DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
CZECH REPUBLIC

TECHNICAL REPORTS

Part A: Social and Economic Analysis

Part B: Financing Mechanisms

MINISTRY OF 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 **Czech National Review** was prepared under the supervision of the Country Programme Coordinator, **Mr. Milan Bedrich**. The authors of the respective parts of the report are:

- Part A : Social and Economic Analysis: **Mr. Antonin Vaishar**
- Part B : Financing Mechanisms: **Ms. Miroslav Hajek**
- Part C : Water Quality: **Ms. Ilja Bernardova**
- Part D : Water Environmental Engineering: **Mr. Ladislav Pavlovsky**

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Part A

Social and Economic Analysis in Relation to Impact of Water Pollution

Table of Contents

1. Summary 1

2. Description of the State of the Danube Environment 5

2.1. Water Resources 5

2.2. Biological Resources and Eco-systems 7

2.3. Human Impact 8

2.4. Key Issues of Environmental Degradation 9

3. Analysis and Projection of Population and Water Sector relevant Demographic Characteristics 11

3.1. Present Situation 11

3.1.1. Population 11

3.1.2. Area 12

3.1.3. Per Capita Income 12

3.1.4. Domestic Water Demand 13

3.1.5. Domestic Wastewater Production 14

3.2. Projection for Planning Horizons 2010 and 2020 17

3.2.1. Population 17

3.2.2. Domestic Water Demand 18

3.2.3. Domestic Wastewater Production 20

4. Actual and Future Population Potentially Affected by Water Pollution 21

4.1. Actual and Future Population Potentially Affected by Health Hazards through Raw Water Quality Exceeding Defined Quality Standards for Drinking Water 21

4.2. Actual and Future Population Potentially Affected by Health Hazards and Other Impacts on Welfare through Unsanitary Conditions in the Danube River System 22

4.3. Description of Main Health Hazards through Water Pollution in the Danube River and Tributaries 23

4.4. Hazard of Floods 25

5. Analysis of the Economic Significance of the Danube River System and Impacts of Economic Activities 27

5.1. Actual Situation 27

5.1.1. Abstraction of Raw Water from the Danube River System 27

5.1.1.1. Domestic Raw Water Demand 27
5.1.1.2. Industrial/Mining Raw Water Demand 28
5.1.1.3. Agricultural Raw Water Demand for Irrigation 29

5.1.2. Wastewater Discharge to the Danube River System 29

5.1.2.1 Municipal Discharge 29
5.1.2.2 Industrial/Mining/Shipping Discharge 30
5.1.2.3. Agricultural Discharge (major point sources) 31

5.1.3. Pollution of Aquatic Systems through Potential Soil and Ground Water Contamination: Municipal and Industrial/Mining Hazardous Solid Waste Disposal 31

5.1.4. Hydro Power 33

5.1.5. River Fisheries (Danube and Main Tributaries) 34

5.1.6. River Shipping 34

5.1.7. Water Related Recreation/Tourism 35

5.2. Projection of Expected Economic Significance/Impacts 36

5.2.1. Projection of Abstraction of Raw Water 36

5.2.2. Projection of Wastewater Discharge 37

5.2.3. Projection of Other Major Impacts 38

6. Analysis of the Relevant Legal and Institutional Framework and its Adequacy for Sound Environmental Management of Water Resources and Eco-systems 39

6.1. Documentation and Short Analysis of the Relevant Legal Framework 39

6.2. Analysis of Relevant Institutional Framework 40

7. Description and Analysis of Actual Policies and Strategies 43

7.1. Actual Policies and Strategies 43

Annex 1 Bibliography

List of Tables

Table 2.1. Water management figures characterizing both partial catchment areas of the Morava River basin

Table 2.2. The most important rivers

Table 2.3. The largest man-made lakes in the Morava River basin

Table 3.1. Towns with a population of over 20,000 (1996) on the territory of the Morava River basin

Table 3.2. The structure of expenses

Table 3.3. Aggregate data on the abstraction of water by public water supply systems

Table 3.4. Abstraction of water by households between the years 1990-1995

Table 3.5. Waste water discharged to watercourses in the Czech part of the Danube River basin between the years 1990-1995

Table 3.6. Amount of waste water discharged to watercourses between the years 1990.1995

Table 3.7. Amount of domestic waste water produced by households

Table 3.8. The amount of pollution discharged to watercourses between the years 1990-1995

Table 3.9. The comparison of population projections

Table 3.10. The values contained in the forecast for the abstraction of water by population and by public water supply systems in the Czech part of the Danube River basin for the time horizon 2015

Table 4. The population living on the banks of watercourses classified by the individual ranges of water purity

Table 5.1. Abstraction of water by public water supply systems between the years 1990-1995

Table 5.2. Water abstracted by public water supply systems in the Czech part of the Danube River basin and in the Czech Republic

Table 5.3. Data on industrial water supplied to industries from the own industrial water resources in the Czech part of the Danube River basin between the years 1990-1995

Table 5.4. The registered amount of water abstracted for irrigation from watercourses administered by Water Management bodies in the Czech part of the Danube River basin and in the Czech Republic between the years 1990-1995

Table 5.5. The values estimated for the amount of waste water discharged to watercourses by public sewerage systems in the Czech part of the Danube River basin and the Czech Republic between the years 1990-1995

Table 5.6. The results achieved by estimating the amount of waste water directly discharged by industry to watercourses in the Czech part of the Danube river basin between the years 1990-1995

Table 5.7. Examples of dumps threatening water resources in the Morava River basin

Table 5.8. The forecast for waste water discharge in the Czech part of the Danube River basin

1. Summary

On the territory of the Czech Republic, the Danube River basin is primarily represented by the Morava River basin and its tributaries. This basin has an area of 21,145 square kilometers (26.8 % of the total area of the Czech Republic), and a population of 2.78 mil. (26.9 % of the total population of the Czech Republic). The length of watercourses, which are of importance from the point of view of water management, is 3,747 km, the length of other watercourses 30,000 km. The basin is characterized by a great biodiversity since it crosses three biogeographical zones of central Europe. The ecosystems of almost all vegetation zones of central Europe can be found in altitudes between 148 and 1,491 m above sea level. Eight large protected areas can be found in the basin.

The basin has been intensively exploited since prehistoric times. The Moravian vales are among the most fertile regions of the Czech Republic. The basic pattern of settlement was established in the early Middle Ages. The biggest concentrations of population include the Brno industrial agglomeration, the town of Olomouc with its surroundings and the area around Zlín-Otrokovice. However, what is typical of many areas of the Morava River basin is rural settlement. Mechanical engineering is the leading branch of industry, with the processing of local raw materials complementing it. During the socialist era, some metallurgical and chemical plants and facilities were established in the Morava River basin. Also the only Czech nuclear power plant in operation can be found in the Morava River basin, namely in Dukovany, a small village in southern Moravia.

At present, the Morava River basin is among those Czech regions, which do not face any serious environmental problems, with part of the Brno agglomeration being the only area within the basin facing serious environmental problems. At present time, the main environmental problems include the negative impacts of large agglomerations of settlement and industries, the adverse impacts of large-scale agricultural production and the negative impacts of a rapid development of car traffic.

In the Morava River basin, about 80 % of the population are supplied with water from public water supply systems. In 1995, the abstraction of water dropped to 71 % of the 1990 figure, id. to 79.3 mil.m^3. The specific water demand of the population supplied from public water supply systems is 248 l per capita and day, the actual water consumption of the population is estimated to be 98 l per capita and day, The amount of discharged wastewater dropped to 72 % of the 1990 figure in 1995, id. to 256.4 mil.m^3. The pollution from point resources has also dropped significantly.

In the period up to the year 2020, a slight decline in the number of population may be expected to take place in the Morava River basin. According to demographic forecasts that have been elaborated, the abstraction of water by population will reach, about the year 2015, values roughly identical with those recorded at the end of the 1980's. Thus, the current water resources will be sufficient for another 20 years if their quality does not deteriorate in the meantime. However, the production of wastewater is expected to increase to 102 mil. m^3 as a result of the increase in the specific water consumption by population, which is expected to take place again.

The quality of drinking water in watercourses is, in the absolute majority of cases, not adequate for the purposes of water supply, with the exception of watercourses ranked in the Quality Range I and II, on the banks of which only 120,000 inhabitants live. By way of contrast, 1.11 mil. inhabitants live on the banks of watercourses, whose water is unsuitable for the purposes of water supply, and another 1.08 mil. inhabitants live on the banks of watercourses, whose water quality are not measured and may achieve very unfavorable values. Thus, the potential health hazard for population is relatively high.

As a matter of fact however, only less than one fourth of water abstracted for the purposes of water supply is taken from watercourses, but exclusively after having been treated, and through public water supply systems. The quality of water is systematically monitored by the Hygiene Service, and its fitness for drinking water supply is comparable with most of the countries of Western

Europe. The problem is that most watercourses in the Morava River basin are not fit for swimming, aquatic sports, the breeding of salmonoid fish and for branches of industry dependent on high-quality technological water. The polluted watercourses are also of low value in terms of landscape management.

Recently, there has been a slight decline in organic pollution and nitrogenous substances, while in the case of phosphorus the decline has been insignificant so far. This is due to the decrease in wastewater discharges from point sources, the reduction of the amount of mineral fertilizers used in farming and the decrease in atmospheric deposits. An improvement has occurred practically in all monitored sections. However, the improvement manifests itself most significantly in the most polluted watercourses. A slight improvement can be also expected in future as a result of constructing and reconstructing wastewater treatment plants.

The quality of drinking water abstracted from watercourses has minimum direct effects on the health state of the population. From the point of view of long-term loads, nitrates constitute the biggest problem, being the greatest hazard to babies. Accidents also bring potential hazards with them but even in terms of this, there have been no acute health hazards lately. Also in the event of extreme floods that occurred in the summer of 1997, the epidemiological situation in the Morava River basin was extraordinarily ”calm”, with the exception of few cases of leptospirosis.

People swimming in watercourses may be at risk for some health hazards; certain health hazards also result from untreated wastewater discharged to watercourses. Two thirds of the population are served by sewerage systems whose wastewater is then treated in wastewater treatment plants. However, most of the wastewater treatment plants are not equipped with technologies enabling to remove the compounds of nitrogen and phosphorus. However, a direct epidemic hazard from wastewater has not been stated.

The Morava River basin was among those most severely affected during the 1997 floods. There were several dozens of casualties and serious material damage. Some drinking water resources were damaged or destroyed, and some wastewater treatment plants flooded. The course of the floods and their implications may be, to a large extent, attributed, besides the extreme climatic situation, also to anthropogenic interventions carried out in the landscape. All hydraulic works to be constructed in the Morava River basin in future will have to reflect the experience gained during these floods.

The abstraction of water from surface resources dropped to 53.8 mil.m^3 in 1995, which is less than 60 % of the 1990 value. The significance of water abstracted for drinking water supply from watercourses in the Morava River basin is decreasing not only absolutely but also faster in relation to the groundwater resources. In contrast, industries abstract water from surface resources to a larger extent. Industries abstracted 164 mil.m^3 of water from watercourses, which made up 91 % of the total amount of water abstracted by them, and 62 % of the 1990 value. In 1995, 55 % of water abstracted by industries was used for through-flow cooling. The abstraction of water for irrigation dropped to 11.2 mil.m^3, which is 22 % of the 1990 value. However, from the nationwide point of view, the amount of water used for irrigation in the Morava River basin is higher than in other river basins.

The amount of wastewater discharged to watercourses from public sewerage systems is estimated to be 150.7 mil.m^3, while that discharged by industries 105.7 mil.m^3. The amount has been steadily decreasing. Ten large-scale pig farms constitute the main source of pollution caused by agriculture, each having more than 10,000 pigs shed in it. In 1996, the operation of all unsafe solid waste dumps was discontinued. However, old loads produced in a period when deposited waste was not registered represent a certain hazard. In the Morava River basin, there may presumably be about 3 to 4 thousand sites contaminated with old loads, with only part of them, however, having a direct relationship to watercourses.

More than 50 % of hydraulic electric power of the Czech Republic is generated in the Morava River basin. Pumped-storage hydroelectric power plants in Dlouhé Stráně and Dukovany-Dalešice are important from the point of view of covering the peak sections of the electric power consumption diagram. Game-fishing almost exclusively represents fishing on the watercourses in the Morava River basin. The deterioration of fish environment is another problem. There is no shipping on the watercourses in the Morava River basin. For water-related recreation, primarily water reservoirs are exploited, with the Vranov water reservoir, the Brno water reservoir and the Nové Mlýny water reservoir being the most significant of them. Recreation activities, including boating, performed directly on watercourses are only of local or occasional nature.

The abstraction of water for the population, agriculture and industries will depend on the overall development of the economic situation in the Czech Republic. However, it may not be assumed that water demand in the year 2015 will exceed the level of consumption of the late1980's. Significant hydroelectric power stations are not expected to be constructed. At present, a discussion is under way about water management measures to be taken to prevent floods. Theoretically, also the Danube-Oder-Elbe Canal may be under discussion in terms of this since a significant part of this canal would pass through the territory of the Morava River basin.

Water management in the Czech Republic is governed by numerous acts and other legal regulations whose aim is to regulate ownership relations, to bring Czech legislation close to the norms and standards of the European Union and to ensure that it is compatible with the standards of other branches of economy. Other issues to be addressed include the monitoring of water quality and quantity, problems of making the obtained data available free of charge, issues related to permitting construction in flood areas etc. Czech Republic is still missing a new water act that would replace the old one adopted in 1973. The absence of this new act is perceived as a disadvantage.

Watercourses and the structures built on them are managed and administered by Povodí Moravy, a.s. Brno, which came into existence through the transformation of the previous state company, and is now under the jurisdiction of the Ministry of Agriculture of the Czech Republic. In addition, some minor watercourses are managed by Státní meliorační správa (State Melioration Management), Lesy České Republiky (Czech Republic's Forests), Správa Národního parku Podyjí (The Podyjí National Park Management), military domains authorities and by municipalities. Bodies of the Ministry of Environment responsible for water management include The Czech Environmental Inspection, The Czech Hydrometeorological Institute, The Research Institute of Water Management and The Geofund.

The Ministry of Environment of the Czech Republic has laid down the basic watercourse management policy. Its basic principle includes the responsibility of the present generation toward future generations. Therefore, emphasis is placed on a rational and effective exploitation of resources based on the following principles: the recycling of resources, the reduction of pollution to a level at which irreversible changes do not occur any more, the protection of biological diversity and the seeking for such ways of satisfying human needs which are in harmony with the principle of sustainability. In doing so, emphasis is placed on the expected membership of the Czech Republic in the EU. Until recently, the policies of manufacturing industries were formulated on the basis of the principle of the self-regulation of the market, and they ended up at best in general declarations concerning nature resources. Apparently, they have not been worked out up to the level of water management.

2. Description of the State of the Danube Environment

2.1. Water Resources

The Danube River basin on the territory of the Czech Republic is primarily represented by the Morava River basin. It is a natural spatial unit situated at the crossing point of the Bohemian Highlands, the Carpathians and the Pannonia Province. The Morava River and the Dyje River, its dextral tributary, are the major watercourses of the Morava River basin.

The Morava River springs under Kralický Sněžník in an altitude of 1,380 m above sea level, and flows roughly in the north-south direction across the Mohelnice furrow through the Hornomoravský a Dolnomoravský Vales, and at the joint Czech-Austrian border it takes the Dyje River, its most important tributary. The Bečva River which takes waters from the western part of the Beskydy Mountains is the most important sinistral tributary of the Morava River.

The Dyje River has two springs: the Moravská Dyje River springing in the Brtnická Highlands in an altitude of 635 m above sea level, and the Austrian Dyje (Thaya) springing in Lower Austria. The Dyje River flows in the west-east direction through the Dyjsko-Svratecký and Dolnomoravský Vales. The Svratka and Jihlava Rivers draining the Bohemian-Moravian Highlands, the Brno Highlands and the northern part of the Dyjsko-Svratecký Vale are its important tributaries.

Tab. 2.1 Water-management figures characterizing both partial catchment areas of the Morava River basin

DATA	UNIT	MORAVA UPSTREAM DYJE	DYJE	TOTAL
area of the river basin	km^2	10,691	13,419	24,110
of it on the territory of CR	km^2	9,975	11,144	21,119
average annual discharge	$m^3.s^{-1}$	65.0	43.8	108.8
total annual run-off	mld m^3	2.05	1.38	3.43
minimum annual run-off	mld m^3	0.86	0.50	1.36
number of water reservoirs, total	ks	14	20	34
total volume of water reservoirs	mil m^3	42.2	526.8	569.0
rate of storage	%	2.2	37.9	18.1
total abstraction of water from surface resources (1995)	mil m^3	86	124	210
total BOD_5 pollution discharged	$t.r^{-1}$	2,410	6,510	8,920
of it municipal wastewater	$t.r^{-1}$	2,115	5,557	7,672
area of put-up irrigation systems	ha	2,900	30,000	32,900

Source: Povodí Moravy, a.s.

Atmospheric precipitation is the basic water resource for the whole area. Water reservoirs (man-made lakes and ponds) have been largely constructed in the part of the river basin formed by the Dyje River. In the partial catchment area formed by the Morava River, the rate of water storage is very low. Groundwater occurs in limited amounts, and is concentrated in the floodplains of the Morava, Dyje and Svratka Rivers and in other watercourses. The whole water demand for surface water abstraction is covered from water reservoirs on the one hand and directly from watercourses on the other hand. In consideration of the low rate of water storage and the high rate of abstraction of water, the water management balance in the Morava River basin is considerably unfavorable even if, in comparison to the year 1990, the abstraction of water dropped by 5.69 $m^3.s^{-1}$, id. by 46 %. The total amount of water abstracted in 1995 was 377 mil.m^3, of it 310 mil.m^3 were re-discharged, with 279 mil.m^3 being polluted.

Water quality in the watercourses of the Morava River basin is not good. Watercourses are polluted by discharged wastewater, and in terms of purity, they predominantly fall into Quality Ranges III and IV, with the purity decreasing to Quality Ranges IV and V downstream of big towns. Furthermore, also watercourses with low aqeousness, on which major sources of pollution with insufficient water treatment are located, are polluted to reach Quality Range V. These are: Trkmanka, Litava, Prušánka, Rokytka, Valová, Olšava and Haná. In contrast, Quality Range I only occurs in short sections in spring areas.

The average annual atmospheric precipitation is about 635 mm, with its maximum on Lysá Hora in the Beskydy Mountains (1,150 mm) and the minimum in Břeclav District (450 mm). Thus, the area involved may be ranked among those with average precipitation occurrence, with its southern part belonging to subarid areas. More than 34 % of the area is covered by forest plantations. In contrast, 53 % of the area is made up by agricultural land, with 45 % of it being arable land.

The length of watercourses important in terms of water management is 3,747 km, with the length of other watercourses being about 30,000 km.

Tab. 2.2 The most important rivers

RIVER	AREA OF THE BASIN (sq. km)	LENGTH OF COURSE (km)	FLOW Q_{100} $m^3.s^{-1}$	FLOW Q_{365d} $m^3.s^{-1}$
Morava	10690.9	284.0	715	5.60
Dyje	13418.7	209.3	876	8.12
Svratka	3998.8	174.0	440	2.17
Jihlava	2998.1	184.4	380	0.54
Bečva	1625.7	157.6	670	1.12
Svitava	1145.8	98.0	181	1.05

Source: Povodí Moravy, a.s.

Tab. 2.3 The largest man-made lakes in the Morava River basin

NAME	WATERCOURSE	IN OPERATION	VOLUME (mil.m^3)	HEIGHT OF DAM
Nové Mlýny	Dyje	1978-89	133.90	9.8
Vranov	Dyje	1934	122.70	47.0
Dalešice	Jihlava	1978	122.20	88.0
Vír I	Svratka	1958	53.10	66.2
Brno	Svratka	1940	18.40	23.5
Mohelno	Jihlava	1977	17.00	38.7
Mostiště	Oslava	1960	11.00	32.7
Letovice	Křetínka	1976	10.58	28.5

Source: Povodí Moravy, a.s.

In the Morava River basin, there are 2,900 ponds, with their total volume of water being 90 mil.m^3. The Nesyt pond embracing an area of 294.8 ha and having a volume of water of 4.33 mil.m^3 is the largest one.

Significant groundwater resources are to be found primarily in the quaternary fluvial sediments of the Morava, Svratka, Jihlava and Bečva Rivers and in some other areas. Their theoretically exploitable capacity is 8.48 $m^3.s^{-1}$. As a matter of fact, only 5.50 $m^3.s^{-1}$ is made use of.

2.2. Biological Resources and Eco-systems

The Morava River basin has a unique geographical position since all three main biogeographical units of central Europe meet in it. The western Hercynian biogeographical subprovince meets here with the eastern Carpathians subprovince of the biogeographical province of central European broad-leaved forests, with the Panonnian province reaching the southern part of the river basin. Characterized by a diversified relief and a diversified geological parent rock, this unique geographical position results in a diverse mosaic of ecosystems and a high biodiversity.

Within the range of altitudes of 148 m (the confluence of the Dyje River with the Morava River) up to 1,491 m (the Praděd Peak in Hrubý Jeseník), ecosystems of almost all central European altitudinal vegetation zones are represented: 1. oak, 2.beech/oak 3. oak/beech 4. beech 5. fir/beech 6. spruce/fir/beech and, in the highest altitudes, to some small extent, also 7. spruce and 8.subalpine.

The occurrence of some species of submediterranean and pontic-panonnian geoelement on the absolute northern border of the area, such as *Fraxinus angustifolia* and *Leucojum aestivum* in floodplain forests, and *Crambe tataria, Orlaja gradiflora, Inula oculus-christti* etc. in warmer dry ecotypes, are among the significant specific features of biodiversity. Also some perialpine species, such as *Cyclamen purpurascend,* grow on the northern border of this enlargement. Of the significant animals living in this area, at least the residual populations of *Otis tarda* and *Burhinus oedicnemus* must be mentioned, both living in the southern part of the river basin. Here, also *Merops apiaster* has been spreading in recent years. Floodplain forests in the broad river floodplains are important nesting places of rare birds of prey (such as *Milvus migrans* and *Falco cherrug*). Also the sea eagle *Haliaeetus albicilla* hibernating here in large numbers tries to nest down in this area. The ponds and water reservoirs are important European winter habitats of birds, particularly of various species of geese and ducks. In the last years, the population of the "artificially" released beaver (Castor fiber) has been spontaneously spreading in the broad river floodplain of the Morava River. From the point of view of fauna, the mountainous, more continuously afforested parts of the river basin are also remarkable, among other things for the occurrence of big beasts of prey - lynx (*Lynx lynx*), wolf (*Canis lupus*) and brown bear (*Ursus arctus*), which are coming here from the Slovakian Carpathians. Of the game, the roebuck (*capreolus capreolus)* and the wild boar (*Sus scrofa)* occur here in large numbers. In the floodplain and mountain forests, also the European deer (*Cervus elaphus)* occurs.

