DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
CZECH REPUBLIC

EXECUTIVE SUMMARY

MINISTRY OF ENVIRONMENT

in cooperation with the

Programme Coordination Unit
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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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1. Executive Summary

1.1. The State of the Danube Environment in the National Context

New political orientation of the country after 1990 has led to significant changes. Transformation of economy, which brought about a gradual renewal of value relationships, has had favorable consequences for the impact on the environment. Decrease in production has led to a decrease of pollution loads to the environment. Decreased agricultural production, along with a considerable increase in the cost of agrochemicals resulted in a decrease of pollution of both surface and ground waters.

The cut-back in economic activities has provided an opportune capacity for carrying out a new environmentally oriented strategy in renewed protection of the air, water, soil, forests, nature and landscape.

After completing an inventory of environmental conditions in the country, the Czech Ministry of the Environment formulated a document called ”State Environmental Policy” in 1995, which was based on two main principles:

- responsibility of the present generation for preservation and transmission of fundamental life values to future generations
- gradual shift of part of the responsibility for the state of the environment from the State to the population and private sector

Although a relatively short period of time has passed since the new approach was adopted, significant results have been achieved. Total pollution discharges from point sources were reduced, but unfortunately, the expressive decrease in the use of produced fertilizers did not lead to a corresponding decrease in concentrations in nitrates and phosphates. Together with other effects, the high nutrient content leads to eutrophication of some water flows and reservoirs. Water at about 40 % of the monitored stations on large rivers was heavily polluted by inorganic nitrogen. Long-term trends mostly reflect only a decline in average concentrations of ammonium nitrogen. As regards phosphorus, water at 60 % of monitoring stations is ranked to heavily polluted waters. Moreover phosphorus concentrations in last years show an increasing trend. As far as the organic pollution concerns, more than 50% of sampled sites corresponded in 1996/97 to heavily polluted waters, but the long-term trends are mostly decreasing. In the last several years, when the spectrum of monitored chemicals was enlarged, a problem of notably high concentrations of PCBs in the surface water in the Morava River basin appeared. Comparatively high mercury content has been recorded. The most important point sources of pollution are cities and metropolitan areas. There are 33 towns with more than 10,000 inhabitants in the Morava River basin. Municipal wastewater together with flood drainage from hard-surface city areas constitute a source of organic substances, nutrients, oil and microbiological pollution. Nearly all these towns are fitted out by wastewater treatment plants, but they are mostly on the limits of their capacity. The sewer systems also represent a considerable problem, as they are old and/or poorly built and make a source of ground and surface water contamination.

Sometimes the poorly sealed sewer systems drain ground water into the wastewater treatment plants and thus decrease the efficiency of water treatment.

Of the industrial sectors, the great polluters in the Morava River basin are the food, consumer, paper, power and chemical industries. Contamination by heavy metals comes from smaller metallurgical plants and tanneries that are also a source of poorly degradable organic substances. The oil pipeline network, the subdued uranium industry and the operation of the Dukovany Nuclear Power Plant are potential hazards to the basin.

1.2. Population Affected by Water Pollution, Impact on Ecosystems

The region of the Morava River basin belongs to the least problematic areas in the Czech Republic. At the end of the period of directed central planning, which was distinguished by the highest stage of environmental disturbance, the greatest environmental problems were concentrated in the Elbe and Oder River basins. The only region in the Morava River basin with strongly disturbed environment of national importance is a part of the Brno town laying in the Svitava River subcatchment, where the old industry is concentrated. As a continuous area with disturbed environment is also indicated the middle and downstream part of the Morava River valley (between the towns Olomouc and Hodonin) with a combination of the influences of nearly continuous settlements, industry and intensive agriculture.

On the other hand there are a lot of areas with little disturbed environment which are mostly protected by declaring them as National Parks, protected Landscape Areas or Wetlands. Important marsh localities have been preserved along the Upper Morava upstream Olomouc (Litovelské Pomoraví) and along the Dyje River from the confluence with the Jihlava and Svratka Rivers to the confluence with Morava. Nevertheless the construction of the Nové Mlýny reservoirs on the Dyje River interrupted the continuous biocorridor along the Morava and Dyje Rivers. This floodplain still remains in a relatively well preserved natural state with old floodplain forests, riverbank meadows, with oxbows offering wetland biotopes for numerous rare plant and animal species. This area should become a part of the proposed Trilateral National Park spreading out along the Danube, Morava and Dyje Rivers at the territory of Austria, Slovakia and the Czech Republic.

The most important environmental problems in the Morava River basin should be seen in the following aspects:

- comprehensive impact of great settlement agglomerations, especially of the cities of Brno, Olomouc, Zlín-Otrokovice with high concentration of population, human activities, industrial production and traffic
- comprehensive impacts of the largescale agricultural production which is concentrated in the most productive areas resulting in unfavorable large scale landscaping, mass applications of agrochemicals and liquidation of significant segments of the original greenery.
- Rapid development of the individual traffic, shift from the ecologically favorable kinds of traffic to the trunk roads.

1.3. Hot Spot Analysis

The first attempt to make a list of hot spots in the Morava River basin on the territory of the Czech Republic was prepared in the Diagnostic Preinvestment Study elaborated by BCEOM – Lahmeyer joint venture under a World Bank contract between the end of November 1992 and April 1993. This list of hot spots was adopted by the Strategic Action Plan for the Danube River basin, which has been approved by the Danube Environmental Programme Task Force in October 1994.

Updating of this first list of hot spots was realized in the framework of the National Action Plan preparation. The basic information on the most important sources of pollution and the actual list of hot spots were prepared in the period of 1992 – 1995 within the national study on water protection – Project Morava. The hot spots given there were ranked into five lists covering municipal, industrial and agricultural hot spots as well as dangerous waste dump localities and endangered ground drinking water resources.

The first stage of the national Project Morava gave a complex survey of water quality and ecosystems protection and identified the main sources of pollution. It formed an important background of all national and transboundary activities in the field of water quality protection. For

the purpose of the GEF – Danube River basin pollution Reduction Programme there were made some changes in the list of hot spots elaborated within the National Action Plan. Five previous municipal hot spots were deleted (Jihlava, Vyškov, Třebíč, Hanušovice, Valašské Meziříčí) with respect to the state of improvement of their treatment process and/or to their transboundary effect. On the other hand several new polluters potentially causing higher transboundary effect were added to the list.

To assess the priorities and rank of these hot spots an attempt to create an objective system of universal criteria for use in a simple multicriterial decision analysis was made. According to the methodology given for this GEF Programme ten criteria covering all the given ranking aspects were used. Besides application of those aspects a new criterion was introduced evaluating the state of river denaturalization downstream the hot spot together with the influence of diffuse pollution from the detached river basin upstream the assessed hot spot. Using the scale with maximum five-point assessment for all ten incorporated criteria a scheme for the decision analysis was elaborated. This scheme enabled to elaborate an assessment and rank the hot spots with maximal objectivity.

The summary of this evaluation for municipalities made the final score from 26 to 39 points. Among the high priority municipal hot spots were ranked those with the point assessment score higher than 31 points. The group of medium priority hot spots achieved more than 28 points. In the group of industrial hot spots, the high priority hot spots were those that gained more than 30 points and the medium priority ones those with more than 24 points.

The summary of hot spots is presented in the table in the Annex.

1.4. Actual Foreseen Pollution Reduction Measures

The actual measures for pollution reduction are mostly of technical character. They include constructions, reconstructions, extensions and intensifications of municipal and industrial wastewater treatment plants, reconstruction of sewer systems and remedy of old dumping sites. Likewise there are also prepared some measures in agriculture including important projects of landscape rehabilitation and of animal farms sanitation. These measures for water pollution reduction are the practical result of implementation of normative, economic and informational measures. In these consequences there should be particularly mentioned the Governmental Regulation No 171/1992 Coll. aiming at limits of wastewater discharges. The implementation of this regulation has had a crucial influence on water quality improvement and its consistent application could be indicated as the turning point in the unfavorable former tendency.

1.5. Planned Projects and Investment Portfolio

Based on the revision of the hot spots the following high priority projects are planned in view of their transboundary effects:

Numbers in brackets indicate the investment portfolio in million US$.

Municipalities:

1. Brno WWTP. Extension and intensification of WWTP (39.7 MUS$)
2. Zlín WWTP. Extension and intensification of WWTP (10.8 MUS$)
3. Uherské Hradiště WWTP. Reconstruction of the technology (5.0 MUS$)
4. Hodonín WWTP. Reconstruction, intensification and extension of WWTP (2.3 MUS$)

Industry:

5. WWTP at Koželužny Otrokovice tannery. Intensification of wastewater treatment. (2.4 MUS$)
6. Remedial works at Fosfa Poštorná phosphate factory. Remedy measures for removal of previous environmental damages. Upgrading of WWTP (3.4 MUS$)

Agriculture

7. Remedial Measures and Reduction of Slurry Production in the Large-capacity Pig Farm Dubňany (4.6 MUS$).

2. Description of the State of the Danube Environment

2.1. Water Resources

The Morava River basin can be characterized as an area with limited water resources and high population density (about 130 inhabitants per km^2). It is highly exploited both economically and agriculturally.

Precipitation represents the only source of water in the Morava River catchment, the average yearly sum of precipitation varying from 478 mm in the southern lowland to 1,474 mm in the mountainous area in the north.

The Morava River basin territory makes up 3.25% of the area of the Danube basin, but it contributes only by 1.93% to its mean yearly discharge. Thus only 1,158 m^3 of annual runoff corresponds to each inhabitant of the Morava River basin, which is 82 % of the average value for the Czech Republic and only 45.5% of the mean value for the Danube catchment inhabitant.

The small amount of water in the catchment is exacerbated by the low capacity of groundwater resources, caused by geological structure of the area. Water bearing Quaternary sediments cover only a small part of the territory along the main watercourses. Full 82% of the total reserves of ground water is already being utilized.

