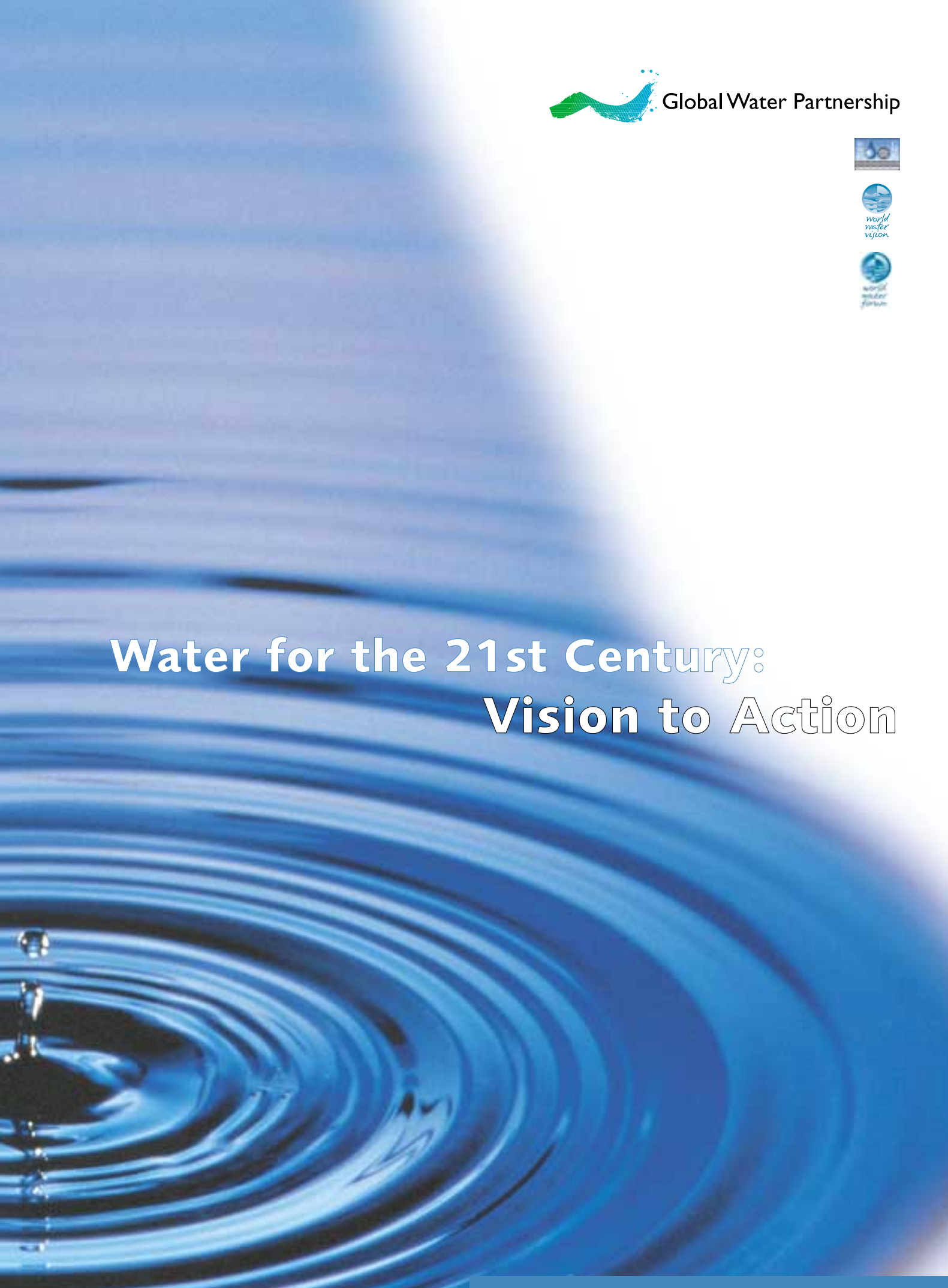
Global Water Partnership

Water for the 21st Century: Vision to Action



Central & Eastern Europe

This document, *Water for the 21st Century: Vision to Action – Central and Eastern Europe*, was prepared for presentation at the Second World Water Forum and Ministerial Conference at The Hague, the Netherlands, 17 to 22 March 2000.

The Vision was prepared under the guidance of the World Water Commission on Water for the 21st Century – an initiative of the World Water Council. Development of the corresponding Action plans was executed by the Global Water Partnership (GWP). This document addresses the Actions that need to be taken to reach the Vision. Over the forthcoming year, the process of identifying the solutions to support the actions will continue.

The Vision to Action process was designed to be as broad based as possible. Consequently, the building blocks for the development of the Vision and Action were constructed through consultations with the principal stakeholders in the major regions of the world. Through regional meetings and workshops this consultation process brought many experts together – government agencies, key water practitioners, UN agencies, donors, the private sector, and others – to establish a shared view of appropriate strategies, mechanisms for implementation, and priorities for immediate action and investment. The participatory nature of the whole process will deliver new hope for sustainable water management in the new millennium.

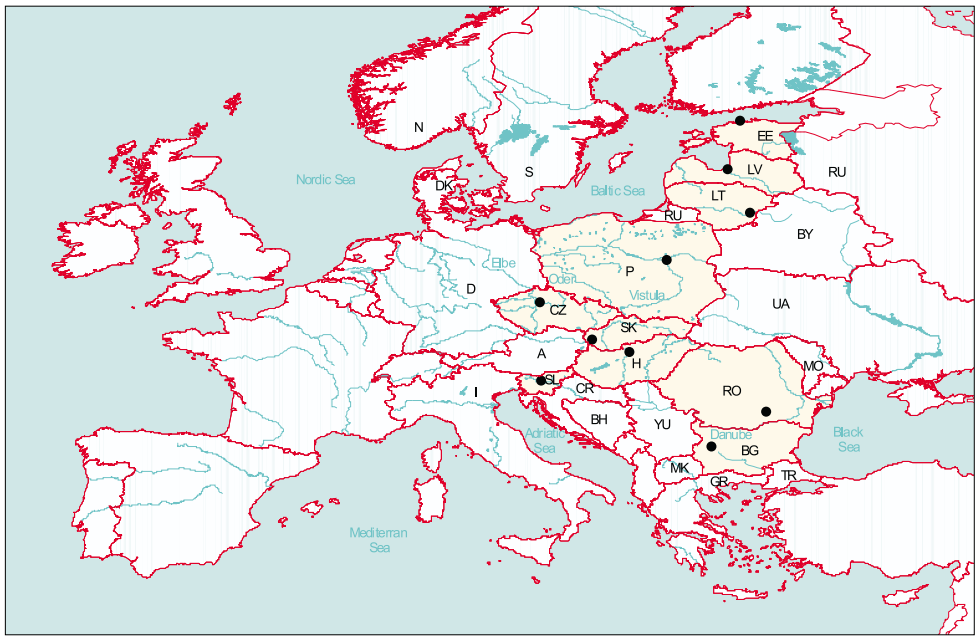
Our vision is that in two to three decades there will be sufficient, safe, clean and healthy water for nature and people living in stable societies in the region.

Water for the 21st Century:

VISION TO ACTION

Central and Eastern Europe

Report of a consultative process



The CEE Region: BG – Bulgaria; CZ – Czech Republic; EE – Estonia; H– Hungary; LV – Latvia; LT – Lithuania; P – Poland; RO – Romania; SK – Slovakia; SL – Slovenia

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(CEETAC)
OF THE GLOBAL WATER PARTNERSHIP

February 2000

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1. INTRODUCTION AND BACKGROUND

1.1 General

In the past ten years, the countries of Central and Eastern Europe (CEE) continued their efforts to address water management problems in the very unique context of a transition from the centrally planned to market economies. Although the problems which need to be dealt with are still many, there are clear signs of a rethinking of water policies in the region. However, trying to compile, understand and synthesise water policy issues, including the long term vision of water sectors in ten different countries of the region is like trying to catch and hold water itself. Water flows and seeps through, sometimes it is lacking, and other times water defies human attempts to control it. This paper presents the results of the consultation process with key stakeholders at regional, national and local levels, carried out across the region in years 1998-1999 under the auspices of the Global Water Partnership. The purpose of these consultations was to understand better key issues and opportunities in water resources management, to formulate a long-term water Vision for Water, Life and Environment, and to conceive ways of transforming that vision into a set of implementation mechanisms and investment priorities.

The CEE region covered by this report includes ten countries of Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia containing well over 100 million population. For more than forty years the planned economies of these countries focused on raising output through quantitative production targets, with not much regard for costs and with drastically underpriced capital and natural resources. Expansion of heavy industries, often using coal as the main source of energy, was a high priority. The pollution effects were intensified by the underpricing and overuse of energy, water and other raw material inputs. Even where pollution control installations were in place, poor maintenance and operating practices meant that they were rarely operated at their full design efficiency. Limited steps have been implemented to improve controls and safety equipment and operating procedure, but not much more. As a result, water pollution is one of the most pressing problems of the CEE countries inherited from the past.

Since early 1990s, dramatic political, economic and institutional change in the CEE countries have affected every aspect of life, including water resources management. Central planning by the state has been almost completely abandoned, and there

is a strong movement toward decentralisation and privatisation. The institutional system is undergoing significant change, leading to a strongly increased role for local self-governing authorities. Responsibility for municipal water supply, wastewater treatment, and ownership of the infrastructure is being transferred to municipalities. Due to general budget constraints, direct state subsidies have phased out, however, state-owned enterprises continue in economically-extensive performance and different forms of hidden subsidies and cross-subsidies are employed. Varied approaches to project financing are promoted, including enhanced local sources of revenue from taxes and water user charges, user taxes on polluting substances, and private investments that supplement traditional public sector and budgetary resources.

The countries of Central and Eastern Europe embarked on transition from different starting points. It is obvious that they could not ignore their history, geography and climate, and this legacy, together with political developments, profoundly affected both the relative importance of different economic and other reforms and how policymakers approached them. But in all countries the core reforms included liberalising prices, markets, new business entry, and implementing program to regain and preserve stability. The freeing of markets was the basic reform from which all the potential benefits of transition flow. Restituting property rights, incentives and a private economy was another challenge. Here, too initial conditions varied across the region. A special challenge that is of a fundamental significance for political, social and economic reasons was, and to large extent still is, to relieve poverty and address ill effects of transition on particular groups of citizens. Thus, liberalisation, stabilisation, privatisation and poverty relief are intrinsic to transition.

With the rapidly changing political, economic and social situation in CEE countries opportunities not available for water resources management before are appearing. Integration with the European Union is a single, probably the most important challenge for all countries of the region. Potentially it will allow much faster adoption of modern industrial and agricultural techniques than otherwise. If these intensive techniques and methods are not assimilated hand-in-hand with appropriate safeguards to the environment, including aquatic ecosystems, new and difficult to solve problems may arise. Dialogue over shared resources and regional problems, particularly concerning international catchments, are now much freer than before. Disintegration of some states (as has happened to former Czechoslovakia and former Yugoslavia) means that number of national units that need to interact has increased. Within the nations, decentralisation of state administration, restitution of self-governing bodies at the county level, introduction of new legislation, privatisation of state-owned enterprises, and other fundamental changes in the political, economic and social spheres have serious impact on water resources management.

1.2 GWP and the process followed

The Global Water Partnership is an international network open to all organisations involved in water resources management. The partnership was created in response to the need to promote the management of water resources in a non-fragmented, coherent manner. Integrated Water Resources Management (IWRM) is thus the focus of GWP's provision of advice on strategic issues through the central and regional Technical Advisory Committees and through specialised network of Associated Programmes. Today, three years after the establishment of GWP, the international network comprises a large number of developed and developing country government

institutions, agencies of United Nations, development banks, professional associations, research institutions, NGOs and private sector organisations.

In the CEE region it was decided that the GWP activities will, at least for the time being, be focused on 10 countries mentioned above. These countries cover almost 90 percent of the region which politically and geographically is termed Central and Eastern Europe. In addition, all ten countries are covered by the PHARE programme of the European Union (EU). This programme is one of the main EU instruments for bringing the so called "partner countries" into the Union. PHARE provides the funding which contributes to make the proposed "structured institutional relationship" between the partner countries and the EU reality. One of the relevant areas is environment, including water resources management.

In 1998, the GWP helped to establish the interim Technical Advisory Committee for the Central and Eastern Europe (CEETAC). Members of CEETAC which includes water resources engineers, economists, lawyers, practitioners and academics, from a variety of water-related institutions, held a series of meetings between November 1998 and December 1999. These meetings and intensive consultations were intended to get the stakeholders or their representatives to talk with each other about the water issues dominating in the CEE region. In slightly more than a year, the interim CEETAC:

- ❑ developed knowledge about water resources availability and uses in the region, identifying some trends and issues that may affect the future use of water;
- ❑ developed a regional vision for the year 2025 that have been generated in discussion with water specialists, policy makers, the private sector, NGOs, governments, and civil society;
- ❑ developed a regional framework for action which brings the vision closer to reality, and sets out a path, a direction, to achieve a sustainable water future.

This report is the outcome of two rounds of consultations in all ten CEE countries in the spring and the fall of 1999. Around 500 women and men from national governments, research and non-profit organisations, non-governmental organisations (NGOs), UN agencies, multilateral Banks, private companies, and many other institutional stakeholders took part in those consultations. Stakeholders came from various sectors of economic and social life that use water, such as water for food and rural development, water for people, and water and nature. CEETAC members formatted the results of the national consultations into comprehensive Vision and Framework for Action reports, which form the backbone of this regional report. Consecutive drafts of the present report were discussed, commented upon, corrected and finally approved in a series of CEETAC meetings. Representatives of the sectoral vision to action exercises were invited to all of these meetings.

1.3 Objectives

The principal objective of this report is to present a regional water vision and framework for action, seen as a widely shared view of how water resources should be used, allocated, shared and managed in the region of Central and Eastern Europe over next 25 years to meet the needs of the people, maintaining at the same time a suitable balance between demand and supply, without compromising the needs of life supporting ecosystems. The report seek to influence national water and related "non-water" policies – it also seek to influence the way people behave with respect to water in the CEE region. Even though Governments may not agree with all the ideas presented in the report, the ultimate objective is to stimulate thinking towards adoption of new approaches of Integrated Water Resources Management.

1.4 Structure of the report

Following these introductory comments, the report describes briefly the current state of water resources management in the region. The discussion recognises division of the region into river basins discharging their flows into the Baltic Sea, and the Danube river basin outflowing into the Black Sea. Next, the principal forces and processes, the so called "drivers" that shall decide on the overall future of the region, including water resources management, are reviewed. They include political factors, economic and technological developments, social processes, changing concepts in water resources, financial constraints and water resources management in the transboundary basins. At this background, regional water vision and strategy are formulated. Framework for action that may lead the region towards vision implementation is discussed in the next section of the report. At the end some concluding remarks on the uncertainties, risks and possible "surprises" involved in vision implementation are brought up.

2. WATER RESOURCES MANAGEMENT IN THE REGION

The CEE region covered by this report (see Fig.1 – map of the region) has a total land area of nearly 1.1 million km^2 and is mostly located in the Baltic Sea and the Black Sea basins. Parts of the Czech Republic drains to the Nordic Sea and the percentage of the Bulgarian territory draining to the Danube River, Black Sea and Mediterranean Sea, is 36.1, 20.1, and 48.3 percent respectively. Basins of the CEE rivers discharging their flows to the Baltic Sea are located in Poland, Lithuania, Latvia and Estonia. These basins (Odra, Vistula, Nemunas, Daugava, Parnu, Matsalu, Emajogi and others) are hydrologically independent from each other being bound only through the discharge of their rivers to the Baltic Sea. The second group of countries including the Czech Republic, Slovakia, Hungary, Slovenia, Bulgaria and Romania are located in the basin of the Danube River outflowing into the Black Sea (this applies only partially to the Czech Republic since 70% of its population drains to the Nordic Sea; see before). Those six countries occupy about 60 percent of the total area of the Danube Basin. Due to decoupling of water problems within the Baltic basins and strong linkage existing in the Danube group, the corresponding priorities in managing their water resources somewhat differ.

2.1 Physical and hydrographical conditions – water supply

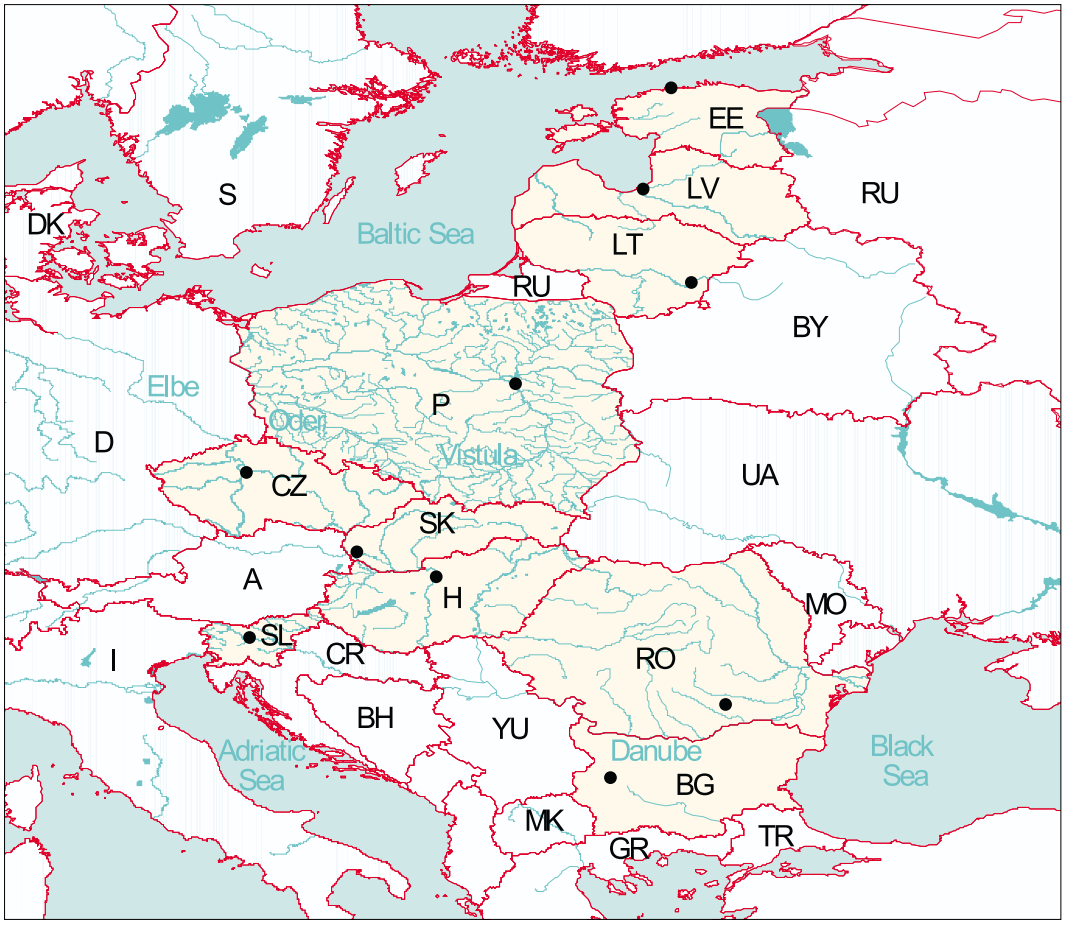
As shown in Table 1, water availability varies substantially across the CEE region (we note that values of Table 1 are nation wide- and long term averages which are used to give order of magnitude only). Among the countries of the region Slovenia is richest in water. Estonia and Latvia are also well-endowed in water resources. In contrast, the Czech Republic, Poland and – on the basis of the internal resources – Hungary feature much lower water availability. In the dry years, water availability in these countries may be even in the order of 1000 m^3/capita, which is usually, considered a limit below which water “scarcity” begins. Hungary is in a peculiar situation – it is rich in waters if all surface water resources are considered (about 10,000 m^3/capita per year), but the estimate is much lower if only runoff generated

within the country is accounted for (only about 5 percent of total inflow). Problems are caused by uneven distribution of precipitation and runoff in time and space, low river density in some of the countries, seasonal and year-to-year runoff changes. In other words, country-wide and annual average data do not reflect all difficulties encountered in water resources management; this is for instance the case for Hungary where the eastern Tisa valley is characterised by much scarcer resources than the western Danube valley.

Hungary – poor or rich in water resources?

Hungary is in a peculiar situation – it is rich in waters if all surface water resources are considered (about 10,000 m³/capita per year). Of all water resources only about 5 percent of the total inflow is runoff generated within the country itself. If the water availability is calculated on the base of internal resources the availability falls to about 600 m³/capita per year, and the country should be considered as a water scarce country.

The *Danube* is recognised as one of the most international rivers in the world. Its basin belongs to twelve countries and it shows a high variability of topographic conditions, including high mountains covered by snow all the time, flatlands, and hilly regions. The character of the Danube River (and its tributaries) varies from mountain stream to lowland river. The upper zone of the river ends close to Bratislava (Slovakia). There is a sudden reduction in the river bed slope that results in a unique inland delta and one



BG – Bulgaria /*Sofia*/
CZ – Czech Republic /*Prague*/
EE – Estonia /*Tallinn*/
H – Hungary /*Budapest*/
LV – Latvia /*Riga*/
LT – Lithuania /*Vilnius*/
P – Poland /*Warsaw*/
RO – Romania /*Bucharest*/
SK – Slovakia /*Bratislava*/
SL – Slovenia /*Ljubljana*/

Figure 1. The CEE region: countries, capitals, rivers and inland seas
The map is based on the ESRI Data & Maps package of GIS by ESRI ArcView 3.1, 1999. The Former Yugoslavia region is modified by the World Atlas, Cartographia Ltd., Budapest, Hungary, 1998/1999.

of the largest European subsurface freshwater resources of high quality. The middle zone extends to the Iron Gate dams. Here the river enters a flatland region.
The Danube Delta covers an area of about 6,000 km². It is a unique biosphere reserve of complex and varied ecosystems.

Annual Renewable Water Resources

Countries	Internal (km^3)	Internal per capita (m^3)	Rivers flow from other countries (km^3)	Total (km^3)	Total per capita (m^3)
Bulgaria	20.00	2410	5.00	25.00	3 010
Czech Republic	6.20	600	0.54	6.70	650
Estonia	11.70	8050	4.68	16.38	11 290
Hungary	6.00	570	109.00	115.05	10 930
Latvia	14.60	567	19.40	34.00	11 940
Lithuania	15.40	4140	10.80	26.20	7 043
Poland	53.60	1440	5.00	58.60	1 580
Romania	34.00	1501	85.00	119.00	5 253
Slovakia	14.20	284	62.30	76.50	1 530
Slovenia	32.20	16100	13.20	45.40	22700

Table 1. Mean annual water resources of the CEE countries (mid-1990s estimates taken mostly from outcomes of the consultation process)

The climatic conditions in the *Danube* Basin are highly variable (overall temperate under continental Mediterranean and Atlantic influence) resulting jointly in a rather complex pattern of hydrometeorology and its parameters (temperature, precipitation, runoff, ice, sediment, groundwater, evaporation etc.). Annual precipitation is above 1200 mm in the southern upper zone, but in the north it is only half of it. In the middle Danube stretch it is roughly 800 mm/year with low values of 550 mm/year or even less (e.g. in 54 percent of the Hungarian catchment of the Tisa River). Downstream of the Iron Gates it falls below 600 mm/year, with peaks of more than 1000 mm/year in areas under Mediterranean influences. The mean annual Danube flow in Budapest is about 2,300 m^3/s, while it is about 6,500 m^3/s at the entrance to the Delta (here the flow varies between 1,600 m^3/s and 15,500 m^3/s). The seasonal and inter-annual flow variability is very high.

The natural variability of water resources is also a characteristic feature in about 300,000 km² of the *Vistula* and *Odra* river basins. These two predominantly lowland basins cover almost 90 percent of Poland's territory. Mean water resources per capita are estimated at 1,580 m^3/year (see Table 1), what is the second lowest value in Europe and about three times less than the average value for the continent. In a year of average hydro-meteorological conditions, Poland is supplied with about 186 km^3 of precipitation water (about 600 mm). This amount of precipitation, plus about 5 km^3 of water inflowing Poland from the neighbouring countries, produces the average runoff of 58.6 km^3. Renewable groundwater resources understood as a volume of water that is available in 95 percent of years is 12.5 km^3.

