sava catchment area will be 827.750 m^3/day or 9.581 liters per second or 338 liters per an inhabitant per day. In the catchment areas of Drava and Danube, the projection for water demand in the year 2015 is 284.550 m^3/day or 3.293 liters per second or 298 liters of water per an inhabitant per day.

In the Sava catchment area 920.000 inhabitants or 41,0 % of the total number are connected to the *public sewage systems*, in the Drava catchment area 361.000 or 41,0 % of the total number and in the immediate Danube catchment area 66.000 or 47,5% of the total number of inhabitants. In the

total Danube catchment area it makes a total number of 1.347.500 inhabitants or 41,0 % of the total number. Major cities are supplied with good sewage centralized systems, but even in the major city, Zagreb, not all areas are connected to the system. A special problem consists of the lack of any sewage systems in rural settlements, villages in which a system of public running drinking water exists but there are no sewage systems. In many households, septic containers are used with free discharge into channels and streams nearby which contribute very much to the contamination and pollution of rivers and soil.

There are only estimations on the actual number of *waste disposal places*. So, it is estimated that in 1996 in Croatia a total number of 700 major and mostly not properly regulated waste disposal places are existing and are used by municipal companies. There also c/a 1.300 smaller waste dumps, usually called "wild ones". The total quantity of waste for Croatia is yearly 7.720.000 tons or 1,4 tones per inhabitant. 1.350.000 tons per year are classified as municipal waste and c/a 330.600 tons per year is classified as a dangerous waste. It is also estimated that only 10,0 % of this waste is properly treated. Only 4 cities in Croatia (only one along the Sava River - Sisak) are properly equipped with waste treatment facilities. Sporadic hydroid epidemics are only examples of the population in health hazards due to the drinking water below standards. The problem consists in the fact that these diseases appear only with population using water from their own wells.

REPUBLIC OF CROATIA
STATE WATER DIRECTORATE

CROATIAN WATERS

GEF - DANUBE RIVER BASIN POLLUTION REDUCTION PROGRAM

NATIONAL REVIEW OF REPUBLIC OF CROATIA

2. Description of the State of the Danube Environment

Croatia is divided into four major *geographical areas* - in the Panonia area which lies in the Eastern part covering approximately 11.100 km^2 with a median yearly precipitation of 600 to 700 mm. The second part is Middle Croatia, which covers c/a 19.700 km^2 and the regime of precipitation is under the influence of Mediterranean as well as continental part of the country. Median precipitation is between 700 - 900 mm. The third part of the country is the Mediterranean part, which is partly a mountainous area, and partly coastline area. It covers c/a 14.000 km^2 and a median yearly precipitation is c/a 1.000 mm. The fourth area is Middle and Southern Dalmatia, which covers an area of c/a 11.740 km^2 with median yearly precipitation of 1.000 mm or more.

Today (1998), Croatia is divided into 20 counties and the major city of Zagreb, which also holds a position of a county as well as two areas with special status. The counties are divided into cities (69 cities) and municipalities (432 municipalities). Today's total population is 4.784.265 (1991) and an average density of population is 85 inhabitants per a square kilometer.

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. Within these 4 major water management areas, a total number of 32 smaller water management units are also organized.

But, many settlements and towns as well as industries are located along the Drava river which also contributes to the quality of Drava water as well as to the quality of water of Danube river. Many problems affecting the quality of the Danube river water are listed in the Strategic Action Plan (Strategic Action Plan..., pp. II-III) and are also relevant for Croatia as well: *changes of patterns of river flow, pollution of rivers with dangerous substances, municipal and industrial waste, uncontrolled dumping of waste into the river or close to it, many possibilities of pollution of underground waters, agricultural pollution by different farms, irrigation, uses of pesticides and fertilizers as well as by untreated municipal, industrial and individually produced wastewater*.

Also, the following reasons for deterioration of water resources in Croatia could be mentioned (Basis for the..., part II, pp. 71-72):

- the development of water provision was much higher then the development of sewage systems as well as the treatment of sewage waters;
- the development of economy after 2nd World War was not followed by adequate water management which resulted in many cases by the construction of big industrial capacities on the small rivers and without sewage waters treatment facilities;
- the construction of sewage system was not followed with construction of wastewater treatment facilities;
- environmental protection was very weak, especially in bigger towns;
- industrial wastewater had been discharged almost regularly directly into rivers or into public sewage systems without any treatment (untill recently).

Tourism is not yet very developed along the Danube River in Croatia as well as along its tributaries, but one must bear in mind also its future influence and need for protection of many wetland areas along the Sava, Drava and Danube rivers in Croatia.

There are 4 major *wetland areas* in the larger Danube catchment area covering the total area of c/a 282.000 ha (Forest areas along Drava river - 2.500 ha, Kopački rit national reserve - 50.000 ha, Alluvial marshy land and wetland along the Sava river - 210.000 ha in which a Nature Park Lonjsko Polje /60.000 ha/ is located, and the Turopolje area, the territory of c/a 20.000 ha of flood area and a natural reserve for drinking water, fish ponds, wild animals, potential recreation, etc.) /Strategic Action Plan..., pp. 30-31/.

Trying to develop a sound environmental policy, Croatia has signed - untill now - (1997) several *international conventions* regulating the duties of each country to comply to the rules and regulations adopted (for example, The Ramsar Convention, Convention on the Biological Diversity and a Convention on the Protection of the River Danube) /Strategic Action Plan..., p.7/.

2.1. Water Resources

The Danube River is not the longest but is definitely the biggest river in Croatia. River Danube in Croatia covers the area of 2.523 km^2 or only 0,3% of the total area of the river in its total length. It goes through Croatia in the total length of 188 km and it does not have that importance as a water resource as do have Drava and Sava rivers.

Major tributaries to the river Danube in Croatia are River Vuka (1.120 km^2) and river Baranjska Karašica (1.160 km^2).

Even, there are just a few settlements along the Danube river and only two major towns (Vukovar and Ilok), the area is populated mostly by agricultural population who depend on the water as well as who produce wastewater and influence the quality of Danube water in general. From the other side, it also means that many problems connected with Danube River system are coming through the water of the river from the countries lying upstream. It especially counts for different type of pollution, water degradation and other non-controlled situations, which could happen in the countries upstream.

Apart from this situation, the river Danube has some major *tributaries* in Croatia. One, the biggest and longest river in the country, Sava , with the total length of 518 kilometers and covering a total territory in Croatia of 25.100 km^2, is a major contributor to the quality of waters of the Danube River itself due to the highest number of settlements, industries and tributaries.

Main tributaries of *Sava River* are:

1. Sutla river, with 118 km^2 (89 km length in Croatia)
2. Krapina river, with 1.123 km^2 (75 km)
3. Trebež, Lonja and Ilova rivers with 5.944 km^2 (133 km)
4. Orljava river with 1.944 km^2 (89 km)
5. Bosut river with 2.572 km^2 (151 km)
6. Kupa river with 8.225 km^2 (116 km)
7. Sunja river with 470 km^2 (62 km)
8. Una river with 1.100 km^2 (107 km)

Major problems facing water management and water demand in the Slavonia region of Sava catchment area is that only c/a 25,0 % 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 the Sava catchment area, especially in Zagreb and in its vicinity, there is a heavy water demand. On average, c/a 75,0 % of the demand is satisfied by the public water supply, even the ratio ranges between 40,0 % to 90,0 %. 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 a transitory solution. (Long-term Programme..., pp.26-27).

The other major tributary to Danube in Croatia - the river Drava - is not a national river, but also comes from the countries located to the North and West of Croatia. The total length of river Drava in Croatia is 323 kilometers, with the total area of 6.888 km^2. Major tributaries of Drava River in Croatia are:

1. Mura river, 508 km^2
2. Plitvica, 321 km^2
3. Bednja 592 km^2
4. Bistra, 397 km^2
5. Kopanjek, 415 km^2
6. Županjski kanal, 675 km^2
7. Karašica, 1.033 km^2
8. Vučica, 1.337 km^2

Major problems facing water supply in the catchment areas of Drava and Danube rivers are that only (on average) 53,0 % 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. Due to the fact that raw water of Drava and Danube rivers could not be used as a good solution for supply of drinking water, it means that more investigation of the underground waters in this area must be organized (Long-term Programme..., p. 27).

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 (see later the data on population living along all three catchment areas). The waters of rivers are also used for many industries, agricultural needs, fishponds and to a lesser extent for other purposes (for, recreational tourism, for example).

It is estimated that 12,0 % 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 90,0 % of all cities (settlements) use underground water for drinking purposes. Generally, the quality of underground waters is rather good, especially in comparison with other European countries which means that this is a very important resource for Croatia (Basis for ..., part I, p. 3). But, due to the constant degradation of underground waters, especially in and around bigger cities (the biggest consumers of underground water in Croatia are Zagreb /Sava/, Osijek /Drava/, Vukovar /Danube/, Varaždin and Koprivnica /Drava/) and settlements as major concentration of industries as well as population where the pollution is the highest, water reserves in karstic systems of the country must also be taken into account. The biggest consumers of *surface waters* for drinking purposes are Osijek (partly - Drava river), Vukovar (Danube) and Sisak (Kupa river).

River monitoring shows slight improvement on all three river basins as well as on other river basins in Croatia during last ten years. It means that in the total catchment Danube area (basin area) the water quality had been substantially improved during last 15 years (Basis for..., part II, p. 65).

2.2. Biological Resources and Eco-systems

The catchment areas of Drava, Sava and Danube are extremely biologically rich. There are areas with many animal and plant sorts, rich in soil and of a great biodiversity. Many eco-systems are still "untouched", especially in the national parks and reserves. Some eco-systems are endangered by the human impact, but the whole area is still an ecological resource. The efficient organization of environmental protection of all three catchment areas will be a good basis for the further promotion bio-diversity and sustainability of the many eco-systems living there.

2.3. Human Impact

Major elements of *human impact* on the Danube River and its tributaries in Croatia can be summarized as follows:

1. The uncontrolled dumping of waste into rivers or on irregular dumping places which cause pollution of underground waters or surface waters as well.
2. The discharge of sewage waters without or with only primary treatment directly into rivers.
3. The use of river waters for irrigation of agricultural fields which causes degradation of quality of water and further environmental pollution of underground water.
4. The discharge of partially treated or not treated at all wastewater from agricultural farms or hog raising farms along the Sava river as the main tributary to the river Danube in Croatia.
5. Transport of crude or refined oil or other dangerous substances, which can cause a major threat to the rivers in the case of spilling.
6. The increase of number of population living in the catchment areas which means the increase in the production of waste, wastewater, and the rise of many more general possibilities of different types of degradation of soil and water.

2.4. Key Issues in Environmental Degradation

Taking into account many already mentioned points and descriptions, let us mention briefly major "hot spots" and other key issues in environmental degradation in the catchment area of the rivers Sava, Drava and Danube (Strategic Action Plan..., pp. 43-44):

Sava catchment area	10 hot spots
Drava catchment area	9 hot spots
Danube catchment area	3 hot spots
Total	22 hot spots

Specification and places of "hot spots" are as follows:

1. *Sava catchment area:*
   - 3 municipal wastewater treatment facilities:
     a. Sisak - population equivalent, p.e.=67.000
     b. Karlovac - p.e. = 144.000
     c. Zagreb - p.e. = 1.455.000
   - 3 factories:
     a. Oil treatment and the production of artificial fertilizers factory in Kutina
     b. Meat industry Vrbovec - p.e. 160.000
     c. Metal industry, Sisak - p.e. 800.000
   - 3 waste disposal dumps:
     a. Zagreb - in 30 years, 343.500 tones per year
     b. Sisak - municipal and dangerous solid waste, in 15 years, 106.500 tones per year
     c. Karlovac - municipal and technological solid waste - in 20 years, 30.000 tones per year
   - 1 municipal and industrial waste treatment facility in Slavonski Brod - p.e. 250.000

2. *Drava catchment area:*
   - 3 municipal wastewater treatment facilities
     a. Varaždin - p.e. 170.000
     b. Čakovec - p.e. 85.000
     c. Osijek - p.e. 245.000
   - 2 municipal and industrial wastewater treatment facilities
     a. Belišće - (damaged in the war 1991-1995)
     b. Belje - (damaged in the war 1991-1995)
   - 1 factory wastewater - Osijek, sugar factory, p.e. 380.000
   - 3 municipal and industrial waste disposal dumps
     a. Osijek - in 20 years, 50.000 tones per year
     b. Varaždin - in 11 years, 25.000 tones per y.
     c. Koprivnica - in 12 years, 16.000 tones per y.

3. *Danube catchment area:*
   - 1 municipal and technological waste disposal dump - Vukovar - in 30 years, 18.000 tones per year
   - 2 municipal discharge wastewater treatment facilities:
     a. Vukovar - sewage system (in reconstruction)
     b. Vukovar - p.e. 120.000, damaged in the war 1991-1995

Many problems of great importance to the environmental degradation of soil and water are connected with lack of systematic monitoring of water quality. First of all, there is no systematic monitoring and there are no specific data on organic pollutants, collected data in different monitoring locations are not comparable due to their different statistical values, there is no research on the quality of river sediments, there is no monitoring of the transport of pollution along the rivers, the system of grading of quality of surface and/or underground waters is not precise enough, there is no systematic monitoring of underground waters and there is no monitoring of the quality of water of lakes and accumulations, except in the case of the Drava River accumulations (National Report, part I, p. 2.43). But, nevertheless, monitoring activities in the catchment areas of Sava, Drava and Danube rivers in Croatia, in the last 15 years have shown some improvements in the quality of waters, especially in the river Drava as well as on the river Danube (Basis for the ..., part II, pp.73-74).

3. Analysis and Projection of Population and Water Sector Relevant Demographic Characteristics

3.1. Present Situation

3.1.1. Population

(1) *Total* population of the country in 1991: 4.784.256[1]

(2) Ratio of *agricultural* population for the country in 1991: 409.647 or 8,56 % (no data available for the ratio of rural/urban population - an estimation will be that in 1997 there were c/a 20-30,0 % of rural population in the country).

Croatia is a country with many smaller, in many cases highly dependent settlements. This could be illustrated by the fact that in Croatia in 1991 there were 6.520 settlements with up to 2.500 inhabitants (out of it 5.260 settlements with only up to 500 inhabitants!), 135 settlements with between 2.500 and 10.000 inhabitants, 31 settlements (smaller or medium sized cities) with between 10.000 and 50.000 inhabitants and 8 settlements (bigger cities) with more then 50.000 inhabitants. In the catchment Danube River area there were in 1991 (last census year) 4.478 settlements with up to 2.500 inhabitants (out of it 3.620 with only up to 500 inhabitants!), 81 settlements with between 2.500-10.000, 22 settlements with between 10.000 and 50.000 and 4 settlements (cities) with more then 50.000 inhabitants (see in National Report, part I, p. 1.5).

(3) Population in the *relevant counties* in which catchment areas are located

Table 3.1. Overall Population in Counties in Drava Catchment Area (1991)

Counties	Population
1. Varaždinska	187.853
2. Međimurska	119.866
3. Koprivničko-Križevačka	129.397
4. Virovitičko-Podravska	104.625
5. Požeško-Slavonska	99.334
6. Osječko-Baranjska	367.193
7. Vukovarsko-Srijemska	231.241
Total:	**1.239.509**

Source: Statistical Yearbook, 1997.

[1] These population figures are given on the basis of the "Statistički ljetopis 1997" (Statistical Yearbook 1997), Zagreb: Državni statistički zavod, as on the 7th of February 1997 (on the basis of the 1991 census). The reader must bear in mind that all data had been collected during the census 1991 and that the war 1991-1995 in Croatia had a tremendous impact on the population distribution and number of inhabitants in the country in general as well as in some regions (forced migrations, refugees, displaced persons, ethnic cleansing, etc.), especially in the Eastern part of the country (i.e. in the Danube immediate catchment area) which means that the given data could be - due to the circumstances - to some extent incorrect at present time.

Table 3.2. Overall Population in the Counties of Sava Catchment Area (1991)

Counties	Population
1. Zadarska	212.920
2. Ličko-Senjska	86.992
3. Karlovačka	184.577
4. Zagrebačka	283.298
5. Krapinsko-Zagorska	148.779
6. Sisačko-Moslavačka	251.023
7. Bjelovarsko-Bilogorska	144.042
8. Koprivničko-Križevačka	129.397
9. Požeško-Slavonska	99.334
10. Brodsko-Posavska	174.998
11. Osječko-Baranjska	367.193
12. Vukovarsko-Srijemska	231.241
Total	**2.313.794**

Source: Statistical Yearbook, 1997.

Table 3.3. Overall Population in the Counties of Danube Immediate Catchment Area (1991)

Counties	Population
1. Osječko-Baranjska	367.193
2. Vukovarsko-Srijemska	231.241
Total	**598.434**

Source: Statistical Yearbook 1997.

(4) Population of major cities (settlements) in each relevant catchment area[2]

Table 3.4. Drava Catchment Area - major cities (settlements), 1991

City (settlement)	Population
1. Varaždin	41.846
2. Čakovec	15.999
3. Prelog	4.247
4. Koprivnica	24.238
5. Đurđevac	6.845
6. Pitomača	5.942
7. Virovitica	16.167
8. Podravska Slatina	11.416
9. Đurđenovac	3.923
10. Našice	8.235
11. Orahovica	4.314
12. Donji Miholjac	6.935
13. Belišće + Valpovo	15.824 (7.619 + 8.205)
14. Beli Manastir	10.146
15. Bilje	3.571
16. Darda	6.751
17. Osijek	104.761
Total	**291.160**

Source: Statistical Yearbook 1997.

Table 3.5. Sava Catchment Area -major cities (settlements) 1991

Cities (settlements)	Population
1	**2**
1. Plaški	2.271
2. Ogulin	10.857
3. Plitvice (c/a)	1.000
4. Duga Resa	7.513
5. Karlovac	59.999

[2] Source: "Stanovništvo prema narodnosti po naseljima" (Population according to nationality in settlements), Republika Hrvatska, Republički zavod za statistiku (Croatian Statistical Office), Zagreb, 1994.

1	2
6. Petrinja	18.706
7. Samobor	14.170
8. Zaprešić	15.678
9. Zagreb	706.770
10. Sesvete	35.337
11. Velika Gorica	31.614
12. Sisak	45.792
13. Dugo Selo	6.508
14. Ivanić	7.104
15. Križevci	11.236
16. Bjelovar	26.926
17. Čazma	2.785
18. Kutina	14.992
19. Garešnica	4.308
20. Grubišno Polje	3.501
21. Daruvar	9.748
22. Pakrac	8.179
23. Lipik	3.725
24. Novska	8.053
25. Nova Gradiška	14.044
26. Požega	21.046
27. Oriovac	2.049
28. Slavonski Brod	55.683
29. Đakovo	20.317
30. Vinkovci	35.347
31. Županja	11.947
Total	**1.217.205**

Source: Statistical Yearbook 1997.

Table 3.6. Danube Catchment Area - major cities (settlements) 1991

Cities	Population
1. Vukovar	44.639
2. Ilok	6.775
Total	**51.414**

Source: Statistical Yearbook 1997.

(5) Overall Population, *urban and rural* population in relevant catchment areas[3]

Table 3.7. The total catchment Danube Area (Drava catchment area + Sava catchment area + inner catchment Danube area) 1991

1. Total population	3.248.750
2. Urban population	1.783.073 or 54,9%
3. Rural population	1.465.677 or 45,1%

Source: Statistical Yearbook 1997.

Table 3.8. Sava Catchment area 1991

1. Total population	2.339.341
2. Urban population	1.339.893 or 57,3%
3. Rural population	999.448 or 42,7%

Source: Statistical Yearbook 1997.

Table 3.9. Drava Catchment Area 1991

1. Total population	705.929
2. Urban population	333.541 or 47,3%
3. Rural population	372.388 or 52,7%

Source: Statistical Yearbook 1991.

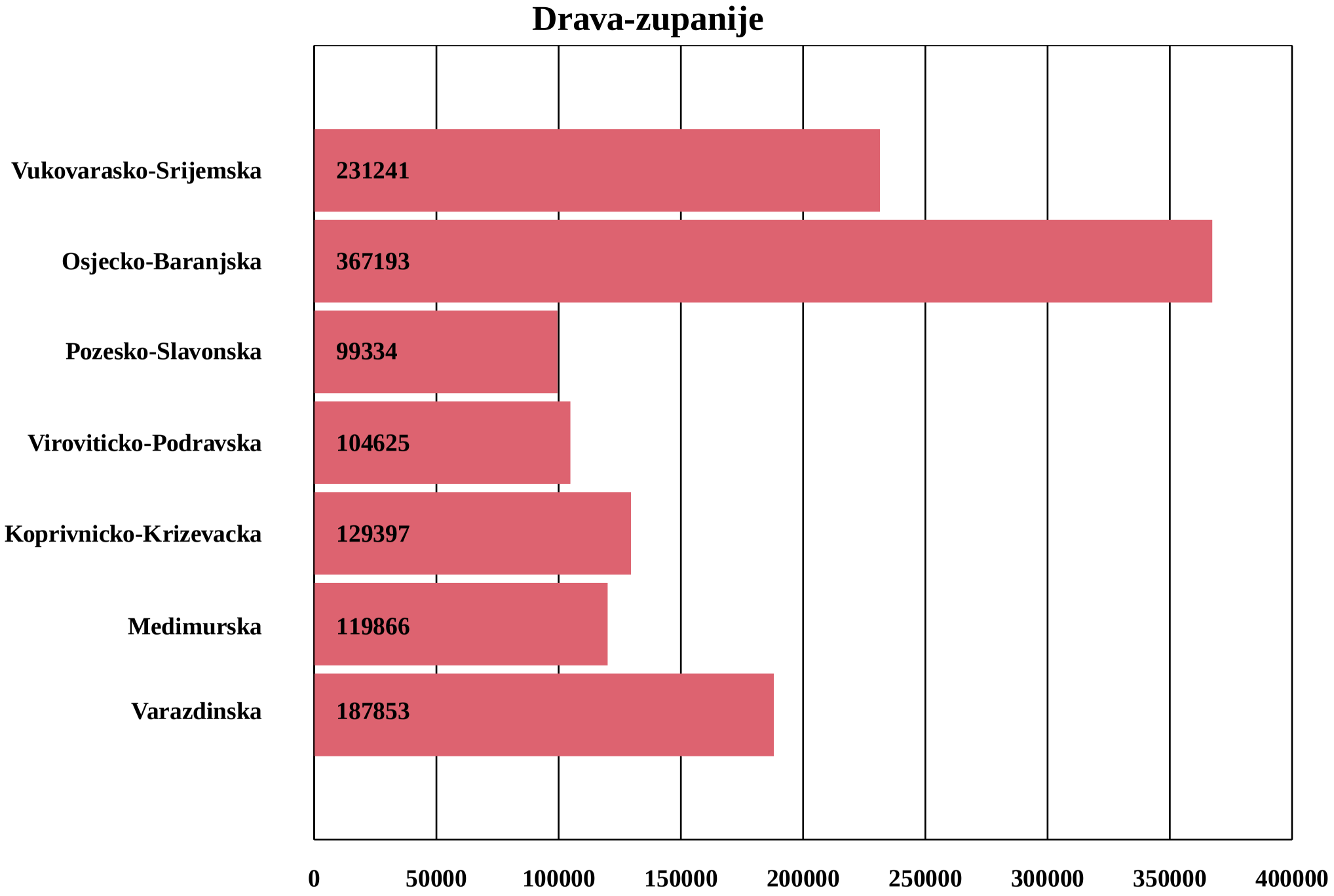
Table 3.10. The Immediate Catchment Danube Area 1991

1. Total population	203.480
2. Urban population	109.648 or 53,9%
3. Rural population	93.832 or 46,1%

Source: Statistical Yearbook 1991.

[3] Source: The same source as stated in the footnote No. 4. Due to the lack of official data, rural population is calculated as all population living in settlements with 2.500 or less inhabitants.