Law protects these areas of the natural water accumulation, nevertheless the danger of their contamination is high. Most of the human activities are concentrated in the alluvial valleys (towns, industries, villages, waste disposals), where the porosity and thus the vulnerability to the pollution coming from air, soil and water bodies is the highest.

Surface water quality in water bodies is unfavorable. Most river reaches are marked three or four according to Czech five-degree classification of surface waters. It means that they are polluted and can only be used for industrial supply (3^{rd} class) or heavily polluted thus suitable only for limited purposes (4^{th} class).

Downstream of large cities (Brno, Olomouc, Zlín-Otrokovice) and on streams with low discharges (polluted by intensive agricultural activities), the water quality is so deteriorated that it comes under 5^{th} class. Such water is not suitable for any purpose.

For drinking water supply only water of the first or second class can be used (after adequate treatment). This quality is met only at few upstream reaches of watercourses.

2.2. Biological Resources and Ecosystems

The Morava River basin territory is characterized by a special geography – there are represented all three main Central European biogeographical units. The geographical position along with various kinds of landscape and varied geology brings a mosaic of ecosystems and great biodiversity. Also the altitude varies considerably (148 – 1491 m a.s.l.).

There are several plant and animal species whose habitats are at the northernmost reach of their territory.

Several rare bird species breed here or at least attempt breeding, including White-Tailed Eagle while ponds and reservoirs are quested for by wintering bird species.

There are successful attempts to re-establish the population of beaver. The mountainous regions in the north are linked to the Slovak Carpathian Mountains from where large beasts like bear, wolf and lynx occasionally come to the Morava River basin.

The most important biotopes with high biodiversity include flood plain forests and wetlands, limestone cliffs, deep cut parts of river reaches, nature-like meadows and forests with ancestral plant (tree) composition. Most valuable habitats are protected in natural reserves, including 27 natural parks, 7 protected landscape areas and 1 national park. Two of the protected landscape areas were given the status of UNESCO biospherical reserve. Large protected areas make up 14% of the basin area.

Floodplains of the Morava River and its tributaries function as a natural migration passage for animals and plants. Some of them belong to the European ecological network ECONET.

Man has considerably modified major part of the landscape within the Morava River basin. Forested area has diminished: from almost the whole territory to one third of that. The tree composition of forests changed significantly. Agricultural (arable) land is characteristic for lowlands, whereas meadows and pastures are common in higher altitudes. For southern parts of the region orchards and vineyards are typical.

The most negative features in the basin include especially:

- Continuous arable land, connected with pastures and meadows liquidation and of scattered woody plants along with intensive use of agrochemicals
- Large scale drainage of wet agricultural land
- Large scale conversion of original deciduous and mixed forests to coniferous ones
- Mountainous parts of basin touched by fytotoxic imissions
- River training and other technical works on rivers
- The most ecologically valuable areas flooded by backwater of reservoirs

Attempts are made to alleviate the negative features by various programmes focussing on landscape management, rehabilitation of rivers, formation of ecological stability systems, agricultural landscape revitalization and nature friendly forest management.

2.3. Human Impact and Key Issues of Environmental Degradation Due to Water Pollution

Man has used lowland areas within the Morava River basin territory since prehistoric era. Earth in the river valleys is very fertile which has induced development of intensive agriculture. It results in huge areas of transformed landscape, demand for water for irrigation, effects of animal farms operation, overapplication of agrochemicals. In the era of socialism the intensive agriculture extended to the hilly and highland areas where it is neither effective nor appropriate with respect to landscape management.

The three main municipalities in the basin - Brno, Olomouc and Zlín - are the most important water consumers and wastewater producers. Besides them there are another three towns with population about 50,000 and 12 towns with population 20-50,000. A typical feature for the countryside is a dense network of small towns with population less than 5,000. In these regions the water consumption is lower but on the other hand water supply and wastewater treatment is more costly.

Engineering industry along with food processing, tannery, wood processing and construction materials production is typical of the basin. During the socialist era such industries like metallurgy, chemical industry and power engineering also developed in small towns. There is one nuclear power station in the basin that abstracts water for cooling purposes.

In respect of transportation the region is important for transit by road and by rail. After break-up of Czechoslovakia the importance of north – south transportation raises instead of former west – east direction. Brno is a highway node point whereas Bøeclav is a railway junction of international importance. Navigation did not develop.

Water related recreational activities, water contact sports including, are most significant at the reservoirs Vranov, Brno and Nové Mlýny.

Although there are not such intensively deteriorated areas in the region as in other parts of the Czech Republic, a part of the Brno town, so-called Posvitavská zóna ranged among the areas with damaged environment of national importance (air pollution and high production of wastewater). Also the area between the towns of Olomouc and Hodonín (approx.) has a significantly deteriorated environment. It is densely populated and there are numerous middle size towns, industries and intensive agriculture.

On the other hand there are many regions in the basin with relatively low degree of environmental degradation.

After 1990 the pollution from many industrial, agricultural and communal water pollution sources diminished due to decline in production and more economical management of the natural resources. Boost of individual automobile transportation brings problems. There is a shift in the consideration of polluting matters from their amount rather to their structure and hazard they present.

Main environmental problems in the region:

- Complex effects of large agglomerations like Brno, Olomouc, Zlín-Otrokovice (population concentration, activities, industries, transportation)
- Complex effects of agricultural production concentrated in the most fertile areas (large area landscape management, application of chemicals, liquidation of important segments of original verdure
- Boost of individual transportation, shift from ecological types of transportation (railway) to road transportation.

3. Population Development and Water Sector Relevant Characteristics

3.1. Analysis of Demographic Data and Projection of Urban and Rural Population in the Morava River Basin

By January 1, 1996, there were 10,321,344 inhabitants in the Czech Republic, one year later it was only 10,309,137. Data for municipalities are available from January 1, 1996, when in the territory of the Morava River basin lived 2,778,168 inhabitants, which was 26.9% of the population of the Czech Republic. Population density in the basin was 131 inhabitants per km^2, which corresponds to the Czech Republic, mean value.

There are 19 towns with population higher than 20,000 inhabitants within the Morava River basin. The most significant urban centers are:

Town	Population
Brno	390,000
Olomouc	105,000
Zlín	83,000
Jihlava	52,000
Prerov	51,000
Prostìjov	50,000

In 1996 the urban population within the Morava River basin represented 60.47% of the whole population. From the point of view of water management the most important factor is not only the number of inhabitants but also the level of technical infrastructure of municipalities and households. This can wipe off the differences between urban and rural areas. The greatest differences can be seen in municipalities with population of about 500 inhabitants. Generally an opinion is accepted that under this limit it is not economical to build classical public water supply systems, sewerage systems and wastewater treatment plants.

In 1991, 391,756 inhabitants within the Morava River basin lived in municipalities with less than 500 inhabitants, representing 14.3% of the total population.

On the whole, the sanitary infrastructure equipment is of a good standard in the basin. 80% of the population is connected to public water supply systems, the remaining 20% is supplied with water individually, mostly from private wells. 72% of inhabitants is connected to the public sewerage systems, 85% of the collected wastewater is treated.

3.2. Estimation of Actual and Future Demand of Water

The new political orientation of the country after 1990 has led to significant changes. Transformation of economy brought about a gradual renewal of value relationships, which led to a considerable increase in the price of water. It resulted in a dramatic decrease of water consumption. Drinking water intakes still have declining trend. In 1995 water withdrawals represented only 70.9 of those in 1990. Estimations for the Czech part of the Danube basin give the following numbers:

Year	1990	1991	1992	1993	1994	1995
Drinking water invoiced to households (million m^3)	111.9	102.2	99.3	87.9	84.6	79.3

Differences in water consumption between urban and rural areas are not too significant in the Czech Republic. The consumption rather depends on the connection to the public water supply.

Since 1990, water intakes are changing so significantly that it is very difficult to forecast their future development. Extrapolation of the actual trends is not possible because there are also significant changes in population reproduction rates. The total fertility rate sank from 1.87 in 1989 to 1.18 in 1996. The prognosis for the Czech Republic prepared by water management experts can be conditionally applied also in the Morava River basin.

This prognosis reflects some development assumptions, which leads to estimation of the minimal and maximal expected values. For the time horizon of 2015 the prognosis gives the following numbers:

Indicator	Upper limit	Lower limit	Average
Specific domestic water demand (l/person/day)	170	150	160
Specific water demand (rate of total amount of water produced by public waterworks - l/person/day)	373	282	328
Total population (Mil.)	2.78	2.70	2.74
Supplied pop. (Mil.)	2.40	2.29	2.345
Water intakes by population (Mil. m^3)	149	125	137
Water produced by public waterworks (Mil. m^3)	327	236	281

This consideration indicates that in 2015 water intakes for public water supply systems will approximately reach the level of the end of nineteen-eighties. It means that the present water resources will be sufficient for the following 20 years supposing they will not be depreciated.

3.3. Estimation of Actual and Future Production of Wastewater

Information on the quantity of wastewater discharges in the Danubian part of the Czech territory in the period 1990 – 1995 gives the following table:

Year	1990	1991	1992	1993	1994	1995	1996
Wastewater discharges into water courses (Mil. m^3)	358.1	345.3	338.5	311.1	299.3	256.4	263.3

Wastewater discharges into watercourses still show declining tendency. In 1995 only 71.6% was discharged of the amount in 1990. This closely corresponds to water consumption figures.

Also the pollution discharged into watercourses is decreasing. Information is given in the following table:

Indicator	1990	1991	1992	1993	1994	1995	1996
BOD_5 (thousands t/year)	24.3	29.7	25.8	24.3	17.5	16.2	6.6
COD_{Cr} (thousands t/year)	76.0	72.0	71.2	70.0	56.0	45.5	23.9
Undissolved matters (thousands t/year)	31.3	30.0	29.3	27.2	24.5	20.0	10.8

The prognosis of wastewater production by the population for the year 2015 is based on two assumptions. The mean value of the specific wastewater production is 180 l/person/day. It corresponds to the forecasted drinking water consumption in 2015 lowered by irrecoverable losses of water (20%).