The Lower Nemunas River drains the southern generally flat part of Lithuania and its basin (the Lithuanian part only) covers 74 percent of the country's area. The northern more hilly part of that country is covered by three basins of the *Vente, Lielupe* and *Daugava* rivers that flow towards the Baltic Sea via Latvia. Wetlands and lakes densely cover eastern part of Lithuania. Mean annual precipitation in Lithuania is 748 mm, with 236 mm forming surface and underground runoff. On average, water resources generated within the country are in the order of 15.4 km^3/year, with additional 10.8 km^3/year coming from Belarus, Poland and Russia. Hydrogeologic estimates suggest a safe groundwater yield for Lithuania of some 3.2 million m^3/year.

The territory of Latvia is divided into nine drainage basins of *Western Kurzeme, Vente, Northern* and *Eastern Kurzeme, Lielupe, Daugava, Gauja, Vidzeme, Saloaa* and *Vejlikaja* rivers. Average precipitation is 700 mm/year. The mean annual runoff from this country is in the order of 33-35 km^3, however, about 19.4 km^3/year are transboundary resources inflowing Latvia from Belarus, Lithuania and Russia. The renewable groundwater resources are approximately 13 million m^3/day.

Estonia, the northernmost of the three Baltic States, is divided into four watersheds: the *Narva-Peipsi* basin, the Gulf of Finland basin, the Gulf of Livonia basin and islands. The mean annual runoff is 11.7 km^3 which constitutes 35 to 40 percent of precipitation. The runoff is formed mainly in the territory of Estonia. Mean annual renewable groundwater resources slightly exceed 3 km^3.

2.2 Municipal, industrial and agricultural water demands

Water demands in the CEE region are satisfied from both surface- and groundwater. Household water uses rely primarily upon groundwater in Hungary, Slovakia, Bulgaria, Lithuania, Latvia and Estonia. Slovenia, Romania and the Czech Republic use for municipal water supply mostly surface waters. In Poland, groundwater resources supply about half of urban and 95 percent of rural household water demands. Industrial water demands, including cooling water withdrawals for electric thermal power supplied from surface water across the Region. About 93 percent of total surface water withdrawals in Lithuania are used for power plant cooling purposes. Irrigation withdrawals relying mostly on surface water, have significantly fallen back during the past decade (especially in Slovakia, Hungary, Romania and Bulgaria) due to new pricing structure and the reduction of crop production (often by a factor of five or so). The collapse of many oversized irrigation and drainage systems inherited from the past have also contributed to the reduction of irrigation water use. The fate of the old-fashioned irrigation systems is one of the major strategic issues in the Region.

As illustrated by Table 2, annual water uses shows considerable differences in their structure as well as per capita in the CEE countries. Cooling water use is dominating in many countries. For example, in Lithuania very large volume of water is used for cooling the Ignalina nuclear power plant (4.8 km^3/year). If this water is considered separately (as most of it returns back to environment), the remaining water (about 0.3 km^3/year) is distributed in the following way: municipalities 45 percent, industry – 21 percent, agriculture – 0.5 percent, fisheries – 33 percent, and others 0.5 percent. Similar comment could be made about Estonia, where most of water is used for cooling the Narva thermal power plant. This is just an example to illustrate difficulties of systematic data collection and evaluation. Although water demands depend substantially on local conditions, from the available data it is evident that there are many opportunities for water saving.

Annual Water Uses

Country	Year of Data	Total (km^3)	Sectoral Uses %				Per Capita (m^3)
			Municipalities	Industry	Thermal/ nucl. power	Agriculture	
Bulgaria	1997	12.90	11	11	38/38	2	1 554
Czech Republic	1998	2.3	27.2	72[b]	-	n	225
Estonia	1998	1.40	4.3	4.4	84	7.3[a]	1 000
Hungary	1995	6.7	13	3	69	15	657
Latvia	1997	0.41	38	35	7	2	91[c]
Lithuania	1998	5.06	2.8	1.2	94	2.0[a]	1 179
Poland	1995	12.07	20.4	24.6	45.2	9.8	383
Romania	1996	10.45	20	26	10	44	461
Slovakia	1997	1.28	36	60[b]	–	4	1 058
Slovenia	1996	0.34	76	21	2	1	170

n: No data available
a: including fisheries
b: including cooling water for thermal power
c: per capita water use estimated for largest cities (no individual wells taken into account)

Table 2. Mean annual water uses in the CEE countries (estimates taken mostly from outcomes of the consultation process)

Overall, a pronounced reduction of water demand has been observed across the region in all water use sectors, mostly as a consequence of the fall in economic activity and pricing. Especially in the early years of transformation, structural changes in the economy crashed several industrial enterprises, or limited their production, and consequently reduced water withdrawals. The municipal water use also decreased considerably during the last decade. Due to the general increase of water prices and wastewater charges, as well as due to technological changes, water consumption was reduced in many urban areas by about 40 percent. For example, in Budapest water consumption now is only 60 percent of that recorded in the late 1980s, mostly because of new incentives promoting more efficient use of water. The tendency towards reduction of water consumption still continues. In the near future increase of water withdrawals by industry may be expected (though past levels will never come back). Water withdrawals by agriculture have been at the same level for the last several years and increases – depending on the region – may be anticipated only after longer term re-structuring of agriculture. The municipal water demands are expected to be less intensive because of more common usage of water meters and fairly high increases in water tariffs. The CEE region is likely following the EU trend which means further reduction of water use in urban areas. In rural regions some increase is anticipated since the present overall service level is very low.

2.3 Drinking water supply and sewerage

The water supply coverage in CEE countries is in the order of 80 percent, and is not completely satisfactory (Table 3). However, quality problems often occur. For example, lack of efficient technologies for removing iron and manganese from abstracted groundwater is a serious problem in Latvia and Lithuania. Water supply in small settlements is also far from being adequate (frequently under 50 percent, Table 3). The issue is closely related to broad development needs of generally poor rural regions.

Country	Population (million)	Urban (%)	Supply* (%)	Sewerage* (%)	Treatment* (%)	GDP** ($/cap/y)
Bulgaria	8.3	69	85	49/70/2	36	1 118
Czech Republic	10.3	68	92/n/n	79/n/n	74/n/n	4 771
Estonia	1.4	70	77/n/n	60/80/45	50/n/n	3 360
Hungary	10.2	69	94/96/88	43/63/8	30/n/n	4 382
Latvia	2.47	70	93/n/<50	92/n/<50	88/n/n	2 430
Lithuania	3.72	65	70/n/n	60/n/n	36/n/n	2 887
Poland	38.7	62	90/n/n	80/n/n	60/n/n	3 590
Romania	22.6	60	55/n/n	40/n/n	28/n/n	1 532
Slovakia	5.4	67	81/n/n	54/84/16	36/n/n	3 662
Slovenia	2.0	50	76/n/n	74/n/n	43/n/n	9 053

* total/urban/rural
** 1997 data (Economist World in Figures)
n: Non-available information

Table 3. Major parameters of drinking water supply, sewerage and biological wastewater treatment (1997/98 data, mostly expert estimates collected during the consultation process)

In some of the CEE countries, recent investigations on water demand show that water losses in the supply systems are still significant. Moreover, large parts of water supply systems are constructed from asbestos cement pipes that are more than 25 to 30 years old. The municipal water supply networks show a similar picture.

Water losses due to downgraded supply systems in Bulgaria

Estimated water losses of average daily water use in Bulgaria are 30 percent in small settlements and 70 percent in big settlements. The water supply system having 22,000 km of water mains needs upgrading. The main pipes are of various materials, such as steel (19.5%), asbestos cement (77.5%), cast iron (1.5%), percent-prestrained concrete (1%), and concrete (0.5%). Renovation of water pipes is the main activity under a loan agreement with the World Bank.

The level of sewerage is far behind that of water supply being less than 50 percent on average. At the early 1990s it varied between 40 and 90 percent. The so-called utility gap (percentage population connected to public water supply minus that of connected to sewerage) is large in many countries (it is close to 50 percent in Hungary). Bad sanitation services lead to increased pollution of surface and subsurface waters and health risks.

Sewage treatment coverage is even lower than water supply (Table 3). Only 35 to 80 percent of collected sewage water is treated biologically (the lowest value applies to Romania, while it is the highest for the Czech Republic). About 10 percent of wastewater discharged into sewers are mechanically treated only (in some countries its level reaches 30 percent), and 20 percent is discharged without any treatment. The most common treatment (52 percent of population equivalent) is high loaded biological treatment and only 18 percent are served with a higher level of treatment (nitrification with or without nutrient removal). The level of sludge management is even poorer than that of treatment; in fact, about half of the sludge produced has an unknown fate.

Drinking water supply and wastewater management is very unsatisfactory in rural areas of most CEE countries. Coverage of water supply is not complete, and parts of the rural population rely on low quality water sources such as shallow wells. In Poland, more than 50 percent of rural population relies on water withdrawn by hand from local sources, usually shallow wells. With the collapse of large Soviet-style collective farms, which were

supplied with potable water from deep wells, the small private landholders are again turning to shallow unsafe groundwater because they cannot afford drilling deep wells. Sewage disposal of small rural settlements is at critically low level (not exceeding 5 to 10 percent). The low level of wastewater management considerably contributes to the pollution of surface waters, to the rising of the groundwater level under settlements, and to the deterioration of quality of groundwater and waters of deep confined aquifers.

Rural water supply in Lithuania

Some 350,000 shallow wells supply drinking water for approximately 1 million people living in rural areas of Lithuania. About half of these wells are contaminated either bacteriologically and/or by nitrate.

In spite of all the shortcomings, the existing water supply and wastewater management represents an important basis for actual and future management. Repair and maintenance as well as good operation of this infrastructure should have first priority in order of not worsening the present situation.

2.4 Water quality

The poor quality of surface and groundwater resources in CEE region has been documented extensively in a number of technical and popular reports published in the first years of transformation. Indeed, in the early 1990s the ability of water resources to meet human and ecosystem needs in the region has been seriously threatened by continuing degradation of resource quality. Health risks from low water quality have been much greater than those accepted in the OECD countries. Also the economic costs of water-quality degradation have been substantial. According to some independent estimates they were reducing the GDP of individual countries by 5 to 10 percent.

There are several causes of water quality degradation in the region. Most of the region's water bodies (rivers, natural and manmade lakes, groundwater aquifers) receive excessive amounts of untreated or insufficiently treated municipal wastewater. Although in the last 10 years many new wastewater treatment facilities were build and several old installations were modernised, the situation is still far from satisfactory. Until today, relatively large quantities of industrial wastewater and chemical liquid wastes are discharged into municipal sewage systems. Pre-treatment of industrial effluent is often insufficient for biological treatment processes to operate efficiently. Without pre-treatment (or separation of noxious industrial wastes from household sewage) sludge disposal presents serious problem. An important source of water pollution and one, which is attracting increasing attention, is stormwater runoff from urban areas.

Industry accounts for a significant part of the discharge of polluting substances into inland waters in the region. Both the agro-food and the pulp and paper industries discharged substantial amounts of oxygen-consuming, nutrient-rich, and slowly degradable substances. Metallurgical and chemical industries discharged a variety of inorganic wastes, which affected the usability of water in diverse ways, including making it utterly toxic. The production of synthetic chemicals brings new and more exotic types of production wastes. Many technologies are obsolete. Wastewater treatment installations typically suffer from insufficiency, overloading, and poor operation and maintenance. Doubtless, as industrial enterprises in the CEE countries become economically more efficient, water quality improvements will to a large extent

be side effects of the overall change. In fact, this was already justified during the past decade in several CEE countries. First impacts observed were consequences of the overall collapse. The first effects of the introduced clean production technologies can be identified today. However, it must be recognised, that this process will realistically take one or two decades.

Agricultural activities make a substantial contribution to the overall nutrient load in surface water and groundwater. Even in the Danube, with its high discharge and dilution rates, nutrients cause eutrophication that is visible already in the Hungarian stretch of the river. Eutrophication of inland and coastal waters is one of the major problems of Latvia. Surface and groundwater contamination by non-point pollution of agricultural origin is a major problem in practically all CEE countries. Problems include ammonia volatilisation, nitrogen leaching (nitrates and organic nitrogen), phosphorus leaching and erosion, and discharge of farm waste such as effluent from animal houses, manure storage and silage heaps. Nitrate leaching is mainly the result of inadequate handling and low utilisation efficiency of commercial fertilisers. Many problems are site specific, however nitrate contamination is typical for the CEE region due to high nitrogen surpluses and the low level of sewerage, particularly in rural regions (see later).

Price increases for fertiliser and pesticides in the past decade have resulted in massive declines in their use. But the situation may change in the future. The experience of the industrially developed countries shows that as countries develop and per capita income rises, the relative importance of agriculture in the national income diminishes to 5 or even less percent. At the same time, its share in employment declines to less than10 percent. The future developments in the CEE region will be strongly influenced by the success of the EU integration and trade opportunities with the newly independent states of the former Soviet Union. More intensive (high yield) agricultural practices usually call for fairly intensive use of chemical fertilisers and protective measures will have to be taken against uncontrolled rise of their use.

Water quality monitoring systems are poorly developed in most of the CEE countries. This is especially important since in many cases the neighbouring countries are responsible for low water quality. For example in Latvia, the largest rivers *Daugava, Venta* and *Lielupe* originate in neighbouring countries and bring from them a noticeable pollution load. In this respect the Danube countries are in a better situation since for many years at least the main river is covered by an international convention including water quality control. Emission monitoring is poor everywhere.

2.5 Droughts, shortage of water and irrigation

In several regions of the *Danube* Basin evapotranspiration is high (500-600 mm/year) and it can exceed the amount of precipitation. This is especially characteristic in the *Tisa* basin, where evapotranspiration exceeding precipitation was recorded in seven years in the period 1984-1996. If the growth of vegetation needs more than the summer rainfall or respectively the periods without precipitation are too long, surplus water is only available to plants that receive supply from the groundwater by capillary action. Supplementary irrigation is meant to prevent damage in agriculture and large-scale irrigation systems were constructed in the past. Most of them are out of usage at present since the area irrigated was drastically reduced. Drought is an issue in particular in Slovakia, Hungary, Poland, Romania, and Bulgaria.

Recent droughts in Bulgaria

Bulgarian water resources are unevenly distributed in time and space. Almost 120 towns (including some of the large cities such as Vratza, Montana and Lovech) and 1200 villages have suffered water shortages for many years. The last few years have shown a number of serious droughts. In the summer of 1994 the water supply to more than 70 percent of the population of the country had to be interrupted. Recent water rationing in Sofia, the capital of Bulgaria, and the decision to proceed with the construction of inter-basin water transfer, have led to a political crisis of national dimensions.

In dry years, the annual runoff from the *Vistula* and *Odra* basins may be about 50 percent less than the mean annual value. The situation is made especially difficult in case of the always-possible several years long sequences of dry years. Drought situations are quite common especially in the west central Poland where average precipitation is less than 500 mm what is characteristic for the moderately dry climatic regions. Under such circumstances, natural supply of water for agriculture varies substantially from year to year and supplemental irrigation is required. The river basins of Lithuania, Latvia and Estonia are much richer in water resources than Poland. Still in dry years local shortages may develop but usually they are relatively easy to handle. All three Baltic states are in the zone of surplus humidity, therefore, water excess here is more important issue than irrigation.

2.6 Floods and excess water problems

The hydrological regime of many rivers in the *Danube* Basin is extreme due to the hydrometeorological conditions and large variability in the precipitation. The high to low flow ratio of the Danube at the middle stretch is about five. It is however 50 for the *Tisa* River and 500 for small to medium rivers. The *Danube* floods every 2-3 years on average (while for example, the Tisa does every 1.5-2 years). Extreme floods occur every 10-12 years. Such events are caused by “surprises” and the coincidence of unusual factors, such as local storms, unusual areal rainfall pattern, high soil moisture content, and so forth. Land use changes, climate changes, and illegal constructions in the flood plain are thought behind these extreme events.

Excess water: dilemmas of transition

Large areas of drainless land in the Tisa valley in eastern Hungary are endagered by excess water problems. Several ten thousand kilometres of ditches were constructed during the past fifty years. Many ditches serve as irrigation ditches during the vegetation period, and as drainage ditches during wet spells. The tremendous change in property conditions in agriculture, and the reduction of average farm size to 1-5 hectare cause serious operational and maintenance problems. Excess water often appears together with floods and there can be conflicts between the control of the two phenomena. These can be associated with water quality problems: not adequately treated municipal wastewater cannot be released by ditches not functioning due to flood related high water level in receiving rivers. There were serious damages in 1998-2000. In spring 1999 about 450 000 hectare agricultural land was inundated for several weeks. In rural villages several thousand houses were partially or fully destroyed due to high groundwater table level to which also the lack of sewerage contributed.

Generally flood control systems are well developed in the *Danube* basin (though maintenance is not satisfactory and the monitoring network should be improved in the most eastern part of the basin). The total length of protective dykes can be expressed in thousands of kilometres in the basin (in Hungary alone 4,200 km). Many settlements, several ten million people, railway lines, public roads, industrial plants, and a significant portion of the countries' GDP are protected. It is generally believed that constructed civil engineering works reduce the consequences of large disastrous floods. But such events are still occurring and cause substantial economic and social damages.
For instance during the past decade a number of major floods occurred: e.g. 1990 and 1998 in Slovenia, the mid-nineties in Czech Republic and Slovakia, 1998 and 1999 in Hungary and Bulgaria. Many of them were evaluated as 100-year return events. New concepts of flood focus on likely future land use changes (mostly in agriculture), emergency reservoirs and needs of nature conservation.

Due to specific climatic conditions over the *Vistula* and *Odra* basins in Poland (the boundary between continental and oceanic climates), the year-to-year variability of annual runoff is very high. In the wet years the annual runoff from the territory of Poland may be in the order of about 90 km^3, i.e. 50 percent higher than the mean rate of about 60 km^3. Flood management is a serious national issue as seen recently in 1997 when flood losses reached about USD 10 billion. Mostly poorly maintained protective dikes of about 10,000 km total length provide protection against floods. Flood storage volume in the storage reservoirs is quite limited. One of the principal causes of serious flood losses is human encroachment into floodplain zone.

In Lithuania spring floods incur heavy losses mostly in the delta of the *Nemunas* River. These floods occur even during the low flow years, since ice jams are often formed on the tributaries of the *Nemunas*. Construction of flood levees is under consideration, although non-structural solutions, like local insurance schemes, may be sufficient.
The flooding problems in Latvia focus mainly on the protection of lowlands and flood losses experienced in the past have been moderate. Flood protection problems are usually related to the sea water level rise in coastal areas, spring floods in the lowlands, and ice jams in the upper reaches of the *Daugava* River. Although flooding occurs in Estonia, fortunately flooded areas are generally small (they do not exceed 200 km^2) and poorly inhabited, like the *Soomaa National Park*. Still some cities, like Tartu, the second largest city of Estonia, may experience flood problems. Therefore, the flood control should be taken quite seriously, although it is not the priority problem in Estonia.

Several areas in the CEE region (especially the three Baltic states) have problems with evacuation of excess water accumulating in the lowlands and local depressions during the intensive and often long-lasting rainfall events.

Water accumulating in lowlands: Lithuania

Out of almost 3.4 million hectares of agricultural lands 80 percent (2.6 million hectare) is drained. About 90 percent of agricultural production of the country is being produced on drained lands. Land reclamation has proven to be an economically efficient tool for extending agricultural activities but at the same time it caused serious environmental damages. About 70 percent of smaller Lithuanian rivers are regulated and only 30 percent remained natural, including the largest rivers of Nemunas and Neris. The total length of subsurface drains in Lithuania makes around 1.6 million kilometres. The drainage water is being collected and transferred by 53,000 km of open ditches and around 10,000 km of interceptor ditches, both including around 730,000 different hydraulic structures. The balance value of land reclamation systems is considered to be in the order of 1.9 billion USD. Due to the collapse of former collective farms and establishment of small farms (8-20 ha) many drainage systems are left without proper attention. At present 263,000 ha of lands are not used due to the damage of drainage systems. In 1997 over 290,000 ha of drainage structures and 7,400 km of open ditches have been transferred to the new land owners.

2.7 Transboundary issues

Changes of the past decade have increased the recognition of the importance of international co-operation in water resources management across the region. Reference can be made here to the Dublin-Rio process, the Helsinki and Sofia/Danube conventions, the increased need for integrated strategies, the preparation of the EU water policy, impacts of the EU accession process, the regional problems of inland seas, international programs (such as the Danube Environmental Programme), and the establishment of the international catchment commissions (such as the *Danube* Commission, the *Odra* Commission, and the *Peipsi* Commission). Bilateral and multilateral agreements regulating water use and management in international river basins will be needed on several rivers, among them such as *Nemunas, Lielupe,* and *Venta*. Some larger lakes situated in the near-border areas like Lake *Druksiai* and Lake *Vistytis* of Lithuania, call also for international regulations.

The main issue is how these agreements, conventions and programs can lead to more integrated actions in the future. The challenge for many countries is institutional in nature. Further improvement in international collaboration is also needed in the area of flood management, as shown in case of severe regional floods of the past few years. An additional element of transboundary water management stem from the establishment of a number of new independent states in the region (see earlier). Countries were born which face now problems that did not exist before or they remained hidden. After joining the European Union, a number of joint river basin authorities for shared rivers and river basins should be established with countries which at that moment will not yet be members of the EU.

2.8 Laws, legislation, institutions and water policy

During the past 10 years many important laws influencing water resources management were passed in the CEE countries in relation to environment, water, agriculture, nature conservation, regional development, and others. Sometimes time pressure led to shortcomings (see box).

Introduction of new laws under time pressure

In Hungary, the 1991 law of municipalities placed the development of water supply as a compulsory task of municipal authorities while responsibilities for sewerage and wastewater treatment practically remained open. These issues were felt to belong to the environmental law that was passed in 1995 only and related regulation is still not complete. The positive outcome was that public water supply exceeded 95%, while the negative one was the further widening of the utility gap; a tendency which started to change only in the second half of the 1990s.

In many CEE countries water administration at the policy level belongs to at least two ministries which stem from the specific nature of water that is needed in many sectors of the economy. In practice, institutional fragmentation is serious and different aspects of water management are allocated to different ministries that deal with “water”, “environment”, “forestry”, “agriculture”, “public health”, “domestic affairs” and others. The same pattern is followed when it comes to regional units, such as district water authorities, river basin agencies, regional environmental agencies, and the like. At the same time some of the necessary linkages are not sufficiently developed for example the one with physical and regional planning. Overcomplicated and intransparent institutional water management structures are a problem in all countries of the region.

Recent changes have led to a significantly increased role of local governments, the creation of new water boards by watersheds, and the disappearance of state owned water and wastewater companies (except some regional systems). The responsibility for water supply and treatment and ownership of the infrastructure has been transferred to municipalities. As noted earlier, the centralised planning by the state has been almost completely abandoned, and there is a strong movement towards decentralisation and privatisation. These changes have a positive impact on water quality management in the region. But still changes are needed, like in Lithuania where restructuring water treatment and supply companies is required by forming stronger, well managed, and hence more efficient institutions.

Transformation of water utilities: an easy task?

Water supply assets in Slovakia were divided into "main infrastructure" and "water supply services". The main infrastructure was excluded from the privatisation process, but the water supply services were transferred from centralised state-own enterprises to municipal and/or private companies. Forty percent of the over 1800 municipalities had applied for a free-of-charge transfer of infrastructure property by the end of the 1998. The first experiences and lessons learnt are as follows:

- *The Ministry of Finance still regulates the maximum prices applied for municipal consumers (60% of total consumers), thus transformed water services operate in a distorted market;*
- *The Ministry of Soil Management does not have the capacity to process and approve transformation projects. The process is slow and without feedback;*
- *Municipalities are reluctant to take over the services due to unclear future development in tax, price, insurance and depreciation policies, as the law on public water supply and sewerage systems is still awaiting government approval;*
- *Municipalities where water supply and sewerage services are profitable are not willing to enter into companies with other municipalities in the region. Thus, unprofitable units stay in the state-owned structure and become extremely under-financed;*
- *The transformation process is based upon a voluntary approach and its implementation schedule is not defined. The government did not set up phases or deadlines and the unclear situation about the future development is de-motivating;*
- *Municipalities are reluctant to receive facilities under construction as the government did not allocate resources for further development. Municipalities without water infrastructure in place were excluded from the transformation;*
- *There are cases, where the principles of transparent transformation were not attained.*

The next stages of transition, the regulatory system will be brought under review in all CEE countries and the operation of river basin authorities will certainly be revised in the light of the EU Framework Water Policy. Conditions of financing, the usage of various funds, grants, subsidies (often abused) and loans will be re-thought. The main challenge is that all these interrelated modifications be performed in such a way as to take into account the past experience and long tradition of water management in the CEE countries.