Republic of Croatia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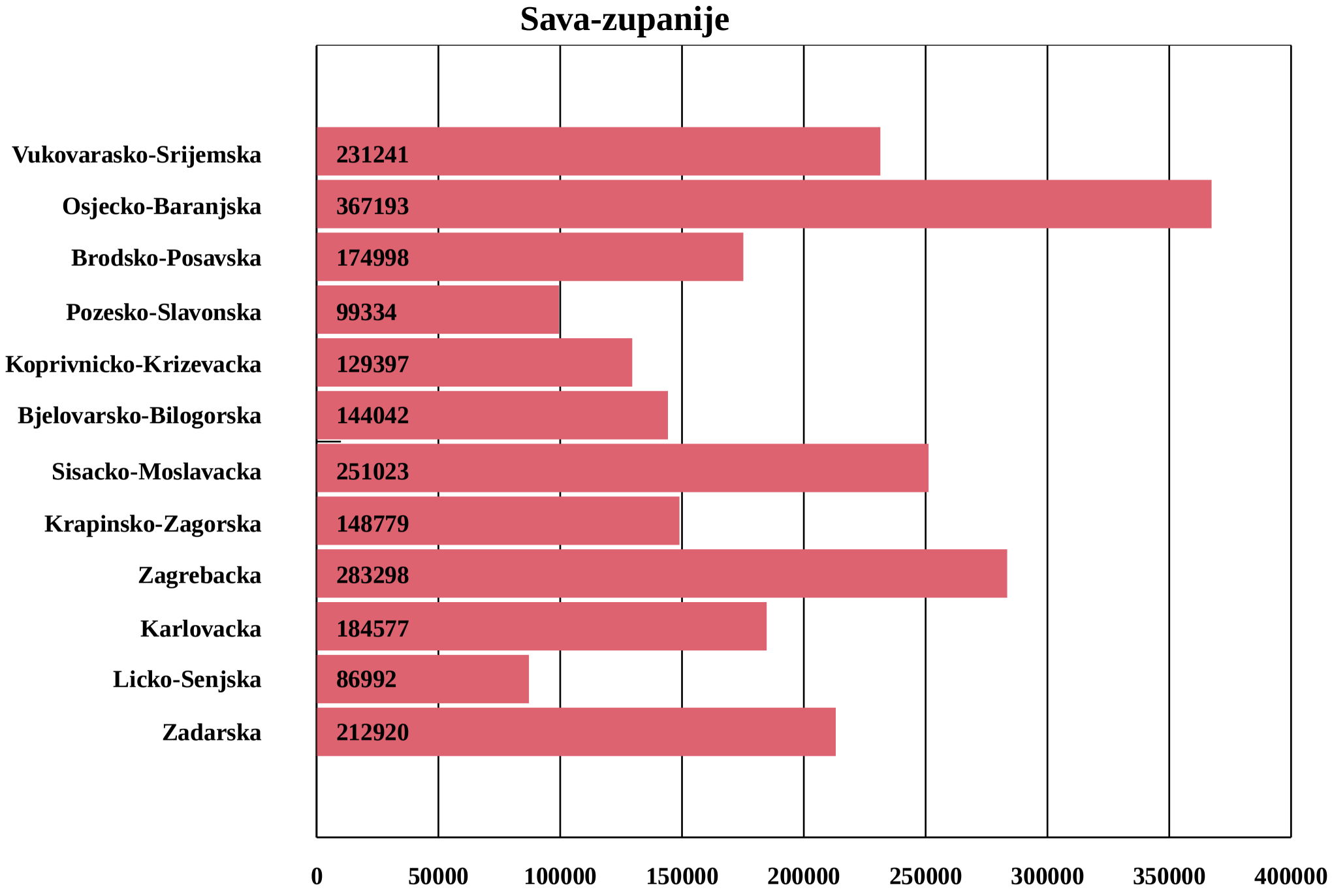
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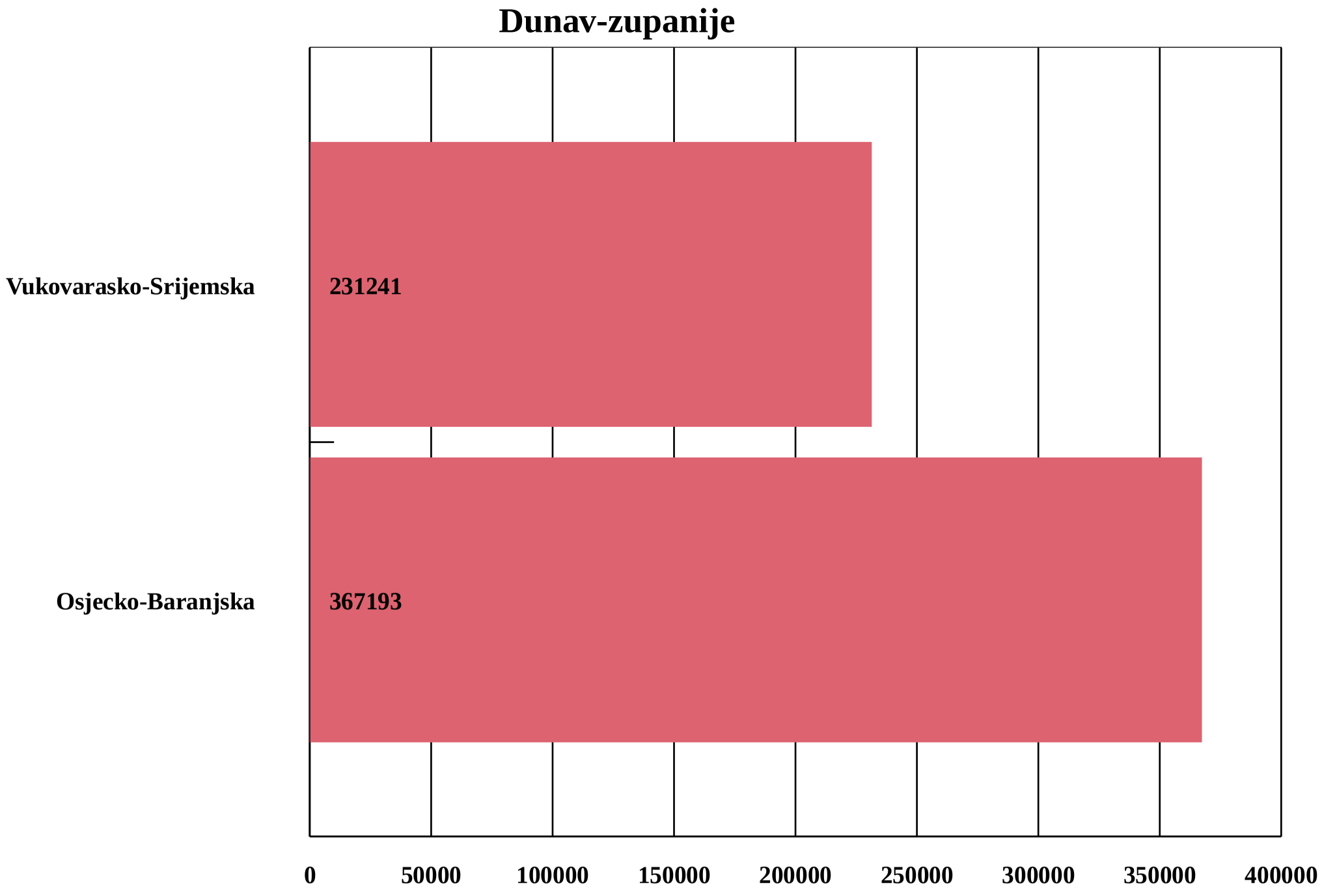
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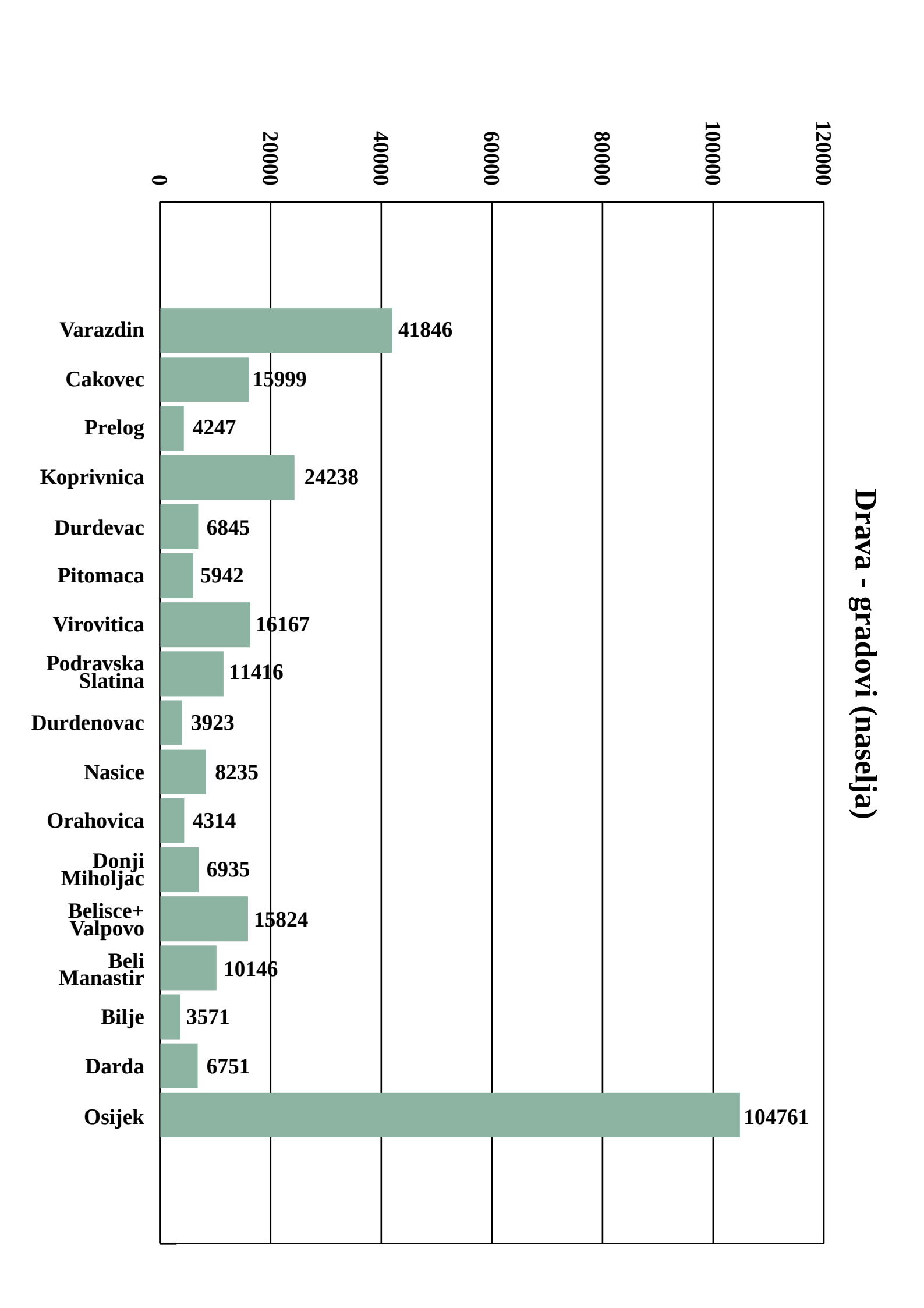
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Durdevac
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Pitomaca
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Virovitica
16167
Podravska Slatina
11416
Durdenovac
3923
Nasice
8235
Orahovica
4314
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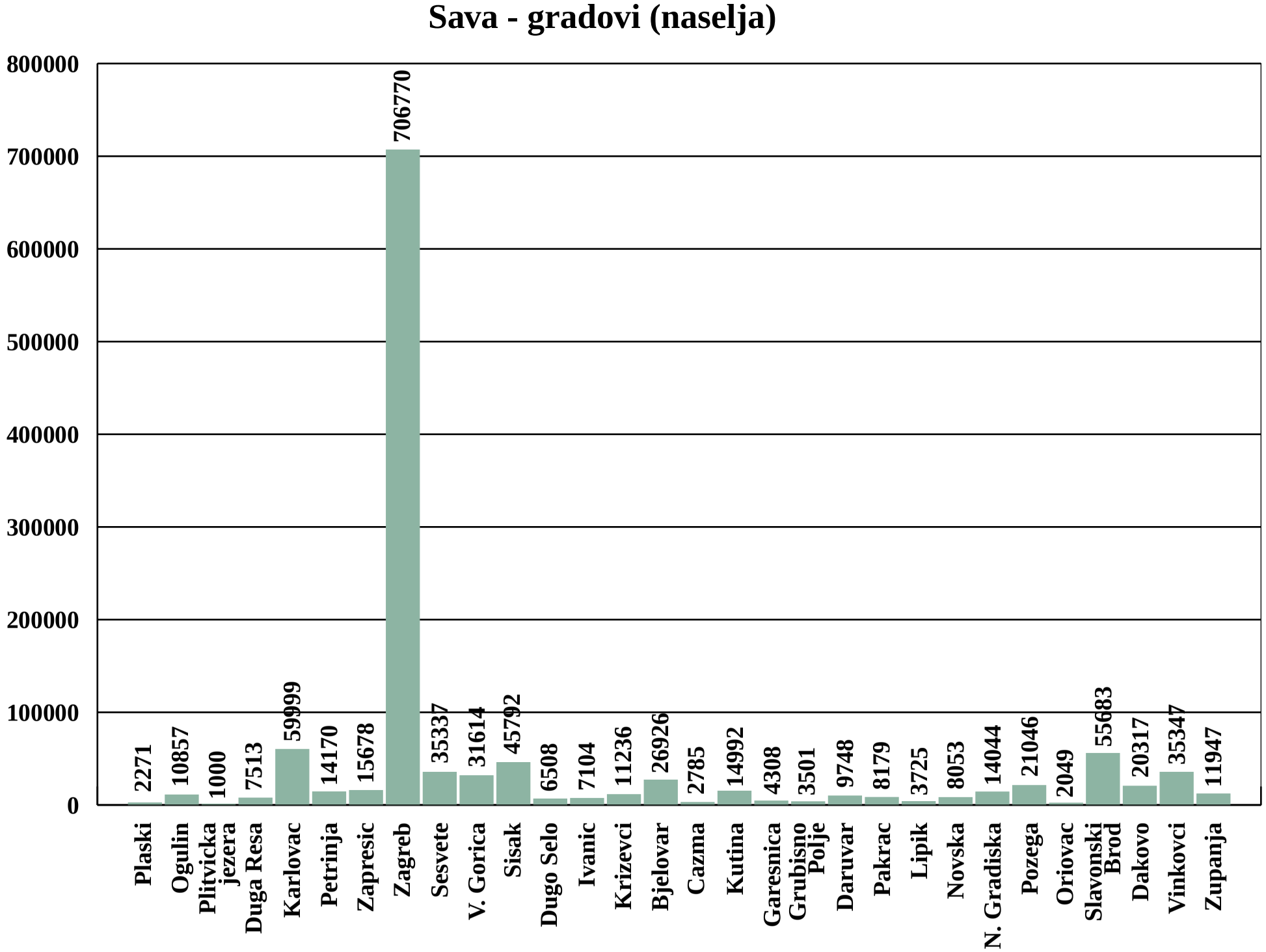
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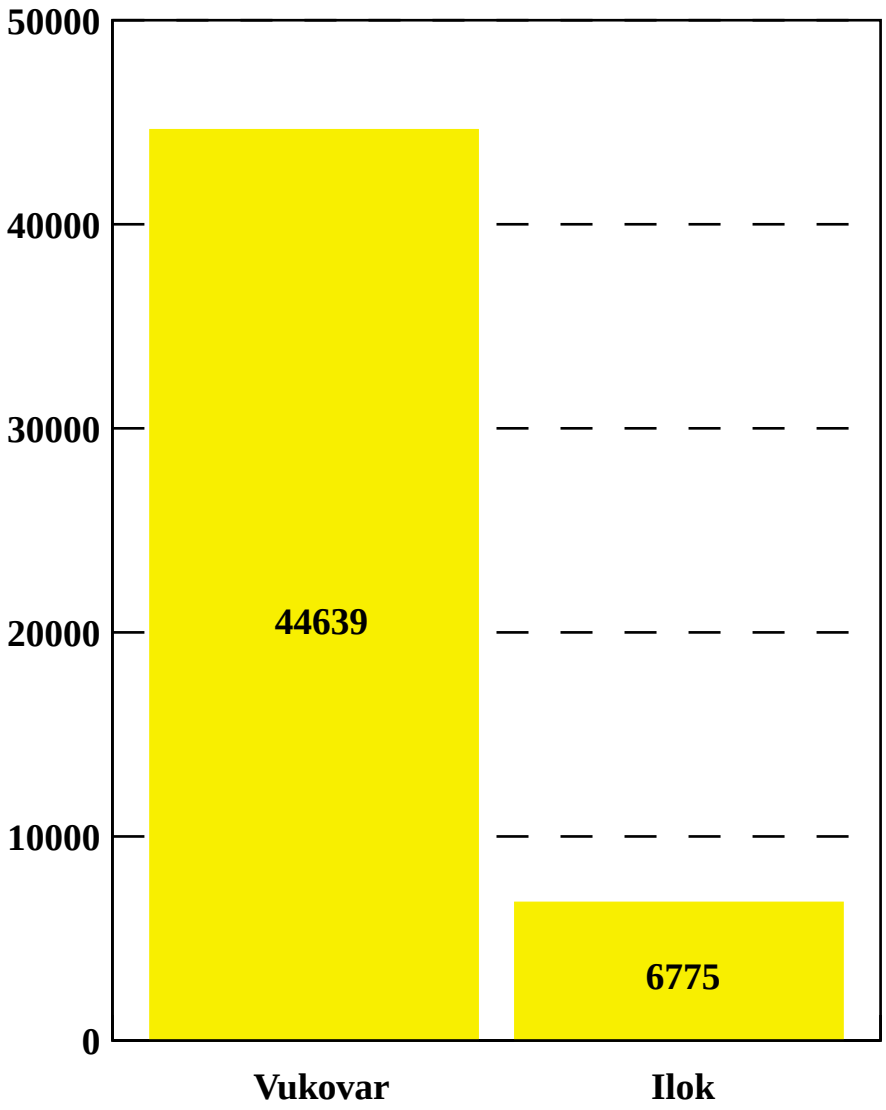
35347
11947
Plaski
Ogulin
Plitvicka jezera
Duga Resa
Karlovac
Petrinja
Zapresic
Zagreb
Sesvete
V. Gorica
Sisak
Dugo Selo
Ivanic
Krizevci
Bjelovar
Cazma
Kutina
Garesnica
Grubisno Polje
Daruvar
Pakrac
Lipik
Novska
N. Gradiska
Pozega
Oriovac
Slavonski Brod
Dakovo
Vinkovci
Zupanja

Dunav - gradovi (naselja)



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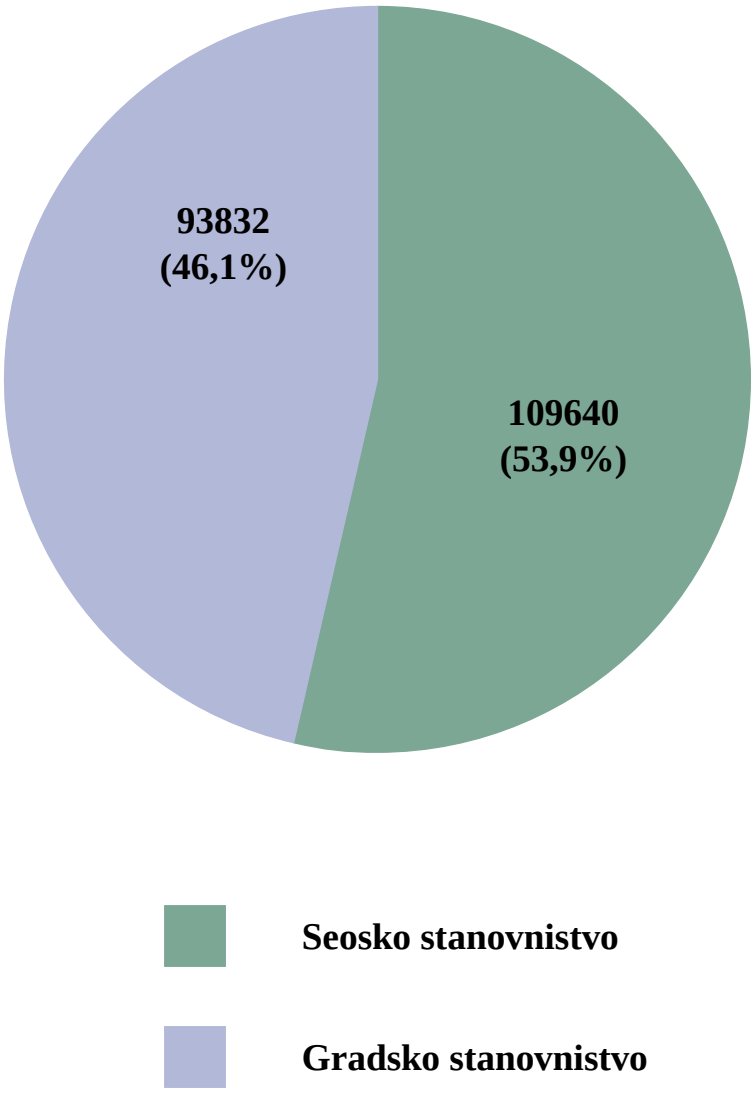

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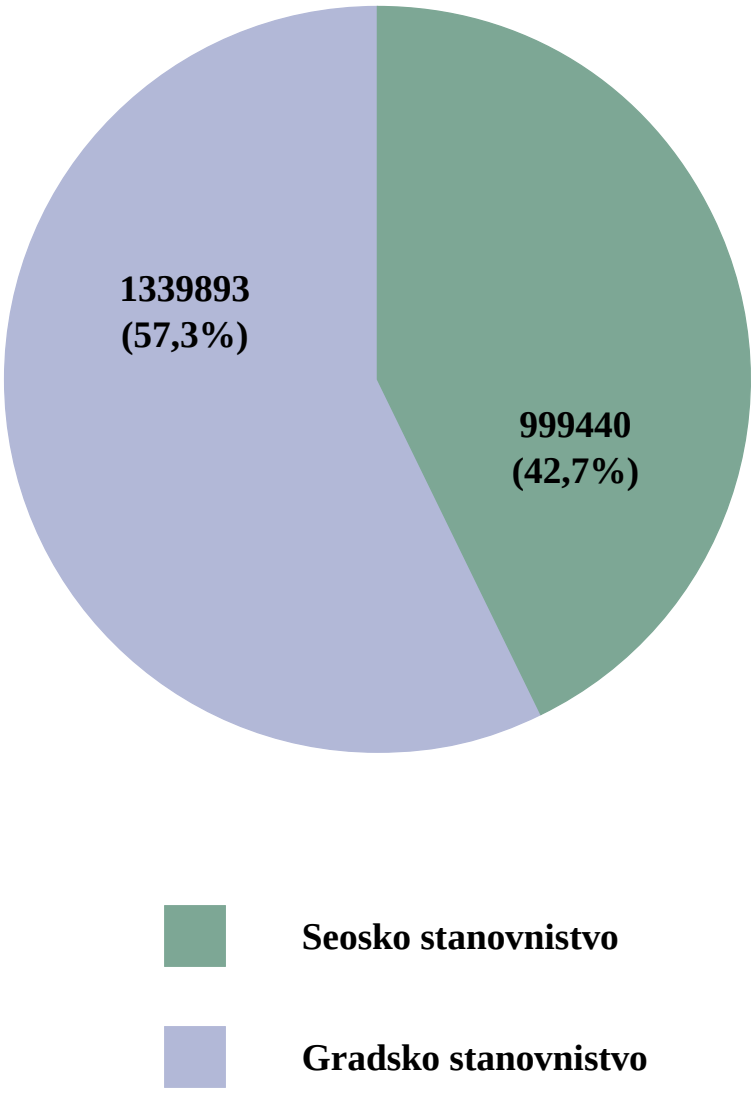

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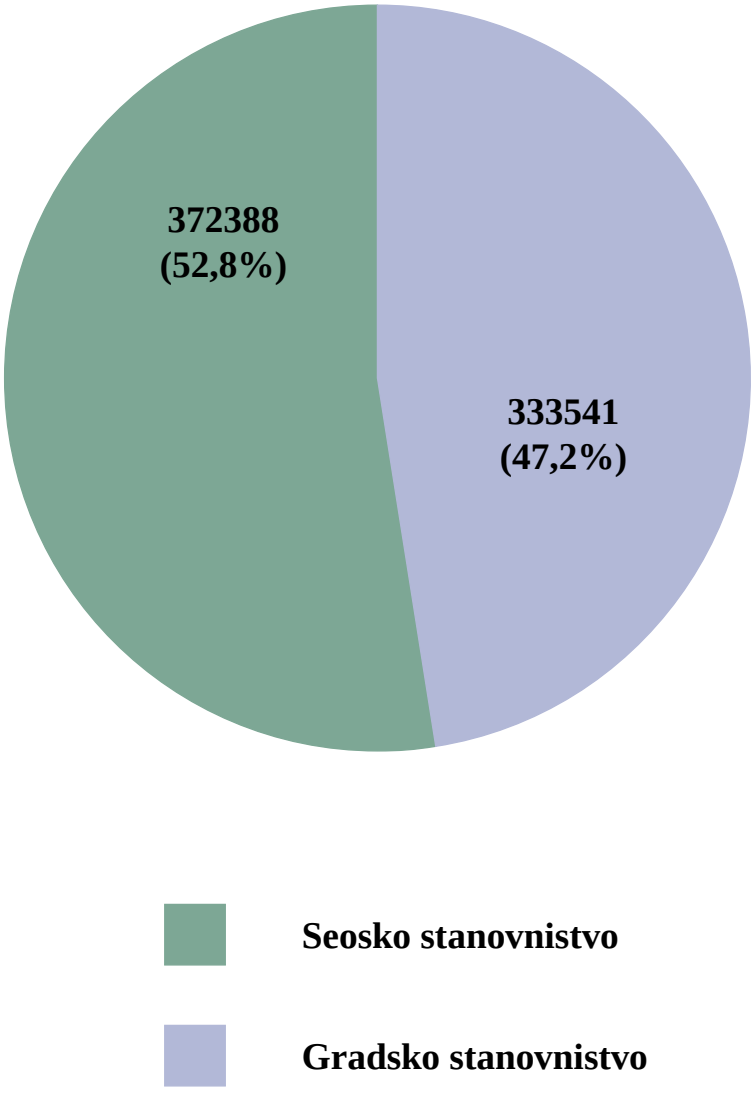

3.1.2. Area

(1) Country area: 56.542 km^2

(2) Catchment areas for the relevant tributaries[4]

(3) Catchment area of the river Drava: 6.888 km^2

(4) Catchment area of the river Sava: 25.100 km^2

(5) Catchment area of the river Danube: 2.416 km^2

3.1.3. Per Capita Income[5]

(1) For the country as a whole in 1996 it was 2.033 kunas (c/a 350 $). Rate of exchange is 1$ = c/a 6,5 kunas as in May 1998. Per capita income is a netto average income of permanently employed persons in the country.

(2) Minimum monthly wage for the country (state guaranteed) was in 1996 1.300 kunas (c/a 200$) (see footnote No. 5).

3.1.4. Domestic Water Demand

Table 3.11. Total water demand in households (excluding economic activities, industries, tourism, public administration, losses etc.) was as follows (in '000 m^3 per year)

	1994	1995	1997
Total	77.000	77.000	65.572
In cities	63.910	63.910	54.425
In villages	13.090	13.090	11.147

Source: Croatian Waters Data, 1998.

The respective data are only on the level of the whole country, which means that there are no specific data on the ratio of urban/rural population, as well as on the exact figures on how many households are connected to the centralized pipeline systems as opposed to the ones supplied by other sources. Also, losses are given only as an average percentage (ratio) of losses. Also, there are no specific data on the domestic water demand for the total catchment area of Danube River as well for the catchment areas for each tributary.

The system of *public water pipelines* was used by 63,0 % of the inhabitants of Croatia in 1991 (no data available for specific catchment areas). Water consumption was approximately, in the days of maximum consumption 22,0 m^3 of water per second. 55,0 % of the quantity of water was used by the economy (production) and 45,0 % by the population. Average water consumption per an inhabitant, connected to the public water systems, without industry and tourism and other activities, was c/a 170 liters per inhabitant per day. In 1990 the total yearly consumption of drinking water provided by public pipeline systems in the country was c/a 500 millions m^3 of drinking water (Strategy,...p 127).

[4] The data are given on the basis of the "Republika Hrvatska: Nacionalni izvještaj, dio I" ("Republic of Croatia: National Report, part I"), Zagreb: Ministarstvo poljoprivrede i šumarstva (Ministry of agricultuire and forestry), 1994, pp. 1.4. -1.8.

[5] The available data are only for the country as a whole. Source: Statistical Yearbook of Croatia, State Statistical Office, 1997, pp. 138, showing the 1996 situation.

It is estimated that in Sava catchment area 62,0 % of population is supplied with public pipeline water systems, in Danube and Drava areas 61,0 % and in Croatia 68,4% in 1997. It is also estimated that total water consumption per an inhabitant with all loses for 1997 was c/a 190,0 liters of water per day and without loses 140,0 liters per day.

Still 1.700.000 inhabitants of Croatia are not yet connected to the public system of water supply (Long-term Programme..., p. 20). In 1994 in Sava catchment area 51,0 % of the population is connected to the centralized water supply systems, but the ratio varied between 8,0 % and 80,0 % (Long-term Programme..., p. 26), in Drava catchment area 52,0 % and in immediate Danube catchment area 60,0 %.

The ratio of *raw water* (water used directly from the rivers, not underground water) used in the centralized public water supply systems to satisfy domestic water demand was in Sava catchment area in 1994 2,3%, in Drava catchment area 6,6% and in immediate Danube catchment area 85,2%.