The total population in the Czech part of the Danube basin in 2015 is expected to be 2.74 million. It is further assumed that the population connected to wastewater treatment systems will increase from 71% (1995) to 80% (2015), and that the total amount of wastewater produced by the population will reach 102 mil m^3. For a comparison, the highest real production of wastewater by population so far was in 1991 – 84.1 mil m^3, whereas the lowest – 57.2 mil m^3, in 1995. The expected rise in wastewater production is mainly caused by the rise of expected water consumption by households.

3.4. Analysis of Health Hazards through Water Pollution and Unsanitary Conditions.

The greatest part of the population (1.7 Mil. inhabitants) lives in the area where the water quality in watercourses corresponds to the third and fourth class of the Czech classification:

Class III – polluted water suitable only for:

- industrial supply
- drinking water supply only if no better quality water is available

Class IV – heavily polluted water suitable only for limited purposes.

The direct relevant influence on the health condition of the population can not be proved. The negative impact is rather on the environment, direct epidemiological threat has not been registered. In 1996 no case of infection by drinking water consumption was proved (from the total sum of 30,000 registered infections). Certain risks can arise from water contact sports exercise at rivers and reservoirs though it does not present a source of serious diseases and infections. In respect to that it is necessary to stress, that drinking water supply in the Morava River basin is to a great extent covered by abstractions from the protected ground water resources. Due to the water consumption decrease the proportion of ground water used is increasing.

Population supplied from individual domestic wells is highly exposed to nitrates, which represents a dominating problem. This water must not be used for food preparation for nurslings.

Generally, it can be stated that in all watercourses monitored in the Morava River basin the water quality improved during last several years. This trend can be expected to continue. In the medium and long-term perspective the decrease of emissions from diffuse sources of pollution is expected.

Vulnerability of the shallow groundwater resources to accidental pollution or to pollution from abandoned waste dumpsites is an everlasting problem. The potentially endangered resources are intensively monitored.

4. Analysis of Actual and Expected Impact of Economic Activities on Water Demand and Potential Pollution of Aquatic Systems

4.1. Industrial Activities

Since 1990, water abstractions by industries continually decline. In the period of 1990 – 1995 it dropped by 36.1%. Mostly abstractions of surface water declined, proportion of groundwater abstractions by industries is low (9%).

Also for once-through cooling purpose the trend of abstractions declines (in period 1990 – 1995 by 45%).

By the industrial discharge is understood water coming to water bodies directly from industries. In 1995, 105.7 Mil. m^3 was discharged, that was 59.7% comparing to 1990.

Complex data on proportion of treated and biologically treated industrial wastewater discharges in the Morava River basin are not at disposal.

Since 1990, industry in the Czech Republic is undergoing considerable changes. It is being restructured, privatized and production decreases. Therefore the evolution of water consumption by this sector will depend on production revitalization, implementation of new, water saving technologies, efficient water management by industries, substitution of once-through cooling by circulation cooling in energetics etc. According to experience from EU countries water consumption by industries can decrease by 10% in 2015 comparing to 1995, on the other hand experience from other EU countries shows that it can rise by 20% as well. It is assumed that by 2015 industrial water consumption will not have reached numbers from 1990.

So the present water resources should be sufficient in the long-term time horizon.

4.2. Municipal Discharges

By municipal wastewater is understood water discharged by public sewerage systems. It is usually a mixture of household wastewater and industrial wastewater.

It is estimated that comparing to the year 1990, in 1995 discharges from public sewerage systems dropped by 17% (from 81.7 to 57.2 Mil. m^3). In the region of south Moravia, which makes up essential part of the Morava River basin, in 1995, 6.3% of water discharged from public sewerage systems to water bodies was not treated (precipitation water excluded).

4.3. Agricultural Activities

Water abstractions for irrigation decline since 1990 as well (with the exception of 1994). Abstraction of 11.2 Mil. m^3 in 1995 presented only 21.5% (!) of abstractions in 1990. In the present situation, when the future development of agriculture in the Czech Republic is not known and can be significantly influenced particularly in connection with the incorporation of the country to EU, it is very difficult to make prognosis of future abstractions for irrigation. Nevertheless it was attempted to make prognosis for the time horizon of 2015 which reckons with two scenarios of development in the Czech Republic. In average year the abstractions would reach 54 Mil. m^3, 84 Mil. m^3, respectively, whereas in a dry year these numbers are assumed to be 88 Mil. m^3, 126 Mil. m^3, respectively.

Austria is seriously interested in purchasing water from the Czech part of the Morava River basin for irrigation.

Concrete data on discharges of agricultural wastewater from point sources are not available. Large animal farms present a serious danger for surface and ground waters. Problems arise, where capacity of a farm is higher than the capacity of fields available for slurry disposal. In the frame of an Action Plan for the Morava River priority localities were defined regarding the threat to water by slurry production and disposal at large capacity animal farms. Ten large capacity pig farms were concerned, each with the capacity higher than 10,000.

4.4. Solid Waste Disposals and Possible Soil and Groundwater Contamination

In 1991 there were 8,536 solid waste disposal sites recorded in the Czech Republic, out of which 2020 were still in operation. Only 6% of the operated ones complied with then valid operational regulations.

Most of the waste sites were illegal with no protection measures to assure safety of groundwaters from pollution.

In 1996 the operation of unsafe waste sites was stopped. At most of them monitoring drill holes were done and sampling conducted twice a year. Progressively, these sites must be remedied, rehabilitated and decontaminated.

In 1996, in the Morava River basin there were 83 waste sites in operation, which complied with technical parameters needed for a safe operation.

On the other hand, in the same area, it is expected that 3-4,000 (!) abandoned waste sites still present a peril for soil, their underlay and groundwater.

At present, investigation of these sites is still going on. It comes out, that the extent of damages at the abandoned waste sites is higher than it has been expected. The problem is enhanced by the fact that there is no evidence of the type of the dumped materials. Nevertheless it is clear, that the biggest peril comes from the abandoned waste sites where industrial and other hazardous wastes were disposed.

5. Analysis of Water Quality Data and Description of Environmental Impact on Ecosystems and Human Quality of Life

5.1. Water Quality Data Critical to the Transboundary Analysis

For the purpose of the transboundary diagnostic analysis a large set of data measured in the reference period of 1994 – 1997 has been prepared. The data set incorporates the permanent sampling stations that lie close upstream or downstream the high priority hot spots. Among them there are also two Czech Transnational Monitoring Network stations, both situated in the transboundary stretch of the Morava and Dyje Rivers confluence (stations Morava-Lanžhot and Dyje-Pohansko). The stations characterizing water quality upstream the confluence of the Morava River and the Danube River are situated on the Slovak and Austrian border outside the Czech Republic territory. From the analyses it can be seen that the predominant problem for the Morava surface water quality is the presence of nitrogen and phosphorus compounds. As to other water quality parameters from the group of heavy metals and other hazardous chemicals mercury and PCB concentrations are worth of attention. The COD_{Cr} shows the adverse conditions in terms of high concentrations of organic pollution that is a serious problem downstream the large towns on the Morava River.

Nitrogen: in the last four years the concentrations of the total inorganic nitrogen fluctuated in the chosen 11 sampling sited between 1.4 – 12.2 $mg.l^{-1}$. The maxima of nitrogen were found in the Svratka River downstream the Brno hot spot (12.2 $mg.l^{-1}$), in the Svitava River upstream Brno (10.5 $mg.l^{-1}$), in the Svratka River in Brno-Pisárky (11.0 $mg.l^{-1}$) and in Døevnice River downstream the Zlín hot spot (10.5 $mg.l^{-1}$). A slightly lower maximum concentrations, assessed in the Morava River itself (above 7 $mg.l^{-1}$), reflect certain improvement in this water quality parameter. The total inorganic nitrogen downstream the pigs farm Gigant Dubòany amounts to 12 - 25 $mg.l^{-1}$ in the Kyjovka River. In ammonium nitrogen 39% out of 73 sampled sites were assessed by the 4^{th} and 5^{th} class of quality, which means heavily and very heavily polluted water.

Results gained when smaller watercourses show that about 16% out of 816 sampled sites were ranked in this water quality class. The long-term trends (1966-1991) mostly reflect a decline of average concentrations of NH_4^+. Also the last decade (1986-95) trend shows a decline in ammonium nitrogen and mostly no trend in nitrate nitrogen.

Phosphorus: concentrations of total phosphorus in 1994-97 were within the range of 0.06-1.52 $mg.l^{-1}$. From the survey of total phosphorus data it can be seen that the maxima in this parameter (>1 $mg.l^{-1}$) were found in 1994-97 downstream the Brno hot spot in the Svratka River (1.55 $mg.l^{-1}$), downstream Hodonín (1.43 $mg.l^{-1}$), downstream Otrokovice (1.52 $mg.l^{-1}$) and in Lanžhot (1.25 $mg.l^{-1}$). The Lanžhot station is located very close to the Morava River boundary profile. Assessment of the main rivers in the Morava River basin shows that in the last four years 58% of the monitored stations was evaluated by the 4^{th}-5^{th} classes, but only 20% of small rivers. The long-term trends available only for phosphate phosphorus showed in 1966-91 strongly increasing trend. In the last decade the increasing trend of concentrations has been found in major part of sites in the Svratka River basin, in other parts of the Morava River basin this trend was either declining or statistically significant. In major part of the stations the average value has come up to 0.3-0.5 $mg.l^{-1}$, while the permissible imission value in surface waters is according to the Governmental Regulation 0.4 $mg.l^{-1}$.