2.9 Similarities, dissimilarities and country specific issues

National differences among principal water management objectives and characteristics are substantial, and it is difficult to make general statements about the region as a whole. Still the following comments on similarities, dissimilarities and country specific issues can be made:

- Water resources of the four Baltic countries and their basins can generally dealt with separately as only a few catchments are shared. Still there is a number of common issues and problems for which similar solutions must be sought, for example protecting the water quality of the Baltic Sea. Several transboundary issues

must be solved among the Baltic countries (e.g. between Latvia and Lithuania), including agreements with some of the countries that are not covered by this report (e.g. Belarus, Russia);

- The six countries along the *Danube* river are strongly linked by the largest Central European river and consequently there should be a strong focus on solving transboundary issues. This is not easy since they are often in conflict with handling national problems of higher priority for the local population;

- Estonia, Latvia, and Slovenia are countries with relatively abundant water resources and have most of their problems on the "demand side" of water resources management (e.g. quality of drinking water, obsolete water supply and sanitation infrastructure, and inefficient small water utility companies);

- Some of the Danube countries, Poland and Lithuania have problems both on the "demand" and "supply" sides. The supply problems are especially acute because of the considerable year-to-year variability of water resources. Persistent water shortages in some parts of these countries cause resource allocation problems, conflicts and competition between different water uses;

- Water quality of both surface- and groundwater is a common problem for all countries in the region. The problem is multidimensional in its nature, i.e. legal (environmental liability), technological, informational, and institutional. Pollution by inadequately controlled discharges of waste of municipal, industrial and agricultural origin (non-point pollution sources) provides risk to human and ecosystem health alike;

- Flood management is mostly a problem in Poland, Lithuania as well as in all countries located in the *Danube* River basin that are highly vulnerable to floods and excess water situations. Most of the current flood protection is based on flood levees, with the relatively small flood capacities in storage reservoirs. The number of storage facilities is limited due to the predominantly flat topography of the region (the Carpathian Mountains are the only exception). Uncontrolled urbanisation, land use changes, and economic developments in the floodplains as well as institutional weaknesses are considered to be major causes of high flood losses;

- Water-related institutional arrangements in all CEE countries are considered overcomplicated, intransparent, and not financially self-supportive. Economic, regulatory, and institutional arrangements need to be strengthened at regional, national, river basin, and local levels to make them compatible with the new political and economic realities of the CEE countries;

- The principle of river basin management is well known across the region and in some countries river basin agencies are introduced (e.g. Poland, Hungary and Czech Republic). Those agecies are often not well nested into the overall institutional arrangements. Throughout the region there is a long tradition of long-term water resources development planning with application of mathematical models and computerised decision support systems. It should be recognised, however, that in the past it was more investment planning (with central implementation) than strategic planning (with adequate emphasis on management instruments and implementation via democratic institutional systems).

2.10 Summary of key issues

The priority water management issues in the CEE region include:

- Water quality improvement and pollution control, including protection of surface and subsurface waters, and the marine environment of the Baltic and Black Seas.
- Investment demanding water supply and sanitation in rural regions but also in urban centres and settlements (small, medium and large-size);
- Ecosystems at risk due to land conversion, changes of hydrological regimes (water management) and pollution by inadequately controlled discharges of agricultural and other non-point pollution sources;
- Rehabilitation of degraded areas;
- Flood management, as illustrated by recent floods of regional dimensions;
- Satisfying water demands in areas with scarce resources;
- Supplemental irrigation in the function of structural changes of agriculture that is needed to sustain and stabilise crops yields in dry years (including consequences of possible climate change);
- Strengthening economic, regulatory and institutional arrangements at the regional, national, river basin, and local level in a compatible way with the new political and economic realities of the CEE countries;
- Allocation of scarce financial resources in a strong transition when water as a whole may not be recognised as a primary issue;
- Capacity building and raising awareness in the area of water resources management.

3. THE DRIVERS

In a broad sense drivers can be demographic, technological, economic, social, environmental and governance related. Demography is not a strong driver in the region: population is rather stable (or declining) in most of the countries. Technology development will enable different and more efficient micro- and macro scale solutions that will lead to more economic water use and less residuals. Economic and social drivers are probably the most important: the challenge is whether all CEE countries will be able to approximate the EU within the considered time horizon. Environmental drivers will appear via changing concepts and integrated water resources management. Finally, governance is crucial as it offers the framework to implement any strategy in a democratic system.

This section discusses some specific pillars of future water resources management, which are typical for the CEE region. First, we discuss external drivers that have a fundamental impact on water resources management and other future developments in the CEE countries. Secondly, we discuss driving forces that are internal to water management.

3.1 Political, social and economic transition

Unique and fundamental changes in the political, economic, and social structure of the CEE countries over the past ten years are associated with a strong decentralisation in planning, institutions and decision making, the increased responsibility of municipal governments, the introduction of new laws and legislation, a drastic privatisation (up to 90 percent of the national economy), the transfer of foreign capital and so forth. By its very nature, the transition has been characterised by many abrupt and chaotic changes on top of the gradual ones, as well as by a number of mistakes which seem to be unavoidable.

The transition of the agricultural sector will certainly be one of the critically important drivers in the region. At present, this sector in most of the CEE countries

accounts for 20 to 30 percent of GNP, employing up to 30 percent of the labour force. Agriculture has gone through a period of substantial property changes as the earlier large-scale government and/or collective farms of a typical size of 100-1000 hectares have been replaced by many private family farms, often of no more than 2 hectares. The average farm size in Poland, where 90 percent of agricultural land always remained in the private hands, is not much bigger – about 8 hectares. With development of the service sector and reduction of unemployment, the agricultural sector will certainly become less labour-intensive and this will have an impact on water management.

" Generally, it is obvious to shift the responsibility of water resources management more towards self-governments of local municipalities and definite water users and polluters ensuring in that way their rights, obligations and liability, also affordability of funding of necessary water resources protection measures. "
From: Report of first round of consultation in Latvia

A fall in industrial output during transition reduced environmental damage in most CEE countries during the early nineties. There are signs that the economic recovery may not be accompanied by equivalent increases in pollution, because of more effective environmental regulation and improved enforcement. In all transition economies a combination of further market reforms and sound water policies can improve environmental performance:

- First, changes in relative prices should promote more efficient use of water;
- Second, privatisation and reduced state interference in economic decisions will encourage improvement in operating performance of water users, while replacing old equipment by less water-intensive and cleaner production technologies. Well-prepared water laws and investments can contribute to this process;
- Third, a clear institutional separation of enterprise ownership from regulatory authorities should help ensure realistic water quality standards;
- Fourth, international co-operation can bring some of the best water management practices from around the world to the CEE countries.

How other macroeconomic changes will affect water resources management is difficult to assess. Certainly less capital is available for large-scale water management infrastructure (e.g. storage reservoirs of regional importance), because of the state budget constraints. Unemployment is still high: 15% in some of the CEE countries, while values up to 50% occur in poor areas. Foreign investments will drive future developments in the water sector, but should adhere to a strong regulatory framework. Education is a critical factor for integrated water resources management, and reform must focus on developing an education system that is more responsive to demand.

The economic heritage and its recent developments over the past decade differ from country to country. This is clearly reflected by the simplest indicator, the per capita GDP (see last column of Table 3 in Section 2). For instance the per capita GDP in Bulgaria and Romania is about one-third of the per capita GDP in Poland, Czech Republic, or Hungary. It is a challenge for the entire region to accelerate the development of countries with poorer economic conditions in order to join the EU roughly within the same time horizon.

3.2 EU integration

There is a consensus in the region on the necessity of the EU integration and thus it is obvious that the requirements of the integration constitute one of the most important boundary conditions for the future water management. Joining the EU and fulfilment

of the necessary criteria shall provide a good basis for the development, prescribe deadlines and influence the process of political and economic decision making.

The water policy of the EU is based on sustainability. Major objectives are healthy drinking water supply, rational water use, preservation of ecosystems and prevention of risks. Basic concepts include the pre-cautionary- and polluters pay principle, prevention, cost-effectiveness, integration, subsidiarity, international collaboration and others. Among the criteria of water resources management, effluent requirements, ambient water quality goals, the definition of different zones and the importance of river basin management all appear.

One of the major issues of the integration procedure is the harmonisation of the legal system in the CEE countries with the EU legislation. Especially important in this respect will be the new Water Framework Directive. This directive establishes a framework to achieve several objectives such as sustainable water policy, sufficient provision of water for drinking and economic purposes, protection of the environment and alleviation of the adverse impacts of floods and droughts. Its environmental objective is to achieve "good status" for all groundwater and surface waters. At present it is not yet clear on how the new Water Framework Directive will be implemented and to what extent it will lead to an integrated policy. The risk that some of the emission related directives (e.g. the urban wastewater one) are very well (perhaps too well) defined while other emissions (e.g. diffuse pollution) – partially due to their nature – are handled rather differently, should be considered by CEE countries.

The Framework Directive sets out general principles, procedures, and requirements for legislation. Other "daughter" directives in each sector will conform to the general requirements of the framework directive. The adoption and the implementation of the EU directives require the evaluation of the existing legislation gaps. The gap analysis carried out in the CEE countries indicates that:

(i) the harmonisation of water-related rules has not yet been performed;
(ii) the adoption of EU water legislation requires efforts both in the administration (structure and capacity building) and in the development of water infrastructure and service;
(iii) the desired development of water service leads to the serious economic consequences.

The implementation of the still debated regulation concerning the proposed full cost recovery is a less investment-intensive challenge. However, serious difficulties can be foreseen when the full cost recovery is applied rigorously in pricing of drinking water and the sewerage charges. Significant portions of the population, who live in less developed areas, will not be able to pay for full cost, without adequate subsidies. This situation has already been observed in low-income areas. Thus affordability, financing, and avoiding the abuse of subsidies are crucial issues which together with the development of economy will influence the pace of the approximation process.

It should be noted that due to the Framework Directive, river basin planning will be a "compulsory" task, and this will certainly be a strong motivation to enhance river basin management and administration in a unified way. The relatively new EU water policy may not reflect local CEE conditions properly at all times. Directives will be likely modified in the future. There is space and need for negotiation with the EU of the application to the specific CEE conditions and economic implications.

The EU integration is undoubtedly the decisive driver of water resources management of the coming two to three decades. It will be a major political milestone for the entire region when the first set of countries is accepted to the EU.
In a broader sense, the EU integration will ensure political stability in the region, politically settled and legally regulated population migration, economic development along the same line, and much smaller stratification within the region.

"EU accession will be the main driving force in the water management sector of Lithuania."
From: Report of second round of consultation in Lithuania

3.3 Financing and affordability

Lack of financial resources call for the definition of priorities with the highest economic, social, and environmental benefits. This clearly requires strengthening institutional capacity. Careful negotiations are needed to agree on EU criteria according to local conditions and on reasonable transition periods. It is also important to develop a timetable of phased investments over a long period (and action plans associated) so as to let incomes rise sufficiently. Finally, subsidies seem to be unavoidable in implementing public investments. However, the proportion of grant funding should be limited to give incentives to municipalities to construct and to operate their utilities more efficiently.

Investment needs in the water sector to meet EU directives vary roughly between 500 USD/capita and 1000 USD/capita (see section 5). This it is a considerable investment when compared to per capita GDP in CEE countries (see Table 3). Clearly, CEE countries and poorer segments of the society still have bread and butter worries, and it is not easy to allocate the needed budget for environmental and water purposes. Thus, affordability is a serious problem and calls for sensitive, efficient, multi-phased developments and policies. On the positive side, skill in CEE countries exist to develop such strategies.

3.4 Other international dimensions

One of the drivers of water resources management is how the existing and future international agreements will be implemented and enforced.
As countries gradually join the European Union (which we assume), a number of joint river basin authorities for shared tributaries will be established with the countries that are still outside of the EU family. The process will result in continuous changes in the coming decades unless the CEE countries voluntarily decide to accept the related EU policies, irrespectively of their status. This would be an advisable decision due to the strong need for more integrated regional planning in the Baltic and Danube basins alike.

"Latvia is aware of its responsibilities for taking concrete action to cut the pollution of surface water and is striving to reduce its pollution load. Under HELCOM, the Baltic Sea Joint Comprehensive Environmental Action Programme encourages countries to focus on and combat pollution from the hot-spots."
From: Report of first round of consultation in Latvia

Water resources management may have many other implicit international dimensions in the CEE region (and the former Soviet Union countries), that depend on political stability, bi- and multilateral trade agreements, and other basically "non-water" factors. The Kosovo war and the case of Yugoslavia are examples in this respect.

Danube upstream and downstream of Yugoslavia

The air strikes on Yugoslavia in the first half of 1999 led to significant water pollution of the Danube river. Although not all consequences are yet well explored, it is sure that the environment was heavily overloaded with different hazardous materials from destroyed and damaged industrial complexes, explosives, combusted jet fuel, etc. The water and sediment pollution, especially in the hydropower reservoir Iron Gate, causes long term social-economical and ecological consequences in riparian countries along the middle and lower part of the Danube River. Extensive investigations should be performed to quantify damages in the entire downstream section of the Danube and set up priorities for reconstruction and environmental rehabilitation of the whole sub-region.

Air strikes destroyed five bridges and damaged three bridges over the Danube, blocking all navigation on the river. The destroyed bridges splitted the river into two parts, upstream and downstream of Yugoslavia, and created considerable economic loss for all Danubian countries. The destroyed bridges also cause significant changes of water and sediment flow regimes. The intensive turbulence near the bridges was followed by rapid riverbed deformation. The destroyed bridges could provoke serious problems during wintertime in the form of ice jams and flooding. Another serious problem is the presence of unexploded missiles and bombs in the riverbed. Cleansing of the riverbed is of utmost importance.

3.5 Present features of water resources management: opportunities and constraints

In many CEE countries water resources management has a history of about two centuries. Similarly to Western Europe, most of the river regulation and flood protection works have been completed in the second half of the 19th century. The same applies for public water supply and wastewater collection systems in larger towns. Many additional developments were made after the Second World War, which included the construction of reservoirs, dams, irrigation schemes, diversions and other facilities very much reflecting the philosophy of unidirectional, linear, quantity oriented expansion of the socialist economy.

As discussed in Section 2, developments during the era of central planned economies show negative impacts such as eutrophication of standing waters, unbalanced development of water infrastructure leading to nitrate contamination, and changes of the groundwater level. Lack of sewerage resulted in the increase of groundwater levels in the vicinity of many settlements. Irrational mining activities had drastic impacts on subsurface and karstic waters. Industrial and military production activities based on outdated technologies generated large quantities of toxic residuals and large spread contamination of soil and groundwater.

Institutions and legislation are relatively well developed in the region, although management structures are still fragmented. Law enforcement is traditionally weak. River basin agencies or district water authorities have been established in many CEE countries, but they do not function yet as effectively. However, the existing systems of water resources management and past experiences offer a solid base for further developments.

There are also serious constraints. For instance the remediation of degraded regions and “chemical time bombs” are rather cost and time demanding. More important is perhaps the high inertia and long economic life (often 50-100 years) of water projects. This applies to flood protection dikes, sewers and many other structures. Changing concepts and future demands often call for developments and reconstruction under new principles. This creates a strategic dilemma: can we introduce new concepts to change existing systems (which may be still attractive to the society) or rather we preserve solutions of the last century for the next one?

3.6 Changing concepts and needs

The philosophy and underlining concepts of water management have changed substantially and the trend towards more integration is ongoing. The first element of that trend is to replace “protection” by prevention. Meeting short-term demands shall be replaced by long term sustainable solutions, stressing at the same time water quality objectives, ecology, and nature conservation. New concepts and methods will include sustainability, life cycle assessments, and material balancing and accounting. Second, water awareness is growing – the importance of water for the economy and the society is more and more appreciated. Water is accepted as an economic good and pricing is becoming an important issue. Third, the obvious decline of traditional water engineering and its integration into water management is observed. Integrating water resources management with land use management, environmental management and nature conservation, and finally with the economy and the society is crucial and unavoidable.

The linkage of water and the environment is problematic in itself. Water is an element of the biosphere and thus it is subject to environmental management. At the same time water must be managed as a resource. This raises serious institutional issues observed all over the world. The preparation of a strategy for the future will be much tougher than it was in the past: more and more driving factors will be located outside of water management. Next, globalisation and regional dependence is to be emphasised. Finally, uncertainties inherent in all “predictions” may produce unpredictable by now new concepts and needs.

3.7 Sectoral changes and impacts on water resources

Heavy industries that strongly relied on state subsidies, have been going through major alterations. Military industry has nearly completely disappeared. Smelting, mining and steel and chemical manufacturing have declined since they could not compete with the world market prices. They have been frequently replaced by more competitive industries (automobiles, electronic and light industry, general manufacturing, services etc.) that are less water-intensive. Multinational companies entered the market and this led mostly to modernisation, structural change, introduction of clean technologies and meeting environmental requirements. Some examples of the usage of outdated technologies, exist. All the changes were associated with major reduction in energy consumption. For example, in years 1990-1996 energy consumption in the Czech Republic, Poland and Hungary dropped by about 20 percent , and as a result, lignite mining reached the post war level.

These features are typical for CEE countries that are well progressed in the EU approximation process. In the other countries large scale industrial enterprises with obsolete technologies, high raw material and energy consumption continue to operate. Many industries are in a deadlock. The introduced reshaping mechanisms were often insufficient and lead to adverse effects. Such negative tendencies may push economies away from the European path and sustainable economic targets.

The shift from large scale collective farms to small family farms is marked by excessively large diversification that reduces the opportunities for application of efficient planning, management and decision making procedures. Reduction in agricultural production is particularly pronounced in mountainous areas where farming is less productive. Marginal lands have been frequently abandoned. As noted earlier the relative importance of agriculture in the national income is likely to further diminish. Large-scale irrigation and drainage systems that have collapsed in the past years are not likely to be used in the future without major reshaping. The stabilisation of ownership conditions, changes in crop production and the overall re-structuring of the agricultural sector in the light of European changes will define its future water demands that generally should not depart much from their present levels. The application of fertilisers, pesticides and herbicides has declined by a factor of 2 to 5. These have not necessarily led to a serious decline in crop production, which suggests that too many chemicals were applied in the past. Diffuse pollution has been reduced, however high yield farming is likely to result in an increase in the future. Incentives to control activities are crucial. It should be recognised that with enhancing point source abatement the relative role of non-point sources increases. However, diffuse sources are much more difficult to control. Good agricultural practice is still underdeveloped in the region.

Industrial emissions have been significantly reduced in many countries, and this reduction will continue. Overall, rivers in industrial areas (e.g. the *Nitra* River in Slovakia, the *Mura, Drava* and *Sava* Rivers in Slovenia, the *Sajó* River in Hungary) exhibit significant water quality improvements, by one to three classes. Significant improvements in water pollution by micropollutants have been achieved, although often contaminated sediment cause severe rehabilitation problems for the future. These changes clearly underline opportunities of restructuring of the future industry with a focus on clean production technologies and prevention.

Municipal pollution has hardly been reduced by the transition process and future developments will require significant investments. Water consumption decreased by about 40% in many urban areas, as a result of general increase of water prices and wastewater charges, as well as due to technological changes. Reduced water consumption resulted in stronger raw wastewater and hydraulic underloading of wastewater treatment plants (in contrast to the overload of the eighties). It also led to larger residence time of water in the distribution network that can induce negative water quality alterations. Also, excess capacities should be maintained, thus reduction of consumption has also adverse consequences. Because of late recognition of the changing trends several new water supply and sewerage systems have been over-designed. The tendency towards reduction of water consumption still continues. Another problem is ageing of water infrastructure, substantial non-accounted-for losses, and high in- and exfiltration (about 30 percent depending on site-specific conditions). The lack of adequate sludge disposal facilities is an issue all over the CEE region and urban stormwater management is far beyond the level of more advanced European Union countries.

Water pricing and consumption

In Slovakia in 1996, the specific water consumption was about 300 l/capita/day for consumers of water and sewage works companies, and 150 l/capita/day for consumers of municipalities. In 1997, specific consumption in households decreased to 130 l/capita/day (in 1990 it was nearly 200 l/capita/day) and 83 l/capita/day for the above two clusters. Thus, the specific water consumption in households compared with European countries (147 l/capita/day) is below average and is close to the hygienic minimum (80 l/capita/day). The decisive factor in the reduction of water use was the significant and needed increase in drinking water price. Similar changes occurred in all the CEE countries, even if they were less abrupt. However, the alterations caused surprises. In many towns non-utilised capacities should be still maintained. Increased residence time in the distribution network may cause undesired quality deterioration. Reduction in water consumption led to less but "stronger" wastewater. Wastewater treatment plants originally planned for different conditions can not be re-adjusted all the time what results in higher operation costs and poorer performance. Integration is a key issue also here.

More investments have been made in municipal water infrastructure in the past five years or so than ever in the history in several CEE countries. This is very positive. At the same time over-expenditures were made and/or unnecessary capacities were created. These were due to unclear definition of objectives, hasty tendering procedures, poor project preparation, management and implementation, and so forth. The lessons learned should be used in the future in other CEE countries which plan similar projects now.

Investment in municipal water supply and treatment in the Czech Republic

Wastewater treatment coverage in the Czech Republic has increased from 72% to 91% in ten years. This increase is the result of major investments. Among other developments, 150 plants were built, extended or upgraded.

Municipal point sources will be influenced according to changes in the level of sewerage and wastewater treatment. In the EU priority candidate countries a number of large wastewater treatment plants have been installed and river stretches of critically low water quality and DO sags can now be rarely found.

3.8 Institutions: overcoming the lack of integration in water resources management

Institutional development is a major driver for water resources management in the region. Institutions incorporate the legal, administrative and economic system as well as regional agencies acting on different fields. Many water laws have been passed recently in CEE countries. These laws are based on principles of decentralisation, subsidiarity and integration. The major issue is whether the rather complex institutional system ensures the meaningful implementation of a strategy with inherent conflicts, risks, uncertain elements and surprises. The brief answer is that the system usually incorporates barriers, which often hinders to realise objectives as planned.

The definition of river basin authorities will have a wider impact on water resources management. There is no such a country in the region, as for instance France, where

large river basin units have significant income from taxes and budget, as well as clear development objectives and priorities. These basins have also "water" government and parliament, i.e. a full water related integrated institutional system (as an exception, Poland is trying to introduce a similar model). Many countries cannot be clearly subdivided into river basins or their basins are just too small from an administration and management viewpoint. Quite frequently a lake or a river (or even two banks of a river) belongs to two or more agencies clearly indicating the existence of "shared" river basins within a country.

The degree to which sectoral approaches remain in place, will determine the fate of integrated water resources management in the region. A mix of actions leading to more integrated solutions in water supply, sewerage, or flood control, will be preferred than strictly sectoral investments. Transparency of financing and subsidies systems will to more cost-effective solutions. In several CEE countries the system of financing and funding is permanently changing. This is not secure enough and not necessarily serves public interests all the time. In this context development of municipal authorities will have to be monitored to avoid the situation that no space is left for river basin scale initiatives (national and international alike).

3.9 Climate change

Climate change has a definite, although not fully known, influence on the hydrographical conditions in the region. However, climate change related water resources impacts are of major concern since we have practically no influence on the phenomenon characterised by huge uncertainties: political systems typically do not take up unknown problems. Potential impacts may affect availability, demand and quality alike, ecosystems, and the hydrologic cycle as a whole. Concerns are primarily high in the areas already characterised by water scarcity. In addition to impacts on availability, extremes and fluctuations may become larger, and seasonal distribution of precipitation and/or runoff may alter negatively.