In the Morava River basin, the most significant biotops with a high diversity of species and with the occurrence of rare and endangered species of flora and fauna include primarily floodplain forests and wetlands in the broad riverine floodplains. Furthermore, limestone rock cliffs and underground karstic phenomena, valley cuttings in the middle sections of rivers (primarily the rivers Dyje, Jihlava, Svratka and Rokytná) with a very diversified mosaic of ecosystems, nature-close meadows with scattered trees in the White Carpathians characterized by an exceptionally high biodiversity (primarily of the Orchidaceae family) and forests with a natural composition of tree species ranging from oak groves, beechwoods and fir beechwoods to mountain climax clusters of spruce. Samples of these significant biotops and ecosystems are preserved in a dense network of specially protected areas. In terms of large protected areas, one national park (Podyjí) and 7 protected landscape areas (The Jeseníky Mountains - part of them, The Beskydy Mountains - part of them, the White Carpathians, The Žďár Highlands - part of them, Litovelské Pomoraví, the Moravian Karst and Pálava) may be found in the Morava River basin. In addition, the character of the harmonic cultural landscape is protected in natural parks so that large protected areas make up more than 14 % of the area of the river basin. Within these areas or outside them, 530 locations have been declared to be small protected areas (national nature preserves, national nature monuments, nature preserves and nature monuments), with their total area covering more than 17,000 ha. Two protected landscape areas - The Pálava and The White Carpathians - have been included in the worldwide network of biospherical preserves of the UNESCO.

The valley floodplain and the valley of the Morava River and its tributaries are natural migration routes of plants and animals. Some of them have been included - as significant European bio-corridors with the appropriate bio-centers of European importance (there are 11 of them in the Morava River basin) - in the European Ecological Network of the UNESCO.

However, the prevailing part of the territory of the Morava River basin is, to a various degree, subject to anthropogenic influences and changes. The forests that would have covered - without man's interventions - almost the whole area of the river basin take up only one third of it at present. The flat parts of the river basin are almost forest-free, on the contrary, the mountainous parts are almost continuously afforested, with spruce being the prevailing tree species in higher altitudes and pine prevailing in lower altitudes. Natural broad-leaved forests have been preserved predominantly in the Carpathians section of the river basin.

Agricultural field landscape prevails in the lowland sections of the river basin, while meadows and pastures prevail in the mountainous parts of the river basin. Numerous orchards may be found especially in the southern half of the river basin, with extensive vineyards to be found in the southernmost part of the river basin.

The main influences and phenomena having negative impacts on the ecosystems in the Morava River basin include:

- continuous breaking of land connected with the liquidation of meadows, pastures and scattered vegetation of tree species and with an intensive application of chemical substances,
- large-scale drainage of wet agricultural land,
- large-scale transformation of originally broad-leaved and mixed forests to coniferous monocultures,
- impacts of phytotoxic air pollutants in the mountainous sections of the river basin,
- technical regulations of watercourses,
- construction of water reservoirs in the ecologically most valuable sections of the river basin.

At present, landscape management programmes focuses on reducing negative trends, which still continue. These programmes include; in particular, the revitalization of watercourses, the establishment of spatial systems of ecological stability, rural landscape revitalization and a new approach to forest management based on preferring natural aspects of forest management.

2.3. Human Impact

The landscape in the Morava River basin has been exploited by man since prehistoric times. The lowlands, id. the Dyjskosvratecký, Hornomoravský and Dolnomoravský Vales, represent, together with the Elbe area, the most fertile part of the Czech Republic. Intensive agriculture exercised in these regions has significant impacts on water management because of high water consumption including irrigation, intensive large-scale landscape transformation which substantially affects the hydrological regime, and last but not least, because of waste generated by an excessive application of fertilizers and in large-scale livestock operations. During the period of socialism, intensive agriculture expanded into hilly and piedmont parts of the river basin where such form of farming was neither effective nor suitable from the point of view of landscape management.

The basic pattern of cities and towns in the Morava River basin was established in the early Middle Ages. Brno, the biggest city of Moravia, and its agglomeration lie on the Svratka River. The ancient cultural center Olomouc is located directly on the Morava River, while Zlín, developed by T.Baťa, a renowned entrepreneur of the inter-war period, lies, together with its satellite Otrokovice,

on the Dřevnice River and at its mouth into the Morava River. These three urban junctions represent points, which are among the most significant ones in terms of water consumption and municipal wastewater production. In addition, there are another three towns with a population of over 50,000 and 12 towns with a population between 20,000 and 50,000 in the Morava River basin. However, a number of rural regions are also typical of the Morava River basin, with a dense network formed by small towns with a population of less than 5,000 being their dominating element. Water consumption and wastewater production in these regions are lower, indeed, but the construction of public water supply and sewage disposal systems and wastewater treatment plants is financially more demanding.

What is typical of the Morava River basin is the mechanical-engineering manufacturing complemented by the processing of local resources in food, leather and wood-working industries and in the manufacture of building materials. Some of the plants operating in the above-mentioned branches of economy make higher demands on water consumption or they produce more wastewater. However, textile industry was the original historical industry of Brno. Heavy industries - metallurgy, chemistry, power engineering - represent, more or less, the result of the so called socialist industrialization when industrial plants were also located in small towns. The only Czech nuclear power plant as yet in operation is located on the territory of the Morava River basin near the village of Dukovany. The power plant makes use of water for cooling.

From the point of view of transport, Moravia is more or less a through-region. After the split of Czechoslovakia, the western-eastern directions lost their importance, and the traditional north-south and northeast-southeast directions were revitalized. Motorways and railways pass through the territory of the Morava River basin in these directions, with Brno being the main motorway junction and Břeclav the main railway junction (from the international point of view). Shipping has not developed here because watercourses to be found here represent their upper reaches.

The territory of the Morava River basin has also numerous attractive places in terms of recreation and tourist travel. Architectural and historical places of interest, protected areas, cultural and sport events and "undemanding" hiking are also of importance. Intensive recreation has developed primarily at waterworks, with the Vranov and Brno water reservoirs and the Nové Mlýny waterworks being the most important of them. Recreation at waterworks also serves as complementing other recreation and tourist travel activities.

2.4. Key Issues of Environmental Degradation

The area of the Morava River basin is among those facing the least serious environmental problems. At the end of the period of planned economy characterized by major environmental problems, the vast majority of Czech areas with strongly degraded environment could be found on the territories of the basins of the Elbe and Odra Rivers. In terms of the whole of the Czech Republic, the only region with strongly degraded environment included part of the Brno agglomeration, namely the so called Posvitavská zone where old industries and residential neighborhoods built in the period of the industrial revolution were concentrated. Besides air pollution, a high production of wastewater manifested itself negatively, with this production reaching values of 4,000 t of BOD_5 annually.

The Lower and Middle Pomoraví comprising the area from Hodonín to Kroměříž and Olomouc has been also declared an area with disturbed environment. In this area, adverse environmental impacts combine with those produced by the pattern of settlement, industries and intensive farming, the pattern of settlement being characterized by a very high density of municipalities, with numerous medium-sized towns being its dominating element.

In contrast, many regions with relatively little disturbed nature environment occur in the Morava River basin. Many of these regions have large protected areas (national parks, biospheric preserves and protected landscape areas). The Morava River basin is also a region with the highest standard of social milieu, a relative high level of social control, the lowest incidence of socially pathological phenomena and a high demographic stability.

After 1990, the importance of many industrial, agricultural and municipal sources of pollution substantially decreased since production was reduced and natural resources started to be managed more economically. Problems associated with the rapid development of (individual) car transport got bigger. Not the quantity but the structure and the hazardous nature of harmful substances are becoming an issue of common concern as a result of new technologies being applied not only in industries but also in municipal management (packaging, washing and cleaning technologies etc.).

The major environmental problems faced by the region of the Morava River basin include particularly:

- complex impacts of large urban agglomerations, in particular Brno, Olomouc, Zlín-Otrokovice and, to some extent, also others, resting in the concentration of humans, their activities, industrial production and transport,
- complex impacts of large-scale farming operations, with these impacts manifesting themselves more and more in the most productive areas; these impacts include, first of all, unfavorable large-scale landscape management, mass application of chemical substances and the liquidation of significant segments of greenery,
- rapid development of individual transport, and the shifting of traffic streams from ecologically more favorable modes of transport onto roads.

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

3.1. Present Situation

3.1.1. Population

As of 1 January 1996, Czech Republic had a population of 10,321,344 and this number decreased to 10,309,137 as of 31 December 1996. The latest data for villages are available as of 1 January 1996. As of this date, the territory of the Morava River basin had a population of 2,778,168, which makes up 26.9 per cent of the total population of the Czech Republic. The average population density in the Morava River basin is 131 inhabitants per square kilometer, which corresponds with the national density average.

Tab. 3.1 The following towns with a population of over 20,000 (in 1996) can be found on the territory of the Morava River basin:

Brno	390	Kroměříž	30
Olomouc	105	Hodonín	29
Zlín	83	Valašské Meziříčí	28
Jihlava (part)	52	Uherské Hradiště	28
Přerov	51	Břeclav	27
Prostějov	50	Vyškov	23
Třebíč	40	Blansko	21
Znojmo	37	Otrokovice	20
Vsetín	31	Hranice	20
Šumperk	31		

Source: Soupis měst, obcí a okresů ČR.. REGIOGRAPH Brno 1997

Of the 2.78 mil. inhabitants of the Morava River basin, 1,679,905 mil. of them, that is 60.47 per cent, lived in urban municipalities in 1996. From the point of view of water management, the difference between central and marginal regions is very important since the individual regions may differ not only in the standard of public utilities available in municipalities but also in the provision of households with articles of long-term consumption. However, the most significant differences may be observed in municipalities with a population of 500. Generally, it is stated that it is not effective to build public water supply systems, public sewage disposal systems and classical wastewater treatment plants in municipalities with less than 500 inhabitants.

In 1991, 391,756 citizens of the Morava River basin lived in municipalities with less than 500 inhabitants (14.3 % of the total population) and 113,858 citizens lived in municipalities with less than 200 inhabitants (4.2 % of the total population). Since then the number of inhabitants in the smallest villages has been decreasing, on the other hand, however, some settlements tend to fall into this category. Therefore, the available figures may be, more or less, accepted as relevant also for the present-day state.

3.1.2. Area

The Czech Republic covers 78,866 square kilometers. On the territory of the Czech Republic, the Danube River basin is represented primarily by the Morava River basin. A small part of the area (464 km^2) is taken up by the Vlára River basin, which takes water into the Danube River through the Slovak Váh River. With a population of less than 40,000, this river basin immediately follows the Morava River basin, and was considered, in the analysis, as its inseparable part.

In addition, waters from the westernmost bulges of Bohemia flow directly into the Danube River in Bavaria. This part of the Danube River basin in the Czech Republic stretches over the mountainous positions of the Bohemian Forest, covers 517 square kilometers, has a population of about 5,000 and a very small number of productive or non-productive activities. The area is in a considerable distance from the Morava River basin, and is managed, in terms of water management, by institutions responsible for the Elbe (Vltava) basin. It is for this reason that it has not been included in this analysis.

The territory of the Morava River basin (including the Vlára River basin) comprises complete areas of the following administrative districts: Blansko, Brno-město, Brno-venkov, Břeclav, Hodonín, Kroměříž, Prostějov, Šumperk, Třebíč, Uherské Hradiště, Vsetín, Vyškov, Zlín and Znojmo, and parts of the following districts: Bruntál, Frýdek-Místek, Chrudim, Jihlava, Jindřichův Hradec, Nový Jičín, Pelhřimov, Olomouc, Přerov, Svitavy, Ústí nad Orlicí and Žďár nad Sázavou. This area has 21,145 km^2, which makes up 26.8 % of the territory of the Czech Republic.

3.1.3. Per Capita Income

According to official sources, the average monthly income was CZK 9,676 (USD 276). According to investigations, in which part-time workers have not been considered, the average monthly income was CZK 11,069 (USD 316). The minimum wage was fixed to be CZK 2,650 (USD 76) as of 1 January 1998.

Since 1 April 1998, subsistence minimum for an adult citizen has been CZK 2,130 + CZK 1,300 for a single-person household (USD 98 altogether). Subsistence minimum varies according to age and the number of household members.

Incomes and expenses of households differ. In employees households, the average annual per-capita income was CZK 82,900 (USD 2,370), in households of independent persons the income was CZK 75,663 (USD 2,160), in farmers households CZK 70,400 (USD 2,010) and in pensioners households CZK 55,200 (USD 1,580).

Tab. 3.2 The structure of expenses

	EMPLOYEES	INDEPENDENT	FARMERS	PENSIONERS
expenses total (CZK)	79,382	77,647	68,937	56,058
food (%)	21.6	23.0	21.3	35.6
clothing, shoes (%)	7.3	8.8	10.0	8.5
housing (%)	11.0	11.0	10.5	21.2
Household operation (%)	7.5	8.8	10.0	8.5
personal demands, health care (%)	4.3	4.9	3.7	4.8

transport and communications (%)	10.2	12.4	12.5	6.6
culture, educat., sport (%)	8.8	11.8	6.8	6.6
taxes, payments (%)	26.4	16.2	24.8	7.9
alcohol, tobacco (%)	2.9	3.1	3.4	3.4

Source: Ročenka Hospodářských novin 1998. Praha ECONOMIA 1998, p. 77

However, the average per-capita income is, in the major part of the area of the Morava River basis, lower than the national average. In the 1st half of 1997, the highest average income was in Prague (CZK12,438), central Bohemia (CZK 10,252), north Bohemia (CZK 9,714) and north Moravia (CZK 9,690). In the south Moravia, which represents the largest part of the Morava River basin, the average income in this period was CZK 9,283, with only in south and east Bohemia being lower.

3.1.4. Domestic Water Demand

Of the total number of 2.78 mil. inhabitants living in the Czech part of the Danube River basin as of 1995, 2,224 mil. (80 %) were supplied with water from public water supply systems. A minor part of the population, namely 556,000 (20 %) are supplied with water from individual resources, primarily from house wells.

The available basic data used to set the amount of water abstracted by population in the Czech part of the Danube River basin were data on the amount of water abstracted by public water supply systems in this area between the years 1990-1995. Data on the abstraction of surface water by public water supply systems were contained in Vodohospodářský sborník 1995 (Water Management Proceedings), Volume I. Data on the abstraction of ground water by public water supply systems in the years 1990, 1991 and 1995 are contained in Vodohospodářský sborník 1995, Volume II. For 1992, 1993 and 1994, estimates for the abstraction of water have been made on the grounds of water abstraction trends in the Czech Republic.

Tab. 3.3 Aggregate data on the abstraction of water by public water supply systems (mil.m^3)

YEAR	1990	1991	1992	1993	1994	1995
abstraction of water by public water supply systems	226.4	253.9	239.0	228.5	216.1	201.0

Source: Vodohospodářský sborník 1995, Vol. I.

Of the total amount of water abstracted by public water supply systems from watercourses or from groundwater resources, one part is made up by technological water, the second part by non-invoiced water represented, primarily, by water losses in the piping systems[1], and the third part is made up by invoiced water. Of the invoiced water, one part of it is invoiced to farming, the second part to industries, the third part to households and the fourth part to other consumers. Thus, the actual amount of water abstracted and used by households represents only one part of the total amount of water abstracted by public water supply systems, namely that which is left over after all the above-mentioned items have been deducted.

As regards the fact that data necessary to directly determine the actual amount of water abstracted by population in the Czech part of the Danube River basin have not been available, this amount has been estimated at least. The estimate has been made on the grounds of the average amount of water invoiced to households in the Czech Republic between the years 1990-1995.

[1] The estimate of average water losses in the centralised water supply systems in the Czech part of the Danube River basin was 26 % of water production for centralised water supply systems in 1995

Tab. 3.4 Abstraction of water by households between the years 1990 - 1995

YEAR	1990	1991	1992	1993	1994	1995
Abstraction of water by households (mil.m^3)	111.9	102.2	99.3	87.9	84.6	79.3

Source: Vodohospodářský sborník 1995, Vol. I.

Since 1990, the amount of water abstracted by population has been steadily decreasing. As compared to 1990, the 1995 value of the amount of water abstracted by population was only 70.9 %.

The estimate of the total amount of water abstracted by population in the Czech part of the Danube River basin from house wells has been made on the grounds of the following assumptions:

- the specific water demand of people supplying themselves with water from house wells is 60 l per inhabitant per day,
- the number of inhabitants not supplied with water from public water supply systems is 556,000 in the given area.

On the grounds of these assumptions, the amount of water abstracted by population from house wells in the Czech part of the Danube River basin is estimated to be 12.2 mil.m^3 per year.

In the Czech Republic, the differences between urban and rural population are not very significant. From the point of view of water supply, the main difference is just whether people are or are not supplied with water from public water supply systems. For these reasons, the specific water demand is not stated for urban and rural population separately. However, what is stated separately is the specific water demand of inhabitants supplied with water from public water supply systems and of those supplying themselves with water from house wells.

The value of the specific water demand determined on the grounds of the amount of water abstracted by public water supply systems in the given area of the Czech part of the Danube River basin to the year 1995 is 248 l per person and day.

The value of the specific water demand set on the grounds of the estimate of the actual amount of water taken by the population has been calculated for the Czech part of the Danube River basin to be 98 l per person and day.

In *Vodohospodářský sborník 1995, Volume II,* the specific water demand of inhabitants supplying themselves with water from house wells is stated to be 60 l per person and day. This value is higher than that stated in the Decree N^o 9/1973, where 40 l per person and day are stated to be the amount of water taken from public water supply systems. This value is based on the census according to which most of these inhabitants supply themselves with piped water abstracted from their private wells. That means that the amount of water abstracted by them from their house wells is likely to be higher than 40 l per person and day if the capacity of the well allows this.

3.1.5. Domestic Wastewater Production

Data on the amount of wastewater discharged to watercourses in the Czech part of the Danube River basin between the years 1990-1995 are shown in the following table.

Tab. 3.5 Wastewater discharged to watercourses in the Czech part of the Danube River basin between the years 1990-1995

YEAR	1990	1991	1992	1993	1994	1995
Amount of wastewater discharged to watercourses (mil. m^3)	358.1	345.3	338.5	311.1	299.3	256.4

Source: Vodohospodářský sborník 1995, Vol. I.

The amount of wastewater discharged to watercourses has been steadily decreasing since 1990. In 1995, the amount of wastewater discharged to watercourses decreased to 71.6 % of the amount discharged in 1990.

The proportion of wastewater discharged to watercourses from public sewerage had to be estimated since direct data were not available. The estimate has been made on the grounds of the amount of wastewater discharged to watercourses from public sewerage systems in the Czech Republic between the years 1990-1995.

Tab.3.6 Amount of wastewater discharged to watercourses from public sewerage systems

YEAR	1990	1991	1992	1993	1994	1995
Amount of wastewater discharged to water-courses from public sewerage systems (mil. m^3)	181.1	180.6	176.7	155.0	161.4	150.7

Source: Vodohospodářský sborník 1995, Vol. I.

Wastewater discharged to watercourses from public sewerage systems comprises, on the one hand, wastewater discharged to public sewerage and, on the other hand, precipitation and ballast waters. Wastewater discharged to public sewerage systems comprises, on the one hand, the actual domestic wastewater produced by population and, on the other hand, wastewater produced by industrial plants connected to public sewerage. Thus, domestic wastewater represents only one part of wastewater discharged, by public sewerage, to watercourses.

As regards the fact that data necessary to directly determine the actual amount of domestic wastewater produced by population in the Czech part of the Danube River basin have not been available, the amount has been estimated at least. The estimate has been made on the grounds of the values of the average proportions of domestic wastewater in the Czech Republic between the years 1990-1995.

Tab. 3.7 Amount of domestic wastewater produced by households

YEAR	1990	1991	1992	1993	1994	1995
Amount of domestic wastewater produced by households (mil. m^3)	81.1	84.1	83.2	66.3	66.8	57.2

Source: Vodohospodářský sborník 1995, Vol. I.

Since 1991, the amount of wastewater produced by households has been decreasing. Between 1991 and 1995, the decrease was about one third.

The value of the specific production of wastewater in the Czech part of the Danube River basin set on the grounds of the estimation of the amount of wastewater produced by population, and on the grounds of the number of inhabitants served, in this area, by public sewerage, is 80 l per person and day to the year 1995.

Data on the amount of pollution discharged to watercourses from the registered point sources in the Czech part of the Danube River basin between the years 1990- 1995 - expressed by means of the indicators BOD_5, COD_{Cr} and undissolved substances - are shown in the following table. Pollution discharged to watercourses in the Czech part of the Danube River basin between the years 1990-1995:

Tab. 3.8 The amount of pollution discharged to watercourses between the years 1990 -1995

INDICATOR	1990	1991	1992	1993	1994	1995
BOD_5 (ts. t . $year^{-1}$)	24.3	29.7	25.8	24.3	17.5	16.2
COD_{Cr} (ts. t . $year^{-1}$)	76.0	72.0	71.2	70.0	56.0	45.5
Undissolved subst. (ts. t . $year^{-1}$)	31.3	30.0	29.3	27.2	24.5	20.0

Source: Vodohospodářský sborník 1995, Vol. I.

The amount of pollution discharged to watercourses from registered point sources in the Czech part of the Danube River basin has been decreasing since 1990, too. Measured by BOD_5, the 1995 pollution was only 58 % of that of 1990, in terms of COD_{cr}, the 1995 pollution was only 60 % of that of 1990. In terms of the indicator *undissolved substances,* the 1995 figure was only 64 % of that of 1990.

In terms of pollution produced by population and discharged to watercourses, no data are available. On the one hand, this pollution comprises pollution and wastewater discharged to watercourses by households not served by public sewerage. On the other hand, it also comprises part of pollution and wastewater produced by households served, indeed, by public sewerage in small municipalities, but, since these systems are mostly registered as rain sewer systems, they need not necessarily be included in the register of wastewater discharge.

To make estimations of pollution produced by non-registered municipal sources, it is therefore more advisable to base these estimations on a slightly higher number of population rather than on the number of inhabitants not served by public sewerage. It is recommended (see *Vodohospodářský sborník 1995, Volume II*), to make estimations on the grounds of the number of inhabitants living in settlements with up to 500 inhabitants since a settlement with 500 inhabitants roughly represents the size from which on it is registered as wastewater source.

In the Czech part of the Danube River basin, 392,000 inhabitants live in settlements with less than 500 inhabitants. The results of investigations carried out in model river basins suggest that 17 % of the population of the Czech Republic living in settlements with up to 500 inhabitants is served by a wastewater treatment plant, while 83 % is not. It my be derived from this proportion for the Czech part of the Danube River basin that the number of inhabitants living in this area in settlements with up to 500 inhabitants and served by a wastewater treatment plants is 66,640, while the number of inhabitants living in settlements of that size without a wastewater treatment plant is 325,360.