COD: Values of COD_{Cr} fluctuated from 5.3 to 75 $mg.l^{-1}$ in 1994-97. The most serious problems were found in the Morava River downstream the major towns of Otrokovice, Zlín and Kromìjíž as well as Prostìjov and Pøerov where the cumulative effect of the pollution discharges was evident.

The maximum value of about 75 mg.l^{-1} occurred downstream Zlín (Døevnice River), another high value coming up to 59 mg.l^{-1} was found in the Morava River downstream Otrokovice. When assessing all the 73 sampling sites situated at important rivers, 51% of these sites showed 4th-5th class of quality. Long term trends of this water quality parameter were mostly decreasing reflecting improvements in organic pollution loads. Though the most significant sources of pollution have their treatment plants, an increasing trend in one third of the evaluated stations in the Dyje River basin still can be seen.

Mercury: as the most dangerous for human and aquatic life out of the group of heavy metals high mercury concentrations were assessed in the national Project Morava in 1992-1995. Except for 4 stations, in all other measured sites presented in this study the maximum concentrations of Hg were higher than the permissible value for this parameter in the Governmental Regulation (1.0 mg.l^{-1}). The maximum concentrations were found in sampling station at the Svratka River downstream Brno (2.8 mg.l^{-1}), in the Morava River downstream Otrokovice (2.6 mg.l^{-1}) and the Svitava River upstream Brno (2.0 mg.l^{-1}). It is not possible to assess the long-term trends in this parameter because the monitoring of heavy metals started only at the beginning of 90s.

PCB: In the last several years with the enlarged spectrum of monitored chemicals a problem of notably high concentrations of PCBs in the surface waters in the Morava River basin appeared. PCBs originate in the old loads of the environment from products with their content. Even now after their prohibition their leaching into water cannot be excluded. In the period of 1994-97 the highest value of PCBs was found in the Svitava River (3345 ng.l^{-1}). Also the concentrations in the Morava River in Lanžhot and Uherské Hradištì were notably high (221 and 105 ng.l^{-1}resp.). According to the Governmental Regulation No 171/1992 Coll. the permissible imission value is 25 ng.l^{-1}. As the PCBs have been monitored only since 1991, no trends in concentrations can be given.

Transboundary effects of pollution

In the Czech Republic the quality standards for wastewater imissions into water courses are given by the Decree No. 171/1992 Coll., which provides the admissible water discharges. Mostly they comply with the EC regulations and transboundary requirements in Austria and Slovakia. Since 1967 the water quality in the shared waters has been monitored bilaterally on the basis of a special treaty between the former Czechoslovakia and Austria, dealing with the solution of the water management concerns. The results of the monitoring are annually evaluated and measures for the improvement are recommended. Similar treaty with Slovakia is under preparation.

6. Identification, Description and Ranking of Hot Spots

The first list of hot spots for the Czech part of the Morava River basin was prepared in 1994 within the Strategic Action Plan for the Danube River basin. The list was updated then in the framework of the National Action Plan where five lists of hot spots were presented: municipal, agricultural and industrial hot spots as well as dangerous waste dump localities and endangered sources of ground water for drinking.

For the purpose of the GEF – Danube River Basin Pollution Reduction Programme there were made some changes in the list of hot spots elaborated within the National Action Plan. Five previous municipal hot spots were deleted (Jihlava, Vyškov, Třebíč, Hanušovice, Valašské Meziříčí) with respect to the state of improvement of their treatment process and/or to their transboundary effect. On the other hand there were added several new polluters that potentially cause higher transboundary effect. Only high priority hot spots are listed below.

6.1. Municipal Hot Spots

Four municipalities in the Morava River basin were identified as high priority hot spots. They are the greatest polluters of transboundary rivers within the basin, threatening the downstream users and the aquatic life, especially in protected areas. Below, the hot spots are numbered in accordance with the annexed map.

Hot spot 1

The first rank within the assessment belongs to Brno with more than 400,000 inhabitants (PE=500,000). There is a great contribution of structural and textile industries. Dilution factor of the Svratka River downstream Brno is rather low. Insufficient capacity of the municipal WWTP along with an old municipal sewerage network system presents a persistent water quality problem for downstream users (infiltration drinking water uptakes, irrigation, recreation) as well as for the nature in the largest wetland in the area and proposed Trilateral National Park. In 1996 this polluter did not fulfil the emission limits given by Governmental Regulation No. 171/92 Coll. in parameters of ammonium nitrogen and total phosphorus.

Hot spot 2

Pollution produced in Zlín (PE=150,000) is not sufficiently treated and the dilution of discharged water in the small Døevnice River is very low. There is a significant industry contribution to pollution produced in Zlín. The pollution endangers drinking water uptakes from alluvial ground water resources as well as aquatic life in the transboundary area where the Trilateral National Park is proposed. In 1996 the WWTP did not fulfil any of the three given water quality parameters.

Hot spot 3

In Uherské Hradištì (PE=83,000) the WWTP needs to be completed with a nutrient reduction unit. Downstream water quality problems arise due to combination of high nutrient emissions, upstream water quality and periods of low discharges. This hot spot is situated in a protected area of natural water accumulation, rather close to the transboundary river stretch.

Hot spot 4

The town Hodonín is located on the border with Slovakia and close to Austrian border. Its WWTP needs improvement of organic matter and nutrients removal. In 1996 it did not meet emission limits in COD and N-NH4+. The town pollutes the river in transboundary area and represents a danger to an area of natural water accumulation as well as to the proposed Trilateral National Park.

6.2. Industrial and Mining Hot Spots

Hot spot 5

The Koželužny Otrokovice (Otrokovice Tannery) is a dominant industrial polluter in the central part of the Morava River basin. Though the third phase of WWTP intensification was finished in 1994, ammonium nitrogen removal is low efficient and COD pollution is high. Intensification needed, including nitrification and denitrification. This would lead to improvement of quality of ground water resources. Proposed Trilateral National Park would be affected positively.

Hot spot 6

The phosphate factory FOSFA Poštorná discharges wastewater to the Dyje River very close to the common Czech-Austrian river reach. Testing period of a new decontamination unit finishes in June 1998, but further WWTP upgrading with phosphorus removal is strongly needed. There are also problems with leaches from the adjacent dumpsite. Pollution from this hot spot contributes in a very short distance to pollution from the WWTP in Bøeclav. Danger to protected area of natural water accumulation and to Trilateral National Park.

6.3. Agricultural Hot Spots (Point and Diffuse Sources)

The investment preparedness of agricultural projects is different and many difficulties have been connected with vague ownership relations and with very slow transition procedures in agriculture. These hot spots are not included in the annexed map.

Hot spot 7

The large-capacity pig farm "Gigant" Dubòany with 20,000 of livestock is close to the border profile near the district town Hodonín. Total capacity amounts to the value of 27,000 pieces of livestock. There are two special problems here: 1) need of remedial measures according to the risk analysis recently carried out and 2) relevant reduction of slurry production in the pig farm. The farm must be reconstructed and upgraded and it is necessary to propose the best available technology for the purposes of reducing impacts of slurry production and application. The existing slurry treatment covers the fugate storing in a pond and on fields by means of irrigation.

However, there are some other agricultural hot spots in the basin, e.g. pig farms Milotice (near the pig farm Gigant Dubòany), Tišnovice (near the district town Kromìríž) etc.

Pig farm Milotice

Milotice pig farm with 22,000 pieces of livestock; the capacity is almost 30,000 pieces. The farm is not far to the Dubòany pig farm and to the border profile. The fugate from the farm is stored in lagoons and spread over fields.

Pig farm Tišnovice

Pig farm Tišòovice with the capacity for 20,000 pieces of livestock. It is very near the district town Kromìríž - in the middle part of the Morava River basin. Wastewater from the farm has been treated in the municipal wastewater treatment plant Kromìríž, which is overloaded.

6.4. Ranking Criteria under Consideration of Transboundary Effects

To assess the priorities and rank the hot spots, an attempt to create an objective system of universal criteria for use in a simple multicriterial decision analysis was made. This scheme enabled to elaborate the assessment and ranking of a hot spot with maximal objectivity respecting all the given aspects.

Besides the criteria like COD, N-NH4 and Pt., upstream water quality, dilution factor and amount of water discharged from effluent also the criterion called downstream use of water was applied. Within this criterion a high priority was given in case of downstream drinking water uptakes or if the river reach passes a protected area.

The last two criteria cover the transboundary effect evaluating the distance from the effluent to the international border. The last criterion reflects the denaturalization of the river bottom and banks downstream the hot spot considering also the upstream diffuse pollution effect. Each polluter given in the list of hot spots has been assessed using the data from 1996 (emissions) and 1996-97 (river water quality and other background data).

7. Identification and Evaluation of Pollution Reduction Measures

7.1. National Targets and Instruments for Water Pollution Reduction

National targets for water pollution reduction are entirely presented in the document of "State Environmental Policy" forwarded in 1995 by the Ministry of Environment and approved by the Czech Government. This policy proceeds from generally accepted fundamental principles of environmental protection. On the basis of comprehensive analysis of the state of the environment the document defines the main problems and suggests short- and medium term priority measures to be taken. The goals of the environmental policy and the instruments for their attainment are formulated to maximize the potential for creating an optimal system. This process aims at finding a socially acceptable level of environmental and health risks. The targets concerning the water issues have been reflected into the following priorities towards the water in the short-term context (1995-1998).

- Water quality improving by limiting the pollution discharges
- Reducing the waste production, in particular hazardous waste production
- Eliminating the impacts of harmful physical and chemical factors
- Remedying previous environmental damages
- Improving the air quality through the reduction of harmful emissions, considerably influencing water resources

In the medium term context (1999-2005) resolution of the following problems will increase in importance:

- Creating land use provisions which would safeguard an efficient water protection and fulfil international commitments through regional planning
- Increasing the water retention capacity of land by improving the revitalizing measures already provided for under the Programme for the Revitalization of River Systems).