Climate change in the middle zone of the Danube Basin

A study characterising the middle zone of the Danube Basin led to the following conclusions:

(i) *The climate will likely be shifting towards Mediterranean one with increased temperature (by 0.2-0.4 C° per decade in winter and 0.2-0.8 C° per decade for the coming 30 years);*
(ii) *Rainfall may decrease in the summer (by 20-100 mm/year depending on location), while it could increase slightly in the winter;*
(iii) *Runoff of most of the rivers is likely to be reduced to larger extent than rainfall (15 to 30 percent depending on site specific conditions);*
(iv) *Winter runoff will probably increase, while summer one will decrease (it can be halved under low flow conditions);*
(v) *The amount of snow may be reduced and snow melting as well as floods may appear earlier influencing water extremes;*
(vi) *Water balance and quality of lakes may be subject to many sided impacts;*
(vii) *Soil moisture is likely to be reduced, and consequently the length of droughts and extension of arid areas grow.*

Large number of international organisations (IPCC, WMO, IGBP, ICSU and others) deal with the issue of climate change, its research and policy aspects. From a policy point of view climate change can be considered as an incremental element on top of many existing problems. The IPCC reports recommend focusing more on flexibility of designs in the future to keep the options open. Decisions taken should be justifiable also in the absence of climate change. Adaptive actions should be undertaken only if the expected cost of inaction is very high. Options to decrease water demands should be also kept in mind when talking about climate change impacts. There are examples of countries that well manage their scanty resources by rational allocation, water savings, promotion of water re-use and re-cycling.

The issue of climate change is not yet high on the political agenda in the CEE countries, but it is promising that in a number of countries consultations and research programs are going on. Examples include Poland, Slovakia, Hungary and Bulgaria.

4. CENTRAL AND EASTERN EUROPE WATER VISION

Developing a regional Vision for water resources management for the year 2025 is a difficult task. Projections of political, economic and social situations become unreliable as the time horizon expands to 25 years. Our limited understanding of economic, social, and natural processes complicates visualising the future. It is difficult to foresee how the current political, economic and social transition processes will unfold, so how can we envisage the transition to sustainable water resources management?

We know that the future will not look like the past. Economic development and the associated growth will put more pressure on water resources. But democratic and market forces are likely to affect water resources management in a positive way. The private sector, which generally is more effective and efficient than the public sector, will grow and develop. How will economic, social and technological changes affect water? What strategies and investments should be made to take advantage of those changes to meet future water demands and to ensure that water resources and the ecosystems on which life depends are protected for future generations? This regional Vision tries to take into account the complex relations between society, drivers and water resources management as shown in Fig. 2.

How do you imagine Bulgaria in the year 2025?

The second round of consultation for the Vision and Framework for Action included a questionaire among 628 people (54% women and 46% men) in three towns in Bulgaria. Interviewees included pupils, students, teachers, and other citizens.

Half of the interviewed people had a pessimistic view on the Bulgarian situation in the year 2025, including absolute economic collapse, heavy pollution, and insufficient water resources. Thirty six percent were optimistic and foresaw that Bulgaria will overcome the current crisis, and will become integrated in the European structures. This group envisaged a cleaner and more beautiful environment to live in. Eight percent of the questioned people were hesitant and state that the features of a future Bulgaria depend largely on concrete plans of the government and international support. Six percent did not answer this question.

		Society						
		Enough Water?	Risk, Security	Life Quality	Ecology	Agriculture & Rural Development	Institu-tions	Drivers
Water Resources Management	Demand and Supply	●			❍	❍	●	1,4,8
	Flood Control		●		❍	❍	●	4,8
	Municipal Water Management	❍	❍	●		❍	●	1,2,3,7
	Water Quality		❍	●	❍	❍	●	1,2,3,4,7
	Ecology, Nature Conservation	❍		●	●	❍	●	2,7,8
	Agricultural Water Management	❍	❍		❍	●	●	1,2,7,8
	Institutions	●	●	●	●	●	●	1,2,3,4,7
	Drivers	1,4,7,8	4,8	1,2,3,4,7	7,2,8	1,2,7,8	1,2,3,4,7	

❍ Connection*
● Strong Connection

Drivers:
1. Transition
2. EU Integration
3. Affordability and Financing
4. International Dimension
5. Present WRM*
6. Changing Concepts*
7. Sectoral Changes
8. Climate Change

* Applies to all the elements

Figure 2. Relations between society, drivers and water resources management

4.1 Regional Vision

This regional water is built on the assumption that a strong commitment to averting a water crisis is made by all concerned — those who govern and those being governed.

Our Vision is that in two to three decades there will be sufficient, safe, clean and healthy water for nature and people living in stable societies in the CEE region.

This is an ambitious Vision. At present many areas of the CEE region face water shortages, flood control measures are insufficient to guarantee safety, drinking water supply and sanitation are not always at the adequate level, our water environment and ecosystems are polluted, and societies are still in a transition period. To implement that Vision will require a joint and serious effort from all of us.

"The Water Vision for Hungary is: The future is a society of well-fed people supplied with reasonable amount of water, served with proper sanitation in a healthy environment containing viable and diverse ecosystems."
From: Report of second round of consultation in Hungary

4.2 Objectives, targets and milestones

The Vision statement for 2025 can be translated into a number of objectives, targets, and milestones. Milestones are measurable indicators of success and their scheduling. Figure 3 shows the path from the present state to the future Vision. Targets and milestones help to specify the Vision and detailed strategies and actions. Since the future incorporates a number of uncertainties, risks and surprises inherent to water resources management, monitoring and timely adjustments of strategies play a crucial role.

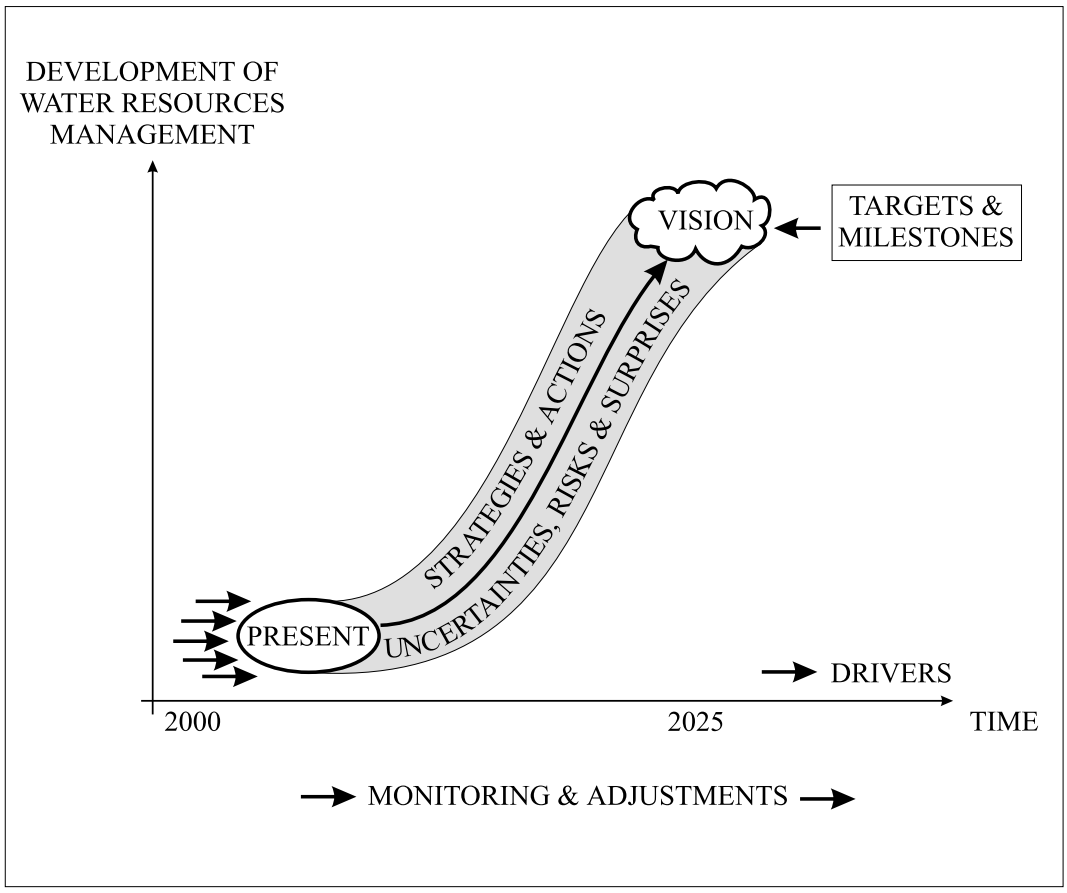


Figure 3. From the present to the Vision: strategies, actions, targets and monitoring

Water shortage is no longer an issue. All the rational water demands are satisfied by equitable allocation of water to all users, even under potential negative impacts of climate change. Economic growth increases neither the demand for water nor the emission of waste substantially. Water use efficiency is high due to demand management, water reuse, and recycling. These processes are facilitated by adoption of appropriate technologies, best practices, and management systems developed through continuous investments in R&D. Production of goods and services uses less water because of increased material and energy efficiency.

Targets and milestones:

2025	The per capita water withdrawal and use of water resources is reduced by 10% in all countries of the region, compared to 2000.

Strategic actions and initiatives enable people living in urban and rural areas to enjoy uninterrupted *supply of safe, good quality water at affordable prices* as well as adequate sanitation. Pricing policies for water supply and wastewater disposal have enabled full recovery of investment and O&M costs for local water quality management infrastructure (e.g. wastewater treatment plants). Investment costs for large-scale water management infrastructure, such as multipurpose storage reservoirs of regional significance, are still partly paid from state budgets in the countries, that are not endowed with sufficiently large natural water resources. Pricing policies encourage competition in water supply services through more active participation of the private sector.

Targets and milestones:

2025	Water supply meeting EU drinking water standards is delivered in >98% of all households, both rural and urban.
2025	Adequate sanitation coverage is at least 95%.
2025	Pricing policies for water supply and wastewater disposal have enabled full recovery of investment and O&M costs. The money that is collected by water pricing is reinvested in water management.

Floods and droughts are mitigated according to internationally accepted safety criteria by both structural and non-structural measures. Highly effective early warning systems are in operation. Wetlands are formed in those regions where ongoing land use changes allow it without safety risks. Flood fighting and rescue measures are in place in case of major flood events.

Targets and milestones:

2025	Well-maintained flood protection measures are implemented according to internationally accepted principles (e.g. 100 or 1000 year return periods depending on the importance of the region to be protected).
2025	Along the line of changes in land use pattern, many wetlands have been reconstructed (their extension should be at least doubled)

Adoption of *eco-friendly farming, improved nutrient management and industrial practices*, provision of extensive sewerage services and waste management systems, have reduced point and non-point source pollution substantially. These measures have contributed to reverse past trends in pollution of both surface resources and groundwater aquifers, though soil nutrient content is still higher than desired. Tourism and recreation flourish around the water environment. Advanced and clean technologies are applied combined with reuse, recycling and source control.

The need to rehabilitate and protect the aquatic environment is appreciated by water users and decision-makers, and ecosystem restoration and water conservation become principal objectives of water resources management.

Targets and milestones:

2025	In comparison to the year 2000, C, N and P point source and diffuse emissions are reduced by more than 50%. Industrial emissions are cut by 70%, while that of toxic materials by 90%. As a result of actions made, most of the surface waters belong to Class I and II in a five-class evaluation scheme. Class III may appear rarely. By employing simple treatment techniques groundwater can be used – except the upper aquifer – for drinking water purposes;
2025	Most rivers, including Danube, Odra, Vistula and Nemunas, have been largely restored.

2025	Inland seas and lakes including Danube Delta, the Black and Baltic Sea are on a well-progressed way to be rehabilitated; 75% of all lakes meet internationally accepted standards.
2025	Tourism and recreation trade contribute substantially to the total GDP of the ten CEE countries in a sustainable way.

Strengthened *institutions,* harmonised laws and legislation and their enforcement guarantee the implementation of integrated water resources management at the national and international river basin level. These institutions function on the basis of decentralisation, subsidiarity, integration and participation principles. Governments recognise that their principal role is to provide a regulatory framework to protect the citizens rather than to provide services directly. Systems operation is characterised by cost-effectiveness and transparent schemes of financing. Institutions ensure equitable allocation of water to all domestic, industrial, and agricultural users, without compromising the sustainability of precious life-support systems. The authorities are efficient, transparent, and maintain good contacts with NGOs, CBOs and other locally elected bodies. Public access to information is enforced. As a result of co-ordinated regional and national efforts, *sustainable water resources management* becomes a part of sustainable economic and social development.

Targets and milestones:

2005	Information is freely available to the public.
2015	The authorities are efficient, transparent and in good contact with NGOs and community based organisations (CBOs).
2025	Strengthened institutions, harmonised laws and legislation and their enforcement guarantee the practical implementation of integrated water resources management principles.

River basin authorities are responsible for designing, implementing and executing the integrated water resources management principles. They have a strong legal base, are politically recognised, and are supported by the national and international political bodies. The river basin authorities have adequate and stable financial resources, which are generated mostly internally, and are sometimes supported by the state budget for large-scale projects of national significance. They have adequate and well-trained professional staff and technical means to implementation of the IWRM principles in practice.

Targets and milestones:

2025	Well-defined institutions and organisations function to realise integrated river basin management on national and international level alike.

The countries of Central and Eastern Europe have all attained the status of full members of the European Union. The countries are proud to have a water sector that is managed efficiently and in an integrated manner. This became possible largely through partnership agreements signed by all the CEE countries that eventually led to a complete settlement of all *transboundary problems* in the region. Water, apart from

being regarded as an economic and social good, is recognised as an essential commodity for co-operation rather than conflict. Efficient planning and international co-operation helps to solve all transboundary issues.

Targets and milestones:

2005	The first group of candidate countries has joined the EU, while the other countries since have justified that they are in all respects prepared to join the European integration process.
2025	All ten CEE countries are EU members, characterised by stable societies and economies.
2025	The smallest per capita GDP is not less than half of the EU average.

Principles, such as polluter pays principle, precautionary principle, pollution prevention at source, subsidiarity principle, are introduced across the region. Environmental quality and ecosystems stability is substantially improved. Economic development decisions take adequate account of the needs of ecosystems. As a result biological diversity has improved, and landscapes are better protected.

Targets and milestones:

2025	Principles of sustainable management and ecological economics are increasingly implemented in the practice.

Implementation of innovative policies and legislation in all CEE countries provide the enabling environment for the sustainable management and use of water resources. Water satisfies the needs stemming from high living standards. Rural development has taken a positive path, and urbanisation had stopped. Stratification between rural and urban areas has largely disappeared.

Targets and milestones:

2025	The ratio between urban income and rural income is less than two.

4.3 Implementation strategy

The above Vision is a broad definition for the entire region expressing wishful thinking like it was done by the 1972 U.S. Clean Water Act. The rate of realisation may vary from country to country, due to differences among countries in their present situation and future developments. Thus, both the present and the desired future are characterised by a broad range of conditions rather than one single regional status (see Fig. 3).

"Targets for the objective 'Sufficient availability of water quantity and quality for human consumption, economic development, and environment' include:

(i) River Basin Management Plans for 8 main River basins will be elaborated by 2010 (refer to Water framework Directive)

(ii) main point sources of pollution from municipalities will be reduced by 2006 (refer to Urban Waste Water Directive)

(iii) dispersed sources of municipal pollution will be reduced by 2017

(iv) conservation and protection of biodiversity

(v) efficient water supply system"

From: Report of second round of consultation in Slovenia

There are alternative routes and strategies leading from the present to the Vision, depending on scenarios composed mainly of drivers and adjustments made during implementation (Fig. 3). A strategy needs to visualise "future history" for several decades. Since the future is not known and is influenced by several uncertainties and surprises, it is expedient to analyse possible scenarios, for raising and answering key "what if?" type of questions. The approach may help to avoid the mistakes of the past which can often be characterised by evaluating as "too little, too late" and utilise the existing knowledge better and in a more action-oriented way than formerly. Objectives and milestones can be used to develop and monitor the strategy in more detail. Strategies and objectives can lead to action plans with detailed targets and their scheduling. If at a given time horizon a target is not met, adjustments should be made.

From the viewpoint of the future at least two questions should be addressed, even if we do not necessarily know the answers:

(i) which of today's problems may have serious impacts in thirty-fifty years' time that we would like to avoid? and

(ii) are we always going to follow the same development paths (with the same mistakes) as the more developed countries?

In principle, the implementation strategy should follow the IWRM principles, with a special focus on:

- *Integration.* Practical ways to reconnect present fragmentation and to avoid institutional fragmentation need to be developed.

- *The principle of ecosystem management.* The perspective needs to be shifted towards recognising all values of biodiversity and all those to whom biodiversity represents a value. It is necessary to adopt a more comprehensive view of aquatic ecosystems and nature, and learn how to interact with ecosystems in such a way as to maintain their integrity;

- *Communication.* Communications between main actors in water resources management, interest groups should be enhanced. Dialogue among politicians, water consumers, water specialists and other stakeholders should be improved;

- *Capacity building.* Training in IWRM develops professional skills. Raising public awareness increases public participation;

- *Orientation towards EU accession.* All short-term actions on IWRM oriented towards EU accession.

Integrating what?

The concept of *Integrated* Water Resources Management (IWRM) – in contrast to "traditional" water resources management – should be considered as a management set-up that requires an integrated approach at the technical/physical level as well as at the planning and management level. But *what* is to be integrated in pursuing IWRM? IWRM involves the following aspects of integration:

Integration of physical aspects

- The vulnerability of water resources entails a need for integration of water quality and quantity aspects.
- Groundwater management and surface water management are strongly interrelated.
- Freshwater management and coastal zone management need to be integrated.

Integrating various water uses

- Water supply and sanitation, irrigation and drainage, and ecosystem preservation policies are traditionally sectoral. The major users compete for the same scarce good water quality resources, and good water resources management requires a dialogue.
- Water resources management should be demand driven and involve all stakeholders – public as well as private – at the earliest possible time and at all levels. Decisions or actions concerning water resources management should be taken by those affected i.e. at the lowest appropriate level (the "principle of subsidiarity").
- In water quality control, policies on emissions stemming from various sectors (municipalities, industry, and agriculture) need integration, as well as the control of point and non-point sources of pollution.

Integrating upstream – downstream

- There is a need for recognition of the linkages between upstream and downstream users of water. Upstream users must recognise the legitimate demands of downstream users for sharing the available water resources. Excessive waste or pollution of water by upstream users may deprive the downstream users of their legitimate use of the shared resource. This clearly implies that dialogue is needed in order to reconcile the needs of upstream and downstream users.

Integrating water resources management into national policies and economy

- Recognition of strong links between energy and water.
- Integrating WRM in the national economy and physical planning policies.

5. FRAMEWORK FOR ACTION

Implementation of the regional Vision requires effective actions to provide safe, clean, and healthy water for people living in the CEE countries without compromising the sustainability of vital ecosystems. The challenge is to find the right balance between competing uses at every level – regional, national, community and household. This balance must take into account efficiency, equity and sustainability criteria. This section is based on the second round of national consultations carried out in the second half of 1999. The results of these consultations are presented under two basic categories. The first category incorporates enabling actions of basic importance for all further initiatives. They are related to the governance arrangements, accession to the EU, generation of knowledge, and public participation. The second category includes several action themes directly related to water resources management. To the extent possible, distinction is made between short-term (2000-2005), mid-term (2005-2010) and long-term (2010-2025) actions.

5.1 Setting the scene – enabling actions

A. Making governance effective

Governance is the framework of political, economic and legal structures within which societies choose and accept to manage their affairs. It thus includes governments, the market forces that help to allocate resources, and any other mechanism that regulates human interaction. The question is to what extent the present governance systems have the capacity to meet demands of present and future water-related problems. Fragmented, inefficient management structures encourage division rather than sharing of our water resources. Only integrated and efficient management structures can enable us to govern complex systems of surface and groundwater flows across political boundaries and its multitude of competing interests.

Mobilising political will around water and related environmental issues is one of the critically important short-term priority actions across the region. For example,

political lobbying around the national heritage bill was proposed in Poland as a way of promoting water issues among national priorities. Another important action that has already been initiated in several CEE countries (i.e. Bulgaria and Hungary) is building public-private partnerships. Adequate regulatory arrangements must be developed to manage these partnerships effectively. Improving procedures for assessing social, cultural and environmental risks associated with water management is not less important. The proposed social safety project in Bulgaria is one of the interesting initiatives in this respect. Enhancing role of women at all governance levels is also an important task in all CEE countries.

Requests were made on several occasions during the Vision consultations to send copies of water laws, policy statements, or organisational diagrams. But in every case it became apparent that available material cannot be simply duplicated and that a legal solution in one country cannot be replicated in another country. However in this context, three basic questions must always be answered: Who owns the water? How is it to be allocated, distributed and managed? And how does the law avoid or resolve disputes? The current work on new water laws in several CEE countries (e.g. Poland and Hungary) illustrates that answering these questions is not an easy task, especially when the objective is to avoid over-regulation and not to repress the creativity of water users and water managers. The consultation process showed that there is a strong need for co-ordinated "East to East" dialogue, and exchange of ideas and experiences within the CEE region.

"Obtaining the Vision will require establishing the nation-wide professional water-oriented organisation which unites the people who (1) do understand water issues, (2) are politically and legally recognised by the state institutions and (3) have considerable impact on national policy concerning water."
From: Report of second round of consultation in Poland

Separation of water management and water delivery is a key governance change. Policy, planning, and regulatory functions should be separated from engineering, construction and operational activities at all levels. Operations should be assigned to specialised decentralised agencies or companies. Government still have an important role, but they must concentrate on the things that they, and only they, can do: ie to define and enforce the appropriate legal, regulatory and administrative framework. Decentralisation of state administration (including water administration) is already well on its way in all CEE countries, but the challenge is to recognise that decentralisation requires adequate co-ordination mechanisms.

Monitoring of past actions and their impacts and timely adjustment of implementation strategies are required to make governance effective. Water quality monitoring is a critical issue in the region. At present some countries have over-ambitious water quality monitoring plans, while monitoring is very limited in practice, and the obtained data are not used appropriately. Measure less, but do it reliably, and use the obtained data- this should be the underlining principle. Clear objectives (trend detection, estimation of average loads, water quality classification and maps, etc.) must be defined before designing a water quality monitoring network. Monitoring is expensive and water quality parameters, the number and location of monitoring sites and sampling frequency should be identified according to the existing budget limitations as well as spatial and temporal resource variability, the use of the information obtained and risks associated. Water quality monitoring requires accredited laboratories and solid

"Taking into account more than 40 years experience in the field of water management in Romania, the required steps for the implementation of the water resources strategy will be based on the river basins framework schemes and the complex development works programmes, elaborated in accordance with socio-economic changes of Romanian society. Requiring approvals and permits for the works carried out in water system and the application of economic incentives will be the main factors ensuring that the objectives of the water strategy are met."
From: Report of second round of consultation in Romania

and linked national and international inter-calibration programmes. Actions should focus on automatic monitoring (for such parameters where it can reliably be done), on forwarding information for early warning purposes, on resolving institutional barriers (who owns the data?) and on free access to information. Budget should be secured for monitoring organic and inorganic toxic micropollutants, as well as for monitoring sediments (functioning as the catchment's memory).

B. Preparing for EU accession – towards compliance with EU directives

EU accession is the single most important goal for the CEE countries. The EU Framework Directive has a major impact on water resource management, but it is demanding, some directives may not comply directly with local conditions and compliance cost is often high. Developing better understanding of water quality related EU directives and facilitating integrated media management as required by IPPC (Integrated Pollution Prevention Control) directive is needed. A key immediate action to support the CEE countries is to establish regional discussion groups to develop appropriate water policies to comply with European Union rules, and to share knowledge and experience in "east -east dialogues".

Above all, existing tools and techniques must be refined to bring them in line with the Directive requirements. The CEE countries should join their forces to develop a system for monitoring and classification of the water quality and ecological status of rivers and lakes. An assessment system acting as an indicator of the general state of the ecosystem is required. This is not an easy task, there is still a theoretical debate how to do it and very little experience is available. Water-related legislation needs to be created, improved and enforced in order to be compatible with the EU requirements, with special focus on water quality management and economic incentives. Government policies on privatisation of water utilities and other water management institutions need to be developed.