On the grounds of these investigations, also the average values of specific amounts of pollution discharged to watercourses have been obtained in terms of the BOD_5 indicator. These values are 1.3 kg per inhabitant and year for settlements with less than 500 inhabitants with a wastewater treatment plant, and 5.8 kg per inhabitant and year for settlements of the same size without a wastewater treatment plant. For the Czech part of the Danube River basin this means that, in terms of BOD_5, the total pollution discharged to watercourses in this area is 87 tons per year in settlements with less than 500 inhabitants with a wastewater treatment plant, and 1,887 tons of wastewater per year in settlements with less than 500 inhabitants without a wastewater treatment plant. In terms of BOD_5, the total amount of pollution discharged, by population, to watercourses from non-registered sources in the Czech part of the Danube River basin is estimated to be 1,947 t per year.

3.2. Projection for Planning Horizons 2010 and 2020

3.2.1. Population

The forecast for the demographic development in the Czech Republic covering this period cannot be based upon current trends since demographic development in the Czech Republic underwent a relatively dramatic change after 1990. The length of duration of, and the ultimate values achieved during this transitional period can be hardly estimated. Discussing this issue, the following projections are taken into consideration:

- the projection prepared by the Czech Statistical Office - ČSÚ (1995); this forecast may be considered official,
- the projection prepared by TERPLAN Prague Inc. (1996), which is the most updated one, and
- the three-variant UN Projection (1994) that also takes supranational aspects into account.

Tab. 3.9 The comparison of the above-mentioned projections (thousands of inhabitants)

VARIANT	2000	2005	2010	2015	2020
ČSÚ (low)	10,265	10,165	10,001	9,781	9,505
ČSÚ (high)	10,278	10,208	10,107	9,989	9,851
TERPLAN	10,226	10,124	9,973		
UN (low)	10,210		10,042		9,764
UN (mean)	10,346		10,444		10,551
UN (high)	10,437		10,744		11,132

Source: Demografie 39, 1997, No.4, pp. 291-292

At present, the fertility rate is the decisive factor affecting the forecast for the demographic development. The total fertility rate in the Czech Republic rapidly dropped from 1.87 in 1989 to 1.18 in 1996, the gross rate of reproduction thus being 0.58. From this point of view, all the UN forecast variants are out of the question since they count on the total fertility rate to be minimally 1.50 in the low variant. However, even the Czech forecasts could not foresee the 1996 fertility rate. It means that the forecast made by TERPLAN might also appear to be too optimistic. Naturally, the question is whether the decline in the fertility rate continues. If this is the case, then the questions are: *1. How long will it continue? 2. What value will it stop at? 3. Will it be followed by a slight growth?*

Of the other trends currently existing in the Czech Republic, the increase in the average life expectancy may be worth mentioning. This increase might slightly change the declining birth rate, which would, however, lead to worsening the age structure of population. However, in consideration of the currently bad state of health of the population, this factor cannot be expected to have strong effects on demographic forecasts in future. Not a single forecast takes foreign migration into account. However, it can hardly be expected that this migration will have a significantly positive balance. All in all, we suggest that the low variant of the official forecast made by the Czech Statistical Office should be taken into consideration. In doing so, we must be aware of the fact that this forecast may be too optimistic.

Thus, if the demographic development in the Morava River basin does not differ from that in the whole of the Czech Republic, a maximum of 2.69 mil. inhabitants might be expected to live in this region to the year 2010, and about 2.56 mil. to the year 2020. In terms of the demographic development, this region may not be considered extreme in any case. Being relatively low also in

previous periods, the internal migration within the Czech Republic dropped to 2.37 per cent of inhabitants who change their domicile during the year. It is migration over longer distances that declined most. From the point of view of their distribution within the territory of the country, the inhabitants of the Czech Republic are very stable. However, the question is whether this situation can hold until 2010 or 2020. However, no changes may be expected in the near future. If some changes do occur in a distant future, they will be characterized by the population tending to concentrate near the western borders (including immigrants from east and south) and in important centers of settlement rather than in the Morava River basin. Thus, on the grounds of these demographic forecasts, the Morava River basin will be likely to loose inhabitants rather than to gain them. We do not think that the number of inhabitants of the Morava River basin will substantially exceed the value of 2.5 mil. in the year 2020. What may be expected to grow in the Morava River basin is the number of inhabitants living in the main urbanized locations, this grow being accompanied, however, by the stagnation of the core areas of these locations.

3.2.2. Domestic Water Demand

The amount of water abstracted by consumers has been changing so principally since 1990 that it is not easy to forecast the future water demand at all. The amount of water abstracted by population and by public water supply systems dramatically decreased between the years 1990-1995 since a dramatic increase in water and wastewater disposal fees occurred (in some locations, fees increased 20 times for households), the decline in industrial production and farming took place, the checking of invoiced water abstracted by private consumers became more accurate with the same being true of the measurement of water abstraction, and because other factors emerged.

Nationwide statistics show that the amount of water abstracted by population decreased by 28 per cent and that abstracted by public water supply systems by 24 per cent. In the Czech part of the Danube River basin this amount decreased by 29 per cent with the population and by 25 per cent with public water supply systems. At the same time, the proportion of non-invoiced water increased during this period from 25 per cent to 32 per cent in the Czech Republic, and from 20 per cent to 26 per cent in the Czech part of the Danube River basin.

Experts in water management have made a forecast for water abstraction by population and by public water supply systems in the Czech Republic for the time horizon 2015. This forecast is based upon the following assumptions:

1. According to demographic projections concerning the future development of population, no increase in the number of inhabitants may be expected in the Czech Republic until 2015. Basically, the current state will remain unchanged, or a slight decline in population may be expected respectively. The forecast predicts a population of 10.1 mil. to the year 2015 in the lower variant, and 10.3 mil. in the higher variant. The proportion of population supplied with water from public water supply systems may increase from 85.8 per cent in 1995 to 91 per cent in the lower variant and to 93 per cent in the higher variant by 2015.
2. Specific abstraction of water by households will increase from 122 l per person and day in 1995 to 150 l per person and day by 2015 in the lower variant (the current average level of water abstraction in Germany and Austria), or to 170 l per person and day in the higher variant (the average level of Denmark, the Netherlands and France). A still higher increase, e.g. to the level of Sweden (220 l per person and day) or Switzerland (270 l per person and day) may not be expected on any account.
3. Specific abstraction of water by industries, services, trades and other water consumers from public water supply systems may, in harmony with trends that have been existing in various countries of Western Europe over the last 15 years, decrease, as compared with the year 1995, by 10 per cent in the lower variant or increase by about 20 per cent in the higher variant by 2015.

4. Neither of the two variants envisages that the proportion of insignificant specific abstraction of water to supply farming from public water supply systems will greatly differ from the 1995 level.
5. The proportion of non-invoiced water will stagnate at the level of 1995 in the higher variant, that is 32 per cent on the average, while in the lower variant it will gradually decrease approximately to the 1990 level, that is 25 per cent.

The combination of higher demands and some factors on the one hand, and minimum needs on the other, gives the upper and lower limits for the water abstraction forecast. It is unlikely that an accumulation of only favorable or, on the contrary, only unfavorable preconditions of the forecast would occur. It may be expected that the ”reality” will range somewhere around the mean value of the predicted upper and lower limits. The so called "catastrophic variants" have not been considered in the forecast. What we mean by "catastrophic variants" is, for example, that the proportion of non-invoiced water will continue to grow, the number of population supplied from public water supply systems will stagnate, or decrease respectively as a result of people re-starting to supply themselves, for economic reasons, with water from their wells, or that water supplies from some water treatment plants and some other water resources will be discontinued in the event of their water quality not complying with the quality standards, or a decline in population will occur. Considerations upon which the forecasts are based do not take into account the abstraction of technological water.

The forecast for the abstraction of water by population and by public water supply systems in the Czech part of the Danube River basin for the time horizon 2015 is based upon analogical assumptions:

1. The total number of population living in the Czech part of the Danube River basin to the year 2015 is 2.78 mil. in the higher variant and 2.70 mil. in the lower variant. If the number of population supplied with water from public water supply systems in this area increases in the same ratio as is envisaged in the forecast for the whole of the Czech Republic, the proportion of this population will increase from 80 per cent in 1995 to 84.8 per cent in 2015 in the lower variant, and to 86.4 per cent in the higher variant.
2. The proportion of non-invoiced water in the Czech part of the Danube River basin will stagnate at the level of 1995 in the higher variant, that is 26 per cent, and it will decrease roughly to the level of 1990 in the lower variant, that is 20 per cent.
3. The predicted values of specific water demand of households and other consumers are identical with the nationwide forecast (see Table).

Tab. 3.10 The values contained in the forecast for the abstraction of water by population and by public water supply systems in the Czech part of the Danube River basin for the time horizon 2015

INDICATOR	VARIANT A (UPPER LIMIT)	VARIANT B (LOWER LIMIT)	AVERAGE OF VARIANTS
Specific water demand of households (l per person and day	170	150	160
Specific water demand for water produced by public water supply systems (l per person and day)	373	282	328
Total number of population (mil.)	2.78	2.70	2.74
Number of supplied inhabitants (mil.)	2.40	2.29	2.345
Abstraction of water by population (mil. m^3)	149	125	137
Water produced by public water supply systems (mil. m^3)	327	236	281

Source: Vodohospodářský sborník 1995, Vol. I.

Demographic forecasts discussed in Chapter 3.2.1. predict a greater decline in population than the above-mentioned water-management forecasts. According to forecasts presented in Chapter 3.2.1., the number of population in the Czech part of the Danube River basin will decrease to 2.63 mil. by the year 2015. If this number of population is used for the lower variant of the forecast for the abstraction of water, the lower limit of the predicted amount of water abstracted by population will decrease from 125 mil.m^3 to 122 mil.m^3, that is approximately by 3 mil.m^3 of water, and the lower limit of the amount of water predicted to be produced by public water supply systems will decrease from 236 mil.m^3 to 230 mil.m^3, that is approximately by 6 mil.m^3 of water.

The forecasts suggest that the time horizon 2015 will be a period in which the amount of water abstracted by public water supply systems is likely to achieve roughly the level of water abstracted in the late 1980s again. This means at the same time that the current water resources will very likely be sufficient also in the next 20 years unless they will be depreciated.

3.2.3. Domestic Wastewater Production

The forecast for the amount of wastewater produced by population in the Czech part of the Danube River basin to the year 2015 is based on the following data:

1. The expected value of the specific amount of wastewater produced by population in the year 2015 will be 128 l per person and day. This value has been determined on the grounds of the specific water demand of 160 l per person and day predicted for households to the year 2015 (see Chapter 3.2.2.) diminished by 20 per cent (non-returnable water consumption). In terms of population, the non-returnable water consumption is estimated to be 20 per cent of the water withdrawal (*Vodohospodářský sborník 1995, Volume I).*
2. The total number of inhabitants living in the Czech part of the Danube River basin will be 2.74 mil. to the year 2015 (see Chapter 3.2.2.). If the number of inhabitants served by public sewerage in this area increases between the years 1995-2015 in the same ratio - as predicted by the nationwide forecast for this period - from 73 per cent to 83 per cent (see *Vodohospodářský sborník 1995, Volume II),* the proportion of population served by public sewerage in the Czech part of the Danube River basin will increase from 71 per cent in 1995 to 80 per cent in 2015. The number of inhabitants served by public sewerage in this area will be 2.19 mil. inhabitants to the year 2015.

As predicted for the year 2015, the ultimate value of the amount of wastewater produced by population in the Czech part of the Danube River basin will be 102 mil.m^3 of wastewater if the above-mentioned preconditions are met. For comparison's sake, the highest amount of wastewater produced by population during the 1990-1995 period was 84.1 mil.m^3 in 1991, with 57.2 mil.m^3 in 1995 being the lowest. Therefore, the amount of wastewater produced by population is expected to increase, primarily due to the expected increase in the specific water consumption in households.

4. Actual and Future Population Potentially Affected by Water Pollution

In the Czech Republic, water purity in watercourses is evaluated by means of the so-called Quality Ranges. The characteristics of these ranges suggest how they can be applied. Also the limits of their application may be derived from these characteristics.

Tab. 4. On the banks of watercourses classified by the individual ranges of water purity, the following numbers of population lived in 1996

QUALITY RANGE	NUMBER OF POPULATION (MIL.)
Quality Range V	0.20
Quality Range IV	0.91
Quality Range III	0.47
Quality Ranges I and II	0.12
Watercourses not measured	1.08

Source: Own calculation based on water purity data of Povodí Moravy, a.s.

Methodical notes: The numbers of population have been calculated by means of the group of A Indicators (dissolved oxygen, BOD_5 and COD_{Cr}). The evaluation by means of B Indicators (ammonia nitrogen, nitrate nitrogen and all phosphorus) would be somewhat different but basically, the same proportions would be achieved. Naturally, measurements are made at certain points, and the situation is related to the whole sections. To make calculations, municipalities have been taken as the basic units of settlement. It means that in the case of a large municipality situated at a watercourse or in the case of scattered settlement, the distance between homes of part of residents and the appropriate watercourse may be up to several kilometers, while, on the contrary, some people living in a municipality situated several kilometers away from the watercourse may have their homes directly at it. The relationship between the number of inhabitants living at the watercourse and its function may sometimes be very loose. For example, Brno, the largest city in the Morava River basin, is supplied with drinking water predominantly from underground resources. Often, only a very small number of inhabitants have their homes near water reservoirs but a large number of holiday makers coming here to have a swim have their homes in relatively great distances (as exemplified by the Vranov water reservoir). In terms of 39 per cent of population not residing directly at watercourses with monitored water quality, no unambiguous evaluation can be made. In some cases, small watercourses may be polluted, even by relatively insignificant sources, much more than monitored large and medium-sized streams because these small watercourses may have low flows.

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

For the purposes of water supply, water of Quality Ranges I and II is suitable. However, even water of this quality requires treatment. Water in streams belonging to Quality Range III is conditionally suitable for treatment, it means only in the event of no other water resource of better quality being available, and on condition that multi-stage treatment technology is available. It follows from it that about 120,000 inhabitants live on the banks of rivers whose water is fit for drinking water supply,

while about 470,000 inhabitants live at watercourses containing water conditionally fit for drinking water supply. In total, more than 1 mil. inhabitants live on the banks of watercourses whose water is not fit for treatment in any case, and another 1 mil. inhabitants or more live at small watercourses.

However, it must be noted that drinking water supply in the Morava River basin is, to a large extent, covered by water from underground water resources, and that the proportion of water abstracted from watercourses for drinking water supply is steadily decreasing with the rapidly decreasing water consumption. In 1995, 46.2 mil.m^3 of water were abstracted from surface water resources for the purposes of treatment (23.17 per cent) while 153.26 mil.m^3 of water were abstracted from underground water resources (76.83 per cent).

In the Czech Republic, 85.8 per cent of population (1995) is supplied with water from public water supply systems. The quality of this drinking water is regularly monitored by the Hygiene Service and by the operator of the public water supply system. The quality of water supplied from public water supply systems and monitored by the Hygiene Service remained unchanged during the period 1993-1997. Its safety for drinking water supply is comparable with that available in the majority of developed western European countries. In 1996, the limiting values, or the limiting values of acceptable risks respectively, were most frequently exceeded for beryllium (11.5 per cent), chloroform (3.5 per cent), chlorobenzene (2.7 per cent) and dichlorobenzenes (2.0 per cent). The results of biological and microbiological analyses of drinking water show positive findings for coliform bacteria in 4.5 per cent of cases, enterococcus in 1.5 per cent of cases and fecal coliform bacteria in 1.1 per cent of cases.

Between the years 1995-1996, the incidence of selected trace elements was monitored in relation to the proposal for the amendment of the regulation of the EU. Of 684 analyses that have been carried out, in 17 cases the content of boron exceeded the value of 0,3 mg B/l. In the case of beryllium, lithium and antimony, the proposed EU standard was sporadically exceeded, in the case of nickel and vanadium, the permitted values were not exceeded.

There is no general overview of the situation in terms of small public water supply systems. However, water in individual resources does not comply with the standard for nitrates and bacterial pollution in 95 to 98 per cent of cases. However, small and individual water supply systems predominantly make use of underground water resources.

In future, the number of people residing on the banks of strongly polluted rivers whose waters are not fit for drinking water supply even after a multi-stage treatment will decrease with the water quality in watercourses gradually improving.

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

Water of this range of purity is of great value in terms of landscape management. However, water of that quality scarcely occurs in watercourses of the Morava River basin (in sections where human settlements are found).

In addition to being fit for the purposes of water supply, the water of Quality Range II is also fit for aquatic sports, fish-farming and industries. Water of that range of purity is valuable in terms of landscape management. About 120,000 inhabitants of the Morava River basin have their homes on the banks of watercourses of Quality Range II.

Water of Quality Range III is conditionally usable for treatment and other purposes, and its value in terms of landscape management is low. About 470,000 people have their homes on the banks of watercourses with this water quality. Water of Quality Range IV (affecting 910,000 people) is

usually fit only for a limited number of uses. Water of Quality Range V is not fit for any use. Among other things, water of that quality may have direct impacts on residential population (200,000 persons) because of depreciating residential environment, bad smell and other adverse impacts.

In future, this situation will be dependent on the water purity in watercourses rather than dependent on the demographic processes which are, more or less, stable. The hitherto trends show that a decline in organic pollution has been taking place in the Morava River basin since 1991. Inorganic nitrogen substances began to slightly decline only after 1993, the content of phosphorus is declining insignificantly. It may be said that the decline in pollution is in correspondence with the reduced amount of wastewater discharged from point sources. Other positive factors include the reduction of the application of mineral fertilizers in farming and the reduction of atmospheric depositions. At present, the specific load of the Morava River basin is higher than that in the Elbe and Odra River basins.

It may be said that, recently, improvement has occurred virtually in all monitored watercourses in the Morava River basin. This is also true of watercourses that have remained, in terms of water purity, in the Quality Range V. A significant improvement in surface waters quality occurred, since a number of watercourses shifted from Quality Range V to Quality Range IV (500 km of watercourses) and from Quality Range IV to Quality Range III. However, this improvement is significant not only from the point of view of drinking water supply. It may be assumed that a general improvement in water quality of watercourses will continue to take place as a result of the construction and reconstruction of wastewater treatment plants. Also the reduction of emissions produced by non-point sources is likely to manifest itself within long-term horizons. However, it is difficult to estimate the rapidity and extent of these changes since they are unique.

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

The state of health of the Czech population is not very good. This is primarily due to bad nutrition habits, the lack of physical movement and the growing amount of psychical stress. Although the average life expectancy has increased in the past years to be 70.4 years with men and 77.3 years with women in 1996[1], it still remains to be one of the lowest in Europe, with prospects for an improvement being rather poor. Most people die of blood circulation diseases (56.0 %), tumours (24.7 %), injuries and intoxication (6.9 per cent), respiratory diseases (4.1 per cent) and digestive tract diseases (3.7 per cent). Infant death rate has dropped to 6 per mille. However, in the prevailing part of the territory of the Morava River basin, the situation is better than the average of the Czech Republic, with some districts being, in terms of the state of health of population, among the best. In districts located in higher altitudes (the Bohemian-Moravian Highlands, the White Carpathians, the Beskydy Mountains), the state of health of population is, as a rule, better than in districts located in lowlands including large and medium-sized towns. It may be assumed that the differences in the state of health of population may be due, among other things, to a higher stability of population in the Morava River basin generally and in its rural regions especially.

The quality of drinking water supplied from watercourses has currently only minimum direct effects on the state of health of population. Nationwide surveys carried out in the Czech Republic suggest that in 1996, not a single case of water-borne infection induced by drinking water abstracted from a public water supply system was registered (out of almost 32,000 cases of registered infections). In 8 cases, water-borne infections were registered, the infection being induced, for example, by water used for bathing. Measurements of the incidence of radionuclides suggest that water has a share of about 1 per cent in the total amount of natural resources radiation,

[1] Czech Statistical Office

with the isotope ^{222}Ra having the highest share in this radiation. In terms of evaluations of long-term loads of population caused by receiving selected harmful substances through drinking water, the exposure to nitrates clearly dominates. In the case of nitrates, 50 per cent of population received 50 per cent of the permitted daily amount of nitrates, and only 3 per cent remained under 1 per cent of the permitted daily amount. This exposure is particularly hazardous to infants, therefore packed drinking water is recommended to be used to provide for their drinking regimen. Exposure to other harmful substances is very low.

Potential hazards may be due to accidental pollution of watercourses. In 1995, 243 cases of accidental pollution of surface and underground waters were registered in the Czech Republic, which is less than half of the 1991 figure. During the monitored period between the years 1991-1995, in 54 per cent of cases waters were polluted by oil substances, in 18.5 per cent of cases by chemical substances, in 7.2 per cent of cases by wastewater, in 5.5 per cent of cases by livestock waste etc. During this period, 17.4 per cent of accidents happened in farming, 13.6 per cent in transportation, 9.1 per cent in mechanical engineering and electrotechnical industries etc. However, in 34.6 per cent of cases, the originator was not found out or classified by the branches of economy. In the structure of accidents, the proportion of farming is decreasing while that of traffic accidents is increasing. It may be estimated that about one third of accidents happens on the territory of the Morava River basin. However, no acute case of health hazard due to accidents has been registered.

The 1997 summer floods represented an extreme case of accidents in which numerous drinking water resources were depreciated, wastewater treatment plants flooded and various industrial chemicals and waste etc. got into water. Nevertheless, during the floods and immediately after them, the epidemiological situation in the Morava River basin was extraordinarily “calm”. As was expected, some cases of leptospirosis occurred, 5 of them in the South Moravian region.

In certain periods, some hygienic risks may arise during swimming in watercourses and reservoirs, particularly if the valid hygienic regulations are not observed. Water quality in public swimming pools is regularly monitored by their operators, and irregularly by the Hygiene Service. There is no general overview of the situation, but water is not the source of serious diseases and epidemics. However, swimming pools may be the source of coetaneous diseases. The situation in public swimming pools is more complicated since their operators face problems of low-skilled personnel, seasonal overloads and an insufficient hygienic background.

The increase in water consumption was accompanied by an increase in the amount of wastewater (by 32.1 per cent). In the Czech Republic, 73.2 per cent of inhabitants is served by public sewerage systems. In 1996, 90.3 per cent of wastewater discharged into public sewerage systems was partially purified at least. It follows from it that about 65.9 per cent of inhabitants were served by public sewerage with wastewater treatment, this figure slightly exceeding the OECD average. In spite of this, problems still persist. There is no public sewerage in the most of municipalities with less than 500 inhabitants. Some of the public sewerage systems are not connected to wastewater treatment plants. Most of the large wastewater treatment plants currently in operation are not equipped with technologies making it possible to remove the compounds of nitrogen and phosphorus. There are potential risks, or aesthetical risks respectively. No direct health hazard through wastewater has been stated.

4.4. Hazard of Floods

In the summer of 1997, the Morava River basin (together with the Odra River basin and, to some smaller extent, the Elbe River basin) in the Czech Republic was hit by extreme floods. During 6 days in early July of 1997, $3.10^9.m^3$ of precipitation fell on the territory of Moravia and eastern Bohemia. The Morava River basin (excluding the Dyje River basin but including the Svratka River, a tributary to the Morava River) was among the most severely hit. These intensive rains caused an extreme run-off. As a result of this run-off, the values of centenary water were substantially exceeded in numerous places. The flood came very quickly especially in small river basins while Břeclav came under threat by the flood wave only eight days after the rains had set in.