The analysis of the effectiveness of the current system of instruments for the protection and improvement of the environment demonstrates the need to implement three kinds of measures:

- Normative measures
- Economic measures
- Informational measures.

The normative measures include the whole institutional and legal framework on the basis of private law. The economic measures include different kinds of charges, fines, taxes, and a range of further economic measures. The informational measures should establish an integrated monitoring and information system. Completion of unified methodology for assessing environmental and health risks, introducing the environmental education and public awareness system

7.2. Actual and Planned Projects and Policy Measures

The actual and planned measures/projects are prepared in accordance with the document of the State Environmental Policy of the Czech Republic and due to analysis of the environment stage after 1989. In order to provide protection goals within the Czech Republic and to ensure active

international cooperation, three complex projects have been under way since 1991. They were related to the main sea drainage areas: the Labe (Elbe) Project – North Sea, the Odra Project (Baltic Sea) and the Morava Project (Black Sea). The main interests of the projects were as follows:

- basin hydrology
- changes of runoff conditions (including water erosion, influence of low flow and flood regime)
- water quality monitoring
- point water pollution
- non-point water pollution
- threat to drinking water resources
- evaluation of water quality with the view of drinking water supply
- water balance in the basin
- water use and water management in the basin
- water quality modelingnatural values and denaturalization degree referring to watercourses morphology and ecology
- conclusions and recommendations

The last stage of the Morava River project since the year 1997 is dealing in detail with some special tasks concerning the water quality and water management with respect to some subbasins or smaller regions.

The Czech Ministry of Environment grants these projects. The responsible institute is the Water Research Institute Prague (Branch Brno, for the Morava Project). There are other water-oriented projects dealing with the long-term environmental risks. They are focused on soils, sediments and ground water in the Morava River basin, for example the national programme “Renaturalization of River Systems to Maintain Natural Conditions for Water Life and Wetland Ecological Systems”, and the “Programme for the Care for the Landscape”.

7.3. Expected Effects of Planned and Current and Planned Projects and Policy Measures

Municipal and industrial point sources and agricultural non-point sources of pollution are responsible for a significant proportion of pollution discharged to watercourses. That is why the main attention must be paid to the adequate solution of connected challenges. About five years ago these problems started new approaches to wastewater, to the need of their effective treatment, water law and its amendments, to closer cooperation with downstream countries and water protection and management. These changes were followed by many new studies and projects, which were worked up, especially with regard to municipal and industrial water pollution issues. Especially after 1989 there appeared many documents that aimed at wastewater treatment, first as strategic bases or studies and then as detailed projects. They were relevant to factual situation in rivers, basins, municipalities and industrial establishments in the Morava River basin.

An examination of 50 municipal sources of pollution was conducted in terms of key water quality parameters BOD_5, COD_{Cr}, undissolved and dissolved compounds of nitrogen, dissolved oxygen, dissolved solids, suspended solids, metals as Fe, Mn, Hg, Cd, Pb, Zn etc. The examination of industrial and agricultural sources of pollution was focused on key (below mentioned) localities or regions, which caused water contamination in the Morava River basin. According to the draft of

national Action Plan of the Czech Republic (1996) and part C "Water Quality" six key hot spots in the Morava River basin were chosen and upgraded projects for these priorities were prepared dealing with proposals of water pollution reduction downstream the hot spots:

- municipal WWTP Brno (discharging into the Svratka River),
- municipal WWTP Zlín-Malenovice (discharging into the Dřevnice River),
- municipal WWTP Uherské Hradiště (discharging into the Morava River),
- municipal WWTP Hodonín (discharging into the Morava River),
- industrial WWTP Koželužny Otrokovice (combined effect together with town of Otrokovice, discharge to the Morava River),
- remedial measures in the industrial area of Fosfa Poštorná (combined effect of WWTP and measures round the dump site of the factory, with discharge to the Dyje River),
- remedial measures and reduction of the slurry production in the large-capacity pig farm Gigant Dubňany.

In the period 1991 to 1998 20 wastewater treatment plants were constructed, equipped and completed to operate in municipalities with more than 5,000 inhabitants.

At issue are expected effects of current and planned projects and policy measures for a significant reduction of emissions and water pollution in watercourses till 2004/2005. All implemented and planned measures would contribute to meet the limits by the Czech Government Decree No. 171/1992 Coll. and limits according to European standards. Only five municipalities between 5,000 and 10,000 inhabitants have no sewage treatment plant.

There are some municipal WWTP projects for larger towns whose implementation is either running or prepared: Přerov, Prostějov, Znojmo, Břeclav, Jihlava, Třebíč, Kroměříž, Valašské Meziříčí, Svitavy. However, some other WWTPs will have to be reconstructed or extended in the course of next years: in Olomouc, Šumperk, Vsetín, Blansko, Vyškov and maybe in some other towns, too. Very serious problems have been coherent with a lot of sewerage systems, which are often obsolete and not leak-proof. Municipalities should exert main effort concerning these challenges.

It is sure that all measures in question together with necessary policy means have contributed and will contribute to environmental improvement of water bodies. It will refer to reduction of nutrient emissions, to the decrease of concentrations of hazardous substances, to mitigation of microbiological load in surface waters and groundwaters.

7.3.1. Reduction of Nutrient Emissions

Expected impacts of programmes and projects on reduction of nutrient emission (above all nitrogen and phosphorus) correspond to past environmental damages and to real or prepared remedial measures. Problems of most point sources have been solved step by step, but not always effectively. Mainly the removal of phosphates and phosphorus has not been sufficient and many issues refer to the nitrogen, to nitrites, nitrates, to ammonia and to organic nitrogen, too. In the Czech Republic the essential effort was focused on the improvement of other water quality parameters, especially on BOD, COD, dissolved oxygen, dissolved and suspended solids, acidity, alkalinity, some physical, chemical, biological and microbiological parameters. However, also the problems of nutrients, heavy metals and other priority pollutants had to be highlighted and a strong accent was put on the requirement of their necessary load reduction in waters; this tendency started only in the course of recent years.

The estimated amount of nutrient reduction expected from each current or planned project has been quantified in detail, but all results will have to comply with limits or modified limits of the Czech Governmental Decree No. 171/1992 Coll.

Immediately after the implementation of projects referring to six point sources and key hot spots the following nutrient parameters (in mg/l) could be achieved after January 1, 2005:

Project relative to hot spot	parameters	
	NH_4	P_{Tot}
WWTP Brno	5.0	1.0
WWTP Zlín	5.0	1.5
WWTP Uherské Hradiště	10.0	3.0
WWTP Hodonín	10.0	3.0
Industrial WWTP Koželužny Otrokovice	10.0	3.0
Remedial works of Fosfa Poštorná	11.0 *	0.4 *
Remedial measures + Slurry reduction Gigant Dubňany	11.0 **	0.4 **

Note:

** Parameters relate to the receiving Dyje River. Remedial works at Fosfa Poštorná concern four special measures: industrial WWTP (with daily discharge into the river Q = 5.5 l/s, daily discharge of N-NH_4 = 1.45 kg, daily discharge of P_{Tot} = 138 kg), hydraulic screen (with Q = 5.0 l/s, N-NH_4 = 4.01 kg/d, P_{Tot} = 449 kg/d), flow of groundwaters under setting pits (Q = 4.3 l/s, N-NH_4 = 0.81 kg/d, P_{Tot} = 178 kg/d), flow of groundwaters under building zone of company (Q = 7.5 l/s, N-NH_4 = 2.05 kg/d, P_{Tot} = 29 kg/d). In total it represents values as follows: daily discharge into the river Q = 22.3 l/s, daily discharge of N-NH_4 = 8.33 kg (i.e. 4.3 mg/l ... it is good), daily discharge of P_{Tot} = 792 kg (i.e. 412 mg/l ... it is very unfavorable).*

*** Parameters relate to the receiving Kyjovka River downstream the pig farm Gigant Dubňany.*

However, the present efficiency of existing WWTPs and other remedy measures with respect to discharged concentration of N-NH_4 and P_{Tot} is mostly very low (according to data from 1995-96):

WWTP	Purification effectiveness (%)	
	N-NH_4	P_{tot}
Brno	40 - 55	45 – 50
Zlín	10 - 20	30 – 45
Uherské Hradiště	ca. 10	ca. 50 – 60
Hodonín	50 - 65	30 – 45
Olomouc	85 - 90	25 – 40
Přerov	10 - 15	ca. 50
Prostějov	20 - 40	ca. 80 – 85
Znojmo	20 - 25	25 – 35
Kroměříž	10 - 15	35 – 55
Koželužny Otrokovice	30 - 35	...
Fosfa Poštorná ***	...	90 – 95
Gigant Dubňany ***	20 (appr.)	...

**** without other measures*

It must be said that the reduction of nutrient emissions will depend on other necessary measures with view to

- measures relating to non-point sources in agriculture and forestry in the whole region (measures dealing with water erosion, implementation of organic farming, sustainable use of fertilizers, manure, slurry, dung-water, straw, pesticides, products of silage, restoration of small watercourses, meanders, meadows, forests, groves, floodplains and wetlands),
- economic and tax measures to reduce the use of washing powders with phosphate, of artificial fertilizers,
- educative and training activities relative to mentioned measures and to healthy nourishment, to consumption of proteins and substances containing nitrates and nitrites.

It is very complicated to quantify these effects.

7.3.2. Hazardous Substances

A partly, favorable impact of minimization of contamination by hazardous substances - with regard to heavy metals, persistent substances etc., has been evident from the year 1989 to 1997. The situation is rather complicated by short-term sampling and monitoring of these substances. A regular monitoring started four years ago and there are still few verified data concerning heavy metals, PAH, PCB, AOX, volatile halogenated hydrocarbons, organochloro-pesticides, chlorinated phenols and so forth.

