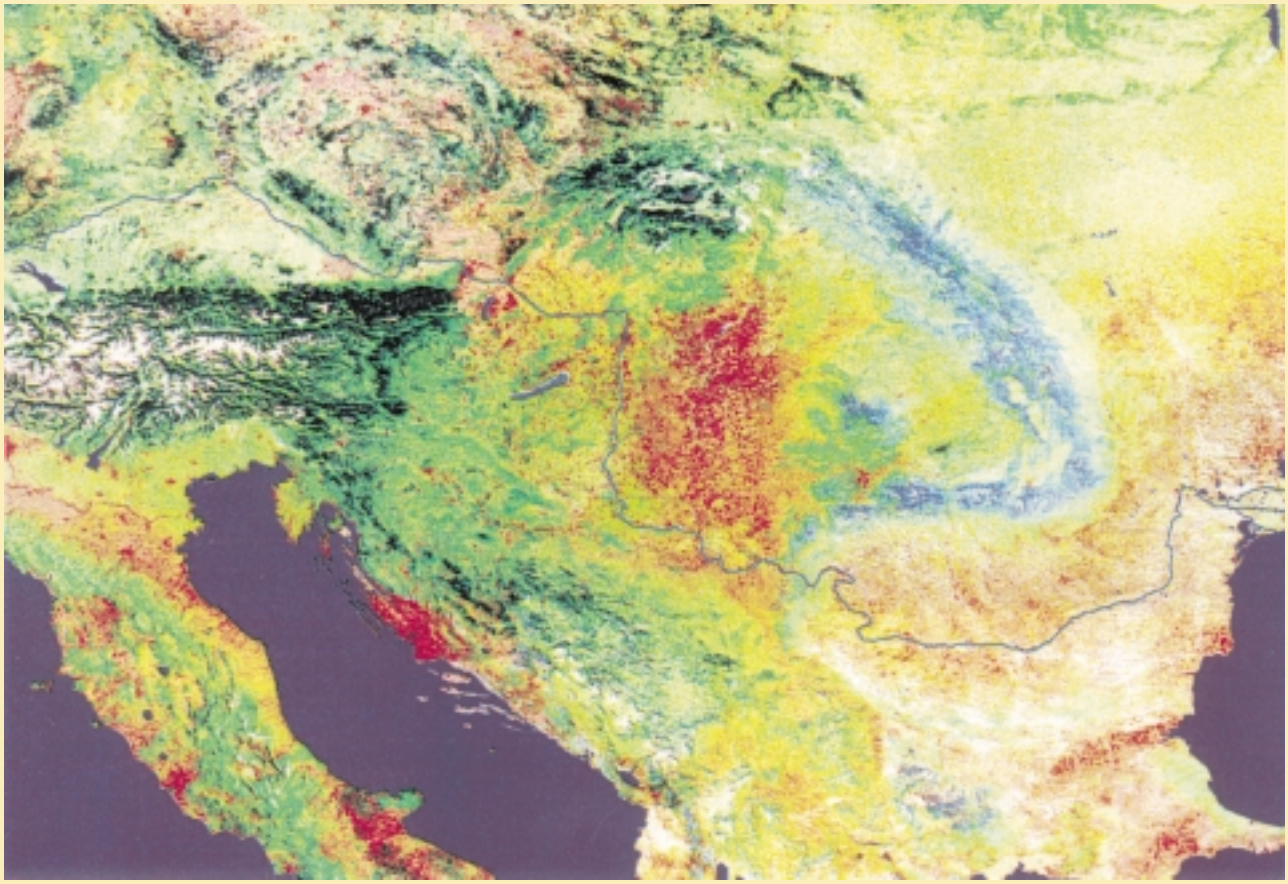
DANUBE POLLUTION REDUCTION PROGRAMME

STRATEGIC ACTION PLAN FOR THE DANUBE RIVER BASIN

1995 - 2005

REVISION 1999



Programme Coordination Unit
UNDP/GEF Assistance

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Preface

The present Report of the SAP has been prepared on the basis of existing analytical documents, in particular the National Review Reports and the results of the National Planning Workshops. A genuine bottom-top approach has associated in the elaboration of this SAP about 300 professionals and experts from all Danube countries, from central and local Governments, from Non Governmental Organizations (NGOs), from universities and research institutions and from the private sector.

This planning process has allowed to reflect national considerations concerning the analysis of problems, the formulation of objectives and targets and the identification of appropriate measures for pollution reduction. Transboundary effects of pollution have been identified and the need for regional cooperation has been defined.

The first draft of the SAP has been reviewed in the frame of Hernstein II Workshop, Austria, from 12 to 16 May 1999. Experts from all Danube Countries and invited specialists from international and financing institutions have thus contributed to produce a coherent document reflecting genuinely policies and strategies of the Danube River Protection Convention.

The ICPDR Steering Group, at the Meeting in Vienna on 10 and 11 June 1999 has agreed on the following statements:

The ICPDR Steering Group

- recognizes the efforts of the UNDP/GEF Project Team for having drawn up and organized a new approach of participating planning in using logical framework methodology for the elaboration of the revised SAP;
- appreciates the consultative, iterative planning process of the Revision 1999 taking into account the results of the National Reviews and in particular the results of the National Planning Workshops from 1998 as well as the review of the document at the Hernstein Workshop in May 1999;
- realizes that through this process account was taken of all national objectives and targets aggregating them to joint regional ones;
- encourages that the identified impact indicators and targets are reflected and translated into national objectives and targets for implementation;
- appreciates the close linkage the Revision 1999 holds as to the relevant provisions of the DRPC, demonstrating the complementary tool function of the SAP and Pollution Reduction Programme for implementing the DRPC;
- strongly welcomes the approach opened up for developing financing mechanisms supporting the implementation, in particular regarding investment for pollution reduction measures;
- agrees to hand over this document to all delegations for revision and comments until end of September 1999; the S/EG, whose competence should be adopted to the circumstances, shall examine the results and propose a draft version to the forthcoming ICPDR meeting in November for consideration and for final adoption.

Overall conceptual guidance, supervision and technical advice for the elaboration of the present Document was given by Joachim Bendow, UNDP/GEF Project Manager.

The compilation of information and analytical treatment of documentation has been carried out by Mihaela Popovici (Land Use - Agriculture and overall objectives), Gyorgy Pinter (Municipalities), Miroslav Spasojevic (Industry and Mining), Wilhelm Kittinger, (Preamble, Introductory framework and institutional and policy issues), Reinhard Wanninger (Demographic, social and economic characteristics) and Alexander Zinke (Hydrological and ecological factors of the DRB). The document was edited by Michael Sokolnikov.

Danube Basin Map

- Catchment boundary
- State boundary
- City
- River
- Water level measuring station
- Hydropower dams

0 100 200 km

Date: January 1996

Prepared by: delft hydraulics

Table of Contents

1. Introduction and Framework 1

1.1. The Danube River Basin 1

1.2. The Environmental Programme for the Danube River Basin (EPDRB) 1

1.3. The Danube River Protection Convention (DRPC) 2

1.4. Related International Agreements and Programmes 3

1.5. Principles of Environmental Protection 4

1.6. Aspects of Integrated Basin Water Management 5

2. Demographic, Social and Economic Characteristics 7

2.1. Introduction 7

2.2. Population 8

2.3. Economic Activities and Employment 11

2.4. Water Demand and Water Tariffs 15

2.5. Waste Water Management 17

2.6. Particular Situation of Transition Countries 20

2.7. Particular Situation of the EU Accession Countries 21

2.8. Development Prospects 22

3. Hydrological and Ecological Factors of the Danube River Basin 23

3.1. Basic Hydrological and Ecological Characteristics 23

3.1.1. Hydrological and Ecological Factors in the Danube River Protection Convention (DRPC) 23

3.1.2. Description of Hydrological and Ecological Factors 23

3.2. Description of River Basin Areas 39

3.2.1. River Basin Management Approach 39

3.2.2. Hydrological and Ecological Factors of Sub Basin Areas 40

4. Regional Policies and Strategies 45

4.1. Analysis of Problems and Identification of Causes of Water Pollution and Water Management 45

4.1.1. Core Problem 45

4.1.2. Direct Causes of the Core Problem 45

4.1.3. Root Causes of the Core Problem 47
4.1.4. Direct Effects of the Core Problem 50
4.1.5. Ultimate Effects of the Core Problem 50
4.1.6. Analysis of Hot Spots and Diffuse Sources of Pollution (Causes) 52
4.1.7. Analysis of Significant Impact Areas and Transboundary Effects within the Danube River Basin (Effects within the Danube River Basin) 53
4.1.8. Effects on Black Sea Ecosystems (Regional Transboundary Effects) 53

4.2. Analysis of Objectives and Targets for Pollution Reduction and Sustainable Water Management 60

4.2.1. Description of Objectives 60
4.2.2. Expected Results (Outputs) and Targets by Sectors of Intervention 61
4.2.3. Important Assumptions for the ICPDR Program and Sector Objectives 63
4.2.4. Impact Indicators for the ICPDR Program and Sector Objectives 64
4.2.5. Impact Indicators for Nutrient Reduction in the Black Sea 65

5. Sector Strategies 69

5.1. Municipal Sector 69

5.1.1. Situation Analysis 69
5.1.1.1. Importance of the Sector, Analysis of Stakeholders and Activities Leading to Water Pollution and Environmental Degradation 69
5.1.1.2. Current Strengths/Assets 72
5.1.1.3. Analysis of Transboundary Effects 73
5.1.2. Problem Analysis 73
5.1.2.1. Sector Core Problem 73
5.1.2.2. Causes Leading to Environmental Problems 73
5.1.2.3. Environmental Effects 74
5.1.3. Description of Sector Objectives 77
5.1.3.1. Description of Sector Objective 77
5.1.3.2. Expected Results (Outputs) and Targets by Sector of Intervention 77
5.1.3.3. Important Assumptions for the Sector Results 79
5.1.3.4. Impact Indicators for the Sector Results 80

5.2. Industry and Mining 81

5.2.1. Situation Analysis 81

5.2.1.1. Importance of the Sector, Analysis of Stakeholders and Activities Leading to Water Pollution and Environmental Degradation 81

5.2.1.2. Current Strengths/Assets 84

5.2.1.3. Analysis of Transboundary (TDA) Effects 85

5.2.2. Problem Analysis 87

5.2.2.1. Sector Core Problem 87

5.2.2.2. Causes Leading to Environmental Problems 88

5.2.2.3. Environmental Effects 90

5.2.3. Description of Sector Objective 93

5.2.3.1. Description of the Sector Objective 93

5.2.3.2. Expected Results (Outputs) and Targets by Sectors of Intervention 93

5.2.3.3. Important Assumptions for the Sector Results 96

5.2.3.4. Impact Indicators for Sector Results 97

5.3. Land Use - Agriculture 99

5.3.1. Situation Analysis 99

5.3.1.1. Importance of the Sector, Analysis of Stakeholders and Activities Leading to Water Pollution and Environmental Degradation 99

5.3.1.2. Current Strengths/Assets 102

5.3.1.3. Analysis of Transboundary Effects 104

5.3.2. Problem Analysis 105

5.3.2.1. Sector Core Problem 105

5.3.2.2. Causes Leading to Environmental Problems 106

5.3.2.3. Environmental Effects 107

5.3.3. Description of Sector Objectives 110

5.3.3.1. Description of Sector Objective 110

5.3.3.2. Expected results (Outputs) and Targets by Sectors of Intervention 110

5.3.3.3. Important Assumptions for the Sector Results 113

5.3.3.4. Impact Indicators for the Sector Results 114

6. Financing Mechanisms for Implementation of the ICPDR Action Plan 117

6.1. Existing Financing Mechanisms and Resources 117

6.1.1. Funding Mechanisms at National Level 117

6.1.2. National Funding Resources 118

6.1.3. International Funding Resources 119

6.2. Appraisal of Financial Requirements for the Implementation of the ICPDR Investment Programme 120

6.2.1. General 120

6.2.2. Financial Requirements by Sector and Priority 120

6.2.3. Financial Requirements by Effects 121

6.3. Concepts and Actions for Financing Implementation 122

6.4. Development of Funding Mechanisms 124

6.4.1. Program Implementation Facility (PIF) 125

6.4.2. Project Appraisal Group (PAG) 125

7. Institutional and Policy Issues 127

7.1. Introduction 127

7.2. Policy Making Tools and Processes 127

7.3. Criteria and Mechanisms of Implementation 128

7.4. Specific Institutional Components Carrying Implementation 129

7.5. System of Plans and Programmes under the DRPC 131

7.6. Cooperation with the Black Sea Convention Countries 132

Annexes

Annex I **Organizational and institutional components for implementing the DRPC**

Annex II **High and medium priority hot spots in Sub-Basin Areas**

Annex III **Sector Planning Matrix:**

- Municipality
- Industry and Mining
- Land Use - Agriculture

Annex IV **Livestock and cereal statistics**

Executive Summary

With its entry into force on 28 October 1999, the Danube River Protection Convention (DRPC), to which the ECE-Convention for the protection and use of transboundary waters (Helsinki Convention 1992) is the framework, became the overall legal instrument for cooperation in the Danube River Basin. Its main objective is the protection of water and ecological resources and their sustainable use. Hence the prevention, reduction and control of water pollution and measures for environmental impact abatement form the central part of policies, strategies and actions in particular with transboundary relevance.

In this context the need to cooperate with national and international organizations is emphasized aiming at their contributions in form of legal, financial and technical inputs to respond to regional and global concerns. The related International Agreements based on the principles of the Agenda 21 and Programmes, as well as the commonly acknowledged guidelines for environmental protection as the operational principles of the Global Environmental Facility are referred to. Particular emphasis is given to integrated river basin management and, in this respect, to the European Union/Water Framework Directive (EU/WFD).

1. Complementary Tools of the Strategic Action Plan

The joint multilateral cooperation for the protection and sustainable use of the Danube River is performed through three main instruments, which are complementary to each other.

The Danube River Protection Convention (DRPC) is a legally binding instrument, which provides for the substantial framework and the legal basis of cooperation, including enforcement. The main objective is the protection and sustainable use of waters and of ecological resources, directed to basin-wide and sub-basin-wide cooperation with transboundary relevance. Joint activities and actions are focused on coordination and enhancement of policies and strategies, whereas the implementation of measures lies mainly with the executive tools at the national level. The institutional arrangements for the joint part of implementation are established together with the main procedures; the International Commission (ICPDR), entrusted with steering and decision making, is mandated to take up additional tasks under the DRPC. The Conference of the Parties is mandated to decide upon policy issues.

The Strategic Action Plan provides for guidance concerning policies and strategies in developing and supporting the implementation of measures for pollution reduction and sustainable management of water resources, enhancing the enforcement of the Danube River Protection Convention and the political will to provide the required resources. It specifies the legal framework by setting priorities and quantifying the progress to be achieved in terms of targets and pertinent time frames. Its planned actions and proposed activities can be modified with a certain flexibility as far as they remain compatible with the legally binding determinants. Hence, it is designed to become politically obligatory although not legally binding.

The Action Programme of the ICPDR is the framework for coordination and executive implementation of pollution reduction measures by the DRPC Contracting Parties. It becomes legally binding if the ICPDR so decides. It contains technical development and operation of joint networks, systems and non-structural action. First of all, it contains structural measures, i.e., the well-prepared and committed projects among which priority actions are selected (Selected Programmes) to form the Investment Programme of the ICPDR.

2. Approach and Methodology of the SAP Update

The applied approach, called "Guided Democracy Approach", is intended to involve all the concerned stakeholders in a comprehensive but tightly built -up process. The process starts from a broad planning basis at the national level. It is then aggregated in a joint, basin-wide framework planning process, and returns to the national level again for its executive implementation. This allows the integration of all partners cooperating and supporting the implementation of the DRPC and the SAP, in particular NGOs, governmental and local authorities as well as International Financing Institutions (IFIs) and donor organizations. In order to achieve this goal, their active participation was mobilized through a series of joint action, such as workshops at the national and regional levels.

The very well-developed methods are intended to focus on the core issues, such as measures for pollution prevention, reduction and control as well as the development of appropriate financing mechanisms and economic incentives. Broad account was taken of essential factors, influencing the planning process and its executive implementation, such as demographic, social and economic characteristics as well as the specific hydrological and ecological factors prevailing in the Danube River Basin or in particular Sub-river Basins. From this, planning elements such as sub-river basin areas and significant impact areas have been identified for tailor-made sector programmes and priority projects.

Regarding the analysis of prevention, reduction and control of water pollution, a logical framework methodology was applied in order to confirm and further develop the pertinent policies, strategies and actions. Based on the input from the national reviews and planning workshops, a chain of planning steps was performed starting with the problem analysis, defining the objectives and arriving at quantified targets and time frames.

3. Features and Results of the SAP Update

The declared purpose of the SAP as the "Policy Plan" of the ICPDR and the need to clearly distinguish it from the other two main planning and implementation instruments called for substantial changes regarding its content. The role of SAP as a policy and strategic tool has been emphasized, whereas typical programme-elements, such as hot spot lists, have been shifted to the Danube Pollution Reduction Programme (DRPC). The part of SAP related to its implementation has also been substantially updated, in particular with reference to its institutional and financing mechanisms.

Reference to the Convention (DRPC) is made in all sections of the SAP to demonstrate the close relationship between both instruments and to emphasize their complementarities for implementation. Particular reference to the Convention is in the following sections:

- the overall objective of cooperation being the protection and sustainable use of water in the Danube River Basin refers to Articles 2 and 3 concerning objectives and principles of the Convention;
- prevention, control and reduction of transboundary impact refers to Article 5 concerning domestic conditions and measures (legal, administrative and technical) for efficient water quality protection and sustainable water use;
- the protection measures for specific water and ecological resources, in particular ground water and wetlands refers to Article 6;
- water quality objectives and criteria refer to Article 7 and Annex III in respect to specific reaches of Danubian surface waters;

- emission limitation, emission inventories, action programs and progress reviews refer to Article 5, 7 and 8 and Annex I and II of the Convention;
- monitoring and assessment of the riverine conditions in the Danube river basin , refering to Article 9 concerning water quality, sediments and ecosystems to be analyzed as to the present state and the progress made.

The first chapters of the SAP contain an analysis of the most outstanding facts and figures about the Danube River Basin with reference to both the water and ecological resources as well as to the manifold branches of their utilization. Integrated policies and actions are required in order to implement the environmental protection plan and achieve sustainable management of water resources.

The subsequent three chapters present, by sector, the main results concerning policies, strategies and actions for the prevention, reduction and control of water pollution. The three sectors of pollution origin are at the same time the three main sectors of intervention. They include: (i) Municipalities, (ii) Industries including Energy and Mining and (iii) Agriculture and Land Use. In order to develop appropriate sector strategies, an analysis has been carried out of the current strengths and assets, problems with particular attention to transboundary environmental effects, and their causes. The Programme Planning Matrix represents the overall objective and summarizes the results by sector of intervention in terms of objectives, expected results or outputs and required measures and actions. Finally quantified targets and time frames have been identified.

The outstanding components and results are the following:

(i) **Problem analysis** identifying the degradation of water and ecological resources and the declined quality of life resulting from unsustainable human activities and resources management, which are specified by the three main sectors of origin. Significant Impact Areas (SIAs) are determined considering the accumulative effects of pollution from point and diffuse sources. In most cases, the areas targeted by protection and rehabilitation projects are the site of wetlands. Regarding the impacts affecting the Black Sea ecosystems, the entire Danube Basin and its regional transboundary effects are to be taken into consideration. The main features of the analysis are presented below**:**

CORE PROBLEM:	Ecologically unsustainable economic activities and inadequate natural resources management
SECTOR PROBLEMS:	
Municipality:	Inadequate management of wastewater and solid wastes
Industry and Mining:	Ecologically unsustainable industrial and mining activities
Land Use - Agriculture:	Inadequate land management and improper agricultural practices

ROOT CAUSES:

- Socio-political transition, reforms and general economic recession
- War and displacement of population
- Price liberalization and free trade
- Unclear land ownership in many of the transition countries
- Ineffective implementation of structural adjustment strategies
- Incomplete legislation, regulations, standards and norms

- Low public ecological awareness, education and training
- Lack of financial sustainability of institutions
- Absence of a national strategy for water management
- Lack of economic instruments and incentives
- Lack of master plans for water resources management at the sub-river basin level
- Inefficient environmental management, enforcement and compliance

MAJOR EFFECTS

- Pollution of surface and ground water
- Eutrophication
- Accelerated run-off and erosion

ULTIMATE EFFECTS

- Reduced availability of water
- Degradation of biodiversity
- Human health risk
- Economic decline

(ii) **The Scheme of Development Objectives defines** specific Sector Objectives for the three sectors of intervention, taking into account the Overall Objective, which has been identified in all National Planning Workshops as the "Achievement of sustainable development in the Danube River Basin" and the Core Objective of the DRPC concerning "Protection and sustainable use of waters in the Danube River Basin". In order to achieve these objectives, sector specific outputs have been identified, and measures and actions have been defined aimed at reducing pollution from point and diffuse sources, protecting natural habitats and restoring wetlands in the Danube River Basin with effects extending to the Black Sea ecosystems.

OVERALL OBJECTIVE:	**Achievement of sustainable development in the Danube River Basin**
ICPDR CONVENTION OBJECTIVE:	**Protection and sustainable use of waters of the Danube River Basin**
BLACK SEA PROTECTION OBJECTIVE:	**Reduction of pollution loads in particular nutrient transport to the Black Sea**

SECTOR OBJECTIVES / OUTPUTS:

Municipality: **Improvement of the wastewater and solid waste management**

- Extension and upgrading of public sewer system
- Appropriate treatment of wastewater
- Proper management of solid wastes

Industry and Mining:	**Introduction of BAT, BEP and abatement of water pollution** ➢ Introduction of clean technologies and abatement of water pollution ➢ Implementation of pre-treatment facilities for industrial wastewater ➢ Appropriate treatment and disposal of hazardous substances
Land Use - Agriculture:	**Implementation of good agricultural practices and mechanisms for sustainable land management** ➢ Integrated approach for land and water management ➢ Adequate use of pesticides and fertilizers ➢ Proper treatment of wastewaters discharged from animal farms ➢ Prevention of accelerated run off and erosion ➢ Protection and restoration of wetlands and floodplains

(iii) **Specific measures and actions** have been developed for each expected result or output in order to ensure that sector-specific objectives and targets for pollution control and sustainable management of resources are met. These identified actions are translated into structural and non-structural projects defined in the Pollution Reduction Programme and presented in the form of Project Files. In this way, policies and strategies of the SAP are achieved through the ICPDR Action Programme and the respective Investment Portolios.

(iv) **The Programme Planning Matrix** brings together all the planning components as identified. The expected results and outputs are listed under the overall and sector objectives. Pertinent actions and measures necessary to achieve the objectives have been described.

Impact Indicators for objectives and expected results have been developed to enable the monitoring of the implementation of the programme through quantified targets and within the set time frames. The indicators describe, in the most comprehensive way, the quantification of targets for the achievement of pollution reduction and environmental protection; in some sub-sectors, this can only be done generally or indirectly.