According to the latest official estimations, the damage totals CZK 60 bil. (about USD 1.7 bil.), with 538 towns and villages having been affected and 49 people having lost their lives. 2,151 flats have been completely destroyed, 5,652 flats have become uninhabitable for a long period of time and 11,000 flats have been damaged. About 10,000 people have become homeless. Furthermore, 25 railway bridges, 13 railway stations, 946 km of railways, 51 road bridges and 592 km of roads have been destroyed or severely damaged. About 2,000 km of roads has become non-passable. About 100,000 telephone stations have been completely destroyed or put out of operation temporarily. About 100,000 ha of agricultural land have been flooded, with the crop having been completely destroyed. 291 pieces of beef, 2,928 pigs, 20 horses, 200,000 pieces of poultry, 31,232 small domestic animals etc. have perished. Drinking water resources have been damaged or destroyed and wastewater treatment plants flooded. The floods have also resulted in numerous landslides destroying or damaging other buildings and roads. Many damaged industrial plants have lost their buildings, machinery, output and raw materials. Many of their employees have lost their jobs. As a result, the national revenue has been much lower since fewer taxes have been paid to the treasury. Losses of psychological nature can hardly be calculated.

Anthropogenic interventions carried out in the landscape in the last centuries, particularly in the last 40 years, have undoubtedly contributed to the course of the floods and their implications. These interventions primarily include the following ones: intensification of farming, some melioration measures, the damaging of forests resulting in the decline in their water retention capacity, alignments and regulations of watercourses, the disrespect for flood control in the constructing of buildings and roads and the like. There are disagreements in terms of the importance of hydraulic structures, in particular man-made lakes that objectively retained flood waves in many places.

It may be assumed that the 1997 floods are not likely to reoccur in the near future. Nevertheless, each further hydraulic structure in the Morava River basin will have to consider the issues of flood risks.

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

5.1. Actual Situation

5.1.1. Abstraction of Raw Water from the Danube River System

5.1.1.1. Domestic Raw Water Demand

Data on the abstraction of water by public water supply systems in the Czech part of the Danube River basin between the years 1990-1995 are set forth in the following table. Data on the amount of surface and ground water abstracted by public water supply systems in the years 1990, 1991 and 1995 are taken from *Vodohospodářský sborník 1995, Volume II.* For 1992, 1993 and 1994, estimations have been made on the grounds of water trends in the Czech Republic.

Tab. 5.1 Abstraction of water by public water supply systems between the years 1990-1995

Abstraction of water by public water supply systems (mil. m^3)	1990	1991	1992	1993	1994	1995
Abstraction total	266.4	253.9	239.0	228.5	216.1	201.0
Abstraction of surface water	91.1	91.5	77.3	73.5	67.9	53.8
Abstraction of ground water	175.3	162.4	161.7	155.0	148.2	147.2

Source: Vodohospodářský sborník 1995, Vol. I.

The amount of water abstracted by public water supply systems has been steadily decreasing since 1990. Between the years 1990-1995, it decreased approximately by one third. As compared with 1990, the abstraction of water by public water supply systems in the Czech part of the Danube River basin was only 75.5 per cent. The decrease in the amount of surface water abstracted by public water supply systems is much greater than that of ground water abstracted by public water supply systems. While the abstraction of surface water dropped in the given period to 59.1 per cent, id. more than by 40 per cent, the abstraction of ground water dropped only to 84.0 per cent, id. by 16 per cent. Therefore, the ration of the amount of water abstracted from surface water and ground water by public water supply systems changed, too. In 1990, surface water abstracted by public water supply systems made up 34 per cent of the total water abstraction, while ground water abstraction made up 66 per cent of the total water abstraction. In 1995, the abstraction of surface water made up only 27 per cent of the total abstraction of water, while the proportion of water abstracted from groundwater resources increased to 73 per cent.

Tab. 5.2 Water abstracted by public water supply systems in the Czech part of the Danube River basin and in the Czech Republic

WATER ABSTRACTION BY PUBLIC WATER SUPPLY SYSTEMS (MIL. M^3)	1990	1991	1992	1993	1994	1995
Abstraction of water in the Czech part of the Danube River basin	266	254	239	228	216	201
Abstraction of water in the Czech Republic	1,300	1,265	1,218	1,140	1,062	991
Proportion of water abstracted in the Czech part of the Danube River basin in the total abstraction of water in the Czech Republic (%)	20	20	20	20	20	20

Source: Vodohospodářský sborník 1995, Vol. I.

The proportion of water abstracted by public water supply systems in the Czech part of the Danube River basin in the total amount of water abstracted by public water supply systems in the Czech Republic was exactly one fifth, with this proportion remaining unchanged during the 1990-1995 period.

5.1.1.2. Industrial/Mining Raw Water Demand

Tab. 5.3 Data on industrial water supplied to industries from the own industrial water resources in the Czech part of the Danube River basin between the years 1990-1995

ABSTRACTION OF WATER BY INDUSTRY (mil.m^3)	1990	1991	1992	1993	1994	1995
Abstraction of water, total	282.8	248.2	227.9	218.5	181.2	180.7
Abstraction of surface water, total	262.9	229.7	209.5	200.9	164.4	164.0
Abstraction of surface water for through-flow cooling	123.1	99.8	91.5	88.3	57.8	67.3
Abstraction of surface water excluding abstraction of surface water for through-flow cooling	139.8	129.9	118.0	112.6	106.6	96.7
Abstraction of ground water	19.9	18.5	18.4	17.6	16.8	16.7

Source: Vodohospodářský sborník 1995, Vol. I and II

The abstraction of water by industry has been steadily decreasing since 1990. In the 1990-1995 period, it dropped by more than one third. In 1995, the amount of water abstracted by industry in the Czech part of the Danube River basin made up only 63.9 per cent of the 1990 water abstraction. First of all, the amount of surface water abstracted by industry dropped (by 28 per cent between 1990 and 1995), while the amount of water abstracted from the own ground water resources dropped by 16 per cent only. However, the proportion of ground water abstracted by industry in the total amount of water abstracted by industry is generally low (7 per cent in 1990). In 1995, this proportion increased to 9 per cent since a great decline in the abstraction of surface water by industry took place.

The abstraction of surface water for through-flow cooling has been also decreasing since 1990 (with the exception of 1995). In 1995, it made up 55 per cent of the amount of water abstracted for through-flow cooling in 1990. The proportion of surface water abstracted for through-flow cooling in the total amount of water abstracted by industry dropped from 47 per cent in 1990 to 41 per cent in 1995.

The proportion of industrial abstraction in the Czech part of the Danube River basin in the total water withdrawals in the Czech Republic was 14 per cent in 1990, while it dropped to 12 per cent in 1995.

5.1.1.3. Agricultural Raw Water Demand for Irrigation

Tab. 5.4 The registered amount of water abstracted for irrigation – between the years 1990-1995 - in the Czech part of the Danube River basin and in the Czech Republic from watercourses administered by Water Management bodies

ABSTRACTION OF WATER FOR IRRIGATION (MIL.M^3)	YEAR					
	1990	1991	1992	1993	1994	1995
Abstraction of water in the Czech part of the Danube River basin	52	30.5	27.3	16.5	21.0	11.2
Abstraction of water in the Czech Republic	114.5	61.8	59.0	36.0	42.0	28.4
Proportion of water abstracted in the Czech part of the Danube River basin in the total amount of water abstracted in the Czech Republic (%)	45	49	46	46	50	32

Source: Vodohospodářský sborník 1995, Vol. I.

The table shows that the amount of water used for irrigation has been steadily decreasing since 1990 (with the exception of 1994). In the Czech part of the Danube River basin, the abstraction of water for irrigation dropped to 21.5 per cent in 1995, id. approximately to one fifth of the amount abstracted for irrigation in 1990. During the same period, the amount of water abstracted for irrigation dropped to roughly one fourth in the Czech Republic.

In the Czech part of the Danube River basin, the proportion of water used for irrigation in the total amount of water used for irrigation in the Czech Republic is high. It is due to the fact that the Czech part of the Danube River basin also includes the area of southern Moravia, which is among the most arid areas in the Czech Republic, and is a typical irrigation area of the Czech Republic. During the monitored period, the abstraction of water for irrigation in the Czech part of the Danube River basin made up almost one half of the amount of water abstracted for irrigation in the whole of the Czech Republic. Only in 1995, this proportion dropped to 32 per cent.

Austria intends to buy water for irrigation in the Austrian part of the Dyje River basin.

5.1.2. Wastewater Discharge to the Danube River System

5.1.2.1. Municipal Discharge

What we understand by municipal wastewater is wastewater discharged to watercourses by public sewerage. This wastewater consists of a mixture of domestic wastewater produced by population and industrial wastewater produced by industrial plants served by public sewerage.

No direct data are available on the total amount of municipal wastewater produced in the Czech part of the Danube River basin. This amount had to be estimated on the grounds of the proportions of municipal wastewater in the Czech Republic between the years 1990-1995.

Tab. 5.5 The values estimated for the amount of wastewater discharged to watercourses by public sewerage systems in the Czech part of the Danube River basin between the years 1990-1995

YEAR	1990	1991	1992	1993	1994	1995
Amount of wastewater discharged to water courses by public sewerage (mil. m^3)	181.1	180.6	176.6	155.0	161.4	150.7

Source: Vodohospodářský sborník 1995, Vol. I.

Since 1990, the amount of wastewater discharged to watercourses from public sewerage in the Czech part of the Danube River basin has been steadily decreasing (with the exception of 1994). In 1995, the amount of wastewater discharged from public sewerage dropped to 83.2 per cent of the amount of wastewater discharged to watercourses from public sewerage in 1990.

In terms of municipal wastewater treatment, no aggregate data are available for the Czech part of the Danube River basin concerning the proportion of untreated municipal wastewater and that of biologically treated municipal wastewater. The only available data concerned the proportion of untreated municipal wastewater in South Moravian region, which makes up approximately three quarters of the area of the Czech part of the Danube River basin. In South Moravian region, 6.3 per cent of wastewater (excluding precipitation) discharged to public sewerage remained untreated. As far as the proportion of biologically treated municipal wastewater is concerned, 92.4 per cent of treated municipal wastewater (including precipitation water) was treated biologically.

5.1.2.2. Industrial/Mining/Shipping Discharge

They are wastewater produced by industrial plants that discharge them directly to watercourses. For the Czech part of the Danube River basin, no direct data are available on the total amount of this wastewater. This amount had to be estimated on the grounds of the proportions of industrial wastewater in the Czech Republic between the years 1990-1995. The estimation was related to industrial wastewater excluding cooling and mining waters.

Tab. 5.6 The results achieved by estimating the amount of wastewater directly discharged, by industry, to watercourses in the Czech part of the Danube River basin between the years 1990-1995

YEAR	1990	1991	1992	1993	1994	1995
Amount of industrial wastewater discharged to watercourses (mil. m^3)	177.0	164.7	161.8	156.1	137.9	105.7

Source: Vodohospodářský sborník 1995, Vol. I.

The amount of industrial wastewater discharged directly to watercourses in the Czech part of the Danube River basin has been steadily decreasing since 1990. In 1995, the amount of this industrial wastewater made up only 59.7 per cent of the amount discharged, by industry, directly to watercourses in 1990.

In terms of industrial wastewater treatment, no aggregate data are available for the Czech part of the Danube River basin either on the amount of untreated wastewater discharged by industry directly to watercourses or on the amount of biologically treated industrial wastewater.

5.1.2.3. Agricultural Discharge

No concrete data are available on direct discharge of agricultural wastewater to watercourses from point sources. From the point of view of the registration of wastewater discharges (sewer waters excluded), agricultural enterprises do not release wastewater in fact but they retain it and then distribute it in the fields. However, the reality is more complicated in many cases.

From the point of view of potential hazards to watercourses and underground water, one of the greatest agricultural risks is the disposal of liquid manure from large-scale livestock operations in which no litter is used. This waste is usually put to soil but, in doing so, there are certain limitations. Liquid manure produced by 2 to 4 cows or 9 to 15 pigs can be permanently distributed on an area sized 1 ha. If the capacity of a large-scale livestock operation is larger than the area of fields in which liquid manure can be applied, problems may arise.

Large-scale livestock operations producing large quantities of liquid manure may be - in consideration of the high concentration of animals in one building and the different standards of the disposal of their excrements - an extraordinary hazard to watercourses and underground waters and an extraordinary load for soil. Under the Action Plan for the Morava River basin, the largest operations specializing in livestock production have been evaluated, and the main sources of agricultural pollution have been defined in the Morava River basin in terms of their impacts (by agricultural pollution, the production and disposal of liquid manure is understood hereof, not the discharge of agricultural wastewater to watercourses). The above-mentioned large-scale livestock operations include 10 large-scale pig farms, each having more than 10,000 pigs shed in it.

5.1.3. Pollution of Aquatic Systems through Potential Soil and Ground Water Contamination: Municipal Solid Waste Disposal and Industrial / Mining Hazardous Solid Waste Disposal

Before the Waste Act No.238/1991 came in force in 1991, more than 10 000 dumps had been in operation throughout the whole of the Czech Republic. In 1991, a total of 8, 536 dumps were registered, of which 2,020 were still in operation, while operation was discontinued in the rest of them. Of the dumps still in operation, only 122 (id. about 6 per cent) were sanitary landfills operated in harmony with the then valid legal regulations.

The vast majority of the above-mentioned dumps have been established illegally. Scarcely one quarter of them have come into existence on the grounds of the planning permission and the waste deposition permit. However, they were not only unsanitary, anyway, but they lacked the basic safety elements providing protection to their surroundings against hazardous substances leakage. In addition, "wild dumps" existed completely chaotically and incidentally, especially in areas located a good distance away from towns and villages, such as in woods, ravines and hollows, in the beds of brooks and rivers, in former quarries, sand-pits and in other depressions formed on the surface of the ground.

The operation at insufficiently controlled dumps or at those not controlled at all that had been established before 1991 was terminated to 31 July 1996. Test monitoring holes have been carried out at most of them to monitor potential hazardous substances leakage into the subsoil of dumps twice a year. These dumps, in particular those containing also some hazardous waste, must be gradually sanitized and reclaimed and, at the same time, the surface and subsurface pollution of soil and rocks must be removed.

At the end of 1996, the total number of technically safe dumps in operation in the Czech Republic was about 380. Of the total number of dumps, 83 were registered in the Morava River basin. However, these dumps should not be considered pollution sources in the Morava River basin if all safety rules are observed.

Old loads represent much higher environmental risks. The total number of locations where soil, underlying rocks and water are at risk for being contaminated by spills, may be estimated at about 10,000 to 15,000 in the Czech Republic. Inasmuch as the Morava River basin takes up about 30 per cent of the total area of the Czech Republic, it may be assumed that there are about 3,000 to 4,000 locations contaminated with old loads in the Morava River basin.

- Report on the State of Environment in the Czech Republic in 1996,
- The State of Environment in the Areas of Brno and Olomouc.

At present, the examination of the extent and type of ecological loads is still under way, especially in areas where industrial activities were performed previously, or are still being performed respectively. These are in particular the area of the City of Brno, and locations in the districts of Břeclav, Hodonín, Olomouc, Zlín etc. Investigations carried out so far indicate that the actual extent of old loads is greater than originally expected.

Unfortunately, no records of the deposited waste and its quantity were kept for most dumps operated until 1991. Thus, it is impossible to define the risk of contamination without a detailed monitoring. Nor is it possible in many cases to classify the dump by the nature of waste (municipal, industrial etc.). Dumps that contained industrial and other hazardous wastes and were not sufficiently safe in the past may represent the biggest risk of contamination as may be exemplified by the dumps in Diváky, Hustopeče, Násedlovice and Kostelec.

Tab. 5.7 Other examples of dumps threatening water resources in the Morava River basin

N^{O}	MUNICIPALITY	OPERATOR	CAPACITY (ts.m^3 deposited)	THREATENED WATER RESOURCE	NOTE
1	Bílá Voda	Community of Červená Voda	no data	river Březná	Soviet army waste
2	Brtnice	Snaha Brtnice	no data	hydr. watercourse	Chromium
3	Bzenec	Town of Bzenec	300 (250)	public water supply	municipal and hazardous
4	Horní Štěpánov	Community of Horní Štěpánov	100 (60)	PHOIII, water resource Bělá	municipal waste
5	Hluk	Community of Hluk	(250)	water resource Hluk	plating plant sludge
6	Holešov	Town of Holešov	280 (250)	PHOII, water resource Holešov	municipal waste
7	Hulín - Padělky	Town of Hulín	(70)	The Morava River Quaternary	municipal and industrial
8	Napajedla – Kvítkovice	Otrokovice Technical Service	(130)	water retention area, water resource Kněžpole	municipal waste
9	Němčice	Town of Ivančice	(230)	water resource Ivančice	municipal waste
10	Olšany - Dýmák	OLPA Inc.	(18)	The Morava River Quaternary	municipal, industrial
11	Otrokovice	TOMA Inc.	40 (40)	retention wells	tannery waste
12	Poštorná	FOSFA Inc.	no data	The Morava River Quaternary	phosphate waste
13	Přerov - Žeravice I	Town of Přerov	(24.5)	The Morava River Quaternary	municipal waste
14	Přerov - Henčlov	PRECHEZA Přerov, Heating Plant	no data	PHO Troubky	Chlorohydrocarbon, gypsum sludge

15	Spytihněv	Community of Spytihněv	6.5 (6.5)	retention area	municipal waste, oil-containing waste
16	Staré Město	Colorlak Inc.	9 (9)	harmful substances in water resource leakage	painting substances, wastewater treatment plant sludge
17	Svitavy	Town of Svitavy	(5.0)	water resource Březová	municipal waste
18	Štíty	Štíty Community	(13.0)	watercourse Březná	Soviet army waste
19	Uhřínovice	Sběrné suroviny Brno Inc.	No data	water reservoir Střížov	photographic laboratory waste

Source: Vodohospodářský sborník 1995, Vol. I.

Besides, there is a number of other dumps, or old loads respectively, in the Morava River basin that threaten underground water resources such as the water retention area in the surroundings of Lednice, Vranovice, Ostrožská Nová Ves etc.

Total production of solid wastes in Czechia amounts 92,600,000 tons (1996)[1]. From it, 42 % is industrial wastes, 14 % wastes from power plants, 7 % agricultural wastes, 5 % mining wastes, 3 % domestic wastes and 29 % other wastes. About 17,600,000 tons of wastes were placed on dumpsites. Annual total amount of solid wastes in the Morava River catchment area is estimated for less than 25,000,000 tons.

5.1.4. Hydro Power

In 1995, 2,126,8 GWh of electric power were generated in hydro-electric power plants in the Czech Republic, which makes up 3.7 per cent of the total power generation. Even if the proportion of hydro power in the total volume of power generation is small, the pumped-storage hydro-electric power plants and peak-load hydro-electric power plants play a vital role in covering the needs for electric power in the peak hours of its consumption. In this respect, they are irreplaceable within the Czech system of power stations.

In total, there were 27 hydro-electric power plants in the Morava River basin in 1995, these plants generating 407.6 GWh of electric power, which makes up 19.2 per cent of the nationwide proportion. The average installed capacity of these hydroelectric power plants reached 494.1 MW, which makes up 36.1 per cent of the nationwide capacity of hydroelectric power plants.

The latest pumped-storage hydroelectric power plant in the Czech Republic was put in operation in Dlouhé Stráně on the Divoká Desná River in 1996. Its installed capacity is 650 MW, which more than doubled the total installed capacity of hydroelectric power plants in the Morava River basin. The installed capacity of hydroelectric power plants in the Morava River basin now exceeds 50 per cent of all hydropower capacity in the Czech republic.

In terms of power generation, the pumped-storage hydroelectric power plant in Dalešice with its installed capacity of 450 MW is the second most important hydraulic structure to be found in the Morava River basin. This hydroelectric power plant is part of the system of power stations comprising the atomic power station in Dukovany and the pumped-storage hydroelectric power plant, whose water reservoirs in Dalešice and Mohelno serve as technological water reservoirs for the atomic power station in Dukovany.

Of the classical hydroelectric power plants, the hydroelectric power plant in Vranov on the Dyje River has the highest installed capacity (16.2 MW), with that in Vír (called Vír II) having the second highest capacity (12 MW). The former was put in operation in 1934, while the latter in

[1] Webpage of the Ministry of Environment

1958. The installed capacity of all the other hydroelectric power plants built in the Morava River basin is lower than 5 MW. The total amount of power generated in small hydro-electric power plants is, in terms of the nationwide average, lower than 1 per cent, and is not significant in the Morava River basin either.

5.1.5. River Fisheries (Danube and Main Tributaries)

In terms of fishing, the absolute majority of watercourses and reservoirs are managed by the Czech Anglers´Association. The Czech Anglers´Association is an interest group associating voluntary members for the purposes of game-fishing and fry management. There are two categories of fishing grounds. In trout grounds, the fry of salmonoid fish is kept. They occur, as a rule, in mountainous and piedmont areas and on small watercourses downstream of water reservoirs. Other grounds are classified as non-trout grounds.

In terms of fishing, the problem is that the environment of fish is deteriorating due to the decrease in water quality, the loss of areas serving for spawning and the decline in the number of areas regarded as typical habitats of the individual fish species. All this is due to the fact that the beds of rivers and brooks have been regulated, water is used for industrial purposes etc. Artificial releasing of fish compensates the negative impacts of these factors. The problem is however that the number of fish artificially released exceeds the capacity of environment, or that non-domestic species are released. All this leads to the impairment of balance and to inadequate pressures on the other competing species of fauna.

In terms of fishing as a branch of livestock production, it is exercised, in the Morava River basin, almost exclusively in water reservoirs of pond-like nature, which are seldom directly linked with watercourses[2].

5.1.6. River Shipping

In the Czech Republic, river shipping is exercised only on the rivers Elbe and Vltava, which are parts of the Elbe River basin. Shipping is not exercised on watercourses in the Morava River basin.

In consideration of the conditions currently existing in the Czech Republic, it is almost always necessary to combine shipping with some other mode of transport. The importance of river shipping within the system of transportation in the Czech republic has been declining for a long period of time. Shipping is being replaced by pipeline service, railway traffic and, recently, it has been replaced especially by long-distance road transport.

According to the Decree No 212/95 Coll., there are two watercourses in the Morava River basin that may be used as waterways for shipping, namely the Morava River itself in the reach from the mouth of the Bečva River to the point where the Morava River empties into the Dyje River, and the Bečva River from the Town of Přerov to the mouth into the Morava River.

In the 1930s, the so-called Baťa Canal was built to transport mass substrates (transport of lignite). This canal leads from Rohatec to Otrokovice and is fed with water from the Morava River. After World War II, the operation on this waterway was discontinued. It is a waterway, which does not meet current conditions necessary for it to be classified as a "waterway". In terms of the technical parameters of the Canal, it was built for ships with the maximum width of 5.05 m and length of 35 m. To re-start operation, the canal section between Hodonín and Uherské Hradiště would have to be reconstructed. At present, there are tendencies to use this waterway for recreation and sport at least.