The 91/271 Urban Wastewater Directive may be used as an example in this respect. In some of the CEE countries even some of the basic principles of that directive, e.g. the population equivalent value (PE), are not used for the planning purposes.
The definition of a cluster of municipalities (e.g. above 100 000 PE) may also not be a straightforward task. Surface water is used for drinking water in most EU countries; therefore the above directive does not refer to groundwater. Groundwater is used for drinking water in several CEE countries and thus subsurface water "vulnerability" may play a decisive role in constructing sewerage, even for settlements < 2,000 PE.
This leads to the situation that in certain regions on-site treatment may be satisfactory for larger settlements (2,000 PE – 5,000 PE) while smaller settlement (< 2,000 PE) should construct sewerage. We note that the focus should be (i) on principles – protecting surface and subsurface waters rather than on technical solutions and (ii) on sewerage since it represents about 70%of municipal wastewater management investment costs (i.e. it is extremely expensive). While there is little flexibility in relation to the EU drinking water directive, the above issues of municipal wastewater management may lead to about 30% cost savings (or more), depending on the country.

The definition of sensitivity in the EU Urban Wastewater Directive (91/271)

The definition of "sensitivity" is ambiguous. Sensitive are those regions and standing waters that should be protected against contamination by nutrients, due to the possibility of their eutrophication and the consequent violation of drinking water abstraction requirements. On the basis of such definition of "sensitivity", about 20 percent of Hungary's territory should be identified as "sensitive" (and since most of the lakes and reservoirs are phosphorus limited, P control is needed). However, if the interpretation covers also inland seas, the entire country can be looked at as "sensitive" (the same would apply to the entire Danube basin and its countries). In principle, the Black Sea is the recipient of all the emissions, although significant load of nutrients settles in the course of their transport along the watershed and in the rivers. Cost implications of the way "sensitivity" is interpreted are very substantial. Exactly the same question of "sensitivity" towards eutrophication applies to the entire territory of Poland and the Baltic Sea.

The new EU Water Directive has a special focus on the establishment of river basin management (RBM) organisations and planning. Although RBM organisations exist in the region, they should have increased power and money to function to meet the needs of integrated management. A lot of questions need to be answered. Are the territories of existing RBM units properly defined? Are they large enough? Do their territories overlap, leading to regions that are "shared" between two RBM organisations within the country? Is smooth collaboration with administrative units, counties, regions, environmental agencies ensured? Are their principles corresponding to that of the EU water policy? What are the objectives, duties and rights of RBM organisations? Are they collecting fees and taxes? Is their structure similar to that of the French, British, or any other system? Which are the alternative structures under respective country specific conditions? Are they well suited to realise planning on the river basin level? Are not there additional organisations needed for this purpose, e.g. water management associations? What is the linkage to local governments, NGOs and CBOs? Are they capable to integrate water communities nationally and regionally? Are they well suited for international collaboration and forming international shared river basin organisations? These questions need to be answered in a relatively short time.

The EU member states must draw up management plans for each river basin. These plans must be action oriented, specifying structural and non-structural measures to be taken. They have to account for the interdependency between natural and human factors within the basin. Preparation of these plans must involve local communities and their representative organisations to be successful. The plans must integrate land use planning and development control into water resource planning. They should incorporate the affordability issue in policy planning concerning water prices and charges for wastewater disposal.

Pilot River Basin Management in the Lower Danube Basin

A pilot catchment study has been proposed in the Lower Danube Basin shared by Bulgaria and Romania. This particular project, if implemented in the near future, could clarify also the ecological impacts of the recent Yugoslavian and Kosovo war. Similar projects in the coastal areas of both the Baltic Sea and the Black Sea aim to assess and classify estuaries and coastal waters. Pilot catchment studies offer an invaluable opportunity to check to which extend the existing management techniques can meet Directive requirement prior to it coming into national regulations.

C. Generating knowledge for action

Professionals of the CEE countries are well known for their high level of theoretical knowledge. At the same time there are shortcomings in transferring this knowledge into the practice. Management, financing and economics knowledge has been traditionally weak, although the past decade brought positive changes in this respect. Introduction of some of the state-of-the-art methods (i.e. GIS systems) is often much slower than desired. Capacity building will be especially needed in the fields where priority activities are anticipated for the coming decade, such as all type of EU accession related issues, legislation, integrated water resources management, financing, environmental economics, project and wastewater management (operation and design alike).

"For the implementation of the new river basin management principle, the effectiveness and arrangement of the monitoring system should be improved. Special attention should be given for elaborating and implementing the Geographical Information System (GIS). This is actually one of the main prerequisites for implementing the integrated water management plans for larger and medium-sized river basins, where the borders of the basins are larger than one county. "
From: Report of second round of consultation in Estonia

There will be significant research needs. It is obvious for instance, that the large number of future drinking and municipal wastewater treatment plants will require knowledge on the vast amount of achievements and innovations of the developed world of the past two decades. This kind of technology transfer cannot be performed without having well educated national professionals and research scholars, and in a broader sense, strong "water industries". Having a cadre of such specialists is a condition sine qua non for practical implementation of quality control principles in water management and water engineering. It should be recognised, that technological research and development requires a leap-frog approach to address the needs of the region, rather than copying other European countries. Again, it also requires an efficient technology transfer within the CEE region.

The importance of the relation of water and society is increasingly recognised worldwide. This is a field where research is unavoidably needed to gain better understanding of changing objectives, views and judgements, on the likely acceptance of new concepts and ideas. Stock taking and better use of the existing information and knowledge should be promoted. Extending knowledge through special thematic studies and social polls will be needed in this area. Better knowledge is also required on awareness raising, education and environmental communication.

Introducing foreign language education in schools and universities

Foreign language education is key to progress, and has been introduced in several CEE countries. For example one or two foreign languages are pre-conditions of getting a university degree in Hungary.

D. Increasing public participation

The right of public participation in water resources planning and management is generally accepted world-wide. Agenda 21 places public participation as one of the fundamental conditions for the achievement of sustainable development. Generally, three prerequisites for public participation are identified. These are:

- access to water-related information;
- opportunity to participate in decision-making; and
- access to redress and remedy.

These prerequisites are often translated into a law under the general umbrella of a right to safe, clean and healthy water. National laws and regulations can ensure the observance of public participation. This legislation is often lacking or is not fully enforced in the CEE countries.

Access to water-related information is perhaps the most critical of the prerequisites of public participation. Information is essential for awareness raising. Awareness raising does not only influence people's behaviour at the household level (increased water use efficiency and hygiene standards), but also is a means to improve practices and performance of governments, utilities and other actors. This requires that the law not only provides the freedom to seek information, but an actual right to access water-related information pertaining to both government and private sector activities that impact the hydrosphere. A right to access water-related information should force government agencies in the CEE countries to actively seek, compile and disseminate water-related information to public, such as the resource assessment, activities that are harmful to water resources, and measures taken to protect the aquatic environment.

Public participation is founded on the right of the public to influence and share control over decisions relating to water. As all human livelihoods depend on water, it is important that the law views everyone as having a vested interest in the protection and management of water resources. The participation of the public through non-governmental organisations is now an established feature in all CEE countries. Full participation includes not only the right to be heard, but also a right to affect decisions.

Effective access to judicial and administrative proceedings, including redress and remedy, is important for integrated water resources management and for public participation. Governments and parliaments in the CEE countries should establish judicial and administrative procedures for legal redress and remedy of actions affecting water that may be unlawful or infringe on rights under the law. Governments and parliaments are further called upon to provide access to such procedures to individuals, groups, and organisations with a recognised interest. The discretionary power granted to water authorities under which no obligation exists to provide reasons for decisions taken should be removed. One of the short-term actions needed in the CEE countries is to assess the extent to which present law meets these requirements. A legal obligation to provide reasons for specific decisions, particularly those relating to hazardous activities is an important component of water-related information that must be availed by authorities.

What would you do immediately if you were water Minister ?

In a questionnaire among 628 people in three towns in Bulgaria, people were asked what their priority actions as a water minister would be. The respondents were 54% women and 46% men, and included pupils, students, teachers, and other citizens. The following urgent measures were mentioned (in order of priority):

- *rational usage and protection of water resources;*
- *increased ecological public knowledge;*
- *protection of the Black see from pollution;*
- *application of EU legislation concerning environmental protection;*
- *giving opportunities to young people to get specialised training in the developed countries and to take part in the water resources management.*

5.2 Themes for action

E. Reducing surface and groundwater pollution

The principal sources and causes of surface and groundwater pollution in the CEE region have been discussed in Section 2 of this report. Foreign investments in the past decade in the water industry improved water quality management, but the water quality in the CEE countries is still much worse than in European Union countries. It is expected, however, that the gradual replacement of obsolete technologies, the introduction of the ISO 14 000 standard and environmental management will gradually improve the current unsatisfactory situation. Economic incentives such as water pricing and pollution charges fees will certainly support introduction of clean technologies.

Cost-effective, short-term priority actions ("hot spots") need to be identified and implemented in order to meet ambient water quality goals. Later on more weight can be given to meet effluent standards (or differently, effluent standards can be tightened) in order to meet all the requirements of the EU Framework Directive. This approach enables phased investments and proper scheduling of the introduction of various water quality standards. It can be used to handle jointly the control of emissions of various origins (municipal, industrial, agricultural, point sources and diffuse ones, transboundary loads etc.), very much along the line of integrated pollution control. Objectives can be formulated such that regional impacts on inland seas (e.g. the Baltic or the Black Sea) can also be included to identify incremental costs and sites where incremental water quality improvements are most efficient.

River basin least-cost approaches in water quality planning and management must be introduced across the region. The importance of regional and river basin planning is recognised in the EU countries and elsewhere. In the CEE countries water quality planning is more important than ever before, since financial resources are scarce and efficient strategies are needed in the short run that can also lead to sustainable policies on the longer run. For this purpose, application of regional water quality models and decision support systems are recommended which on the basis of a mix of effluent standards and ambient criteria can be used to develop least-cost river basin strategies.

Direct discharge of manure into receiving waters should be stopped, and manure should be used as an organic fertiliser instead, in order to reduce water pollution. Agricultural practices should be made sustainable as much as possible within the existing property conditions in the short term. In the longer term agriculture needs to be reshaped in many CEE countries, but this will take at least a decade. Non-point pollution sources cause, among others, soil erosion and runoff modifications. Increased nutrient concentrations in topsoil layers intensify these processes. The present intensities are rather high and they may grow further, even when best available practices are implemented. Thus extreme care needs to be applied, and long term soil mass balances need to be prepared in order to develop future agricultural policies. Well known tools of erosion and runoff control measures, including aforestation and reforestation in susceptible areas must be applied.

It should be recognised that about 40-50 percent of phosphorus and 60-70 percent of nitrogen loads of the Baltic Sea and Black Sea originate from agricultural non-point source pollution. Agriculture is a key sector of restoring the two seas and the Danube Delta and the application of more sustainable practices is imperative. It is unclear at present how the desired land based emission reductions could be achieved, as the transition of agriculture is difficult to forecast. It is well known, however, that control

of point sources alone will not result in significant alterations. Pollution control for oil tankers in another important action to protect the seas.

Industrial wastewater problems should be solved by an integrated pollution prevention strategy. The control of hazardous substances should be based on a strong precautionary concept and the application of clean technologies, starting with new industries. Environmental management systems and related standards (ISO 14 000 and EMAS) must be introduced. These systems are progressing much faster than anticipated a few years ago.

Strongly reduced water consumption has led to frequent underloading of municipal wastewater treatment plants. This allows to introduce (more) nitrification and partial denitrification, to optimise the operation and to reduce OMR costs, or to receive more wastewater. Solutions include combined biological-chemical methods, improvement of aeration, enhanced monitoring and control, selectors, regenerators, step feed, the separation of anoxic and anaerobic zones.

Where sewerage is already in place, but wastewater treatment is missing or inadequate, treatment should be added first. Adding wastewater treatment plants to existing sewerage is a more cost effective means to reduce pollution, than the construction of new sewerage, as the cost of wastewater treatment is about 30% of the total cost of wastewater management cost.

The upgrading of the present water supply and sewerage systems should be priority above the construction of new infrastructure. The first, most cost-effective, action should be to upgrade the capacity of individual elements of the entire system of existing systems and to adjust the system for flexible use of the existing treatment capacity. The construction of a sewerage connection or a pumping station may allow utilising excess capacity of a treatment plant. New water supply systems must be designed and constructed in parallel with waste management systems to avoid side effects such as further increase in nitrate contamination. Careful design and implementation of infrastructure development is important for budgetary and environmental reasons.

Improving sludge management is an important action required. As already noted, the fate of about half of the sludge is not well known in the region; dumping is still the dominating “disposal” method. Sludge contains useful nutrients and it can be utilised for energy production. Several ten thousands medium-size and small wastewater treatment plants will be constructed in the future in CEE countries. Agricultural use of the sludge of these plants is an obvious solution, practised in many EU countries. Improved industrial pre-treatment and appropriate disinfection of wastewater are prerequisites to meet sludge and soil standards. A computerised inventory, advanced and safe facilities of transportation and land disposal, and soil monitoring are also crucial elements of a well-developed sludge handling system.

Natural treatment methods (e.g. the root zone method) can successfully be used in rural regions where land is available and receiving water allow a lower level of wastewater treatment. Advantages are low investment cost (if free land is available), simple operation and consequently low OMR cost. The economic life is certainly much shorter than for an activated sludge plant. Natural treatment systems should be properly designed, and the area of natural treatment plants should not be underestimated to decrease investment cost. Natural ecosystems (wetlands, marshlands, flood plain vegetation, etc.) can play an extremely important role in controlling nutrient cycling, as a significant portion of the CEE population lives in rural areas.

Introducing natural treatment systems

A number of natural treatment systems are already in operation in the region, based on the German, Danish and US technologies. These methods offer a lower level of treatment (suspended solids and organic material removal, but no nutrient removal) in comparison to "engineered" treatment methods.

F. Protecting ecosystems and their management

Aquatic ecologists are just beginning to fully comprehend the great extent by which many rivers, lakes and wetlands in the CEE region deviate from natural state. The (segments of) water bodies that still retain some of their natural functional attributes must be preserved to the largest extend possible. It has to be stressed that: (i) floodplains and alluvial aquifers are integral functional components of river corridors; (ii) the connectivity between landscape elements is crucial for sustaining functional processes; (iii) effective conservation and restoration efforts require a strong conceptual foundation and a thorough understanding of natural processes; (iv) ecosystem management of damaged river corridors involves reconstituting disturbance regimes and reconnecting landscape elements; (v) once functional processes are re-established, the water bodies themselves become the restoration agent.

Free-flowing rivers in the region, such as the middle Vistula in Poland and the upper Tisa, contain some of the last remnants of a semi-natural alluvial landscapes in Europe.* However, flood protective dikes reduce surface connectivity with the extensive floodplain system in many river segments. Hydrological connectivity can be restored by lowering sections of flood protective dikes, at certain places, taking into account the resulting flooding risks. It is important that post-restoration sampling is established, including abiotic parameters, biota and limnological processes within floodplain water bodies. River restoration strategies is an important R&D requirement.

Let the river do the work

River restoration strategies should be based on the reconstitution of certain functional processes that they resemble natural dynamic interactions. For example, river rehabilitation strategies should not involve the construction of islands, but the objective should be much more to create such conditions, that rivers themselves have the capacity to construct their own islands.

Water resources managers in the CEE region need to be advised on the water quantity and quality needs for maintaining specific habitats. Until this happens, there is little opportunity for rationalising the allocation of water to different stakeholders, of which the ecosystem is clearly a key contender. The first short term requirement is to develop practical methods to identify thresholds water quantity and quality requirements for ecosystem functioning. Ecosystem protection considerations should be into the planning process built to the largest extent possible, even without complete knowledge. This is also one of the fundamental needs required in river basin management by the new EU Water Framework Directive. The precautionary principle must be applied, when there are reasonable grounds for concern over ecosystems damage.

* This may not be valid any more: the largest accidental pollution ever occurred in the Tisa region happened just after the completion of this report causing Hungary's worst ever ecological disaster. A huge spill of highly toxic cyanide reached one of the tributaries in Romania and caused major ecological damages in the downstream part of the Tisa. The recovery time of the river and cost implications are not yet clear. The accident calls the attention to the necessity of improved international co-operation including the preparation of detailed emission and risk inventories for shared river basins, the free access to information and the application of the polluter pays principle also for transboundary cases.

Over the past two decades there have been many versions of the “ecosystem approach” to river basin planning and management. Much of the work has been rather abstract and relatively difficult to implement by water resource planners. Most of these approaches share certain characteristics such as: (i) a primary focus on ecological phenomena as opposed to engineering, economic, or jurisdictional aspects; (ii) a perception of some self-regulatory capacity on the part of an ecosystem; (iii) a recognition of the responsiveness of many ecosystems to natural and human activities; and (iv) a readiness to strike a pragmatic compromise between detailed reductionistic understanding and more comprehensive, holistic meaning. Practical introduction of “ecosystem approach” remains a question of better water resources management, including limiting pollution activities. This is not just a question of available technology, but includes the need to have appropriate institutional frameworks, supported by effective legislation, and guided by reliable monitoring that allow management to modify interventions in the light of changing pressures and demands.

One of the world-wide shortcomings in this field is to be able to define ecological objectives one would like to achieve. Which engineering solutions may lead these vaguely specified goals? What are the conflicts with short term goals mostly driven by economic considerations? What are the ecological criteria of water management? How can we express them by traditional parameters of water management (water level, flow, water quality and their dynamics etc.? How to handle unknown uncertainties and surprises inherent to ecology as contrasted to engineering risks? How to employ principles of prevention and feed-backs of ecosystems into planning?

Estimating the value of ecological services that can be set against the cost of wastewater treatment, enables the use of economic and financial cost benefit analysis as a decision making tool. Until realistic values can be placed on ecological services, economic planning techniques will largely ignore the role of ecosystems as a service provider and user of water resources, and hence will marginalise the cumulative values of the many “minor” products derived from the ecosystem services. One of short term action that is required in the CEE region is to promote the development and dissemination of a “toolbox” dealing with the valuation of ecological services – and the costs of maintaining or losing those services, that can be incorporated into standard decision making procedures.

Even without complete knowledge of ecosystem services and requirements, it is still possible to improve the management of existing wetlands. This action is of a special importance in the CEE region where a number of valuable wetlands were eliminated, often through improper land melioration, drainage and river training actions. Upstream storage reservoirs and river canalisation changed flow regimes and further deteriorated downstream wetlands. Still, the region is known for a number of wetlands that are relatively untouched and unique worldwide, such as the Danube Delta, Biebrza wetlands in north-east Poland and several wetlands in Hungary. Nature reserves and wetland areas will grow as a result of future changes in agricultural land use. Each wetland area will require specific management solution, with ownership rights granted to stakeholder communities providing the legal framework for improved local control. Improved management can be initiated on the basis of existing knowledge, with the development of appropriate institutional management frameworks, supported by relevant monitoring procedures.

G. Improving drinking water supply and sanitation

Combating pollution of groundwater, which is the principal source of drinking water in most of the countries of the region, is an action of special importance that has already

been discussed in this Section. Expansion of the existing water treatment facilities and construction of new facilities will be needed to improve drinking water quality because of human health concerns. This is crucial in rural area where simple, inexpensive and efficient water treatment facilities are needed to replace today's shallow wells. Drinking water standards will most likely be tightened and the number of controlled pollutants will increase, as analytical techniques are refined. This raises the question whether there is any space for changing principles in urban water infrastructure. Are we going to further develop and upgrade present systems and infrastructure? Is the idea of flushing toilette going to sustain (wastes are transported after mixing by water)? Are there alternative solutions such as supply of different quality on the household level and utilising bottled water, treatment at the source (also household level), re-use and re-cycling? Some of these ideas may seem naive, but the overall question is, are we going to preserve expensive technologies of the last century for the future or do we launch at least R&D projects to test the reality of alternative solutions even if their introduction may not be easy.

The long-term goal is to introduce adequate tariffs based on the full-cost recovery principle. The current under-pricing of water is not the only reason for unreliable services, but it certainly results in decline in capacity to provide services. As the tariffs generally are too low, water utilities are often unable to recover their own costs, which leads to a vicious cycle of inadequate maintenance, poor services, unwillingness to pay even nominal charges, and then still lower revenue, and so on. On the other hand, drastic increase of water prices raises the issue of affordability. Nobody in the region advocates a purely market solution for water. All agree that regulations are necessary to ensure that the market operates efficiently and equitably. The appropriate legal and institutional framework must be developed, to make regulation work properly and attract private funds for the sector.

Water pricing and decreasing water use

Between 1990 and 1996 average water use decreased from 200 l/capital/day to 130 l/capita/day in Slovakia. The decrease was mainly caused by a significant increase in drinking water prices. It was noted that in several poorer areas water use came close to the hygienic minimum (80 l/capita/day). Adequate pricing policies or subsidies should guarantee sufficient clean water supply to all sectors of society.

In the CEE countries water supply services usually involve "natural monopolies" and as such, the political possibilities for introducing markets into their management are somewhat limited. There are also technical limits in this respect. These factors notwithstanding, privatisation (asset ownership and management) of urban water supply infrastructure may take place in the mid-term future. There is a variety of concession systems (i.e. the delegation of authority to private concerns), involving both public water supply and wastewater services, that may supplement more traditional forms of direct (municipal) or delegated public capacity systems.

Project implementation should be considerably improved in the CEE region in the future. Experiences of the past decade shows that mistakes and over-expenditure can primarily be decreased during the preparation period, including the definition of major parameters of e.g. a wastewater treatment plant (future flow, composition of raw wastewater and effluent criteria), pre-feasibility and feasibility plans, tendering and so forth. The design practice should be also enhanced following good international examples (e.g. measure wastewater composition if possible already at this stage and estimate the growth rate of nitrifier bacteria with care since it can lead to large volume savings). In many CEE countries (e.g. Poland, the Czech Republic, Slovakia, Hungary)

non-governmental, wastewater associations were created recently shaped to western European examples. These bodies – if developing efficiently – can play an extremely positive task to get strong water and wastewater industries in the respective countries and to realise professional and cost-effective project implementation.
Following the above arguments, benchmarking should become an important tool. It should be realised that water and wastewater services are expensive and competition will grow. Thus, following the trend in industry, there should be a continuous process to be introduced which compares the products (technologies) used, services, business and all the related costs against that of the strongest competitors or "world class" companies. This should lead to permanent enhancement of the operation of companies, service improvement and significant cost reductions. Cost transparency is one of the main principles of the EU, which is an additional reason to introduce benchmarking in the near future.

"The basic law on water resources management, the Water Law of Romania and Governmental Decision 1001/91 explicitly mentions two kinds of payments for water and water use: "payments for water use" and "payments for water services". The payment for water use represents a small portion of the payment for the water service to the local Water Company. Therefore, an increase of the raw water price might affect the final consumers."
From: Report of second round of consultation in Romania

Integration of municipal water management should be stressed again, considering technical solutions, R&D efforts, financing, pricing, legislation and other issues. This should involve not only elements already listed in Section 5E, but also stormwater management and sludge handling; an issue strongly overlooked in the CEE countries. Newly developed systems should take focus at the full chain of water use from water supply to sludge management, keeping in mind closed water and material cycles.

H. Improving level of protection against floods and droughts

Priority actions to improve the level of protection against floods and droughts must deal with structural protection measures, as well as legislative, legal, policy, monitoring, and planning issues. The extent of damage caused by extreme hydro-meteorological events is determined not only by the capabilities of passive structural protection measures (flood and drought storage, dikes, supplemental irrigation, etc) but by active preparedness and response systems, and the active management of risk in flood and drought hazard areas. Regional and basin-wide planning in flood and drought prone areas needs special attention. Active and effective risk management at the local level must be strengthened. Preparedness and response systems must be well planned, and must have reliable monitoring, forecasting and warning procedures, including reliable dissemination of the right kind of data and information. Priority actions include: improving maintenance, improving inappropriate data collection, and enhancing joint control of shared river basins.

Present flood and drought management systems in the CEE countries generally do not meet international security standards, and extreme hydro-meteorological events cause growing negative economic and financial consequences. Flood protection should particularly focus on main cities and centres of economic activities, while drought protection plans are needed especially in rural and agricultural sector.

Basin-wide flood and drought management strategies can provide a framework for sound and timely investment and the development of local protection and response plans. The plans should be matched to a reliable and timely information system, accompanied by extensive and specific training for those who must play a role in the response systems as well as the general public. Flood protection infrastructure must be improved and modernised to account for recent and future economic development,

flexible flood management operations and response, and reduced flood risks. Developing and implementing aforestation and reforestation plans in order to reduce flood and erosion potential is one of the important actions to be taken in the rural areas.