Table 3.12. The total volume of water taken from the catchment areas in 1996

Danube catchment area	282.003.000 m^3
Drava catchment area	46.951.000 m^3
Sava catchment area	190.085.000 m^3
Total	**519.039.000 m^3**

Source: Longterm Programme.

It means that per capita water demand was in 1996 108.494 $m^{3.}$

Table 3.13. Water taken according to the type of users in 1996 (total)

Households	184.477.000 m^3
Activities	161.959.000 m^3
For other water supply systems	27.550.000 m^3
Total	**373.986.000 m^3**

Source: Long -Term Programme.

If we take only the water demand for households, then we get the data that in 1996. water demand in households per capita (per year) was 38.561 m^3

Water loss within waterworks network in 1996 (total) was 151.467.000 m^3 or c/a 40,0 % of all water taken (Statistical Yearbook, 1997, p. 394). According to another source it is estimated that water loss ranges between 30,0 -35,0 % (Long-term Programme..., p. 54). According to that source, a reduction of the loss to c/a 20,0% could be relatively easy due to the fact that major losses appear on the most concentrated defects in the pipeline systems. As an illustration we will give the quantity of drinking water supplied by centralized pipeline system in the major city of Croatia (Zagreb).

Table 3.14. Quantities of supplied underground drinking water by pipelines to different users 1994-1997 for Zagreb area

Year	Water taken	To households	Others	Total	Loses
	in m^3	in m^3	in m^3	in m^3	in m^3
1994	142.214.335	3.796.936	1.624.114	6.421.050	1.737.947
1995	142.532.820	3.982.176	1.579.829	5.562.005	1.559.466
1996	146.482.240	4.028.461	1.709.177	5.737.638	1.696.203
1997	147.468.109	4.115.615	1.554.410	5.670.020	1.771.870

Source: Hrvatske vode, (Croatian Waters) data on waters, 1998

3.1.5. Domestic Wastewater Production

Table 3.15. Wastewater production in centralized sewage systems in 1996 in Croatia by the type of producers

Households	127.176.000 m^3
Activities (economy)	137.126.000 m^3
Public utilities services	6.641.000 m^3
Total	**270.943.000 m^3**

Source: Hrvatske vode, (Croatian Waters) data on waters, 1998

Total domestic wastewater production in centralized sewage systems per capita was in Croatia in 1996 c/a 56.566 m^3 of water (Statistical Yearbook 1997, p. 399). If we take only households' wastewater production then we get the data that per capita total wastewater production in centralized sewage systems in Croatia in 1996 was 26.583 m^3.

There are no data on domestic wastewater production in centralized sewage systems for specific catchment areas as well as for urban and rural population. Also, there are no data for quantities of domestic sewage collected in septic tanks for the country as a whole and for the specific catchment areas as well as for quantities spilled directly on the ground or into the rivers. Also, there are no data on the ratio of domestic sewage waters, which are purified (treated) in any way. This means that we are unable to give a detailed explanation as asked for in this section. In this section it is visible that we must rely on different sources and estimations which vary in quantities greatly.

According to some other data (See in Basis for..., part III, p. 17), in major cities in Croatia with a total number of 1.639.7272 inhabitants a yearly total wastewater production is 187.360.059 m^3 or 114,3 m^3 per inhabitant per year. The analysis of data in different cities has shown that there are no necessary correspondence between the size of a settlement and the quantity of wastewater production per one inhabitant in a given time span (a year).

Table 3.16. Total discharge of wastewater from public sewage system in 1996 was for Croatia:

Unpurified water	**212.934.000 m^3**
Out of it into the Black Sea watershed (catchment areas of Danube, Sava and Drava)	148.122.000 m^3
Purified water	**58.009.000 m^3**
Out of it into Black Sea watershed	31.594.000 m^3
Total	**270.943.000 m^3**

It means that 78,5% of total sewage waters had been discharged into the catchment river systems without purification, and only 21,5% had been purified (Statistical Yearbook 1997, p. 399).

Table 3.17. Types of wastewater purification in Croatia in 1996

Mechanically	39.229.000 m^3
Biologically	4.971.000 m^3
Combined	13.809.000 m^3
Total	**58.009.000 m^3**

Total *length* of sewage system in Croatia in 1996 was 4.573 kilometers and a total number of connecting pipes was 272.294 (Statistical Yearbook 1997, p. 399).

Relatively small number of households (population) in the catchment areas in Croatia (1991) had been connected to the centralized sewage system:

- in the Sava catchment area: 920.000 pop. or 41,0 %
- in the Drava catchment area: 361.500 or 41,0 %
- in the immediate Danube catchment area: 66.000 or 47,4%, which means that in the total Danube catchment area 1.347.500 inhabitants had been connected in 1991 to the centralized sewage system which makes 41,0 % of the total population in the catchment area.

Primary wastewater *treatment* is organized for 260.000 inhabitants in the Danube catchment area which makes only 8,0 % of the total number of inhabitants, whereas the secondary treatment has been provided for 130.000 inhabitants, or only for 4,0% of total population in the Danube catchment area. In 1990 a total quantity of 253.360.000 m^3 of wastewater was supposed to be treated and actually only 15.250.000 m^3 or 6,0 % was adequately treated, partially 34.020.000 m^3 (13,4%) and without any treatment or as a direct discharge in the streams a total quantity of 204.090.000 m^3 had been discharged (80,6%) (National Report I, p. 1.12).

It is also estimated that in 1990 in industry, in other economic activities as well as in households a total quantity of 253.360.000 m^3 of wastewater had been produced. Wastewater mentioned here does not comprise total wastewater - cooling water used in industry is excluded from this figure. In separate catchment areas the situation was as follows:

Table 3.18. Production of wastewater in specific catchment areas

Sava catchment area	200.000.000 m^3
Drava catchment area	43.360.000 m^3
Danube immediate catchment area	10.000.000 m^3

In Sava catchment area 920.000 inhabitants (40,0 %) are connected to the centralized sewage system and 1.380.000 population (60,0 %) is connected to the individual sewage collection tanks; in the catchment areas of Drava and Danube a total number of 427.500 inhabitants (47,5%) are connected to centralized sewage system and 522.500 (52,5%) to individual sewage collection tanks and in the overall catchment area of the Danube river a total number of 1.347.500 (41,5%) inhabitants are connected to centralized sewage systems and 1.902.500 (58,5%) are connected to the individual waste collector basins (tanks). It also must be mentioned that content of septic basins (tanks) is usually taken and dispersed to agricultural fields and very rarely it ends in the sewage systems due to the fact that tanks are not constructed properly (National Report, part II, p. 5.46).

3.2. Projection for Planning Horizons 2010 and 2020[6]

3.2.1. Population

Due to specific situation in the country (war damages after 1991, see footnote No. 1.), only tentative projections of future population had been made till now. One estimation predicts the total number of 4.500.000 inhabitants in the year 2015 (Strategy.., p. 61.), and the other gives two possible options: for the year 2011 4.627.029 inhabitants, and for the year 2021 4.452.500 inhabitants (National programme.., p. 25.). There are no separate projections for rural and urban population for the future as well as for special water catchment areas in Croatia. However, it means that Croatia can expect only very modest increase in its population in the next 20 years, which can have as a consequence lower level of water and soil degradation due to the stabilized number of population, low level of new production units construction as well as generally better results due to the increase of the implementation of higher measures for water and environmental protection in the country.

3.2.2. Domestic Water Demand

Due to the fact that no greater increase of population is expected (see the population forecasts), domestic water demand could be slightly bigger then the present one due to the general increase of standard of living, extension of public water systems in smaller settlements, etc., but no bigger water demand is expected. One goal is to reach 95,0 % of the supply of drinking water through public water supply systems till the year 2015 (Long-term Programme..., p. 12), but the question is whether this forecast is realistic or not. The planning of future water demand in the continental part of Croatia is based on the following data in the Table below (Long-term Programme, p. 36).

[6] Taken into account the effects of war, there are no official statistical projections of population increase/decrease by the State Statistical Office. We will give two estimations by two Croatian ministries - one based on the "Strategija prostornog uređenja Republike Hrvatske" ("A Strategy of Spatial Organization of Croatia"), Zagreb: Ministarstvo prostornog uređenja, graditeljstva i stanovanja (Ministry of urbanism, building and housing), 1997, p. 61, as well as a projection given in the "Nacionalni program demografskog razvitka" ("National programme of demographic development"), Zagreb, Ministratsvo razvitka i obnove (Ministry for development and reconstruction), 1997, p. 25.

Table 3.19. Projection of future water demand in the continental part of Croatia

Type of settlement	Specific water demand (liters/inhabitant/day) in years		
	1995	2005	2015
Rural centers	150	200	220
Local centers	200	240	260
Municipal centers	250	285	300
Regional centers	300	335	350
Centers of macroregions	330	370	380
Zagreb	350	380	400

Source: Long-term Programme, p. 36

It is also predicted that the level of water supply will be different in different settlements according to their types

Table 3.20. Projection of future water demand in the Sava catchment area

Type of settlement	Water provision (in %) in years		
	1995	2005	2015
Regional centers	72	85	92
Municipal and local centers	62	81	90
Other settlements	35	64	85
Total	**54**	**78**	**90**

Source: Long-term Programme..., p. 50

Table 3.21. Projection of future water demand in the Drava and Danube catchment areas

Type of settlement	Water provision (in %) in years		
	1995	2005	2015
Regional centers	80	90	95
Municipal and local centers	74	85	92
Other settlements	41	70	85
Total	**56**	**79**	**90**

Source: Long-term Programme..., p. 50

In another words, a total water demand for the year 2.015 in the Sava catchment area will be 827.750 m^3/day or 9.581 liters per second or 338 liters per an inhabitant per day. In the catchment areas of Drava and Danube, the projection for water demand in the year 2015 is 284.550 m^3/day or 3.293 liters per second or 298 liters of water per an inhabitant per day (Long-term Programme..., p. 45). It is also planned that in the 2015 year industry in the Sava catchment area will need 11.247

liters per seconds of water and tourists 784 liters of water per second and the inhabitants 9.581, while in the Drava and Danube catchment areas the need for water (water demand) will be for industry 2.484, tourists 191 and the inhabitants 3.293 liters per second of water (Ibid., p. 47).

Table 3.22. Projection of future water demand per different users in Sava catchment area

Type of users	Water demand (liters/per second) in years		
	1995	**2005**	**2015**
Population	4.381	6.809	8.665
Tourism	140	509	764
Industry	5.142	7.994	10.172
Total	**9.663**	**15.312**	**19.601**

Table 3.23. Projection of future water demand per different users in Drava and Danube catchment areas

Type of users	Water demand (liters/per second) in years		
	1995	**2005**	**2015**
Population	1.150	2.326	2.980
Tourism	51	140	191
Industry	1.094	1.755	2.248
Total	**2.495**	**4.211**	**5.419**

Source: Long-term Programme..., p. 57.

3.2.3. Domestic Wastewater Production

Due to the stabilized demographic situation and because greater changes in the increase of population are not expected and projected, and due to the lack of any official estimation, it could be estimated that the domestic wastewater production could be slightly greater then the present one due to the increase of future population using public water systems and automatically producing more wastewater as well as due to the new investments, new factories and rehabilitation of totally or partly damaged factories during the war 1991-1995.

4. Actual and Future Population Potentially Affected by Water Pollution

4.1. Actual and Future Population Potentially Affected by Health Hazards through Raw Water Quality Exceeding Defined Quality Standards for Drinking Water

In Croatia, a classification and categorization of waters is done on the basis of several legal acts and regulations. It is important to note that the basis for measurements and setting the standards - for water management - only standards for the recipient are in use and not standards of effluents. It means that quality control and protection of water quality is done through the setting up of certain standards (concentrations) of the effluent which is based on the quality or receiving capacity of the recipient. According to the law regulation on the classification and categorization of surface and underground waters - according to the use and level of cleanness of water - 4 *categories* of water are presently in use:

1. Waters which could be used for *drinking* - in their natural stage or after purification as well as in the food processing industry, and as surface waters for breeding of some better quality fish (salmonids);
2. Waters which, in their natural stage, can be used for *bathing and recreation*, for water sports and for breeding of other kinds fish (ciprinides) or waters which, after treatment could be used for drinking and for industry which needs a clean water;
3. Waters which either in their natural conditions or after treatment can be used in *agriculture* and in *industries* which do not need a clean water;
4. All other kinds of waters.

Each of these standards does have its maximum and minimum set values of concentration of certain substances. According to these 4 categories, all waters in the republic are classified according to their possible use. In general, all river waters in their upstream flow are categorized in 1st category, lower streams of rivers in the 2nd category, and parts of river streams under great load of pollution are classified in the 3rd category (National Report..., Part I, pp. 2.28-2.29).

According to this classification river Sava is classified into category II except in the part of the river when the river Bosut joins Sava where category III is allowed. Rivers Drava and Danube should be classified in the 2nd category.

River Sava is monitored through 69 monitoring stations (17 on Sava River and 52 on its tributaries). River Drava and its catchment area as well as the immediate catchment area of Danube river is monitored by 36 monitoring stations - 8 on Drava, 2 on Danube and the rest on the tributaries.

Drinking waters are supplied in Zagreb region only by the use of underground water, which is compatible with standards in use for drinking water. It means that all drinking water in Zagreb area is only underground water. It also means that in the catchment area of Sava no river (raw) water is taken directly and supplied to the users.

In other catchment areas the situation is different. But in any case, it is not at all possible to estimate how many inhabitants living in each river basin or along each tributary is potentially in danger due to the unsanitary conditions of the water taken for drinking due to the lack of any data concerning these aspects. It means that for the present situation as well as for the future projections, we are unable to provide the data and evaluation on the number of people living along the tributaries of the three major catchment areas in Croatia potentially in danger due to the quality of

raw water which exceeds the European standards for drinking water due to at least two reasons: (1) there are no data on the quality of water used for drinking in the tributaries by the people living in, mostly smaller settlements (villages); (2) there are no systematic measuring of the water quality used for drinking being classified as the water belonging to the type below EU standards for drinking water. We can provide only some data on the measurement of the drinking water quality as well as for the research based on samples taken in some areas in the country as a whole.

Here are the data on the quality of *drinking water* (all types of sources) in Croatia (for the country as a whole) based on the water safety control findings in 1996.

Table 4.1. Quality of drinking water in Croatia in 1996 based on the findings on samples

	Sample total	Chemical analysis		Microbiological assay	
		No. samples	Unsafe	No. samples	Unsafe
DRINKING WATER	39710	32620	5033	35924	6244
from public water supply	26271	22879	2122	24753	2353
a. raw water	3876	2443	1416	3718	844
b. treated water	22395	20436	706	21035	1509
from other public water supply facilities	7782	4227	1345	5710	1801
from private facilities	5657	5514	1566	5461	2090

Source: Croatian Health Public Office 1998

- Sample total = a total number of collected samples
- No. Sample = number of samples taken for further analysis
- Unsafe = number of samples found unsafe from the number of samples taken for the analysis

Generally, it could be said that type of underground water in Northern Croatia is of a good quality, even on this territory the biggest number of potential sources of pollution are located. The area is densely populated along big rivers, the settlements are connected with major roads, the biggest industrial capacities are built in this area, and that is the most advanced agricultural area in Croatia. Due to these reasons, the quality of underground water is partially and only on some spots degraded by the higher concentrations of nitrites or by the temporary increase of the concentration of organic dilutes. Major reasons of overrepresentation of nitrites is the excessive use of artificial fertilizers and pesticides in agricultural production as well as organic pollution which is caused by the closeness of industrial zones. The monitoring of water quality is organized only on pumping stations for drinking water which is supplied by the public supply system (Basis for the..., part II, p. 114).

In Drava River basin major factors contributing to the degradation of underground waters are agriculture and industry, but on Sava catchment area, especially in Zagreb area, anthropological influence is a major contributor to the environmental degradation and increased water pollution. For example, many pumping stations for drinking water used to be located in the city, but recently many of them had been "lost". In this sense a total quantity of 1.360 liters per second of drinking water is lost which is a consequence of disconnection of 19 pumping stations for drinking underground water in the period 1980-1992. In ten pumping stations with 31 water wells traces of industrial pollution could be detected. Other problems connected with water degradation are industrial untreated wastewater as well as waste dump stations. The major waste dumping location in Zagreb - Jakuševec - is just under reconstruction and when it will be finished, another pumping station of drinking underground water (Črnkovec with the capacity of 4-5 m^3 water per second) could be put in action (Basis for ..., part II, p. 115, 138).

According to the data acquired by the Croatian Waters (June, 1998) a total number of potentially exposed population to health hazards in Sava catchment area could reach up to 240.000 persons (but they are not spatially detected!) due to different reasons: municipal wastewaters, fertilizers, oil spills, industrial pollution, traffic pollution (potential accidents and spills), unprotected pumping stations of underground water, wastewater from agricultural farms, degradation of eco-system due to the high level of exploitation.

Another, very important problem affecting the quality of drinking water, is relatively high proportion of population who use drinking water from private wells where no control of water quality is organized. According to the data, in Croatia 55,0 % of population (1980) is connected to public centralized systems of drinking water provision. In 1991 the situation is improved - 63,0 % of the population is supplied with drinking water from 412 public water provision systems. Another problem is that in these areas inadequate sewage system is in function as well as discharge of wastewater is not properly organized which might cause that a quality of underground water could be in question in some areas (Basis for..., part II, pp. 117, 198). Also, it could be said that underground waters are not investigated thoroughly enough.

Here are the data on the quality of drinking water on the basis of sample analysis from *public drinking water provision systems in Croatia.*

Table 4.2. Quality of drinking water from public drinking water provision systems in Croatia on the basis of testing the samples in the years 1992-1996

Year	Chemical analysis			Microbiological analysis		
	Samples tested	Unsafe	%	Samples tested	Unsafe	%
1992	23080	3392	14,7	24498	1845	7,2
1993	23954	1106	4,8	23867	2592	10,8
1994	25160	1853	7,4	27435	2181	7,9
1995	22312	1177	5,3	24453	1680	6,9
1996	20436	706	3,5	21035	1509	7,1

Source: Basis for..., Part II, p. 199.

- Sample tested. = number of samples taken for further analysis
- Unsafe = number of samples found unsafe from the number of samples taken for the analysis

Here are the data for *other* public water provision systems.

Table 4.3. Quality of drinking water from other public water provision systems in Croatia based on sample analysis 1992-1996

Year	Chemical analysis			Microbiological analysis		
	Samples tested	Unsafe	%	Samples tested	Unsafe	%
1992	5265	1423	27,0	5865	2756	47,0
1993	6033	934	15,5	6499	1979	30,5
1994	5627	997	17,7	6860	2381	34,7
1995	6404	1276	20,0	7944	1848	23,2
1996	4227	1345	31,8	5710	1801	7,1

Source: Basis for..., Part II, p. 200.

- Sample tested = number of samples taken for further analysis
- Unsafe = number of samples found unsafe from the number of samples taken for the analysis

Here are the data on the quality of drinking water based on samples in the *individual drinking water provision systems* (wells). It is estimated that c/a 27,0 % of Croatian population use that kind of drinking water.

Table 4.4. Quality of drinking water in Croatia based on samples in the individual drinking water provision systems (wells) 1992-1996

Year	Chemical analysis			Microbiological analysis		
	Samples tested	Unsafe	%	Samples tested	Unsafe	%
1992	5719	2305	40,3	6546	2758	42,1
1993	5798	2237	38,6	6728	2680	39,8
1994	4524	1752	38,7	4769	2210	46,3
1995	4219	1448	34,4	5294	2112	39,9
1996	5514	1566	28,4	5461	2090	38,2

Source: (Basis for..., Part II, p. 201)

- Sample tested. = number of samples taken for further analysis
- Unsafe = number of samples found unsafe from the number of samples taken for the analysis

From these tables it is evident that the lowest quality of drinking water could be found in individual sources as well as in other types of sources (it is not defined what does it mean "other").

The Republic of Croatia is preparing to adopt also newly set standards for water quality (Basis for..., Part I, pp.20-21) in which major three groups of water can be differentiated:

1. "Ecological quality of water" reflects in itself the whole complexity structures and functions of living communities taking into account natural, geographical and climatic factors as well as physical, chemical conditions and conditions which are the result of human activities. Aesthetic values must also be taken into account.
2. "Good ecological water quality" is a type of water, which is suitable for the use of eco-systems taking into account their capacities for self-purification.
3. "High ecological water quality" is a type of water, which has not yet been exposed to human influence.

4.2. Actual and Future Population Potentially Affected by Health Hazards and Other Impacts on Welfare through Unsanitary Conditions in the Danube River System

We stated earlier that tourism is not very developed in the Danube river basin in Croatia. Scattered bathing capacities along Drava, Sava and Danube rivers (on the banks or in the gravel) are used by the nearby population, especially around bigger cities. This water is under control and has been monitored on a regular basis. Here are major data on the research on the quality of recreational river waters, or bathing water quality, but on the level of Republic Croatia as a whole (the water safety control findings in 1996).

Table 4.5. Quality of recreational river waters in Croatia in 1996 based on sample analysis

	Sample total	Chemical analysis		Microbiological assay	
		No. Samples	Unsafe	No. Samples	Unsafe
Recreational water total	9529	9221	1151	9516	1223
Swimming pools	3580	3403	1001	3567	687
Lakes and gravel	227	96	20	227	23
Surface waters-lakes, rivers	2144	2109	605	1621	996
Other waters	613	562	139	555	12

Source: Croatian Health Public Office, June 1998.

- Sample total = a total number of collected samples
- No. Sample. = number of samples taken for further analysis
- Unsafe = number of samples found unsafe from the number of samples taken for the analysis

As it can be seen from these data, roughly c/a 20,0 % of the samples had been found unsafe. Also, due to the lack of data, we are unable to provide the data on specific tributaries as well as the number of present and future population potentially in danger due to the low quality of bathing river waters. We are unable to provide more precise figures for the stretches in the Danube catchment area due to at least two reasons: (1) there are no data on the quality of bathing water in the tributaries by the people living in, mostly smaller settlements (villages); (2) there are no systematic measuring of the water quality used for bathing being classified as the water belonging to the type below EU standards for drinking water.

4.3. Description of Main Health Hazards through Water Pollution in the Danube River and Tributaries

We showed earlier that quality of drinking underground water, which is used in Croatia for drinking purposes in c/a 90,0 % of cases is in most of the cases of satisfactory quality. But, signs of deterioration had been noticed during last 10-15 years. Further measures to be taken to prevent further degradation and pollution of drinking waters are the following (Basis for..., Part II, p. 202):

1. Reduce pollution of surface and underground waters through construction of treatment facilities for wastewaters;
2. Organize proper waste dumping;
3. Introduce strict control over the use of chemicals in agriculture;
4. Enforce legal measures strictly;
5. Organize continuous monitoring of the quality of drinking water;
6. When planning and constructing water provision systems a maximum precautionary measures against pollution or water degradation must be organized;
7. Population must be more and more connected to the public drinking water provision systems;
8. A better information system on water quality must be introduced;
9. Better education of professionals must be organized;
10. Population in general must be better educated on the environmental protection;
11. Enforcement of repressive measures against polluters must be active.

Due to the fact that we do not have exact or even indicative data on the major hazards due to the pollution of waters, we will present the data on the level of health hazards in Croatia in the years 1992 - 1996 due to the use of drinking water below the standard quality

Table 4.6. Hydroid epidemics in Croatia 1992-1996

Year	No. of epidemics	Illness and reason	No of patients	Area	Type of water object
1992	4	Enterocolitis	30	Rijeka	Cistern of technical water
		Enterocolitis	21	Slavonski Brod	Village pipeline supply system
		Dysentery	76	Pregrada	Village pipeline supply system
		Typhus abd.	14	Pakrac	House well
1993	2	Dysentery bac.	130	Slavonski Brod	Village pipeline supply system
		Dysentery bac.	170	Rijeka	Unregulated captivation
1994	4	Dysentery bac.	7	Virovitica	Village well
		Dysentery bac.	16	Duga Resa	Home pressure device
		Enterocolitis	11	Crikvenica	Local public water supply system
		Hepatitis A	9	Zadar	House well
1995	0				
1996	1	Enterocolitis	38	Imotski	City's public pipeline system

Source: Croatian Public Health Office, data on water, 1998

In the period of 1987-1996 in Croatia a total number of 28 hydroid epidemics had been recorded with a total number of 1.565 persons. Major reasons for illnesses had been the following: house well as a source of drinking water (11 epidemics), a village pipeline drinking water provision system (9 epidemics), city pipeline drinking water provision system (3), a cistern (2), a factory water pipeline system (1), karstic water source (1), water pipeline system in a multi-store building (1)(Basis for..., Part II, p. 204).

The data we presented are showing that hydroid epidemics are rare in Croatia and that we could expect even smaller numbers in the years to come due to the fact that more and more population will be connected to the public water provision of drinking water.

5. Analysis of the Economic Significance of the Danube River System and Impacts of Economic Activities

5.1. Actual Situation

It is understandable that actual quality of waters in the catchment Danube area depends partly also on the type and quality of water coming from other countries, lying upstream, to Croatia. After 1990, some changes had been registered in the quality of waters depending mostly on the following (see National Report, Part I, p. 2.64):

1. The development of water management was much faster then the development of sewage systems and wastewater treatment facilities;
2. Fast economic development after 2nd World War was not followed by the adequate water management which resulted by the construction of big industrial enterprises along small rivers or streams and without facilities for wastewater treatment;
3. The construction of sewage systems was not followed by the construction of adequate facilities for wastewater treatment;
4. Environmental protection was very weak, especially in cities and in the sector of economy;
5. Until recently, industrial wastewater had been discharged without adequate treatment into the systems of public sewage or directly into river streams;
6. Water is cheap so water savings is not stimulated which - on the other hand - stimulates high hydraulic loads in drainage systems as well as in the facilities for wastewater treatment;
7. Major reasons for low efficiency of systems for wastewater treatment are the following: peak hydraulic loads and high loads of pollution, there is a lack of professional staff for facilities' maintenance, the firms to run the treatment equipment are not stimulated to organize the proper work of facilities, etc.

So, taking into account the recent trends it could be concluded that a certain *improvement* had been gained in the qualities of Drava, Sava and Danube waters. Major reasons are: in the upper streams of the rivers Sava and Drava, in Slovenia and in Austria an improvement in the construction of water protection facilities had been registered, and in the countries of Central Europe, and in Croatia, economic recession had been registered too. This recession reduced the level of environmental degradation due to simple fact of reduction in capacities of produced goods, etc. One must bear in mind also that between 1991-1995 we had war in Croatia and some major industrial facilities had been destroyed. Also, tourism had ceased almost completely for some years which also - paradoxically! - contributed to better environmental situation in general (National Report, part I, p. 2.74).

5.1.1. Abstraction of Raw Water from the Danube River System

Surface waters are collected for public use in the centralized pipeline systems or are taken directly by different users (mostly for industrial purposes and agriculture - for irrigation).