All industrial, agricultural and service polluters must solve their problems of the high amount of heavy metals, but also a lot of minor problems wait for future solution. Main issues in the region have been connected with zinc, mercury, iron, nickel, chromium and lead.

Likewise the pesticides are serious pollutants in the Morava River basin. Ten years ago there were approved 374 pesticides in the Czech Republic out of 650 pesticides that were applied. In the Morava River basin there was applied about 4,000 - 5,000 t of pesticide substances annually. About 15 - 35% of this amount, that is from 600 to 1,750 t of pesticides could affect almost all water bodies and their water quality in the Morava River catchment. Residua of very persistent pesticides still remain in soil, sediments, plants and animals. There are for example residua of formerly used DDT or HCH there. The use of both these chlorinated hydrocarbons was forbidden in the Czech Republic in 1974. Till then mainly the DDT had been used excessively for at least 30 - 35 years.

Insecticides used in the Morava River basin are stable substances. This group includes lindan, toxaphen, hexachlocyklohexan, fluor agents and DDT. Czech herbicides often contain very toxic matters, derivatives of phenols, phenoxy-aliphatic acids, triazines, amides, atrazines, carbamates or urea. Fungicides are formed by substances containing heavy metals (copper or mercury) or by hydrocarbons with sulphur. There have been many groups of pesticides applied, a lot of them very toxic. Especially pesticides soluble in water represent a serious danger. Mainly the lowland areas of "Dolnomoravský úval" (Vale of the Lower Morava River) and partially of "Hornomoravský úval" (Vale of the Upper Morava River) were exposed to pesticides to a great extent in the past. In the Morava River basin there was applied about 100 kg of "efficacious" pesticides per 1 km^2 in 1993.

The use of some herbicides is forbidden in "sanitary protection areas" of surface water and groundwater resources.

High attention must be paid to oil contamination.

The most important objectives and measures comprise innovation, rationalization and better monitoring network reliability (aiming at less stations but at the same time dynamic and long-term-running information), follow-up analyses and holistic evaluation.

It has not been specified how the planned projects will influence the concentration of the hazardous substances in discharged water. Quantification of these parameters is difficult due to the lack of input information in previous times. It is sure, however, that all the actual and planned projects contribute to the reduction of heavy metals and other hazardous substances in the Morava River basin.

7.3.3. Microbiological Contamination

With respect to improved wastewater treatment in many municipalities and industrial establishments a decrease of microbiological contamination may be expected throughout the Morava River basin. Essential sources of water contamination by bacteria and viruses in the Morava River basin are agriculture, inhabitants and animals living in municipalities. Microbiological contamination of water is mainly caused by discharges from municipal sewerages, washing from agricultural land, washing out from "open" manure stores in the field and from bad stacks, runoff or leakages of agricultural wastewater, dung-water, liquid manure, liquids from silo pits, silage tanks, wash-outs from dump sites.

Microbiological pollution of water bodies in the Morava River basin originates mostly in non-point sources. It is not a simple task to quantify the expected reduction of microbiological contamination, in connection with realized measures of sewerage systems and sewage treatment systems in municipalities and industries. In the Governmental Decree No. 171/1992 Coll. there are mentioned the following limits:

- coliforms 20 CCU/1 ml (raw water for drinking water supply), 200 CCU/1 ml (other waters),
- fecal coliforms 4 CCU/1 ml (drinking water purposes), 40 CCU/1 ml (other waters),
- enterococcuses 2 CCU/1 ml (drinking water purposes), 20 CCU/1 ml (other waters).

Many microbiological parameters are not directly mentioned in actual and planned WWTP projects. These values will be mostly determined in detail in the follow-up projects and the operation rules will be specified on the basis of the updated knowledge available, new monitoring, analyses and evaluation in the course of future operation. Similarly, it must be said that the most important objectives and measures concerning hazardous substances include improvement, rationalization and better monitoring network reliability, aiming at dynamic, chronological and continuous data bases and high quality information, reliability of further analyses and systematic evaluation.

7.3.4. Wetlands Rehabilitation

From the point of view of biodiversity wetlands in the Morava River basin belong to the richest ecosystems in Europe. In the last fifty years these wetlands were unfavorably influenced, several of them changed their character and some wet meadows and forests disappeared. There are eight wetlands of transboundary and trans-regional importance. They vary considerably in size from the smallest ones (13 ha) to the Lower Dyje Wetlands (11,500 ha). The last ones can be assigned as the most important wetlands in the Morava River basin, they should become a part of the proposed Trilateral National Park Danube-Morava-Dyje on the territory of the Czech Republic, Slovakia and Austria.

7.3.5. Sedimentation and Hydrological Regime

The hydrological department of the Czech Hydrometeorological Institute has performed special sediment monitoring of the Morava River since 1985. In the last years the sediment sampling at four gauging stations has been realized on a daily basis. Preliminary evaluation of the results gained from the daily average concentrations covering the whole measured period showed that there was about three times higher sediment load compared to suspended solids load. The average monthly silt content reached the maximum value of 500 mg/l at the Kroměříž station in 1995, the silt rates at the same station reached the maximum value of 58 kg/s.

8. Analysis of National Financing Mechanisms

8.1. Policies 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 for 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 investments (approximately more then 100 billion CZK). At the present time there is only an estimation of these costs provided. 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 improvement 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 to meet the EU requirements and set priorities. The economic 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 (approx. 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

8.2. Funding Mechanisms for Water Sector Programmes and Projects

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

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%.

There were realized the following expenditures for the environmental protection of water management (including drinking water) from central resources in 1997: (The budget costs for 346 construction projects were above 5 Mil. CZK).

Total resources (in Mil. CZK)	3 846
includes:	
State budget	
State Environmental Fund	1 475
Own resources	1 572
Loans	518
From abroad	94
Other	187

The 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 also the above mentioned other expenditures were realized in 1996 (in Mil. CZK):

1. State budget total	3 680
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 for 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.

8.2.1. Centralized National Institutions and Banks

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. 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. For example the share of crown credits in GDP in current prices stood for example at 63.3 % as to 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 Czech National Bank is responsible for monetary policy. Only as an exception in early 90´s it was involved in channeling and distribution of the loans from abroad. Since that period it has strongly refused to be involved in commercial operations either as a provider or guarantor.

The ten largest commercial banks, as measured by the volume of the balance sheet as to 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)

The four largest banks are providing about 70-80% of the credits. Domestic banks are able to offer loans with the maturity from 4 to 6 years. Less frequent but still existing are loans with the maturity from 8 to 10 years. Only the mortgage banks, like an exemption, are supplying their clients with 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 long-term funds maturing from 7 up to 15 years.

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.

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

The problem analysis in banking sector indicated certain shortcomings in the legislative and institutional environment, not only in the banking area but also in the financial and economic area as a whole. The process of creating the legislative and systematic framework will form financial market institutions and enforce the financial and economic sector.

Amendment of the Act on Banks is currently under preparation. The amendment should solve the actual problems of everyday practice, improve definitions of some terms and put into law some bank obligations that have been stimulated by less forceful regulations until now.

8.2.2. International Cooperation in Establishing Development Banks and/or Funds to Finance Water Sector Projects

The Czech Republic is exerting great efforts to improve rapidly the entire environment and is spending extraordinarily large sums on this purpose. The economy in the transformation period is not capable of creating sufficient finances to solve all the problems in foreseeable future. The majority of the measures are designed to remedy inadequacies incurred during the previous regime when the state owned the entire infrastructure and finances. Due to the absence of inland sponsors it is difficult to obtain sufficient finances to implement measures that would lead to a higher level of effectiveness than it is given by the current emission limits. For the Morava River basin, which

covers less than one third of the area of the country, only the liquidation of the most urgent point pollution hot spots would require 68.2 MUS$. Thus it is obvious that, in the absence of effective financial assistance, the economy is not capable of dealing with these high priority problems in a desirably short time. The delay in implementation of these measures could result in irremediable damage to the environment.

Between 1990 and 1993, foreign assistance supported non-investment projects. In 1994 some support to investment projects was launched especially within the framework of CBC – PHARE Programme. It is anticipated that the support for environmental projects will continue.

There are several banks in the Czech Republic, which are responsible for handling international funds. For example Investièní a poštovní banka, Èeskomoravská záruèní a rozvojová banka, Hypobank.

Also the State Environmental Fund is responsible for handling international funds. There is a possibility of adapting rules for a concrete support or programme and of adapting a required accounting system.

8.3. Actual Cost and Price Policy

8.3.1. Water and Wastewater Tariffs and Charges

Prices for surface water withdrawal, drinking water tariffs and wastewater tariffs are defined according to rules mentioned in paragraph 2.1.1. individually by River Basin Companies (surface water) and water supply companies (drinking water tariffs and wastewater tariffs) for every year.

In some River Basin Companies and also in some water supply companies there exist certain forms of state supply both for investment and non-investment funds, which basically reduce the calculated price of the companies.

As regards the drinking water tariffs and wastewater tariffs it can be seen in surveys that according to given calculation formula there exists a cross grant which gives advantage to population against industry.

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

Every River Basin Company and every water supply company has then a different price for the mentioned services.

Charges for surface water withdrawal for 1996 and 1997 by each water basin are in CZK/m^3 (discounts are for cooling of steam power stations).

CHARGE	1996		1997	
	CZK/m^3	discount	CZK/m^3	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	-

The total revenue for all water basins in 1996 for surface water withdrawal was 1 595 Mil. CZK.

For wastewater discharge into surface waters 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 operators of public sewer systems. The rates differ according to the extent 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 depending on the character of wastewater.