Co-ordination of actions and decisions during extreme hydro-meteorological situations should be streamlined; adjustments in existing legislation and institutional arrangements are needed. Monitoring, forecasting and warning systems, reliable communication, analytical tools and models are needed to improve and support decision making and planning, particularly contingency planning. It should be recognised that frequency and extent of flood and drought losses can be reduced enormously if suitable precautions are taken on a variety of levels. For example flood loss prevention actions may include instructions to local population on how to make structural changes to their buildings or property, by keeping portable emergency equipment (e.g. sandbags) close at hand, by reorganising their valuables (e.g. vertical redistribution of goods in storage), and by taking pre-planned protection measures in response to flood warnings.

The dramatic increase in the frequency and intensity of natural extreme events (which are not fully understood) that has been observed in recent decades is leading to the obvious need of insurance against flood and drought damages. For example, flood damage caused by frequent flush floods is certainly insurable in the CEE region. Adequate premiums can be calculated with a relatively high degree of reliability and the necessary spread of risks can be identified. It is a job of insurance companies in the CEE region to create technical preconditions for the insurance of natural hazards. They must calculate and agree on prices that take into account the specific exposure to the individual risks. To do it well they must involve themselves in analysing the geoscientific aspects of these hazards and the ways of dealing with them within the framework of insurance. Given the loss potential inherent in them, floods represent a particular challenge to the insuring companies.

I. Promoting international cooperation to prevent water disputes and conflicts

There is the need to quantify transboundary impacts of water use and wastewater disposal. High priority must be accorded to improved methods for conflict resolution and joint management, whether these involve two communities on opposite sides of a border or entire nations depending upon the same watercourse or aquifer. An important requirement, especially for large transboundary catchment areas such as Danube, Odra or Nemunas, is maintaining an exchange of information. This applies also to interrelated transboundary issues handled by different conventions and agencies, e.g. the Danube and the Black Sea. To be of real use for management purposes, it must be made available quickly and at any time. Today's hardware and software developments open up new perspectives in the area of information technology.

The management of shared river basins or aquifers should be based on the concept of sustainable development. This implies that equity between people is fostered, ecological values are preserved, and economic development is encouraged. These goals are somewhat incompatible, and therefore require that value-laden decisions be made in order to balance them. A mechanism for addressing disagreements over any facet of the joint management strategy should also be developed. Such mechanism should make an important element of multilateral and/or bilateral agreements on all transboundary water bodies in the region (rivers, lakes, aquifers). In that spirit, bilateral and multilateral agreements should be established with bordering countries, for example

in Latvia with Russia, Belarus and Lithuania. Co-operation of the Black Sea countries should be improved, with the focus on the Danube Convention. Improving regional co-operation of the Baltic Sea countries is also an important short-term action, including Odra Convention, Nemunas Convention and others.

International Commission for the Protection of the Danube River (ICPDR)

The Commission is effective in full legal since the entry into force of the Danube River Protection Convention in 1998, after a six years period of preparation. Countries that are represented in the Commission include, EU countries, countries in the accession process, and others. Socio-economic conditions vary widely, the GDP is in the range of 1,000 to 25,000 USD per capita. Still the same targets are set for all countries. ICPDR has a close co-operation with the Black Sea Commission, as the Black Sea is the recipient water body of the Danube river. Objectives of ICPDR include:

- *reduction of point source pollution (municipal, industrial, agricultural),*
- *reduction of non-point source pollution*
- *restoration of wetlands and aquatic ecosystems.*

The agreements signed should have a crisis-management orientation, because management of international river basins or aquifers faces its most severe test during crises. Several types of crises are possible. There might be sudden crises, such as the spilling of toxic material, the discovery of hazardous materials in drinking water, or the breaking of levees built as part of the flood protective system. There might be also cumulative crises, stemming from the cumulative effects of certain trends or natural events, such as droughts. Crisis management involves three basic actions: first, recognition of the crisis; second, agreement on the steps that need to be taken to address the crisis (contingency planning); and third, implementation of crisis management schemes, which requires the availability of appropriate facilities, accurate real-time data, personnel and means.

J. Improving financial flows

Efforts to estimate the financial flows (investment costs and recurrent expenditures) related to the implementation of actions discussed in this Framework for Action are hampered by the limited available of adequate data. Operation and maintenance (O&M) costs are often absent. In Poland, for example, there is no official statistics concerning that category. The differences in the definition of the term “water sector” in various CEE and EU countries make data incomparable. Again in Poland, costs of water intake and improvement of the quality of drinking water are not included in the national statistics under the rubric “water sector”, while in the EU these are the priority costs in that sector. The only material available to CEETAC were some data given in various publications (including some of the national CEETAC reports) estimating the cost of approximation of EU environmental legislation. These estimates, however, are of unknown accuracy because in each CEE country the costs depend on a number of not unified assumptions (economic growth, policies selected, etc.). The estimates vary depending on the assumptions used.

For most of the EU candidate countries municipal water issues form one of the key elements of the accession. In Hungary the cost requirements are estimated at about USD 5 to 6 billion (500 – 600 USD per capita) for water supply and wastewater management, a rather high value. Similar per capita figures were obtained for the Czech Republic and Poland. If one assumes 1 to 1.5 percent of the GDP as affordability

criteria, 4 to 5 percent of net income as an amount that can be spend on new water infrastructure (a very high value keeping in mind the present service costs), and 5 percent annual economic growth rate – about 15 years are needed for the transition to comply with the requirements of the respective EU directives. If the growth rate is only 3 percent, the period increases to about 20 years. Countries with less developed economy (such as Bulgaria or Romania) are in a much more difficult situation. Even if we assume the same per capita accession cost as above, the transition period should be much longer or the annual payments should be unrealistically high and thus probably not affordable (unless the annual GDP growth rate is not close to about 10%).

Table 4 offers a summary of EU accession costs for the CEE countries. The table should be used solely for indicative strategic purposes since data and estimates available from different sources are uncertain and often contradictory. The important message of Table 4 is that even the most developed CEE countries should spent about 2 percent of the present GDP annually for the coming 15 years to construct and operate new facilities according to EU requirements. For the rest the range is 5 – 10 percent. These are country wide aggregated data which should be added to existing service costs being rather high already now (not infrequently around 3 percent of net incomes).

Country	Investment cost						Annual cost			
	Water supply	Sewerage	Waste-water treatment	Total			OMRC[1]	AIC[2]	Total[3]	
	billion EURO	billion EURO	billion EURO	billion EURO	EURO /cap	% of GDP[4]	EURO/ cap/y	EURO/ cap/y	EURO/ cap/y	% of GDP[4]
Bulgaria	2.2	0.7	2.0	4.9	590	53	39	77	116	10
Czech Rep.	2.2	1.2	2.0	5.4	524	11	32	68	100	2
Estonia[5]	0.27	0.15	0.2	0.62	427	6	30	33	66	1
Hungary	0.8	3.4	1.4	5.4	529	10	25	69	94	2
Latvia	0.1	0.2	1.4	1.7	923	38	38	120	158	7
Lithuania	0.1	0.3	2.0	2.4	649	28	37	84	121	5
Poland	2.7	6.8	1.5	13.4	346	10	13	45	58	2
Romania	3.8	1.8	4.6	10.2	451	29	28	59	87	6
Slovakia	1.0	0.1	0.8	1.9	352	10	24	46	70	2
Slovenia	0.5		0.7[a]	1.2[b]	600	6	24	66	90	1.3

Sources: national reports and expert estimates;
1 – OMRC – operation, maintenance and repair cost,
2 – AIC – annual investment cost (assuming 15 years and 10 % interest rate),
3 – total annual cost is AIC + OMRC,
4 – GDP is at the 1997 level
a – total wastewater and sewerage
b – additional investment cost of waste management is estimated to be 1.1 billion USD

Table 4. Investment needs and affordability estimates for CEE countries (rounded values in billion EURO)

From Table 4 one can draw the following conclusions:

- The high GDP/year values call for an extremely careful planning;
- The transition period should be estimated thoroughly. Action plans should be prepared serving as a basis of negotiation with the EU;
- First, priority actions should be implemented that bring the highest benefits;
- The transition period for some of the countries can be two to three decades, depending on how the economy is developing;
- The accession and developments associated raise a number of social issues;
- High costs suggest to look for innovative ways of financing specific actions.

The analysis of the gap between capital supply and capital demand for national pre-accession programmes to meet objectives of some EU water-related directives was again hampered by the lack of data. It has to be recognised, however, that in all CEE countries this gap is quite substantial.

Differences in financing situation between CEE countries

The following two examples show clearly that financing situations are different in different CEE countries:

- *In Poland, the gap between capital supply and capital demand is estimated at a level close to 0.5 billion EURO for the six years from 2000 to 2006. Private sector funds are expected to grow much faster than the state budget expenditures. Participation of foreign funds is estimated at the level of 5 percent only.*
- *In Lithuania, national and foreign investments in the environmental sector (including water) in the period of 1992-1998 has been distributed as follows: (1) national budget – 112 million USD; (2) foreign investments – 96 million USD (including soft loans of 62 million USD and grants 34 million USD). In years 1997-1999, foreign investments comprised in Lithuania 57 percent of the total investment for the environment.*

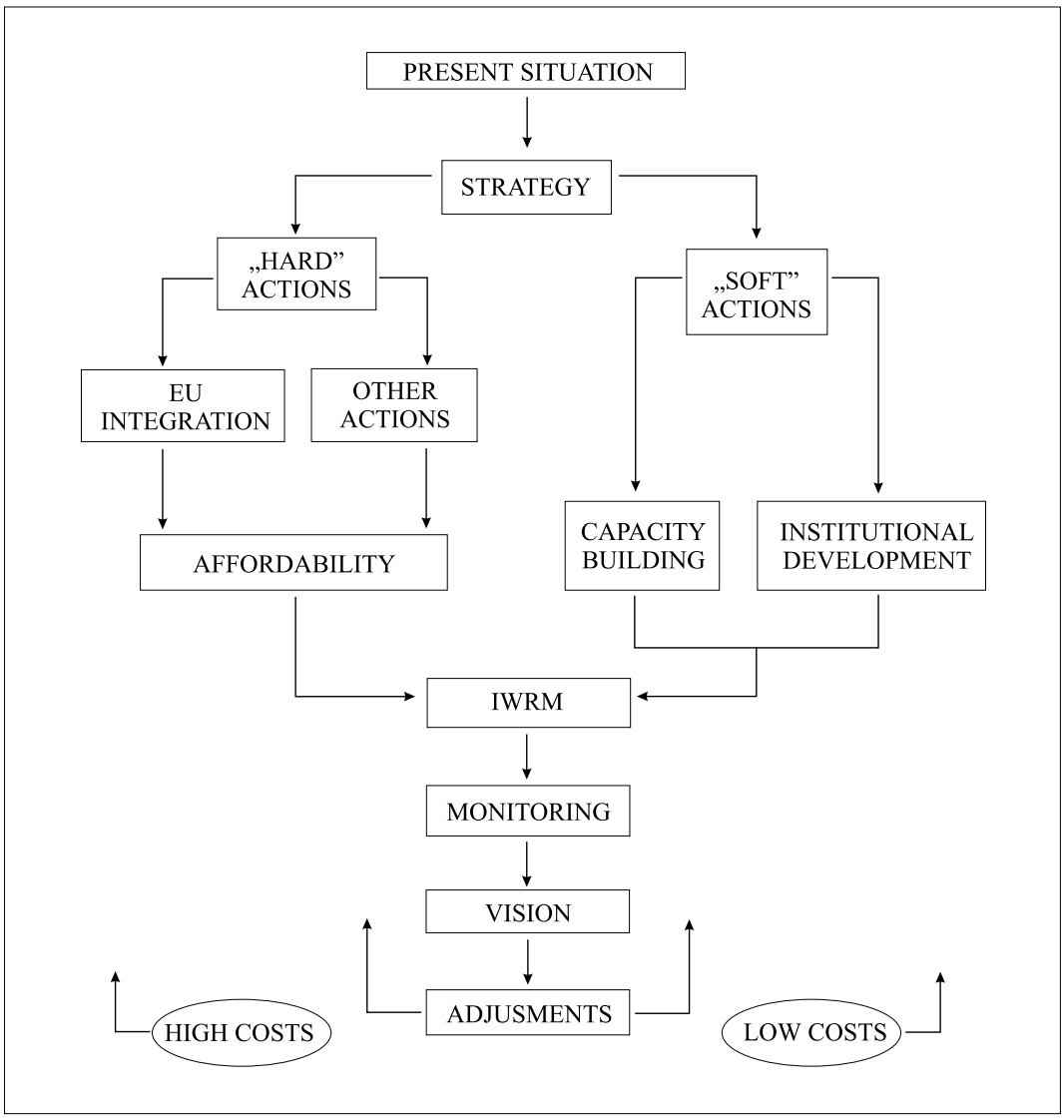


Figure 4. Implementation of integrated water resources management and the Vision

It should be kept in mind that integrated water resources management have cost implications other than investment costs directly related to the EU accession shown in Table 4. Flood control, drought control, excess water management, demand management, non-point source control, urban stormwater management, reconstruction of existing facilities, institutional re-shaping and strengthening are just the most important examples which may represent 30–40 percent of all the costs. In these fields the EU expects no strict compliance, but still the existing and emerging problems should be solved.

Figure 4 demonstrates main elements of implementing IWRM and the Vision outlined which should be looked at with Figure 3. It illustrates not only the process but also the type of actions: hard (mostly technical) and soft ones. EU integration results in the largest portion of needed investments (about 70%) to which country specific control measures related to floods, excess waters, draughts, demands etc. should be added (see above). Here we see a number of dilemmas. First, governments obviously put a strong focus on meeting requirements of the EU and thus the fear is that other elements of water resources management may be somewhat neglected. Second, costs of the EU accession are rather high. Third, as said before, its largest component is defined in a single area: the urban wastewater management. This states technical solutions without leaving space for alternatives (or it is interpreted this way) rather than identifying water related objectives which should be handled one way or another. In this sense CEE countries should consider principles of the directive and develop their "doable", site specific solutions rather than considering mechanistic implementation. Fourth, even if clever and efficient options are developed, affordability is a serious issue (Figure 4) and thus development of the economy is of crucial importance. The overall question is, will be able the CEE economy catch up as outlined in Section 4? Will be able the at present less developed CEE countries increase their GDP by an order of magnitude?

"Modernisation and construction of wastewater treatment plants is the most important and expensive water management task today and in the future."
From: Report of second round of consultation in Lithuania

Figure 4 and what was said above suggest that the "cost" pair of scale is much heavier on the left side than on the right one. However, implementation and the realisation of IWRM requires significant capacity building, institutional development and education on all the levels. Even if all the needed money is spent it can become a wasteful effort if soft actions are not "perfectly" done. The "institutional" pair of scale shows just the opposite position than the cost related one. IWRM is there if both pair of scales are balanced. It is probably the most crucial, non-quantifiable success criteria. To achieve the second balance is an extremely difficult task requiring to introduce changed attitudes and a new "culture".

"The costs of complying with the EU directives will depend heavily on the way of the process is managed. For, example, costs will be especially high if municipalities act independently to improve or construct water treatment and distribution systems. Investment planning on the basis of water basins would significantly reduce costs. In addition, a detailed least-cost-planning may reduce the estimates."
From: Report of second round of consultation in Slovakia

5.3 The way forward

As demonstrated there are a number of urgent and strategic actions that can be taken forward immediately within the CEE countries and with the help of regional CEETAC can be undertaken almost immediately.

GWP CEETAC first step actions

The CEETAC of GWP has together with other actors in the region initiated a number of strategic first steps for action:

- *The establishment of country level Water Clubs to (1) foster cross-sectoral dialogue on water issues; (2) facilitate the introduction of IWRM, (3) give a voice to water professionals to create political will among decision makers and (4) to initiate to set up permanent non-political platforms for dialogue as a continuation of the Vision to Action consultations;*
- *Introduction and strengthening of River Basin Organisations thorough the reinforcement of the regional RBO network of International Network of Basin Organisations (INBO). The first efforts should focus on gaining experience through pilot RBOs and sharing this experience between CEE countries;*
- *Development of a toolbox on ecosystem valuation and a knowledge network for water quality management;*
- *A creation of a platform for stakeholders in Water Supply and Sanitation under the auspices of Water Supply and Sanitation Collaborative Council (WSSCC);*
- *A study on financial flows for investments and water resources management.*

Practical introduction of the IWRM principles should be seen as a paradigm shift from traditional water resources planning and management schemes that emphasise development supply options only. The IWRM should expand the set of alternatives to induce demand management as well as supply augmentation. It must address a diverse set of selection criteria beyond economic development, including environmental and social consideration. It must conduct the planning and management processes in public inviting participation of stakeholders and all interested parties. Water authorities in the CEE countries must recognise that, with the transformation of their economies shifts in allocation must be allowed between users (and uses) in space and time, and across economic sectors, to ensure that the greatest value is produced from the use of water resources. They should find the ways to counter market failures in resource allocation that cause water pollution, groundwater overdraft, and the loss of valuable ecosystems by explicitly addressing multiple goals and objectives in the water management decision process. The way forward requires that issues and constraints are recognised, alternatives are formulated and evaluated, plans are selected and implemented, performance is monitored, achievement of objectives is evaluated, and modifications and corrections are identified and made.

The provision of data to guide that management remains a fundamental issue to be solved. The present water quality monitoring networks are not providing appropriate information to governments and their agencies. As a result many water quality management policies are inappropriate because they are based on inadequate data. Again the problem is complex, relating to poor institutional frameworks with split or conflicting responsibilities, lack of capacity and lack of tools. Although monitoring is costly, the objective must be to promote simple low cost technologies that focus on key indicators providing information in a timely manner, and allowing management policies and interventions to react to changing circumstances. Part of the requirement for monitoring is transparency, both locally and internationally where river basins are transboundary, and methods should be standardised to provide comparable data.

6. CONCLUDING REMARKS

There is a number of good reasons for trying to imagine what the region of Central and Eastern Europe may be like over the next twenty to thirty years. The simplest approach would be to try to predict future conditions in reasonable detail and to evaluate how outcomes depend on current policy choices. If only this were feasible, we could expect with fairly high reliability to change the future through appropriate policy changes today. Unfortunately, the uncertainties in any study looking more than five to ten years ahead are so substantial that the simple chain of prediction, policy change, and new prediction raises serious doubts. It is not that more distant time horizons are too far away to be of interest. A child born today will be only 25 years old in 2025 and many of today's adults will still be taking active roles at that time. However, it is simply impossible to make long-range predictions well, and even more difficult to assess how more distant future depends on current policies.

Although there are many similarities across the CEE region, individual countries and specific sub-regions face different situations, constraints, and opportunities. These are related to the wide range of geography and topography, climate and hydrological conditions, and institutional, political, economic, social and cultural situations. Few of these variables are well understood, and all of them need to be carefully assessed before viable and sustainable solutions, tailored to each situation, can be identified. Cautious that any move towards resolution must be based on what people on the ground know, can do, and want to do, the CEETAC has undertaken in 1999 region-wide and national consultations. The purpose of the process was to take stock of the present situation and to get better understanding of the opinions and priorities that should be taken into consideration when setting a vision and framework for action for sustainable water management.

The overhelming consensus emerging from the CEETAC consultations is that in two to three decades there will be sufficient, safe, clean and healthy water for nature and people living in stable societies in the region. Any vision, however, is only as good as its implementation, and the vision consultation process emphasized from the start the importance of setting priorities and creating

responsible regulatory and enforcement institutions. Especially the latter was always one of the weakest aspects of water resources and environmental management in the CEE region. Since all countries face multiple water-related problems, governments must set priorities on the basis of informed analysis so that they can make the most efficient use of administrative and financial resources. In the CEE countries top priority must be given to water-related impacts on human health and ecosystems as well as to the reduction of risks due to water excess. More detailed discussion of priority actions is presented in Section 5 of this report.

Once priorities have been determined and appropriate actions designed, their implementation and the resolution of conflict become important. Whether it is watershed management to protect the downstream population, allocation of available water resources among competing users, or the complex problem of managing a city's water supply and sewerage systems, many different actors must be brought together. Agencies need to collaborate, and some machinery for resolving conflict is needed. A common problem in the countries of the CEE region is the absence (or at least weakness) of an effective mechanism for coordinating the work. Laying the legal foundations for better co-ordination mechanisms frequently necessitates the repeal of outdated laws and the codification of new concepts. The key is firmly in the hands of governments, for the single most important factor is political will.

To allow change to occur, the governments must concentrate on the things that they, and only they, can do. Their job is to define and enforce the appropriate legal, regulatory, and administrative framework. This includes tasks as fundamental and diverse as building a capacity for environmental and economic regulation, developing financial mandates for utilities that encourage conservation, and creating enabling environment for increasing community involvement. Private involvement in the water sector is not a panacea and is never simple. In adition to the obvious macroeconomic risks, knowledge about the condition of assets is ussually only rudimentary. Still, the role of the private firms which depend for their survival on their reputation for performance and which assume legal liability for the consequences of any professional negligence should be expanded in the water sectors of CEE countries.

Over the next decades, the single most important consideration in water management in the CEE region will be that of institutional design – developing a set of rules that water suppliers, water users, and policy-makers understand, agree upon, and are willing to follow. Organisational blueprints do not exist, nor are they likely to be readily adopted. Instead, within broad frameworks set by government, water users and suppliers need to design their own institutions, matched to their particular set of physical, economic and social conditions. At the same time it is important to keep in mind that decentralisation and market systems have their own problems; "perverse" incentives also face private firms and local management institutions responsible for systems operation and maintenance.

The shift to basin management and planning is recognised throughout the region as a logical and necessary step. However, development of full working relationships between national administrative structures and the new river basin authorities is an intricate process that has just began. While supporting the concept of basin management, the administrative structures are often losing part of their authority over water finances to pay for local operations. The principles are correct, but the devil is in the details that must be agreed upon between all the "non-water" and water parties concerned. The past 10 years brought in the region more investments in developing municipal water infrastructure than ever in the history. This is very positive. At the same time the systems were often oversized and unnecessary capacities were created.

These were due to unclear definition of objectives, hasty tendering procedures, poor project preparation, management and implementation, and so forth. The lessons learned should be used in the future all across the CEE region.

Aquatic ecosystem health, while simple to understand in the abstract, is difficult to assess in meaningful terms and is closely linked to water quality. The economic value of ecosystem maintenance is another aspect, which is difficult to quantify. The science behind ecosystem health is not fully developed in the CEE region, and the general acceptance of a meaningful implementation of the concept is still difficult. Whereas aquatic biodiversity is acceptable as a public good in more advanced countries, such a concept is not generally acknowledged in the region where basic public health needs and economic development are the priorities. Nevertheless, in the CEE countries it is recognised more and more often that degraded (aquatic) ecosystem health, however defined, is causing systemic failure in economic and social development.

The challenge of the next decade is to rethink in the CEE region how water quantity and quality data are collected and used, and to take advantage of new capabilities that can improve the effectiveness and cost-efficiencies of data and assessment programmes at the national level. Water quality and quantity data systems are failing to provide the kinds of information governments need to develop, implement and monitor respective policies and programmes. They are often duplicated in two or more government agencies, are expensive to operate, and fail to provide the appropriate information required for management purposes.

In the case where information is available, the challenge is how to make the information useable. Accessing knowledge and its use in decision-making remains difficult in the region. Specific attention needs to be paid to new information technologies that provide user-friendly information for decision-making.