[2] According to the Statistical Yearbook of the CR, annual catch amounts about 20 thousand tons of fishes (mainly carps) in the whole country. More than 80 % originates from ponds of State Fisheries. It is possible to estimate that the annual draught in water streams of the Morava River catchment area do not exceed 1 thousand tons.

Regular seasonal recreational navigation on commercial basis is performed on the Brno water reservoir (ships with electric drive). Recreational navigation was also exercised on the Vranov water reservoir (on the Dyje River). After this water reservoir had begun to be used as a water supply source, recreational navigation was terminated without replacement to protect this water resource against additional pollution.

5.1.7. Water Related Recreation/Tourism

The term water-related recreation is usually used to mean a set of purpose-oriented recreation activities such as bathing, swimming, rowing, rafting, sailing, water skiing, windsurfing, winter aquatic sports (e.g. skating) and other uses of water and the adjacent bank land. Game fishing may be also considered a special mode of using watercourses for recreation. The preconditions for recreational water uses include the appropriate water quality, the appropriate infrastructure of the locations involved and certain climatic conditions.

In the whole of the Czech Republic, water reservoirs (ponds and man-made lakes) are used for water-related recreation and aquatic sports rather than watercourses.

Pursuant to the State Water Management Plan of 1975, the document “Water-Related Recreation in the Czech Socialist Republic” was prepared and published in 1982. All water reservoirs and watercourses suitable for recreation have been classified in this material.

At the same time, their capacities and the necessary infrastructure have been determined. However, the desirable recreation infrastructure has not been developed in a series of locations because of the lack of financial means.

Similarly to the remaining part of the Czech Republic, primarily water reservoirs are used for water-related recreation in the Czech part of the Danube River basin. Locations to be found at watercourses suitable for swimming are primarily visited by local people. They are mostly locations having no infrastructure necessary for recreation. However, there are several places at which recreation parks are located directly on the banks of watercourses. The camping site Pahrbek situated on the blind arm of the Morava River is among the biggest in terms of capacity.

According to the above-mentioned document *Development of Water-Related Recreation in the Czech Socialist Republic*, the total length of about 740 km of the Morava River and its tributaries might be used for rafting. However, none of these watercourses is a "classical boating" river and recreational boating activities on them are, more or less, sporadic. However, practice and racing tracks have been marked out in suitable reaches of these watercourses to be used by sport clubs. In the past few years, attempts have been made to make use of the Baťa Canal for recreation and sport (the Canal was built in the 1930’s between Otrokovice and Rohatec; originally intended to serve as a waterway to transport lignite, it is fed by water from the Morava River). However, it is also an activity, which is only beginning to develop.

In the first place, water reservoirs are used for water-related recreation. Here, water quality must also comply with hygienic requirements. In the peak season, some of these water reservoirs face the problem of the occurrence of Aphanizomenon *flos-aqaea,* which may cause coetaneous allergic reactions in some more sensitive humans.

The greatest capacities for water-related recreation and aquatic sports are located on the banks of the Vranov water reservoir on the Dyje River. The total lodging capacity of the local recreation centers and private weekendhouses exceeds 10,000 beds. Of the other recreation centers, the following ones may be named: The Brno water reservoir (on the Svratka River), Nové Mlýny (on the Dyje River on its confluence with the rivers Jihlava and Svratka), Luhačovice (on the Luhačovice Brook), Bystřička (on the Bystřička River), Horní Bečva (on the Bečva River), Plumlov (on the Hloučela River), Jevišovka (on the Jevišovka River) and Oleksovice (on the Skalička River). Other locations are of minor importance.

5.2. Projection of Expected Economic Significance/Impacts

5.2.1. Projection of Abstraction of Raw Water

Inasmuch as the forecast for the abstraction of raw water by population and public water supply systems is discussed in Chapter 3.2.2., Chapter 5.2.1. only deals with the forecast for the abstraction of raw water for irrigation and with the abstraction of raw water by industry.

Abstraction of raw water for irrigation has been steadily decreasing since 1990 (with the exception of 1994). In the Czech part of the Danube River basin, the registered amount of raw water abstracted for irrigation from watercourses managed by Water Management Bodies dropped from 52.0 mil.m^3 in 1990 to 11.2 mil.m^3 in 1995, that is to merely 21.5 per cent. In the Czech Republic, this abstraction decreased - during the same period - from 114.5 mil.m^3 to 28.4 mil.m^3, that is to 24.8 per cent. In consideration of this situation and, without knowing how Czech agriculture will develop in future, especially after the Czech Republic will have joined the European Union, it is very difficult to make a forecast for the amount of raw water abstracted for irrigation in the years 2010 or 2020. In spite of this, experts in water management have prepared a framework orientation projection of the abstraction of raw water for irrigation in the Czech Republic for the time horizon 2015.

Two contradictory tendencies may be expected to be formulated in the forecast for future developments: on the one hand, large-scale irrigation systems will not be made use of, since, after changes in ownership rights have occurred and state subsidies have been cut down, there will be, in some cases, no one to operate these irrigation systems so that they may be put out of operation for ever and, on the other hand, private local small-scale irrigation systems will develop, primarily to irrigate vegetable, fruit, wine and eventually also hop. At present, no reliable estimates or quantifications can be made about which of these two tendencies will prevail. Therefore, the above-mentioned forecast is based on the probable number and size of operated irrigation systems, and on the number and size of irrigation systems built and operated in the Austrian part of the catchment areas of the rivers Danube and Morava.

The forecast envisages to the time horizon 2015 that in the year with average aqueousness, the amount of water abstracted for irrigation will be 54 mil.m^3 in the lower variant and 84 mil.m^3 in the higher variant. In a normally dry year, which repeats itself 4 times out of 5 years, the abstraction of water for irrigation will be, according to this forecast, 88 mil.m^3 in the lower variant and 126 mil.m^3 in the higher variant.

Thus, the forecast is optimistic, and the assumption is that, in a year with average aqueousness, the abstraction of raw water for irrigation will double or triple and, in a normally dry year, it will be three times to 4.5 times higher than the abstraction of raw water in the year 1995. Only in the higher variant and for the normally dry year, the predicted amount of water abstracted for irrigation achieves the amount of water abstracted for irrigation in the period before the decline in water abstraction took place.

Related to the area of the Czech Republic as a whole, the aim of the forecast is to set out a framework and orientation. Therefore, the forecast is not concerned with issues such as to what extent the abstraction of water for irrigation will increase or decrease in the individual regions of the Czech Republic. The Czech part of the Danube River basin also comprises the area of southern Moravia, which is, together with central Bohemia (the Elbe River basin), a typical irrigation area. This is also testified to by the abstraction of water for irrigation in the Czech part of the Danube River basin and by its contribution to the total amount of water abstracted for irrigation in the Czech Republic. Between the years 1990-1995, that is in the period in which fundamental changes in the abstraction of water for irrigation took place, this proportion remained constant reaching values approaching 50 per cent. Only in 1995, it decreased to 32 per cent. Southern Moravia is

among the most arid areas of the Czech Republic, with plant production being dependent on irrigation to some extent. Therefore, if the above-mentioned forecast for the abstraction of water for irrigation predicts that the abstraction of water for irrigation will increase in the Czech Republic, it is particularly true of central Bohemia and southern Moravia.

Also the amount of water abstracted by industries and by other branches of economy has been steadily decreasing since 1990. In the Czech part of the Danube River basin, the abstraction of raw water by industry decreased from 282.8 mil.m^3 in 1990 to 180.7 mil.m^3 in 1995, id. to 64.0 per cent.

Similarly to other branches of economy, Czech industry has been undergoing fundamental changes since 1990, with restructuring, privatization and the decline in industrial production being their dominating characteristic features. In terms of the abstraction of raw water by industry, further developments will depend not only on when and to what extent industrial production will intensify, but also on what scale water-saving technologies will be introduced, how rational water management in industry will be, on what scale power engineering will replace through-flow cooling by circulation cooling and on a series of other factors.

The forecast for the abstraction of raw water by industry worked out by experts in water management for the time horizon 2015 (see *Vodohospodářský sborník 1995, Volume II)* is based on the trends of the abstraction of raw water in the countries of the EU observed in the last 15 years. According to the experience gained by some countries of the European Union, the abstraction of water by industry may decrease - even if the volume of industrial production and services is growing - by about 10 per cent by the year 2015 as compared to the 1995 value, which is considered the lower limit formulated in the forecast. According to the experience made by other countries of the EU, the abstraction of water by industry may increase by about 20 per cent by 2015 as compared to 1995, which is considered the upper limit of the forecast.

The forecasts show that the abstraction of surface water by industry will not achieve the 1990 values in 2015 either, which is even true of the upper limit of the potential development. Similarly to this, the abstraction of water from the own groundwater resources should not exceed this level. Therefore, the current water resources should be sufficient for all uses of water even for more distant time horizons.

5.2.2. Projection of Wastewater Discharge

It is extraordinarily difficult to make a forecast for wastewater discharge since there is a great number of factors playing a vital role in its preparation. The forecast must be primarily based on the forecasts for the development of the abstraction of water, on water production, on changes expected to take place in water consumption and on a number of other important and less important factors.

The forecast for wastewater discharge made by experts in water management for the Czech Republic for the time horizon 2015 (see *Vodohospodářský sborník 1995, Volume II)* is based on the following preconditions:

1. The amount of domestic wastewater produced by population will increase since the specific water demand of households is expected to grow (see Chapter 3.2.2). The number of inhabitants living in buildings served by public sewerage will increase to 83 per cent by 2015.
2. The amount of precipitation and ballast waters in public sewerage systems will largely stagnate.
3. The amount of wastewater produced by industry and by other users will decrease by 8 per cent by 2005, and almost stagnate by 2015.

With respect to these conditions and those stated in Chapter 3.2.3. dealing with the forecast for wastewater produced by population, the forecast for wastewater discharge in the Czech part of the Danube River basin for the time horizon 2015 will be as follows (see Table):

Tab. 5.8 The forecast for wastewater discharge in the Czech part of the Danube River basin

Year	1990	1995	2015
Amount of wastewater discharged to watercourses (mil. m^3)	358.1	256.4	289.0
of it:			
Public sewerage	181.1	150.7	192.0
Industry and others	177.0	105.7	97.0

Source: Vodohospodářský sborník 1995, Vol. I.

Thus, it is assumed in the forecast that the amount of wastewater discharged to watercourses by public sewerage will roughly increase by one third as a result of the expected increase in the specific water demand of households, which will, in turn, lead to an increased amount of domestic wastewater produced by population. No other significant changes in the amount of discharged wastewater are expected to take place.

5.2.3. Projection of Other Major Impacts

The development of other large hydroelectric power plants is not expected to take place in the near future. The absolute majority of locations selected to be potential locations for the construction of these plants are out of the question because of nature protection or because of international relations (in the Dyje River basin). Besides, the future need for large hydroelectric power plants is questionable. On the other hand, small hydroelectric power plants may play a vital role in entrepreneurial intents of some companies despite the capacity of these power plants being negligible. Therefore, they must be taken into account.

The intention to make the Morava River navigational has been more than 300 years old (the first scheme for making it navigable dates back to the year 1700). Later, a scheme was drawn up to interconnect the rivers Danube, Odra and Elbe by means of a canal, with an eventual branch line to Brno. Its planned line is passing through a protected area. The latest amended proposals for marking out the line of the canal dates back to 1989. In consideration of the decreasing volumes of transportation of mass substrates, the effectiveness of investments made, the environmental aspects as well as the issues related to the position of the canal from the point of view of international law, the implementation of this scheme seems unrealistic in the near future. In consideration of the fact that this intention is significant from the point of view of the European transport systems rather than from the point of view of the Czech Republic, discussions about this intention may be re-opened after Czech Republic will have joined the European Union as is expected. The Ministry of Transport of the Czech Republic supposes the Morava River to become navigable as far as Hodonín between the years 2006-2012.

In connection with the water purity improving, a more intensive recreational use of the hydraulic work Nové Mlýny may be taken into consideration (although its originally planned capacity of 160,000 holidaymakers was clearly overestimated). The actual exploitation of this potential naturally depends on whether there is an investor willing to put money into this scheme.

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

The most important water management laws include:

- Water Act
- Act on Public Administration in Water Management
- Waste Act
- Environment Inspection Act
- Act on Public Administration in Waste Management
- Act on the State Environmental Fund
- Environment Act
- Nature and Landscape Protection Act
- Act on Payments in Water Management
- Environmental Impacts Assessment Act
- Town and Country Planning and Building Regulations Act
- Act on Protection and Exploitation of Mineral Resources (mining law)
- Act on Air Protection against Pollution
- State Statistical Service Act
- Inland Navigation Act
- Forest Act
- Act on Peaceful Utilization of Atomic Power and Ionizing Radiation
- Waste Act
- Outdoor Design and Land Settlement Office Act
- Agriculture Act

Generally, legislative tools should address the ownership relations to water, water resources, hydraulic works and land, and the owner's rights and duties resulting from the public interest. Furthermore, it is necessary to bring Czech legislation closer to legal regulations in effect in neighboring countries and in the European Union, and to ensure that other Czech laws and acts, particularly those concerning environment, agriculture, forest management, shipping, fishery etc., are compatible with them. From this point of view, the preparation of a new water act that will replace the outdated legal regulation of 1973 appears to be the most urgent task.

The amendment to the Water Act (No 14/1998 Coll.) was passed in March 1989. This amendment governs some issues related to water resources protection zones, measures to be taken to remove water pollution, small watercourses management and flood control. The Act No58/1998 Coll. governing charges for wastewater discharge to surface waters was passed in 1989, too.

In addition to acts, water management is governed by other standards approved before 1990. Generally binding regulations contained in Government decrees include:

1. 27/1975 Coll. Decree of the Czech Government on flood control
2. Decree of the Czech Government on protected areas of natural accumulation of waters the Beskydy Mountains, The Jeseníky Mountains, The Jizerské Mountains, the Bohemian Forest, The Žďárské Hills, The Giant Mountains and The Orlické Mountains
3. Decree of the Czech Government on protected areas of natural accumulation of waters Brdy, Jablunkovsko, The Ore Mountains, The Nvohradské Mountains, The Vsetínské Hills and Žamberk-Králíky
4. Decree of the Czech Government on Payments in Water Management
5. Decree of the Czech Government on protected areas of natural accumulation of waters Chebská pánev (The Cheb basin), Slavkovský les (The Slavkov Forest), Severočeská křída (North Bohemian Cretaceous), Polická pánev (the Police basin), Třeboňská pánev (The Třeboň basin) and the Morava River Quaternary)
6. Decree of the Czech Government by which the indicators of permissible water pollution are fixed
7. Decree of the Czech Government by which the indicators of permissible water pollution are changed.

In addition, there are various "sublegal" standards prepared by the individual sectors, particularly by the former Ministry of Water and Forest Management and by the Ministry of Environment.

In terms of legislation, issues related to the provision of monitoring water quantity and quality, and those concerning unpaid-for handing over of obtained data not only to authorities but to the public as well should be discussed.

It is also necessary to tackle issues concerning the permitting of buildings, their protection and removal in flood areas, and some other problems as well.

6.2. Analysis of Relevant Institutional Framework

Professional management of watercourses and buildings constructed on them plays a vital role in the water management system. For watercourses significant in terms of water management, this activity is provided, in the Czech Republic, by joint stock companies called Povodí (catchment). These companies came into existence to replace the former state enterprises as a result of their transformation. In 1997, these companies were transferred from the jurisdiction of the Ministry of Environment to the jurisdiction of the Ministry of Agriculture. Povodí Moravy a.s., Brno, is the company responsible for water management in Moravia. This Company has three subsidiaries: Dyje with the head office in Brno, Střední Morava (central Moravia) with the head office in Uherské Hradiště and Severní Morava (north Moravia) with the head office in Olomouc. The mission of the Company is to promote public welfare. Its activities are aimed at managing and developing the property entrusted to it, and at providing services beneficial to the public. Entrepreneurial activities are aimed at supporting the main subject of business, and must not interfere with the Company's mission. As related to the watercourse and its waters, the main subject of business primarily include the following activities:

- performing the function of the manager of significant, borderland and selected watercourses important from the point of view of water management,
- managing waters within the area of the appropriate water management system according to the conditions defined,
- creating prerequisites and conditions for a rational, economical and environment-friendly exploitation of surface waters, watercourses and tangible property for the purposes of water supply, protection against accidental water pollution, protection against adverse impacts of water, exploitation of watercourses for navigation, exploitation of hydro power, fishing, recreation and sports and games.

At present, primarily the fact is stressed that Povodí Moravy is formally a private institution, whose majority owner, however, is the state. It is feared in particular that the company may sell real estate bound up with resources of public nature. Government officials admit that the way of privatizing the most significant watercourses was not very good but they refuse the possibility to re-nationalize them. The distribution of competencies between the Ministry of Agriculture and Ministry of Environment, particularly the new subordination of the joint stock companies Povodí, may also be regarded as a problem.

In addition, there are other five groups of managers performing their function: The State Melioration Management responsible for small watercourses and melioration canals, the Forests of the Czech Republic responsible for small watercourses bound up with forest management, National Parks Management responsible for those sections of watercourses to be found in national parks (Podyjí National Park located in the Morava River basin), the authorities of military domains responsible for the sections of watercourses to be found in military domains, municipalities responsible for small reaches of watercourses passing through the internal section of these municipalities.

In addition to direct management, some other activities falling under the jurisdiction of numerous other sectors must be secured. Most of the above-mentioned managers fall under the jurisdiction of the Ministry of Agriculture (in addition to Povodí companies, also the Forests of the Czech Republic and the State Melioration Management). In addition, this ministry is also responsible for fishery, (anglers´ unions, anglers´ associations and state fishing companies), water supply management (trade companies at work in the sector of public water supply and sewerage systems) and for some segments of the research carried out in the field of forest management and hunting, melioration and water protection and fishing.

The Ministry of Environment administers national parks. Czech Environmental Inspection is the Ministry's body responsible for environmental aspects of water management. The Czech Hydro-Meteorological Institute, the Research Institute of Water Management and the Geofund are entrusted with tasks to be tackled in the field of research and information.

Other sectors involved include the Ministry of Interior responsible for the administration of the territory, the Ministry of Health responsible for hygienic issues related to watercourses, the Ministry of Transport (shipping), the Ministry of Industry and Trade (power engineering and industrial plants) and, in a long-term perspective, also the Ministry of Local Development (regional policy).

7. Description and Analysis of Actual Policies and Strategies

7.1. Actual Policies and Strategies

Water management in the Czech Republic has a long tradition, which was partially carried on even in the period of centrally planned economy. Despite this fact, some principles, now considered important, were violated in the period before 1990. They included particularly insufficient legislative and economic tools encouraging the economic sphere to conduct adequately, inefficient public administration as a result of "deformed" prices (subsidies), preference given to extensive development over intensive development and the underestimation of environmental issues. In some spheres, these deformations still persist to some extent.

The basic starting point of the Government's environmental policy includes the responsibility of the present-day generation toward future generations for the preserving and handing over of the basic values of life, with usable water taking an important position among them. Therefore, emphasis is placed on rational and effective exploitation of resources and their recycling, on reducing pollution to a level at which no irreversible damage to human health and nature occurs, on protecting biological diversity and seeking for such ways of satisfying basic human needs, which are economically justifiable and, at the same time, environment-friendly. The Government's environmental policy is in line with internationally recognized principles, and places emphasis on the membership of the Czech Republic in the OECD and its expected future membership in the EU.

The fundamental task of the state is to primarily protect environmental components, to create legal framework for environment protection and to guarantee international commitments. The aim also is to transfer the solution to problems from the public sector to the private sector if possible.

To create normative fundaments for the Government's environmental policy, the principles of critical loads, accessibility of technologies and preliminary precaution are adopted.

Priority environmental problems in the Czech Republic include:

A. for the short-term horizon (until 1998) by importance:

   1. to improve air quality by way of reducing emissions of harmful substances
   2. to improve water quality by way of reducing pollution discharged
   3. to reduce the production of waste, particularly hazardous
   4. to remove the effects of hazardous factors of physical and chemical nature
   5. to preferably remove hazardous old ecological loads.

B. for the medium-term horizon (until 2005)

   6. to provide an optimum structure of land use
   7. to increase the capacity of landscape to retain water
   8. to continue to reconstruct forest stands
   9. to continue to restore areas devastated by mining activities

C. long-term principles of the Government's environmental policy include:

   10. to protect climate by reducing emissions of greenhouse gases
   11. to protect ozone layers
   12. to protect biological diversity.

It is apparent that water plays an important role in the Government's environmental policy. The basic current goal is to reduce ground and surface water pollution by taking preventive and remedial measures. The greatest attention must be paid to the protection of drinking water resources, and to further reducing the content of pollutants in surface waters, particularly BSK_5, heavy metals, nutrients and specific organic substances. After tackling the large point sources of pollution (big and medium-sized towns and industrial plants), the focus of water protection will be on scattered sources of pollution and on wastewater treatment in small towns and villages where alternative facilities can be made use of, with technical infrastructure related to them being less costly.

To achieve this, it will be necessary to complete the changes taking place in ownership relations to waters and their environment, and, following this, to complete the preparation of a comprehensive new legislation governing water protection. Furthermore, it will be necessary to change the indicators of the permissible rate of water pollution to bring them into line with the EU, to tackle the issue of compensations paid to companies for reducing their economic activities in buffer zones of drinking water resources, to adjust mechanisms employed to prevent accidents and to remove their implications and to unify administrative procedures related to charges. In terms of charges for wastewater discharges, it will be necessary to increase their encouraging effect.

Certain commitments result for water management in the Czech Republic from the Agenda 21. They primarily include the integrated development of water resources and their management, the systematic evaluation of water supplies, the protection of water resources, the quality of water and aquatic ecosystems, the systems of drinking water supply, the drinking water treatment, water for sustainable development of cities and towns, water for sustainable production of food, the development of rural areas and the monitoring of the impacts of changes in the climate on water resources.

Pursuant to international agreements and commitments, the contribution of the Czech Republic to the pollution of the North, Baltic and Black Sea will be monitored despite this contribution being not very significant. Transboundary waters constitute another specific problem. It is important for the Czech Republic to fulfil its commitments resulting from its membership in international organizations, particularly in the UN bodies and in international non-governmental organizations concerned with water management. After joining the EU, as is expected, Czech Republic will have to fully respect the appropriate commitments in the sphere of water management, too.

The main goals of the Government's water management policy are as follows:

A. Protection and Management of Water Resources and Aquatic Ecosystems to Achieve Standards, Norms and Legislation of the European Union

To achieve this goal, it is necessary to fulfil the following tasks:

1. to reduce the amount of pollution discharged from point sources
2. to gradually extend and modernize municipal wastewater treatment plants
3. to reduce discharged pollution and the amount of waste produced by industry, trade and services
4. to reduce agricultural emissions, primarily nutrients
5. to reduce non-point and scattered pollution from other non-agricultural sources
6. to implement prevention against accidental pollution
7. to remove sections of the Quality Range V in the medium-term horizon and those of the Quality Range IV in the long-term horizon

B. Provision of Sustainable Development and Protection of Aquatic Wealth of the Country as One of the Basic Components of Environment

To achieve this goal, the following tasks must be fulfilled:

8. to rehabilitate and remove dumps including old loads hazardous to water quality
9. to protect areas important for water management and places suitable for water storage
10. to complete water monitoring in resources, monitoring of discharged waters and bio-monitoring
11. to ensure abstraction of water and, at the same time, to preserve the ecologically necessary minimum residual flow
12. to improve conditions for preserving and restoring biodiversity.