Important Assumptions describe the conditions - such as superposed or flanking policies and strategies, economic status and financial cooperation - that are assumed to be available for supporting the implementation of the planned measures and activities**.**

Matrix of indicators and assumptions

Objectives	Impact Indicators	Important Assumptions
Overall Objective: Achievement of sustainable development in the Danube River Basin		
Program Objective: Protection and sustainable use of waters of the Danube River Basin	➢ Significant reduction of surface and groundwater pollution shall reduce health risks and shall enhance preservation of biodiversity by the year 2005 in the Danube basin	➢ The willingness for long-term implementation of sustainability principles in the governments policies guaranteed ➢ Strengthening cooperation between the countries within the Danube basin
The Black Sea Protection Objective: Reduction of pollution loads, in particular nutrient transport to the Black Sea	➢ In short and medium terms, owing to the adoption of appropriate strategies, in particular in the transition countries, that will permit economic development, while at the same time assuring a recovery of the agricultural and industrial sector activities, the discharge of nutrient and hazardous substances into the Black Sea shall not exceed its 1997 level; ➢ In the long-term, the Black Sea ecosystems shall recover to conditions similar to those observed in the 1960s through progressive reduction of loads of anthropogenically applied nutrients and hazardous substances in all countries of the Black Sea Basin. ➢ Achievement of the Danube Pollution Reduction Programme: The nutrient load reaching the Black Sea from the Danube River Basin will be reduced by the year 2010, by 13,9 % for nitrogen (from current 566 kt/a to 487 kt/a) and by 27,4 % for phosphorus (from current 48,8 kt/a to 35,4 kt/a.	
Sector Objectives: **1. Municipalities:** Improvement of the wastewater and solid waste management	1. Country specific emission reduction of BOD by 2010 achieved. Soil contamination and impact on natural water bodies controlled through appropriate solid waste management, by the year 2010.	1. Achievement of higher levels of environmental compliance and abatement
2. Industry and Mining: Introduction of BAT and BEP and abatement of water pollution	2. Organic and inorganic effluents reduced up to 30% by 2010, and discharge permits for industrial and mining enterprises with regard to BAT/BEP examined and revised by the year 2005.	2. Enforcement of BAT and BEP regulation in industrial sector by authorities remains priority
3. Land Use - Agriculture: Implementation of good agricultural practices and mechanisms for sustainable land management	3. Increased application of good agricultural practices by 15% in large farms by the year 2005 and by 20% by the year 2010	3. Governments are progressively implementing adequate policies leading to sustainable land use (wetland restoration) and agricultural practices

4. Financing and Institutional Mechanisms for Implementing the SAP

The development of suitable financing and institutional mechanisms is vital for the implementation of the SAP and the ICPDR Action Programme to ensure an efficient application of the Convention (DRPC) at the regional and the national levels.

(i) **Financing Mechanisms** for the implementation of the ICPDR Action Programme must integrate several constitutive components. The existing financing mechanisms and resources, in particular those at the national and local levels, are to be mobilized first. The transition countries, in particular those applying for accession to the EU, can expect financial and technical support from the EC and International Financing Institutions as well as from bilateral donors. To facilitate this, a general appraisal of financial requirements by sector and priority has been carried out by analyzing environmental benefits with particular attention to transboundary and global effects and taking into account the various possibilities for the best

available financing concepts and conditions. In this context, institutional arrangements to be established within the structures of the ICPDR have been proposed and their mandate and operational conditions have been described**.**

- **The Programme Implementation Facility (PIF),** mandated with supporting and assisting the ICPDR and its Contracting Parties, shall develop appropriate investment models and identify sources of preferential financial conditions for loans and grants. The PIF shall also assist countries, communities and the private sector to develop project documents and formulate requests for financial support to IFIs and other international organizations. Particular assistance shall also be provided to formulate requests to the Global Environment Fund (GEF) with attention to incremental costs for the achievement of transboundary benefits.
- **The Project Appraisal Group (PAG)** is envisaged to perform specialized project preparation, with special attention to examining the conformity of projects with all the relevant conditions and standards and checking the management plans for financing, operation and maintenance. This institutional set-up is designed to facilitate funding and to increase the efficiency of financial support from IFIs and other international donor organizations**.**

(ii) **Institutional components under the Convention** were to a great extent established during the transitional period. However, they need to be further developed. The Commission (ICPDR) - responsible for both the implementation of the DRPC and the SAP - is the main steering and decision making body under the Convention. It is based on the work of its Expert Bodies and supported by specific bodies such as the Programme Management Task Force (PMTF). The latter was established together with the International Financing Organisations (IFIs), Donors and NGOs for the purpose of reinforcing financial and technical cooperation. Besides their responsibility for investment preparation and technical assistance, IFIs and Donors should also support the institutional components under the DRPC in becoming fully operational and ensuring a full participation of all Contracting Parties, regarding both the Transition and in Accession Countries in the middle and lower Danube River Basin**.**

5. Co-operation with the Black Sea Protection Commission

The joint ad-hoc Technical Working Group established in January 1998 between the International Commission for the Protection of the Black Sea (ICPBS) and the International Commission for the Protection of the Danube River (ICPDR), takes a pragmatic approach to the issue of pollution control which follows the “paradigm of iterative management”. The coastal states of the Black Sea and the countries of the Danube River Protection Convention, as the co-operating partners, agree in step by step approach on short, medium and long term targets for nutrients reduction. At the same time, public understanding of the issues will also gradually improve, as will the public's demands for tighter criteria for protection and, hopefully, their willingness to pay. Such an approach avoids creating a stark division between “the public” and “the polluters” and seeks a consensus that addresses pollution at its root causes.

This general approach was applied by the "Working Group" in the following manner:

- by recognising and thus proposing to both Commissions concerned that the ecological status of the Black Sea to be aimed at should be similar to the one of the 1960s but that it is not practicable to achieve this in a short time frame;
- by considering that in order to start with, an agreement is needed on the limits of the inputs of nutrients (and in fact also hazardous substances) into the Black Sea (and the Sea of Azov) and on the ecological status related with these inputs;

- to propose to both Commissions to limit the discharges to the Black Sea to the (only partially known) 1997 level, in order to learn to know how the Black Sea ecosystem(s) respond in regard to the already observed improvements.

In order to arrive at the goal to further maintain and hopefully improve the ecological status of the Black Sea, the following principles for nutrient management measures and strategies will be necessary:

- Nutrients have to be 'kept on land' where they are needed for phototrophic productivity, and
- they have to be kept away from any waterborne transport.

Based on the reported positive signs (reduced input loads and improved ecological status in the Black Sea shelf), and aware that economic development in the future is expected to take place in the wider Black Sea Basin, leading to increase of nutrient loads, the 'Working Group' defined, amongst others, the following possible strategies:

- The long-term goal for all States in the wider Black Sea Basin is to take measures to reduce the loads of anthropogenically applied nutrients and hazardous substances to such levels necessary to permit Black Sea ecosystems to recover to conditions similar to those observed in the 1960s.
- The ecological status of the Black Sea and the Sea of Azov has to be further assessed, and comparability of the data basis has to be further increased.
- Both the reported input loads as well as the assessed ecological status will have to be reported annually to both the ICPBS and the ICPDR.
- The States within the wider Black Sea Basin shall have to adopt strategies that will permit economic development, whilst ensuring appropriate practices and measures to limit the discharge of nutrients and hazardous substances, and to rehabilitate ecosystems which assimilate nutrients.
- Based on the annual reports and on the adopted strategies for the limitation of the discharge of nutrients and hazardous substances, a review shall be undertaken in 2007. It will focus on the further measures that may be required for meeting the long-term objective (reaching an ecological status similar to the conditions observed in the 1960s).

The 'Working Group' has proposed some of the low-cost measures that could be taken to prevent increases in nutrient discharge to the Black Sea. These measures fall into four general categories:

1. **Reform of agricultural policies.**
2. **Improved wastewater treatment, where applicable through the use of alternative technologies.**
3. **Rehabilitation of key basin aquatic ecosystems (wetlands).**
4. **Changes in consumer practices (including use of phosphate-free detergents).**

Placing such a "cap" on nutrient discharges would be a bold step towards restoration of the Black Sea ecosystem. It would give the Black Sea ecosystem a chance to recover and would offer economic benefits for the coastal countries in terms of improved fisheries and tourism. It would also offer global and regional benefits, measured in terms of biological diversity. By contributing to this process, the non-coastal areas within the wider Black Sea's hydrographic catchment – including those within the Danube River Basin – would also contribute to these non-tangible global benefits.

1. Introduction and Framework

1.1. The Danube River Basin

The main river is 2780 km long and drains 817 000 sq.km. This includes: all of Hungary; nearly all parts of Austria, Romania, Slovenia, Slovakia and FR Yugoslavia; significant parts of Bosnia – Herzegovina, Bulgaria, Croatia, the Czech Republic, Moldova and small parts of Germany and Ukraine. Areas smaller than 2000 km², where the DRPC similarly does not apply, are left out of consideration. The Danube River discharges into the Black Sea through a delta that represents the second largest natural wetland in Europe.

The Basin is characterised by an aquatic ecosystem with numerous important natural areas, including wetlands and floodplains. It is not only of a high environmental but also economic and social value. It supports the drinking water supply, agriculture, industry, fishing, tourism and recreation, power generation, navigation and the end disposal of wastewater. A large number of dams, dikes, navigation locks and other hydraulic structures have been built throughout the region.

Utilizing water resources for important human activities, such as municipal ones, industry and agriculture, has resulted in changes in the hydrological systems. Problems of water quality and quantity have been created, including significant environmental damage and impaired quality of life, such as public health problems.

During the period of centralised planning systems, central and eastern European countries failed to develop adequate environmental protection policies and subsequent measures to fully respond to the degradation of the river environment. The future development of human and economic activities must better integrate environmental and water management concerns into municipal, industrial and agricultural policies and strategies. The transition process to market economy and the accession to the European Union provide plenty of opportunities for these steps.

1.2. The Environmental Programme for the Danube River Basin (EPDRB)

The EPDRB was established in Sofia in September 1991 by the Danubian countries, donors and international finance institutions, G-24 countries and non-governmental organisations. A Task Force comprising these partners was established in Brussels in February 1992 and a first Programme Work Plan was endorsed. Phase I provided institutional and technical building blocks for short-term action as well as the development of a Strategic Action Plan (SAP). The SAP was approved through the Danube River Basin Environmental Declaration at the Bucharest Ministerial Meeting in December 1994, and it is subject to progress review after 3 years. Its updating has resulted in this Revised Action Plan (SAP 1999). This development was mostly supported by PHARE/TACIS and by UNDP/GEF.

The Danube Strategic Action Plan Implementation Programme (SIP) has intensified since 1995 the technical assistance to continue and introduce new demonstration projects and activities for transboundary issues. The main objective of the EPDRB was to strengthen the operational basis for environmental management in the Danube River Basin and to support the Danube countries in implementing the Danube River Protection Convention (DRPC).

With its entry into force in October 1998, the transfer of tasks, results and responsibilities from the EPDRB under the umbrella of the DRPC was achieved. The Expert Groups developed through PHARE/TACIS support came under the umbrella of the International Commission (ICPDR). The financing and investment-oriented tasks were shifted to the Programme Management Task Force (PMTF) that was established by the Commission together with the relevant international partners. At the same time, the EPDRB Task Force ceased to exist. The follow-up of the UNDP/GEF

Danube Pollution Reduction Programme (DPRP: 1997-1999) will also be transferred to the Commission. The responsibility for the integrated implementation of the objectives and provisions of both the DRPC and the SAP now lies with the Commission.

1.3. The Danube River Protection Convention (DRPC)

A suitable framework and mandate for developing the DRPC was the "*ECE-Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (Helsinki Convention 1992)", subsequently referred to in the DRPC context as the "Framework Convention". The "*Convention on Co-operation for the Protection and Sustainable Use of the Danube River*" was agreed in Sofia on June 29, 1994. At the same time, a high-level Declaration of Signatories provided for a preparatory period the interim implementation of the DRPC in close co-operation with the EPDRB development, i.a. producing the preceding SAP. Through this, the co-operation with international donors and IFIs could already be initiated in terms of a "modus operandi". On October 22, 1998, the Convention entered into force.

The scope of the DRPC and its main objective is reflected in its name: it is on the one hand the protection of water and ecological resources and a sustainable use of water on the other, the latter being primarily related to water quantity management, but closely linked with quality management and protection.

The DRPC is primarily designed for basin-wide and sub-basin-wide co-operation with transboundary relevance. In terms of emphasis and specification it focuses on pollution prevention, reduction and control, still covering all the main issues of water-oriented protection and resources management. The International Commission (ICPDR) can be mandated to further develop and specify any relevant sector under this broad scope. In addition, the DRPC provides for an efficient basis, substantial contribution and executive response at the domestic level, and requires the implementation of integrated river basin management and co-ordination.

Being responsible for the DRPC implementation, the ICPDR is able to join the objectives and requirements deriving from the forthcoming "*European Union Council Directive Establishing a Framework for a Community Action in the Field of Water Policy (EU Water Framework Directive, EU/WFD*)". This directive is expected to have a strong policy momentum through its competence and coordinating effect, in particular its guiding role for river basin management. This momentum will extend beyond the territory of the Community, which in the Danube region will be supported by the EU accession process.

There are six main pillars supporting the integrated implementation of the DRPC and of the SAP and its enforcement:

- the legal capacity of the DRCP in general and of its particular obligations, including the ICPDR's decisions assuming binding force;
- the political capacity of policies and strategies, jointly declared by the Contracting Parties, and at a high level supported by relevant GOs and NGOs;
- the legal and political domestic capacity of Danubian governments and competent authorities for setting their priorities and enforcing implementation;
- the support resulting from public awareness and participation, in particular at the domestic level, stimulating all other kinds of support;
- the financial support and the economic incentives granted to Countries in Transition and to Countries in Accession regarding investments and technical assistance;
- the legal and political momentum emanating from the EU Water Framework Directive.

The ICPDR is advised to streamline the presently handed down series of Plans and Programmes under the DRPC. One executive framework Action Programme should be derived from the DRPC, in addition to one corresponding policy document that would provide the necessary political momentum and guidance. The latter is intended to be achieved with this Revised SAP, which is, however, limited to pollution reduction and water quality management. The pertinent executive framework is the "*Danube Pollution Reduction Programme*", as developed with the assistance of UNDP/GEF. Regarding water resources, quantity management and related issues under the DRPC, equivalent tools should be developed with a view to integrated implementation.

The DRPC provides for getting on board the relevant partners willing to contribute substantial input. To this end, the ICPDR is mandated to co-operate with international and national organisations and with other relevant bodies. This is designed to enhance co-ordination and avoid duplication. The need for this is particularly highlighted by the fact that many existing sub-basin river agreements have a similar scope as the DRPC. As to financing technical assistance and investments, the ICPDR has established, together with all its relevant partners, a "*Programme Management Task Force* "(PMTF).

1.4. Related International Agreements and Programmes

Different Contracting Parties or Signatories to the DRPC are at the same time parties to other environmental and/or water-related instruments, which may directly or indirectly influence the preparation and implementation of the SAP.

Specifically, they include the following agreements or other arrangements:

- **Convention on the Protection and Use of Transboundary Watercourses and International Lakes** (Helsinki Convention 1992; Framework Convention). It provides a framework for co-operation on transboundary water problems.
- **Agreements and other arrangements for cooperation on transboundary water problems** to be associated to the Helsinki Convention 1992 or being concluded through its mandate. They provide for sub-regional and sub-basin-wide cooperation on transboundary water problems within the Danube Basin.
- **Europe accession and association agreements**. Austria acceded to the EU in 1995; the membership is connected with the full acknowledgement and implementation of the "acquis communautaire". Associated Danubian countries include Bulgaria, the Czech Republic, Hungary, Romania, Slovakia and Slovenia, three of them already involved in the accession procedure. The association is aiming at a gradual approximation of policies, laws, EU environmental standards and directives, including the participation in EU monitoring and networking systems. This will equally apply to the forthcoming EU-Water Framework Directive (EU/WFD).
- **Convention on the Protection of the Black Sea against Pollution** (Black Sea Convention). This legal regime for controlling marine pollution including land-based sources was signed in 1992 and came into force in 1994; several protocols are to be developed to execute specific fields of protection. A joint Ad Hoc Technical Working Group between the DRPC and the Black Sea Convention was established in 1998.
- **Declaration on the Protection of the Black Sea** (Odessa Declaration). Adopted in 1993, it formulates the principles, goals, priorities and actions to be taken in order to rehabilitate and protect the Black Sea.
- **Convention on Wetlands of International Importance, Especially as Wildfowl Habitat** (Ramsar Convention). Signed in 1971 and ratified by all the Danubian states; it sets out the measures for the protection and sustainable use of wetlands ("wise use").

- **Convention on Biological Diversity.** Signed in 1992 by the EU and some 80 other countries including all the Danubian states, it aims at the conservation of biological diversity through a sustainable use of natural resources.
- **Danube Navigation Convention** (Belgrade Convention 1948). Regulates the technical and nautical handling of the Danubian transboundary inland navigation, including its water pollution control measures.
- **Draft Danube Basin Ecological Declaration**. Presently negotiated upon, it will be based on a comprehensive environmental approach and focused on nature conservation. It recommends that a "Draft Nature Conservation Convention" should be developed.
- **Environmental Action Programme for Central and Eastern Europe (EAP)**. Endorsed in 1993 at the ministerial level, it represents a broad consensus on environment and development calling for governmental action regarding economic reconstruction and sustainable development, institutional capacity building and immediate assistance. Investment projects for priority needs are offered.

1.5. Principles of Environmental Protection

The main principles and approaches are commonly acknowledged. This applies in particular to the Contracting Parties to both the 1992 Helsinki Convention (ECE-Framework Convention) and the Danube River Protection Convention (DRPC). Like these agreements, this Action Plan (SAP) is based on them and supports their execution, setting out goals and actions tailor-made for the Danube River Basin.

The following principles need to be emphasised:

- **Precautionary Principle.** Planned and current activities are to take into account the possible adverse effects, even those whose existence has not yet been conclusively proven. The principle should be used in policy-making and investment choices.
- **Best Available Techniques/Best Environmental Practice (BAT/BEP).** The principles are basic options for the DRPC, which describes them exhaustively (DRPC, Annex 1). They also play a key role in the relevant EU directives.
- **Control of Pollution at Source**. In connection with BAT/BEP, higher priority is to be given to preventive measures, such as changed consumption patterns, than to curative actions, such as costly end-of–pipe control technologies. This similarly applies to the related "**Low and Non-Waste Technology**" principle.
- **Polluter Pays Principle (PPP).** Together with the related "**User Pays Principle**", it states that the costs of maintaining or restoring affected resources are to be borne by the users and polluters. Using fees or levies, this promotes pollution reduction and rational water use through setting financial incentives.
- **Shared Information.** The sharing and exchange of information is fundamental to regional cooperation. The Contracting Parties to the DRPC will use the Information Management System of the ICPDR as developed with UNDP/GEF support in the framework of the "Danube Pollution Reduction Programme (DPRP)".

1.6. Aspects of Integrated Basin Water Management

The basin-oriented character of both the DRPC and the EU/Water Framework Directive (EU/WFD) provides for a transboundary framework for developing integrated river basin management, including the basic executive and operative tools which have to be applied at domestic level. The EU/WFD is intended to achieve an all-European harmonisation; the DRPC emphasises the specific Danubian conditions for an integrated water management in this region. This Action Plan (SAP) is intended to initiate close co-operation between both instruments.

Due to the experience already gained under the Bucharest Declaration and through the early phase of the implementation of the DRPC, the issue of tailor-made methodologies is vital for Danubian co-operation, both regarding the entire basin and the major sub-basins. Specific water conditions and the specific structures of cooperation and joint action between the international/supranational and the national/domestic levels must be taken into account. Both levels must play a substantial role in the integrated basin water management.

A framework methodology has already been established for water balancing as an important basis (Article 9(3) and 1(h) DRPC). It provides for national water balances to be based on a harmonised methodology. From this, all data and information are derived as an input to the neighbouring countries' national balances and to transboundary co-operation (connecting data). There, the balances for "international river basins" are developed on the same harmonised methodology. In the Danubian context, the entire basin balance is addressed regarding specific transboundary impacts, including the Black Sea, in particular regarding pollution reduction. However, concerning water quantity management, co-operation will focus on the major tributaries and their sub-basins, depending on specific conditions and demands, in particular for competing water uses.

According to the forthcoming EU/WFD, Member States will ensure co-ordination with the aim of producing a single International River Basin Management Plan for the basin concerned. It will include information covering the following components:

- characteristics of the international river basin, including surface and ground waters;
- a summary of estimated significant impacts of human activities on water condition;
- identification and mapping of protected areas;
- monitoring the established networks and the results of the respective programmes carried out;
- a list of environmental objectives for waters and protected areas in the Member States;
- an economic analysis of water use, including fees and charges;
- a summary of national programmes of measures for achieving the objectives, including transboundary implications and priority setting; list of competent authorities;
- involvement of the public through information and consultation measures.

Table 1.6.1. Danube states, which have signed or ratified relevant international conventions as of mid 1999

	Europe Association or Accession Agreement		Transboundary Watercourses Convention*		Black Sea Convention**		Ramsar Convention***		Convention on biological diversity		Danube River Protection Convention	
in force since			1996		1993		1975		1993		1998	
	Association signed	Accession ratified	signed	ratified	signed	ratified	signed	ratified	signed	ratified	signed	ratified
Austria		+	+	+			+	+	+	+	+	+
Bosnia-Herzegovina												
Bulgaria	+		+		+	+	+	+	+	+	+	+
Croatia				+			+	+	+	+	+	+
Czech Republic	+						+	+	+	+	+	+
European Union			+	+							+	+
Germany		+	+	+			+	+	+	+	+	+
Hungary	+		+	+			+	+	+	+	+	+
Moldova			+	+	+	+	+	+	+	+	+	+
Romania	+		+	+	+	+	+	+	+	+	+	+
Slovakia	+	+		+			+	+	+	+	+	+
Slovenia	+						+	+	+	+	+	+
Ukraine					+	+	+	+****	+	+	+	
Yugoslavia												

* *Convention on the protection and use of transboundary watercourses and international lakes*
** *Convention on the protection of the Black Sea against pollution*
*** *Convention on wetlands of international importance, especially as wildfowl habitat*
**** *1997 through declaration of continuity after the USSR*

2. Demographic, Social and Economic Characteristics

2.1. Introduction

The Danube River Basin (DRB) can be divided into three major parts:

i. the upper region, which extends from the source tributaries Brigach and Breg to the confluence with the river Morava at Bratislava;
ii. the middle region, extending from Bratislava to the Iron Gate dams at the Yugoslavian/Romanian border; and
iii. the lower region, downstream of the Iron Gate dams, and comprising the Danube River Delta.

Altogether, there are 17 DRB countries, of which 4 countries have an insignificantly small share in the DRB. In order to better understand the country-specific data and information provided within this SAP, the remaining thirteen DRB countries can be broadly categorised as follows:

(i) Germany and Austria

These two countries are located at the upper end of the DRB and, compared to all other DRB countries, have significantly higher economic development levels, represented by a high per capita income at about 25,000 USD per annum. They have achieved high standards of emission reduction and water pollution control and have therefore an exceptional status within the EPDRB.

(ii) Czech Republic, Slovakia, Hungary, Slovenia and Croatia

These countries are located in the middle part of the DRB. They have already overcome the former central state planning systems and have reached medium economic development levels, represented by annual per capita incomes ranging between USD 4,000 and USD 9,000. The economic transformation process has caused significant reduction of industrial and agricultural production, thus temporarily reducing production-related pollution loads. This has created the opportunity to establish and integrate environmental objectives into industrial and agricultural policies before economic activities continue to intensify.

(iii) FR Yugoslavia and Bosnia & Herzegovina

These two countries, also located in the middle Danube River Basin, are still in the critical phase, struggling to overcome the war aftermath. In the forthcoming period, their main task will be to re-organise their political, legal, administrative and socio-economic structures in order to comply with the requirements of the commencing process of economic liberalisation and privatisation and of international normalisation. With annual per capita incomes of USD 1,100 (BiH) and USD 1,500 (Yugoslavia), both countries are presently well below their pre-war levels.