Table 5.1. Total capacity of surface waters taken for public use in the centralized pipeline systems in three major catchment water areas in Croatia (1994)

Sava catchment area	920 l/s
Drava catchment area	650 l/s
Immediate Danube area	400 l/s

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Table 5.2. Total quantity of water taken in the catchment areas of Drava and Danube 1994-1997

Year	Quantity (in m^3)
1994	8.763.000
1995	8.080.000
1996	7.351.000
1997	7.917.000

Source: Hrvatske vode Zagreb (Croatian Waters Zagreb), data on waters for Drava and Danube, June 1998.

(Unfortunately, we were unable to acquire the data on the water taken from Sava River).

5.1.1.1. Domestic Raw Water Demand

Domestic demand for water in some cases is satisfied by the direct take of river waters (surface raw water).

Table 5.3. A ratio of total surface raw water taken from the three catchment areas in 1994

Sava catchment area	1,1%
Drava catchment area	2,9%
Danube immediate catchment area	25,6%
Total	2,2%

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998). We were unable to acquire the absolute figures.

Table5.4. Quantities of surface water used by the *households* from the public pipelines for drinking water in the three catchment areas in 1994

Sava catchment area	9,3 M l/d
Drava catchment area	1,1 M l/d
Immediate Danube area	32,9 Ml/d

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Surface waters for public pipeline water demand are used the most in the immediate Danube catchment area (85,2%), much less in the Drava catchment area (6,6%) and the least in the Sava catchment area (2,3%).

More precisely, in the Drava and Danube catchment areas raw water in much more used for drinking, industry and agriculture then in Sava catchment area.

Table 5.5. Quantities of raw water taken from Drava and Danube rivers and supplied to households1994-1997

Year	Quantity (in m^3)
1994	1.960.000
1995	1.913.000
1996	1.955.000
1997	2.045.000

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Table 5.6. Quantity of underground water used for public use in centralized water supply systems in three catchment areas in 1994 (only data in % were available)

Sava catchment area	67,3%
Drava catchment area	63,9%
Danube immediate catchment area	14,8%

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

In general, total quantities of water demand from underground waters are realized with 95,8% in the catchment Sava area, 97,3% in the Drava catchment area and only with 4,6% in the immediate Danube catchment area which means that in the immediate Danube area, as we showed earlier, water supply is organized mostly through raw water supply. So, it is not surprising that the Drava and Danube catchment areas in 4 major towns (Osijek, Vukovar, Belišće and Valpovo) drinking water is supplied by taking raw water.

5.1.1.2. Industrial/Mining Raw Water Demand

Water in need for industry and mining is taken usually in two ways: directly by the industries (direct use - surface waters or underground waters) or from public pipeline water systems. We will present both ways and responding quantities.

Table 5.7. Surface raw waters taken for industrial purposes in catchment areas in 1994

	for cooling	other use
Sava catchment area	79,4%	19,5%
Drava catchment area	18,4%	78,7%
Danube immediate catchment area	7,8%	66,6%

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998).

More precisely, in the Drava and Danube catchment areas raw water is much more used for industrial purposes then in the Sava catchment area.

Table 5.8. A total quantity of raw water used for industrial purposes in the Drava and Danube catchment areas (1994-1997) (in m^3)

	For technology	For cooling
1994	5.003.000	1.300.000
1995	4.270.000	1.397.000
1996	3.659.000	1.237.000
1997	3.895.000	1.477.000

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Table 5.9. Quantity of surface waters used by the industry through public pipeline system in three catchment areas in 1994:

Sava catchment area	9,3 M l/d
Drava catchment area	1,4 M l/d
Immediate Danube area	23,0 M l/d

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Table 5.10. Quantities of surface waters taken for industrial purposes by direct use in three catchment areas in 1994:

	industry	cooling	total
Sava catchment area	151,0 M l/d	654,0	805,0
Drava catchment area	28,5	7,0	35,5
Immediate Danube area	2,7	3,0	5,7

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Table 5.11. Percentage of underground waters used for industrial purposes in three catchment areas in 1994

Sava catchment area	32,7%
Drava catchment area	36,1%
Danube immediate catchment area	85,2%

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

It is interesting, as an illustration, to see In Zagreb area, which belongs to the Sava river basin, how much of raw water was taken for cooling in the electric power station and stations for providing hot water for centralized heating systems.

Table 5.12. Quantity of raw water taken for cooling in the electric power station and stations for providing hot water for centralized heating systems in Zagreb 1994-1997 in m^3

Year	Quantity of water in m^3
1994	30.540.000
1995	69.341.000
1996	35.200.000
1997	35.143.000

Source: Hrvatske vode, (Croatian Waters), data on waters, June 1998.

At the same time, industry had taken in 1997 from its own wells a total of 17.784.291 m^3 of water (Hrvatske vode, (Croatian Waters) data on waters, 1998).

5.1.1.3. Agricultural Raw Water Demand for Irrigation

Table 5.13. Total quantities of water used for irrigation in Croatia in 1996 according to the source of water

Underground water	232.000 m^3
Watercourses (direct)	9.000.000 m^3
Other	365.000 m^3
Total	9.597.000 m^3

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998).

Table 5.14. Total quantity of water spent for irrigation areas in Croatia in 1996 in m^3

Total irrigation area spent	2.291.000
Irrigated on surface	2.244.000
By sprinkling	47.000

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998).

The difference between the quantity of water taken for irrigation and water used for irrigation through different systems is due to the losses of water and the data, which is not precise enough. Also, there are no separate data for each catchment area concerning the use of water for irrigation.

Irrigation areas (melioration areas) are located along all three major rivers in Croatia. Along the Sava River they are covering a total area of 25.100 km^2. *Agricultural* areas are covering 12.052 km^2, which makes 48,0 % of the total areas, *forests* make 9.158 or 36,0 %, *other areas* make 11,0 % or 2.670 km^2 and *unsuitable* areas make 1.220 km^2 or 5,0 % of the total irrigation areas.

In the catchment areas of Drava and Danube a total of 9.304 km^2 is classified as irrigation areas, and 61,0 % or 5.709 km^2 is classified as agricultural areas.

Table 5.15. Use of raw water for agricultural purposes in the catchment areas of Drava and Danube 1994-1997 (in m^3)

1994	500.000
1995	500.000
1996	500.000
1997	500.000

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Table 5.16. A ratio of use of underground water for irrigation in three catchment areas in 1994

Sava catchment area	0,3%
Drava catchment area	0,6%
Danube catchment area	2,8%

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

In the catchment areas, there are many irrigation pumping stations.

Table 5.17. Number of irrigation pumping stations in three catchment areas in 1994

	No. of pumping stations	Capacity in m^3
Sava catchment area	38	167,1
Drava catchment area	7	18,3
Danube catchment area	20	45,25
Total	**65**	

Source: Hrvatske vode Zagreb, (Croatian Waters Zagreb), data on waters for rivers Drava and Danube, June 1998.

Total capacity of all pumping stations was 212,4 m^3 per second. Part of pumping stations had been damaged during the war 1991-1995.

5.1.2. Wastewater Discharge to the Danube River System

Wastewater centralized systems had been built mostly in major cities, centers of municipalities as well as for the supply of bigger enterprises, companies or administrative, cultural or tourist centers. Smaller, especially rural settlements and villages had not been supplied with centralized sewage systems. The existing systems are taking c/a 35,0 % of the total quantity of sewage waters which means that a reduction of the equivalent sewage load is for c/a 25,0 % (Strategy..., p. 135).

Major *reasons* for pollution of the Danube system waters are:

1. Continuous discharge of wastewater
2. Waste disposal
3. Use of pesticides and manure on agricultural fields and their discharge into underground waters as well as into surface waters
4. Erosion processes
5. Aerial pollution
6. Accidents
7. Thermal pollution (Nuclear power plant "Krško", and thermo power electric stations Sisak and Zagreb)

The sources of pollution numbered 2-5 are usually called dispersed or diffused. It is very difficult to quantify them but their share in total pollution is more then respectable due to the unsolved problems with municipal and industrial waste in general. Thermal pollution, according to the results produced by the monitoring stations had been exceeded (allowed maximum is 3 K) a few times yearly, but without greater consequences. The power electrical stations Sisak and Zagreb are discharging also high quantities of cooling waters, but, till now, without greater consequences.

It has been estimated that in 1990 (no newer data available) in the catchment Danube area in Croatia a total quantity of c/a 253.360.000 m^3 of wastewater had been produced.

Table 5.18. Production of wastewater in three catchment areas in 1990 in m^3

In Sava catchment area	200.000.000
In Drava catchment area	43.360.000
In Danube immediate catchment area	10.000.000
Total	**4.253.360.000**

Source: National Report, part II, pp. 3.3-3.

Clean *cooling waters* are excluded from this categorization. It is estimated that in Sava catchment area a total of 200.000.000 m^3 of cooling waters are yearly produced, and in the Danube and Drava catchment areas 3.650.000 m^3. Also, only 10,2% of the total quantity of wastewater had not been discharged into rivers, but it is dispersed in the space - on the agricultural fields, in wells, etc. It has been estimated also that in 1990 a total of 3.-4.000.000 P.E. had been received by the catchment Danube area through concentrated discharge through sewage systems. The total organic load is higher then 1.500.000 P.E. from the number of inhabitants, but due to the treatment facilities it has been reduced by c/a 1.000.000 P.E. in Sava catchment area and for c/a 500.000 in Drava catchment area and in the immediate Danube catchment area. Mechanical and biological treatment of wastewater was done for c/a 8.250.000 m^3 in Sava catchment area, in Drava catchment area c/a 7.000.000 m^3 which makes a total of 15.250.000 cubic meters or only 6,0 % of the total quantity. Tertiary type of wastewater treatment is not at all organized yet.

Table 5.19. Mechanical treatment (purification) of wastewater in industrial facilities located in three catchment areas in 1990

In Sava catchment area	15.000.000 m^3
Drava catchment area	17.520.000 m^3
In the immediate Danube area	1.500.000 m^3

Source: Basis for..., part III, p. 20.

Table 5.20. Discharge of wastewater produced in industry with no treatment into rivers in 1990 in three catchment areas

In Sava catchment area	176.750.000 m^3
In Drava catchment area	18.840.000 m^3
In the immediate Danube area	8.500.000 m^3
Total	**204.090.000 m^3**

Source: Basis for..., part III, p. 20.

The data show that 80,6% of industrially produced wastewater had been discharged directly into rivers in 1990.

In principle, in Croatia, two types of wastewater treatment facilities are in use: type A, with primary mechanical type of water treatment, and type B with biological treatment.

Table 5.21. A list of cities in the catchment areas Sava and Drava, which use wastewater treatment facilities

City	Catchment area	No. of inhabitants	Type of facility
Samobor	Sava	14170	AB
V. Gorica	Sava	31614	AB
Kutina	Sava	14992	A
Bjelovar	Sava	26926	AB
Daruvar	Sava	9748	AB
Varaždin	Drava	41846	AB
Koprivnica	Drava	24238	A
Virovitica	Drava	16167	AB
Belišće	Drava	7619	AB
D. Miholjac	Drava	6935	A
Čakovec	Drava	15999	A

Source: Basis for..., part III, p. 20.

Table 5.22. Total quantities of treated and non-treated wastewater in three catchment areas in 1990 showing the percentage of treatment

Catchment area	Waste-water for treatment	Treated mechanic & biologically		Treated only mech. and in industry		Discharged directly	
	in m^3 in '000	m^3 in '000	%	m^3 in '000	%	m^3 in '000	%
Sava	200.000	8.250	4,1	15.000	7,5	176.750	88,4
Drava	43.360	7.000	16,1	17.520	40,4	18.840	43,5
Danube	10.000	-	0,0	1.500	15,0	8.500	85,0
Total	253.360	15.250	6,0	34.020	13,4	204.090	80,6

Source: National Report, Part II, p. 3.5.

Due to the lack of objective statistical data on the quality of wastewater in the catchment areas, we will present some research data on the quality of wastewater, but only on the level of Croatia as a whole.

Table 5.23. The quality of wastewater in Croatia in 1996

	Sample total	Chemical analysis		Microbiological assay	
		No. samples	Unsafe	No. Samples	Unsafe
Wastewater	7285	7285	-	1780	-

Source: Croatian Health Public Office, June 1998.

- Sample total = number of samples collected
- No. samples = Number of samples taken for analysis

In most of cities systems for wastewater discharge are of a mixed type (sanitary, technological and surface precipitation waters) which means that all types of wastewater use the same pipeline systems.

5.1.2.1. Municipal Discharge

In Sava catchment area 920.000 inhabitants or 41,0 % of the total number are connected to the public sewage systems, in the Drava catchment area 361.000 or 41,0 % of the total number and in the immediate Danube catchment area 66.000 or 47,5% of the total number of inhabitants. In the total Danube catchment area it makes a total number of 1.347.500 inhabitants or 41,0 % of the total number. Major cities are supplied with good sewage centralized systems, but even in the major city, Zagreb, not all areas are connected to the system. A special problem consists of the lack of any sewage systems in rural settlements, villages in which a system of public running drinking water exists but there is no sewage systems. In many households, septic containers are used with free discharge into channels and streams nearby which contribute very much to the contamination and pollution of rivers and soil.

During the last 25 years in the Danube catchment area a total number of 13 municipal wastewater treatment facilities had been built. The smaller is in city Garešnica with the capacity of 7.000 ES and the biggest in the city Virovitica with a capacity of 265.000 ES. Some more wastewater treatment facilities are under construction. Major problems connected with new treatment facilities, especially in the largest urban centers, are great initial financial investments and the lack of sewage systems for discharge of wastewater. Moreover, in many treatment centers a major reconstruction is needed, pre-treatment in many cases is lacking and there are no containers for mud disposal as well as there is a lack of professional workers. Also, in many cases wastewater from different industries are directly connected to the public municipal sewage systems.

Major problems connected with the estimation of quantities of industrial/mining/shipping discharge of wastewater and determination of the size of waste treatment facilities is a real quantity of wastewater produced from different sources. The problem is even more complicated by the fact that different quantities of wastewater are discharged either directly to the rivers, some to the lagoons lying nearby factories and some to the sewage systems of municipal wastewater discharge systems (with or without treatment).

Table 5.24. The data on the water expenditure in some selected cities in the Sava and Drava catchment areas in 1990

City	Area	No. of inh.	Water consumption per year in m^3	Water consumption per inhabitant in m^3
V. Gorica	Sava	31614	2838000	89,0
Zagreb	Sava	706770	78840000	111,5
Krapina	Sava	4481	543443	121,3
Kutina	Sava	14992	1314000	86,7
Karlovac	Sava	59999	7100000	118,3
S. Brod	Sava	55683	3650000	65,5
Županja	Sava	11947	590000	49,4
Đakovo	Sava	20317	1400000	68,9
Varaždin	Drava	41846	6605459	157,9
Koprivnica	Drava	24238	3770700	155,6
Bjelovar	Drava	26926	2130000	79,1
Virovitica	Drava	16167	1800000	111,3
Čakovec	Drava	15999	2083230	130,2

Source: Basis for..., part III, p. 17.

5.1.2.2. Industrial/Mining/Shipping Discharge

In most of industrial estates, independent - non-treated or treated wastewater are discharged directly into water. Only a smaller number of factories do have satisfactory wastewater treatment facilities. Many problems arise due to the fact that discharges are sometimes very intensive and sometimes there are reduced or even lacking at all - due to the nature of production (for example, treatment of sugar).

Still, in some cases wastewater are purified.

Table 5.25. Discharge of purified wastewater from manufacturing and mining in 1995 for Croatia (in '000 m^3)

	Into public sewage	In land	In water courses	In reservoirs	In the sea
Electrical industry	836	-	95	215	72
Other industry	9565	770	11761	2457	7987
Total	**10401**	**770**	**11856**	**2672**	**8059**

Source: Statistical Yearbook 1997, p. 398.

We will also give the breakdown of major factories who discharge directly (with or without any treatment) their wastewater for 1990.

Table 5.26. Major factories in the catchment areas, which directly discharge their wastewater in 1990.

Type of industry	Quantity of wastewater in Ml. d.	
	Treated	Non-treated
1. Sava catchment area		
Pig farm "Dubravica"	0,25	
Meat industry, "PIK Vrbovec"	4,30	0,30
Pharmaceutical industry "Pliva", Zagreb	8,0	0,40
Oil industry "INA, Sisak	9,6	
Thermopower station Sisak	0,5	
Metal industry Sisak	36,0	
Oil treatment industry Kutina	16,0	
Agricultural industry Jasinje	0,4	
Alcohol industry Županja		33,6
Milk industry V. Zdenci	0,95	
Total	**76,0**	**34,4**
2. Drava catchment area		
Sugar factory, Osijek	41,0	
Pig factory, V. Zdenci	0,12	
Pig factory, Darda	1,4	
Meat industry	1,0	
Pig industry	0,40	
Cement industry	0,27	
Foundry factory, Našice	0,15	
Total	**44,49**	
3. Immediate Danube catchment area		
Pig factory	0,15	
Rubber factory Borovo		11,4
Total	**0,15**	**11,4**
Total for the Danube catchment area	**120,64**	**45,80**

Source: National Report, Part II, pp. 5.12-5.34.

5.1.2.3. Agricultural Discharge (major point sources)

Agricultural discharge could be divided in two major parts: (1). Water pollution due to the cattle, pig, horses, sheep and chicken farms. In most of the cases, wastewater are not discharged directly to the sewage systems but are discharged in lagoons as one type of a pre-treatment of wastewater. One part of these waters and solid waste is used on agricultural fields as fertilizers. According to the data, in 1996 in Croatia a total number of 461.000 cattle, 1.197.000 pigs and 21.000 sheep and horses had been breed.

The second part of agricultural pollution comes from the agricultural production itself. In 1996, a total area of 619.000 ha had been used for wheat, 74.000 ha for industrial plants, 116.000 ha for vegetables and 125.000 ha for roughage (fodder). In the same year, a total quantity of 50.787 tones of nitrogen based fertilizers had been used in agriculture, 38 tones of phosphates and 1579 tones of potassium mineral fertilizers (Basis for..., part III, p. 13).

5.1.3. Pollution of Aquatic Systems through Potential Soil and Ground Water Contamination

5.1.3.1. Municipal Solid Waste Disposal

There are only estimations and current researches on the actual number of waste disposal places. So, it is estimated that in 1996 in Croatia a total number of 700 major and mostly not properly regulated waste disposal places had been in use by municipal companies. There are also c/a 1.300 smaller waste dumps, usually called "wild ones". The total quantities of waste produced in Croatia yearly (on average) is 7.720.000 tons or 1.4 tons per inhabitant. 1.350.000 tons per year is classified as municipal waste and c/a 330.600 tons per year is classified as dangerous waste. It is also estimated that only 10,0 % of this waste is properly treated. Only 4 cities in Croatia (only one in Sava catchment area - Sisak) are properly equipped with waste treatment facilities (Strategy..., p. 145). Major municipal solid waste disposals, in many cases "hot spots", are located in (data on the quantities from 1997):

1. Sava catchment area:
   3 waste disposal dumps:
   - Zagreb - in use 30 years, 343.500 tones per year
   - Sisak - municipal and hazardous solid waste, in use 15 years, 106.500 tones per year
   - Karlovac - municipal and technological solid waste - in use 20 years, 30.000 tones per year
2. Drava catchment area:
   3 municipal and industrial waste disposal dumps
   - Osijek - in use 20 years, 50.000 tones per year
   - Varaždin - in use 11 years, 25.000 tones per year
   - Koprivnica - in use 12 years, 16.000 tones per year
3. Danube catchment area
   1 municipal and technological waste disposal dump - Vukovar - in use 30 years, 18.000 tones per year

Another important problem consists of the fact that in most of cases municipal waste is mixed with industrial and dangerous waste as well and dumped on the same landfills or dumps. The process of decision making on the special location for hazardous solid waste disposal places is just in its way in Croatia and till that moment hazardous (and dangerous) waste is mostly kept within places where it is born (hospitals, industry, laboratories etc.).

Nevertheless, we will provide major facts concerning the locations and quantities of waste disposal places (landfills) in the whole Danube catchment area (the data are acquired by the APO - Agency for Hazardous Waste in Zagreb from the ongoing project on this matter). According to their data, there are c/a 140 major waste disposal places (landfills) in Croatia and in the Danube catchment area 93 places. A total capacity of the landfills in the Danube catchment area is 65.500.000 m^3 of waste and till now a total quantity of 23.000.000 m^3 waste had been dumped on these 93 landfills (35,0 % of the total capacity). The data also show that on average c/a 6,5 m^3 per inhabitant in the Danube catchment area had been dumped till now.

We will give also the list of major cities in the catchment areas of Drava, Sava and immediate Danube area, which are supplied with municipal solid waste disposals on which mixed waste is dumped regularly.

A list of major cities in the catchment areas supplied with waste disposal dumps on which waste is dumped on the regular basis.

Table 5.27. Drava Catchment Area - major cities (settlements) supplied with municipal waste landfills

Name of the city	Population 1991	Does have	Does not have
Varaždin	41.846	+	
Čakovec	15.999	+	
Prelog	4.247		-
Koprivnica	24.238	+	
Đurđevac	6.845	+	
Pitomača	5.942	+	
Virovitica	16.167+		
Podravska Slatina	11.416	+	
Đurđenovac	3.923		-
Našice	8.235	+	
Orahovica	4.314	+	
Donji Miholjac	6.935	+	
Belišće + Valpovo	15.824 (7.619 + 8.205)	+	
Beli Manastir	10.146	(no data available)	
Bilje	3.571	(no data available)	
Darda	6.751	(no data available)	
Osijek	104.761	+	
Total	**291.160**		

Table 5.28. Sava Catchment Area - major cities (settlements) supplied with municipal waste landfills

Plaški	2.271		-
Ogulin	10.857	+	
(Plitvice) c/a	1.000		-
Duga Resa	7.513		-
Karlovac	59.999	+	
Petrinja	18.706	(no data available)	
Samobor	14.170	+	
Zaprešić	15.678	+	
Zagreb	706.770	+	
Sesvete	35.337	+	
Velika Gorica	31.614	+	
Sisak	45.792	+	
Dugo Selo	6.508		-
Ivanić	7.104	+	
Križevci	11.236	+	
Bjelovar	26.926	+	
Čazma	2.785	+	
Kutina	14.992	+	
Garešnica	4.308	+	
Grubišno Polje	3.501	+	
Daruvar	9.748	+	
Pakrac	8.179	+	
Lipik	3.725	+	
Novska	8.053	+	
Nova Gradiška	14.044	+	
Požega	21.046	+	
Oriovac	2.049		-
Slavonski Brod	55.683	+	
Đakovo	20.317	+	
Vinkovci	35.347	+	
Županja	11.947	+	
Total	**1.217.205**		

Table 5.29. Danube Catchment Area - major cities (settlements) supplied with municipal waste landfills

Vukovar	44.639	(no data available)	
Ilok	6.775	(no data available)	
Total	**51.414**		

Source: Research data acquired by the APO-Agency for Hazardous Waste, Zagreb, July 1998.

+ = does have a regulated dump place

- = does not have

Special problem of waste dumping is caused by the disposal of solid waste produced in the wastewater treatment facilities. This solid waste is also disposed on municipal solid waste disposal places which are not constructed properly as well as properly maintained. Surface water from precipitation gets polluted in its way into underground waters. Moreover, there is a problem of mud collected in the wastewater treatment facilities. Primary mud is firstly stabilized and then it is disposed in the fields for drying and then taken to the waste dump places as a normal solid waste and municipal waste. Secondary mud could be also treated but on the installations for wastewater treatments in Croatia this problem is not solved on a satisfactory way for the time being (Basis for..., Part III, p. 23).

5.1.3.2. Industrial/Mining/Hazardous Solid Waste Disposal

Hazardous waste in Croatia is classified according to two major principles: according to the Basel Convention and recently according to the EEC standards (Centers for..., 1996, p. 7). On the basis of Basel convention 18 types of hazardous waste is registered:

- Y1 - Waste from human and animal medical care
- Y2 - Waste from pharmaceutical industry
- Y3 - Old pharmaceutical drugs
- Y4 - Waste from production and application of biocides and means for protection of agriculture
- Y5 - Waste from production and application of means for wood protection
- Y6 - Waste from production and application of organic dilutes
- Y7 - Waste from the thermal treatment of metals which contain cyanides
- Y8 - Waste mineral oils
- Y9 - Waste mixtures of oil and water, carbon/water and emulsions
- Y10 - Waste and things which contain PCB
- Y11 - Waste from oil refineries
- Y12 - Waste from production of colors, pigments and varnish
- Y13 - Waste from production and application of raisins, latex, and glues
- Y14 - Waste chemicals out of research treatments, development or education
- Y15 - Explosive waste which had not been treated elsewhere
- Y16 - Waste from photographic industry
- Y17 - Waste from the surface treatment of metal and plastics
- Y18 - Remains which are left during the process of dumping of industrial waste

According to the investigations estimation had been made by the Agency for Hazardous Waste (APO), from Zagreb that structure of waste in 1991. was:

Table 5.30. Structure of waste in Croatia in 1991

Sources	waste quantities (in tones)
Agriculture	1.400.000
Mining	789.000
Industry	3.181.000
Households	1.350.000
Total	**6.720.000**

Source: Agency for Hazardous Waste (APO), Zagreb, June 1998.

A total quantity of 5,0 % or 350.000 tones out of total waste are estimated to be a hazardous waste in 1991 in Croatia. According to newer estimations a total quantity of hazardous waste in Croatia ranges (in the years 1994-1996) between 280.000 and 320.000 tones. In municipal waste, which is estimated as a total quantity of c/a 1.100.000 tones per year for Croatia, there are c/a 2,0 % or more then 20.000 tones of hazardous waste (An Overview of..., 1996, p. 7; Čaldarović, O. et al., eds., 1997, pp. 6-12).

Table 5.31. Data on the types of hazardous waste in the counties of the Danube catchment area

Counties	Types of hazardous waste
Zagreb	Y1-Y8; Y11-Y17
Krapinsko-Zagorska	Y1, Y6, Y9, Y17
Sisaèko-Moslavaèka	Y1, Y4-Y6, Y8, Y9, Y11, Y17
Karlovačka	Y1, Y8, Y9, Y17
Varaždinska	Y1, Y6, Y8, Y9, Y17
Koprivničko-Križevačka	Y1-Y3, Y8
Bjelovarsko-Bilogorska	Y1, Y8, Y9, Y12
Virovitièko-Podravska	Y1, Y4, Y8, Y17
Požeško-Slavonska	Y1, Y4, Y8, Y17
Brodsko-Posavska	Y1, Y4, Y6-Y9, Y17
Osječko-Baranjska	Y1, Y4, Y6-Y9, Y17
Vukovarsko-Srijemska	(due to the war 1991-95, no data are available)
Međimurska	Y1, Y6-Y9, Y17

Source: An Overview..., pp. 8-48.