C. Provision of Possibilities to Citizens and Juristic Persons to use and manage water to Enable them to Satisfy their Economic, Social and Biological Needs, Simultaneously with the Provision of Protection against Harmful Effects of Water

To achieve this goal, it is necessary to fulfil the following tasks:

13. to provide all citizens of the Czech Republic with safe water
14. to provide for raw water quality in resources selected as fit for drinking water supply
15. to provide for a sufficient amount of suitable drinking water resources to increase the proportion of population supplied from public water supply systems to the level of the EU
16. to provide for the necessary amount and quality of water to be abstracted by industry, power engineering, trades, services, agriculture and by other consumers
17. to enable the exploitation of hydro power to generate environment-friendly power in small hydro-electric power plants; to build large hydro-electric power plants only exceptionally, that is only if they are part of multi-purpose water management structures
18. to maintain operation on the Elbe-Vltava waterway, which is important in terms of transport
19. to enable to make use of water, in the public interest, for water-related recreation, aquatics, game-fishing and the like,
20. to create conditions for flood control.

D. Creation of Favorable Legislative, Economic and Institutional Environment Enabling Entrepreneurial Activities in the Field of Using and Managing Water to Develop with Respect to Ecological and Other Public Interests

To achieve this goal, the following tasks must be fulfilled:

21. to focus the water management planning system on a complex protection of waters and aquatic ecosystems in relation to managing water within the river basin,
22. to set out a new legislative framework focused on ownership relations and conditions for managing water, and on mobilizing financial resources through a system of charges and fines
23. to involve the public and private sector into water management activities.

E. To Fulfil Commitments Resulting from International Treaties, Conventions and Agreements and from the Membership of the Czech Republic in International Organizations and International River Task Forces

To achieve this goal, the following tasks must be fulfilled:

24. to reduce, in accordance with the goals of bodies responsible for the protection of the North, Baltic and Black Sea, future pollution of watercourses in borderland sections,
25. to promote international cooperation in water management within the framework of international organizations, particularly the UNO and its specialized organizations and, later on, within the framework of the EU.

Among other things, it results from the above-mentioned tasks for the medium-term horizon:

- to build or reconstruct wastewater treatment plants in municipalities with over 10,000 equivalent inhabitants to eliminate phosphorus and nitrogen in sensitive areas, in other areas without this elimination,
- to individually evaluate the necessity of eliminating phosphorus and nitrogen in resources with over 2,000 equivalent inhabitants upstream of water reservoirs and in towns with over 150,000 equivalent inhabitants,
- in terms of industrial resources, to preferably solve the problem of disposing wastewater in industrial plants discharging AOX and heavy metals, and in sources of organic pollution with over 4,000 equivalent inhabitants,
- in terms of agriculture, to tackle the problem of removing pollution in sources with over 20,000 equivalent inhabitants

and for the long-term horizon

- to build wastewater treatment plants in sensitive areas upstream of water resources in municipalities with over 2,000 equivalent inhabitants to eliminate nitrogen, upstream of water reservoirs also to eliminate phosphorus, to build waste water treatment plants upstream of multi-purpose water reservoirs in municipalities with over 5,000 equivalent inhabitants to eliminate phosphorus,
- to build or reconstruct wastewater treatment plants in municipalities with over 5,000 equivalent inhabitants in other areas,
- to build wastewater treatment plants in industrial plants with biologically degradable substances, in particular in food processing plants, in municipalities with over 2,000 equivalent inhabitants,
- to tackle the problem of discharges from agricultural operations in municipalities with over 5,000 equivalent inhabitants.

Annex 1

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Part B

Financing Mechanisms

Table of Contents

1. Summary 59

2. Legal Basis 61

2.1. General Information 61

2.2. Compilation of Relevant Laws and Regulations with Financial Relevance to Water Quality and Water Management Programmes and projects 63

2.3. Assessment of Main Deficiencies and Needs for Improvement 67

3. National Policy and Strategy for Funding of Water Sector Programmes and Projects 69

4. National Sources, Instruments and Mechanisms for Funding of Water Quality and Water Management Programmes and Projects 71

4.1. Relevant Public Funding Sources and Instruments in Use 71

4.2. Standardized Funding Mechanisms for Investments in Water Pollution Control 73

4.2.1. Typical Sources of Investment Money for Municipal, Industrial and Commercial Wastewater Treatment Plants 73

4.2.2. Typical Sources of Money for Industrial and Commercial Wastewater Treatment/Pre-Treatment 74

4.2.3. Patterns and procedures for Municipal and Industrial Wastewater Treatment 74

4.2.4. Agricultural Pollution of Ground Water and surface Water 74

4.3. Private Financial Models in Use 75

4.3.1. BOT (build-operate-transfer) 75

4.3.2. Private Management of services 75

4.3.3. Leasing Models 75

4.3.4. Other Financing Models 75

4.3.5. Licensing and Monitoring of Privately Financed or Operated Services 75

4.4. Actual Water and Wastewater Tariffs/Charges 76

4.4.1. Actual Tariff Policies and systems 76

4.4.2. Level and Structure of Tariffs 76

4.4.3. Level and Structure of Cost 76

4.4.4. Level of Actual Cost coverage 77

4.5. Actual System and Practice of Pollution Charges, Fees, Penalties 77

4.5.1. Charges for Water Abstraction (municipal, industrial, irrigation) 77

4.5.2. Charges for Wastewater Discharge (exceeding defined quality standards) 77

4.5.3. Other Relevant Charges/Penalties 78

4.5.4. Assessment of Efficiency of Actual Practice 78

4.6. Economic and Financial Incentives for Pollution Reduction Measures 78

4.7. Quality and capacity of the National banking System for Funding of Larger Infrastructure Projects (especially water sector projects) 79

5. International Assistance in Funding of Environmental/Water Sector Programmes and Projects 81

5.1. Documentation of National Policies and decision Mechanisms for International Co-funding of Environmental and Especially Water Sector Programmes and Projects 81

5.2. Actual Financial Assistance from Bilateral and/or Multilateral Institutions 82

5.3. Centralized National Institution/Development or Promotion Bank for Handling International Funds 82

5.4. Assessment of Main Weaknesses and Needs for Improvement 82

6. Actual and Planned Public and Private Investment Portfolio for Water Quality and Water Management Programmes and Projects 83

6.1. Compilation of Actual and Planned Investment Portfolio 83

6.2. Inventory of Actual and Planned Investment portfolio 83

6.3. Assessment of Main Deficiencies, Problems, Delay in Project Implementation 83

Annexes

Annex B-1: Description of State Environmental Fund

Annex B-2: Compilation of Actual Investment Portfolio

Annex B-3: Compilation of Planned Investments

Annex B-4: Bibliography

List of Tables

TABLE 2-1 List of relevant laws

TABLE 2-2 Drinking water tariffs

TABLE 2-3 Wastewater tariffs

TABLE 2-4 Charges for discharging of untreated surface water

TABLE 4-1 Expenditures for environmental protection in water management

TABLE 4-2 Water management investment

TABLE 4-3 State budget and State Environmental Fund expenditures

TABLE 4-4 State Environmental Fund incomes and expenditures in water sector

TABLE 4-5 Share of investment sources on water protection construction with budget costs over 5 mil. CZK

TABLE 4-6 Tariffs in water sector

TABLE 4-7 Water treatment costs

TABLE 4-8 Charges for surface water withdrawal

TABLE 4-9 State Environmental Fund incomes from wastewater discharges and expenditures

List of Figures

FIGURE 2-1 Environmental expenditures from the central resources in the Czech Republic

List of Abbreviations

CR	Czech Republic
GDP	Gross Domestic Product
EU	European Union
NPF	National Property Fund
OECD	Organization for Economic Cooperation and Development
SB	State Budget
SEF	State Environmental Fund
UN	United Nations
UNEP	United Nations Environmental Program
VAT	Value Added Tax

1. Summary

The current environmental policy of the Czech Republic is implemented through a set of legal provisions, which establish normative, economic, informational and institutional instruments. Implementation of the environmental policies is supported by the state budget, the State Environmental Fund and the National Property Fund. The fundamental objective of the state environmental policy is to systematically improve the quality of the environment in the Czech Republic and contribute towards the solution of global environmental problems.

System of economic instruments in the Czech Republic is primarily based on the use of charges. The system of charges for the discharge of wastewater into surface waters, charges for releasing harmful substances into the air, charges for waste disposal, charges for the requisition of agricultural land and charges for the withdrawal of ground water. Revenue collected from these charges is directed into the State Environmental Fund, which in turn uses this revenue to provide soft-loans and grants to support environmental improvements for municipalities and small and medium-sized enterprises. The fundamental act of water management is Act No. 138/1973 Coll. Another legal regulation of payments has a basis in the Decree of the Government of the Czech Republic No. 35/1979 Coll., on payments in water management, in the wording of later amendments and regulations.

The concrete determination of some payments - surface water prices, drinking water tariffs and wastewater tariffs - are described in the price measurement of the Ministry of Finance, which is released annually. At present time there is a system of so called price regulation for these payments, where only justifiable costs can be included into the price, for drinking water tariffs and for wastewater tariffs there is a calculating figure, for surface water prices there is only a word definition. Concrete prices are assessed on the basis of these rules by individual subjects - organizations for water services. There are also differences in these prices between suppliers of surface water and between water services organizations, which supply drinking water and discharge wastewater. There are no regulations on agricultural water use and agricultural soil pollution in connection with underground and surface water. There are only differences in calculation of drinking water prices and wastewater prices between industry and inhabitants, where the prices for inhabitants are subsidized. It is planned to have the same price in the future.

The payments under the Act No. 388/1991 Coll. are collected in the State Environmental Fund. They are assigned as a one of funding sources for the support of the water management and water quality improvement. In 1996 was 47,798 tons of the pollution subjected to charges under BOD_5 indicator. Since 1990 to 1997 the pollution under this indicator sank by 76%, most of all thanks to the intensive wastewater treatment construction. The wastewater treatment plants are almost in all towns with more than 10 000 inhabitants and in last 3 towns they are already under construction. The supervision and control activity is practiced by the Czech Environmental Inspection in cooperation with river basin companies.

The main step towards the modernization of the whole system of the payments for wastewater discharge to the surface water was already provided by the acceptance of Act No. 58/1998 Coll. Other payments in water management will have to be established in prepared act on water and in the new act on payments in water management, which should solve these problems in harmony with the new requirements, especially according to the harmonization of water management legislation with the EU regulations.

The harmonization of legislation in water management is connected with new requirements on changes in the whole sector, which should be accepted as soon as possible. These changes will bring considerable financial costs approximately more then 100 bn. CZK (35 CZK = 1 USD). At present time there is only the estimation of these costs provided. The adaptation to the EU conditions in technical parameters will require many technical measures which will improve water quality and will have positive influence on water quality in the Morava basin and in the Danube basin.

The necessary measures are aimed at construction of mechanical-biological wastewater treatment plants for municipalities with 2000 - 10000 inhabitants until the year 2005, construction of nitrogen and phosphorus removal in big wastewater treatment plants, demarcation of sensitive zones, application of the Nitrogen Directive and removal of the old burdens with influence on surface and underground water quality.

State support on the investment expenditures to the water management consists of subsidies and advantaged loans from the state budget (34%) and contribution of the State Environmental Fund (18%). Typical supports and sources for investment to the construction of industrial and municipal wastewater treatment plants are own sources, loans from commercial banks, grants from the state budget, grants from the State Environmental Fund, grants from municipal budgets and foreign financial sources.

Commercial banks provide credits to environmental construction under normal business conditions (interest rate approximately 16 % p.a., maturity approximately 4 years), unfortunately no commercial bank provides advantageous credits or longer maturity terms. State Environmental Fund provides support to municipalities, which is usually divided by 30 % grants (irrevocable) and 30 % advantageous loans. Advantageous loans have approximately half interest rate of commercial banks and longer maturity period for entrepreneurs. State budget provides grants either through budgets of ministries, especially the Ministry of Agriculture and the Ministry of Environment and sometimes other resorts or through so called public cash administration, which is financed directly by the Ministry of Finance itself and through municipal budgets as well. Competence and correctness of drawing funds from state budget are monitored by control authorities of competent ministry, Ministry of Finance and especially by the Highest Control Authority.

There are no funds and institutions in the Czech Republic for support of restriction of underground and surface water pollution by agriculture. Removing of old damages, especially from dumps and industrial pollution - industrial areas, which influence quality of underground and surface water by dangerous materials is supported by the National Property Fund within the framework of Privatization.

Between 1990 and 1993, foreign assistance supported non-investment projects. Later, some support was also targeted to border region projects and it is anticipated that support for these projects is continued.

2. Legal Basis

2.1. General Information

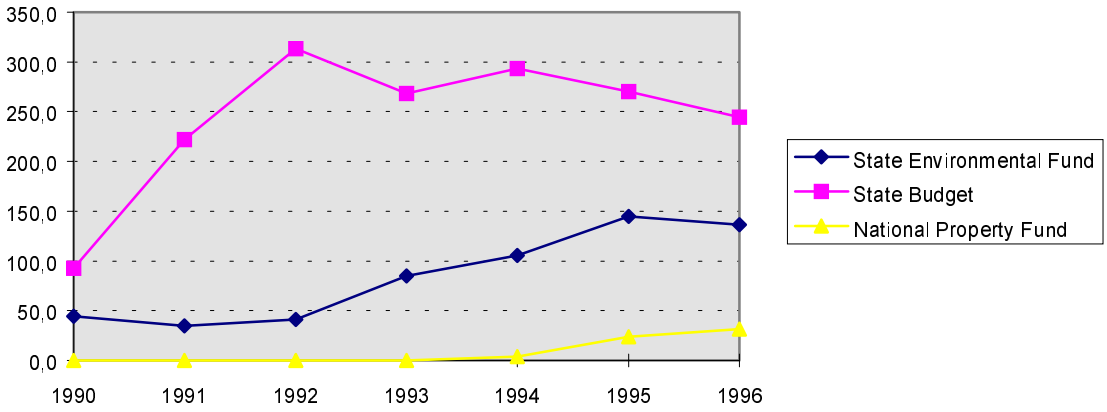
The process of economic transformation has contributed, by the removal of the centrally controlled economy, to the renewal of market relations, the restructuring of the industrial sector towards production processes that are less demanding on energy and natural resources and improvements in the state of the environment. However, some of the side benefits from the transition process which contributed to improved environmental quality have been exhausted and an urgent necessity has arisen to update existing mechanisms and develop new instruments to continue the positive results attained during the transition process and to address new needs, which were impossible to anticipate in the early 1990s. The completion of the privatization process creates the basic conditions for the broad implementation of civic law approaches to the protection of the environment.

The primary objective between 1990 and 1994 was to terminate, as quickly as possible those policies which lead to further deterioration of the environment and to immediately introduce policies, which would lead to improvements. Therefore, policy instruments were implemented on the base of how quickly they would become effective. However in some instances (such as water protection and waste management), this approach had the unintentional effect on creating policy instruments, which were not optimally efficient. In conjunction with the environmental policies of the developed countries, emphasis will gradually be shifted from normative to economic and informational instruments, which will contribute towards changes in production and consumption patterns.

The Czech government has supported environmental protection primarily through economic instruments and measures. The economic instruments used in the care of the environment are part of the state's environmental policy and serve to enforce environmental protection. The importance of these tools increases in the period of transition to the market economy. The most important instruments are pollution charges, which motivate measures to reduce pollution and secondly to provide fiscal income which enables the financial support of actions and measures to improve quality. One of the other significant instruments is subsidies from public resources, which represent from 38 to 45% of investment expenditures.

The government's financial support has been realized through the following three sources: The State Environmental Fund, the National Property Fund, and the state budget.

FIGURE 2-1: Environmental expenditures from the central resources in the Czech Republic (1990 - 1996, thous. USD, current prices)



Expenditures from the state budget soared during initial period and are now slowly decreasing. It is anticipated that the state budget's contribution will stabilize in the short and medium-term context. In future, funding from the state budget should be used for measures, which concern the public or state interest and in those instances where other sources of funding may not be readily identified.

Expenditures from the State Environmental Fund have increased steadily and it is expected that this trend will continue. However, after the 1998 compliance deadline for reduction in air emissions is met, revenue generated from air pollution charges will decrease substantially, which will subsequently decrease environmental expenditures from the State Environmental Fund. Currently, the State Environmental Fund primarily supports investment projects for water pollution control and air pollution control through direct allocations and soft loans.

In connection with the privatization process, the National Property Fund assists in addressing problems associated with previously damaged sites.

The private sector's environmental expenditures have continued to increase and it is anticipated that this trend will accelerate in the next three years as the compliance deadlines for emission reduction will come into force (especially as concerns air pollution control, water pollution control and waste management). Projected investments for the largest polluters indicate that the total annual expenditure within this sector between 1994 and 1998 will exceed 10 billion CZK (35 CZK = 1 USD). However, two predominant factors, which have negatively affected the growth of private investment (both domestic and foreign) were the lack of medium and long-term credits and the demand for state guarantees by many international financial institutions.

The major problem of the currently existing price and tariff system is not so much the volume of total revenues provided by the current general price level but rather the strongly distorted pricing structure for various groups of consumers. Until now, we have failed to stop the cross funding of unprofitable electricity prices for households from the much higher prices for small and large industrial customers. In 1991, we carried out the first major increase in electricity price for all customers by 70-80 %, gas prices for households by 134 % and heat prices by 324 %. Since then, although the prices for households, growing annually by 10-15 %, surpassed the annual inflation roughly by half, they failed to reach the prices of energy paid by industrial consumers. In total, in the period between 1991 and 1ST July this year, the prices of electricity for households grew by 120 % and the prices of gas by 64 %. For the respective period, the producer price index grew by 44 %.

Environmental problems are increasingly becoming central issues for the international community and they frequently receive priority on the agendas of international organizations both within and outside of the UN system. This trend is reflected in the activities of international bodies such as the UNEP and the UNCSD. Practically all developed countries have formulated their environmental policy in the form of a government policy document as evidenced by the European Union's ongoing formulation of environmental action programmes. The evaluation of a state's environmental policy, legal norms and environmental standards is a critical element for consideration in the admission process to international organizations.

The Czech Republic supports both global and regional commitments made at numerous international environmental conferences and is actively involved in offering ongoing support and follow-up to these commitments.

Table 2-1 List of relevant laws

Law No. 138/1993 Coll. on waters (the Water Act).	The basic law on water management and water protection.
Law of the Czech National Council No. 130/1974 Coll. on state administration in water management.	The basic law on state administration in water management.
Degree of the government of the Czechoslovak Socialist Republic No. 35/1979 Coll., on payments in water management.	The basic law on payments in water management.
Decree of the Government of the Czech Republic No. 171/1992 Coll., setting forth indices for an acceptable level of water pollution.	Regulation fixes level of an acceptable level of water pollution.
Decree of the Government of the Czech Socialist Republic No. 40/1978 Coll. on the protection against flooding.	Regulation evolves basic rules on the protection against flooding.
Law No. 58/1998 Coll., on the charges for discharging polluted water.	A new law which modifies charges for discharging polluted water (according European Union).

The Czech Republic is a signatory of the most important international conventions for environmental protection and has met the obligations and commitments, which are connected with these conventions. Bilateral agreements for cooperation in environmental protection efforts have been concluded with 11 states and additional agreements are currently being negotiated. The Czech Republic is a member of the majority of international institutions including the UNEP, UNCSD, UNECE and the WHO and Czech representatives are active in the functions of these organizations. The CR's efforts to harmonize its environmental policy with EU.

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

Between 1990 and 1995, 14 new acts, numerous amendments and dozens of other legal provisions were adopted and enacted to establish a system of normative, economic, institutional and informational instruments to protect the environment in the Czech republic.

The current system of economic instruments in the Czech Republic is primarily based on the use of charges. The system of charges for the discharge of wastewater into surface waters, charges for releasing harmful substances into the air, charges for waste disposal, charges for the requisition of agricultural land and charges for the withdrawal of ground water. Revenue collected from these charges is allocated to the State Environmental Fund which uses this revenue to provide soft-loans and grants to finance environmental improvements for municipalities and small and medium-sized enterprises.

In 1993 and 1994, the ownership relations were transformed. Approximately a third of the infrastructure with an accounting value of 15.8 bn. CZK (35 CZK = 1 USD) was transferred free of charge to individual municipalities or the unions of municipalities. The total volume of the privatized property represented 46.6 mil. CZK in accounting prices. On the basis of privatization projects following subjects had been established: regional mixed joint-stock companies, operating joint-stock companies, joint-stock companies of the infrastructure property owners and limited companies.

The fundamental law of water management is Act No. 138/1973 Coll., on waters, in the wording of later amendments. The economic instruments - payments in water management - are based on §43 - §46 in the 9th part of this act, and on §47 in the 10th part of this act.

Fines are assessed in Act No. 130/1974 Coll., on state administration in water management, in the wording of later regulations, in the 8th part in §24-§24k.

Another legal regulation of payments has also a basis in Decree of the Government of CR No. 35/1979 Coll., on payments in water management, in the wording of later regulations.

Concrete determination of some payments - prices of surface water, drinking water tariffs and wastewater tariffs - are mentioned in the price measurement of the Ministry of Finance (No. 01) for every year, which is published in the Price Bulletin of the Ministry of Finance. At present time there is a system of so called price regulation for these payments used, when only justifiable costs can be included into the price, for drinking water tariffs and for wastewater tariffs there is a calculating figure, for prices of surface water there is only word definition.

Concrete prices are assessed on basis of these rules by individual subjects - water services organizations. There are also differences in these prices between suppliers of surface water and between water service organizations, which supply drinking water and discharge wastewater. Water prices are under discussion by water services organizations and customers before they are published. Municipalities often influence water prices, because they own the infrastructure.

When we talk about water regulations, we must also mention Act No. 388/1991 Coll., on the State Environmental Fund of the Czech Republic, in the wording of later regulations.

There are no regulations on agricultural water use and agricultural soil pollution in connection with underground and surface water.

There are only differences in calculation of drinking water prices and wastewater prices between industry and inhabitants. The price for inhabitants is favorable. There will be no difference in future.

The water relevant regulations and acts in 1998:

1. Charges for withdrawal of surface water:
    a. they are legislatively based on:
        - Act No 138/1973 Coll., §43
        - Decree of the Government of CR No. 35/1979 Coll., §1-§2
        - Price bulletin and price measurement of the Ministry of Finance for every year
        - concrete charges are calculated by relevant River basin companies
    b. The incomes are intended to cover costs of water sources control and they are incomes of River basin companies (approximately 80% of incomes).
    c. In 1996 there was in CR total withdrawal of surface water 1903 m3 and incomes from charges were 1 595 mil. CZK.
    d. The average price of surface water was by River Basin Companies from 0,83 to 1,76 CZK/m3 with considerable allowance for water withdrawal for continuous-flow cooling in steam power stations. In 1997 the prices grew up to 0,99 - 1,92 CZK/m3.
    e. The Ministry of Finance is authorized for price control.