(iv) Romania, Bulgaria, Moldova and Ukraine

These countries located in the lower Danube River Basin are confronted with serious economic and social problems resulting in environmental pollution and change. However, because of the economic transformation process during which many of the large industrial or agro-industrial enterprises were closed or their activities reduced, there was also a significant reduction in the pollution loads. The investment currently allocated for environmental protection and pollution control is not at the appropriate level to allow pollution reduction in either the short or the medium term.

The inferior economic status of these countries is documented by their per capita income ranging between USD 500 and USD 1,500 per annum.

2.2. Population

(i) Population of the DRB countries

According to the officially published or updated figures, the present population of the thirteen DRB countries is about 223 million.

The average share of urban population in the DRB countries is about 63%. The average population density of all the thirteen DRB countries is 119 people/km².

Based on the national projections, the aggregated size of the 13 DRB countries' population can be expected to increase slightly to about 226 million by the year 2020, or remain at its present level. Except for BiH, there is no country for which the projected population figure is expected to vary more than plus or minus 5% by the year 2020 from its present population figure.

(ii) Population of the Danube River Basin

According to national estimates, the present population living in the DRB is about 83 million, 37% of the total population of the 13 DRB countries.

The average share of urban population in the DRB is about 57%, about 6% lower than the average share in the 13 DRB countries.

The area of the DRB is about 817,000 km², about 43% of the territory of the 13 DRB countries. The average population density in the DRB is 103 people/km² , about 14% lower than the average population density of the 13 DRB countries. The population densities by Sub-basin Areas (without major cities) are shown on Map 4.

Based on the national projection figures, it can be anticipated that the population living in the Danube River Basin will by the year 2020 reach about 83 million, i.e. that it will remain at its present level.

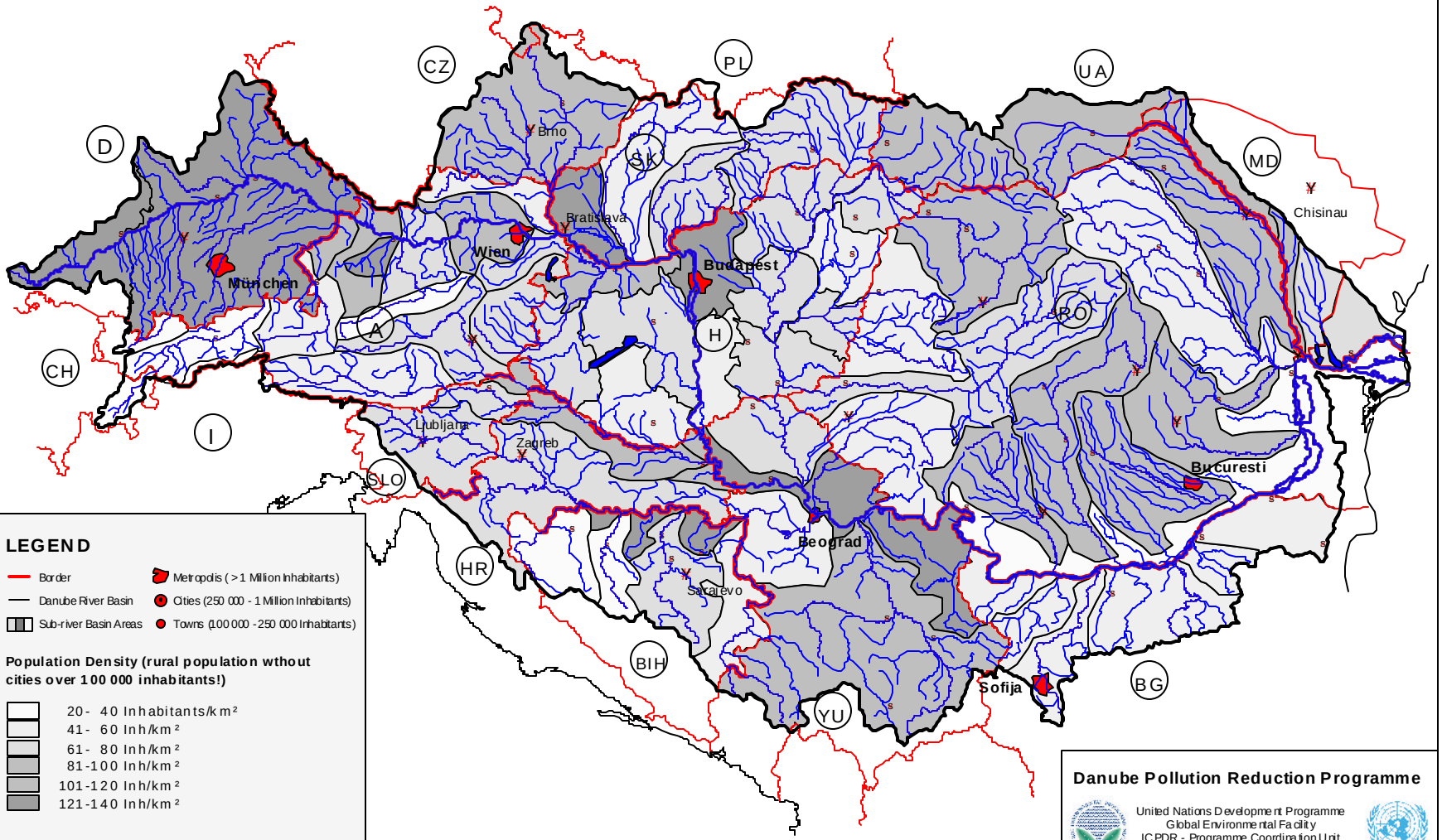
The country-specific development of the population in the DRB countries and in the DRB is summarised in Table 2.2.1:

Table 2.2.1. Population of the Danube River Basin Countries (million)

DRB Countries		A	BiH	BG	HR	CZ	D	H	MD	RO	SK	SLO	UA	YU	TOT
Total	1997	8.1	3.8	8.3	4.8	10.3	82.1	10.2	4.3	22.6	5.4	2.0	50.9	10.4	223
Total	2020	8.3	5.2	8.3	4.5	9.5	82.9	9.5	4.1	22.8	5.5	2.2	52.4	10.8	226
DRB	1997	7.7	2.9	3.9	3.2	2.8	9.1	10.2	1.1	21.2	5.2	1.7	3.1	9.0	83
DRB	2020	8.0	3.7	3.9	3.0	2.6	9.2	9.5	1.0	21.4	5.2	1.9	3.2	8.8	83

Map 4: Population Density in the Danube Sub-river Basin Areas

Based on National Planning Workshop Reports 1998



LEGEND

- Border
- Danube River Basin
- Sub-river Basin Areas
- Metropolis (>1 Million Inhabitants)
- Cities (250 000 - 1 Million Inhabitants)
- Towns (100 000 - 250 000 Inhabitants)

Population Density (rural population wthout cities over 100 000 inhabitants!)

- 20 - 40 Inhabitants/km²
- 41 - 60 Inh/km²
- 61 - 80 Inh/km²
- 81 - 100 Inh/km²
- 101 - 120 Inh/km²
- 121 - 140 Inh/km²

50 0 50 100 150 Kilometers

Scale: 1: 4 500 000

N

Danube Pollution Reduction Programme

United Nations Development Programme
Global Environmental Facility
ICPDR - Programme Coordination Unit
1400 Vienna, P.O. Box 500, Austria

Produced by ZINKE ENVIRONMENT CONSULTING
for Central and Eastern Europe, Vienna, 1999
(Cartography by U.SCHWARZ)

2.3. Economic Activities and Employment

(i) Gross Domestic Product (GDP)

The extremely different economic development level and the actual status of a particular DRB country are basically indicated by the country-specific GDP, which varies greatly from country to country both in terms of absolute figures and sectoral composition.

In 1997, the GDP of the DRB countries ranged from USD 1.9 billion in Moldova to USD 2,034 billion in Germany, i.e. by a factor of more than 1,000.

In 1996, the most recent year with a complete set of data available, the country-specific composition of the GDP by the main economic sectors varied as follows:

- the share of the agricultural sector ranged from 1% in Germany to 34% in Romania;
- the share of the industrial sector ranged from 19% in Romania to 45% in Ukraine;
- the share of the "tertiary sector" (comprising all residual sub-sectors) ranged from 37% in Ukraine to 70% in Austria.

The actual figures and sectoral composition of the country-specific GDP are summarised in Table 2.3.1:

Table 2.3.1. Annual GDP and Sectoral Composition of GDP in the Danube River Basin Countries

DRB Countries	A	BiH	BG	HR	CZ	D	H	MD	RO	SK	SLO	UA	YU
GDP-1997 (Billion USD)	196.1	4.1	9.9	18.8	48.9	2,034.1	44.5	1.9	34.6	19.5	17.4	49.7	15.5
Agriculture (%)	2.1	-	11.7	10.3	5.0	1.1	3.0	30.0	34.2	5.3	5.2	17.8	19.9
Industry (%)	27.6	-	28.3	20.3	33.8	31.9	30.3	25.0	19.1	27.0	36.1	44.8	37.8
Tertiary Sector (%)	70.3	-	60.0	69.4	61.2	67.0	66.7	45.0	46.7	67.7	58.7	37.4	42.3

(ii) National Per Capita Income

In 1997, the GDP per capita (expressed for comparison in USD, therefore not fully reflecting the country-specific "purchasing power parity") ranged in the 13 DRB countries from USD 500 per annum in Moldova to USD 25,600 in Germany, i.e. by a factor of about 50.

The development of the country-specific "GDP/capita in USD" between 1996 and 1997 (reflecting both the economic development in the country, and the variation in the exchange rate between the national currency and the USD) is compiled in Table 2.3-2 and can be summarised as follows:

- 3 countries (BiH, Moldova, Ukraine) report increasing GDP/capita (between 10- 40%);
- 8 countries report approximately stagnating GDP/capita (between -1.0% and +3.5%);
- 2 countries (Germany and Austria) report decreasing GDP/capita (about 11%).

The decrease in the GDP expressed in USD is, especially in the case of Germany and Austria, the result of significant changes in the exchange rate between the countries' national currencies and USD.

Table 2.3.2. Annual Per Capita GDP in the Danube River Basin Countries (USD/Capita/Year)

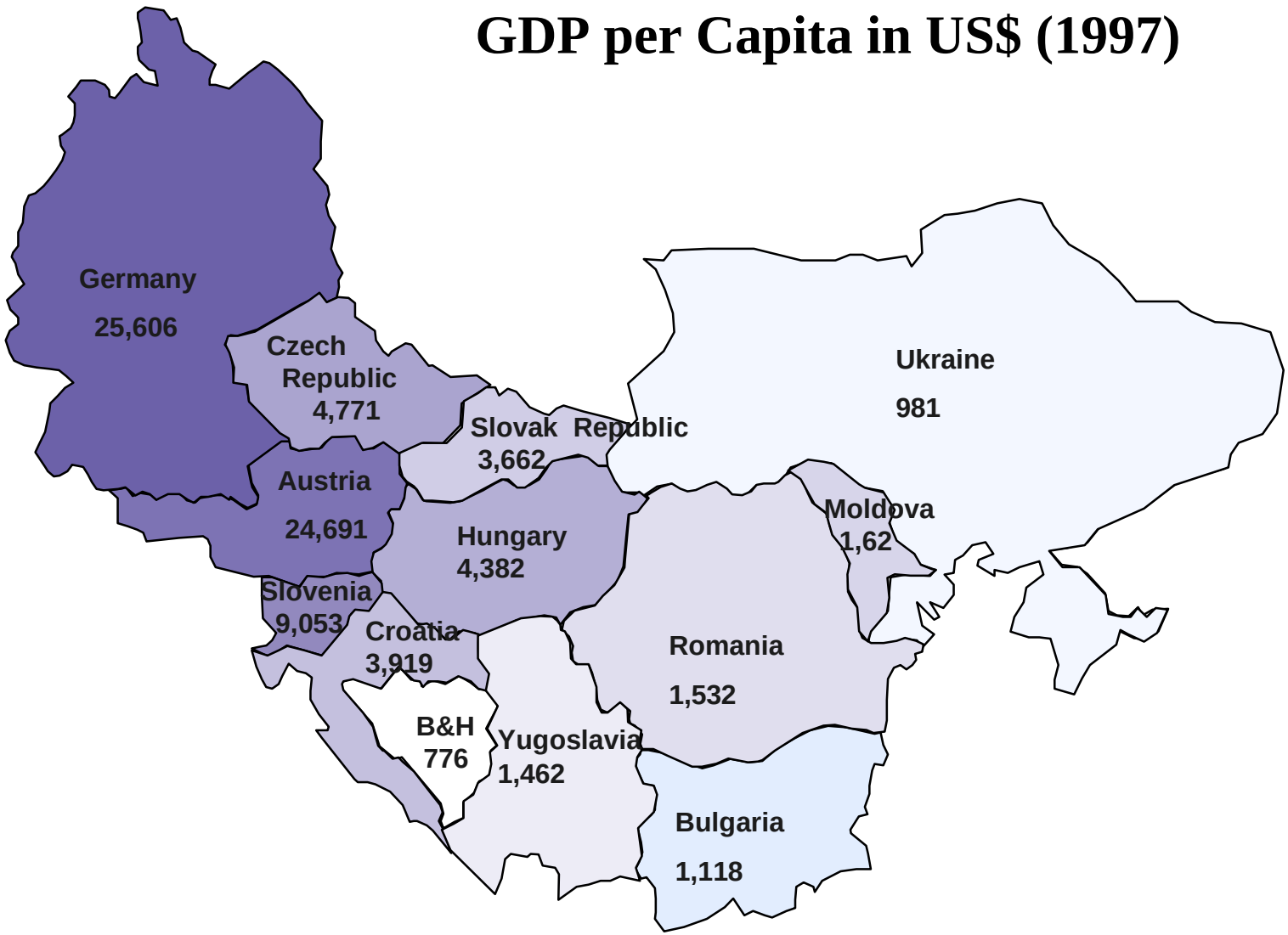
DRB Countries	A	BiH	BG	HR	CZ	D	H	MD	RO	SK	SLO	UA	YU
GDP/c/a -1996	27,950	776	1,114	4,243	5,063	28,790	4,308	455	1,569	3,531	9,254	880	1,477
GDP/c/a- 1997	24,691	1,087	1,227	4,267	5,050	25,606	4,462	504	1,549	3,624	9,101	976	1,462

(iii) Employment

In all the DRB countries, unemployment is currently a severe problem. In the transition countries and those affected by the war in particular, the rate of unemployment has continuously increased during the previous years, mainly due to the fact that the decline in the economic activities in the agricultural and industrial sector could not be fully compensated for by new job creation in the tertiary sector.

The officially published figures for the particular countries indicate unemployment rates between (10)% and (30)%. The actual unemployment rate is certainly higher in most countries, as there is a significant margin of non-registered unemployment and of actual overstaffing of public enterprises and publicly-funded organisations.

The Danube Countries: GDP per Capita in US$ (1997)



2.4. Water Demand and Water Tariffs

(i) Domestic Water Demand

Concerning domestic water demand, there is a principal differentiation between population supplied by individual water sources, and population connected to central water supply systems.

For most of the DRB countries there are no reliable data on the overall, respectively per capita, water demand of the segment of the population supplied by individual water sources. The main characteristics can be summarised as follows:

- The share of population in the DRB supplied by individual water sources varies between 2% (Germany and Bulgaria) and 61% (Moldova); and for the majority of the countries ranges between 11% and 43%.
- The average per capita water demand is somewhere between 30 l/c/day and 100 l/c/day, depending on water availability and on ease of access to water supply (tap in the house or in the yard);
- The main problems regarding individual water supply sources are seasonal variations in water availability and insufficient control of water quality.

Water demand, respectively water consumption, of the population connected to central (mainly municipal) water supply systems can be seen in Graph 1.

Water demand is in this context defined as the quantity of water to be supplied to cover the domestic demand (thus usually including consumption by private households and of commercial, institutional and tourism consumption, as well as losses in the water production and distribution). Water consumption is narrowly defined as the quantity of water which is actually used by private households, usually metered and paid for.

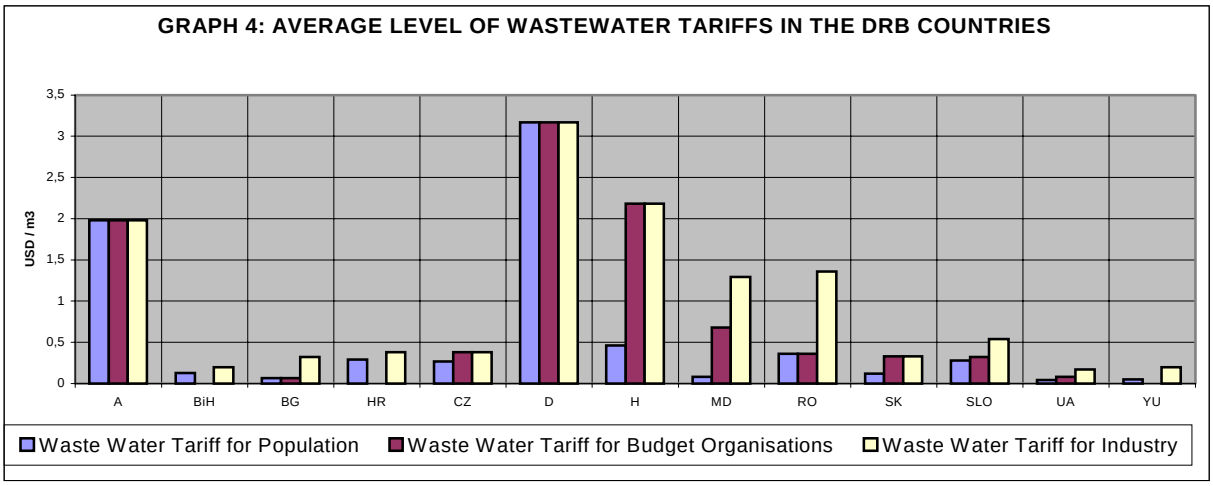
Bearing in mind the basic problems of data reliability, the aggregated annual water demand of the population in the DRB connected to centralised water supply systems is in the order of 6,100 million m^3.

The average per capita water demand varies between 165 l/c/day (Hungary) and as much as 409 l/c/day in Romania and 435 l/c/day in Bulgaria. Without Bulgaria and Romania (two countries with a low degree of consumption metering and with negligably low water prices until 1996), the per capita water demand varies between 165 l/c/day and 255 l/c/day, which is a reasonable range compared to international standards.

The share of population connected to central water supply systems varies between 29% (Moldova) and 98% (Bulgaria and Germany).

Excluding Germany and Austria (with losses of less than 15%), the losses stated for the particular countries vary between 17% (Ukraine) and 43% (Bulgaria).

Not taking into account the extremely high per capita consumption of 244 l/c/day in Romania and the extremely low consumption of 98 l/c/day in the Czech Republic (a figure derived from the actually billed consumption), the average per capita consumption varies between 120 l/c/day (Hungary) and 190 l/c/day (Bulgaria).



(ii) Water Tariffs

The water tariffs in the particular DRB countries (i.e. the price a customer connected to a central water supply system has to pay to the water utility for one m³ of water consumed) are illustrated in Graph 2.

The figures in this graph represent the average level of tariffs, differentiated for the three customer categories of the population, publicly-funded organisations and industry. The tariff figures are given for the most recent year for which data are available and are for the purpose of comparison expressed in USD (based on the official exchange rate between the national currencies and the USD).

In most of the countries, the tariffs for publicly-funded organisations are set between the usually lower tariffs for population and the usually higher tariffs for industry. Agricultural water demand is usually not supplied by public utilities; the cost of agricultural water supply is usually composed of a country specific charge to be paid for abstraction of ground or surface water and the cost for pumping and transmission.

The range of water tariffs to be found in particular DRB countries for population and industry are compiled in Table 2.4.1:

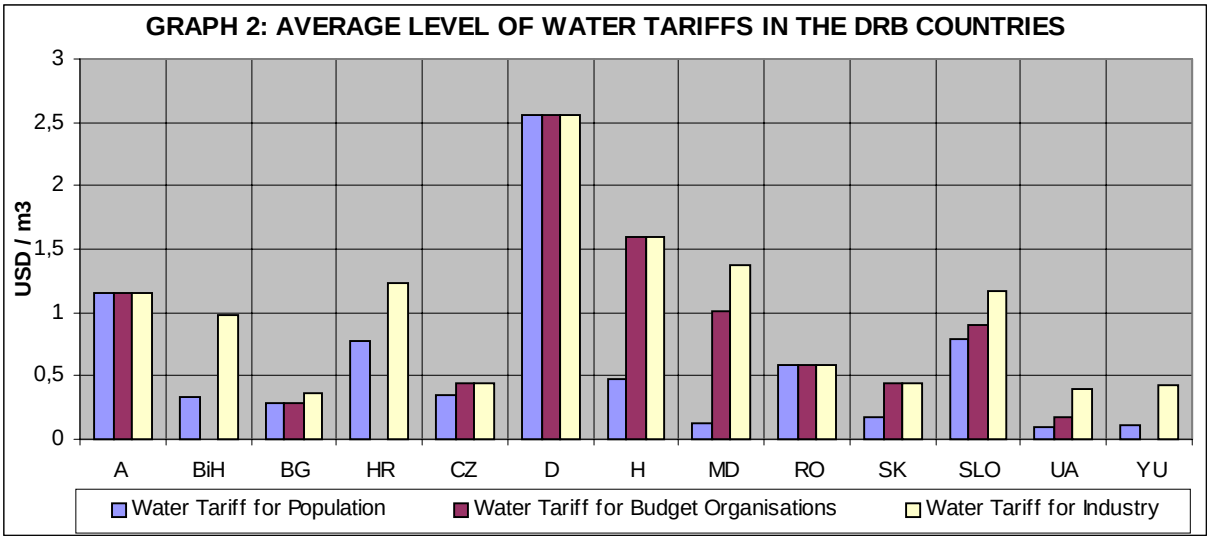
Table 2.4.1. Range of Water Tariffs in the Danube River Basin Countries

Water tariffs for population	
Minimum water tariff:	USD 0.02 (Moldova)
Maximum water tariff:	USD 0.79 (Slovenia);
Average water tariffs:	USD 0.11 (Yugoslavia) - USD 0.79 (Slovenia);
Water tariffs for industry:	
Minimum water tariff:	USD 0.07 (Yugoslavia)
Maximum water tariff:	USD 2.95 (Hungary);
Average water tariffs:	USD 0.42 (Yugoslavia) - USD 1.60 (Hungary);

The main characteristics of water tariffs in the DRB countries can be summarised as follows:

- Water tariffs - even when adjusted for the different purchasing power parities – vary greatly from country to country;
- In all countries, there is a broad differentiation of tariffs for industries, publicly-funded organizations and private households, usually reflecting significant cross-subsiding between industries and population;
- The actual tariff levels cover neither the economic nor the financial cost of adequately maintained and operated water and wastewater services, and are not at all high enough to enable the utilities to create sufficient internal funds for system rehabilitation, improvement and extension;
- The utilities are usually not in a position to set tariffs according to entrepreneurial requirements. Tariff setting as well as the application of measures needed to improve the usually unacceptably low collection rates are rather strictly determined by the existing legislation, respectively by the control authorities;
- In most of the DRB countries water tariffs should be considered as the most promising source of additional sources of funding for investment in water sector programmes and projects.