APPENDIX I

Members of the interim CEETAC

Ms Galia Bardarska
Bulgarian Academy of Science, Institute of Water
Acad. G. Bontchev Str. Block 1
1113 Sofia, Bulgaria
Tel: +359 2 979 2454
Fax: +359 2 722 577
Email: bardarska@usa.net

Mr Indrikis Barkans / Ms Sandra Krivmane
Ministry of Environmental Protection
and Regional Development
Peldu iela 25
LV-1494 Riga, Latvia
Tel: +371 702 6503
Fax: +371 782 0442
Email: indrikis@varam.gov.lv / SandraK@vvi.gov.lv

Mr Petr Dolejs
Water and Environmental Technology Team
Box 27, Pisecka 2
370 11 Ceske Budejovice, Czechia
Tel./Fax: +420 38 55 22 109
Mobile phone: +420-603-44 09 22
Email: petr.dolejs@paegas.vol.cz

Mr József Gayer (chair person)
VITUKI, Water Resources Research Centre Plc.
P.O.Box 27, Kvassay Jenő út 1
H-1453 Budapest 92, Hungary
Tel: +361 215 3043
Fax: +361 215 3043
Email: gayerjozsef@vituki.hu

Ms Danka Jassikova-Thalmeinerova
Ministry of Environment
Nam. L. Stura 1
812 35 Bratislava, Slovakia
Tel: +421 7 5956 2181
Fax: +421 7 5956 2213
Email: jassikova.dana@flora.lifeenv.gov.sk

Mr Janusz Kindler
Warsaw University of Technology
ul. Nowowiejska 20
00-653 Warsaw, Poland
Tel: +48 22 660 5362 (direct)
Fax: +48 22 625 4305
Email: jkindler@iis.pw.edu.pl

Mr Harry Liiv
Ministry of the Environment of Estonia
Toompuiestee 24
15172 Talliinn, Estonia
Tel: +372 62 62850
Fax: +372 62 62869
Email: harry@ekm.envir.ee

Mr Marek Nawalany
Warsaw University of Technology
ul. Nowowiejska 20
00-653 Warsaw, Poland
Tel: +48 22 621 8993
Fax: +48 22 625 4305
Email: marek.nawalany@iis.pw.edu.pl

Mr Bernardas Paukstys
Hydrogeological Company “GROTA” /
Vilnius University
Eisiskiu plentas 26
LT -2038 Vilnius, Lithuania
Tel: +370 2 233 623
Fax: +370 2 267 471
Email: bernardas@iti.lt

Mr Liviu-Nicolae Popescu
M.W.F.E.P. – I.C.I.M.
Aleea Fizicienilor Street N4,
bl. 3c, et 2, ap 16, Sector
374558 Bucharest, Romania
Tel: +40 1 221 5758 / 221 9226
Fax: +40 1221 9204
Email: lipopesc@pcnet.pcnet.ro

Mr László Somlyódy
Budapest University of Technology and Economics
Műegyetem rkp. 3
H-1111 Budapest, Hungary
Tel: +36 1 463 3713
Fax: +36 1 463 3753
Email: somlyody@vcst.bme.hu

Ms Martina Zupan
Hydrometeorological Institute of Slovenia
Vojkova 1 b
1000 Ljubljana, Slovenia
Tel: +386 61 178 4102
Fax: +386 61 133 1396 / 178 4102
Email: martina.zupan@rzs-hm.si

APPENDIX II

CHARACTERISTICS OF CEE COUNTRIES

1. Bulgaria

The Republic of Bulgaria is a middle-size country situated in the Southeast of Europe on the Balkan Peninsula. The surface area of the country is 111 000 km^2. By the end of 1997 the population was 8.3 million. Most of the population is concentrated in the urban areas (about 69%). The average population density is 75 inhabitants per km^2, a moderate value. Geographically and climatically Bulgaria can be categorised as semiarid. Rivers are generally short, with the exception of the Danube on the northern border. The percentage of the Bulgarian territory draining to Danube River, Black Sea and Mediterranean Sea is 31.6%, 20.1% and 48.3%, respectively. There are 18 major lakes with a total area of 77 km^2 and 2100 man-made reservoirs with total capacity of 6 billion m^3. Average rainfall is 673 mm per year; distribution varies from 450 to 1200 mm.

The main sources of fresh water are small external inputs, groundwater (about 4.2 km^3/y), Danube runoff transiting alongside the border (only 4.1 km^3/y is used, mostly for cooling purposes) and internal runoff (slightly above 20 km^3/y). Average head specific water availability is medium: about 3000 m^3/capita/y, however the unbalanced distribution of water resources causes shortages of water in many areas. The average withdrawal is 1550 m^3/capita/y. Its largest portion is cooling water – 76%, followed by industry and municipalities (both 11%). Agricultural uses are very small at present, only 2%.

The drop of GDP during the transformation in Bulgaria was the largest among the CEE countries: 33.6% between 1989 and 1998. The GDP is about 1200 USD/capita at present. The collapse was due to curtailed domestic consumers' demand, dramatically reduced investment and government's demand and the negative trade balance. The structural transformation is being delayed also by external factors – the global financial crisis and the wars in Yugoslavia. Years will be needed for the reconstruction of the transport infrastructure of Serbia and Danube river navigation, which are of vital importance to Bulgaria as the most direct and cheapest roads to Central and Western Europe. The increasing uncertainly in the Balkans would repel foreign investors for years, or at least make them much more selective. This would further delay the modernisation of the Bulgarian water sector. Bulgaria attracted an insignificant share of the foreign direct investment, coming to CEE countries over the last 10 years (160 USD per capita that is one tenth of Hungary's 1650 USD/capita). In the absence of an all-embracing modernisation of the economic structures in line with the European standards Bulgaria would not be in a position to meet the present criteria for EU membership over the following 15-25 years. Bulgaria might meet only revised EU membership criteria. Such a revision however would strongly affect the economic and social homogeneity of the EU – one of the fundamental principles of its existence. On the positive side the currency board has proved highly effective at reining the inflation and stabilising the financial sector.

Measures implemented during the past eight decades have significantly reduced flood risks. The development of an early warning system for floods and accidental pollution

has been already started (also for the entire Danube catchment in the frame of the Danube Environmental Programme). Bulgaria is increasingly facing long periods of drought with negative effects on water quality (e.g. there were critical periods in 1993 and 1994).

The total length of rivers in Bulgaria is 19761 km. Over 25% of the monitoring sites are with bad or very bad water quality. The transition after 1989 caused a clear trend in water quality improvement. Fertiliser application was reduced by an order of magnitude.
The same statement applies for irrigation. Investigations on water demand during recent years showed that the role of water losses and irrational water control are considerable, extending from 30% (small settlements) to 70% (large ones) of the average water use.
The predominant portion of the pipelines are constructed from asbestos cement pipes (about 80%) that are more than 25-30 years old. Renovation of water pipes is the main activity of a loan agreement with the World Bank.

The level of public water supply is 85% (70% stems from groundwater), while that of sewerage is 49 (70% in towns and nearly nothing in rural settlements). The country wide level of biological wastewater treatment is 36%. 64% of the capacities are used only, mainly due to the lack of sewerage and the drop in water uses. Drought can cause sever water supply problems: e.g. due to droughts in 1994/1995 the city of Sofia was supplied from the almost empty reservoir “Iskar”. Some of the quality parameters (colour, turbidity, iron, manganese, plankton etc.) did not meet Bulgarian drinking water standard.
Altogether 117 towns and 1188 villages have suffered water shortages for many years.
The above drought made the situation even worse and in summer of 1994 caused interruption of the water supply to more than 70% of the population of the country.
Recent water rationing in Sofia and the decision to proceed with the construction of interbasin water transfer, led to a political crisis of national dimensions.

In 1991 the Government of Bulgaria (assisted by the U.S. Government and the World Bank) performed an investigation and developed a National Environmental Strategy and an Action Plan. The strategy emphases updating the environmental legislation and its harmonisation with legal principles of the European Union; institutional strengthening of state and municipal environmental authorities; elaboration and introduction of new mechanisms of inter institutional co-operation; and integrated environmental policy, programs and measures for solving the problem of environmentally endangered areas (hot spots).

Future actions and investments should include the meeting of requirements of the urban waste water treatment directive, the drinking water directive, renovation of existing water supply and sewerage works, new developments etc. For the coming six years alone for wastewater treatment plant construction about 1 billion USD is envisaged which causes a huge burden (e.g. the average pension is about 30 USD).

The New Water Law is effective as of January 2000. Four river basin organizations will be created. All water regulations, standards, methodologies, taxes etc. are in the period of revision by the Ministry of the Environment and Water, following EU principles.
Monitoring and inspection of environment is made by 15 Regional Inspectorates of the Environment and Water. The Ministry of the Regional Development and Public Works is responsible for all the water supply systems and sewerage facilities. 48 state or municipality owned water companies ensure water supply and sewerage services (there is a move towards privatisation). The tariffs are at present inadequate to cover full cost recovery although the new water law introduces the principle. The department Health Care and State Sanitary Control of the Ministry of Health controls the quality of drinking water and bathing water in liaison with 28 Hygiene Epidomiological Inspectorates.
The testing equipments and methods are not in accordance with EU and WHO norms.

2. The Czech Republic

The Czech Republic covers an area of 79 000 km^2. Population is 10.3 million. Terrain character is a mixture of hills and mountains separated by plains and basins. Most of the country lies 200 – 600 m.a.s.l. Average temperature is 8 °C and annual rainfall is about 668 mm +/- 20%. There are three basins: the Elbe Basin (48 500 km^2), Morava and Dyje Basins (20 700 km^2) and Odra Basin. Most of Czech rivers flow into the Northern Sea (65%), less into the Black Sea (28%) and the Baltic Sea (7%). Water from foreign countries is negligible.

Precipitation is distributed into main water balance components as follows: evaporation and soil moisture (68%), groundwater resources (3%) and surface runoff (29%). The average surface runoff is about 1 400 m^3/cap/y, about one third of European average. The total length of water streams in Czech Republic is 75 500 km. The mean density of river length is 0.95 km/km^2. The country can be divided into agricultural area (40%), forests (33%), urbanised area (14%), meadows and pastures (11%) and water areas (2%).

There are 114 large water reservoirs with total volume of about 3 141 millions m^3 (one-third is used for water supply purposes). There are 52 000 ha fish ponds with 625 millions m^3 (very old and big pond system was built in South Bohemia already in the 15 century). About 300 km of rivers Labe and Vltava are used as water ways. The proportion of water power plants is not high (contributing to about 3% of the energy production). There are 18 nature conservation areas. The conceptions of water protection are prepared for one half of the country now. The country co-operates with neighbouring ones in water and environmental protection. Since 1997, when floods strongly affected about one-third of the country, especially the flood early warning system has been further developed and some other arrangements avoiding other flood dangers has been made.

Czech Republic (with Poland, Hungary and Slovenia) is one of priority candidates for EU extension. The per capita GDP is about 5000 USD/y. The improvement of water and environmental quality is one of important elements of approaching EU.

About 75% of the population lives in urban areas (density is 132 inhabitants/km^2). 86% of the population is supplied with public water (in 1996). The quality is satisfactory: only about 5% of water supplied is out of the national standards (similar to WHO ones). However water from private groundwater sources is much more problematic. Here the amount of unsatisfactory quality is estimated to be up to about 98%. The specific water consumption is 260 l/cap/d (1998). It has been dropped a lot since the end of the eighties. The average cost of drinking water from public water supplies is about 0.5 USD/m^3 (1998). Large regional water supply organisations were privatised and small organisations of infrastructure owners were established.

In 1989, 72.4% of inhabitants were connected to sewerage. For 1998 this number has increased to 74.4%. 91.3% of wastewaters entering sewerage systems was treated in 1998 (this number was only 71.5% in 1989). Since 1990 150 larger wastewater treatment plants were built, extended or intensified. The quality of surface water has been improving since the beginning of 1990's, but there is still 34% of river lengths of unsatisfactory quality.

Estimates show that the development of water management till 2010-2015 requires about 4-6 billion USD investments. The largest portion is associated to water supply, sewerage and wastewater treatment – about 80% (within which reconstruction needs are

high). The rest should primarily go to flood protection and industrial wastewater management.

The Government of the Czech Republic supervises water management by the Ministry of Agriculture and the Ministry of Environment. Some water issues are within the competency of other ministries (transport, industry etc.). After privatisation, rivers are administrated by five state owned stock companies connected with particular basins. Recently it was noted that formation of these companies was not in accordance with the law. Thus, these corporations are planned to be transformed back into the state enterprises. The State Budget and the State Environmental Fund aid the development of drinking water and wastewater investments. The proportions of self financing and subsidies in water supply and sewerage systems is about 15% and 60%, respectively, from the total investment cost, i.e. from 1.1×10^9 CZK (31 million USD) annually (data from 1998).

Strengths of the Czech water management is considered to be qualified workforce and long tradition in all fields (water and wastewater technology, civil engineering, limnology etc.). The earlier state water management plans had many positive features. Weakness involve the possible lack of cooridination between river boards and water companies (supplying drinking water and treating wastewaters). Insufficient information flow between parties involved in solving water related matters should be also mentioned (a feature in many other countries).

3. Estonia

Located on the eastern coast of a Baltic Sea with a territory of 45 000 km^2. Population is 1.46 million, declining. 30% lives in rural areas, 30% in the capital city of Tallinn. Flatland, 40% of the territory is 50-100 m.a.s.l, only 10% above 100 m, the highest location is 318 m. Precipitation exceeds evaporation by 30%. Inland waters cover 4.6% of total area, river density is 0.72 km/km^2. Main rivers: Pärnu, Narva, Emajőgi. Largest lakes: Peipsi, Võrtsjärv and Narva lake. Shared river basins: Narva River and Lake Peipsi (both with Russia). Internal renewable water resources are 8050 m^3/cap/y for surface water and 2285 m^3/cap/y for groundwater. River flows from other countries form 4.7 km^3 annually (3357 m^3 per capita). Transboundary issue is not crucial in Estonia, however continuous cooperation with neighbouring countries is necessary.
Economic transition is ongoing in all the sectors. GDP is 3340 USD/cap/y, increasing 3-4% annually. Unemployment rate is about 9-10% and differs by regions.

Water consumption has decreased approximately 43% since 1992 and stabilized at the level of 1403 million m^3 in 1998, mainly due to the increase of water price and the reduction of leakages. Drinking water for 35% of population comes from surface water (Tallinn, Narva), for 65% of inhabitants from groundwater. About 73% of population has a public water supply (more than 80% in larger settlements). Quality of potable water has deteriorated in some regions due to the past pollution (e.g. oil products in groundwater from previous military sites), intensive land use (e.g. high nitrate levels in groundwater in agricultural regions) or natural conditions (high concentrations of some elements – Fe, Mn, F, Ba – caused by geological conditions). The poor quality of pipelines causes excessive iron, hydrosulphide etc concentration in drinking water. Significant investments (about 260 million USD) are necessary to water treatment and renovation of the water pipelines.

70% of the population of Estonia is connected to sewerage (80-95% in large settlements, in small settlements about 50%). About 43% of wastewater is treated mechanically and 52% is handled biologically (biological-chemical processes). About 5% of wastewater is not treated. Only 58% of wastewater treatment plants are working at satisfactory level. 60% of sewerage is out of age. The investment need is 260 million USD to wastewater treatment and renovation or construction of sewerage. The average price for water and sewerage services is 1.4 USD/m^3 (including wastewater treatment). It does not exceed 4% of the average income per household member. Water tariff is too high in some regions. State subsidises only investment cost in economically underdeveloped areas (8 million USD annually). Water companies are owned by municipalities. Small water companies work inefficiently and need management reorganisation. The control over the management efficiency of the big monopolistic water companies is also a crucial issue. The public water supply and sewerage act was approved, which restrict inter alia the activities of monopolistic companies.

Water use is managed through special water permits, regulating the water abstraction as well as wastewater discharges (quality and quantity), issued by the regional environmental departments. General pollution charges are given in the law, (water) resource fees in a regulation. The latter are split 50:50 between state budget (environmental fund) and local municipalities. Pollution charges enter the state budget (environmental fund). Environmental taxes paid in state budget can be used only for environmental activities (including investments).

The status of ground and surface water is satisfactory or relatively good. However, rivers, lakes and coastal waters suffer from eutrophication. Since 1994, more than 100 wastewater treatment plants were constructed or renovated. BOD7 load decreased from 5700 t/y by more than 30% (1994-1997). There are plans to establish state water protection districts in main ground water recharge areas. Also the integrated river basin management action plans are under preparation.

Reform of water management is going on under the jurisdiction of the Ministry of Environment and Ministry of Social Affairs (the latter dealing with drinking and bathing waters). It is planned to form six river basin districts and to delegate river basin (RB) administration functions to selected regional environmental departments. Their main roles will be elaboration, co-ordination and implementation of RB management plans. IWRM has some administrative barriers in the practice. Many water/environment related laws/regulations were passed during the last decade. EU directives are to be harmonised by 2003. With the current investment schedule (40-46 million USD annually) the transition period until the compliance with EU requirements will last about 14 years (total estimated cost for EU compliance 660 million USD). Annual investment cost per capita is estimated to about 33 USD. The amount of total investments is about 1% of GDP.

4. Hungary

Located in the Danube catchment and the deepest area of the Carpathian basin. Strong economic transition including all the sectors. Extension 93 000 km^2. Population 10.1 million, declining. 36% lives in small settlements. GDP is 4500 USD/cap in 1998, increasing by about 4-5%/y. Flatland with large drainless areas and shallow lakes (including Lake Balaton). Main rivers: Danube, Tisa, Drava. Extremes: floods, excess waters and droughts, all particularly in the Tisa valley in the east. Shared river

basins: 95% of the waters stem from abroad. Surface water availability is 10 500 m^3/cap/y; the contribution of runoff in the country is only about 500 m^3/cap/y (sensitive to potential changes of climate). Important thermal water potential. Water management basically depends on transboundary issues. In a country wide average the use/availability ratio is about 0.15. It is much higher for the Tisa valley and can reach 1 for catchments fully located in Hungary. Resources in the Tisa basin are vulnerable for two reasons: climate change impacts and potential future utilisation in upstream countries. These may significantly reduce the amount of resources free at present. Problems may appear in the future as irrigation needs may grow and a real water market may develop. Recent flood and excess water events showed the huge variability of extremes and vulnerability of the defence system.

90% of drinking water relies upon vulnerable groundwater (quality problems include ammonia, iron, manganese and arsenic of natural origin). 96% – 98% of the population is served by public water (less than 70% in small settlements). The level of sewerage is only about 45% while that of biological wastewater treatment is 30% (less than 5% in villages). The utility gap (ratio of population connected to public water supply – that of linked to sewerage) is very high. Surface water quality is medium, due to the overall high dilution (it is poor for rivers of low dilution rate). Most of the shallow lakes suffer from eutrophication.

The past non-sustainable development, the neglecting of the maintenance of the existing infrastructure and the uncompleted developments set difficult tasks for the coming decades. River basin authorities operate for more than 40 years. Institutional structure is complex: water belongs at least to three ministries (water, environment, and agriculture and rural development). Drinking water and wastewater standards are not yet EU conform. Some of the utility companies were privatized. Water service tariff is high (as a result of its increase during the past decade consumption has been reduced by more than 40%), it can exceed 3-4% of the net annual income. Wastewater emission charges have not yet been introduced. Fines are lower by at least one order of magnitude than what would motivate to reduce emissions. Enforcement is not strong enough. Many water/environment related laws/decrees were passed during the past decade which follow main principles of the EU regulation. Water and environment funds exist, but they are thin (they should be increased in the future by about a factor of three to five). Financing schemes are not yet well developed. Major source of municipal investments is state subsidy. The related system has a number of shortcomings and may not push towards cost-effective solutions. IWRM has lots of barriers in the practice. Hungary is in the first category of EU candidate countries. Accession cost in water supply and wastewater management is estimated as about 5000 – 6000 million USD. Assuming that about 1% of the GDP and 4% – 5% of the net income can be spent for desired developments, the transition period will be about 15 years, depending on economic growth.

5. Latvia

Latvia is located in the eastern coast of the Baltic Sea (total area 64.6 thousand km^2) and characteristic with level relief (hills, lowland, flats). Population is 2.5 million from which 705 lives in towns, including 34% in the Riga agglomeration alone. GDP was 2302 USD/cap/y in1997 with trend to slowly increase.

The inland waters occupy 4% of the territory. The total surface water resources are estimated about 33-35 km³/y (about 60% of which is of transboundary flow from Belarus and Lithuania). The main rivers are Daugava, Lielupe, Venta and Gauja, which together form 88% of the total discharge. The total length of about 12400 rivers and brooks in Latvia are over 37 000 km. About 35% of rivers longer than 10 km are hydrologically regulated. 4.7 km³ groundwater is available annually (supplying 1.5 million m³/d drinking water).

Groundwater of acceptable quality for water supply is available almost everywhere. Groundwater quality generally meets the requirements of the EU standards for drinking water, except increased iron and reduced fluoride contents, and often from excessive hardness. In Soviet time mainly the surface water was used for drinking water supply not taking into account the large resources of groundwater. The two largest towns Riga and Daugavpils are still supplied with surface water from river Daugava. The treatment plant of Riga drinking water is reconstructed. The main problem for drinking water preparation is threat of transboundary Daugava water pollution from Russia and Belarus. In 1990, a railroad tanks accident occurred Belarus. As a result, the water of the Daugava was pulluted by 128 tons of the very toxic substances, ACH and cyanides. Due to pollution mass fish deaths were observed. In order to guarantee the health of the population, water supply was interrupted for the two largest cities. Till now there is no procedure for compensation of damages in the cases of transboundary pollution.

Total water abstraction in 1998 was 367 million m³/year, of which groundwater represents 42% and surface water 48%. The level of public water supply is 93%, while that of sewerage is 92% (excluding private housing stock owned by natural persons). Sewage from private houses is mainly withdrow to treatment plants or infiltrate in ground. 321 million m³ of municipal wastewater was discharge into natural surface waters in 1998, from which 46% were biologically treated to standards. In large part of rural villages there are biological wastewater treatment plants, but the small municipalities have not money for reconstruction. Average daily consumption in the largest cities was 220-290 l/cap/day (1997). In rural regions mainly wells and less often also bore-holes are used (estimation of water use is difficult). The tariffs are different from place to place: in cities 0.31-0.52 USD/m³ of drinking water and 0.38-0.72 USD/m³ of sewage water.

Assessment of water quality is carried out according to Surface Water Quality Requirements in the Cabinet of Ministers Regulation, which are based on the EU directives of Drinking Water from Surface Waters, Freshwater Fish and Water for Human Consumption. At this moment surface water quality is considered to be good or fair in most rivers (80 per cent). Despite the 90% reduction in mineral fertiliser application since the early 1990s, the trend analysis of nitrogen and phosphorus loads does not show a general decrease in nutrients. This is also the major concern to the Gulf of Riga, which is highly eutrophic.

The largest rivers – Daugava, Venta and Lielupe originate in neighbouring countries and bring noticeable pollution load. To estimate water pollution coming from abroad continuous monitoring systems are necessary to organise. Latvia is going to establish several bilateral and multilateral agreements with bordering countries. The agreement among Latvia, Russia and Belarus in the field of utilisation and protection of waters Zapadnaya Dvina/Daugava river basin is the first step in this respect.

There are more than 2000 lakes in Latvia larger than 1 ha, with a total area of 1000 km². The average depth of about 70% of the lakes is less than 5m. Only 16 lakes exceed 1000

ha in size. The largest lakes in the vicinity of Riga are very important both for the water supply in Riga and for recreational purposes. These water bodies are also a subject to serious eutrophication.

About 40 000 ha of agricultural land in Latvia has been drained with pump drainage and protected from flooding by dams and dikes. Flood problems are generally connected with sea water level rise in coastal areas, spring floods in river low lands and frazil what caused ice jams in upstream part of power station reservoirs. Hydroconstruction and land reclamation has done serious damage to the natural ecosystems of waters and rivers coasts. The construction of the Daugava cascade of hydroelectric power stations has also given rise to other serious problems (deformed flows of groundwater which facilitate accumulation of pollution and stopped fish migration ways). The earlier regulation and straightening of small and sometimes medium rivers had a destructive effect on aquatic ecosystems. The extensive, often ill-considered land reclamation increased this. In 1986, the total length of regulated rivers was close to 3000 km, the total length of drain ditches, regulating ditches and main ditches reached 66 000 km.

The Latvian National Environmental Policy Plan lists transboundary water pollution, eutrophication of water courses, degradation of water ecosystems and the poor quality of drinking water as priority problems. Another priority is the implementation of water management on the basis of the river basin principle. Investment cost related to EU integration is estimated somewhat below 2 billion USD.