2. Drinking water tariffs and wastewater tariffs:
   a. They are legislatively based on:
      - Act No. 138/1973 Coll., §46,
      - Price bulletin and price measurement of the Ministry of Finance for every year
   b. concrete charges are calculated by relevant water service organization companies (approximately 100 of the biggest ones) from 1996: b) incomes from drinking water tariffs and from wastewater tariffs include costs of water service organizations - water supply companies - which are in connection with water production and water parting (drinking water tariffs), with wastewater discharge and cleaning (wastewater tariffs). These charges are the main income of water service organizations and are used to cover the costs.
   c. Following data represents data from water supply
      - drinking water - produced 925 mil. m3
      - invoiced 604 mil m3 (includes 360 mil m3 for inhabitants)
      - incomes from drinking water tariffs 6 997 mil. CZK,
      - wastewater (excluding rainfall)
      - emitted in sewer system 582 m3 (includes 524 m3 cleaned)
      - income from wastewater tariffs 5345 mil. CZK,
   d. In the years 1996 and 1997 average prices of drinking water and wastewater tariffs in CR were following in CZK (35 CZK = 1 USD):

Table 2-2 Drinking water tariffs (1996, 1997)

drinking water tariffs	**1996**	**1997**
total average	11,93	13,44
for inhabitants	10,27	11,86
for industry	14,43	15,85

Table 2-3 Wastewater tariffs (1996, 1997)

wastewater tariffs	**1996**	**1997**
total average	9,81	11,22
for inhabitants	7,91	9,31
for industry	11,88	13,34

   e. The Ministry of Finance is authorized for price control.

3. Charges for withdrawal of underground water:
   a. they are legislatively based on:
   - Act No. 138/1973 Coll., §45
   - Decree of the Government of CR No. 35/1979 Coll., §3-§7
   - The charge is assessed by the government at 2,00 CZK/m3, but there are many exceptions, e.g. there are no charges for water withdrawal by drinking water production for inhabitants.
   b. The charges are incomes of the State Environmental Fund and they are one of the sources for support of improving water quality.
   c. In 1996 there was the underground water withdrawal 486 mil m3. The incomes were 36 mil. CZK.

4. Charges for discharging polluted water:
   a. they are legislatively based on:
      - Act No. 138/1973 Coll., §44
      - Law No. 58/1998 Coll., on the charges for discharging polluted water.
   b. At the present time there are following charges for discharging of untreated surface water in (35 CZK = 1 USD):

Table 2-4 Charges for discharging of untreated surface water (CZK per physical unit)

Pollutant	Range
BOD_5	10 - 35 (CZK/kg)
Undissolved substances	0,1 - 2,6 (CZK/kg)
Dissolved organic substances	240 - 1200 (CZK/t)
Petroleum products	2,00 - 6,00 (CZK/m^3) differs for petroleum products concentration from 5 to 50 mg/l
Acidity and alkalinity	270 (CZK/kmol)

According to the water quality in the stream an additional charge can be assessed up to the 100% of the charge, up to the 200 % in case of waterworks stream. Public sewer systems have an allowance by calculation of the additional charge only up to 20%.

Last valorization of the rates to the mentioned level was provided in 1992 to made them motivating for polluters. It is also evident, that the rates already lost their incidence during last 6 years thanks to the inflation and this absence will be removed by the new, already mentioned act.

The payments under the Act No. 388/1991 Coll. are incomes of the State Environmental Fund and they are assigned to the support of sewage treatment works construction.

   c. In 1996 the pollution, subject to charges in BOD_5 indicator, was 47,798 t. Since 1990 to 1997 the pollution on the base of this indicator sank by 76 %, most of all thanks to the intensive sewage treatment works construction. The sewage treatment works are almost in all towns with more then 10,000 inhabitants and in last 3 towns they are already under construction. Incomes of the State Environmental Fund from these payments were 567 mil. CZK in 1996 and 499 mil. CZK in 1997. (60% of these payments belongs, under the Act No. 281/1992 Coll., to those polluters, who construct sewage treatment works. This is a reason, why the incomes of the State Environmental Fund are about 20% lower then the assessed payments.)
   d. The control activity is provided by the Czech Environment Inspection agency in cooperation with River basin companies, who provide the administration of these payments.

2.3. Assessment of Main Deficiencies and Needs for Improvement

In the field of payments for wastewater discharge to the surface water, the acceptance of Act No. 58/1998 Coll. was the main step towards the modernization of the whole system to the present demands.

Other payments in water management will necessarily to be established in the prepared act on water and in the new act on payments in water management, which should solve this problems in harmony with new requirements especially according to the harmonization of water management legislation to the EU regulations. Especially new requirements of financing will have to be solved:

- economic losses due to cultivation limits in protection zones for drinking water abstraction
- impacts of Nitrogen Directive of the EU
- protection and monitoring of underground water
- above standard protection against flood
- new constructed managing and control authorities according to the EU requirements.

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

The state policy of the environment protection must be revised and adapted to the EU legislation, obligatory for Member States. The harmonization of legislation in water management is connected with new requirements on changes in the whole sector, which will have to be accepted as soon as possible. These changes will necessarily require considerable financial costs, approximately more then 100 bn. CZK (35 CZK = 1 USD). At present time there is only estimation of these costs provided. The adaptation to the EU conditions in technical parameters will require many technical measures, which will improve water quality and will have positive influence for improving water quality in the Morava basin and in the Danube basin.

The Government of the Czech Republic must prepare a screenplay based on estimated costs and choose an optimum variant for the meeting the EU requirements and choose priorities. The economical and financial measures of state regulation will be based on these assumptions.

There are some basic points:

a. construction of mechanical-biological wastewater treatment plants for municipalities with 2000 - 10000 inhabitants until the year 2005 (approximately 200 wastewater treatment plants)
b. construction of nitrogen and phosphorus removal in big wastewater treatment plants
c. demarcation of sensitive zones
d. application of the Nitrogen Directive
e. removal of old burdens with influence on surface and underground water quality.

The Czech government has supported international loans, which were used mainly for energy and transport. There were difficulties with state guarantees, because there is a rather small space in the state budget for guarantees. That’s why international loans depend on necessity of state guarantee and limit in the state budget.

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

There are following financial resources and allowances for financing demands of water management in the Czech Republic used:

a. state budget - through the mediation of resort budgets or directly through subsidies and guaranties,
b. the State Environmental Fund - through subsidies, advantaged loans and guaranties,
c. municipal budgets - through subsidies
d. own resources of organizations
e. commercial loans from inland banks
f. commercial loans from foreign banks
g. National Property Fund - for the removal of old burdens through subsidies,
h. foreign subsidies from international institutions and from foreign governments
i. tax advantages through lower VAT rate of 5%.

The following expenditures for the environmental protection in water management (including drinking water) from central resources in 1997 for 346 constructions projects with budget costs above 5 mil. CZK (35 CZK = 1 USD) were realized:

Table 4-1 Expenditure for environmental protection in water management (1997, mil. CZK)

Total resources (in mil. CZK)	**3 846**
includes:	
Public budgets	1 475
Own resources	1 572
Loans	518
From abroad	94
Other	187

There are not yet statistical data about total water management investment in 1997 (without drinking water). Therefore we introduce data from 1996:

Table 4-2 Water management investment (1996, mil. CZK)

Total investment (in mil. CZK)	**10 011**
includes:	
Own resources	4 502
Loans	2 270
State budget	1 442
From abroad	22
State Environmental Fund	1 335
Other	187

There were following total expenditures (more then 90% are investment expenditures) of the state budget and of the State Environmental Fund for water management including drinking water and these other expenditures in 1996 in mil. CZK (35 CZK = 1 USD) realized:

Table 4-3 State budget and State Environmental Fund expenditures (1996, mil. CZK)

1. State budget total		3 680
including:		
Ministry of Agriculture	- wastewater treatment plants and sewage systems	1 030
	- drinking water	1 707
	- dams	355
Ministry of the Environment	- revitalization	370
	- Jílovský stream	19
	- technical measures	24
	- projects (e.g. Labe)	45
other resorts	- wastewater treatment plants (estimation)	50
public treasury administration	- districts wastewater treatment plants (estimation)	80
2. The State Environmental Fund (SEF)	total	1 946
1. + 2.	**total state support**	**5 626**
3. Other resources		5 274
1. + 2. + 3.	Total investment expenditures for water management	**10 900**
including:	constructions for water pollution control	5 820
	wastewater treatment plants - support from the state budget and from the SEF	3 100

Investment expenditures to the water management were as follows:

- subsidies and advantaged loans from the state budget 34%
- contribution of the SEF 18%,
  which represents 52% of the total expenditures.

The SEF was constituted under Act No. 388/1991 Coll., to support constructions for environment protection. Incomes and expenditures are kept under the environmental components. The incomes are most of all built by fees for pollution of individual environmental components, a smaller contribution is from fines and other resources. The expenditures of the SEF are used for the financial support of wastewater treatment plants construction in the water management.

The incomes and expenditures of the SEF (water sector) in 1997 in mil. CZK (35 CZK = 1 USD):

Table 4-4 State Environmental Fund incomes and expenditures in water sector (1997, mil. CZK)

1. incomes:	- from charges for wastewater discharge		499
	- from charges for underground water abstraction		36
	- from fines		19
	- part payments of loans		295
Total incomes			849
2. expenditures:	- subsidies		1 145
	- advantaged loans		747
Total expenditures			1 892
3. Total (1. - 2.)			**- 1 043**

The negative balance of incomes and expenditures in the component water is covered by incomes in other environmental components through the interior redistribution of the Fund resources. This negative financial situation should be improved after 1999 through coming Act No. 58/1998 Coll. on charges for wastewater discharge to surface water. In 1998 are the incomes approximately at the same level as in 1997.

The casting receivers of the Fund supports are municipalities with less then 10 000 inhabitants. There is construction of wastewater treatment plants in this municipalities supported. The total support is by 80 % in the form of subsidies and by 20 % in the form of advantaged loans.

The Fund for construction of WWTP gives a support to entrepreneurs in form of advantageous loan with a half interest rate (approximately 6 - 8 % p. a.) and longer maturity period than in commercial banks. The Fond gives bank guarantees in exceptional cases too.

4.2. Standardized Funding Mechanisms for Investments in Water Pollution Control

Standardized funding mechanism for investments in water pollution control is still being developed.

4.2.1. Typical Sources of Investment Money for Municipal Wastewater Treatment Plants

Following sources for investment in construction of industrial and municipal wastewater treatment plants are used:

a. own sources
b. loans from commercial banks
c. grants from the state budget
d. grants from SEF
e. advantageous loans from SEF
f. grants from municipal budgets
g. foreign sources (international institutions and funds from countries)
h. other sources

Following table shows shares of these sources for water protection constructions with budget cost over 5 mil. crowns in 1996 in mil. CZK. (35 CZK = 1 USD):

Table 4-5 Share of investment sources on water protection constructions with budget costs over 5 mil CZK (1996, mil. CZK)

Total	**5734**
in it: - own sources	1851
- credits	960
- grants from SB and SEF	2456
- foreign sources	162
- others	305

4.2.2. Typical Sources of Investment Money for Industrial and Commercial Wastewater Treatment/Pre-Treatment

There is similar financing system as in case of municipal wastewater treatment. Main difference is in way of financing from the State Environmental Fund, because support for municipalities includes softer loans and grants. Second difference is that support from the state budget is not offered for industry and commercial wastewater treatment.

4.2.3. Patterns and Procedures for Municipal and Industrial Wastewater Treatment

Conditions of providing financial sources for protection water construction:

1. Commercial banks provide credits to ecological construction in normal business conditions (interest approximately 16 % p. a., maturity approximately 4 years), no commercial bank provides advantageous credits or longer maturity terms.
2. State Environmental Fund provides a) support to municipals usually divided to 80 % grant (irrevocable) and 20 % advantageous loans, b) advantageous loans with approximately half interest than commercial banks (approximately 6 - 8 % p. a.) and longer maturity period for entrepreneurs. Particular financial conditions of providing supports and factual priority are set by SEF for every year.
3. State budget provides grants either through budgets of ministries, especially the Ministry of Agriculture and the Ministry of Environment and sometimes other resorts or through so called public cash administration, which is financed directly by the Ministry of Finance concrete actions itself and through municipal budgets.

Competence and correctness of drawing funds from state budget are monitored by control authorities of competent ministry, Ministry of Finance and especially by the Highest Control Authority.

4.2.4. Agricultural Pollution of Ground Water and Surface Water

In Czech Republic there are no funds and institutions to support restriction of pollution of underground water and surface water by agriculture. Total share of pollution of surface water by areas and diffuse sources was for phosphorus approximately 50 % and for nitrogen approximately 80 % in the first half of 90´s. At the same time consumption of fertilizers of phosphorus like P205 went down from 77,7 kg/ha in 1986 to 11,8 kg/ha in 1996 and nitrogen from 99,4 kg/ha in 1986 to 61,3 kg/ha in 1996. This problem will necessarily have to be judged newly by application of nitrogen guideline of EU.

Removing of old damages, especially from dumps and industrial pollution - industrial areas, which influence quality of ground and surface water by dangerous materials is supported by National Property Fund within the framework of Privatization.

4.3. Private Financing Models in Use

4.3.1. BOT (build-operate-transfer)

There are only a few cases of using this model in the Czech Republic in the central heating sector.

4.3.2. Private Management of Services

This method is not used in Czech Republic.

4.3.3. Leasing Models

Leasing contracts can be used for construction of treatment plants only on a small scale for buying technical equipment. In Czech Republic from the total volume of leasing, 60 % goes to buying cars for entrepreneurs.

4.3.4. Other Financing Models

Following financing models are usual used:

1. Towns and communities: they are dependent in greater part on support from state sources (state budget and SEF) because they have not enough own funds. On a smaller scale they use own sources and commercial loans, using property of the community as a security. Some active towns and communities intensively use international support, which is sometimes the main source of incomes for financing treatment plants and decisive part of sewerage systems.
2. Industry: gets funds especially from own sources and from commercial credits. In smaller part than in communities are used sources from State Environmental Fund like advantageous loans and in case of privatized companies and old damages is a significant source the National Property Fund. Exceptionally are also international supports for priority polluters used.

Foreign help is used both in town and industrial sphere. They use providing sources of specialized foreign international institutions and direct financial support from individual countries, which are particularly aimed, especially in connection with international programmes, e.g. Project Labe. As international institutions can be mentioned e.g. support of the EU and OSN funds. As direct support the significant help of BRD, Denmark, Belgium and Austria can be mentioned.

4.3.5. Licensing and Monitoring of Privately Financed or Operated Services

This method is not yet introduced in Czech Republic.

4.4. Actual Water and Wastewater Tariffs/Charges

4.4.1. Actual Tariff Policies and Systems

Prices for surface water withdrawal, drinking water tariffs and wastewater tariffs are defined according to mentioned rules individually by river basin companies (surface water) and water supply companies (drinking water tariffs and wastewater tariffs) for every year.

Both in some river basin companies and in some water supply companies certain forms of state supply for both investment and non-investment funds exist, which basically reduce companies calculated price.

In case of drinking water tariffs and wastewater tariffs according to given calculation formula cross grant exists, which gives advantage to population against industry how it can be seen in surveys.

However, calculation of prices comes from total costs of company at supply of surface water, drinking water and wastewater conscription including treatment where are deducted costs which are covered by other incomes and grants and from adequate profit which is about from 2 to approximately 20 % from costs.

Every river basin company and every water supply company has then a different price for mentioned services.

Table 4-6 Tariffs in water sector (1997, CZK/m^3)

1. average prices	**total average**	**households**	**others (industry)**
drinking water tariffs	13.42	11.86	15.85
wastewater tariffs	11.22	9.31	13.34
2. minimum prices	**average**	**households**	**others (industry)**
drinking water tariffs	6.43	5.00	7.46
wastewater tariffs	5.00	5.00	5.00
3. maximum prices	**average**	**households**	**others (industry)**
drinking water tariffs	21.35	19.07	28.33
wastewater tariffs	23.24	16.40	31.30

4.4.2. Level and Structure of Tariffs

Level and structure of tariffs was mentioned in Table 4-6. Prices in water management are regulated by Ministry of Finance. Prices in water sector have general account regulation. It means, that prices reflect corresponding costs and adequate profit.

Average drinking water tariffs and wastewater tariffs for years 1996 and 1997 are mentioned in paragraph 2.2.

Complementary information from sample approximately 100 highest organizations in Czech to 30.6.1997 in CZK/m^3 (35 CZK = 1 USD).

4.4.3. Level and Structure of Cost

For orientation there is a structure of wastewater treatment costs from 1994, based on representative sample of 20 mechanic-biological wastewater treatment plants (WWTP) of capacity from 10,000 to 30,000 equivalent citizens, there were old, modernized and new WWTP in the sample included.

Table 4-7 Water treatment costs (1994, CZK/year)

item	thous. CZK/year	% from total
material	360	7.2
electricity	900	17.9
repairs	253	5.0
wages and salaries	1 039	20.6
charges	950	18.8
depreciation	821	16.3
other	715	14.2
TOTAL	**5038**	**100**

4.4.4. Level of Actual Cost Coverage

Costs for water supply and sewage are not available at present time, the data will be available by the end of the year after finishing of a complex study focused on total impacts of accession of the Czech Republic to EU and after harmonization of legislation which is in process now.

4.5. Actual System and Practice of Pollution Charges, Fees, Penalties

4.5.1. Charges for Water Abstraction (municipal, industrial, irrigation)

Charges for surface water withdrawal are listed in the following table.

Charges for surface water withdrawal for 1996 and 1997 by each water basin are in CZK/m3 (discounts are for cooling of steam power stations).

Table 4-8 Charges for surface water withdrawal (1996, 1997, CZK/m^3)

CHARGE	1996		1997	
	withdrawals	discount	withdrawals	discount
Vltava	0,95	0,42	1,03	0,51
Ohře	1,43	-	1,52	-
Labe	0,83	0,33	0,99	0,45
Morava	1,76	0,42	1,92	0,46
Odra	0,94	-	1,18	-

Total revenue for all water basins in 1996 for surface water withdrawal was 1 595 bn. CZK (35 CZK = 1 USD).

4.5.2. Charges for Wastewater Discharge (exceeding defined quality standards)

Charges for wastewater discharge to surface water including rates of the day are described in paragraph 2.2.

There is no charge difference according to regions or consumers in the present system, with the exception of the particular advantage of lower additional charge for the operators of the public sewer system. The rates differ according to the size of pollution.

In the new system , which will come into force in 1999, the additional charge will be removed and the rates will be uniform with the rate difference according to the basic indicator COD based on the character of wastewater.

The incomes of the SEF from charges for wastewater discharge to surface water and the expenditures for the water component of the environment were these in mil. CZK (35 CZK = 1 USD):

Table 4-9 State Environmental Fund incomes from wastewater discharge and expenditures (1991 - 1997, MIL. CZK)

	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
incomes from charges	1119	964	1079	831	654	567	499
expenditures for water	1037	957	1672	1994	2163	1947	1892

4.5.3. Other Relevant Charges/Penalties

Another payments for underground water withdrawal and fines are described in chapter 2.1. The incomes from these charges and a part of incomes from fines raise resources of the State Environmental Fund, but not significantly. These incomes were total 55 mil. CZK in 1997 in the environment component water. The fines can be inflicted by the Czech Environment Inspection agency under Law No. 130/1974 Coll., on the state administration in water management, in the wording of later novels, §24 in exceptional cases to the height of 3 mil. CZK. The rates of fines are in §24 and differences in his parts for individual kinds of obligations breach.

4.5.4. Assessment of Efficiency of Actual Practice

There are made some efficiency studies, which demonstrate, that water pollution charges encourage to implement of corresponding measures to water pollution eliminating and preventing.

From administrative requirements point of view it is true, that environmental charges are rather administrative costly. It’s one of the negative agents by using water pollution charges.

4.6. Economic and Financial Incentives for Pollution Reduction Measures

Wastewater charges are basic economic instrument for pollution reduction measures. These charges have existed approximately 30 years and we have a lot of experience with their using. In the past waste pollution charges did not encourage to pollution elimination.

1. Sphere of tax advantages: abandon current advantageous rate VAT of drinking water and drinking water tariffs and wastewater tariffs, further technology of wastewater treatment tax this advantageous rate too,
2. Take concessions from customs rates or duty-free import of technologies, definitely defined for ecological constructions for environmental protection (e.g. WWTP)
3. Newly introduced bases of economical instruments and payments in water management in new Water act and newly prepared act on payments in water management in connection to new requirements in water protection.

4.7. Quality and Capacity of the National Banking System for Funding of Larger Infrastructure Projects (Especially Water Sector Projects)

Banks operating in the Czech Republic are universal banks, engaged in both commercial and investment banking. Credit transactions account for major part of asset operations, because most businesses are still financed through banking credits. The still insufficiently developed capital market did not allow creating an adequate flexible environment for substantial increase in the business sector financing through this market.

For a long time, credit extensions have been the most important activities of the banking sector. Despite a certain shift to some other activities, the demand for credits is still high and credits remain the most significant resource of financing for the business sector. The share of crown credits in GDP in current prices stood for example at 63.3 % as of 1996.

The Czech banking sector is a standard two-tier system consisting of the central bank (the Czech National Bank) and about 50 commercial banks. 11 of them are controlled by the Czech National Bank or are in the process of liquidation. The framework of the banking institutions is completed with 6 saving institutions oriented toward housing financing and 6 mortgage banks (some of which are working as a part of big commercial banks).

The Czech National Bank is responsible for the monetary policy. Only as an exception in early 90´s it was involved in channeling and distributing of the loans from abroad. Since that period it has strongly refused to be involved as a provider or guarantor in commercial operations.

The ten largest commercial banks, as measured by the volume of the balance sheet as of 31.12.1996 are:

- Komerční banka, a.s. (461 bn.CZK)
- Česká spořitelna, a.s. (359 bn.CZK)
- Investiční a poštovní banka, a.s. (234 bn. CZK)
- Československá obchodní banka, a.s. (210 bn. CZK)
- Konsolidační banka, (120 bn. CZK)
- Agrobanka Praha, a.s. (will be sold to another owner, 67 bn. CZK)
- Vereinsbank (37 bn. CZK)
- Živnostenská banka, a.s. (31 bn. CZK)
- Citibank, a.s. (31 bn.CZK)
- Societe Generale, a.s. (30 bn. CZK)

However, there is a big gap in the balance sheet volume among the four largest major banks and the other banks. These four largest banks are providing about 70-80 % of the credits.

The structure of deposits has improved in comparison with early 90´s. Domestic banks are able to offer loans with the maturity from 4 to 6 year. Less frequent but existing are loans with the maturity from 8 to 10 years. Only the mortgage banks like an exemption are supplying their clients with the loans over this time limit.