GRAPH 2: AVERAGE LEVEL OF WATER TARIFFS IN THE DRB COUNTRIES



2.5. Wastewater Management

(i) Domestic Wastewater Generation

Regarding domestic wastewater generation there is a principal differentiation between population using individual wastewater solutions (e.g. septic tanks, etc.) and population connected to central sewerage systems. For most of the DRB countries there are no reliable data on the wastewater generation by population using individual solutions. The main characteristics of the individual solutions can be summarised as follows:

- The share of population in the DRB using individual systems for wastewater collection, treatment and discharge varies between 11% (Germany) and 86% (Moldova). In 6 countries, more than 50% of the population use some kind of individual solution; in the rural areas of some countries, this share is higher than 95%.

- The average per capita wastewater generation figure is usually not known. If figures are stated, they are derived from the corresponding water consumption (usually between 30 l/c/day and 100 l/c/day) and based on the assumption that portions between 20% (in urban areas) and up to 80% (in rural areas) are directly discharged into the underground or used for agricultural or gardening purposes.
- The main problem of the individual wastewater solutions is that the privately owned facilities are often not properly maintained and operated and therefore constitute a permanent or periodically relevant hazard of soil and ground water contamination. Another general problem is that there are usually no appropriate methods and facilities for adequate disposal of sludge from septic tanks.

The main characteristics of the wastewater generation by the population in the DRB connected to central sewerage systems can be summarised as follows:

- According to the figures provided by the particular National Review Reports the aggregated annual wastewater generation by the population in the DRB connected to central sewerage systems is in the order of 2,500 million m³.
- The per capita wastewater generation varies between 80 l/c/day (Czech Republic; a figure which is derived from the "billed" quantities of water supply) and 202 l/c/day (Slovakia).
- The share of population connected to central sewerage systems varies between 14% (Moldova) and 89% (Germany).

(ii) Total Wastewater Discharge

According to the data provided for the National Review Reports, the total volume of wastewater discharge to the Danube River system is presently about 12.6 billion m³ per year.

This total wastewater volume is composed of 7.4 billion m³ (59%) of wastewater from public sewerage systems and 5.2 billion m³ (41%) of industrial and agricultural wastewater directly discharged into the river system. The ratio between these two categories can substantially vary from country to country, depending on what portion of the industrial and agricultural wastewater is in a particular country collected and discharged via the public sewerage systems or directly discharged into the river system.

The big difference between the annual volume of 7.4 billion m³ of wastewater discharge from public sewerage systems, and the annual domestic wastewater generation of not more than 2.5 billion m³ per year, can be explained by the fact that the volume of public wastewater discharge includes infiltration water (which can be as high as 20 - 30%) and considerable portions of industrial and agricultural wastewater, collected and discharged via public sewerage systems.

(iii) Present Standard of Wastewater Treatment

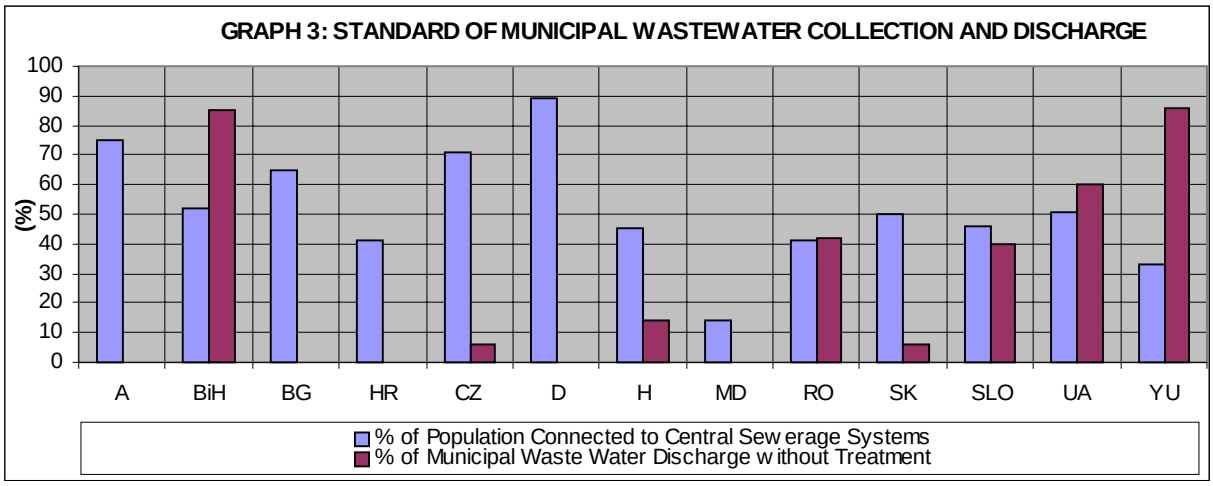
The extent and the standard of wastewater treatment differs greatly from country to country. Country-specific data are available for either overall wastewater discharge or, in some countries, at least for municipal wastewater discharge.

According to the provided data, the share of wastewater discharged without any treatment varies between 0% (Germany) and 86% (Yugoslavia). From this point of view, the DRB countries can be categorised as follows:

- Germany, Austria, Slovakia and the Czech Republic: less than 10% of "non-treated" wastewater discharge;
- Hungary, Moldova: between 10 and 20% of "non-treated" wastewater discharge;

- Romania, Ukraine, Bulgaria, Slovenia: between 30 and 40% of "non-treated" wastewater discharge;
- Croatia, Bosnia-Herzegovina, Yugoslavia: more than 80% of "non-treated" wastewater discharge;

Graph 3 illustrates for each DRB country the share of population connected to centralised wastewater systems and the share of municipal wastewater discharge without any treatment.



(iv) Wastewater Tariffs

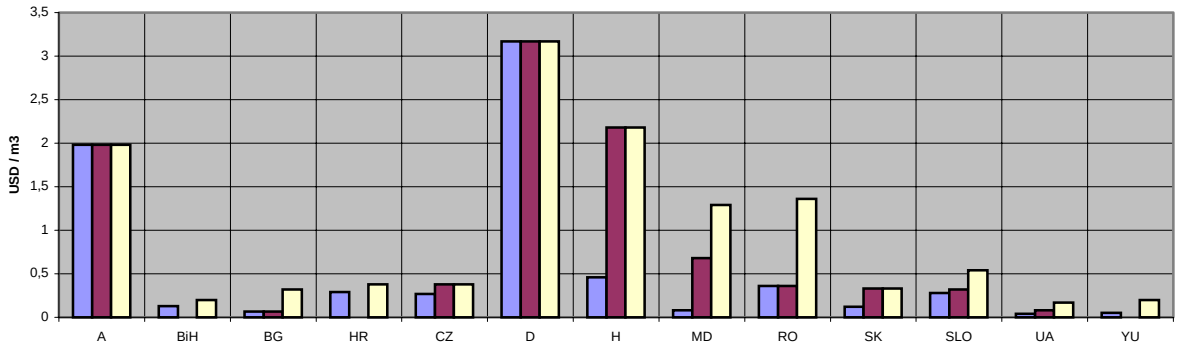
The actual wastewater tariffs in the particular DRB countries (i.e. the price a customer connected to a central sewerage system has to pay to the utility for discharge of m³ of wastewater) are illustrated in Graph 4. The range of water tariffs to be found in particular DRB countries for population and industry are compiled in the following Table 2.5.1:

Table 2.5.1. Range of Wastewater Tariffs in the Danube River Basin Countries

Wastewater tariffs for population	
Minimum wastewater tariff:	USD 0.01 (Moldova)
Maximum wastewater tariff:	USD 0.80 (Hungary);
Average wastewater tariffs:	USD 0.05 (Yugoslavia) - USD 0.46 (Hungary);
Wastewater tariffs for industry:	
Minimum wastewater tariff:	USD 0.01 (Yugoslavia)
Maximum wastewater tariff:	USD 4.22 (Hungary);
Average wastewater tariffs:	USD 0.20 (BiH) - USD 2.18 (Hungary);

The figures in this table show that wastewater tariffs are extremely different from country to country, and that there is usually a significant gap between the relatively low tariffs for population and in some case extraordinarily high tariffs for industry.

GRAPH 4: AVERAGE LEVEL OF WASTEWATER TARIFFS IN THE DRB COUNTRIES



2.6. Particular Situation of Transition Countries

Except for Austria and Germany, all DRB countries were during the previous decade confronted with a transition from the former central planning economy to a more or less modern market economy. In the meantime, individual countries have reached rather different qualitative levels in this process. However, in most of the countries, the legal, institutional and administrative framework is at least to a certain extent still determined by the former structures and therefore not really in compliance with the requirements of the commencing process of economic liberalisation and privatisation.

Steps to be taken in order to remedy the common deficiencies of the water sector-related legislation include:

- Restructuring and adjustment of the relevant legislation in compliance with the requirements of a modern environment-oriented market economy;
- Streamlining, simplification and elimination of inconsistent components mostly resulting from ad-hoc changes during the previous transition period;
- Ensuring utmost compatibility of interacting legislation in the various administrative levels;
- Specification of efficient implementing regulations, and elimination of all kinds of non-justified exemptions.
- Further harmonization of national legislation with EU regulations and standards.

Regarding institutional deficiencies, there are usually a number of different authority departments, institutes and organisations dealing with special administrative, fiscal, scientific, statistical, nuclear, medical, health and similar issues. Some of them used to wield a lot of power in the former systems but are now finding that their tasks have either been streamlined or allocated to other administrative units, or that the shortage of funding is such as to threaten their scientific standards or their very survival. In addition, their tasks are not always reasonably defined and sometimes overlap in different ministerial or sub-ministerial authorities as well as to the state-owned, semi-state-owned or recently-privatised institutes and organisations. Another particular problem in this context concerns the fact that the mechanisms of co-ordination and co-operation are not always appropriately defined or standardised, which occasionally results in overlapping activities on the one side and critical gaps on the other.

However, it must be emphasised that in the less developed DRB countries rehabilitation and construction of new water supply and wastewater collection and treatment systems, required to guarantee at least minimum hygienic and service standards, are essential prerequisites supporting regionally equal living conditions and essential impulses for a country-wide economic development.

2.7. Particular Situation of the EU Accession Countries

The potential EU accession countries can be divided in a group of priority countries which comprise the Czech Republic, Hungary and Slovenia, and a second group of countries consisting of Slovakia, Bulgaria and Romania. All these countries are interested to join the EU in the following decade.

The potential accession countries and especially the priority candidate countries are currently about to:

- restructure and modernize their legal and institutional framework and administrative systems;
- establish sector development policies and programmes as well as funding policies and mechanisms which are more or less in compliance with international standards of modern market economies; and
- encourage privatization and international economic cooperation.

In the priority countries to join the EU, substantial improvement of the existing status of water supply and wastewater collection and treatment systems is required to fulfil the basic accession criteria. Especially in these countries, funding policies and strategies are clearly targeted to achieve the required service levels and quality standards in time. Substantial support will be provided by the newly established PHARE assistance programmes, especially tailored for EU accession countries.

Curtly, the most environment and cost relevant EU directives and regulations to be fulfilled by the accession countries are:

- **EU directives concerning emissions:**
  - Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community.
  - Council directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances
  - Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment
- **EU directives on Water quality**
  - Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water
  - Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States
  - Council Directive 78/659/EEC 18 July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life
  - Council Directive 80/778/EEC of 15 July 1980 relating to the quality of water intended for human consumption

- **Other EU directives**
  - Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture
  - Council Directive 91/767/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources

2.8. Development Prospects

Based on the national projections, it can be anticipated that the population living in the Danube River Basin will approximately remain at its present level within the next 20 years.

Following the projections provided by the National Review Reports, the aggregated water demand of the population in the DRB connected to central water supply systems is anticipated to increase to about 7,400 million m³ by the year 2020, which is about 20 % higher than the present water demand of about 6,100 million m³/year.

This projection is based on the assumption that:

- per capita water demand will either increase or decrease;
- the share of population connected to central water supply systems will increase; and
- the water network losses will decrease.

Following the projections provided by the National Review Reports, the aggregated wastewater generation by the population in the DRB connected to central sewerage systems is anticipated to increase to about 3,900 million m³ per year, which is about 56% higher than the present wastewater generation of 2,500 million m³ per year.

If the projected figures for surface water abstraction provided by eight DRB countries are representative, it can be anticipated that the overall volume abstracted from the Danube River system could increase by about 100% between 1997 and the 2020. However, the actual utilisation of raw water from the Danube River system will depend on the actual quality and availability of surface water at the river stretches and locations where the water is needed.

If the projection figures for wastewater discharge provided by nine DRB countries should be representative, it can be anticipated that the total volume discharged into the Danube River system could increase by about 50% between 1997 and the planning horizon 2020.

3. Hydrological and Ecological Factors of the Danube River Basin

3.1. Basic Hydrological and Ecological Characteristics

3.1.1. Hydrological and Ecological Factors in the Danube River Protection Convention (DRPC)

The DRPC as an instrument of international law refers to hydrological and ecological factors of concern for water management and environmental protection, predominantly in the transboundary context. They are involved both as subjects to and basic elements for the implementation of the Convention under the aspect of protection and sustainable use of the Danubian waters.

Impacts likely to change or to impair these factors are to be prevented, controlled or compensated. This requires a sufficient knowledge and information about the riverine conditions and the environmental mechanisms involved as a basis for taking efficient measures. Criteria and objectives must be developed regarding the environmental and hydrological status to be achieved; changes must be monitored with the purpose of identifying both deterioration and improvement tendencies.

In this context the DRPC stipulates a suitable legal and technical framework:

- **The general scope, objectives and principles of cooperation (Articles 2 and 3, DRPC)** provide for joint action and measures to :
  - achieve sustainable water management and environmentally sound development, directed at maintaining quality of life and access to natural resources and at protecting ecosystems;
  - improve, or at least maintain, the current environmental and water quality conditions, and through this contribute to reducing the pollution loads to the Black Sea;
  - prevent transboundary impact of planned or existing hydrotechnical constructions, including deterioration in the hydrological conditions.
- **Specific water resources protection measures (Article 6 DRPC)**, providing for the protection and the sustainable use of water resources, combined with the conservation of ecological resources; this especially applies to ground water resources and wetlands.
- **Water quality objectives and criteria (Article 7 DRPC; Annex III DRPC)**, provided to be defined and applied for preventing, controlling and reducing transboundary impact at the bilateral and domestic level, tailor-made for specific reaches of Danubian surface waters.
- **Monitoring and assessment of the riverine conditions in the Danube river basin (Article 9 DRPC)**, provided to specify the riverine conditions concerning both water quality and quantity, sediments and riverine ecosystems; river quality characteristics in account of the hydrological and ecological character of the water course.

3.1.2. Description of Hydrological and Ecological Factors

Climate and Morphology

The geography of the Danube river basin is very diverse. It includes high mountain chains, large plains, sand dunes, large forested or marshy wetlands and, very specifically, the karst and the delta. Similarly, climate and precipitation vary significantly; and they continuously form the basin's landscapes.

Generally, the Danube basin is dominated by a continental climate (central and eastern regions). Only the western parts of the upper basin in Germany are influenced by the Atlantic climate and the south-west of the basin (ex-Yugoslavian countries) by the Mediterranean climate. The Alps in the west, the Dinaric-Balkan mountain chains in the south and the Carpathian mountain bow in the eastern center are distinctive morphological and climatic regions and barriers.

These mountain chains receive the highest annual precipitation (1,000-3,200 mm per year) while the inner and outer basins (Vienna basin, Pannonian basin, Romanian and Prut low plains), the lowlands of the Czech Morava and the delta region are very dry (350-600 mm per year). The rivers with their water and moisture from the wet mountains help to balance evapotranspiration deficits, typical for the Pannonian plain and the delta, in the dry lowlands. 50 to 70 days of annual snowfall are recorded at high elevations in the Alps and in the Carpathians, while the plains have just 1-3 days/year of snowfall.

In terms of geomorphology and annual precipitation, 45 regions in the Danube basin can be distinguished, as presented in map 1 (“Geographical Indicators”).

After the source of the Danube in the wet Black Forest, rainfall gradually increases from the west to the east, along the Swabian & Frankonian Middle Mountains (average precipitation 600 – 700 mm/year), the Bavarian Forest & Austrian Mühlviertel (over 1,000 mm). There are 3 pre-alpine and 5 alpine regions, with top rainfalls reaching more than 2,000 mm/year at the Arlberg and the Kitzbühel and Julian Alps. Downstream the Wachau canyon (Bohemian mountains), the Danube enters the Vienna basin which is, together with the Moravian hills and lowlands, the driest area (below 600 mm/yr) of the Upper Danube.

The middle part or ”heart” of the Danube Basin is a circle of mountain chains around the huge Pannonian plain in the center. It is composed of six regions including parts of Austria, Slovakia, Hungary, Romania, Croatia and Yugoslavia. This inner basin is filled with Miocene marine sediments, tertiary clays and sands as well as with Pleistocene fluvio-glacial and loess deposits. This results in little variation in the orography (hilly lands and the Danube and Tisza low plains) and in precipitation (500-750 mm/year).

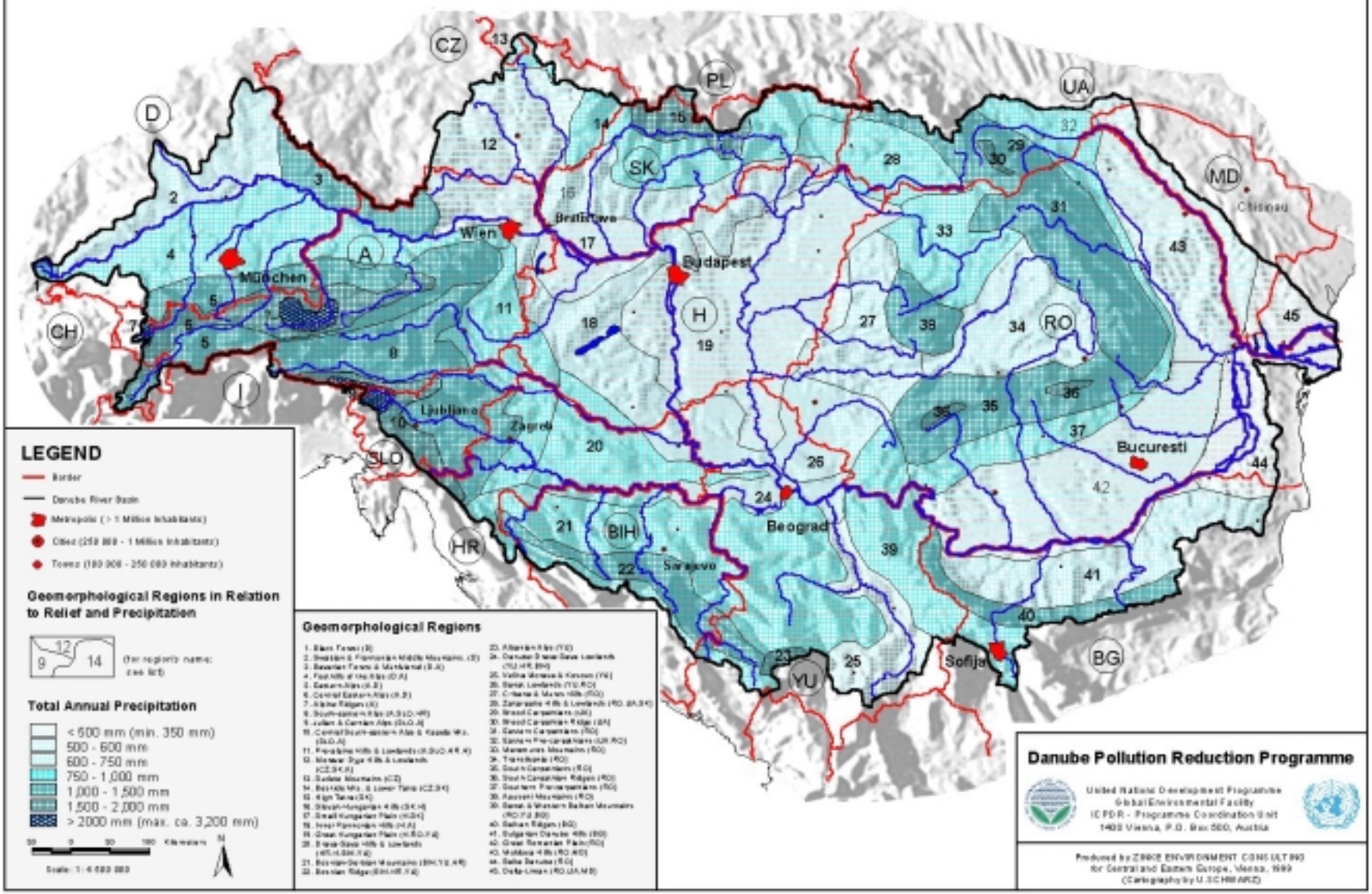
The Carpathian mountains in the northern and the central-eastern parts of the Danube basin receive varying rainfall from 750 mm in the foothills to over 1,500 mm in the ridges, and have quite cold winters (average temperature in January –8 to –10° C). The ridges of the Tatra, the Wood Carpathians and the Southern Carpathians receive highest precipitation (over 2,000 mm/year around the highest peaks at over 2,500 m). The Transilvanian tableland is a dry upland (500-700 mm) in between the moist Apuseni mountains (over 1,000 mm) in the west and the Eastern and the Southern Carpathians (upper reaches of Mures and Olt rivers).

The Dinaric Mountains form the borderline of the south-eastern Danube basin which is under Mediterranean (southern Sava tributaries) and continental influence (Drava-Mura lowlands). Precipitation is over 1,000 mm along the Slovene-Croatian border, along the Bosnian mountain ridges and the Albanian Alps, and goes down below 700 mm in the Danube/Pannonian plains. The Southern Morava valley (Serbia/Kosovo) is a relatively dry, north-south directed barrier (average rainfall at 700 mm, evapotranspiration at 550 mm) between the Bosnian mountains and the Banat/Western Balkan mountains.

The moist Balkan mountain ridges form the southern borderline of the lower Danube and supply water for the relatively hot and dry Bulgarian hills and lowlands. East of the Carpathians, the huge plain of the Romanian Lowlands and the Moldova hills are subject to a temperate-continental dry climate along the lower Danube resp. the Siret and Prut rivers.

The lowlands around the Balta Danube, the Liman lakes and the Danube delta receive an annual precipitation of slightly less than 400mm/year. Frequent droughts and a very high evapotranspiration are balanced by riverine moisture (high groundwater, network of islands and lakes, floodplains).

Map 1: Geographical Indicators: Geomorphological Regions and Annual Precipitation



Hydrological Network

The Danube river basin can be divided into four parts: the *Upper Danube*, from its source to the confluence with the river Morava at Bratislava; the M*iddle Danube*, ranging from Bratislava to the Iron Gate dams (Romania-Yugoslavia); the *Lower Danube* is formed by the Romanian-Bulgarian lowlands, and finally, the fourth part, the *Danube Delta*.

The main tributaries of the Danube are listed in Table 3.1.2-1. The most important Sub-River Basins of the Danube are:

The **Inn** is only the sixth largest and seventh longest Danube tributary. At its mouth in Passau, it brings more water into the Danube than the latter itself. However, its catchment area of 26,130 km² is only nearly half as big than the Danube at this point. Main Inn tributary is the Salzach.

The **Drava** is the third largest and fourth longest Danube tributary. It rises in the southern Alps in Italy but is the dominant river of southern Austria, eastern Slovenia and Croatia. Main Austrian sub-tributaries are Isel, Möll, Lieser and Gurk, and the Mura with its mouth at the Croatian-Hungarian border.

The **Sava** river is the largest Danube tributary. It rises in western Slovenian mountains and passes through Croatian lowland before forming the border between Croatia and Bosnia Herzegovina. Its main tributaries are Kupa, Una, Vrbas, Bosna and Drina.