5.1.4. Hydro Power

In the Drava catchment area three major hydropower stations had been built:

Table 5.32. Types and characteristics of hydro power stations in the catchment areas

Catchment area	Name	Install. power	Yearly production	Water accum.
Drava	Čakovec	75,9 MW	400,0 Gwh	$9{,}0x10^6$ m^3
	Varaždin	85,0 MW	476,0 Gwh	$2{,}8 \times 10^6$ m^3
	Dubrava	75,0 MW	401,0 Gwh	10.8×10^6 m^3
Sava	Dobra (a tributary)	48,0 MW	200,9 Gwh	4.34×10^6 m^3
	Ozalj I (on a tributary Kupa river)	2.9 MW	13.9 Gwh	0.55×10^6 m^3
	Ozalj II	2.2 MW	10.0 Gwh	0.55×10^6 m^3

Source: Statistical Yearbook, 1997.

There are no accumulation or running type power stations in the immediate catchment area of the river Danube.

Out of all river hydropower potentials in Croatia (c/a 20.000 Gwh, today is used 6.100 Gwh and for future use there are estimations that more 6.100 Gwh could be used. Out of 11 accumulation hydropower stations a total of 1.684 MW is installed today, in the 7 running water type energy stations another 362 MW is installed and in the remaining smaller 4 another 14 MW of power is installed (Strategy..., pp. 27, 124).

In 1990 the share of hydropower electrical stations in the total production of electrical energy in the country was 25,0 % (Ibid., p. 129). According to some estimation a total number of 43 hydropower stations with installed power of 1.010 MW and a possible production of electrical energy of 4.600 Gwh could be installed in the catchment areas of Sava and Drava (National Report, Part II, pp. 3.43-3.44).

Due to the fact that other data on the production of electrical energy specified according to types of energy installations and regions in Croatia are not available, we can not provide exact figures on "all accumulation power stations" as well as about the running water type stations in Croatia.

5.1.5. River Fisheries (Danube and Main Tributaries)

The fish catch in river systems of Drava, Sava and Danube is very little except in fish ponds. So the data we present are mostly for the river fish ponds. Individual and recreational fishermen are engaged in river fishing but only for their own needs, not for sale. Mostly fish catch is characteristic for the sea areas, where the most fish is caught. Small number of professional fishermen speaks for itself.

Total fish catch in Croatia in 1996 was 2996 tons (Statistical Yearbook, 1997, p. 242). The breakdown of different sorts of fish is the following:

Table 5.33. Total fish catch in Croatia in 1996 (river and sea)

Carp	1994 tons
Tench	7 tons
Pike	31 tons
Sheat-fish	71 tons
Perch	17 tons
Trout	360 tons
Other fish	466 tons

Total value of exported fish from Croatia in 1996 was 143.456.000 kunas or c/a 23.900.000 $ (Statistical Yearbook 1997, p. 322). A total value of river (and from maricultures in fish ponds) fish catch was estimated in 1996 to be 2.451.104.600 kunas or c/a 408.822.000 $.

The total number of individual *professional fishermen* registered in 1996 was 434 (Statistical Yearbook 1997, p. 242).

Along Sava River there is also a total number of 14 fish ponds with the total area of 9.331 ha with a total yearly water expenditure of 214.000.000 m^3 of water. Along the Danube and Drava rivers a total number of 8 fish ponds had been built with a total area of 3.935 ha with a total yearly water expenditure of 103.550.000 m^3 of water. Water expenditure per one ha in the fish ponds is on average 24.000 m^3 of water per a hectare and the average fish production is on average c/a 1.100 kilograms per one hectare (Strategy..., p. 130).

5.1.6. River Shipping

River Danube, can be used in its total length in Croatia (140 km) for water transport and is classified in the category IV of river suitable for transport. River Drava has been classified into different categories (I, II or III) depending on the deepness of the river: from Danube to Belišće category III (56 km), from Belišće to Donji Miholjac category II (29 km) and from Donji Miholjac to Ždalice category I (113 km).

River Sava is classified as the river of category III for its 144 km (from Slavonski Brod to Brčko), and in the category II from Zagreb to Slavonski Brod (length 287 km) /Strategy..., p. 134/.

In 1995 a total number of 132 domestic commercial vessels were used in the river cargo transport with a total capacity of 90.987 tones (Strategy..., pp. 115-116). In 1996 a total number of tug-boats was 25 and 107 of non-powered cargo vessels and tankers with a total capacity of 89.301 tons. A total quantity of 1.161.000 tons of different goods was transported by river vessels in 1996. They made a total of 22.207.000 tone-km. Domestic transport was 1.127.000 tones with 5.962.000 ton-km and the international one was only 34.000 tones which makes 16.245.000 ton-km. A total of 22.000.000 ton-km was transported by Danube and the main tributaries in 1996.

The total traffic volume in *river harbors* was in 1996 535.000 tones, and domestic traffic was 1.071.000 tons (loaded 536.000 tons and unloaded 535.000 tons) /Statistical Yearbook, 1997, p. 303/. Out of all cargo river transport in the Croatian river harbors c/a 85,0 % was sand and gravel, then c/a 10,0 % on the transport of petrol oil, and 5,0 % on the goods like coal and ore (Strategy..., p. 115-116).

Major river harbors on Danube River is Vukovar, on Drava Osijek, and on Sava River Slavonski Brod and Sisak on the Sava's tributary Kupa.

There are no data about the volume of international traffic in river harbors. Also, there are no data about the number of passengers transported on the rivers. A reader must bear in mind that passenger transport on rivers (especially on the Danube river) was not so popular and widespread in Croatia and that it almost ceased to exist in the years 1991-1995, due to the war in the country and lack of tourist and interest (most of the Danube catchment area was occupied).

5.1.7. Water Related Recreation/Tourism

In major cities along rivers Sava, Drava and Danube (for example, Osijek, Slavonski Brod, Ilok, Vukovar) there are only public beaches, some restaurants and semi-organized places for tourist recreation used mainly by the nearby inhabitants and some visitors from the vicinity. In other words, the number of tourist using the rivers as their recreational destinations is negligible. This could be illustrated by the fact that there are no data and figures about river-related tourism in the official statistics. So, the river Danube is not considered to be a major factor in national or even international tourism. It is very rarely used for passenger transport and not at all for tourist passenger trips. The river is used mostly for bathing and for some boating, recreational fishing and boating-related tourist activities. For the present uses (bathing, etc.) the quality of water is considered of a sufficient quality.

5.2. Projection of Expected Economic Significance / Impacts

Due to the lack of prognostic and reliable data, we can only state that rivers in the Danube catchment area will continue to be an important economic source for the country in general and that the existing uses of water will continue to persist. Due to the lack of precise economic development plans along rivers and in the catchment areas it is not possible to assume potential future economic importance and significance of the Danube river basin in Croatia. Due to the war damages in the country, problems of refugees and damaged and destroyed industrial capacities as well as stagnant and even negative demographic trends, no bigger use of water resources can be expected.

5.2.1. Projection of Abstraction of Raw Water

Due to the lack of data, no projections for the time being could be made (see chapter 5.2).

5.2.2. Projection of Wastewater Discharge

Due to the lack of data, no projections for the time being could be made (see chapter 5.2).

5.2.3. Projection of Other Major Impacts

No major impacts are expected for the time-being.

6. Analysis of the Relevant Legal and Institutional Framework and its Adequacy for Sound Environmental Management of Water Resources and Eco-systems

6.1. Documentation and Short Analysis of the Relevant Legal Framework

6.1.1. General Considerations

Due to the fact that Croatia is an independent state rather recently (from 1990 onwards), it's legal and institutional structure is still in the process of forming, transforming and editing, not only in the fields of water management and environmental protection. Let us firstly briefly describe the regulation in the Danube catchment area.

It was earlier stated that Danube catchment area encompasses 13 counties as a whole and 3 counties partially. Counties are responsible for monitoring, for water inspection, enactment of some legal acts in accordance with laws as well as different jobs of a legal nature prescribed by the Law of Waters. On the higher level, the control and organization of jobs is done by the office on the republican level - such as The State Directorate for Water Management and Ministry of Agriculture and Forestry. A National Council for Waters is expected to be formed in Croatia to monitor different interests, aspects, improvements and maintenance of water systems in Croatia. A body to do that type of job for the moment is partially Council for Spatial Planning and Protection of Environment formed by the Parliament of the Republic of Croatia.

Water management is organized in Croatia according to the recognition of different catchment areas consisting of one or more special areas. There are several water management areas:

1. Catchment area of the river Sava
2. Catchment area of Drava river
3. Immediate Danube catchment area
4. Water management area of Primorje and Istria
5. Water management area of Dalmatia

(1+2+3 makes the total catchment Danube area)

One water management area (catchment area) makes a territorial unit for water management on a local level.

6.1.2. Laws and Regulations Connected with Water Management

Major laws and regulation connected with water management in Croatia are the following:

(1) Zakon o vodama, published in the "Narodne novine"[1] (Official Gazette) No. 53/1990, 61/1991 and 27/1993) (Law on Waters), from 1990. (with supplements in 1991. and 1993.) regulates the relationships in connection with waters, water management organizations, regimes of waters, water financing and organization, lad-use relations and regulations connected with the right to have water, restrictions on the rights of private owners in connection with water protection and protection of water from detrimental influences on the quality of waters, etc.

[1] Each regulation, decision, rule book, law, etc. is firstly discussed and accepted in the Croatian Parliament and then published in the "Official Gazette".

(2) Uredba o klasifikaciji voda (Regulation on Water Classification), published in "Narodne novine" (Official Gazette"), No. 15/1981. This regulation orders the values of indicators for water quality (chemical and physical, biological, microbiological and radiological). According to this criteria all waters in Croatia are classified into 4 major categories (see earlier).

(3) Uredba o kategorizaciji voda (Regulation of Water Categorization), published in "Narodne novine" (Official Gazette), No. 15/1981, classifies water streams, parts of water areas, underground waters, lakes and the sea into different categories according to the type of use and level of quality.

(4) Uredba o maksimalno dozvoljenim koncentracijama opasnih tvari u vodama i obalnom moru (Regulation on the Maximum Allowed Concentrations of Dangerous Components in the Coastal Waters and in the Sea), published in "Narodne novine" (Official Gazette), No. 2/1984 regulates the allowed concentrations of dangerous components in specific water categories and categories of the sea and specifically restricts or forbids the use of their use above certain values.

(5) Uputstvo za vođenje evidencije o učestalosti ispuštanja u vode opasnih i štetnih tvari, količini i sastavu tih tvari i načinu dostavljanja podataka o tome vodoprivrednim poduzećima (Instruction on How to Organize Book-keeping on the Frequency of Discharges into Water of Dangerous and Harmful Components, its Quantities and Number of Components as well as on the Ways How These Data Should Be Distributed to the Water Management Companies), "Narodne novine" (Official Gazette), No. 9/1990.

(6) Pravilnik o uvjetima koje moraju ispunjavati laboratoriji koji se bave ispitivanjem kvalitete voda (Rule Book on the Conditions Laboratories for Inspection of the Quality of Water Must Comply To), "Narodne novine" (Official Gazette), No. 40/1991. This rule book regulates very precisely condition laboratories that perform the inspection of water quality of rivers, lakes and the sea must comply to be able to be licensed for this activities. This rule book secure also the quality of research in which an intercalibration for the indicators each licensed laboratory is allowed to measure.

(7) Pravilnik o zaštitinim mjerama i uvjetima za određivanje zona sanitarne zaštite izvorišta vode za piće (Rule Book for Protection Measures and Conditions for the Declaration of Zones of Sanitary Protection of Sources of Drinking Water), "Narodne novine" (Official Gazette), No. 22/1986. On the basis of this regulation, zones of sanitary protection of sources of drinking water are proclaimed which is followed by the issuing of a specific regulatory decision (previously on the level of municipality, and today on the level of a county assembly).

(8) Plan za zaštitu voda od zagađivanja (A Plan for Water Protection Against Pollution), "Narodne novine" (Official Gazette), No. 22/1986. This plan regulates especially:

- measures to be taken for restriction of termination of disposal into water of dangerous or harmful substances;
- measures to be taken to stop the disposal of waste or other substances in the area in which that disposal could be a deterioration factor to the water quality;
- measures to be taken for purification of polluted waters;
- the way how urgent measures in the hazardous and accidental cases of water pollution should be put into action;
- agents and subjects responsible for the implementation of specific measures; and
- responsibilities and duties in the connection of implementation of measures for water protection.

(9) Pravilnik o izdavanju vodoprivrednih uvjeta, vodoprivrednih suglasnosti i vodoprivrednih dozvola (Rule Book on the Issue of Water Management Conditions and Water Management Compliance and Water Management Permits), "Narodne novine" (Official Gazette), No.

6/1992. Water management conditions and accordance are issued in the relations with the building up of objects, which might have an influence on the water regime. Water management permits are issued in the relations with the activities performed and are given for the use of water and water discharge, or in another words, for production and traffic of chemical substances which come into water.

(10) Odluke o visini naknade za zaštitu voda (Decisions on the Value of Fees to be Paid for Water Protection), "Narodne novine" (Official Gazette), No. 15/1991, No. 19/1992, No. 79/1992 and No. 89/1992). This decision gives details how a fee for water use is calculated.

(11) Odluke o visini naknade za korištenje voda (Decisions on the Value of Fees To Be Paid for Water Protection) "Narodne Novine" (Official Gazette), No. 15/1991, 19/1992,79/1992 and 84/1992. These decisions regulate the level of fees for the use of waters as natural resources from water streams, from the sea, water accumulations, underground waters and other natural resources of drinking water, technological water and water used as a power energy as well as for waters used for other purposes.

(12) Pravilnik o obračunavanju i plaćanju naknade za zaštitu voda (Rule Book On the Ways How to Calculate and Pay the Fees for Water Protection), "Narodne novine" (Official Gazette), No. 30/1991.

(13) Odluka o utvrđivanju slivnih područja u Republici Hrvatskoj (Decision on the Determination of Water Areas in the Republic of Croatia) "Narodne novine" (Official Gazette), No. 53/1991.

(14) Plan za obranu od poplava (A Plan for Defend of Flooding), "Narodne novine" (Official Gazette), No. 13/1992.

(15) The Republic of Croatia has inherited and taken from the former Yugoslavia also some regulations:

a. Zakon o osnovama režima voda važnih za dvije ili više republika odnosno autonomnih pokrajina i o međudržavnim vodama (A Law On the Water Regime which Are Important for Two or More Republics or Autonomous Provinces and in the International Waters) Narodne novine (Official Gazette), No. 53/1991.

b. Uredbe o klasifikaciji voda međurepubličkih vodotoka, međudržavnih voda i voda obalnog more (Rule Book on the Classification of Waters in Interrepublican Waterflows, International Waters and Waters of the Coastal Sea) "Narodne novine" (Official Gazette), No. 53/1991.

c. Odluka o maksimalno dopuštenim koncentracijama radionukleida i opasnih tvari u međurepubličkim vodotocima, međudržavnim vodama i vodama obalnog mora (Declaration on the Maximum Allowed Concentrations of Radionucleids and other Dangerous Substances in the Interrepublican Water Flows, International Waters and the Waters of the Coastal Sea) "Narodne novine", (Official Gazette), No. 53/1991.

6.2. Analysis of Relevant Institutional Framework

Major institutions in the regulation of water management are the following:

6.2.1. Major administrative units

(1) Ministratsvo poljoprivrede i šumarstva - Uprava za vodoprivredu (Ministry of Agriculture and Forestry - Administration for Watermanagement). Major goals of this Watermanagement Administration unit orients long-term watermanagement development, trying to optimize water uses, to initiate laws and regulations in the field of water and other jobs in its competency. This administrative watermanagement unit consists of two divisions:
- Odjel za gospodarenje vodama (The Department for Watermanagement)
- Odjel republičke vodoprivredne inspekcije (The Republican Department for Watermanagement Inspection)

(2) Ministarstvo graditeljstva i zaštite okoliša (Ministry of Construction and Environmental Protection). This ministry is responsible for administrative and other professional jobs concerning environmental protection. The sector for environmental protection consists of several subdivisions: Odjel za upravne poslove (Department for Administrative Affairs), Odjel za stručne poslove (Department of Professional Affairs), Odjel inspekcije (Department for Inspection), Odjel za Jadran (Department for the Adriatic Sea) and Odjel za kontinent (Department for Continent).

(3) Ministarstvo zdravstva (Ministry of Health).

(4) Državna uprava za vode (State Directorate for Waters)

(5) Državna uprava za zaštitu okoliša (State Directorate for Environmental Protection)

6.1.2. Organizations for Water Management and Water Economy

(1) JVP Hrvatska vodoprivreda (Public Water Enterprise - Croatian Watermanagement).Major activities of this organization consists of:
- preparation of watermanagement basis, plans for river basin areas and plans for watermanagement
- protection from harmful effects of water
- uses of water
- water protection
- management of the public water resources
- organization and use of the unified informational system as well as documentation on waters
- other jobs determined by law

(2) Water management as well as other jobs connected with water in Croatia are organized according to the territorial and administrative principles. So, in Croatia today, there are altogether 20 different organizations that take care about jobs connected with waters on local territories and administrative units. Their jobs are: to take care and regulate river basins, to organize technical and economic maintenance of water resources, to regulate and protect constructions connected with water, to maintain irrigation systems, to organize protection against flooding, to maintain waterprotected areas, to organize technical operations for restriction and sanitation (cleaning) of polluted waters, to take care on water provision, to take care on discharge of wastewaters, to manage the devices for use and discharge of waters and to take care on other jobs determined by laws.

All these institutions work is done in close co-operation with relevant university and research organizations located in Croatia, such as School for Civil Engineering in Zagreb, the same schools in Split, Rijeka and Osijek, then, with the School for Chemical Engineering and Technology in Zagreb, the School of Natural and Mathematical Sciences in Zagreb, then with the School for Oil, Geology and Mining in Zagreb, with the School for Forestry as well as with the major state institute "R. Bošković", located in Zagreb which is a scientific institution legalized to do scientific researches for water management institutions on different levels. It does the research on quality of waters, types of wastewater and on chemical substances in waters (a state laboratory). Then, Croatian Office for Public Health also works in close connection with water management institutions, as well as a School of Public Health "A. Štampar" in Zagreb which does laboratory examination of the qualities of international waters between neighboring countries (Hungary-Croatia) through inter-country committees as well as other laboratory examinations as a legalized laboratory. There is also Office for Protection of Health in Zagreb, and State Hydrometheorogical Office in Zagreb, then Institute for Geological Research which does the research on the underground waters, Institute for Civil Engineering and Urbanistic Institute of Croatia who takes care on planning issues.

7. Description and Analysis of Actual Policies and Strategies

7.1. Actual Policies and Strategies

Major activities, actual policies and strategies in the field of water management and protection are concentrated in Croatia around several action plans.

The development of a strategy for environmental protection of all water resources in Croatia which means especially:

7.1.1. Work on and issuing of the national strategy for water protection

The first efforts to build up a sound strategy for dealing with water resources in Croatia had been placed in 1986, but with the recent changes in the governmental and country organization in Croatia many other activities took place. Many international seminars and conferences had been held and the most important one being one held in 1993 on the topic "Basis for a Strategy for Water and Sea Protection from Environmental Pollution in the Republic of Croatia". The results of that conference had been sent to the Parliament of Croatia as a basis for building up a sound strategy for waters. Major points in the strategy are the following:

1. Take care on waters which are still clean as the only reserves for water provision;
2. Remove or take care of the pollution which contributes to the deterioration or pollution of drinking water on the existing or on the planned water sources by the removal of sources of pollution or by the implementation of necessary measures to ensure the quality of water resources needed for healthy environment and health of the people;
3. Take care on water and sea water quality where it satisfies the existing criteria by the implementation of necessary protection measures;
4. Stop the trend of degradation of the quality of underground as well as surface waters and of the sea coastal waters by building up the facilities for treatment of polluted waters on the existing objects and by the implementation of protection measures when new capacities are build;
5. To ensure gradual improvement of the quality of water where it is deteriorated;
6. To secure a comprehensive and steady development in which the resources of space will not deteriorate the quality of waters, people's health and thus leading to the deterioration of further development of a society.

In this strategy, special attention is given to the elaborated programme of activities leading to the enactment of legal material, organizational and staff prerequisites for the implementation of goals, which had been set for. One very important aspects of the strategy is the actual control of the pollutant emission on its source. This is organized through:

1. Enactment of water conditions for new construction units which means that a special act of water accordance (water permit) must be issued by the responsible organization. The objects which might cause deterioration of environment are requested to organize the work on a special study of potential influence on the environment (SUO-studija utjecaja na okoliš = study on the actual and potential influence on the environment).
2. Issuing of plans for water protection which proclaimed that further protection must be organized also in the way to give advantage to the better technologies as well as by the principle that pollution must be removed or reduced on the place of its born;
3. In accordance with the Law on Waters all waters are protected against pollution which means that for every discharge of wastewater and substances a special water management permit must be obtained;

4. Every polluter who discharge wastewater has an obligation that minimally 4 times a year makes control of wastewater on the basis of indicators from a composite sample (BPK5, KPK, suspended substances, pH, temperature, flow and a visible waste substance) as well as on the rest of dangerous and harmful substances which are the result of a technological process;
5. Border values in water management permits start also from the fact that a quality of water of the recipient must be elaborated as well as on the values of each indicators set for a category of a recipient according to the group it is classified into.

7.1.2. The implementation of current activities for water protection

Major activities in this respect are oriented towards the implementation of water protection measures prescribed by the Plan for Water Protection against pollution from city's wastewater. In this respect the major activity is a construction of treatment facilities for wastewater. The facilities are classified into three categories according to the priorities:

1. In the catchment area Sava treatment facilities are planned in Zagreb (Ivanja Reka), Sisak, Karlovac, Plitvička Jezera, Slavonski Brod, Županja, Plaški, Kutina, Bjelovar, Petrinja, Požega, Vinkovci, Zaprešić, Samobor, Velika Gorica, Pakrac, Lipik, Grubišno Polje, Daruvar, Garešnica, Donji Lapac, Korenica and Ogulin.
2. In the catchment area of Drava river the priorities are the following: in Varaždin, Čakovec, Koprivnica, Virovitica, Beli Manastir, Đurđevac, Donji Miholjac, Podravska Slatina, Belišće, Darda and Osijek.

So, in another words, the most urgent problems in catchment areas of Sava and Drava, which means consequently also in the Danube catchment area, is the non-treated wastewater from domestic production as well as the one from industrial activities. On the other hand, the major obstacle how to improve the situation is the lack of money to construct the treatment facilities (National Report, Part II, p. 4.10).

7.1.3. Activities leading to the proclamation of new legislative acts and acceptance of international conventions

In this respect, major activities are oriented towards the acceptance of major European conventions concerning water regulation and protection. At the same time, Croatia is innovating the existing domestic conventions and laws, regulations and rule books to comply to more rigorous standards and expectations on the water standards as well as on the sustainable development of water resources.

Principles which guide also the behavior of different subjects, agents and governmental bodies as well as every inhabitant of Croatia are following several goals and objectives (Basis for..., Part I, pp.6-7). The principle of a comprehensive (integral) approach to all activities in the future include planning dimensions, dimensions of decision making as well as implementation of decisions in the way that the whole water catchment areas are treated in its wholeness. This policy is governed by the adoption of principles of sustainable development, which means satisfaction of needs of today's needs without endangering the possibilities for future generations in their satisfaction of their needs.

Then, the principle of prevention, which could be expressed shortly - "better prevent, then cure". For the water systems, it means the prevention of all possible ways of water pollution as well as the improvement of quality of waters. There is also a principle of caution which mean the avoidance of construction or organization of all activities, which could be harmful for the water system in general.

The principle "the polluter pays" is also implemented as one of the principles leading to better water quality in Croatia as well as an estimation of prices and expected benefits from a certain investment project.

7.2. Sector Policies

The major principle, which governs different sector policies in the field, is oriented towards better co-ordination and planning of different actions organized, planned and financed by different institutions on different levels and with different levels of responsibility and competence. It means that co-ordination between different ministries (for transport, for agriculture, etc.), state directorates (for water management, for environmental protection, for example) is a major activity of the government. Water is recognized as one of the major existing resources in the country as well as a resource, which must be preserved for future generations. It is our conviction that more measures must be organized in the sector of water savings especially in industry, as well as the quality of pipelines must be improved due to the loss of running water. At the same time, the industries must be stimulated directly to use technical waters for their purposes as well as they must be charged much more for the use of drinking water for industrial purposes.

In a more operational way, it means that several principles must be applied in the management of water resources. These actual policies, in accordance with international and domestic conventions signed by the Croatian government or relevant ministries are based on the following:

1. application of wastewater treatment facilities
2. Reduction of wastewater load from industrial facilities;
3. Reduction of discharge of harmful and dangerous components from agricultural production;
4. Increase of control and monitoring measures on risk and hazardous and unexpected and accidental pollution (Basis for..., Part I, p. 7).

Specific policies and guidelines had been developed in accordance with the policies just explained to pursue the targeted goals and objectives. The major ones are the following (Basis for..., Part III, pp.10-11):

1. Work on legal issues for the regulation of water management
2. Work on the national programme for the measurement of the water quality in accordance with regulatory standards on the water quality;
3. Completion on the work on the complex water documentation and the setting up of a comprehensive information system in the water management area;
4. The improvement of the major water quality laboratories;
5. Further professionalization of people employed in the water management area;
6. Reconstruction of the existing wastewater discharge systems;
7. Construction of wastewater treatment facilities in accordance with standards for wastewater and priorities;
8. Construction of sanitary controlled municipal and dangerous waste dumps for the prevention of pollution of underground water;
9. Proclamation of norms for the discharged wastewater following the principle of the "best existing technology".

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Part B

Financing Mechanisms

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1. Summary

With respect to the importance of water for life and national economy, the objectives of the society in the water sector are included in the fundamental document - the Constitution. The Constitution stresses in particular the protection of nature and the environment, conservation and use of natural and cultural resources. The relation to water is further elaborated in more detail by the Water Act (NN 107/95) and the Water Management Financing Act (NN 107/95).

The Water Act defines the legal status of water and water-related estate, as well as the founding of "Hrvatske vode" - legal entity for water management.

Water management is a group of very complex activities aiming at rational use and protection from water (meeting of human demands), simultaneously with protection of natural and cultural heritage and other values.

In this context, particular importance is assigned to designing, construction, maintenance and utilization of multipurpose water management projects.

In planning of water management projects it is necessary to bear in mind the fact that this process is taking place in the context of existing institutions and planning procedures, through two-way dialogue with previously defined problems, tasks, and criteria. The team of professionals involved in the project must cooperate with the institutions which, in accordance with the Water Act, are entrusted with planning and control of water management facilities and systems. Timely incorporating of planning of water management facilities in regional and national plans is of particular importance.