The income of the SEF from charges for wastewater discharge to surface water and the expenditures for the water component of the environment were as follows (in 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

The income from ground water withdrawal charges and a part of income from fines raised the resources of the State Environmental Fund, but not significantly. The total income was 55 Mil. CZK for the environment water component in 1997. The fines can be inflicted by the Czech Environment Inspection agency under the Law No. 130/1974 Coll., by the state administration of water management, in the wording of later novels, §24 in exceptional cases to the height of 3 Mil. CZK. The rates of fines are mentioned in §24 and the differences in this part are in accordance with individual cases of obligation breach.

8.3.2. Public and Private Sector Expenditures for Wastewater Treatment and Environmental Protection of Aquatic Ecosystems

Currently, the following financial models are used:

1. Towns and communities: in their majority they are dependent on a support from state sources (state budget and SEF) because they have not sufficient number of their own funds. On a smaller scale they also use own sources and commercial loans they stand for by the property of the community. Some active towns and communities use international support intensively, which sometimes represents the main source of income for financing treatment plants and a decisive part of sewerage systems.
2. Industry: receives funds especially from its own sources and from commercial credits. For the smaller part the communities there are used sources from the State Environmental Fund like advantaged loans and for privatized companies and old damages from the National Property Fund as a significant source. International supports for priority polluters used are too, but only exceptionally.

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

Foreign help is used both in town and industrial sphere. Funds provided sources by specialized international institutions and direct financial support from individual countries, specially aimed in both cases, are mainly used in connection with international programmes. As for international institutions, we can mention the support of the World Bank, EU and UNO funds. As for direct support, the significant help of Germany, Denmark, Belgium and Austria can be mentioned.

8.3.3. Cost Structure and Cost Coverage for Wastewater Management (Revenues and Subsidies)

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

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

item	thousand CZK/year	% of 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

8.3.4. Economic and Financial Incentives for Investment, and Running of Treatment Facilities and Protection of Aquatic Ecosystems

The economic instruments of environmental policy (charges, tax measures, subsidies) are derived from the principle of individual responsibility for the costs of environmental damage. The principle is based on the assumption that firms and individuals should be explicitly faced with the cost of environmental damage resulting from their activities. The correct application of this principle (when all procedures pay environmental costs) would create conditions whereby activities, which damage the environment, would be economically disadvantageous compared to activities, which are less harmful to the environment. In addition, those activities, which produce positive external effects and which complement the State's efforts in environmental protection should be stimulated. A well-developed, functioning market is a necessary pre-condition of the implementation of market-based approaches.

The development of normative instruments (limits, standards, bans) and economic instruments also utilizes the principle of substitution which provides that, whenever technically and economically feasible, substances and activities which are harmful to the environment should be replaced by those (substances and activities), which are less harmful or entirely harmless.

8.4. Actual and Planned Public and Private Investments for Water Quality and Wastewater Management Projects

At this time the evaluation of total planned investments needed for implementation of priority projects is as follows:

Project	Mil. CZK	Mil. US$
WWTP Brno	1,301	39.7
WWTP Zlín	354	10.8
WWTP Uherské Hradiště	165	5.0
WWTP Hodonín	76	2.3
WWTP Koželužny Otrokovice	77	2.4
Remedial measures at Fosfa Poštorná	110	3.4
Remedial measures and Slurry Reduction in the pig farm Gigant Dubňany	151	4.6
Needed in total	**2,.234**	**68.2**

Part of the investments will be covered from national funding sources (central and local budgets, loans and syndicated loans, Fund of National Assets). It is also assumed that international finances will contribute to effective implementation of projects (EU, EBRD, GEF). It is not envisaged that private investments will be concerned.

9. Development of National Pollution Reduction Programme and Investment Portfolio

9.1. Project Identification, Description and Cost Estimation

See annexed tables

9.2. Institutional Planning Capacities in Public and Private Sector

Actual planning capacities in the field of project preparation concerning the water pollution reduction for structural and non-structural projects seem to be sufficient for the national needs. In the technical sphere of structural projects planning there is a number of experienced companies, for example: Aquatis Brno a.s., DUIS s.r.o., Centroprojekt Zlín a.s., Hydroprojekt Praha a.s., Sigma Engineering Olomouc a.s. Some of the important WWTP projects have been prepared under the support of the Austrian Government by the Austrian firm Schûffl & Forsthuber (Brno, Prostìjov, Prerov).

Although the actual planning capacities according to the opinion of Czech experts and authorities are sufficient for the preparation of bankable projects, the external foreign support or cooperation can be welcome and useful for the exchange of experience and implementation of the best available techniques.

There are good theoretical preconditions for the application of the best environmental practices, but the real implementation must be seen as a process conditioned by environmental education, public awareness and access to information on environmental management techniques and the environmentally friendly technologies.

9.3. Implementation Capacities in Public and Private Sector

The actual implementation capacities of construction companies in the Czech Republic are sufficient. The technical level of the specialized companies is very satisfactory. There are no limitations in procurement of equipment and materials. Renowned foreign companies share some of the inland firms, which enables an easy transfer of new techniques and application of new technologies. This applies not only to construction but also for operation companies. For the Czech investors the lower construction prices of the domestic firms are welcomed and the purchase of foreign technology is mostly restrained to special equipment and devices.

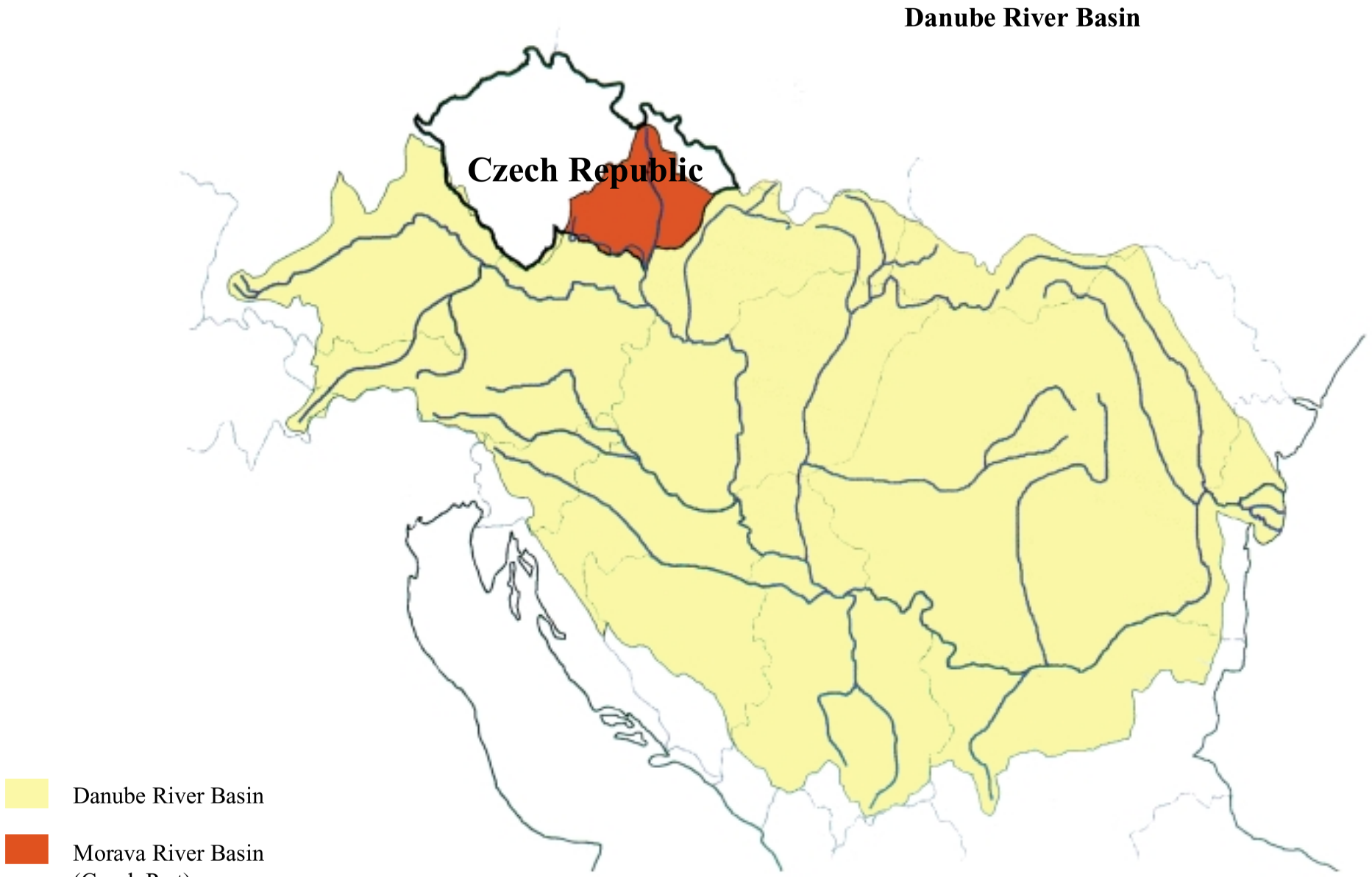
The Government of the Czech Republic is greatly interested in solving environmental problems, which reflects high social concerns over these issues. Studies elaborated by foreign firms (BCEOM, Lahmayer Int., Allplan Austria) dealing with institutional framework of water management in the Czech Republic have confirmed that the institutional base and professional quality of water and environmental protection management are at a very good level. That provides a guarantee of successful implementation of the proposed measures.