The **Tisza** river is the longest (966 km) and by catchment (157.200 km^2) the biggest tributary of the Danube river. Its has the second largest flow volume to the Sava river. Its main tributaries are Hornad, Bodrog, Slana and Bodva in Slovakia; Rica, Teresva, Tereblia, Borjava, Latoritsa and Uz in Ukraine; Somes, Crisul Repede, Crisul Alb, Mures, Timis, Bega in Romania; Tarna, Koros, Krasna, Szamos, and Maros in Hungary.

The **Morava** river basin is one of the major northern tributaries, emptying into the Upper Danube. Its basin of 26,580 km^2 shared by the Czech Republic (20,623 km^2), Austria (3,700 km^2) and Slovakia (2,257 km^2). Its main tributaries are Becva and Dyje.

The **Siret** river basin is situated in the eastern part of the basin and of the Carpathians. It has the third-largest catchment area. The main tributaries are Suceava, Moldova, Bistrita, Trotus and Buzaul.

The **Prut** river is the last tributary of the Danube, with its mouth just upstream the delta. Its main tributaries are Ceremus, Volovat, Baseu, Corogea, Jijia, Chinej, Cigur and Lapusna.

The *Danube Delta* is largely situated in Romania and partly in Ukraine. The entire protected area covers 679,000 ha including floodplains and marine areas. The core of the reserve (312,400 ha) has been established as a "World Nature Heritage" in 1991. The Delta has a canal network of 3,463 km, with a density of 1.03 km/km². The highest density of canals is between the arms Chilia and Sulina, 1,17 km/km², while between Sulina and Sf. Gheorghe their density is only 0.71 km/km². There are 668 natural lakes larger than one hectare and with 9,28 % of the Delta's surface. The Delta is an environmental buffer between the Danube River and the Black Sea, filtering out pollutants and permitting both water quality conditions and natural habitats for fish in the Delta and in the environmentally vulnerable shallow waters of the north-western Black Sea. Moreover, it is Europe's largest remaining natural wetland, with unique ecosystems with extensive reed beds, forests, sand dunes and grasslands. It is home to several rare bird species, an important resting point for migrating birds, rich in fish and unusual flora.

Table 3.1.2 – 1 The main tributaries contributing to the Danube, their length, catchment area and flows:

River	Mouth at Danube km	Length in km	Size of Sub-basin in km² (larger than 4,000 km²)	Flow – m³/sec		
				Min	Max	Average
Lech	2496	254	4,125	*33*	*1350*	114
Naab	2384	191	5,508	*8*	*765*	54
Isar	2282	283	8,964	*60*	*1360*	173
Inn	2225	515	26,130	*195*	*6700*	727
*Traun**	*2125*	*146*	*4,277*	*30*	*369*	*127*
*Enns**	*2112*	*349*	*6,080*	*53*	*603*	*200*
Morava (Czech Republic)	1,880	340	26,642	45	229	110
Raba	1,794	240	14,830			80
Vah	1,766	398	19,131			152
Hron	1,716	260	5,439			54
Ipel	1,708	140	5,145			17
Sio	1,498	124	14,800			30
Drava	1,382	893	40,076			670
Tisza	1,214	966	157,186	380	1,785	813
Sava	1,170	861	100,590	1,022	2,560	1,513
Morava (Yugoslavia)	1,103	430	37,597			236
Timok	846	180	4,600			15
Jiul	692	240	9,200			80
Iskar	636	400	8,437			28
Olt	604	542	23,282			160
Yantra	537	271	7,850			24
Arges	432	270	9,200			80
Ialomita	244	270	9,900			70
Siret	159	520	44,000			300
Prut	134	950	27,447			150

The river's runoff highly depends on the altitude zones and varies in a broad range: average yearly runoff compared to dry years varies from 1:8-1:16.

The river network and sub-basin areas are shown in map 2 (chapter 3.2.2). The following chart 1 provides an overview of runoff in the major river systems.

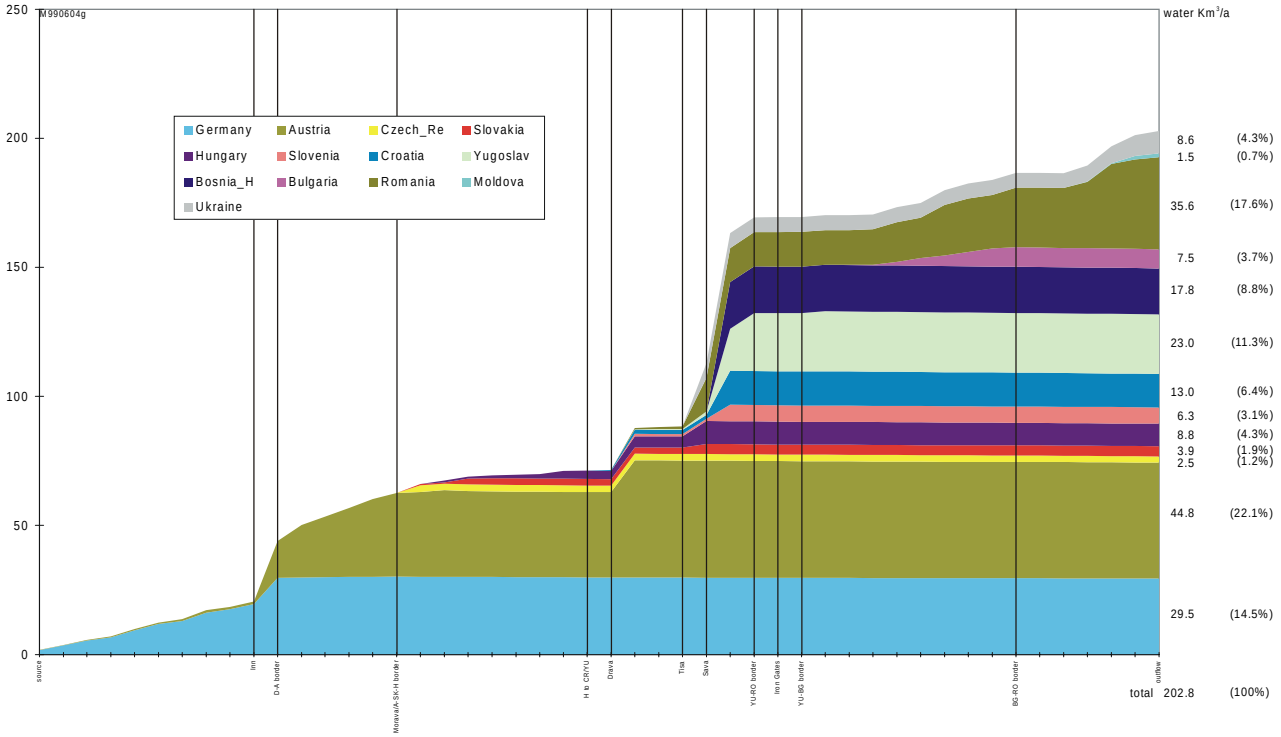


Chart 1 Longitudinal profile of the annual river runoff in the Danube, subdivided over the countries of origin

Surface Water quality

The results of the eleven national planning workshops (conducted in all the Danube countries except for Germany and Austria) indicate that the Danube river basin's water quality is under great pressure from a diverse range of human activities.

In many urban areas, the most significant adverse impacts on water quality are generated by pollution from largely inadequate wastewater treatment plants and from solid waste disposal facilities. In addition, a lack of wastewater treatment plants and their inadequate capacity and technology and/or inappropriate operation have contributed to the increase in water pollution.

In rural areas, the absence of decentralised water supply systems, of sewage networks and wastewater treatment plants have contributed to the worsening of public health. The modernisation and intensification of agricultural practices and livestock production are other major sources of pollution of surface and ground water.

Moreover, *industry* strongly contributes to both the alteration of water quality and water pollution, mainly because of the existing, often obsolete technologies and the absence of wastewater pre-treatment plants.

Therefore, *the Danube river* discharges substantial loads of nutrients and non-degradable contaminants into the Black Sea, reaching a serious level of environmental deterioration, including:

- an increasing degradation tendency over the last 20 years in terms of water quality values, as proved by laboratory analyses. The increase of nutrient salts (nitrogen and phosphorus) and organic matter discharges has caused significant phytoplankton and algae mass growth, oxygen shortage, both in the Iron Gate reservoir on the Danube itself and in the Danube Delta;

- the presence of herbicides and other pesticides in water (in particular groundwater) is mainly due to the past use of these substances and their persistence in soil and sediments;
- unfavorable effects finally noted in the ecosystem, especially in the ichthyofauna, in the Danube Delta and in the Black Sea coast, are due to the increase of the navigation traffic and to harbour activities, as well as to the use of pesticides on agricultural lands;
- production of significant natural and anthropogenic inputs along the lower Danube. Certain industrial sites, as well as the Danube tributaries, are important sources of different pollutants.

The self-regenerating capacity of the Danube and the filtering role of both the wetlands and the Danube Delta are important factors for improving the quality of the river water and partially of its sedimentary load. In the lower section of the Danube and at its mouth, the water quality is clearly improving. For instance, at Bazias where the Danube enters the Romanian territory, the fluxes for phosphates, silicates, TOC, detergents, organo-clorinates and certain heavy metals are much higher than at the point where the Danube empties into the Black Sea.

Groundwater

For selected countries, information on groundwater resources have shown the following situation:

Country	Available Groundwater in Billion m^3 (in m^3/s)	Used Resources in Billion m^3	% of Total
Austria	28	1,5	6
Czech Republic	0,26 (8,5 m^3/s)	0,17	65
Slovakia	2.3	0,50	22
Hungary	1,8	1,10	61
Slovenia	1,6	0,90	56
Yugoslavia	1.4 (45 m^3/s)	0,70	50
Romania	9.0	3,00	33
Moldova	0,14 (4,4 m^3/s)	0,07	50
Ukraine	1,6	0,90	56

Comparative analyses of groundwater *quality* dynamics have pointed out an accentuated depreciation of this water resources' quality, both from the point of view of the spatial extension of the affected areas and of the pollution phenomena intensity in the main polluted areas. There are many interesting areas with respect to the groundwater reserves, which have been more or less affected by the increase of pollutant concentrations. As a consequence, these water resources cannot be directly used as drinking water and require additional adequate treatment measures, selected to suit each particular case.

Soil Quality

Soils serve as the base of life for plants, animals and men (food production). Highest alpine soils and marshy soils in the lowlands provide (economically) important protective and balancing functions. Dominant soils in the higher Alps are podzolised brown-earths and limestone rendzinas. For the Carpathians and the Yugoslav mountains, except for the highest regions, brown-earths on weathered solid rocks are widely distributed. Grey-brown podsolized soils are often found between 300 and 1,000 m, especially around the Carpathians. The Pannonian inner basin is a mixture of loess chernosems, meadow chernosems and various brown-earths. At the eastern banks of the middle Tisza in Hungary, wide areas of Solonetzs are established. Ribbons of grey alluvial soils are found along all middle and lower parts of rivers in the Danube River Basin.

Other soils locally found within the Danube river basin are gley soils along the Sava, Drava and in the Pannonian region; low and high moors in the Alps, the Bavarian pre-Alps, near lake Balaton and Upper Tisza; Vertisoles in small areas in Yugoslavia and Romania.

Large quantities of water and of pollution from point and diffuse sources can be retained in intact soils. When that capacity is exhausted, soil and pollution is washed or blown away – both as a natural phenomenon and as a result of human interference: Erosion was severely increased after intensive land use activities.

Most pronounced down-wash erosion occurs in many upstream river parts in mountains and in hill regions throughout the Danube basin. River bed straightening, bank fortification, canalisation and damming enhances downstream bed erosion. Excavation of gravel and sand is another factor. Bad forest management, deforestation and inappropriate agriculture trigger and increase large-scale erosion problems which can lead to a complete local loss of top soils, to floods, mud avalanches and land slides. High erosion risks exist in particular in the Alps, in the entire chain of the Carpathians and in the Yugoslav-Balkan mountains.

Various Danubian regions are moderately or strongly endangered by aeolian erosion. This particularly refers to large parts of Morava-Dyje catchment area, the Pannonian plain (between Budapest and Szeged; east of Bratislava up to the Ipel river; around the upper Tisa between Kosice and Debrecen) and to the Romanian plain (between Iron Gate and mouth of the Olt; south of Braila city and in parts of the delta).

Wetland Ecosystems

The remaining floodplains and wetlands of the Danube basin are unique ecosystems of European and partly even global importance (the karst and the delta). The fluctuating river discharge is the determining factor for life along the river banks and adjacent floodplains. The living spaces created by the Danube and its tributaries host a unique diversity of species, with about 2,000 higher plants and more than 5,000 species of animals (including 41 mammals, 180 breeding birds, 100 fishes, eight reptiles and twelve amphibians). The remaining large floodplain forests and the Danube Delta are last refuges in Europe for the white-tailed eagle and the white pelicans, the beaver was successfully reintroduced.

In addition, there are some special ecosystems such as lakes (Neusiedl, Balaton, liman etc.), moors, marshes, drylands (puszta, sand dunes) and the karst, all connected to water forces and home to partly endemic fauna and flora.

Many of these species require very special living conditions in terms of velocity, turbidity, depth, temperature and nutrient values of water, or in terms of eroded banks, gravel beds and dead tree trunks. Intact water dynamics (regular low water and inundation periods) and open connections between side-arms and the main bed are crucial conditions for their life-cycles (e.g. feeding, reproduction, sheltering, migration).

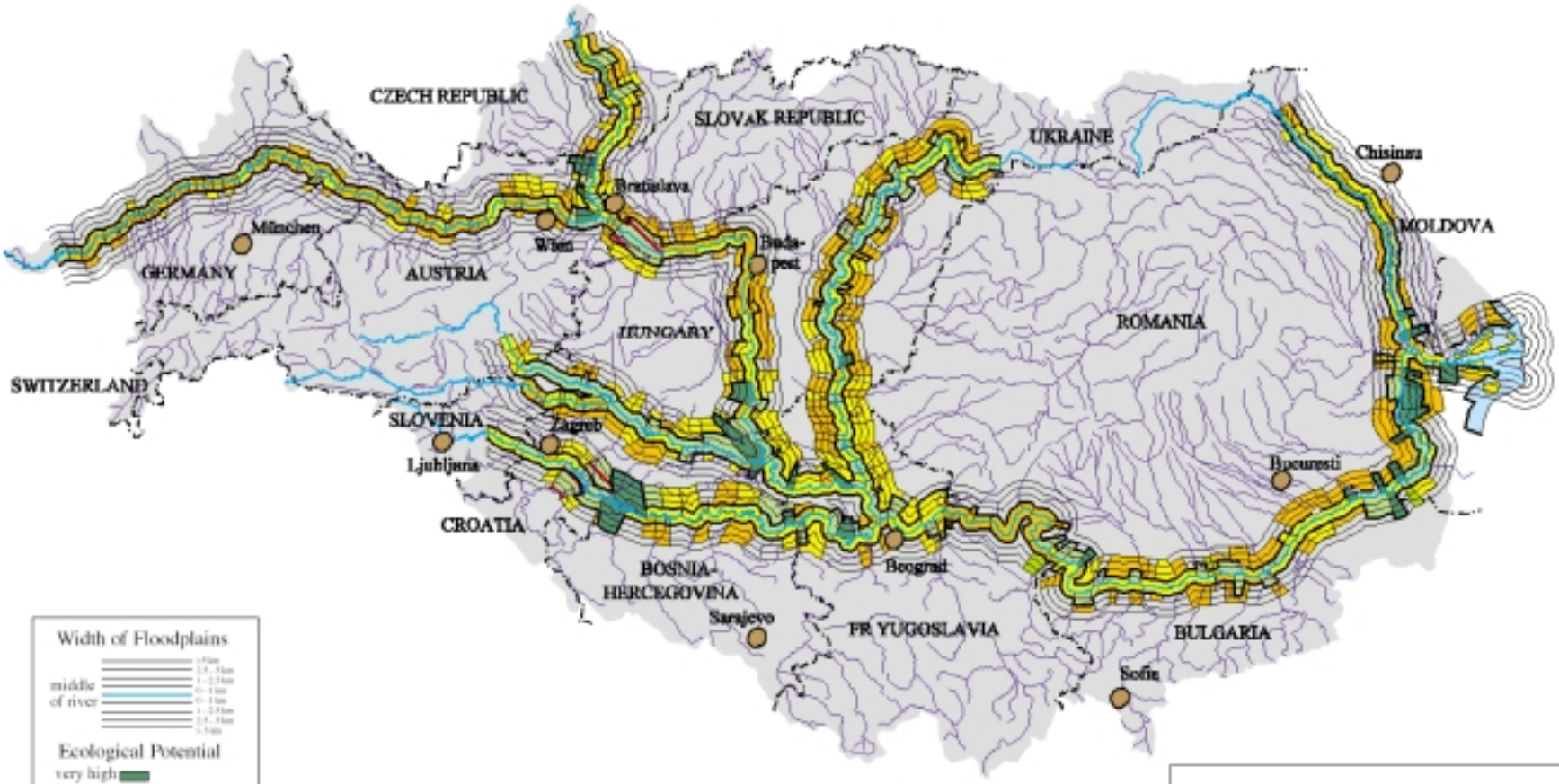
During the last two centuries in particular, most large floodplain areas within the Danube basin have disappeared. Primeval riverine forests, which take some 6.000 years to develop, are almost extinct in Europe. Since these were the most fertile and productive areas, they were the first to be settled; their resources were used early on (e.g. for hunting, fishing, boat building) and they were the site of vigorous economic activities (timber, hay and various products from arable lands). Later, the wild rivers were “tamed” to increase flood protection, navigation, agricultural production, and to allow energy production. Such interference has, for instance, shortened by 21% the length of the Bavarian Danube and from 1,419 to 966 km the length of the Tisza river in Hungary. About 3.7 million hectares of permanently or seasonally inundated land were diked in Hungary in the 19th and 20th century, and in Romania in the 1960s and ‘70s, 435,000 ha (80%) of the floodplains were diked to allow intensive agriculture.

Today, only a few floodplain areas are still near-natural. They include large parts of the Danube Delta, along the lower Prut river, several Bulgarian Danube Islands, the central Sava, the Gemenc – Kopacki Rit border area (H-HR-YU), the lower stretches of the Mura and Drava rivers (A, HR, H), the Danube-Morava-Dyje floodplains between Vienna, Bratislava and south-east Czech Republic, and the mouth of the Isar river in eastern Bavaria. Many floodplain areas are protected as nature reserves, national parks, biosphere reserves, Ramsar sites and Important Bird Areas, but at the same time, they are subject to degrading river bed erosion, pollution, intensive forestry and hunting, intensive recreation etc.

Within the Danube Pollution Reduction Programme, an evaluation of floodplain areas in the Danube River Basin was conducted by WWF in order to identify those wetlands best suited for restoration, as shown in Map "Ecological potential of floodplains in the Danube River Basin". Altogether 17 wetlands with a total of 619,000 ha in 11 countries were proposed, including small floodplains next to Ingolstadt (D), at the mouth of the Isar (D), on the Morava river, in the Drösing Forest (A) and next to Hodonin (CZ). Large wetlands were identified at the Gemenc-Kopacki Rit, at the central Sava (Makro Polje, mouth of Drina), the upper (mouth of Bodrog) and lower Tisa (YU). The proposed areas also include three along the Romanian-Bulgarian Danube (Balta Potelu, Danube Islands and the Balta Greaca/Tutrakan), the Kalarasch area downstream the Romanian city of Calarasi, parts of the Lower Prut and of the Liman Lakes (UA), and, in the delta, the Pardina polder(RO) and the Ukrainian part of the delta.

To maintain and restore these wetlands means to save the gene pool, preserve habitat diversity, and benefit from ”free” economic services (filtering and purification of polluted waters; sediment and erosion control; space for recreation, timber production; flood retention and refilling of groundwater; balance of the local climate). Were it not for the wetlands, these services would have to be technically provided at a much higher cost.

Ecological potential of floodplains in the Danube River Basin



Width of Floodplains

middle of river

Ecological Potential

very high
high
moderate
low
special problem areas

Border between recent and former floodplains

0 50 100 150 Kilometers

Danube Pollution Reduction Programme

United Nations Development Programme
Global Environment Facility
ICPDR - Programme Coordination Unit
1400 Vienna, P. O. Box 500, Austria

Produced by WWF Danube-Carpathian-Programme
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Hydraulic Works

Hydraulic works in the form of dams and reservoirs are found in all mountainous areas of the Danube basin, while most navigation canals, dyke and irrigation networks concentrate on the lowlands along the central and lower Danube.

The building of large dike systems for flood protection started in the 16th century in Hungary. Old networks of drainage/irrigation systems exist in all basins, for instance in the Banat (northern YU) and in southern Romania. The first major Danube regulation works started in 1830 in Upper Austria; the first Danube hydro dam was built in 1927 at Vilshofen (lower Bavaria).

Today, hydro-power utilisation and energy production varies substantially from country to country, e.g.

Hungary:	28 MW = 0.6% of power generation,
Romania:	5,200 MW = 30% of power generation; more than 400 large dams;
Austria:	14,200 MW (DRB) = 70% of electricity production; 78 large dams (DRB); 50.9% of all rivers (catchment > 500 km²) are impacted by hydropower (impounded, residual flow, or peak operation).

The totally installed hydropower capacity in the Danube basin is in the order of 29,200 MW.

The biggest hydropower dam and reservoir system along the entire Danube is located at the Djerdap (Iron Gate) gorge (117 km long). It is a peak operation system with two dams, jointly operated by Romania and the Federal Republic of Yugoslavia (average Danube flow: 5,500 m³/sec, overall drop: 34 m; installed capacity: 1,266 MW, annual production: 6,490 GWh.

The Iron Gate system has transboundary effects. The reservoirs (volume 3.2 billion m³; length: 270 km) catch some 20 million tons of sediments per year, thus serving both as an important nutrient sink and a deposit of hazardous and toxic matter for pollution originating in the upstream Danube catchment. At the same time, sediments are missing downstream and have created erosion problems since the dam was put into operation in 1970.

The second largest dam system is Gabcikovo near Bratislava, in operation since 1992. It is located near one of the once-largest Danube wetlands. Today, 8,000 ha of floodplain forests and a network of side-arms are artificially irrigated: They are disconnected from the river which receives only 10-20% of its water; 80-90% are directed to the power plant, producing some 10% of Slovak electricity.

A few more dams are planned to be built e.g. on the Bavarian Danube, on the Sava and on the Drava along the Croatian-Hungarian border, where the Novo Virje dam (planned capacity: 121 MW) would dissect the still largely pristine Mura-Drava river continuum of altogether 370 km between the Austrian border and the confluence with the Danube.

Main environmental impacts and effects of hydraulic works in the Danube basin are:

Environmental Impact of a Dam	Lasting Effect for the River Environment
Alteration of the hydrological regime of surface and groundwaters	Impoundment ("from a river to a chain of ponds") Loss of regular soil ventilation and moistening, of soil fertility Need for artificial wetland and back-country irrigation and drainage
Change of the sediment regime (natural balance of erosion and sedimentation processes)	Filling-up of the upstream reservoir with silt and toxic substances Bed erosion of downstream river sections and subsequent drying up of surrounding landscapes (need for irrigation) Reduced economic productivity (no free nutrient input) in forestry, agriculture and fisheries Loss of pioneer habitats (gravel / sand banks, islands); ageing of ecosystems
Reduced flood retention capacity	Increased flood hazard and damage downstream of the dam
Reduced self-purification capacity	Reduced water quality Increased need for technical water purification
Dissection of the river continuum (longitudinal and lateral)	Impeded animal migration and plant dispersal Loss of shelter, feeding and reproduction habitats Loss of typical, rare riverine habitat and species diversity Isolation of populations; spreading of monotonous landscapes, invasion of "ordinary" and alien species Altered recreational value

Effect (back water) of the hydraulic works can be seen in Map "Symbolized view of floodplains in the Danube River Basin".