Water supply

Planning of water supply is done at three different levels: the national, county, and town or municipal level. The Water Act of 1995 determines that water use must be regulated through multipurpose planning on the basis of water management permits and concessions. The most important objective of water supply development in Croatia is providing of water of adequate quantity and quality to meat the demands of population and industry. The general development plan of water supply for the period to 2000 is based on the objectives of social and economic development. The water requirements in Croatia for water supply are, as follows: the initial status in 1995 is 27.5 cu.m./sec, and the development program for 2000 is 48.4 cu.m./sec. The planned investment in water supply development amounts to approximately HRK 5,5 billion (USD 900 million), or about HRK 1.150 (USD 180) per capita. The development plan of water supply in Croatia within the National Water Master Plan is adjusted to the national environment planning and protection, and based on the concept of sustainable development.

Municipal wastewater treatment

Water pollution control is one of the essential components of water management. Sewerage is an unavoidable part of infrastructure of vital importance to human health and environment. Its maintenance and improvement is costly. Proper planning is essential for finding of optimum technical and financial solutions.

Water pollution control is regulated by the Water Act (NN 107/1995) and implemented by "Hrvatske vode" as well as by all water users.

Water pollution control regulations determine the limit values of concentration of hazardous and harmful substances in water, limit values to be met by industrial wastewater before discharging into municipal sewerage after pretreatment (effluent standard) and the obligatory treatment of wastewater likely to cause pollution or contamination. The regulation also includes water

classification with regard to quality, and conditions of water use for various purposes. Water pollution control is carried out in accordance with the National Water Protection Plan and the county plans.

Those plans determine, in particular: the required research and monitoring of water quality, protection and emergency measures, plans of construction of wastewater disposal and treatment facilities. The National Plan includes wastewater treatment plants with the capacity over 50,000 P.E. A component of the Plan is also water categorization. The National Water Protection Plan is passed by the Government of the Republic of Croatia.

The county plans are passed by the respective county assemblies, upon proposal by "Hrvatske vode".

Industrial wastewater treatment

At first, discharging of various kinds of wastewater was based on dilution principle, with harmful substances being gradually diluted in water. In the next stage, some plants (filters, pretreatment, etc.) were used before the wastewater leaves the industrial compound. Afterwards, recycling was applied in order to re-use as much waste material as possible, and at present, clean technology is being applied.

Industrial processes produce large quantities of wastewater with varying degree of pollution. Wastewater may be divided into cooling, process, sanitary, rain and percolating water, or a mixture thereof.

In water management an important issue is establishing of monitoring of 2 wastewater industrial plants and issuing of certificates, which is regulated by the Water Act (NN 107/1995) and the basic legal and technical document under the Water Act is the water-management permit.

Improvement of agricultural practice

One of the fundamental preconditions for harmonious development of the society is provision of adequate quantities of food and other agricultural products. As all available agricultural land is, more or less, already utilized, future requirements will be possible to cover only by increasing the yields, which depends on two key parameters: crp varieties, and adequate agrotechnical measures, including water supply.

Increased, i.e. specialized agricultural production is characterized by high input of agrochemicals (pesticides, fertilizers, etc.) and energy, simultaneously resulting in considerable environment pollution. Ecological management in agriculture requires:

- improved organization and control of application of all agrotechnical and other measures in production,
- improved soil utilization and reduction of adverse effects,
- more efficient use of fertilizers and protective chemicals, and reduction of their runoff outside the area of application,
- research and development of non-chemical and non-poisonous methods of fertilization and protection,
- enforcement of discipline and strict control over discharging of wastewater from processing industry and livestock farms, although the Water Act demands wastewater treatment before discharging into the receiving water.

Financing of the water sector is based on the principle that the collected funds are used strictly for specific programs and projects in the water sector (see table).

Water use fee

Water use fee is paid for water intake and use, and for use of hydro power. In addition to the general water use, the funds of the water use fee are used for specific purposes, such a securing of water resources, research and construction of water use facilities.

The water use fee is paid by legal entities and physical persons taking in or pumping water from watercourses, lakes, storage reservoirs, underground or other natural layers, and using it for drinking, industrial, technological, municipal or other purposes (irrigation and fish-farming). This fee is also paid by legal entities and persons using water for electric power generation or driving of industrial plants.

The water use fee is paid per cubic meter of water taken and used, and for water delivered through water supply systems according to the quantity actually supplied.

The fee for the use of water for generating of electric power is paid in proportion to power generated (kWh) and the use of hydro power for other plants is paid according to the plant power (kW). These funds belong to the local administration units and may be used only for development of local infrastructure (water supply, sewerage and local roads). The level of the water use fee is determined by the Government of the Republic of Croatia. The level may vary depending on water quality, specific conditions and investments required to provide adequate water quantities.

The regulations for accounting and paying of the water use fee (NN/97) define the payers and the methods of accounting and payment.

Water protection fee

The fee for water protection from pollution is paid for polluting or contaminating water, and is used for preparing of water pollution control plans and organizing of their implementation, as well as for construction of treatment plants. The water protection fee is paid by legal entities and persons that discharge wastewater or other substances polluting water or affecting its quality and use.

The fee is paid in proportion to the quantity of discharged wastewater and to the degree of deterioration of water quality (quantity of hazardous substance, intensity of influence on water quality). The level of the fee is determined by the Government of the Republic of Croatia. The fee, except by that paid by users using their own treatment plants, cannot be lower than the costs of treatment.

Funds from municipal companies

The Law on Municipal Services (NN 36/95) defined the principles and the methods of carrying out and financing of municipal services, and other issues related to municipal activities. Municipal services, among other things, include:

- disposal and treatment of wastewater,
- solid waste disposal.

The revenues of municipal companies are provided through:

- price of municipal services
- municipal levies
- budgets of local administration units
- other sources subject to special regulations

According to Article 18 of the Law on Municipal Services, the price and the method of payment is determined by provider of the services. The payers are owners or users of real estate.

Funds from the Government Budget

The Law on the Government Budget of the Republic of Croatia determines the structure of revenues and expenditures for the current year management of Government property and debts, use of revenues by the Budget users, sanctions, rights and duties of the Budget fund users. The Budget funds are provided to entities, which are in charge of implementation of specific purposes. The Budget funds may be used only for purposes specified by the Budget, to the level specified therein, and in accordance with the financial plan, quarterly and monthly plans.

Concessions

The Law on Municipal Services includes a possibility of concession awarding for performing of municipal services. The concession is awarded on the basis of public competition or collecting of bids, and the decision is made by representative bodies of local administration units, taking into consideration in particular:

- bidder's reputation,
- bidder's capability to fulfill the conditions of concession,
- bid conditions - technical and financial
- bid conditions from environmental aspect

Social and private sector - costs of water protection and protection of environmental and aquatic ecosystems

Following the democratic developments in the political system of the Republic of Croatia and transition towards market-oriented economy, the differences between social and private sector have been greatly reduced, and the costs of protection of water, environment and aquatic ecosystems are regulated by the Regulations on accounting and payment of the water protection fee (NN 13/1991).

In assessment of the fee, the difference is not made between the private and the social sector, but between payers, who pay the fee to legal entities carrying out water supply services, in proportion to the quantity of water supplied, and payers discharging technological wastewater, for which the degree of pollution is measured. The amount of the fee is determined by "Hrvatske vode".

2. Legal Basis

The modern concept of water management organization must be a combination of the social influence of users and strong administrative hierarchy in a water management institution or enterprise. Therefore, consequential application of the Water Act, as well as efficient organization of the activities of water management services in Croatia are of utmost importance. To realize the problems of excess, shortage and quality of water it is important to keep in mind the teamwork of professionals of various profiles in the process of finding of optimum solutions in all fields of water management activities.

2.1. Compilation of Relevant Laws and Regulations with Financial Relevance to Water Quality and Water Management Programmes and Projects

In connection with international obligations Croatia has signed and - the Croatian Parliament has ratified - all the international conventions. The pertinent international conventions are:

- The Helsinki Convention (Convention on the Protection and Use of Transboundary Watercourses and International Lakes)
- The Danube River Convention (Convention on Cooperation for the Protection and Sustainable Use of the Danube River)
- Ramsar Convention (Convention on Wetlands of International Importance, in particular Wetlands of Waterfowl Habitat)

The Helsinki Convention concerns the transborder watercourses and lakes for the countries of Europe, that is, the countries of the Economic Commission for Europe. The convention was signed in March 1992 and ratified by Croatia in March 1996. The convention came into force in March 1997 and the first conference of the parties was held in Helsinki in July 1997.

Under the framework of the Helsinki Convention, a bilateral agreement was signed between Croatia and Hungary in June 1994. The agreement was ratified by Croatia in October 1994 and Hungary in 1994. The agreement came into force in early 1995. The agreement created a standing commission, known as the Croatian-Hungarian Commission on Water Management. The Commission on the Mura, Drava and Danube Rivers - that is, the subcommission responsible for the area affected by the proposed project - is currently chaired by Croatia.

The Danube River Convention was signed in June 1994 and ratified by Croatia in January 1996. To enter into force, the convention must be signed by nine countries. It is expected that the convention will be ratified no later than the end of 1998. All of the downstream riparians except the Federal Republic of Yugoslavia (Serbia/Montenegro) were signers of the convention. Although Croatia and the Federal Republic of Yugoslavia (FRY) are signed agreements normalizing relations, the FRY is not a member country of the United Nations organizations and is subject to the international sanctions issued by the United Nations Security Council. Among other things, the Convention created the Danube River Basin Commission, of which Croatia is a member.

The Ramsar Convention relates to wetlands and water basins of international importance. The Ramsar Convention was signed in February 1971 and came into force in June 1991. Three sites within Croatia have been designated as Ramsar sites. They are the Kopacki Rit natural park, Lonjsko Polje Natural Park, and the Neretva River Delta. Only the Kopacki Rit natural park is affected by the proposed investments.

The joint conclusion of the subcommission between the Hungarian representatives and the Croatian representatives for the Danube and Drava Rivers (is that) they will prepare a program for the reconstruction of the pumping stations, which is of mutual interest. They will discuss all construction costs, civil works and equipment and prepare a report, with recommendations, for the President of both commissions regarding the possibility of reconstruction.

Under Croatian law, any investments affecting the Kopacki Rit Park must be approved by the State Directorate for Nature and Environment Protection. The Directorate is in the process of preparing a biodiversity study, which would support and contribute to the 1995 - 2000 Strategic Action Plan for the Danube River Basin. From the Global Environment Fund (GEF) a total of ECU 10 million has been earmarked for studies related to the Danube River and another ECU 2 million for studies for the Drava River. In addition, the GEF has awarded a grant of $ 100,000 to Croatia for environmental studies and preparation of a comprehensive environmental management plan that would include Kopacki Rit.

At present, the law in force is the Water act passed by the House of Representatives of the Parliament of the Republic of Croatia on its session of 13th December 1995 (NN 107/95). The Water Act defines the following activities:

- preparation of Master Plans as a basic documents for water management,
- preparation of TORs, preliminary designs, studies and pre/feasibility studies, technical review panels,
- water courses regulation/training and flood protection, protection from ice - monitoring and control, flood and ice protection activities, emergency activities, erosion and torrents protection, construction management, maintenance of water courses and water structures,
- water use - water resources availability calculation, monitoring and control, coordination and control of water use, other activities and measures for achieving the sustainable water use,
- water quality protection - water quality monitoring, implementation of State Plan for Water Quality Protection, coordination of investment plans for water quality protection, measures for prevention and mitigation of water pollution,
- water property (waterbed, watercourse and flood plain) management,
- water register and information system,
- activities and technical issues in connection with concessions on waters and public water properties,
- supervision over concession contracts and concession implementation,
- project implementation for the water related structures and systems,
- construction supervision,
- identification, planning and coordination of financial sources, for financing the water related activities and
- other activities

These fundamental provisions are stipulated in Article 1.

"Article 1

This Act regulates the legal status of water and water estate, the methods and conditions of water management (water use, water protection, regulation of watercourses and other water bodies, and protection from adverse effects of water), the method of organizing and performing of water management tasks and functions, basic conditions for carrying out of water management activities; powers and duties of Government administration and other Government bodies, local authorities and other legal subjects, and other issues of importance to water management.

This Act also establishes "Hrvatske vode" (Croatian Waters) - the legal entity in charge of water management tasks (hereinafter referred to as: "Hrvatske vode").

The funds for financing of water management tasks shall be provided in accordance with a separate act."

Special Act of Financing Water Management passed by the Parliament in 1995 (NN 107/95), defines the sources and methods of these activities:

Water Management activities of interest to the Republic of Croatia are financed through the water tax, water use fee, fee for water protection from pollution, and for excavation of sand, gravel and rock. These compensations are regarded as particular water management compensations and paid in proportion to the quality of water used, or to the influence on the water regime. Each source of financing of water management activities has a specified purpose. The municipal water supply and sewerage services derive their revenue through charges for the water consumed or discharged.

In Annexes 1 is the Table 1-1 with the list of the relevant laws and regulations on the most essential characteristics of each law or regulation.

2.2. Assessment of Main Deficiencies and Needs for Improvement

Water management is a group of very complex activities aiming at rational use and protection from water (meeting of human demands), simultaneously with protection of natural and cultural heritage and other values.

In this context, particular importance is assigned to designing, construction, maintenance and utilization of multipurpose water management projects.

With respect to the importance of water for life and national economy, the objectives of the society in the water sector are included in the fundamental document - the Constitution. The Constitution stresses in particular the protection of nature and the environment, conservation and use of natural and cultural resources. The relation to water is elaborated in more detail by the Water Act (NN 107/95) and the Water Management Financing Act (NN 107/95).

3. National Policy and Strategy for Funding of Water Sector Programmes and Projects

The year 1996 was the first post-war year since Croatia declared independence in 1991. Overall structural changes made during the war years combined with enormous efforts of all of Croatia's citizens as well as Croatia's strong commitment to peace and political stability in the entire region laid foundations for a sustained economic recovery and reforms that would enable feasible and long-term growth.

Croatia's economy is open which was the case even in the former political system when Croatia was far more market-oriented than most of the centrally planned economies of Eastern Europe. Our economic structure is similar to that of the developed economies with services generating around 60% of the GDP manufacturing 30% and agriculture up to 10%.

The Croatian market poses no restrictions on foreign investment. The legal basis for investment is provided by the Constitution. Moreover, the Constitution guarantees the free transfer of invested capital as well as the free transfer of profits resulting from investment activities in the Republic of Croatia. Consequently, any rights acquired by investing capital cannot be diminished by law or any other legal act.

In planning of water management projects it is necessary to bear in mind the fact that this process is taking place in the context of existing institutions and planning procedures, through two-way dialogue with previously defined problems, tasks, and criteria. The team of professionals involved in the project must cooperate with the institutions which, in accordance with the Water Act, are entrusted with planning and control of water management facilities and systems. Timely incorporating of planning of water management facilities in regional and national plans is of particular importance (Format 1-3 in Annex 1).

For optimum technical and financial solutions of water management projects it is important to prepare beforehand the water master plans on river basin, regional and national levels. The water master plan is a long term planning document determining the base of water management, water balance and improvements of the water system, providing the uniform and harmonious water regime on the river basin and the national level. In its policy "Hrvatske vode" integrates relevant scientific institutions in the process of developing of scientific and research projects in search of optimum engineering, technological and financial solutions of water management projects, in particular multipurpose projects. "Hrvatske vode" finances scientific research projects jointly with the Ministry of Science and Technology, together with other beneficiaries including, in the first place, agriculture, municipal companies, transport, forestry and some industries.

In the past, the Government has given priority to upgrading and extending water supply and sewerage systems and constructing treatment facilities in support of tourism areas and flood protection. Recently, the priority has shifted to repairing war damaged (Municipal water supply and sewerage systems and flood control and drainage facilities in Eastern Slavonia, Lika & Cordun). The Water sector is basically decentralized with the Central Government filling the role of regulator, policy maker and a provider of services that go beyond municipal borders such as regional water supply, irrigation, water source protection, flood protection, land reclamation and drainage. The Central Government also provides grants for priority projects with the funds being raised through water use fees, sewage discharge fees, drainage fees, a payroll tax and funding from the central budget. The responsible agencies at the national level are the Croatian Water Enterprise (Hrvatske Vode) and the State Water Directorate. At the local level, municipalities are responsible for providing water and sewerage services.

According to the Water Act, State Water Directorate, with its four division is established. The prime responsibility of the Directorate is directing of long term development of water resources, management of water resources, and supervision over implementation of the provisions of the Water Act and related regulations.

Organized water management in Croatia has a long tradition (since mid-19th century), and has undergone numerous transformations. At present, the firm HRVATSKE VODE is responsible for carrying out water management activities of public importance as defined by the Water Act. HRVATSKE VODE is in charge of preparing studies and development plans, pollution control, ensuring of water resources, protection from harmful effect of water, and operations of public authority in the water sector. For more operational management of the water system, HRVATSKE VODE has established four Water Management Department and one special for city Zagreb catchment area. There are 31 branch offices of the individual river catchment areas.

HRVATSKE VODE, as well as each of the Department, include sectors dealing with the basic components of water management, i.e. water use, water protection, and protection from water.

With respect to the achieved level of the development and possibilities of science and technology, the future water management development plans must be multipurpose, complex and integrated. In considering the needs for the given planning period it is necessary to define the balance of requirements and possibilities at the level of the catchment area, or river basin. The balance of future requirements must be based on the defined needs, the kind and origin of water.

Hrvatske Vode is organized as follows: management, five organizational units (one in each catchment area) which are based in Zagreb, Osijek, Rijeka and Split. There are 29 public water management corporations responsible for individual catchment areas.

Management, as well as each organizational unit, consists of sectors, which deal with basic components of water management - water supply, water pollution control and protection from hazardous water impact.

Hrvatske Vode has qualified and professional personnel with technical and other professions and long-term experience in the areas of civil engineering, projecting and management, so it successfully performs businesses related to water management works (execution of water management basis, execution of studies, projecting, geodetic works and engineering works).

Except for the main tasks, which result from the Water Act, Hrvatske Vode is engaged in the projects of HKBO, World Bank for Reconstruction and Development; through water management funds from the Town Zagreb Fund for Water Management, Housing and Municipal Activities, the Croatian Roads and the Croatian Forests are joined, and that all amounts to HRK 1,020,000,000.00.

Water management activities have special economic, infrasturctural and social importance, what is also conditioned by the economic position of the water management in whole. Socio-economic relations in water management and its position are planned in the constant process of reciprocal operation and accommodation of all factors of social and economic life.

Because of the achieved results, Hrvatske Vode has exceptional reputation and it is highly thought of throughout the country, what is noticeable from the received letters of gratitude and acknowledgements.

Background about Croatian Water Enterprise one can see in Format 2-3 in Annex 1.

4. National Sources, Instruments and Mechanisms for Funding of Water Quality and Water Management Programmes and Projects

4.1. Relevant Public Funding Sources and Instruments in Use

Generally, there are several funding mechanisms for water pollution control programs, which may be divided into several groups, as follows:

- water protection fee for financing of water pollution control in accordance with Article 3 item 4 of the Water Management Financing Act (Narodne novine 107/95)
- prices of municipal services, pursuant to Article 18 of the Municipal Services Act (NN 36/95)
- Government Budget - in accordance the Budget Act (NN 92/94) through State Water Directorate and State Directorate for Nature Protection and Environmental,
- concessions,
- local and foreign loans,
- other sources

The Water Management Financing Act defines the sources for funding of activities constituting water management pursuant to the Water Act, the rates and levels of such funds, individual liabilities and payment, and other related issues.

According to the above Act in 4.1, the funding mechanisms are:

1. water levy,
2. water use fee,
3. water protection fee,
4. sand and gravel mining fee,
5. catchment area fee,
6. local administration budgets,
7. other sources.

The funds under items 1 through 5 are considered public revenues and paid to the account of "Hrvatske vode".

According to Article 2 of the above Act, funding of water management is based on the following principles:

- funds for financing of water management are provided from the water levy and fees paid by users of the water system, and from other sources determined by the Act;
- funds of the water levy and fees may be used only for purposes defined by the Act;
- funds of water levy and fees are used in accordance with the principle of solidarity of all users in the Republic of Croatia or in the catchment area, except if otherwise determined by the Act (irrigation systems)
- funds for financing of construction of new water supply or water treatment facilities, which are not the property of the Republic of Croatia are provided in the form of loans, or as participation in the investment resulting in property rights (stocks, shares, etc.).

According to Article 3, the tasks and responsibilities on water protection financed under this Act are listed in item 4:

"4. Water protection
4.1. preparing of water protection plans and organizing of their implementation
4.2 water quality monitoring and analysis and undertaking of protection measures
4.3. construction of water protection facilities
(Article 9, par. 1 item 4 of the Water Act)."

4.2. Standardized Funding Mechanisms for Investments in Water Pollution Control

Construction of sewerage, treatment plants and discharges solves the problems of wastewater from settlements and a number of industries; however, as a rule, there is never enough money for their construction.

The annual schedule of construction and co-financing by "Hrvatske vode" is based on the management plans, in accordance with the following criteria:

- 25 percent in areas of particular national concern,
- 35 percent in towns and municipalities where the level of development of the sewerage system is below 30 percent,
- 50 percent in other towns and municipalities.

Capital expenditures and transfer are carried out in accordance with the Construction Act (NN 77/92, 26/93 and 33/95) and the Law on Procurement of Goods and Services and Contract Awarding (NN 192/97). The funds of water levy and fees are used on the principle of solidarity of all water users in Croatia, and if these are not sufficient, "Hrvatske vode" provides the funds through long-term loans from Croatian Bank for Reconstruction and Development, World Bank, and European Bank.

The loan conditions are, as follows:

- loan repayment period 5 - 15 years, including 2-year grace period,
- interest rate 5-8 percent per annum.

The funds for construction of new water protection facilities, which are not the property of the Republic of Croatia, are given as loans or as participation in investments resulting in property rights (shares, stocks).

Hrvatske vode (Governmental agency for water management) has an own source of funding. It levies the following fees from citizens and companies:

- water use fee (for water supply) - 0.73 HRK/m^3
- water protection fee (for wastewater treatment and sewerage) - 0.81 HRK/m^3

50% of these funds are used for projects of national interest. The rest is flowing back to regional and local projects in those regions where the fees come from.

HV's funds come from this water fees, which are regulated by the Parliament and the Government, and, substantially, from the Government budget.

The WMP co-finances the water supply and wastewater treatment projects up to fifty percent (50%) of the investment costs, depending on the availability of other finance sources. The funds are being spent as the non-reimbursable for the reconstruction or maintenance of existing plants. The funds for the construction of new plants and facilities are being spent as loans, under non-commercial basis, or as the ownership shares in the local utility companies.

The co-financing of water treatment projects is restricted to transmission mains, wastewater treatment plants, sewerage outfalls and the depending facilities. Other facilities are financed locally.

The range of the financing and the co-financing encompasses the field investigations, master plans, pre-feasibility studies, environmental impact assessments, feasibility studies, preliminary designs, final designs, technical reviews and expertise, construction and supply contracting.

If there are not enough own funds, which is especially the case with big project, HV and the Government try to find additional funding sources, such as

- foreign equipment suppliers, loans or credits
- loans from World Bank and EBRD via HBOR or directly to WMP, or
- HBOR loans

Depends on the financing construction and the kind of project HV takes part in the repayment up to 30% for water supply and wastewater projects, and up to 100% on other projects.

4.2.1. Typical sources of investment money for municipal wastewater treatment plants

The water protection fee is paid as compensation for water contamination and pollution. The funds are used for the following purposes:

1. preparing of water protection plans and organizing of their implementation
2. water quality monitoring and undertaking of protection measures
3. construction of water protection facilities
4. professional, administrative and other activities in water management, having the character of public services.

4.2.2. Typical sources of investment money for industrial and commercial wastewater treatment/pre-treatment

The water protection fee is paid by legal entities and persons discharging wastewater or other substances polluting water or affecting its quality and usability.

The fee is paid in proportion to the quantity of wastewater discharged and to the intensity of effect on water quality or usability (quantity of hazardous substance discharged, intensity of water quality change, etc.).

The level of the water protection fee is determined by the Government of the Republic of Croatia. The level of the fee, except that paid by payers treating water in their own treatment plants, cannot be lower than the costs of treatment.

4.2.3. Patterns and procedures for municipal and industrial wastewater treatment

The municipal wastewater under the Law of Financing of Municipal Water Activities enterprise collects revenues to meet full cost recovery for both operating and maintenance expenses and capital investments.

4.2.4. Agricultural pollution of ground water and surface water

Agriculture is also a serious threat for environmental degradation/pollution among which loss of biodiversity, soil and water pollution and degradation seem to be most obvious. Moreover, regarding the pollution of water resources, particularly the surface water, several studies have shown that agriculture represents the major, considerably more serious source of pollution than any other sector (e.g. industry, transport, population, etc.)

Additionally agriculture is also the main source of pesticides in water and contributes to the contamination with heavy metals as well. All this is resulting in eutrophication and contamination of water by pathogenic microbes and chemicals.

This shows that more attention should be paid to the change of the present agricultural practice. However, this cannot be achieved by mere technical solutions, but also requires the change in economic and agricultural policies on all levels, so that economic and social conditions, in which low input sustainable agriculture is competitive, can be created.

4.3. Advantages and Challenges of BOT Model

In Croatia, the possibilities include the concession and BOT approach to financing of infrastructure projects, which has numerous potential advantages, being a sustainable alternative to other traditional approaches using government credits or government budget funds. Unlike the full privatization approach, the government retains strategic control over the project, which is returned to the public sector after expiration of the concession period.

Potential advantages for the government in using BOT model in development of infrastructure

- Using of financing from the private sector in order to provide new sources of capital, reducing indebtedness and direct consumption, which may improve the credit rating of the country.
- Using of private capital, initiative and know-how to reduce construction costs, period of construction and to improve the efficiency.
- Transfer of risk and burden to the private sector. The private sector is responsible for the performance, maintenance and the capacity of the project over a long period (generally, the government receives the protection only for the standard construction period and for the standard guarantee period for the equipment).
- Involving of private investors and experienced commercial creditors, which ensures comprehensive reviewing of the project and an additional proof of project feasibility.
- Transfer of technology, local staff training and developing of national capital markets.
- Unlike the full privatization, the government maintains strategic control over the project, which is returned to the public sector after expiration of the contract period.
- The possibility of developing private terms of reference to measure the efficiency of similar projects in the public sector, as well as the possibility of improvement of public management of infrastructure projects.

4.3.1. BOT (build-operate-transfer)

1. BOT projects where the private sector designs, constructs and uses the facility for an agreed number of years, and then transfers the property to the government.
2. BOT projects where the facility is not transferred to the government, but remains private property.

4.3.2. Private management of services

Contract where the private sector constructs the facility according to an agreed arrangement or manages the facility for an agreed number of years, with the agreed price without financing or income risk. As a variant of "contracting out" the private sector retains a part of all revenues, thus bearing the revenue risk.

4.3.3. Leasing models

Leasing is the mode where the private sector may design, construct and finance the facility and charge leasing to the public sector.

4.3.4. Other financing models

Use of private capital, initiative and "know-how" to reduce construction costs, shorten the construction works and to improve the efficiency.