6. Lithuania

Lithuania is the southernmost Baltic country with an area of 65 200 km^2 and number of population reaching 3.7 million. 65% lives in urban areas. Lithuania is a flat country with landscape elevations varying from few m.a.s.l. on the coast of the Baltic Sea to 298 m.a.s.l. in the eastern part. Historically Lithuania is an agricultural country. 38% of its territory is occupied by arable lands, 11.5% by pastures, other 15% by urban areas. GDP in 1998 was 2890 USD/cap, growing approximately 5%/year.

There are 29 000 rivers and creeks longer than 0.25 km with total length of 64 000 km but only 18 rivers are longer than 100 km. The Nemunas River basin occupies 74% of the territory of the country (with also 74% of total population). Other major rivers are Neris, Sventoji and Nevezis. Main transboundary rivers are Nemunas, Neris, Musa and Venta sharing waters with Belorus, Russia and Latvia. The average density of the river network is 1 km/km^2. Number of lakes larger than 0.5 ha comprises 2 850 with total area of 908 km^2. Rainfall during an average year amounts to 748 mm. Renewable water resources reach 15.4 km^3. Besides that 10.8 km^3 of water are transit flows from Belorus, Poland and Russia. Surface water availability is 7 043 m^3/cap/y. In 1998 total amount of 5 066 million m^3 of water was withdrawn for power production, industrial and domestic purposes. 94 percent or 4 785 million m^3 was used for energy production (mainly for cooling of Ignalina Nuclear Plant), 1.2 percent was used for industry, 3 percent for domestic purposes, 0.04 percent for agriculture and 2 percent for fisheries.

Spring floods incur losses mostly in the delta of Nemunas river. These floods occur even during dry years, since ice jams are often formed on the tributaries of the Nemunas. 43% of Lithuanian rivers are clean (Class I and II), 48% moderately polluted (Class II and IV) and 9% heavily polluted (Class V and VI).

After the re-establishment of independence the main environmental concern of the country was construction and renovation of municipal wastewater treatment plants. In 1992-1998 from 1.2% to 5.1% of the state budget was used annually for investments. Expenditures for environmental protection (including water management) represents 1-1.3% of GDP. The amount of international loans and subsidies during this period reached 116 million USD with increasing trend until 1994 and a declining one later on.

In 1998 217 million m^3 of municipal and industrial wastewater was discharged into surface waters. 54% of this amount was treated biologically, 30% only mechanically and the rest was released without treatment. Lithuania depends entirely on groundwater for its drinking water supply. 94 centralised well fields supply potable water to 54 major cities. Due to economic changes only 36% of the approved groundwater resources are utilised today. 55% of centralised water supply has an iron concentration above limits. Some 11 000 drilled individual wells draw water from about 20 aquifers. About 70% of Lithuanian population are connected to centralised water supply systems, and close to 60% are connected to sewerage. Rural water supply is based on shallow and often polluted unconfined groundwater aquifers. Sewerage systems are still lacking in rural areas. Water supply and wastewater treatment tariff is uneven and comprises 1.6 – 2.7% of the net annual income. The water tariff is rising permanently.

About 1000 artificial reservoirs with total area of 268 km^2 were constructed in Lithuania since 1970. 17 major dams are registered in the World Register of Dams. The reservoirs are used for power generation, fishery, irrigation and other purposes.

The Ministry of Environment is the main institution responsible for water management. Other institutions are Ministry of Health, Ministry of Agriculture and municipalities. There are no river basin agencies in Lithuania yet. The main economic instruments used for integration of economic and environmental decisions are: taxes on natural resources, charges on the discharge of pollutants into water, municipal user charges for drinking water, sewage and sewerage treatment, fines for exceeding the established discharge limits. Legal enforcement mechanisms are not strong enough. Many water/environmental laws were passed during the period of independence but only the Water Law follows main principles of the EU regulation. IWRM is only under discussion.

In 1995, Lithuania signed an Association Agreement with the European Union and has made a commitment to approximate its legal framework. In February 2000 Lithuania together with a number of other CEE countries will start EU accession negotiations. Economic analysis shows that meeting the EU requirements will be a heavy burden for the nation. Total cost for implementation of main EU water related directives will be about 1 billion EURO for investments. It was calculated that if 4% of mean income is used for water taxes and 3% of GDP for environmental protection (including water protection). The requirements of Water Framework Directive could be reached in 15 years. This is a dificult task for the population of the country. It is expected that environmental protection and water resources management will be financed from the following sources: 30% international loans, 50% subsidies from EU funds and 20% local sources.

7. Poland

Almost 39 million inhabititants living in about 300 000 km^2 of the Vistula and Odra river basins coverin 55.7% (Vistula) and 33.7% (Odra) of Poland's territory. The remaining 10.6% are the drainage areas of small rivers flowing directly to the Baltic Sea (99.7% of Poland is located in its basin). Mean water resources are estimated at 1 580 m^3/cap/y, one of the lowest value in Europe.

Water resources of Poland depend basically on precipitation. Under average conditions Poland is supplied with 186.2×10^9 m^3 of water (about 600 mm). This amount of precipitation, plus 5.2×10^9 m^3 of water in-flowing Poland from the neighbouring countries, produce the average runoff of 58.6×10^9 m^3 (Vistula – 57%, Odra – 30%). Due to the specific climatic conditions (the boundary between continental and oceanic climates), the year-to-year variability of annual runoff is very high. In dry years the annual runoff may drop down to 32×10^9 m^3, while during wet years it may be three times more.

Surface waters are the main source for supply of industry and agriculture. Groundwater resources supply about half of urban needs and 95% of rural needs. About 83% of total water withdrawal comes from surface waters. Water consumption is 310 m^3/cap/y; half of the European average. Industrial withdrawal is high, about 70% (including 58% for cooling purposes). Agricultural withdrawal is in the order of 10%, while municipality one is about 20%. The largest industrial water user is the electric power industry. Concerning industrial process water, key users are steel, metallurgical, chemical, pulp and paper, and food processing industries. The national average recirculation index is in the range of 0.4, a rather low value; the Polish industry is very water-intensive.

In 1995, about 90% of urban population was supplied with potable water (on average 220 l/cap/d). The remaining 10% were relying on their own wells. Urban water supply infrastructure is technically in poor condition. About 20% of the supply systems need to be modernised. 20% of water supplied is of poor or uncertain quality. In the last seven years great effort was made to improve the water supply infrastructure. In dry years several cities suffer occasional water deficits. About 25% of rural population is supplied with piped water. Individual pumps serve about 20%. Thus, more than 50% of rural population relies on water withdrawn by hand from local sources (mostly shallow wells). These numbers illustrate the magnitude of the problem. The quality of well water is often uncertain or poor.

Surface waters of Poland are characterised by high salinity, high contents of nutrients and bacteriological contamination. Taking into account physical and chemical parameters, as well as the bacteriological contamination, 87.3% of Polish rivers were classified as "beyond class" and there were no Class I rivers (if only physical and chemical parameters being taken into account, "beyond class" rivers are only 43.0%). However, in recent years gradual improvement of water quality is observed. "Usable" groundwater resources is estimated as 12.5 km^3. Generally, groundwater quality is better than the that of surface water. About 17% of groundwater belongs to so called I-st class water (drinking water) and 80% to the II-nd class (the rest is of a very poor quality).

Water management in Poland is characterised by institutional complexity and insufficient economic basis. There is a number of institutions responsible for water management out of which the four most important are: Ministry of Environment, Ministry of Agriculture, Ministry of Health and Social Care and Ministry of Economy. The major financing institution is the National Fund for Environmental Protection and Water Management. It normally finances larger investments by subsidising the

construction of reservoirs or large wastewater treatment plants. The institution now functions relatively well but the National Fund is not equivalent to a well based financial system. The seven Regional Councils of Water Management form an institutional seed for future IWRM. Still the state administration based system of collecting water use fees and penalties for excessive discharging of wastewater does not enhance the development of catchment oriented water management. As Poland is expected to access the European Union within 3-5 years, with estimated costs of approximately 30 billion USD (close to 800 USD/cap) for necessary water quality improvements, introduction of "clear-cut" catchment management should be envisaged in the near future.

8. Romania

Located in South-Central Europe, north of the Balkan Peninsula, in the lower Danube basin, bordering the Black Sea. Area is close to 240 000 km^2. Population is above 22.5 million, about 60% living in urban areas (262 cities and towns, 2 686 communes with about 13 000 villages). The relief distribution is as follows: mountains – 31%, hills – 36% and plains – 33%.

In the period of economic restructuring the country has not yet found its direct course having a more difficult start than the other countries in the CEE area. The existing imbalances have become more striking, some of the mechanisms put into operation have stuck, the newly created market institutions have not reached the degree of maturity necessary for a normal market operation and the signals received from abroad were not always the most favourable ones, either. In spite of all these, progress has been achieved in the creation of the institutional-legislative framework of the market economy, liberalization of economy, diversification of the forms of property, privatisation and restructuring of the economy. Thus in 1997, the share of the private sector was of 58% of GDP (almost 89% in the agricultural) and about 52% of the labour force was engaged in the private sector.

The GDP is slightly above 1550 USD/cap/y (less than 87% than in 1990). It is still decreasing/oscillating, in disagreement with the sustainable development demands. The average nominal payment is about 100 USD/cap/month. The unemployment rate is more than 8% of the active population. The structural modifications are still modest and with a reduced effect over environmental protection. The various mechanisms set into operation were often insufficiently substantiated leading to adverse effects.

Romania is a country with abundant water resources including the Danube River and twelve tributary basins, as well as part of the Black Sea. Forest covers 26% of the country's territory, while farmland accounts for 40%. In addition to deposits of ferrous and non-ferrous metals, the country has reserves of oil, natural gas and coal. Romania is also home to the 650 000 ha Danube Delta, the largest wetland in Europe. Water resources are unequally distributed in time and space. Utilisation of water resources needs significant investments in multipurpose water development, schemes of inter-basin transfers and in water/wastewater treatment installations. Floods represent one of the most destructive natural elements, due to their frequency and damages (including human victims caused). Serious floods occurred in 1970, 1975 and in the 1990s nearly every year (the maximum surface exposed to floods is of about 15% of the territory of the country).

Total water availability from inland resources is about 1 500 m^3/cap/y without the Danube and about 5000 m^3/cap/y including the Danube. In the last years withdrawals were about 465 m^3/cap/y, 44% of which is used in agriculture (municipalities account for 20% and industries on 36%). In dry years runoff is strongly reduced calling for improved regulation and increased storage capacities. Groundwater resources, included in the upper estimations, having in most cases a higher quality than the surface ones, are evaluated at a yearly theoretical potential capacity of 9 billion m^3, out of which it is considered that only 5,5 billion m^3/year can be used.

The overall ambient state of national water resources in Romania is acceptable. This does not exclude the occurrence of serious local pollution problems. Although the rate of pollution of surface waters has been lowered, the cleaning-up process proves to be slow and very costly. There are several potential adverse effects that might influence the aquatic eco-system (discharges of toxic substances, organic pollution, leakages, and pollution from reservoirs and sea etc.). The Danube river basin's environmental quality is considered as being under great pressure from a diverse range of human activities.

55% of the inhabitants are connected to centralised water supply systems. The rest (out of which 90% live in villages) has individual sources the quality of which is not ensured/controlled. Quality of the drinking water distributed needs the supplement of the existing drinking water treatment technologies with advanced stages. The realistic pricing of water was recognized as a real driving force for future mechanisms.

In urban areas the most significant adverse impacts on water quality are generated by the pollution from largely inadequate wastewater treatment plants (the national level of sewerage and biological wastewater treatment is 40 and 28% respectively) and solid waste disposal facilities. The lack and inadequate capacity and technology and/or inappropriate operation of the wastewater treatment plants also contribute to the increase of the water pollution. In agriculture the redistribution of land to the previous owners, has decreased the possibilities of applying modern and environmentally friendly techniques, and controlling non-point pollutions. In rural areas, the absence of decentralized supply systems and sewerage and wastewater treatment plants have contributed to the worsening of the public health situation. Industry significantly contributes to the alteration of water quality/pollution, mainly because of the existing of old technologies, the absence of the pre-treatment plants and lack of appropriate maintenance.

Each municipality has his own waste disposal site. 85% of them are outside the localities. Many of them are placed on river banks having adverse impacts on the environment. 30% of the industrial waste disposal sites are located inside urban areas. Industrial discharges, leachate from abandoned waste dumps and soil contamination all contribute to the load of toxic micropollutants reaching the Black Sea via the Danube and its tributaries. Some of the micropollutants are absorbed by sediments and accumulate in dams. Reducing these discharges and eliminating the diffuse sources of pollution is a daunting task.

The anthropogenic polluting activities developed in this huge river basin, the major regulation and hydro technical works achieved upstream on the Danube River (and its main tributaries), and the harmful human interference carried out inside of the Danube Delta area itself have disturbed the natural balance of the sensitive deltaic system. The over-development of the navigation, fish farming and agriculture, the intensive reed exploitation, and badly planning construction of artificial channels and dykes for polder farming and water flood control carried out during the last fifty years, damaged the delta's natural resources. The decrease of the retention capacity, the alteration of the

natural percolation of the water and the shift of the pattern of sedimentation inside the delta have increased the environmental degradation of the Danube Delta and the Black Sea alike.

Costs and benefits to restore the environment are key issues. Great attention has been paid to the design of economic instruments for a more efficient allocation of environmental goods and services and to stimulate environmental investment to reduce the society-wide costs. EU integration costs of the water sector can be estimated above 10 billion USD which sets a very difficult task for the country for the coming few decades.

Responsibilities for water management belong to Compania Națională "Apele Române" (CNAR), under the jurisdiction of Ministry of Water, Forest and Environmental Protection. The water management activity is organised on the river basin level. The Environmental Law (1995) is a basis for the Water Law (1996). All the special laws and related regulations have not been endorsed yet, which should allow application of the framework legislation provisions, but drafts of such provisional laws are being elaborated. In the last eight years, Romania has adhered to most of the international conventions and agreements in the field of environmental protection and nature conservation. The Water Administration Strategy has been elaborated with three variants for investment: corresponding to a minimal, medium and maximal option. For a part of the financial needs the external support is envisaged based on the EU accession costs that Romania will have to cover.

9. Slovakia

The territory of Slovakia is drained by ten major rivers, out of which nine belongs to the Danube river basin. The area of the Danube catchment in Slovakia is 49 000 km^2 representing 96% of the total area of the country. Building of reservoirs on the majority of rivers with the hydro-energy potential, resulted in reduction of the fluctuation of flows, mostly by providing minimal flow during the dry periods. According to the long-term mean river flow is about 3 300 m^3/s, including tributaries from neighboring countries. However, only 400 m^3/s spring on Slovakian territory.

The surface water quality is systematically monitored since 1963, at present in 221 basic and 4 special stations. The number of indicators is between 30 and 70. Among the water courses with heavily polluted water, the worst situation is in the river of Nitra. In the category of biological and microbiological indicators 92% of the monitored rivers are in the category IV-V (heavily and very heavily polluted water). In the period of 1996 – 1997, there was no sampling site, in which water quality would have satisfied requirements of Class I or II. Unfavorable tendency of decrease of groundwater levels lasts already for several years caused by long-term low balance of precipitation during non-vegetation period. A significant difference was recorded mainly between the south of Slovakia and the rest of its territory. Groundwater distribution on the Slovak territory is not uniform. Its quality and potential exploitation depends upon the character of geological formations and location. The groundwater monitoring includes nearly 300 stations. Frequency is twice-a-year. The most often violated parameters are of Fe, Mn, nitrate, nitrite, ammonium ions, non-polar extractable substances, phenols, and trace elements.

The total number of inhabitants connected to public water supply networks in 1998 represents 81% of population. The level of water supply is different in respective regions. The delivery of surface water has been decreasing since 1990 over the whole Slovak territory. The extent of reduction between 1998 and 1990 was 42%. Water withdrawals for irrigation decreased by 87%.

The development of sewerage systems is constantly behind the development of water supply systems. Number of inhabitants connected to public sewerage systems amounts to 2.8 million, i.e. 54% of the population (as of 1998). The country wide level of biological treatment is about 36%. Public sewerage is managed by water and sewage works or by municipalities. The volume of wastewater discharged into watercourses was 1 140 million m^3 in 1998 of which 1/3 is untreated. The number of wastewater treatment plants increased to 204 in administration of water and sewage works companies and 77 in administration of municipalities. Wastewater treatment efficiency is negatively influenced by hydraulic and material overloading, as well as by insufficient operation of treatment facilities and leaking sewerage systems.

In 1998, specific consumption of water in households was 132 l/capita/day for consumers of water and sewerage companies and 83 l/capita/day for consumers of municipalities. Thus, the specific water consumption is seriously below the European average and is close to the hygienic minimum. Drinking water in the systems is reported to be generally safe, but no information is available on the quality of water consumed by the other part of the population.

The price for domestic drinking water and sewerage is regulated by the Ministry of Finance. It is 8 SK/m^3 for drinking water and 4 SK/m^3 for sewerage (1 USD = 41 SK as January 2000). The maximum water prices are lower than the actual cost. For other consumers of drinking, processed and sewerage waters, contract prices with consumers are in place. Deliveries for households and for other consumers are in the ratio 60:40, therefore different forms of subsidies and cross subsidies are employed. Also, the price of surface water withdrawal is established by the Ministry of Finance at a maximum price 1.90 SK/m^3. This charge does not involve an environmental component and the revenue is used by River Basin enterprises to cover maintenance and operation costs of their services. Besides of direct allocation of money from the state budget, there are two state funds supporting water infractructure projects: State Environmental Fund and State Water Management Fund.

The objectives of the Slovak environmental policy with respect to water resources are to attain a good quality of surface and ground water with respect to water eco-systems, to comply with ambient water quality standards in protected areas, to balance withdrawal and available resources of water, to ensure safe drinking water supply to inhabitants and to mitigate negative impacts of flood and drought incidents.

The Water Act 138/1973 is the principal legal document with respect to water issues governing legal aspects of water protection, water management facilities, and defining the responsibility of water management authorities and municipalities. The Water Act stipulates the basic requirements for any activities that could affect the amount and quality of water.

The implementation of the water legislation is carried out by water management authorities, health authorities and environmental inspections. In case of violation of any provision of the Water Act and other water regulations, the water management authority or environmental inspection may impose sanctions and penalties.
The regulation on the protection of surface and groundwater deals also with accidents,

emergency plans and detailed procedures and co-ordination during the accident events (spillage, floods). According to the 1989 regulation on fees each polluter requesting a discharge water permit must pay a charge. These charges are governed by a permit system and are levied based on self-monitoring by polluters. The amount of the charge depends upon the quantity of pollutants in the wastewater and on the quantity of the receiving waters. Base charges are levied on BOD5, insoluble substances, crude oil substances, alkalinity and acidity, and dissolved inorganic salts. Revenue is allocated to the Slovak Environmental Fund and is earmarked to the water sector and includes drinking water supply and wastewater treatment investment projects.

The main institutions in water protection and management are: Ministry of Environment, Ministry of Soil Management, Ministry of Health and Ministry of Interior. Besides these central bodies, in 1995 the Slovak Government established the Central Flood Commission. It co-ordinates and controls the preparation and the implementation of the preventive measures of the central authorities, regional and district authorities for protection against flood.

Although the Slovak Republic has already made substantial progress in transforming its economy and approximating its legal framework to EU legislation, the reform agenda has not been fully implemented yet. The investments required in the area of water and wastewater management are estimated from 2.6 to 3.5 billion USD (the current level of GDP is about 3 500 USD/cap). The highest portion of these investments are tied to the implementation of collection system and biological treatment stages of municipal WWTPs. These estimates are preliminary and subject to considerable uncertainty. The costs of complying with the directives will depend heavily on the way the process is managed. The government is in the process of the preparation of investment strategy for the environmental sector. The Ministry is negotiating transition periods to meet the compliance with the UWW Directive, the Directive on nitrates from agriculture sector, and other three directives dealing with quality of drinking water.

10. Slovenia

Slovenia is a country with a total area of about 20 000 km^2, bordering Italy, Austria, Hungary and Croatia. Its coastline on the Adriatic Sea is 47 km long. There are different geological and climatic zones. The country is generally mountainous, with average altitudes of 300-550 m. The north forms part of the Alps with peaks over 2 000 m, of which the highest is the Triglav (2 864 m). Western Slovenia is a karstic plateau, the south is hilly and the northeast is part of the Pannonian plain. The climate in the southeast is influenced by the Mediterranean, in the north is alpine and in the northeast continental.

The consequence of the variety in topography, geology and climate is extremely high biodiversity in the country. The population stands around 2 million. Merely 7.6% of the population is agricultural, as opposed to half of the population in 1946. However, nearly 50% of the population lives in rural areas. The capital is Ljubljana with population of 274 000, followed by Maribor with population of 132 000. Net demographic changes are very slight, the population having increased by 0.46% between 1980 and 1990.

Slovenia declared independence in 1991. In the first year of independence, the country went into an economic recession, with falling GDP. Economic recovery started in 1993. Slovenia's GDP per capita is still below the EU average, although it is by far the highest in the transition economies (about 9 000 USD in 1997), increasing by about 4% per year.

Slovenia is a country rich in water resources. Average rainfall amounts to 1500 mm, reaching 3 000 mm in the west and 800 mm in the northeast. From a total average precipitation of 32 billion m^3/year, about 19 billion m^3 drain into the rivers of which approximately 80% flow to the Danube and 20% to the Adriatic Sea. There are seven main river catchments: Mura, Drava, Sava, Soèa, Notranjska Reka, Dragonja and Ri□ana. All these rivers, except the last, are transboundary watercourses. Because of the country's hydrological profile, with torrential streams and flood plains, many parts of the country are vulnerable to floods and erosion. Surface water availability in Slovenia is 9350 m^3/cap/y and all (surface and groundwater) renewable internal water resources 16100 m^3/cap/y. Water exploitation index in 1980 was 1.15% and in 1995 1.04%.

Surface water is the dominant source of cooling water and electricity production. Industry and agriculture also use more surface water than groundwater. The most important source of drinking water are groundwater (57%) and springs (43%). About 55% of produced drinking water is used by domestic use, 18% by industry, 16% by business and 6% by others. The municipal water demand is estimated at 210 l/day (120 l/day for domestic use) in 1998. Ten years ago the total demand was about 300 l/day in total and 100 l/day for domestic use. About 75% of the water is distributed from public networks, 14% from private wells, 5% from rainwater reservoirs and 4% from other sources. The larges cities are completely covered by public networks. Average water leakage was estimated at 40% in 1998. The delivery system network needs to be renewed. The reconstruction began 3 years ago by changing asbestos pipes. The main problems regarding drinking water quality are pesticides, nitrates, bacteriology and in some parts of Slovenia organic solvents. However the concentrations in drinking water are still in compliance with the standards in most of the measured samples. The surface water quality has been improved last 10 years. The reasons are the drop in production, changes in technology and rehabilitation measures taken.

About 55% of wastewater is conducted trough sewerage systems. About 30% is treated at wastewater treatment plants (15% with secondary treatment), while 25% of wastewater is not treated yet. About 45% of wastewater is treated in septic tanks and the waste from the tanks is being removed under control. The wastewater tax is paid as by the industry (on the basis of actual emission) and by the citizens (on the basis of drinking water used). In 2000 the wastewater charges will rich about 85% of calculated economic price. The drinking water tariff will rich 90% of the production price.

The mandate of the Ministry of Environment and Spatial Planning for water management issues is laid down in the Environmental Protection Act. However, no formal prescriptions are made for inter-ministerial co-ordination, which causes some difficulties. It is expected that formal co-operation will be established during the EU approximation process. The National Environmental Protection Program was accepted in 1999, which includes most of the actions in water sector to meet the EU legislation. The investment cost in wastewater sector was stated by 700 million USD, 483 million USD for drinking water and water protection issues and 1118 million USD for waste management. The investments should be realized in 10-15 years, depending on economic situation.

Contacts
Mr. József Gayer
Chair, CEETAC
VITUKI, Water Resources
Research Centre plc
H-1095 Budapest, Kvassay J. út 1.
HUNGARY
Mailing address:
VITUKI, H-1453, Budapest, P.O.Box 27
Tel: +36 1 2156140
Tel/Fax: +36 1 2153043
E-mail: gwpceetac@vituki.hu
or
GWP Secretariat, Sida
SE-102 25 Stockholm, Sweden
Tel: +46-8 6985000
Fax: +46-8 6985627
E-mail: gwp@sida.se
Website: http://www.gwpforum.org

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