Symbolized view of floodplains in the Danube River Basin

Width of Floodplains

middle of river

Type of Floodplains

- Former Floodplains
- Recent Floodplains
- Back water area of dams

Scale: 1:4.500.000

0 50 100 150 kilometers

Area of historical floodplains in the study area: 41600 km
Area of remaining floodplains in the study area: 8000 km
A floodplain loss of more than 80%

Danube Pollution Reduction Programme

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An example of the impact on rivers is the upper Danube between the source and Bratislava (the first 1,000 km) with a chain of 58 dams (in average one dam every 17 km), and with only three important free-flowing sections left (Straubing-Vilshofen in Bavaria, the Wachau in Austria and Vienna-Bratislava). Cataracts of dams have produced a similar situation in most alpine and Carpathian tributaries (e.g. Lech, Isar, Inn, Enns, Mura, Drava, Sava, Vah, Somes, Crisuri, Jiu, Olt, Arges, Ialomita or Siret/Bistrita).

Environmental Effects of Navigation

Navigation is a traditional activity on the Danube, facilitating the region's economic development. The first tow path was built by the Roman emperor Trajan in 100 A.D. at the Iron Gate. Intensive works started in 1834 but the dangerous passage through the cataracts ceased with their impoundment over 270 km. In 1972, the Iron Gate I dam was completed and Iron Gate II dam was added in 1984. In the delta, the Sulina arm was made navigable for large sea ships between 1857 and 1902, shortening its formerly meandering route from 85 km to 62 km.

The Danube countries have co-operated in navigation since 1856. In 1948, the Danube Commission was founded in Belgrade. In an annex to the 1988 Danube Convention on Navigation, a further moderate expansion of the navigation route was recommended for the waterway between Regensburg and the delta. All Danube dams between Regensburg and the Iron Gate serve navigation needs. The tributaries also used for navigation include the Drava (up to Cadrice at rkm 1015), the Tisza (up to Dombrad at rkm 600), the Sava up to Sisak at rkm 583 and a short section of the Prut.

Three artificial waterways have been built on the Danube:

- the Danube-Tisa-Danube Canal (DTD) in the Banat region (northern Yugoslavia)
- the 64 km long Danube-Black Sea canal between Cernavoda and Constanta (RO) was built in 1984;
- the Rhine-Main-Danube canal (altogether some 700 km) was built in 1992, providing a link to the North Sea.

While navigation is widely perceived as a cheap, environment-friendly means of transportation, it must be recognised that it contributes to water pollution through accidental and illegal release of toxic substances (bilge oil, wash waters).

3.2. Description of River Basin Areas

3.2.1. River Basin Management Approach

The concept of river basin management provides that decisions affecting the river should be taken within the context of the basin as a whole. Transboundary co-operation requires that issues such as water use, pollution discharges, flood control and the protection of ecosystems should not be considered in isolation from each other or from a local/national perspective but that they should be jointly assessed and agreed between two or all the basin countries.

The Danube River Protection Convention expresses in its preamble and objectives the intention to intensify bilateral and multilateral water management co-operation that shall be oriented towards sustainable water management and pollution control. Six DRB countries are either members of the European Union or in the process of approximating their water and environmental legislation to EU standards. The EU proposal for a framework directive on water policy requires river basin management that includes the establishment of international river basin districts by more than one member state and joint administrative arrangements (e.g. the establishment of relevant river basin district authorities).

The EPDRB also promotes international co-operation in the international watersheds in the Danube River Basin. In addition, transboundary co-operation is one of the key objectives of the Strategic Action Plan Implementation Programme (SIP) and of the Danube Pollution Reduction Programme (PRP). During the Transboundary Analysis of the Danube Pollution Reduction Programme, problems and alternative interventions were identified aimed at reducing pollution and transboundary effects in the Danube River basin and the Black Sea. In a new planning approach which started on the national level through the elaboration of National Reviews and National Planning Reports (collection of viable water quality data, social and economic framework conditions, financing mechanisms and national priority projects for pollution reduction) and continued on the regional level (transboundary issues, regional strategies and actions), the Danube Basin was assessed from a transboundary perspective which resulted in the identification of Aggregated Sub-basin Areas. Further, various basin-wide information was put together on economy, population, agriculture, hot spots, priority wetlands for restoration and significant impact areas.

3.2.2. Hydrological and Ecological Factors of Sub-river Basins

Fifteen Sub-river Basins (map 2) have been identified within the Transboundary Analysis of the Danube River Basin, mainly based on hydrographic facts (catchment areas). All these areas include mountains and lowlands ending at least at the mouth of the main river at the Danube, except for the Pannonian Central Danube Area.

In the **Upper Danube Sub-river Basin**, the Danube rises at the confluence of the two source rivers, Brigach and Breg. The river character in this region is only partly near-natural, as it is impounded by a chain of small hydrodams. The economy is dominated by manufacturing industry, intensive agriculture and the service sector. Population density is at around 130 persons/km². The area touches some foot-hills of the Alps, which are also typical of the Inn, Austrian Danube and Drava-Mura Sub-basin areas. There are no significant impact areas (SIA) but there are seven municipal and one industrial source of pollution in this region.

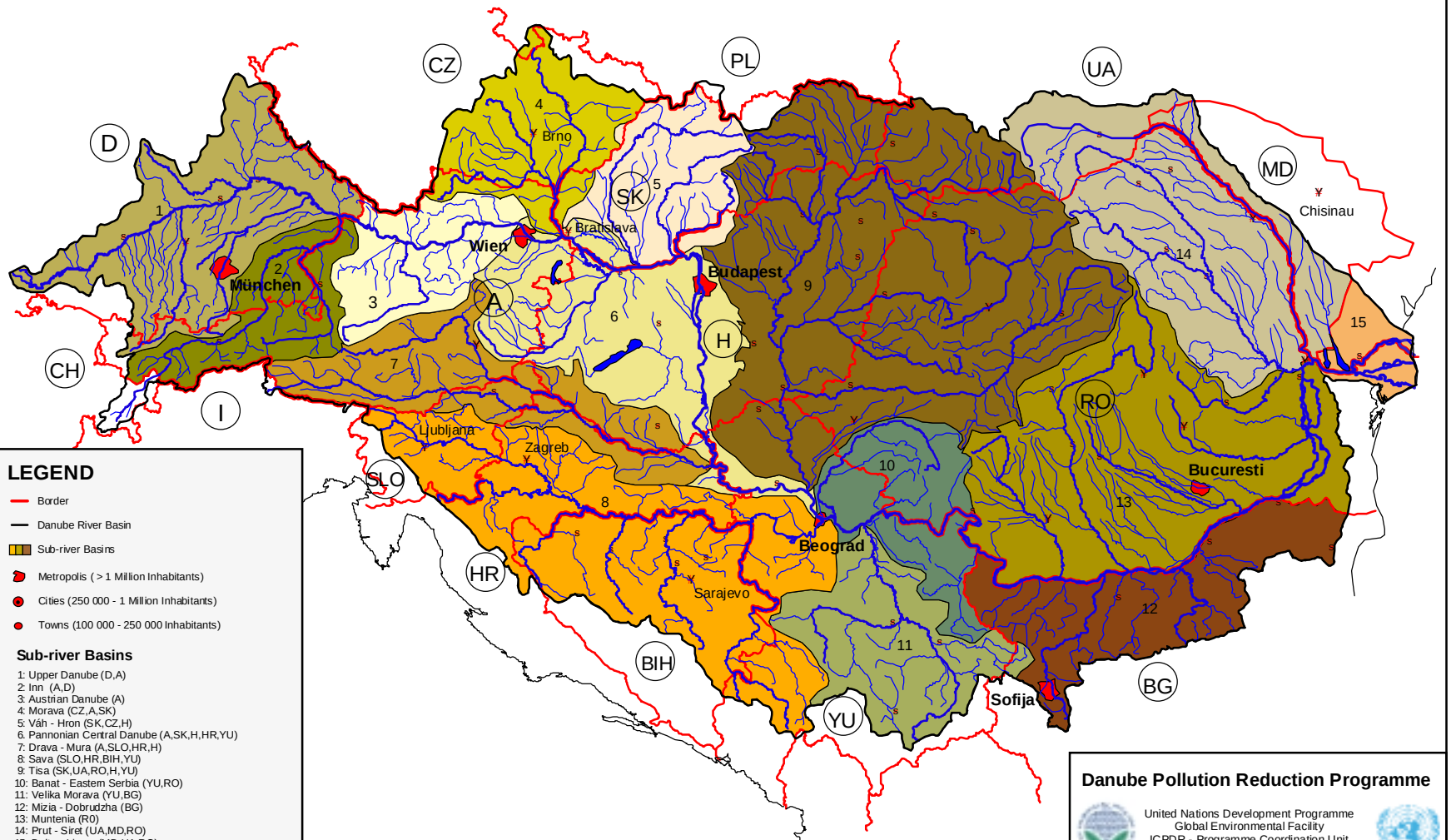
The Austrian part of the **Inn Sub-river Basin** in particular is a high mountain alpine landscape within the Northern Alps with some peaks reaching over 3.000 meters. The Inn, and its side-river, the Salzach, are the main tributaries to the Danube. In the upper and middle river reaches, only the valleys are densely populated while the steep mountain slopes are dominated by protective forests. The service sector with intensive winter and summer tourism is the main economy. Major cities with more than 100,000 inhabitants are Innsbruck and Salzburg. There are two major sources of pollution (a municipal WWTP and chemical industry) at the middle Inn in need of upgrading.

The **Austrian Danube Sub-river Basin** is one of only two non-transboundary areas within the Danube Basin. All larger tributaries discharge directly into the Danube, and those coming from the Alps have a big elevation change between their source and mouth. While the alpine regions can be compared in economic and natural facts with the Inn Area, the low mountains north of the Danube are sparsely populated uplands in a mainly continental climate. High population density can be found in some big cities along the Danube – especially at Linz, the site of Austrias' biggest primary and secondary industry. There are no SIA reported for this area except for one major source of pollution (Linz WWTP) in need of upgrading.

Two smaller river basin areas are located north of the Pannonian plain: The **Morava** and the **Vah-Hron Sub-river Basin**, covering the main parts of the Czech Republic and of Slovakia. The relief of the Morava basin mainly consists of lowlands, Bohemian high lands, limestone hills and some extended valleys. It is one of the driest regions throughout the basin. About 14% of the Czech area is protected. Mechanical engineering and chemical industries, complemented by the processing of local resources (food, leather, wood, etc.) and by the manufacturing of building materials are typical of the Morava area. 2,78 million people live within this area; the regional capital is Brno (390,000 inhabitants). Altogether seven high priority Hot Spots (four municipal, two agricultural and one industrial) and two SIAs have been identified within the Sub-river Basin.

Map 2: Sub-river Basins

Based on Transboundary Analysis Workshop 1999



LEGEND

- Border
- Danube River Basin
- Sub-river Basins
- Metropolis (> 1 Million Inhabitants)
- Cities (250 000 - 1 Million Inhabitants)
- Towns (100 000 - 250 000 Inhabitants)

Sub-river Basins

1: Upper Danube (D,A)
2: Inn (A,D)
3: Austrian Danube (A)
4: Morava (CZ,A,SK)
5: Váh - Hron (SK,CZ,H)
6. Pannonian Central Danube (A,SK,H,HR,YU)
7: Drava - Mura (A,SLO,HR,H)
8: Sava (SLO,HR,BIH,YU)
9: Tisa (SK,UA,RO,H,YU)
10: Banat - Eastern Serbia (YU,RO)
11: Velika Morava (YU,BG)
12: Mizia - Dobrudzha (BG)
13: Muntenia (R0)
14: Prut - Siret (UA,MD,RO)
15: Delta - Liman (MD,UA,RO)

50 0 50 100 150 Kilometers

Scale: 1: 4 500 000

N

Danube Pollution Reduction Programme

United Nations Development Programme
Global Environmental Facility
ICPDR - Programme Coordination Unit
1400 Vienna, P.O. Box 500, Austria

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for Central and Eastern Europe, Vienna, 1999
(Cartography by U.SCHWARZ)

Most of the Vah-Hron Sub-basin Area is under the influence of the High Tatra mountain. The upper river stretches are characterized by largely forested mountains with intensive uses in the valleys. The industrial sector is highly developed (mainly chemical, heavy and food processing) which affects the valuable natural resources. The area is sparsely inhabited (Vah catchment: 50 persons/km²) and influenced by two high priority (industrial and municipal) and four medium priority Hot Spots.

The **Pannonian Central Danube Sub-river Basin** with five contributing countries (A, SK, H, HR, YU) and three capitals (Vienna, Bratislava and Budapest) is one of the two most international Areas of the entire region. It includes the Vienna basin, the small Hungarian plain and the (western) Hungarian low mountains, and extends down the Danube as far as the mouths of the Tisa and the Sava rivers (Belgrade). The Pannonian climate leads to water shortages in this largely rural region. Human activities have cleared most forests and are based today on agriculture and on heavy and manufacturing industries. The area includes some of the largest Danube floodplain forests and the two steppe lakes of Neusiedl and Balaton. Due to many Hot Spots in the area (six high priority industrial and municipal alone) no less than four SIAs (Gemenc-Kopacki Rit, Szigetköz, Danube Bend before Budapest and in Novi Sad) were identified.

The Danube tributaries of the **Drava-Mura Sub-river Basin** are also of Alpine origin. The area itself stretches along both rivers from the southern Alps in Austria (high mountains with forests and alpine pastures) across Slovenia (from alpine to subalpine, karst and sub-Pannonian landscapes) and the Hungaro-Croatian border (Lower Drava lowlands and valleys) to the confluence with the Danube near Osijek. The lowland Drava is still quite unchanged due to its long years of functioning as a strict border line. With the cities Graz (240,000 inhabitants) and Klagenfurt, two Austrian regional centers are within the area. It is in the middle reaches of both rivers in Slovenia and upstream the mouth of the Drava that several hot spots create pollution problems which led to its identification as three SIAs.

The **Sava Sub-river Basin** includes the entire Danube river catchment area of Bosnia-Herzegovina and parts of the catchment area of Slovenia, Croatia and Yugoslavia. The Sava is the biggest tributary by volume and one of the biggest by pollution loads it carries into the Danube due to a big number of hot-spots and a chain of Significant Impact Areas along its entire stretch. Large parts of the river flow through a lowland plain with large meanders, extended meadows and old forests (partly protected wetlands). With 95,020 km², it is the second largest sub-basin area in the Danube region. Again, there is a big elevation difference between the source of the river and its tributaries on the one hand and and their mouths in the lowlands on the other. The latter have a higher density of population, concentrated in three capitals: Ljubljana, Zagreb, and Sarajevo and the town of Banja Luka.

The **Tisa Sub-river Basin** is the largest (size ca. 157.220 km²) and the center of the entire Danube basin. It belongs to parts of five countries (H, RO, SK, UA, YU) with the biggest share in the first two mentioned countries. The area is the second-largest tributary of the Danube (average discharge of 794 m³/s), and only the upper parts of the tributaries and the Tisa itself are largely forested. The middle and lower parts of the Tisa Sub-basin Area are characterized by open grassland and arable land, bigger cities and industries. As a result, the area has a large number of Hot Spots and a high pollution impact on the rivers. Sewage systems in this area are either missing or in a poor condition – a cause of many environmental problems. Nearly all the tributaries to the Tisa were identified as SIAs.

The **Banat - Eastern Serbia Sub-river Basin** is located south of the Tisa basin. It compromises hilly and mountainous terrain and includes the Djerdap gorge (Iron gate). The area encompasses highly-populated parts of Yugoslavia and Romania with the Timis as the biggest tributary. The three Significant Impact Areas are the Middle Banat – Bega & Birzava, the area along the Iron Gates and the region around the lower Timok. Two municipal high priority Hot Spots were identified within the area.

The two branches of the Morava river dominate the **Velika Morava Sub-river Basin** which is almost entirely located in Yugoslavia. Important branches of metal, chemical, wood and paper industry endanger the rivers water quality, especially along the main valleys. Therefore, the SIA Western and Southern Morava SIA is one of the biggest in the entire basin. The Area is highly populated and has three big cities (Nis, Pristina and Kragujevac). Intact nature with forests can only be found in the higher mountains.

The **Mizia-Dobrudzha Sub-river Basin** in Bulgaria includes its capital Sofia. It is characterized by a low mountain or hilly profile and by many small rivers, with a continental and particularly dry climate in the lowlands. The population is exceptionally concentrated in big cities (especially Sofia, Rousse, Pleven and Dobritsch), while the average population density in rural areas is only 50 persons/km². The cities are places with a high environmental impact, which has led to the identification of many small Significant Impact Areas due to municipal pollution hot spots.

The **Muntenia Sub-river Basin** in the east of the Danuibe basin represents about 40% of Romania. The relief varies from very high mountains in the north to high hills (Pre-Carpathians) and to high and low plains in the south along the Danube river and the Black Sea. The plain is the most fertile part of the country with intensive agriculture. Industry dominates the economic activity in the municipalities. Therefore, a lot of problem zones (Hot Spots) have been identified, mainly around Bukarest and Ploiesti. Altogether six cities with more than 150,000 inhabitants lie within the area. Three Significant Impact Areas were identified in Muntenia: at the river Ialomita near Ploiesti, at the Arges and upstream the Danube delta (mouth of tributaries Siret and Prut).

The **Prut-Siret Sub-river Basin** north-east of Muntenia encompasses the north-eastern part of Romania, western Moldavia and south-western Ukraine. Again, the relief descends from mountains to high hills (Siret area), as well as to plains (Prut). Economic activities are predominantly agricultural and include large-scale crop production. Among industrial activities, the food processing industry (canneries, dairies, sugar and wine production) is widely spread. Two big cities (Braila and Galati) at the mouth of the two rivers into the Danube are pollution centers and mark the upper end of the Lower Danube SIA.

Compared to the other regions, the **Delta – Liman Sub-river Basin** is quite small (about 9,330 km²) but it is a separate area and a unique natural landscape. It has with its habitats (reed beds, inner lakes, forests and sand dunes, steppe, sea-side and flood-plain areas, etc.) and biodiversity global importance. However, many environmental problems occur for different reasons (former conversion of wetlands in agricultural land, impact of fertilizers and of urban and industrial wastewater, etc.). The delta is a big natural filter for Danube waters before they enter the Black Sea. The Ukrainian part of the Delta together with the Liman Lakes was identified as a Significant Impact Area. The population density in this part of the basin is very low (between 20 and 40 inhabitants/km²).

4. Regional Policies and strategies

4.1. Analysis of Problems and Identification of Causes of Water Pollution and Water Management

4.1.1. Core Problem

The eleven DRB countries that have held national planning workshops have identified in their reports the core problem considering that: (i) the unsustainable approach of the past decades, when the size and output volume by the enterprises and farms were the only measures of prosperity, has resulted in polluted soil and water bodies, and that (ii) the sub-optimal performance in the natural resources management and pollution abatement and control, has in various water sub-sectors resulted in high costs, declining services, environmental degradation and weakened benefits. The two factors have combined to lead to the unsustainable development of the region. The core problem was identified as:

"ECOLOGICALLY UNSUSTAINABLE DEVELOPMENT AND INADEQUATE WATER RESOURCES MANAGEMENT IN THE DANUBE RIVER BASIN"

4.1.2. Direct Causes of the Core Problem

The following direct causes leading to the core problem were identified:

- **Inadequate management of wastewater and solid waste due to:** improper drainage of wastewater (46% of households in the middle and lower Danube regions connected to central sewerage systems); discharge of 31% of municipal wastewater without previous treatment; absence of central wastewater treatment plants in 62% of townships of more than 100,000 inhabitants; insufficient capacities of treatment facilities; improper operator performance at treatment facilities; inadequate control of individual wastewater treatment (septic tanks) in 89% of households not branched to collective systems, and improper disposal of solid wastes.
- **Ecological unsustainable industrial and mining activities due to:** use of dirty and obsolete technologies; inappropriate management of resources; discharge of wastewater without pre-treatment into municipal systems; inadequate functioning of existing treatment facilities, and inadequate disposal of solid hazardous substances.
- **Inadequate land management and improper agricultural practices due to:** inadequate use and application of pesticides and fertilizers; discharge of liquid waste from farms without pre-treatment; leakage of on-site septic tanks; inappropriate forest management leading, in some areas, to deforestation; improper cultivation practices and accelerated run-off generating erosion.

These direct causes have led to deterioration of water quality in terms of nutrient load, in particular phosphorus and nitrates, contamination with hazardous substances, organic and microbiological contamination as presented in Chart 2, Chart 3 and Graph 6. In many areas of the Danube basin, the water availability is endangered not only by pollution, but also by an inappropriate allocation among the users that compete for water and water structures.