4.3.5. Licensing and monitoring of privately financed or operated services

Possibility of establishing of private guidelines to measure the efficiency of similar projects in public sector, as well as the possibility of strengthening of public management in infrastructure projects.

4.4. Actual Water and Wastewater Tariffs/Charges

Actual financial resources should be used wherever possible to avoid pressure on the country's balance of payments. Given present constraints on public sector expenditures, emphasis should be placed on meeting expenditure requirements from revenues generated at the project level (e.g. charges for municipal water services) before seeking national or international sources of funding. Local sources of funds include all water-related user fees (hydropower, fisheries, recreation, etc.), pollution fees and fines, budgetary allocations and non-budgetary incentives, domestic loans and local private sector investment. Domestic loans may not be a major factor in the short term because local capital markets and banks have not been developed to support environmental improvements and services. Local private investment is constrained by historical barriers to private ownership, a limited local banking and financial sector, and inexperience of potential investors with the types of activities proposed in the Action Plan.

4.4.1. Actual tariff policies and systems

The funds for financing of water management activities are provided in accordance with the Water Management Financing Act.

The annual plans, which are the basis of water management, present separately the expenditures for regular activities, and separately the capital expenditures and transfers. These plans are made before the beginning of the fiscal year, e.e. simultaneously with passing of the Government budget in the Croatian Parliament. According to the Budget Act (NN 92/94) all non-budgetary funds, including "Hrvatske vode", must pass their planning documents at the same time as the Government Budget.

The water sector programs and projects are financed from the sources defined by the Water Management Financing Act. A part of the funds is provided from the Government Budget and the budgets of local administration units. The planned deficit is covered by loans from local and foreign banks and by concessions.

4.4.2. Level and structure of Tariffs

The water use fee is paid per cubic meter of water taken and used, and for water delivered through water supply systems according to the quantity actually supplied.

The fee for the use of water for generating of electric power is paid in proportion to power generated (kWh) and the use of waterpower for other plants is paid according to the plant power (kW). These funds belong to the local administration units and may be used only for development of local infrastructure (water supply, sewerage and local roads). The level of the water use fee is determined by the Government of the Republic of Croatia. The level may vary depending on water quality, specific conditions and investments required to provide adequate water quantities.

The fee for water protection is paid in proportion to the quantity of discharged wastewater and to the degree of deterioration of water quality (quantity of hazardous substance, intensity of influence on water quality). The level of the fee is determined by the Government of the Republic of Croatia. The fee, except by that paid by users using their own treatment plants, cannot be lower than the costs of treatment.

4.4.3. Level and structure of cost

The regulations for accounting and paying of the water use fee (NN/97) define the payers and the methods of accounting and payment. The following are the components of water price in 1996 in table 2 - 4.4.3

1. Water use fee

   Water use fee is paid for water intake and use, and for use of waterpower. In addition to the general water use, the funds of the water use fee are used for specific purposes, such a securing of water resources, research and construction of water use facilities.

   The water use fee is paid by legal entities and physical persons taking in or pumping water from watercourses, lakes, storage reservoirs, underground or other natural layers, and using it for drinking, industrial, technological, municipal or other purposes (irrigation and fish-farming). This fee is also paid by legal entities and persons using water for electric power generation or driving of industrial plants.

2. Water protection fee

   The fee for water protection from pollution is paid for polluting or contaminating water, and is used for preparing of water pollution control plans and organizing of their implementation, as well as for construction of treatment plants. The water protection fee is paid by legal entities and persons that discharge wastewater or other substances polluting water or affecting its quality and use.

Table 2 - 4.4.3. Level and structure of water and wastewater price for private households and industrial consumers

Customer structure of costs	Households per cu.m.	Industry per cu.m.
basic price	HRK 1.26	HRK 3.84
service tax 10%	HRK 0.12	-
specific purpose	HRK 2.00	HRK 2.50
water use fee	HRK 0.71	HRK 0.71
water protection fee	HRK 0.82	HRK 0.82
Total price per cubic meter	**HRK 4.91**	**HRK 7.87**

Source: The Vinkovci Water and Sewerage Enterprise ("VVK") - 1996

Exchange rates USD/HRK: USD = 6,4 HRK

Table 3- 4.4.4. Level and structure of wastewater price for private households and industrial enterprises

Customer structure of costs	Households per cu.m.	Industry per cu.m.
Basic price	HRK 0.68	HRK 1.28
Special purpose	HRK 0.35	HRK 0.35
Water protection fee	HRK 0.83	HRK 0.83
Total price per cubic meter	**HRK1.86**	**HRK 2.46**

Source: "Vodovod Osijek", Osijek - 1996

Exchange rates USD/HRK: USD = 6,4 HRK

4.4.4. Level of actual cost coverage

1. Funds from municipal companies

   The Law on Municipal Services (NN 36/95) defined the principles and the methods of carrying out and financing of municipal services, and other issues related to municipal activities. Municipal services, among other things, include:

   - disposal and treatment of wastewater,
   - solid waste disposal.

   The revenues of municipal companies are provided through:

   a. price of municipal services
   b. municipal levies
   c. budgets of local administration units
   d. other sources subject to special regulations

   According to Article 18 of the Law on Municipal Services, the price and the method of payment is determined by provider of the services. The payers are owners or users of real estate.

   The price of wastewater disposal is described in table 3 - 4.4.4

2. Funds from the Government Budget

   The Law on the Government Budget of the Republic of Croatia determines the structure of revenues and expenditures for the current year management of Government property and debts, use of revenues by the Budget users, sanctions, rights and duties of the Budget fund users. The Budget funds are provided to entities, which are in charge of implementation of specific purposes. The Budget funds may be used only for purposes specified by the Budget, to the level specified therein, and in accordance with the financial plan, quarterly and monthly plans.

3. Concessions

   The Law on Municipal Services includes a possibility of concession awarding for performing of municipal services. The concession is awarded on the basis of public competition or collecting of bids, and the decision is made by representative bodies of local administration units, taking into consideration in particular:

   - bidder's reputation,
   - bidder's capability to fulfill the conditions of concession,
   - bid conditions - technical and financial
   - bid conditions from environmental aspect

4.5. Actual System and Practice of Pollution Charges, Penalties

Description of the following charges, penalties in use in Hrvatske vode income statement. Hrvatske vode Income Statement see in Table 4 - 4.5.

Table 4 - 4.5. Actual system and practice of Pollution (in 10^6 HRK)

	1995	1996	Planned 1997
REVENUES			
Budget Funds	57.5	109.6	123.4
Water Tax on Payroll	176.6	199.0	225.0
Water User Fees (1)	193.2	179.1	315.0
Sewage User Fees (2)	169.4	208.3	245
Fees for Excavation (3)	2.2	2.6	5.0
Catchment Fees (4)	-	85.7	268.0
Total User Fees	364.8	475.7	833.0
Total Fees & Payroll Tax	541.4	674.7	1058.0
Other Income	20.3	35.9	79.0
Total Revenues	619.2	820.2	1137.0
EXPENDITURES			
O&M	211.5	292.0	492.0
Wages	17.2	32.6	55.0
Transfers (5)	241.4	294.7	250.0
Other non-mat exps	26.1	24.5	22.0
Investments	102.2	143.7	295.0
Other non-mat exps	20.5	12.0	23.0
Total Expenditures	618.9	799.5	1137.0
Net Income	0.3	20.7	-

Source: Amounts for 1996 were taken from HV's audited financial statements. Revenues for 1995 were taken from HV's 1996 - 1997 published report on the water sector, assuming and exchange rate of DM:HRK of 2:1, and USD/HRK; USD = 6.4 HRK

(1) User fees for water are based on metered amount of water sold. Water fees are set at DM 0.2 per cubic meter.

(2) Sewerage fees are set at 1.8 x fees of amount due as water fees.

(3) Excavation fees are for cleaning of sand and gravel

(4) Catchment fees are set by the zupanije (counties). The minimum fee by law is the equivalent of 100 kilograms of wheat, l.e. 30 DM, per hectare

(5) Transfers refers to payments to local water companies for investments in water supply & sewerage

4.5.1. Charges for water abstraction (municipal, industrial, irrigation)

Water and sewerage fees on HV's income statement refer to fees collected by local water companies, on behalf of HV. Tariffs charged by local water companies are in two parts: (a) a base tariff to cover the operating and maintenance expenses of each company and (b) a surcharge covering HV's fees, taxes and repayments of loans to HV.

Average water consumption in Croatia is 10 cubic meters per person per day. Thus, average water and sewerage bill is about HRK 67 per person per month. However, the total burden for water, sewerage and flood control investments also includes the water tax collected through the payroll as well as funds collected through the general tax system and paid through the budget.

4.5.2. Charges for wastewater discharge (exceeding defined quality standards)

Of the fees collected on behalf of HV, a minimum of 50% must be invested in capital programs for the local water company that collected the fees. Once the investment is made, title to the facilities is held by the local company. The remaining 50% is invested in other water companies based on national priorities and with input from the counties. As a result, the water companies in the same counties may provide some cross-subsidy for each other's capital investment programs.

In the event that a local water company is unable to meet its debt service payments, the guarantee provided by the county to HV could be called upon, counties have some additional sources of revenue, primarily personal income taxes. The rates on county-levied income taxes vary. For example, in Zagreb the rate is 21%. In most cities it is 8-9%. In war-damaged areas, such as Karlovac, it is 3%.

4.5.3. Other relevant charges, penalties

Investments in flood control and drainage are made directly by HV - and title to the facilities is held by HV. Investments in flood control are paid by the water taxes, collected through the payroll. The payroll is a tax on industrial and commercial companies calculated on the basis of gross wages paid. Investments in agricultural drainage are paid from the catchment fees, charged to property owners. The catchment fees are collected by the local water companies. A minimum catchment fee of the equivalent of 100 kilograms of wheat (or DM 30) per hectare is charged. The county sets the catchment fees and may add additional charges to the fees. In Baranja, the estimated costs for maintenance is DM 30, excluding the power bill of DM 20. Full cost-recovery would thus require a doubling of the catchment fees to 200 kilograms of wheat, or DM 60 per hectare.

Budget funds are used for regional water projects of national importance. They may also be used to support specific investments, such as the flood control and drainage investments in Baranja and Eastern Slavonia.

4.5.4. Assessment of efficiency of actual practice

Capital investment planning is prepared by HV in consultation with the local water companies. Each year HV and the local companies develop a plan for that year. The plan is reviewed by the county governments, whose changes generally relate to changing the order of priorities but not the investments themselves. Following comments from the county governments, HV revised the plan and submits it to the HV Management Council for review and approval. Then the plan is presented to the Government (i.e. the Cabinet) for final approval.

HV's Management Council includes the HV General Manager and representatives from the Ministries of Finance, Agriculture and Forestry, and Construction. It also includes representatives from the Sabor (Parliament), the county administrations, the civil engineering faculty (currently from the University of Zagreb), and local water companies. It does not include representatives from any groups representing water users. The members of the Management Council are appointed by the Government for a period of four years. With a change in Government, the members may also be changed.

While there are no requirements for public meetings, the annual investment plan and its financing plan are published in the official gezette. Tariffs are generally published in the local newspapers.

Two laws govern the water sector in Croatia: the Water Law of 1995 and the Law on Financing of Water Activities also of 1995. In addition, the local water companies are governed by the Law on Municipal Services.

In general, local water services are provided by a municipal level water company, which also provides wastewater services. Most local water companies have been registered as joint stock companies (notes as ("d.o.o.").

4.6. Economic and Financial Incentives For Pollution Reduction Measures

During the transition, critical investments can be greatly facilitated by the government through economic and financial incentives which do not involve a direct budget allocation but which may have a budgetary impact. These include income tax incentives, the conversion of capital into equity and reinvestment of returns, exemptions from duties and special transaction taxes, and export licenses for tradable commodities. Such incentives will improve the financial condition of project authorities and increase the amount of net revenues available for investment and debt service. This will greatly expand the capacity of the utility or authority to mobilize resources for project financing and implementation.

Exemption from duties and special transaction taxes through "The Custom Act" ("Narodne novine" No. 534/91) and "Regulation" ("Narodne novine" No. 93/94; 94/94; 107/95 and 109/95), from goods which have not product in Croatia.

4.7. Quality and Capacity of the National Banking System for Funding of Larger Infrastructure Projects (especially water sector projects)

As the water sector is closely connected and interdependent with the other sectors of economy the Croatian National Bank (HNB) plays on important role. HNB extends loans to other banks, carries out monetary emission operations, controls the operations of other banks, takes care of the foreign change policy and international liquidity of the country, and of the international payment. In 1996, HNB controlled 56 local banks and savings banks, with the total capital of HRK 73.9 billion, or USD 11.55 billion.

The Croatian national Bank cooperates with international financial institutions (IMF, World Bank, European Bank for Reconstruction and Development).

The war in Croatia and the post-war years resulted in great damages to the national economy and for the purpose of reconstruction, the Government of the Republic of Croatia established the Croatian Bank for Reconstruction and Development (HBOR) based on the model of Kreditanstalt fur Wiederbau, Frankfurt/Main, Germany. HBOR has the capital of HRK 3.7 billion, or USD 500 million, and these funds were provided from the Government Budget for the period of 10 years.

HBOR also cooperates with the World Bank and the European Bank, as well as with the German bank for reconstruction - Kreditanstalt fur Wiederbau.

Out of local commercial banks, "Hrvatske vode" cooperates with Zagreba~ka Banka Zagreb, which is the first Croatian bank established as a joint-stock company, and with Privredna Banka Zagreb.

List of the "top ten" Croatian Banks:

1. Zagrebacka Banka, d.d.
   Paromlinska 2, 10000 Zagreb
2. Privredna Banka Zagreb, d.d.
   Rackoga 6, 10000 Zagreb

3. Agro-Obrtnicka Banka, d.d.
   Ignjata Djordjica 8a, 10000 Zagreb
   This bank offers medium to long-term hard currency financing for investment projects of up to DM 1 million in the agri-business sector via an EBRD credit line.

4. Centar Banka, d.d.
   Jurisiceva 24/II, 10000 Zagreb

5. Croatia Banka, d.d.
   Kvaternikov trg 9, 10000 Zagreb

6. Glumina Banka, d.d.
   Kennedyjev trg 6b, 10000 Zagreb

7. Hrvatska banka za obnovu i razvitak
   (HBOR - Croatian Bank for Reconstruction and Development)
   Gajeva 30a, 10000 Zagreb
   Bank-to-bank loan (for tourism projects). This dedicated EBRD credit line enables HBOR to make loans of up to DM 5.5 million, for refurbishment of privately owned facilities.

8. Hrvatska gospodarska Banka, d.d.
   Voncinina 2, 10000 Zagreb

9. Hrvatska Postanska banka, d.d
   Jurisiceva 4, 10000 Zagreb

10. Trgovacka Banka, d.d.
    Varsavska 5, 10000 Zagreb
    Bank-to-bank loan via EBRD credit line. This bank will consider loans of up to DM 1 million to small and medium-sized projects in the private sector.

5. International Assistance in Funding of Environmental/Water Sector Programmes and Projects

For reconstruction and investment in water sector programs and projects, foreign funds are also used, in particular loans from the International Bank for Reconstruction and Development, Washington, and the European Bank for Reconstruction and Development, London, through the Ministry of Finance and the Croatian Bank for Reconstruction and Development. In addition, commercial loans from foreign banks are used through the credit line of Kreditanstalt fur Wiederbau and through the "Hermes" insurance.

International assistance from various international agencies, including the Japanese Grant Fund and GEF funds, is also used for financing of reconstruction of war damages, also through the World Bank - IBRD.

The beneficiaries of such fund may be only the governments, government institutions and private entrepreneurs with government guarantees.

5.1. Documentation of National Policies and Decision Mechanisms for International Co-funding of Environmental and Especially Water Sector Programmes and Projects

The World Bank Group, the European Bank for Reconstruction and Development, and the Inter-American Development Bank the payment made in 1996 - see in the table 5 - 5.

On the basis of the Law on the Acceptance of Membership of the Republic of Croatia in the International Monetary Fund and Other International Financial Institutions on the Basis of Succession (Official Gazette 89/92), the Law on the Acceptance of Membership of the Republic of Croatia in the European Bank for Reconstruction and Development (OG 25/93) and the Law on the Acceptance of Membership of the Republic of Croatia in the Inter-American Bank for Development (OG 94/93), the National Bank of Croatia executes the function of depository. That means that it keeps all depository accounts in the ownership of international credit institutions in the name of and for the account of these credit institutions. It executes all financial transactions with these organizations as fiscal agent of the government of the Republic of Croatia. During 1996, the National Bank of Croatia promptly made all the payments, which the Republic of Croatia had undertaken the obligation to pay, according to the repayment plan specified by specific international credit institutions.

Table 5 - 5.1. Payments made in 1996 on the basis of the Republic of Croatia membership in international financial organizations

Name	Currency	Amount Paid	Promissory Notes of the Ministry of Finance
IBRD		-	HRK 22,147,385.69
IFC	USD	285,600.00	-
EBRD	ECU	1,783,333.34	ECU 1,063,999.99
IDB	a) HRK	601,690.95	USD 1,201,518.00 (Ordinary Capital)
	b) DEM	27,500.00	DEM 2,471,076.00 (Fund for Special Operations - FSO Notes)
	c) USD	32,250.00	USD 64,502.00 (Fund for Special Operations - FSO Notes)

Source: National Bank of Croatia, Annual Report, 1996

5.2. Actual Financial Assistance from Bilateral and/or Multilateral Institutions

The National Bank of Croatia participated extensively in negotiations about the accession of the Republic of Croatia into the World Trade Organization. It was particularly involved in those elements of negotiations involving the banking system and foreign exchange system, as well as macroeconomic policy. The emphasis was on the adjustment of existing legal regulations of the Republic of Croatia to the principles of the WTO ("principle of non-discrimination", "principle of most favored nation" and "MFN clause"). In the field of banking, there are no significant discrepancies between Croatian law and WTO principles. The remaining questions, mainly of a technical nature, will be resolved at several working meetings in 1997. It is expected that the Republic of Croatia will receive full membership right in the WTO by the end of 1997 or the beginning of 1998. This would be a further step in the liberalization of the banking system in Croatia, as part of the liberalization of the whole financial services sector.

5.2.1. Completed and ongoing projects

The funds for financing of treatment plants were never sufficient. Thus, on the territory of the Republic of Croatia about 17 percent of municipal wastewater is undergoing secondary treatment which, including industrial wastewater, comes to about 8 percent P.E. Status of water treatment plants in the Danube basin:

Table 6-5.2.1. Completed project

River basin	Population, 000	P.E. 000	P.E.	
			Connected to plants 1%	
			II stage	primary stage
Save	2,573	5,509	4.5	1.2
Drave i Dunava	343	1,524	33.4	17.5

Source: Monograph "Hrvatske vode", 1991

During the war, many industrial plants were destroyed and the industrial activity has been reduced; as a result, the actual P.E. is considerably lower. Tables is in Annex DX)

5.2.2. Planned Projects

Water pollution reduction measures will be determined and implemented by the new National Water Protection Plan, which is in preparation, and by the County plans based on the National Plan. This plan will also define the financial requirements and sources and methods of financing. This plan will also determine the new water categorization based on the new Decree on Ecological Water Quality, in accordance with the Water Act. Format 2/2 in Annex D2.

5.3. Centralized National Institution/Development or Promotion Bank for Handling International Funds

The Croatian Bank for Reconstruction and Development (HBOR) was founded in June 1992 by the decision of the Croatian Parliament as a state development bank under the name the Croatian Credit Bank for Reconstruction (HKBO). HKBO was founded with the primary task of financing the reconstruction of the Republic of Croatia, following the example of the German bank for reconstruction - Kreditanstalt fur Wiederaufbau, Frankfurt am Main

The founding capital of HBOR is prescribed by the Law and amounts to HRK 3,7 billion (DEM 1 billion). It is provided by the Republic of Croatia by the successive payments from the State Budget during the period of 10 years. The Law gave to HBOR the possibility of obtaining the additional funds by issuing the bonds and taking international loans. Apart from the payments from the State Budget, the capital stock of HBOR consists of the funds of the Croatian Fund for Privatization that was passed in March 1996.

At the beginning of its work, for the reconstruction of Croatian economy the Bank granted loans exclusively from its own funds. But, the first funds from the international sources were the funds from the loan of the World Bank for the Emergency Reconstruction Project granted to the Republic of Croatian in 1994. HBOR took over the managing of this loan as an agent, in the name and for the account of the Republic of Croatia.

5.4. Assessment of Main Weaknesses and Needs for Improvement

The special characteristic of the operation of HBOR is that the loans are granted through the commercial banks pursuant to the provisions of the Law. Exceptionally, by the decision of the Supervisory Board of the Bank, the funds can be granted directly to final borrowers without mediation of commercial banks.

6. Actual and Planned Public and Private Investment Portfolio for Water Quality and Water Management Programmes and Projects

Working out of the environmental impact study is a regular part of pre-investment procedure for projects likely to exert considerable influence on the environment. As an element of timely environmental concern, working out of the study in Croatia is mandatory, subject to the Act on Physical Planning and Development.

Such studies are a contribution to environmental protection and a basis for:

- selection of optimum location or route of works,
- defining and proper managing of technological development,
- remedy measures at the location,
- establishing of data bank for providing information to other countries,
- establishing of basic data for defining of environment development, protection and control strategy.

The requirements regarding the environmental impact study are defined by the Regulations on Environmental Impact Studies and the Environmental Protection Act (NN 82/94) as the fundamental law on environment protection, including water.

6.1. Compilation of Actual and Planned Investment Portfolio

There are 64 projects recommended as measures for reduction of water pollution. Two of them are non-structural projects, whereas all others are structural projects. The total investment costs are estimated at cca 664 millions US$. The summary of number of recommended projects taking into account the type of projects and main river basins in Croatia is given in Format 2/1 in Annex D2.

6.2. Inventory of Actual and Planned Investment Portfolio

In the Republic of Croatia, one firm is registered with the Chamber of Commerce with available capacities for design, construction, installation and start-up of wastewater treatment plants - "Coning-Ekologija", Varazdin. Regarding the technology of water treatment the firm frequently cooperates with Professor Novak from Switzerland, as well as with institutions in Croatia (Faculties of Civil Engineering, Zagreb and Osijek, Institute of Civil Engineering in Croatia - IGH, etc.).

In competitive biddings under international loans, numerous foreign firms have taken part (e.g. Hans Huber, Germany), with their reference lists proving the high quality of construction of wastewater treatment plants.

6.3. Assessment of Main Weaknesses, Problems, Delay in Project Implementation

Today only 63 percent of population in Croatia is supplied from public waterworks, so that the situation in this respect is not satisfactory. These problems affect the standard of living and are in the way of further social and economic development. The development plans ending with the year 2015 include 56 water supply systems intended to cover nearly 90 percent of population.

Large-scale pollution of water streams, ground waters, lakes and the sea is a result of the post-war period. Water pollution prevention is thus the most recent branch of water administration and, certainly, the most demanding in view of both its urgency and the amount of needed investments. About 20 percent of total wastewater in Croatia is being purified. However, with all the existing problems the growing water pollution trend can be said to have been checked.

Annexes

Annex 1.

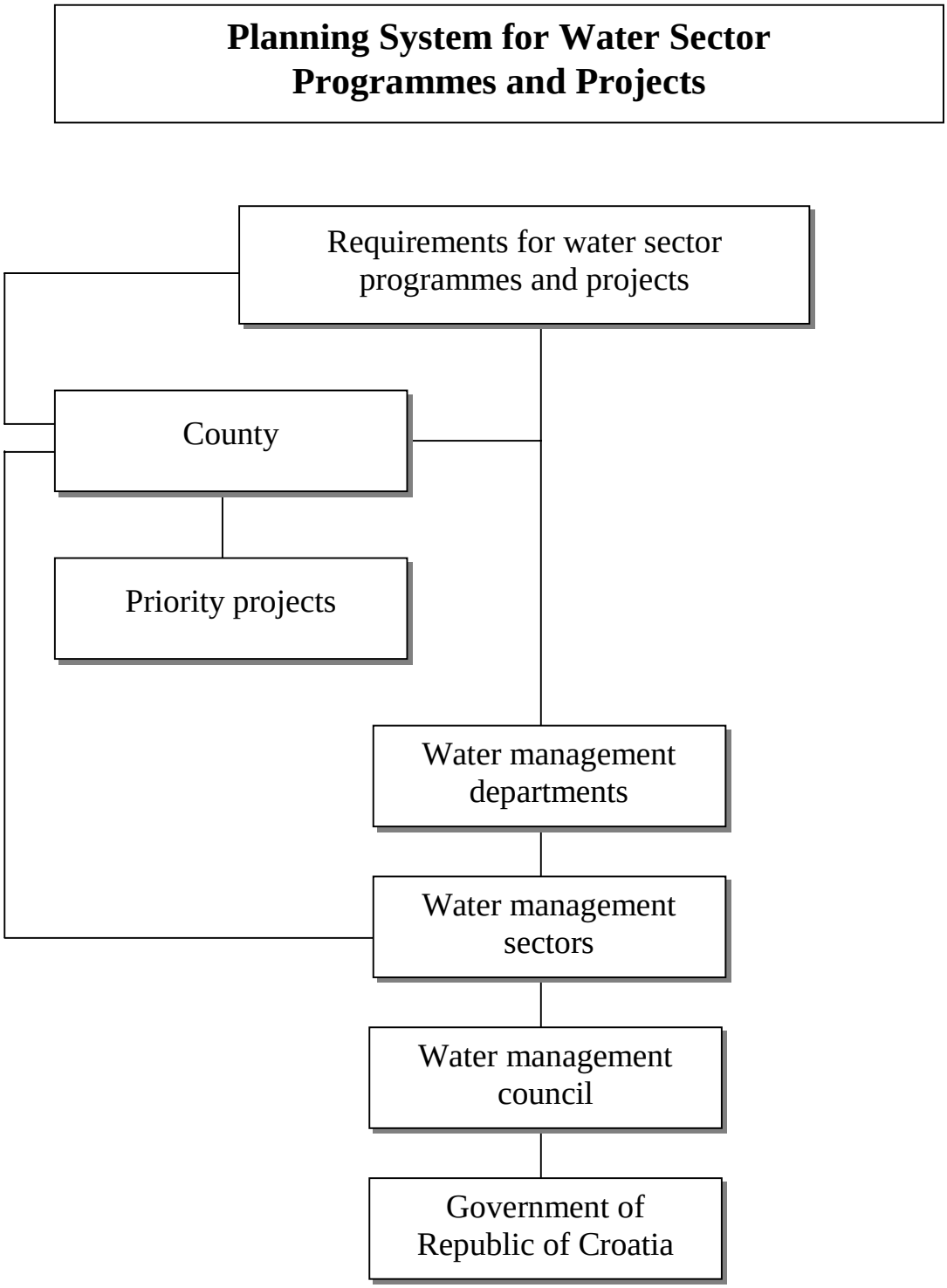
Table 1 - 2.1.	**Compilation of Relevant Laws**
Format 1 - 3	**National Policy and Strategy for Funding of Water Sectors Programmes and Project**
Format 2 - 3	**National Policy and Strategy for Funding of Water Sector Programmes and Project**
Format 3 - 4.4.3.	**Level and Structure of Cost**
Format 4 - 4.4.4.	**Level of Active Cost Coverage**

Table 1 – 2.1. Compilation of relevant laws

No	List of relevant laws and regulations	Most essential characteristics
1	The Helsinki Convention – Narodne novine: International Agreement No. 4/1996	Convention on protection and use of transboundary water courses and international lakes
2	The Danube River Convention Narodne novine; International Agreement No. 2/1996	Convention on cooperation for the protection and sustainable use of the Danube River
3	The Budget Act – Narodne novine No. 92/1994	The Government Budget through State Water Directorate and State Directorate for Nature Protection and Environment
4	The Nature Protection and Environmental Act – Narodne novine, No 82/1994	Responsibility for planning in Nature Protection and Environment – State Directorate for Nature Protection and Environment
5	The Water Act – Narodne novine No. 107/95	This act regulates the legal status of Water and water estate. This Act established "Hrvatske Vode"
6	Act of Financing Water Management – Narodne novine No. 107/1995	Water Management activities of interest to the Republic of Croatia are financed through the Water Law, water use fee, fee to water protection from pollution - Hrvatske vode
7	The Municipal Services Act – Narodne novine No. 36/95	Defined the principles and the methods of carrying out and financing of municipal services, and others issues related of municipal activities.
8	Decision on determining of catchment areas in the Republic of Croatia – Narodne novine No. 23/91	This plan is very important, determining of catchment areas.
9	Ordinance on categorization of watercourses – Narodne novine No. 15/81	The following documents shall remain in force until issuing of the new regulations.
10	Ordinance on water classification – Narodne novine No. 15/81	
11	Ordinance on maximum allowed concentrations of hazardous substances in water and coastal sea – Narodne novine No. 2/84	
12	Regulation on issuing of water management terms, water management approvals and water management permits – Narodne novine No. 6/92	Project implementation for the water related structures and systems.
13	Regulations on accounting and payment of the water protection fee – Narodne novine No. 13/91	The cost of protection of water, environment and aquatic ecosystems
14	The Construction Act – Narodne novine No. 77/1992, 26/1993 and 93/1995	Implementations and reconstructions.
15	The Law on Procurement of Goods and Services and Contract Awarding – Narodne novine No. 192/1997	Planning and Implementation

Source: Official gazette – Narodne novine

Format 1–3 National policy and strategy for funding of water sectors programmes and projects



Format 2–3 National policy and strategy for funding of water sectors programmes and projects

Background

Organized water management in Croatia has a long tradition (since mid – 19th century, and has undergone numerous transformations.