Table 1 Compilation 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

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	


Danube River Basin
Czech Republic
Danube River Basin
Morava River Basin
(Czech Part)

Priority Hot Spots within the Danube Pollution Reduction Programme, 1998

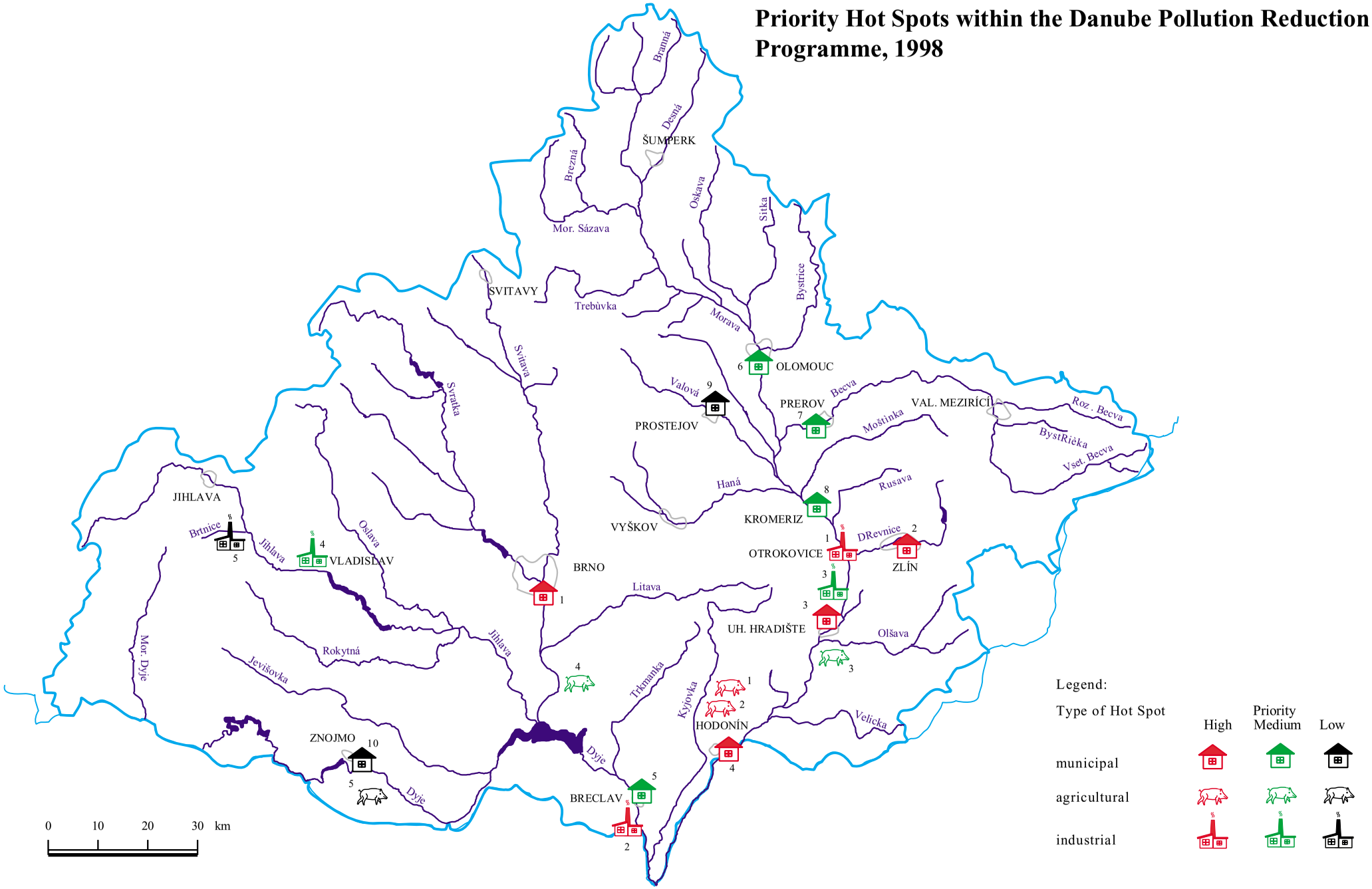
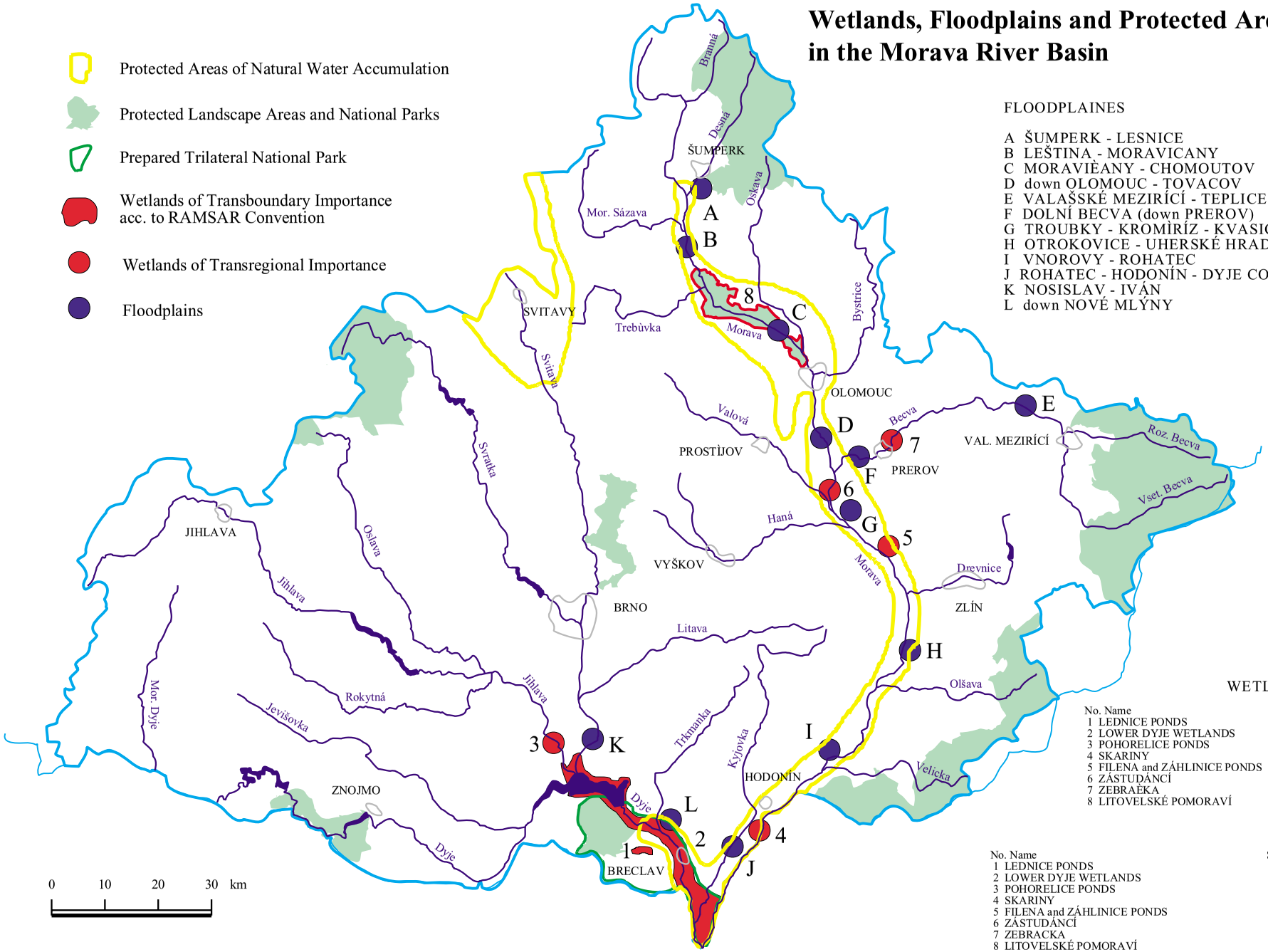


Fig. 3

Wetlands, Floodplains and Protected Areas in the Morava River Basin



FLOODPLAINES	km	ha
A ŠUMPERK - LESNICE	0,0 - 9,5	5,0
B LEŠTINA - MORAVICANY	274,0 - 295,0	21,0
C MORAVIÈANY - CHOMOUTOV	238,0 - 271,5	53,0
D down OLOMOUC - TOVACOV	212,0 - 230,0	12,0
E VALAŠSKÉ MEZIRÍCÍ - TEPLICE	43,5 - 57,5	25,6
F DOLNÍ BECVA (down PREROV)	0,0 - 10,0	
G TROUBKY - KROMÌRÍZ - KVASICE	169,5 - 210,0	33,0
H OTROKOVICE - UHERSKÉ HRADIŠTE	149,0 - 159,5	6,9
I VNOROVY - ROHATEC	111,0 - 122,0	11,7
J ROHATEC - HODONÍN - DYJE CONFL.	104,3 - 111,0	58,9
K NOSISLAV - IVÁN	3,1 - 23,0	30,0
L down NOVÉ MLÝNY	0,0 - 46,0	150,0

WETLANDS

No.	Name	Coordinates
1	LEDNICE PONDS	48°43'-48°48' N 16°42'-16°48' E
2	LOWER DYJE WETLANDS	48°37'-48°51' N 16°35'-16°58' E
3	POHORELICE PONDS	not available
4	SKARINY	not available
5	FILENA and ZÁHLINICE PONDS	not available
6	ZÁSTUDÁNCÍ	not available
7	ZEBRAÈKA	not available
8	LITOVELSKÉ POMORAVÍ	49°48'-49°36' N 16°55'-17°14' E

No.	Name	Size (ha)	Type
1	LEDNICE PONDS	650	fish ponds, sedge, marshes
2	LOWER DYJE WETLANDS	11500	floodplain forests,meadows and ponds
3	POHORELICE PONDS	470	fauna of fish ponds and forests - birds
4	SKARINY	13,2	floodplain forest - fauna
5	FILENA and ZÁHLINICE PONDS	500	fish ponds, wetlands biotopes - birds
6	ZÁSTUDÁNCÍ	100,6	floodplain forest - fauna
7	ZEBRACKA	234,1	floodplain forest - typical fauna
8	LITOVELSKÉ POMORAVÍ	5122	floodplain biotopes and forest oxbows