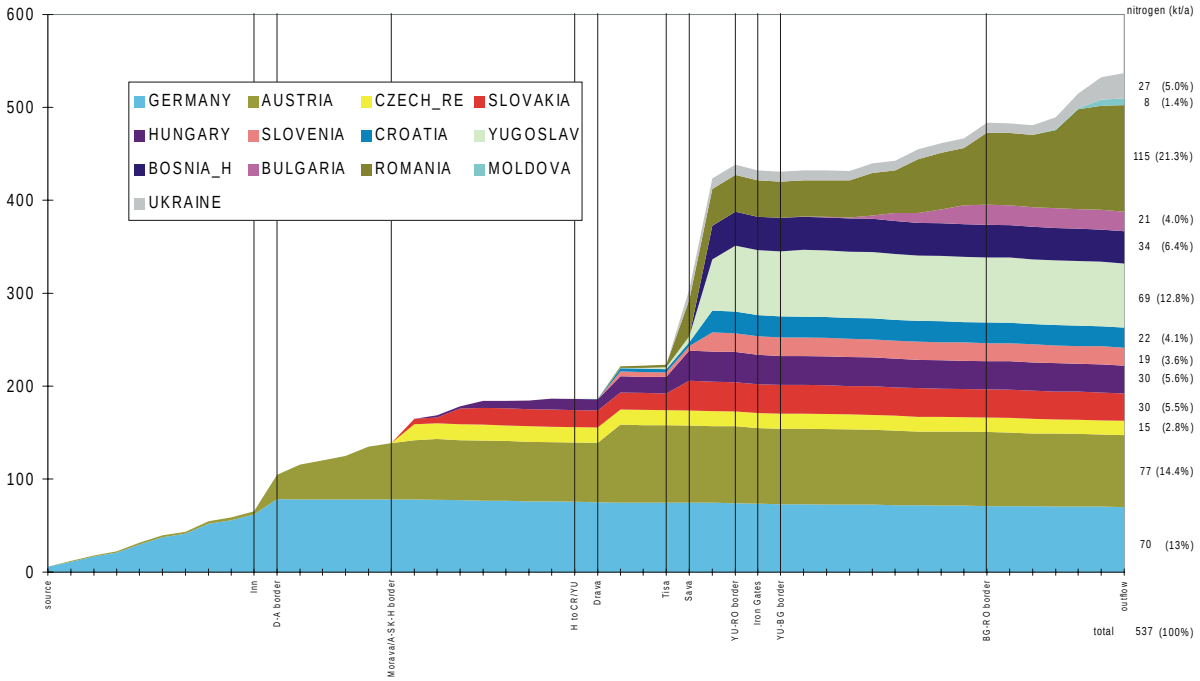


Chart 2 **Longitudinal profile of the annual Nitrogen load in the Danube (in kt/a), subdivided over the countries of origin, with a high estimate for the in stream denitrification (=removal rate)**

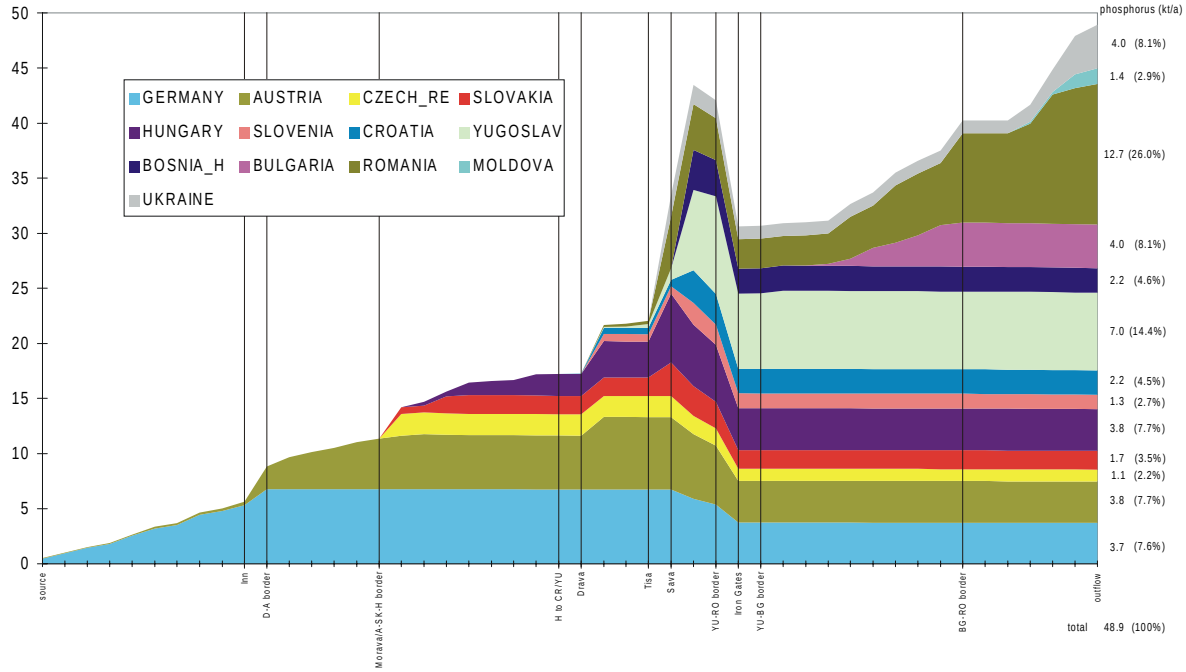
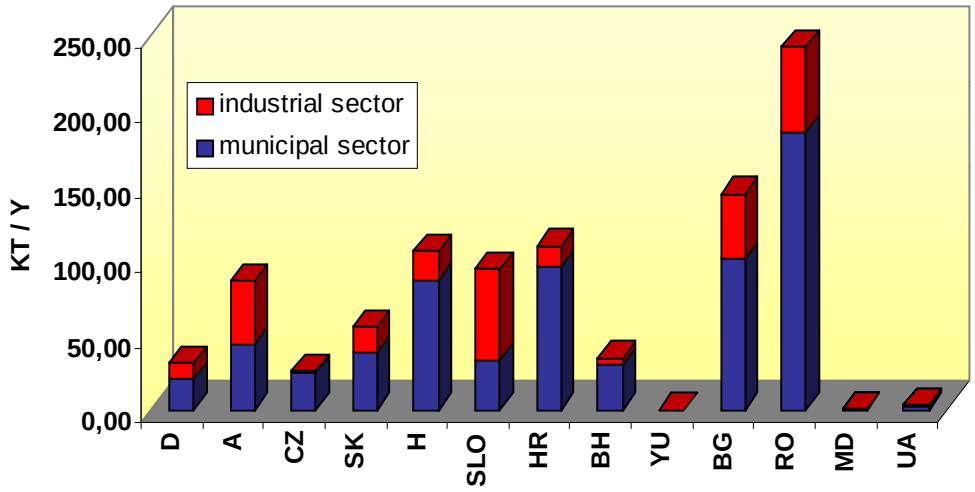


Chart 3 **Longitudinal profile of the annual phosphorus load in the Danube (in kt/a), subdivided over the countries of origin**

Graph 6 **Total load of COD per country and sector from point sources of pollution (EMIS List)**



Source: Emission Inventory - Danube River Basin, Municipal and Industrial Discharges, October 1998

4.1.3. Root Causes of the Core Problem

In the frame of the analysis of the core problem, the following root causes were identified:

- **Socio-political transition, reforms and general economic recession**

  In the middle and lower Danube regions, the strategy of transition from excessive centralization and rigid planning to market economy has combined a paced reform process in the state enterprises with a phased approach to market-based instruments. However, the policy of self-sufficiency at any cost, pursued before the transition, had rendered the entire economy inefficient. The continuous efforts by the policy makers to keep inflationary pressures under control, stop the decline in production and the displacement of labor, have combined with efforts to abate the accompanying social cost of the reforms to produce a general economic recession in the region. As a result, transition became a threat - through poverty, inflation and unemployment – to a convergent evolution of the resources and an efficient and sustainable development of the economy.

- **War and displacement of population**

  The war in some parts of the middle Danube region became responsible for intensifying migration of the population in search of an increased social security and stability. Both during and after the war, the signals of economic decline were accompanied by social injustice and the destruction of public, social, environmental and economic assets.

- **Price liberalization and free trade**

  Trade liberalization has interacted with pricing and privatization reforms in setting the pace of adjustment for the middle and lower Danube economies. The introduction of policies that force producers to compete in open markets has led to a switch from heavy

industries towards less polluting, lighter industries and services. The policy changes (price liberalization and removal of subsidies, creation of competitive markets, tax reforms, change in interest and exchange rates) have resulted in a reduction in operations in a number of industrial enterprises or their complete closures for reasons of unacceptably low efficiency or competitiveness and high pollution impacts. In the free world agricultural market, the accelerated and profitable export of fertilizers, tractors and food items, has impeded the achievement of the country's sustainable agricultural goals, depriving the farming population of a proper income while meeting physical production targets and affecting the quality of the environment. Besides the removal of subsidies, the elimination of barriers to both domestic and foreign trade has played an important role in attaining and maintaining input prices at their economic levels in most of the Danube countries that joined the European Community (EC) and signed free trade agreements with the European Free Trade Association (EFTA). Moreover, the lower countries set the rules for free trade zones in the Danube-Black Sea Canal area as well as near the border crossing points.

- **Unclear land ownership in many transition countries**

  Agricultural transition depends on a diversity of political and social factors that determine the need of marked institutions. While agriculture has changed completely from collective to individual throughout the Danube river basin, there are situations where private ownership is not recognized so that a distinction must be made between privatization of land resulting in individual ownership and individualization, i.e. a shift to individual tenure (the right to use land) without ownership rights.

- **Ineffective implementation of structural adjustment strategies**

  Structural adjustment programmes in the countries of middle and lower regions illustrate the special implementation constraints of these programmes in terms of the attention paid to the scale of pricing reforms and resource reallocations induced by the economic reforms, on the dominant role of privatization and on the scope for restructuring and rationalization. However, the governments aim at linking the scope and the timing of environmental policy measures with the pace of the adjustment programmes.

- **Incomplete legislation, regulations, standards and norms**

  The need for an adequate environmental legislation has emerged as a consequence of the requirements the countries of the middles and lower regions have to meet in order to achieve the ambitious goal of the European integration. The absence of a strong regulatory/legal framework that would define and enforce pollution control policies, water management objectives and enforceable norms, has in several parts of the basin increased the environmental concerns and the conflicting demand for water.

- **Low public ecological awareness, education and training**

  The achievement of the sustainable development objective calls for large-scale consultations over the best way to integrate environment and economy in each sector. The involvement of the public and its ecological understanding are crucial to the establishment and implementation of a realistic and enforceable environmental protection regime. The countries of the middle and lower Danube regions have only partially addressed the problems of public access to government documents and participation in decision-making processes.

- **Lack of financial sustainability of institutions**

  The implementation of full-cost pricing of natural resources and self-financing of regulatory institutions represent the only options able to ensure sustainable development. Very few regulatory institutions responsible for the enforcement of environmental protection policies in the Danube basin have managed to cover the administrative costs

involved in permitting systems including permits issuance, compliance, monitoring and inspection. The obvious solution is to recognize that the permitting system is necessary in order to protect the environment and that the permitted sources are being awarded a valuable right for which they should pay. The *polluter pays* principle should be applied to the issue of administrative cost recovery, by recovering the cost of operations from the charges levied on polluting discharges.

- **Absence of a national strategy for water management**

  In view of the significant damage done to the natural environment, the governments of the middle and lower Danube regions are committed to a development policy that integrates environmental considerations. Such a policy enables the conservation of water resources, the avoidance of irreversible damage to the aquatic environment and the achievement of long-term economic growth on a sustainable basis. Without such a development strategy, the cost of restoring the aquatic ecosystem will be prohibitively expensive in the future, while the investment choices cannot be justified within the context of a cost-effective strategy that balances cost and benefits, social and environmental values and long-term sustainability.

- **Lack of economic instruments and incentives**

  The absence of economic instruments or incentives for improved management of resources and treatment of solid and liquid wastes and for pollution control, the ones that would internalize the external damage cost of pollution due to unsustainable use of natural resources, has impeded the implementation of the "polluter-pays" and the "beneficiary-pays" principles in the middle and lower Danube regions. If correctly designed and applied, such economic instruments will assist the market forces, integrating economic and environmental policy and leading to sustainable financing.

- **Lack of master plans for water resources management at the sub-river basin level**

  The introduction in the river basin water legislation of a multipurpose approach to water management that links social and economic development with pollution of the natural ecosystem, integrates water quality and quantity aspects, and balances in an economically optimal way the use of water by different users and sectors represents the essence of a sustainable, integrated water resources management. There have been some initiatives by the PHARE and TACIS programmes concerning the need for a river basin management approach to be applied on the entire river basin level. However, the absence, in many parts of the basin, of comprehensive river basin development and actions plans impedes the planning process, the prioritization of the investments or a clear allocation of duties and responsibilities among the parties.

- **Inefficient environmental management, enforcement and compliance**

  The lack of an environmental policy framework or an implementation mechanism that would reinforce the credibility of the environmental requirements and the efforts made by the regulatory agency, has undermined the effectiveness of environmental management. In the absence of enforcement of environmental regulations and standards and following a cost-benefit analysis of pollution control, many profit-driven enterprises have decided not to invest their resources in pollution abatement since the expected penalty imposed by regulators is lower than the cost of such investment. The regulator's willingness to undertake strong enforcement actions as well as the possibility for capital markets to rank and compare firms with respect to their environmental performance is negatively influenced by the absence of compliance actions. The application of a compliance schedule in all the Danube countries will increase the flexibility for polluters, provide opportunities for the least costly solutions to compliance problems and reduce the regulatory agencies' implementation and enforcement burden.

4.1.4. Direct Effects of the Core Problem

The following direct consequences of the core problem have been identified:

- **Pollution of surface and groundwater**

  Increased concentrations of nitrate, ammonia, iron, and magnesium and changes in hydrological regime as a result of existing hydraulic works, have raised serious-concerns over various sources of water supply both in terms of accessibility and quality. The deterioration in the quality of groundwater may be irreversible. In some areas of the Danube basin, groundwater has already been abandoned as a potential source of drinking water or for industrial use because of the existing contamination of aquifers.

- **Eutrophication**

  Eutrophication of natural and artificial lakes is considered one of the most important direct consequences of surface water pollution. It is a direct result of inadequate water and soil resources, as well as an immediate cause of water resources degradation.

- **Accelerated runoff and erosion**

  The process of soil erosion due to inappropriate forest management and land use, and environmentally unsound industrial activities cause an aggravation of water pollution through carried sediments, an alteration of the river beds and a decrease in reservoir capacities, thereby restricting navigation and reducing the recreation and scenic value of the surrounding area. The flow coefficient has increased as a result of deforestation, leading in its turn to an increase in the degree of surface flow and, to a lesser extent, micro-climatic changes, including through reduction of lake area in wet areas. Soil productivity in the Danube countries cannot be economically sustained unless erosion is reduced.

4.1.5. Ultimate Effects of the Core Problem

The following ultimate or indirect direct consequences of the core problem have been identified:

- **Decline in the quality of life**

  The quality of life of the population in the DRB countries is an ultimate effect of the deterioration of ecosystems, including changes in the water quality and water regime, negative effects of soil pollution, pressure on land and limited financial resources. Five factors have combined to pose a serious threat to the welfare of the population in the contaminated areas: the existence of real and potential health hazards in various working and living environments, a lack of resources that would facilitate the identification, evaluation and control of the potential safety and health hazards, an absence of personnel trained in the science of occupational health and safety, a lack of monitoring equipment for quantifying the potential stress agents and a lack of funding for the implemention of the controls necessary to alleviate exposures. The consequences are reflected in the lower birth rate, shorter life expectancy and genetic changes. They have become responsible for the decreased living standard. The estimates of wealth reveal significant national imbalances throughout the economies of the riparian countries of the upper, middle and lower regions among the three forms of wealth: human capital, produced assets, and natural resources

- **Human health risk**

  Environmental hazards to human health are mediated by air, soils, and by water. The key causes of the increase in public health risks include: heavy pollution of surface and groundwater by sewage, excessive application of agrochemical, emissions and spills of industrial chemicals and pathogenic pollutants, a lack of central public water facilities and a lack of proper treatment of drinking water.

- **Degradation of biodiversity**

  The lack of balance between the structure and composition of biocenosis has led to degradation of fauna and flora in the watercourses. The high concentration of pollutants has led to a disruption of ecosystems. The pollution of surface water has also affected the recreation potential of the rivers and the riparian areas. The inappropriate location of solid waste landfills, polluted effluents from wastewater pre-treatment plants and inefficient management of municipal wastewater has produced disturbances in the biodiversity and in the overall functioning of the ecosystems. Uncontrolled or degraded land use has triggered a chain of repercussions having adverse effects on biodiversity, with the risk that, under extreme environmental conditions, the superimposed impacts may in several locations in the region lead to a degradation of arable land, eutrophication of natural and artificial lakes and a loss of biodiversity.

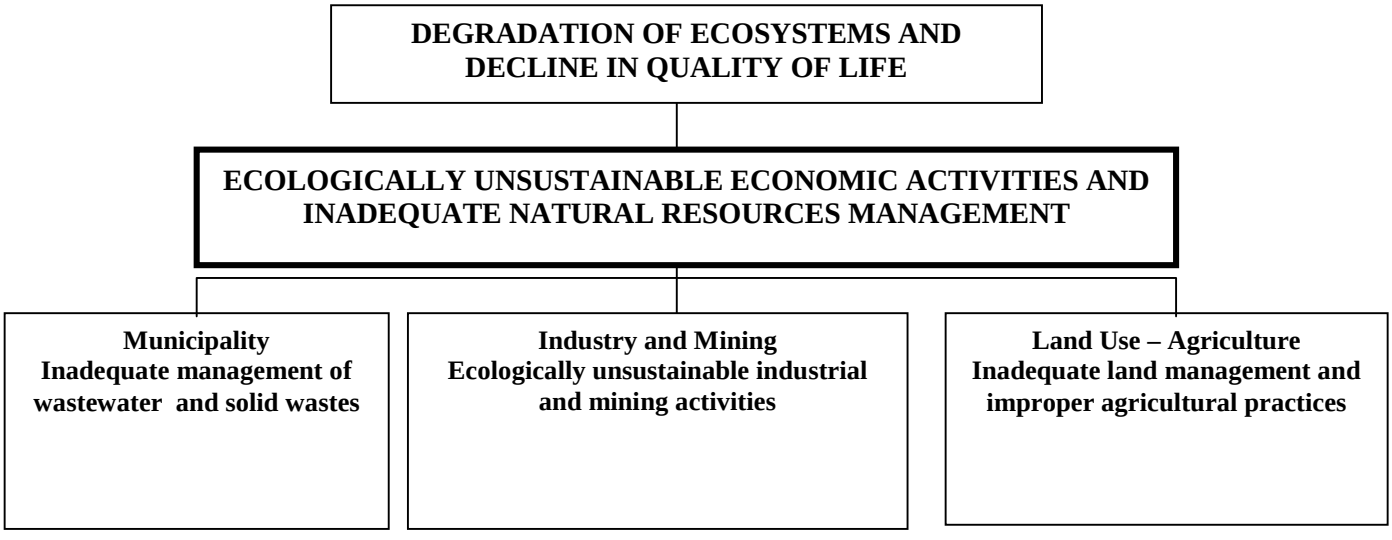
- **Economic decline**

  A lack of appropriate water demand management has not encouraged the adoption of a cost-effective mix of supply and resource conservation measures in the agricultural and industrial sectors. The current pricing incentives have failed to provide a motivation to use water efficiently. The water services are under-priced owing to the use of subsidies and the current market prices that ignore the damage caused by pollution emissions. Tourism represents an important source of income for the local people in some areas. The environmental destruction, the significant disruption of the well being of local communities, the deteriorated lifestyle and the reduced security of access to local resources all point in the direction of reduced development possibilities of the middle and especially the lower Danube regions.

- **Reduced availability of water**

  The surface and groundwaters are affected by pollution by nitrates, heavy metals, organic matters, or microbiologically contaminated due to the use of inadequate agricultural practices, discharge of wastewater from the municipal sector, and inefficient pre-treatment of toxic and other untreated waters released from the industry. Inadequate storage, handling and especially transportation are the main causes of pollution by industrial chemicals. Heavy pollution of surface and ground water by untreated or insufficiently treated sewage poses a serious threat to numerous sources of drinking water supplies. Increased concentrations of phosphorus and nitrogen have resulted in latent eutrophication of the main watercourses and have led to a critical level of eutrophication in the Black Sea. In some regions, water availability is endangered not only by pollution, but also by inappropriate reallocation among the users.

Diagram of Problem Analysis



4.1.6. Analysis of Hot Spots and Diffuse Sources of Pollution (Causes)

The major pollution sources referred to as “hot spots” are identified and grouped by sector (municipal, industrial and agricultural) according to their determined characteristics. The description of the hot spots and diffuse sources of pollution is based on the existing factors such as types of activities involving pollution release, common practices causing transboundary effects or size of the load of critical parameters.

The hot spots that, as emitters, bear the primary responsibility for the environmental disturbances include:

i. insufficiently dimensioned water supply schemes that may develop negative impacts on human health;
ii. municipal water sewage treatment plants discharging low quality water, and
iii. non-existing or under-dimensioned industrial and agricultural wastewater treatment plants.

Other hot spots, which as receivers of pollutants represent secondary sources of environmental degradation, include biodiversity reservoirs, wetlands, ecosystems and habitats or population. The hot spots are prioritised into three levels: high, medium or low priority, in order to facilitate their comparison, technical and economic evaluation and their ranking in a systematic and unified format. For each existing hot spot, the emissions are updated for critical parameters concerning nutrients such as N, P, BOD or COD as well as other parameters such TOC, pathogens, specific metals and other particular hazardous chemicals, including oil.

A list of high and medium priority hot spots is given in Annex II, and a list of data indicating estimated pollution from point sources is presented in table 4.1.6-1. Map No. 9 shows the location of hot spots by country and by sub-basins area.

Table 4.1.6-1 Estimation of pollution from point sources t/year

Sector Pollution	Municipality	Industry	Agriculture	Total
BOD	250,683	73,072		323,755
COD	605,667	245,183		850,850
N	179,000-222,000	43,000-55,000	10,000 - 15,000	232,000 - 292,000
P	34,900 - 44,000	6,200-10,700	2,000 - 4,100	43,100 - 58,800

Concerning diffuse pollution, estimations are taken from the Mass Balance Model indicating the following results:

Table 4.1.6-2 Estimation of pollution from diffuse sources in kt/year

Country pollution	D	A	CZ	SK	H	SLO	CR	YU	BIH	BG	RO	MD	UA
N	100	72	19	40	63	12	27	74	29	16	157	12	31
P	5.8	4.6	0.8	2.6	7.8	1.4	2.7	7.9	1.9	2.5	15.6	2.0	4.6

4.1.7. Analysis of Significant Impact Areas and Transboundary Effects within the Danube River Basin (Effects within the Danube River Basin)

The locations in the Danube basin marked by a distinct combination of cumulative pollution effects have been identified and classified as Significant Impact Areas. The simultaneous presence of

i. one or more sources of pollution,
ii. adverse impacts of the pollution sources on recipient water or other natural receiver,
iii. environmental significance of valuable wetlands or various ecologically sensitive places, and
iv. major transboundary effects

represents examples of categories of effects on the favoured significant impact areas.

The analysis and comparison of the significant impact area has been used to facilitate the selection of the possible alternative interventions in the Danube basin. The size of the fifty-one selected significant impact areas varies from 5,029 km^2 (Western & Southern Morava) to 20 km^2 (Rossitza at Sevlievo). The identified significant areas are shown in Map 10.

4.1.8. Effects on Black Sea Ecosystems (Regional Transboundary Effects)

The anthropogenic pollution, the change in the hydrological regime and the intensified fishery capture have contributed to nutrient enrichment, overfishing and a loss of biodiversity in the Black Sea region. The eutrophication-overfertilization of the sea by nutrients from land-based sources is one of the most serious environmental problems of the Black Sea, one of the key explanations for its environmental decline over the past decades, and the principle cause of degradation of the Black Sea environment.

The main causes of regional transboundary effects on the Black Sea ecosystem include:

- pollution caused by unsound agricultural activities,
- deforestation,
- industrial discharges threatening the existing wetlands.

Evidence of extensive studies shows how the structure of the ecosystem has been damaged at every level, from plants to fish and mammals.