Activity of Hrvatske Vode id defined by the Water Act as follows:

1. study and develop works in water management, preparation of the water management basis and water management plans
2. organizing and directing of the unique informatics system of water management and water management documentation,
3. protection of hazardous water impact: control, prognosticating and informing about the water condition and maintaining of watercourses, flood and ice control, regular maintaining, renewal and construction of the protection water management facilities and other works related to the protection of hazardous impact,
4. water pollution control: monitoring of water condition and quality of water changes, preparation and implementation of the plans for water protection,
5. secure water supply: establishing and monitoring of condition of water supply for the population requirements, agricultural and other purposes, water supply,
6. execution of public authorization in water management in accordance with the law.

Hrvatske Vode can also, in accordance with the Statute, perform other activities and works, if free working capacities are available and under condition that the continuous, professional and complete performing of basic activities is previously secured.

In the field of the international cooperation Hrvatske Vode cooperates with neighboring countries. It also cooperates with the leading world banks (WB, EBRD, ECE/UN) and their institutions in realizing of the loan for reconstruction of the war destroyed water and economic infrastructure and in preparation of construction of water supply and other facilities in the Republic of Croatia. The experts from Hrvatske Vode are actively involved in the working parties of the Economic Commission for Europe (ECE/UN).

The modern concept of water management organization must be a combination of the social influence of users and strong administrative hierarchy in a water management institution or enterprise. Therefore, consequential application of the water Act, as well as efficient organization of the activities of water management services in Croatia are of utmost importance. To realize the problems of excess, shortage and quality of water it is important to keep in mind the teamwork of professionals of various profiles in the process of finding of optimum solutions in all fields of water management activities.

With respect to the achieved level of the development and possibilities of science and technology, the future water management development plans must be multipurpose, complex and integrated. In considering the needs for the given planning period it is necessary to define the balance of requirements and possibilities at the level of the catchment area, or river basin. The balance of future requirements must be based on the defined needs, the kind and origin of water

Hrvatske Vode is organized as follows: management, five organizational units (one in each catchment area) which are based in Zagreb, Osijek, Rijeka and Split. There are 29 public water management corporations responsible for individual catchment areas.

Management, as well as each organizational unit, consists of sectors, which deal with basic components of water management – water supply, water pollution control and protection from hazardous water impact.

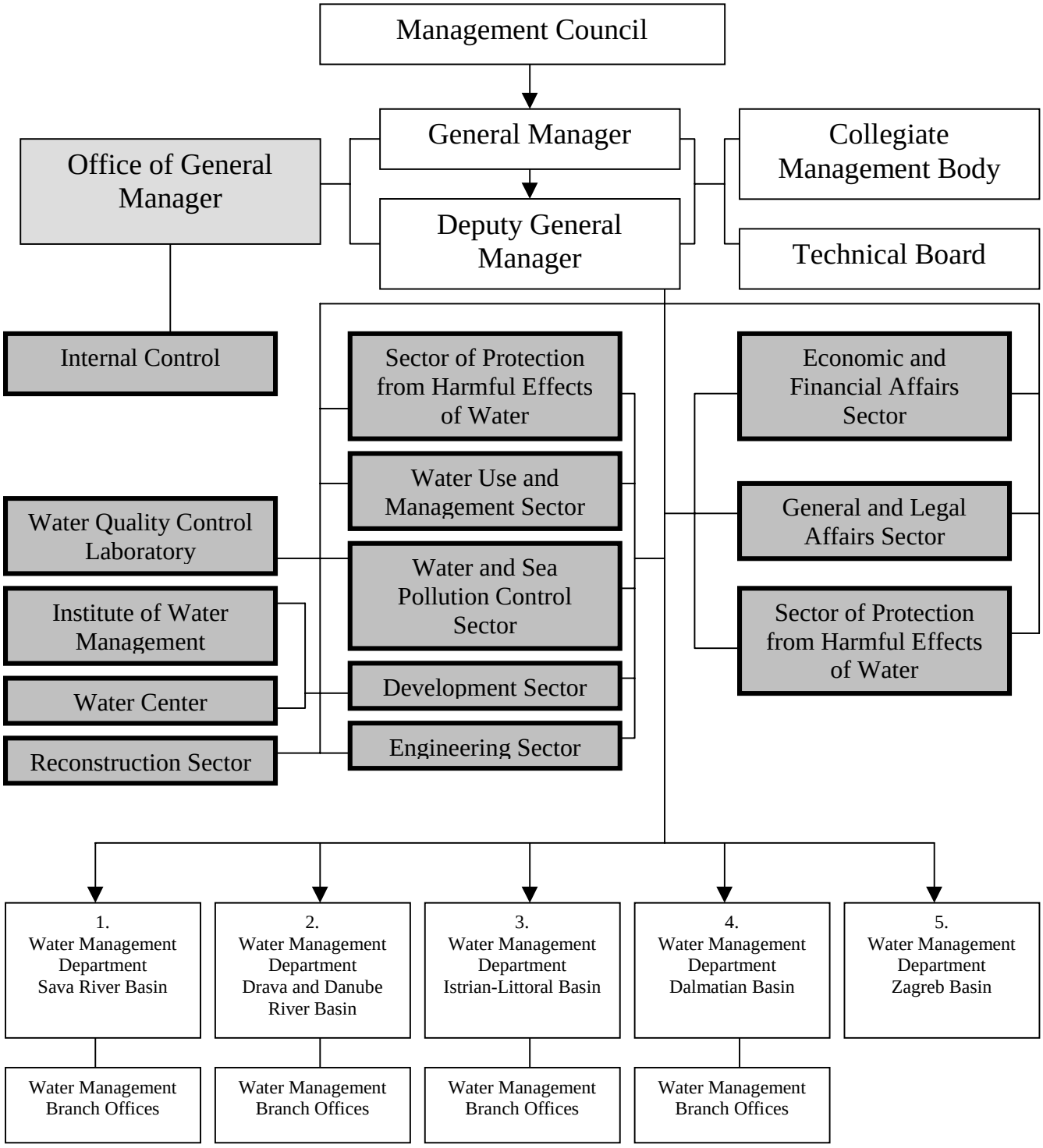
Hrvatske Vode has qualified and professional personnel with technical and other professions and long-term experience in the areas of civil engineering, projecting and management, so it successfully performs businesses related to water management works (execution of water management basis, execution of studies, projecting, geodetic works and engineering works).

Except for the main tasks which result from the Water Act, Hrvatske Vode is engaged in the project of HKBO, World Bank for Reconstruction and Development; through water management are funds from the Town Zagreb Fund for Water Management, Housing and Municipal Activities, the Croatian Roads and the Croatian Forests, and that all amounts of HRK 1,020,000,000.00.

Water Management activities have special economic, infrasturctural and social importance, what is also conditioned by the economic position of the water management in whole. Socio-economic relations in water management and its position are planned in the constant process of reciprocal operation and accommodation of all factors of social and economic life.

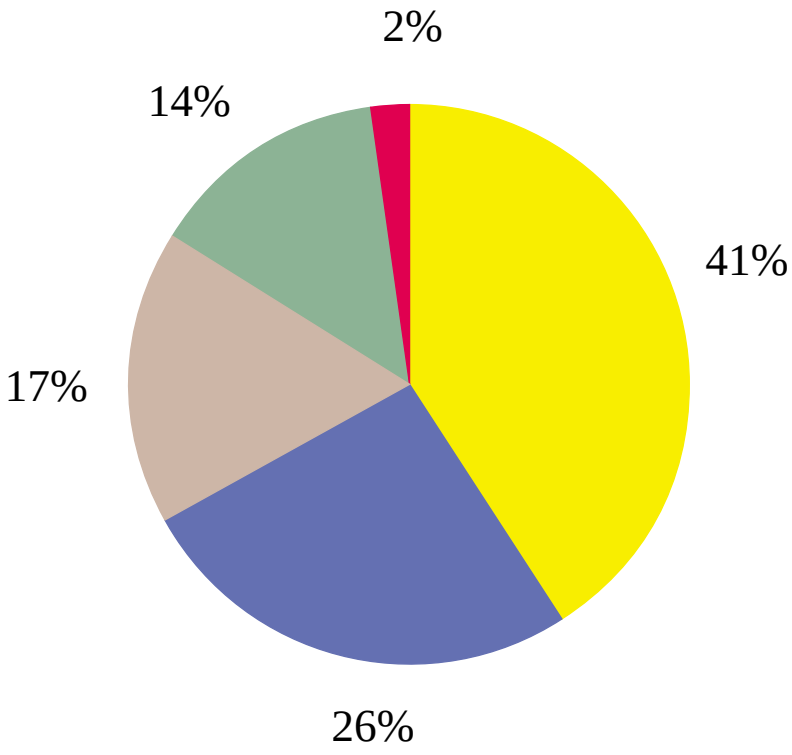
Because of the achieved results, Hrvatske Vode has exceptional reputation and it is highly thought of throughout the country, what is noticeable from the received letters of gratitude and acknowledgements.

Organizational Scheme of "Hrvatske Vode"

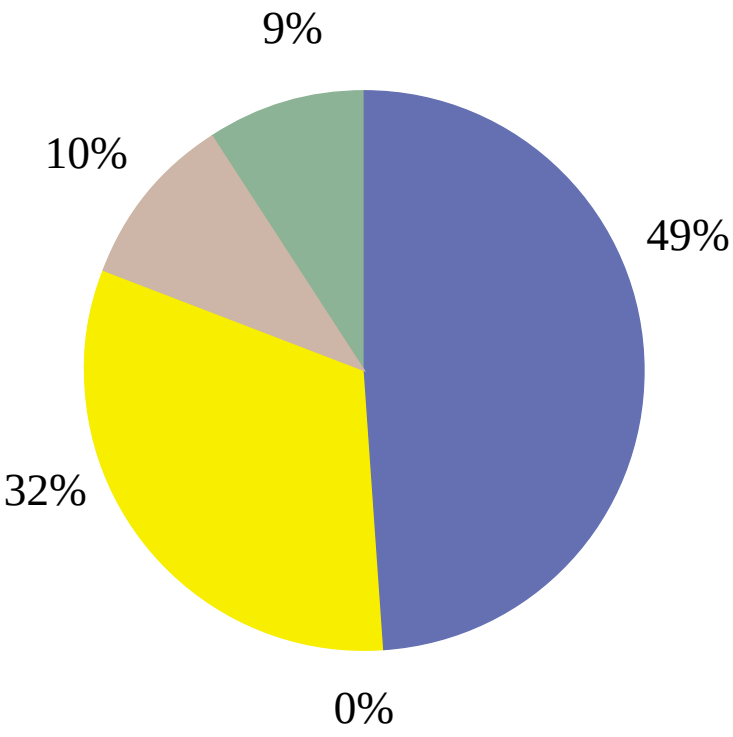


Source: Special edition newspaper "HRVATSKE VODE", 1997

Format 3-4.4.3. Level and structure of costs



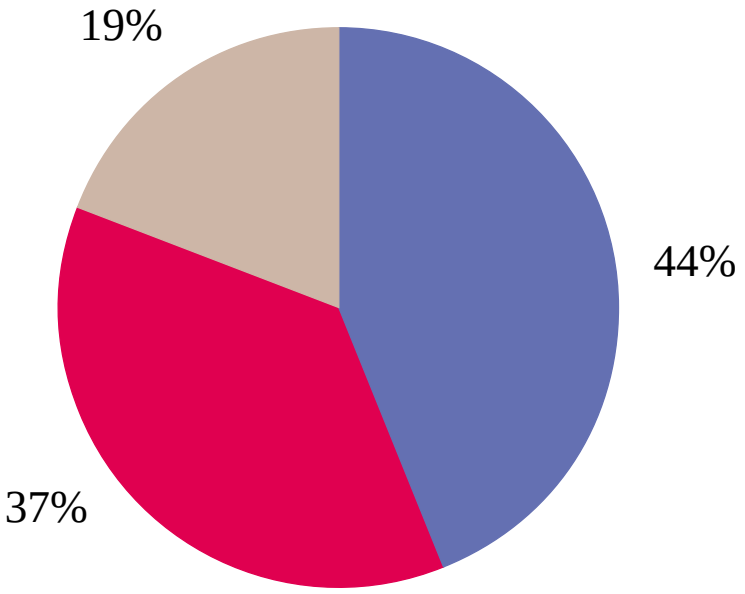
Level and structure of costs for water per m^3 for households in 1996



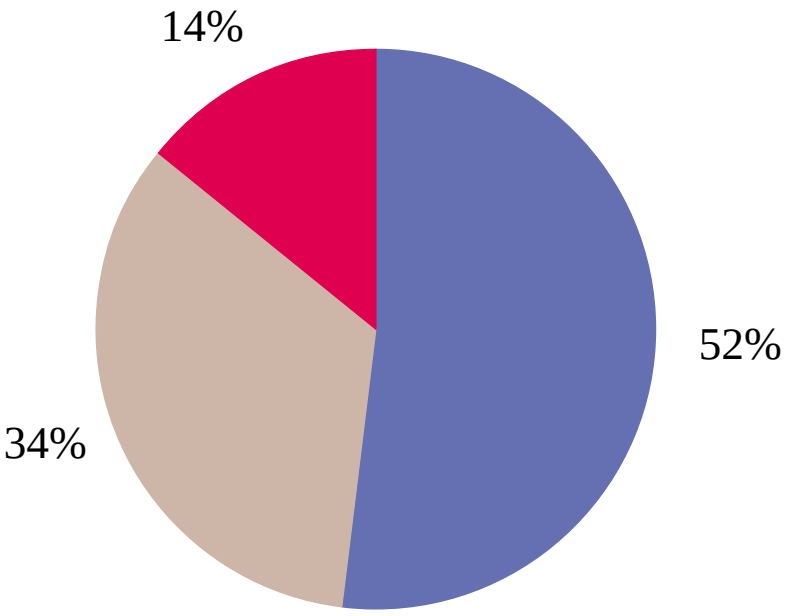
Level and structure of costs for water per m^3 for industry in 1996

Basic price
Specific purpose
Water protection fee
Service tax 10%
Water use fee

Format 4-4.4.4. Level of activity cost coverage



Structure of costs for wastewater discharge per m^3 for households in 1996



Structure of costs for wastewater discharge per m^3 for industry in 1996

Basic price
Water protection fee
Special purpose

Annex 2.

Format 2/1 **Compilation of Actual Investment**

Format 2/2 **Compilation of Planned Investment**

Format 2/1 Compilation of actual investment - Portfolio (Million US$)

No	Type/name of	Total Capital		Funding	National Funding Sources											International Funding			Remarks
	Project or programme	Reqiurements		Period	Equity	Envir.	Water	Public Loans			Public Grants			Comm.	Others	Organisation	Grant	Loan	
						Fund	Manag.	Central	Reg.	Local	Central	Reg.	Local	Bank					
							Fund	Budget	Budget	Budget	Budget	Budget	Budget	Loans					
		(MHRK)	(MUS$)		(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)		(MUS$)	(MUS$)	
4	Municipal waste water treatment plant of	38,700	6,450	1998	3,500		12,000	8,200					5,000	10,000					
	city of Bjelovar																		
5	Sewerage system and waste water treatment	75,000	12,500	1998			0,350				10,900	10,250				IBRD		4,000	
	plant of city of Vinkovci			2001			1,000									IBRD		4,750	
6	Municipal waste water treatment plant	6,400	1,000	1998	1,280		3,200			1,920									
	of city of Velika																		
9	Sewerage system and waste water treatment plant of city of Garešnica	15,040	2,350	1998	3,008		6,016			6,016									
14	Sewerage system and waste water	320,000	50,000	1997	64,000		128,000			128,000									
	treatment plants of towns Karlovac and			2001															
	Duga Resa																		
22	Waste water treatment plant of city of			1997															
	Velika Gorica	14,080	2,200		2,800		5,680			5,600									
24	Waste water treatment plant of city of	6,893	1,149	1998	3,446		3,447												
	Našice																		
25	The general solution of the sewerage system of city of Osijek	36,000	5,630	1997	8,280		8,280			2,880			16,560						
34	Retention basin on the waste water treatment plant of Virovitica	11,328	1,770	1998	2,300		4,531			2,197			2,300						
37	Waste water treatment plant of Čakovec and	47,000	7,833	1997															
	nearby towns and villages			1998	16,450		23,500					3,525	3,525						

No	Type/name of	Total Capital		Funding	National Funding Sources											International Funding			Remarks
	Project or programme	Reqiurements		Period	Equity	Envir.	Water	Public Loans			Public Grants			Comm.	Others	Organisation	Grant	Loan	
						Fund	Manag.	Central	Reg.	Local	Central	Reg.	Local	Bank					
							Fund	Budget	Budget	Budget	Budget	Budget	Budget	Loans					
		(MHRK)	(MUS$)		(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)		(MUS$)	(MUS$)	
43	Erosion and sustainable soil management for middle Croatia region (nonstructural project)	0,461	0,072	1998			0,280				0,181								
44	The influence of increased quantity of mineralised oxygen on its rinse and growth of plants (nonstructural project)	0,205	0,032	1998			0,140				0,065								
46	Treatment of waste water of meat factory "Gavrilović" d.o.o. Petrinja (I phase)	2,195	0,343	1998	0,400		0,900		0,895										
48	Sewerage system and waste water treatment plant of "Petrokemija" d.d. Kutina	6,405	1,067	1997	2,690		3,715												
51	Rehabilitation of the municipal dump site of Sisak	39,000	6,154	1998	7,800				15,600	15,600									
52	Municipal dump site of Bjelovar	14,304	2,235	1998	2,860				5,722	5,722									
65	Reconstruction Project for Slavonia, Baranja and Kopački Rit	285,240	47,540	1998			45,455				45,025					IBRD		31,850	
				2003												GEF	0,610		
	TOTAL	**918,251**	**148,325**		**118,814**		**246,494**	**8,200**	**22,217**	**167,935**	**56,171**	**13,775**	**27,385**	**10,000**			**0,610**	**40,600**	

Format 2/2 Compilation of planned investment - Portfolio (Million US$)

No	Type/name of Project or programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag. Fund	Public Loans Central Budget	Reg. Budget	Local Budget	Public Grants Central Budget	Reg. Budget	Local Budget	Comm. Bank Loans	Others	Organisation	Grant	Loan	
		(MHRK)	(MUS$)		(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)		(MUS$)	(MUS$)	
1	Sewerage system and waste water treatment plant of Slavonski Brod	320,000	50,000																
2	Sewerage system and waste water treatment plant of Županja	70,000	11,000																
3	Sewerage system and waste water treatment plant of Kutina	80,000	12,500																
7	Sewerage system and waste water treatment plant of towns Veliki Zdenci, Mali Zdenci and Grubišno Polje	40,000	6,213																
8	Sewerage system and waste water treatment plant of Daruvar	6,000	0,938																
10	Sewerage system and waste water treatment plant of Pakrac and Lipik	11,000	1,650																
11	Sewerage system and waste water treatment plant of Ogulin	21,000	3,350																
12	Sewerage system and waste water treatment plant of the National Park Plitvice Lakes	102,400	16,000																
13	Sewerage system and waste water treatment plant of Sisak	384,000	60,000																

No	Type/name of	Total Capital		Funding	National Funding Sources											International Funding			Remarks
	Project or programme	Requirements		Period	Equity	Envir.	Water	Public Loans			Public Grants			Comm.	Others	Organisation	Grant	Loan	
						Fund	Manag.	Central	Reg.	Local	Central	Reg.	Local	Bank					
							Fund	Budget	Budget	Budget	Budget	Budget	Budget	Loans					
		(MHRK)	(MUS$)		(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)		(MUS$)	(MUS$)	
15	Sewerage system and waste water	198,000	31,000																
	treatment plant of Petrinja																		
16	The central waste water treatment plant for	175,000	27,300																
	region of towns Zabok-Orosavlje-Donja																		
	Stubica-Gornja Stubica																		
17	Waste water treatment plant of Samobor																		
18	Waste water treatment plant of Sesvete-east																		
19	Waste water treatment plant of Zagreb	1638,000	256,000																
20	Waste water treatment plant of Sesvete																		
	south-east																		
21	Waste water treatment plant of Zaprešić																		
23	Waste water treatment plant of Krašić	3,533	0,552																
26	Treatment of waste water of Đurđenovac	19,000	2,960																

No	Type/name of	Total Capital		Funding	National Funding Sources											International Funding			Remarks
	Project or programme	Requirements		Period	Equity	Envir.	Water	Public Loans			Public Grants			Comm.	Others	Organisation	Grant	Loan	
						Fund	Manag.	Central	Reg.	Local	Central	Reg.	Local	Bank					
							Fund	Budget	Budget	Budget	Budget	Budget	Budget	Loans					
		(MHRK)	(MUS$)		(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)		(MUS$)	(MUS$)	
27	The sewerage system of Đurđenovac	31,000	4,860																
28	Sewerage system and waste water treatment plant of Belišće	31,000	4,860																
29	Waste water treatment plant of Donji Miholjac	-	-																
30	Waste water treatment plant of Orahovica	7,000	1,100																
31	Sewerage system of Bizovac	7,900	1,230																
32	Waste water treatment plant of Bizovac	26,400	4,125																
33	Sewerage system of Čepin	75,320	11,732																
35	Sewerage system and waste water treatment plant of Ilok	201,000	31,310																
36	Sewerage system and waste water treatment plant of Slatina	23,600	3,675																

No	Type/name of	Total Capital		Funding	National Funding Sources											International Funding			Remarks
	Project or programme	Requirements		Period	Equity	Envir.	Water	Public Loans			Public Grants			Comm.	Others	Organisation	Grant	Loan	
						Fund	Manag.	Central	Reg.	Local	Central	Reg.	Local	Bank					
							Fund	Budget	Budget	Budget	Budget	Budget	Budget	Loans					
		(MHRK)	(MUS$)		(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)		(MUS$)	(MUS$)	
38	Waste water treatment plant of	15,000	2,335																
	Novi Marof																		
39	Waste water treatment plant of Ivanec	6,100	0,950																
40	Waste water treatment plant of Koprivnica	69,600	10,840																
41	The sewerage system and waste water	50,000	7,783																
	treatment plant of Prelog																		
42	The sewerage system and waste water		-																
	treatment of the farm "Dubravice" d.d.																		
45	Treatment of waste water of meat factory		-																
	PIK "Vrbovec"																		
47	Waste water treatment plant of		-																
	"Agroproteinka" d.d.																		
49	Treatment of waste water of food factory	1,440	0,225																
	"Kvasac-Podravka" d.d. Koprivnica																		
50	Treatment of waste water of industrial area	25,600	4,000																
	Danica of Koprivnica																		

No	Type/name of	Total Capital		Funding	National Funding Sources											International Funding			Remarks
	Project or programme	Requirements		Period	Equity	Envir.	Water	Public Loans			Public Grants			Comm.	Others	Organisation	Grant	Loan	
						Fund	Manag.	Central	Reg.	Local	Central	Reg.	Local	Bank					
							Fund	Budget	Budget	Budget	Budget	Budget	Budget	Loans					
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
53	Municipal dump site "Grginac" of city of Bjelovar	6,000	0,935																
54	Municipal dump site of Daruvar	7,700	1,200																
55	Municipal dump site of Nova Gradiška	0,610	0,095																
56	Municipal dump site of Oriovac	0,282	0,044																
57	The dump site of Požeška kotlina region	10,000	1,557																
58	Municipal dump site of Čakovec "Pustošije"	-	-																
59	Municipal dump site of Slatina	1,320	0,206																
60	Municipal dump site of Orahovica	4,830	0,752																
61	Regional landfill for Eastern Slavonia	173,340	27,000																

No	Type/name of Project or programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag. Fund	Public Loans Central Budget	Reg. Budget	Local Budget	Public Grants Central Budget	Reg. Budget	Local Budget	Comm. Bank Loans	Others	Organisation	Grant	Loan	
		(MHRK)	(MUS$)		(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)	(MHRK)		(MUS$)	(MUS$)	
62	Centre for pre-processing and storage of dangerous waste for Osječko-Baranjska County	11,360	1,770																
63	Temporary landfill "Lončanica Velika"	17,330	2,700																
64	Municipal dump site of Osijek (locality Sarvaš)																		
	TOTAL	3871,665	604,747																

Annex 3.

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