An evidence of an insufficient offer of the long-term funds are the activities of Municipal Financial Company (shareholders are the Ministry of Finance and Českomoravská záruční a rozvojová banka, a.s.). This company arranges with the help of the state guarantee of the Czech and US government refinancing of Czech commercial banks with the long-term funds maturing from 7 up to 15 years.

The financing of municipal investments, infrastructure projects or water investment is split among several institutions. A part of such investments is funded by commercial banks, especially towards larger municipalities. Probably some projects could be found as a part of the portfolio of Konsolidační banka, which should be completely transformed within a short period. The role of Municipal Financial Company was mentioned above.

There is no institution in the banking system, which is specialized in financing water sector projects. While Česká spořitelna, a.s. was founding programme, which is focused in municipal financing several years ago. This programme offers loans with the maturity up to 10 years. However this programme is not successful probably for interest rate, which is not enough favored.

An analysis of the problems in banking sector indicated certain shortcomings in the legislative and institutional environment, not only in the banking sector but also in the financial and economic area as a whole. The process of creating the legislative and systematic framework, forming financial market institutions and enforcement of the financial and economic sector. The day-to-day experience revealed problem areas in individual laws and initiated their amendment. Although a legal framework for business activities has been established in principle, numerous areas still exist which must be further improved, connected also to the potential entry to the European Union.

Amendment of the Act on Banks is currently under preparation. The amendment should solve the current problems of everyday practice, improve the definitions of some terms, put into law some bank obligations until now stimulated by less forceful regulations. Emphasis will be laid particularly on the following:

- improving the transparency of bank activities by disclosing economic information on bank activities and on shareholder composition of a bank,
- the possibility of banking supervision intervention in the case of unfavorable shareholder influence on a bank's activity,
- bank participation in other legal entities
- establishing a closer cooperation with the supervision of the capital market
- stricter requirements for shareholder entries in banks
- raising the banking supervision requirements towards a bank in the case of detecting shortcomings in it activity including a specific regulation on a bank liquidation etc.

At this moment several approached concerning establishment of so called Development Bank are discussed. It is clear the existing Konsolidační banka should concentrate their activity on the settlement of old debts of the previous state owned enterprises and the small private banks, which received a state financial aid. In the same time is analyzed the mission of Českomoravská záruční a rozvojová banka, which is acting in some areas like institution of development financing too.

The discussed Development Bank should be probably an appropriate partner and provider of financing for municipalities and environmental project. The decision related to the new structure and mission of existing and new established institutions could be adopted this year.

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

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

One of the aims of the State environmental policy is augmentation of quality of water resources by way of reducing pollution discharge. The fundamental aim consists of lowering the level of pollution of underground and surface water resources by means of prevention and correction measures. The highest attention should be paid to the protection of the resources of drinking water and to further reduction of pollutants in the surface water resources. When a final solution is found as to large point sources of pollution, the focus of water protection shall move to dispersed sources of pollution and to sewage water cleaning in small towns and localities.

Beginning in 1994, foreign aid in environmental protection has been gradually moving from the support of non-investment projects towards the support of investment activity.

In terms of the approximation of the Czech Republic to the European Union a study has currently been elaborated (the Czech Republic co-operating with the European Union, World Bank, Denmark, Luxembourg and Belgium); the study deals with the way to achieve the European legislation requirements in water management in the Czech Republic. Further it includes an assessment of economical and financial impact of the approximation process in the sphere of water protection and a proposal for an economically viable factual and temporal harmonization of a part of the legal system with relevant legal provisions of the European Union (including institutional and procedural framework of implementation of the modified laws and secondary legal provisions). Assessment and strategies shall include all three main polluted areas of the Czech Republic. The amount of so called “incremental costs“ is found out. It is assumed that the foreign assistance will cover, first of all, the incremental costs in so called “sensitive areas“.

According to a preliminary analysis, the incremental costs for sewage water cleaning reaching 100.9 bn. CZK (35 CZK = 1 USD) and for drinking water procurement reaching 29.3 bn. CZK need to be covered to meet requirements of the Czech legislation and of the European Union.

The results of the study are arranged to provide a survey of the investments needed, costs of their implementation, and their importance not only for the whole Czech Republic but also for particular catchments and districts. Due to this the document provides an outline of investments and corresponding financial costs necessary for meeting the requirements of the Czech legislation and of the European Union concerning the catchment of Morava which is a part of the Danube and the Black Sea catchments.

At the close it can be stated that the Czech Republic possesses a decision-making mechanism for international co-financing.

It can be stated that water-managing buildings have so far been covered by the State Budget or by the State Environmental Fund. Financing of water managing buildings has had a long tradition in the Czech Republic, which originated from priorities of state environmental policy and public budget policies. On the other hand, substantial finance resources should be made available for this purpose to reach the standards common in the European Union countries.

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

Foreign assistance has so far been used in few cases in the framework of bilateral relations. There was an aid by Denmark with building a water sewage farm in Hořice and presently there is and offer for financial assistance by the FRG with building a water sewage farm in Děčín. In regard of anomaly international assistance in funding of the water investment, there is not introduced a detailed dates about these projects.

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

There are several banks in the Czech Republic, which are responsible for handling international funds. For example Investiční a poštovní banka, Českomoravská záruční a rozvojová banka, Hypobank.

Also the State Environmental Fund is responsible for handling international funds. There is possibility for adapting rules for the concrete support or programme and for adapting a required accounting system. Detail information about State Environmental Fund is included in "ANNEX B-1".

5.4. Assessment of Main Weaknesses and Needs for Improvement

Currently Ministry of Environment in cooperation with Ministry for Regional Development improves financial system for structural fund from European Union. Financial support will be provided through State Environmental Fund, which will be useful for maintenance of financial structure in the Czech Republic, because State Environmental Fund have a god experience with international grants.

Now we will have to localize our attention on superior project preparation to provide god condition for international financing.

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

6.1. Compilation of Actual and Planned Investment Portfolio

Compilation is provided on the basis of identification and evaluation of pollution reduction measures. On the list of the compilation of actual investment portfolio there are only municipalities with total investment 1,452.8 mil. CZK (43.2 mil. USD). The most important financial resources are state budget, State Environmental Fund and local budget.

Plan investment includes seven measures with total capital requirements 2 234,0 mil. CZK (68,2 mil. USD). Share of the municipalities is 84,9 %. Financial support is expected mainly from state budget, local budget, National Property Fund and GEF.

6.2. Inventory of Actual and Planned Investment Portfolio

In the supplement (ANNEX B-2 and ANNEX B-3) is table of compilation of actual and planed investment portfolio. There only the biggest water investments are included. There are a lot of small municipal wastewater treatment, which are financed from the State Environmental fund. In the cases, where an allocation is granted, it is possible to parallel grant a loan, however, provided that the total support does not exceed 60 % of costs recognized as a basic for the calculation of the support. In the case of support of the big water investment from the state budget, the total support does not exceed 80 % of costs.

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

By assessment of the main problem in project implementation is project preparation. There are very often problems with project preparation. Ground is in the absence of the special organization for project preparation. One thing that this type of organization will be useful for is harmonization of project preparation. This system is used for example in Portugal.

Problems, which bear on project preparation, are effective analyses. This analyses are not common component of the environmental project. First of all cost benefit analyses will have to be incorporated in the environmental projects preparations.

Second problem is incomplete list of environmental projects. The best list of projects is available in the State Environmental Fund, but it is incomplete. That’s why Ministry of Environment currently prepares database of environmental projects.

Information about available financial resources is also important condition for successful environmental projects implementation. Partly it is result of unstable economy in the Czech Republic and environmental policy, which is focused on the rapid improvement of the environment. Result of these conditions is, that system of the financial support is relatively changeable.

Rather low level of the own financial resources often makes difficulties by project preparation and implementation.

Annexes

B-1 Description of State Environmental Fund

B-2 Compilation of Actual Investment Portfolio

B-3 Compilation of Planned Investments

B-4 Bibliography

Annex B-1

Description of State Environmental Fund

The activities of the State Environmental Fund of the Czech Republic are the subject of Czech National Council Act No. 388/1991 Coll., on the State Environmental Fund of the Czech Republic and related regulations - the Statute of the State Environmental Fund and Directive of the Ministry of the Environment on provision of financial funds from the State Environmental Fund. A top-priority area of the work of the Fund consists of the annually up-dated Annexes to the Directive. These basic rules for utilization of the finances of the Fund are currently based on material discussed at a meeting of the economic ministers of the Czech government on January 13, 1997 termed "Strategy of the State Environmental Fund in the Years 1997 - 2000". This material evaluated the previous activities of the Fund and simultaneously delimited the future orientation of the Fund.

The chief reason for founding the Fund was the creation of a comprehensive operative and flexible financial instrument of environmental policy that would:

- be related to a system of payments in environmental protection (fees, charges, sanction payments),
- replace the existing specialized funds (the State Water Management Fund and the Air Protection Fund),
- permit mobilization of financial means for environmental protection,
- permit sufficiently flexible reaction to current priorities in environmental protection,
- permit inter-annual transfer of funds.

State Environmental Fund was established as a national fund. There are not regional environmental funds in the Czech Republic. State Environmental Fund is a state organization. Its administrator is the Ministry of Environment. Head of the State Environmental Fund is a director to be appointed and removed by the Minister of Environment.

Table B-1-1 Fraction of the State Environmental Fund expenditures in overall expenditures for environmental protection in the Czech Republic from central sources (1990 - 1997 (comparing with total investments), bn. CZK)

Year	SB	SEF	NPF	Central Sources Total		Total Investments	Investments in % GDP
1990	3.2	***1.9***	-	5.1		6.0	1.0
1991	7.5	***1.5***	-	9.0		9.4	1.3
1992	10.7	***1.5***	-	12.2		16.9	2.1
1993	9.1	***2.9***	-	12.0		20.0	2.2
1994	10.0	***3.6***	0.1	13.7		28.3	2.7
1995	9.2	***4.9***	0.8	14.9		32.3	2.7
1996	8,2	***4.6***	1.1	13.9		approx. 38	approx. 2.7
1997	8.04	***3.3***	1.4	12.7		*	*

** not yet specified for 1997*

- expenditures for environmental protection from budgets of municipalities - approx. 2 000 million CZK

Note: SB - state budget, SEF - State Environmental Fund, NPF - National Property Fund, Central sources total = SB + SEF + NPF (comprehensive expenditures for drinking water), Total Investments - statistically monitored expenditures for investments for environmental protection based on the method employed by the Czech Statistical Office (without expenditures for drinking water) - conformable with European regulations.

Fund office has economic and technical section. Technical section is divided in to departments according domain of support (air cleaning, water treatment, etc.).

Contributions from the Fund shall be distributed by the Minister of Environment. Herewith the Fund Council shall be governed by the order of proceedings to be approved by the Minister. The Fund Council passes judgments in particular on the following items:

- principal questions of how to create and apply the Fund's assets,
- annual budgets of the Fund's receipts and expenditures,
- proposed measures and ensuring of same by means of the Fund's assets.

The Fund Council also judges the projects of allocation of the Fund's assets and recommends the Minister the fund's amounts to be applied to the individual concrete cases and all this shall be done in accordance with the principles of protection of the environment of the Czech Republic.

Replenishment of the Fund:

- charges for discharge of wastewater into surface waters (22%)
- fees for emission of harmful substances into the air (28.2%)
- fees pursuant to the Waste Act (8.7%)
- payments for permanent and temporary withdrawal of agricultural land from agricultural production (9.2%)
- fees for the production and import of substances damaging the ozone layer of the Earth, fines imposed by the administrative bodies of SEF and the Czech Environment Inspection and payments on loans (8.7%)
- transfer from the National Property Fund - Programme for Revitalization of the Air (23%) - 1 bn. CZK in 1994, 1.6 bn. CZK in 1995, 2.0 bn. CZK in 1996 and 1.5 bn. CZK in 1997, i.e. a total of 6.1 bn. CZK
- international grants (for example US government grants in 1992 in value 275 mil. CZK)
- there is also a theoretical possibility given by law to obtain budget grants.

In 1992 - 1997 the income of the Fund attained a total amount of 25.3 bn. CZK, of which 5.3 bn. CZK was received in 1997.

Standard types of expenditures from the Fund consist of:

- subsidies (only to non-business entities or municipalities),
- support through loans with an interest rate of 3% (only to non-business entities or municipalities),
- support through loans with an interest rate of 7% (only to business entities and the other subjects),
- securities for loans, to an amount of 50 mil. CZK with a guarantee period of 10 years - for this service, the Fund receives remuneration in an amount of 2% of the secured amount
- contribution for partial payment of interest on loans up to an amount of 7% for a maximum period of 5 years
- interest-free loans (only to non-business entities, to 1996)
- combination of subsidies and interest-free loans (only to non-business entities, to 1996)
- loans at decreased interest rates (business entities, to 1995)

In order to elucidate the mechanism for evaluation of applications to the Fund, the manner of evaluation of applications for support from the Fund in the sphere of air protection is described:

Formally complete applications are evaluated on the basis of the following criteria:

1. *the level of the concentrations of the chief pollutants at the given locality* - this criterion is established on the basis of the imission and emission conditions at the given location and is expressed in terms of imission and emission orders of municipalities as drawn up by the state administration,
2. *relation to utilization of the current capacities and regional environmental policy* - this criterion is employed to establish the priority assigned to the individual projects by the pertinent territorial department of the Ministry of the Environment; this priority corresponds to the order of projects on the basis of the urgency of a solution,
3. *preference for measures that comply with stricter emission limits* (e.g. a higher technical level of the measure) - factor is determined as a percentage of the value of the emission limits for the chief and possibly other pollutants as set down in *the Measure of the State Committee for the Environmental and Act No. 17/1997 Coll. for the given kind of source;* the values of the criteria of the technical level for the individual measures are given by the order of the technical levels (TL) for all the unresolved applications on the date of evaluation,
4. *the specific financial requirements calculated from the costs for implementation of measures and the requested support from the Fund, related to a unit of pollution abatement* - - the specific financial requirements are defined as the ratio of the investment costs (or total support, or total subsidies) for implementation of the measure and unit emissions calculated from the value for abatement of the chief and/or other pollutants per year (unit emission pollution abatement is given by the sum of the individual abatements in emissions of pollutants in t p.a. recalculated to carbon oxide in the ratio of the amount of fees for emission of pollutants into the air pursuant to the Annex to Act No. 389/1991 Coll., on state administration in air protection and fees for air pollution),
5. *consideration of the requirements of environmentally burdened areas* - this criterion is expressed in terms of a point value of the total sum of all the evaluation factors carried out in the framework of the project "Review of the Delimiting of Environmentally Burdened Areas in the Czech Republic".

In relation to the material content, the criteria are divided into four groups and an appropriate weight is assigned to each according to the following table.

Table B-1-2 Evaluation criteria

Group of Criteria	*Expression of Criteria*	*Ratio in Group*	*Maximum Recalculated Value in the Group*	*Weight in Overall Evaluation*	*Maximum Recalculated Value of the Group*
Environmental	imission order	2	120		
	emission order	2	120	30 %	300
	EBL order	1	60		
Economic	SFR order from BC	1	100		
	SFR order from P	1	100	30 %	300
	SFR order from S	1	100		
Regional	priority of territorial Dept. of ME	1	200	20 %	300
Technical	priority of TL	1	200	20 %	300

Notes: EBL - Environmentally burdened locality, SFR - specific financial requirements, BC - budgetary costs, P - total support, S - subsidies, ME - Ministry of Environment, TL - technical level

The individual criteria are recalculated on the basis of the given weights and their sum, i.e. summary evaluation for the entire Czech Republic forms a basis for proposal of resultant priorities in the framework of the regions.

The expenditure policy of the Fund is governed and will continue to be governed in the 1997 - 2000 period *in accord with the State Environmental Policy* and taking into consideration its overall financial capabilities with the following order of priorities:

1. *air pollution abatement* (especially from medium-sized pollution sources, i.e. 0.2 - 5 MW)
2. *water pollution abatement* (especially from medium-sized pollution sources, i.e. 5 - 10 000 equivalent inhabitants)
3. minimization of waste formation, especially hazardous waste
4. *support for "clean"* (low waste, low emission and low energy consumption) *technologies*, especially for small and medium-sized enterprises
5. *protection of nature and the landscape* (with emphasis on increased retention capacity of the landscape and the flood prevention effect of measures)

Support is typically provided from the Fund to the communal sphere, towns and municipalities, which receive a total of 84.9% of the total financial means provided from the Fund; a further 12.2% is received by the business sphere and 2.9% by budgetary, contributory and other organizations (1997).

In the years 1992 - 1997, expenditures from the Fund attained a total amount of 20.83 bn. CZK, of which 45.2% consisted of loans and, in 1997 - 3.30 bn. CZK (loans - 43.9%).

Financial assistance was provided from the financial means of the Fund in 1992 - 1997 for:

- 469 waste-water treatment plants and sewer systems,
- 96 projects to remedy flood damage (floods in July of 1997),
- 1197 general conversions to gas in municipalities and conversion of furnaces to gas, including other technologies,
- 457 projects to decrease burdens on nature and the landscape.

Over the period of existence of the Fund, support provided for the sphere of water protection led to a *decrease in water pollution by 54 004 t* BSK_5 and also by *75 516 t of insoluble substances.* For comparison in 1996 a total of 49 744 t of BSK_5 and 84 102 t of insoluble substances was produced.

In the sphere of air protection, a *decrease in pollution (dust, sulfur dioxide, nitrogen oxide, carbon oxide and hydrocarbons) of 316 236 t p.a.* was achieved in the years 1992 - 1997. For comparison in 1996 a total of about 628 500 t of the chief pollutants was emitted into the air by small and medium-sized pollution sources.

The fact that the greatest percentage of expenditures from the Fund so far have been directed towards the protection of the air and water is completely in accord with the priorities laid down by the State Environmental Policy for the short-term (1995 - 1998). The character of support projects (construction of small wastewater treatment plants and connected sewer systems, general conversion to gas in towns and municipalities and conversion of furnaces to gas) corresponds to the needs primarily of the communal sector and also to the financial capabilities of the Fund. A larger wastewater treatment plant corresponds to an investment of the order of hundreds of millions of CZK, while technical measures for large energy-production facilities correspond to an investment of the order of billions of CZK. There is a significant disproportion in the work of the Fund between income from fees for pollution of the individual components of the environment and expenditures for their protection. While income in the sphere of the air contributed 31.3% to the total income (fees and Programme of Revitalization of the Air), expenditures for air protection corresponded to only 29.5%. In contrast, income from the water sphere corresponded to 23.2% of total income, while expenditures for water protection equaled 50.9% of total expenditures. Simultaneously, the fraction of expenditures for water protection in the period of interest decreased continuously from 63.2% in 1992 to 56,2% in 1997 and, on the other hand, the fraction of expenditures for air protection increased.

This development reflects the specific features of conditions in CR resulting from the interplay of factors related to the inherited unsatisfactory state of the air and the factor of privatization (in OECD countries, about 2/3 of public expenditures in this sphere are directed towards water protection and only 5% towards air protection; however, the private sector uses about half of their environmental expenditures for air protection).

Annex B-2

Compilation of Actual Investment Portfolio

Compliance of Actual Investments (Million US$, Million CZK)

No	Type/ Project or Programme		Total Capital Requirements		Funding Period	National Funding Sources					International Funding			Remarks
						Envir. Fund	Public Loans	Public Grants		Others	Organisation	Grant	Loan	
							Central Budget	Central Budget	Regional Budget					
			mil. CZK	MUS$		mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		MUS$	MUS$	
1.	WWTP Prostejov		442.0	13.12	1997		-	-		-		-	-	Started 12/97
					1998		88.4	265.2		88.4		-	-	others: town,ind.
							20%	60%		20%				
2.	WWTP Prerov		292.0	8.66	1997		-	-		-		-	-	Started 5/98
					1998		58.4	175.2		58.4				others: town,ind.
							20%	60%		20%				
3.	WWTP Znojmo		228.0	6.77	1997	20.0			20.0	-	Phare	0.30	-	Started 11/96
					1998	73.6			73.6	-	Phare	1.06	-	
						40%			40%					
4.	WWTP Breclav + sewers		339.0	10.06	1997		77.0	77.0		53.0		-	-	Started 6/96
					1998		-	-		24.0	Phare	3.20		others: town,ind.
All other environmental – water management projects till 1997 in the Morava River basin (Σ WWTPs + municipal sewers)														
	year	1993	656	19.5		190	143			323				52 actions
		1994	936	27.8		321	243			372				55 actions
		1995	1,218	36.1		443	328			447				97 actions
		1996	1,305	38.7		533	387			485				102 actions
		1997	1,260	37.4		897	342			421				94 actions
														(122 actions in total)
														others: mostly municipalities

Annex B-3

Compilation of Planned Investments

Table 2 Compliance of Planned Investments (Million US$, Million CZK)

No	Type/ Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources					International Funding			Remarks
					Equity	Envir. Fund	Public Grants		Others	Organisation	Grant	Loan	
							Central Budget	Local Budget					
		mil. CZK	MUS$		mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		MUS$	MUS$	
1.	WWTP Brno (Modrice)	1,301	39.7		37,278	0		167	186	EU	9.1	19.8	others: either GEF(5.7MUS$) or syndicated loan
				1998				20	-	EBRD	1.5	3.0	
				1999				40	50		2.0	4.5	
				2000				40	60		2.0	5.3	
				2001				40	46		2.0	5.0	
				2002				27	30		1.6	2.0	
2.	WWTP Zlin	354	10.8			0	132	117		GEF	1.6	1.6	
				1999			40	35			0.4	0.4	
				2000			40	35			0.5	0.5	
				2001			35	30			0.5	0.5	
				2002			17	17			0.2	0.2	
3.	WWTP Uherske Hradiste	165	5.0			0	75	64		GEF	0.8	0.8	
				1999			15	10			0.2	0.2	
				2000			20	15			0.2	0.2	
				2001			20	20			0.2	0.2	
				2002			20	19			0.2	0.2	
4.	WWTP Hodonin	76	2.3			0	30	2.0		GEF	0.4	0.4	
				1999			5	5			0.1	0.1	
				2000			10	5			0.1	0.1	
				2001			10	5			0.1	0.1	
				2002			5	5			0.1	0.1	
5.	WWTP Kozeluzny Otrokovice	77	2.4		340	0		37	20	GEF	0.3	0.4	others: loan or central budget
				1999				5	5		-	0.1	
				2000				12	5		0.1	0.1	
				2001				10	5		0.1	0.1	
				2002				10	5		0.1	0.1	
6.	Remedial Measures Fosfa Postorna	110	3.4		780	0			65	GEF	0.7	0.7	others: Fund of National Assets
				1999					25		-	-	
				2000					20		0.3	0.3	
				2001					10		0.3	0.3	
				2002					10		0.1	0.1	

7.	Remedial Measurures and Reduction of Slurry Production Gigant Dubnany	151	4.6			0			99	GEF	0.8	0.8	others: Fund of National Assets
				1999					15		-	-	
				2000					30		0.2	0.2	
				2001					30		0.3	0.3	
				2002					24		0.2	0.2	

Annex B-4

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