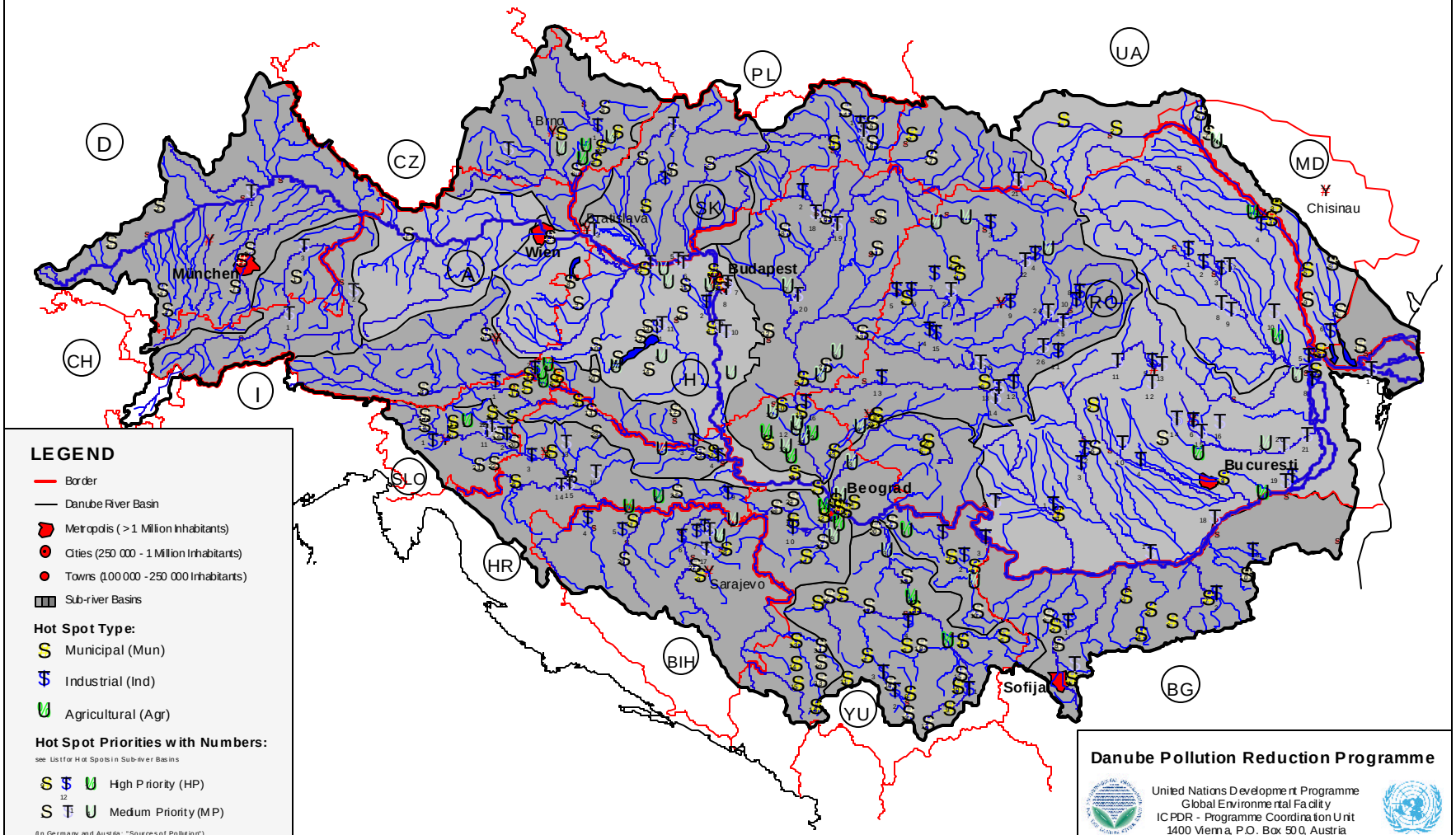
The required interventions involve nutrient discharge control measures that need to be implemented in line with the expected economic growth. These measures fall within four categories:

- improvement of wastewater treatment technologies
- rehabilitation of essential aquatic ecosystems
- reform of agricultural policies and legislation
- changes in the consumer practices

These measures are taken into account in the Danube Strategic Action Plan and its related investment programmes, which will contribute towards the improvement of the Black Sea ecosystem.

Map 9: Distribution of Hot Spots in the Danube Sub-river Basins

Based on National Planning Workshop Reports 1998, Updates March 1999



LEGEND

- Border
- Danube River Basin
- Metropolis (> 1 Million Inhabitants)
- Cities (250 000 - 1 Million Inhabitants)
- Towns (100 000 - 250 000 Inhabitants)
- Sub-river Basins

Hot Spot Type:

- S Municipal (Mun)
- $ Industrial (Ind)
- U Agricultural (Agr)

Hot Spot Priorities with Numbers:

see List for Hot Spots in Sub-river Basins

- S $ U High Priority (HP)
- S T U Medium Priority (MP)

(In Germany and Austria: "Sources of Pollution")

50 0 50 100 Kilometers

Scale: 1: 4 500 000

N

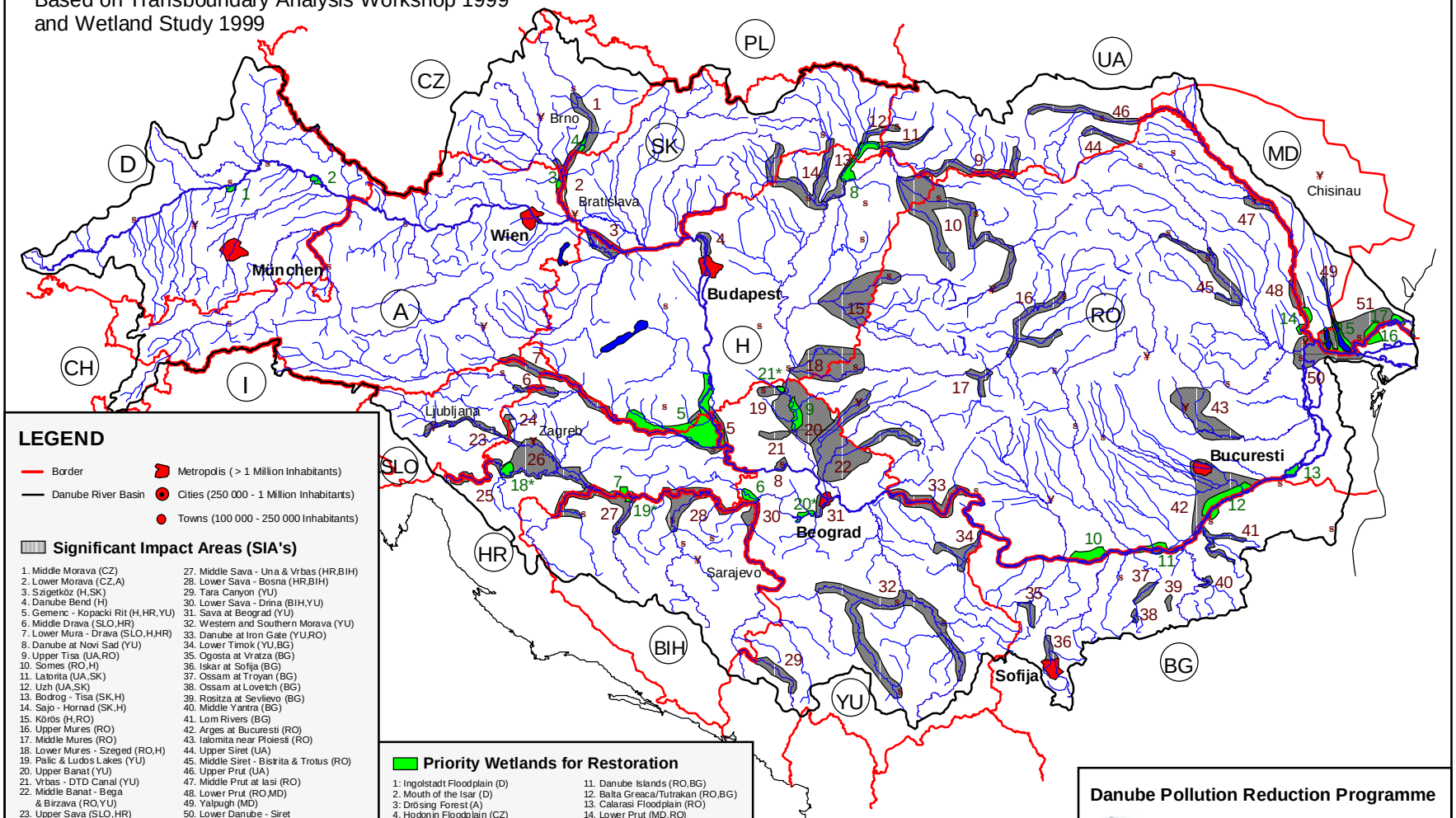
Danube Pollution Reduction Programme

United Nations Development Programme
Global Environmental Facility
ICPDR - Programme Coordination Unit
1400 Vienna, P.O. Box 500, Austria

Produced by ZINKE ENVIRONMENT CONSULTING
for Central and Eastern Europe, Vienna, 1999
(Cartography by U.SCHWARZ)

Map 10: Significant Impact Areas and Priority Wetlands for Restoration

Based on Transboundary Analysis Workshop 1999
and Wetland Study 1999



LEGEND

- Border
- Danube River Basin
- Metropolis (> 1 Million Inhabitants)
- Cities (250 000 - 1 Million Inhabitants)
- Towns (100 000 - 250 000 Inhabitants)

Significant Impact Areas (SIA's)

1. Middle Morava (CZ)
2. Lower Morava (CZ,A)
3. Szigetköz (H,SK)
4. Danube Bend (H)
5. Gemenc - Kopacki Rit (H,HR,YU)
6. Middle Drava (SLO,HR)
7. Lower Mura - Drava (SLO,H,HR)
8. Danube at Novi Sad (YU)
9. Upper Tisa (UA,RO)
10. Somes (RO,H)
11. Latorita (UA,SK)
12. Uzh (UA,SK)
13. Bodrog - Tisa (SK,H)
14. Sajo - Hornad (SK,H)
15. Körös (H,RO)
16. Upper Mures (RO)
17. Middle Mures (RO)
18. Lower Mures - Szeged (RO,H)
19. Palic & Ludos Lakes (YU)
20. Upper Banat (YU)
21. Vrbas - DTD Canal (YU)
22. Middle Banat - Bega & Birzava (RO,YU)
23. Upper Sava (SLO,HR)
24. Sutla (SLO,HR)
25. Kupa (SLO,HR)
26. Middle Sava - Kupa (HR)
27. Middle Sava - Una & Vrbas (HR,BIH)
28. Lower Sava - Bosna (HR,BIH)
29. Tara Canyon (YU)
30. Lower Sava - Drina (BIH,YU)
31. Sava at Beograd (YU)
32. Western and Southern Morava (YU)
33. Danube at Iron Gate (YU,RO)
34. Lower Timok (YU,BG)
35. Ogosta at Vratza (BG)
36. Iskar at Sofija (BG)
37. Ossam at Troyan (BG)
38. Ossam at Lovetch (BG)
39. Rositza at Sevlievo (BG)
40. Middle Yantra (BG)
41. Lom Rivers (BG)
42. Arges at Bucuresti (RO)
43. Ialomita near Ploiesti (RO)
44. Upper Siret (UA)
45. Middle Siret - Bistrita & Trotus (RO)
46. Upper Prut (UA)
47. Middle Prut at Iasi (RO)
48. Lower Prut (RO,MD)
49. Yalpugh (MD)
50. Lower Danube - Siret & Prut (RO,MD,UA)
51. Ukrainian Delta & Liman Lakes (UA)

50 0 50 100 150 Kilometers

Scale: 1: 4 500 000

N

Priority Wetlands for Restoration

1: Ingolstadt Floodplain (D)
2. Mouth of the Isar (D)
3: Drösing Forest (A)
4. Hodonin Floodplain (CZ)
5. Gemenc - Béda - Karapancsa (H), Kopacki Rit (HR,YU) & Ormánság (H)
6. Mouth of the Drina River (BIH,YU) & Bosut Forest (YU)
7. Floodplain next to Mokro Polje (HR)
8. Lower Bodrog (H,SK)
9. Lower Tisa (YU)
10. Balta Potelu (RO,BG)
11. Danube Islands (RO,BG)
12. Balta Greaca/Tutrakan (RO,BG)
13. Calarasi Floodplain (RO)
14. Lower Prut (MD,RO)
15. Liman Lakes (UK,MD)
16. Polder Pardina (RO)
17. Ukrainian Danube Delta (UA)
18. Kupa Floodplain (HR)*
19. Mouth of the Vrbas River (BIH)*
20. Obedska Bara (YU)*
21. Palic and Ludos Lakes (YU)*

* added on Transboundary Analysis Workshop

Danube Pollution Reduction Programme

United Nations Development Programme
Global Environmental Facility
ICPDR - Programme Coordination Unit
1400 Vienna, P.O. Box 500, Austria

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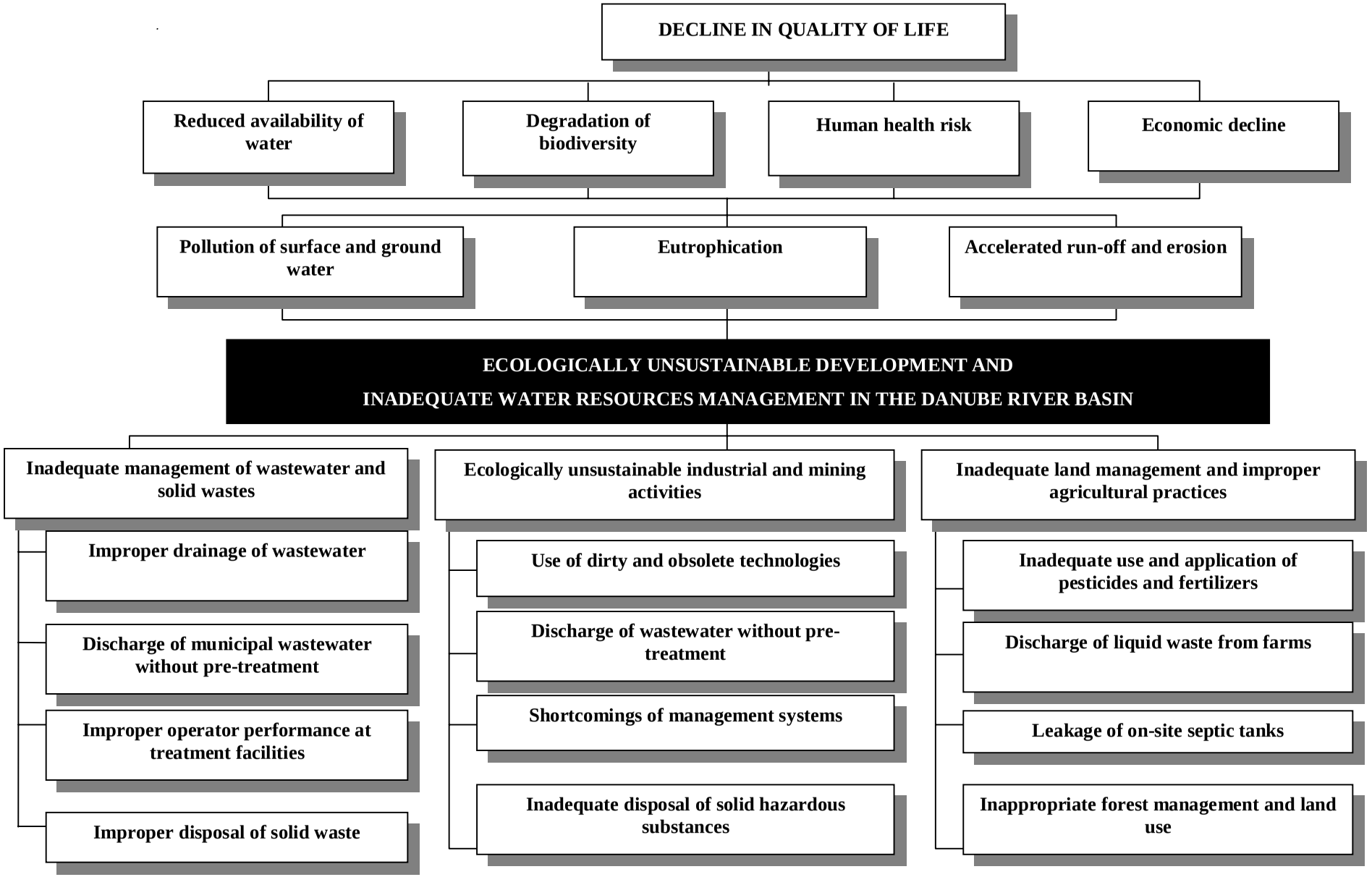
for Central and Eastern Europe, Vienna, 1999
(Cartography by U.SCHWARZ)

Chart 4 General Problem Hierarchy



4.2. Analysis of Objectives and Targets for Pollution Reduction and Sustainable Water Management

4.2.1. Description of Objectives

The specific programme and sector objectives contribute to the **Overall Development Objective**, which was defined in the National Planning Workshops as follows:

"ACHIEVEMENT OF SUSTAINABLE DEVELOPMENT IN THE DANUBE RIVER BASIN"

For the ICPDR-Action Plan, the Objective as described in the Convention is as follows:

"PROTECTION AND SUSTAINABLE USE OF WATERS OF THE DANUBE RIVER BASIN"

Starting from this as an overall ICPDR programme objective, specific objectives have been identified for the following sectors:

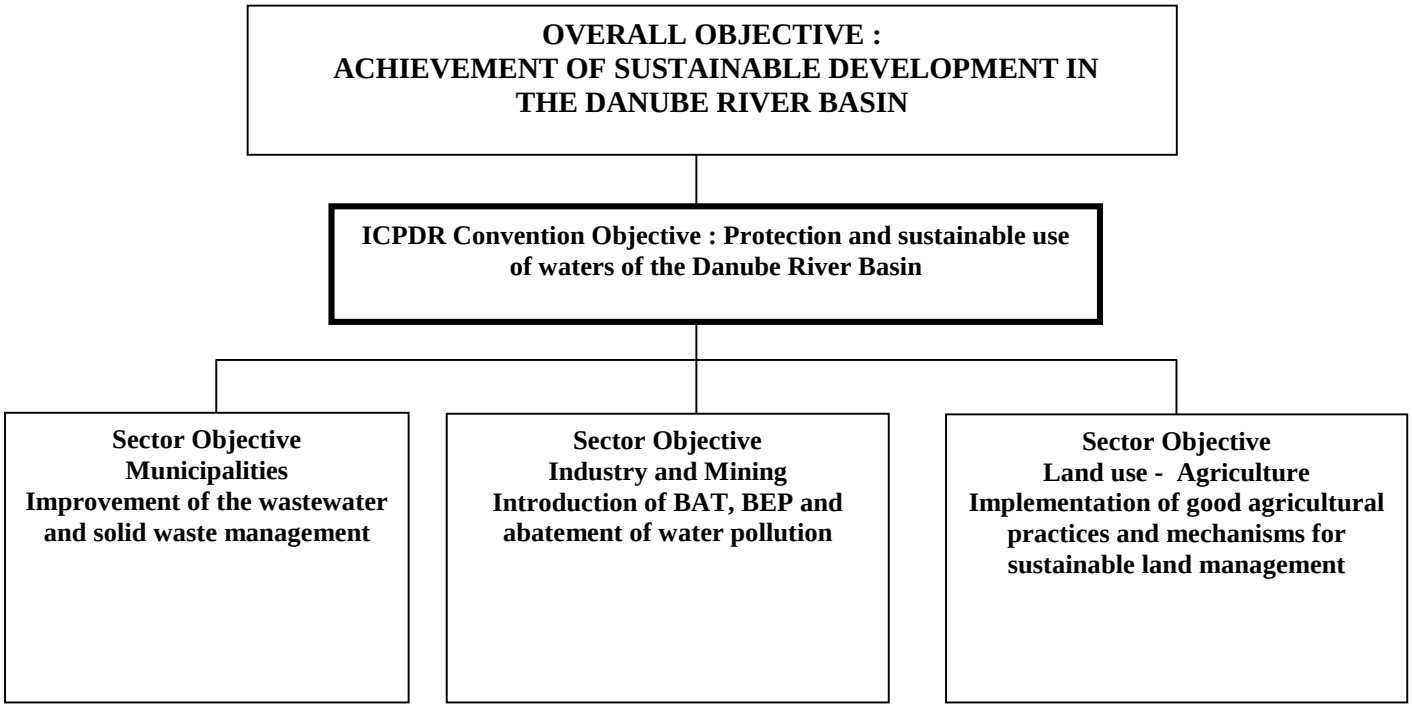
- **Municipalities:** Improvement of wastewater and solid waste management
- **Industry and Mining:** Introduction of Best Available Techniques (BAT), Best Environmental Practices (BEP) and abatement of water pollution
- **Land Use – Agriculture:** Implementation of good agricultural practices and mechanisms for sustainable land management

All these objectives will contribute to improvement of water quality in the Danube River Basin and mitigate effects of pollution on ecosystems not only in the DRB, but also in the Black Sea.

In this context, the objective as stipulated in the Convention is:

"REDUCTION OF POLLUTION LOADS, IN PARTICULAR NUTRIENT TRANSPORT TO THE BLACK SEA"

Diagram of Objective



4.2.2. Expected Results (Outputs) and Targets by Sectors of Intervention

In order to achieve the programme objective, measures have to be undertaken in the following priority sectors:

A. Municipalities

The absence of municipal wastewater treatment plant for the majority of the settlements, improper operation of the existing ones and obsolete and insufficient sewage systems have led to substantial pollution of the surface and groundwater with nutrients. The objectives of the sector include: implementing environmentally sound waste management practices by developing funding mechanisms; introducing a proper monitoring system; considering appropriate legislation, including technical and financial regulations; raising public awareness and commitment; eliminating weaknesses in the operation of wastewater treatment plants by optimising technologies and sludge treatment, developing human resources and managerial skills; operating sewage systems efficiently by expanding the existing network and developing an information system, introducing sound management of the systems and optimising operation activities by introducing modern repair equipment. A major weakness of the past approaches has been excessive reliance on the centralised structures to manage the water resources. The unsatisfactory performance has caused many countries of the Danube basin to seek efficiency gains through decentralisation and greater reliance on pricing and incentives.

The expected results/outputs in relation to the Sector Objective include:

- **Operation of extended and upgraded public sewer system**
- **Assurance of appropriate wastewater treatment**
- **Application of proper solid waste management**

B. Industry and Mining

The structure of industrial production in the countries of the Danube basin, developed under the centrally planned economy was heavily distorted by a rigid pricing system, subsidies to producers and consumers, monopoly and strict administrative regulation.

The policies of growth with no regard to environmental costs are of the past for governments and the diversity of three perspectives: economic, socio-cultural, and environmental needs and concerns suggests that there is no universally "right" or "wrong" policy path to achieve environmentally sustainable development in any country in the Danube river basin. The impacts of the policy changes can be seen in the down-sizing of operations in a number of enterprises in this region and outright closures for reasons of unacceptably high inefficiency, low competitiveness and pollution impacts.

The general lack of sustainability of industrial practices due to the heavy economic frame caused by the transition has also led to unfavourable environmental consequences to the extent that they pose serious threats to health in many parts of the middle and lower Danube regions. In industrial areas, the wastewater is often discharged into the municipal sewage system. This peculiarity (in combination with the absence of economic mechanisms for water supply adjusting) stipulates the principal difference in designing, construction and operation of water supply, sewerage and water cleaning equipment.

The major polluting industries are: ore mining activities; chemical and petrochemical industries; pulp and paper; metal works and machinery; food industry and textile industry. In view of the significant damage done to the natural environment, the governments of the Danube basin are committed to a development policy that integrates environmental considerations. Such a policy enables the conservation of natural resources, the avoidance of irreversible damage to the

environment and the achievement of long- term economic growth on a sustainable basis. Sector industrial policies have been set up together with a programme of rationalisation of the production system and investments in the new macroeconomic environment. The introduction of policies that force producers to compete in open markets leads to restructuring away from heavy industries and towards less polluting lighter industries, clean technologies and services. Favourable impacts on the environment come from price liberalisation and removal of subsidies, privatisation, competitive markets, fiscal reform, and a new interest and exchange rate policy.

The expected results in relation to the Sector Objective include:

- **Introduction of clean technologies and abatement of water pollution**
- **Implementation of wastewater pre-treatment**
- **Ensuring adequate management of enterprises**
- **Treatment and disposal of hazardous substances in proper landfills**

C. Land Use - Agriculture

Since most of the countries of the Danube region have a significant agricultural potential and a long agricultural tradition, agriculture is today their most important economic branch. Unfortunately, the present farming system, known as "conventional farming", has produced progressive social and economic results on the one hand and serious environmental damage on the other, mainly on water and soil, the countries' vital resources, and consequently on bio-diversity as the genetic basis, and on human health. The main problems caused by agricultural activities in all the countries of the Danube basin are due to the inappropriate use of fertilizers and pesticides causing alteration in the nitrogen balance and an increase of pesticides in soil and water. If the potential synergetic effects are considered, there are several pieces of evidence testifying to the irrational and uncontrolled use of land resources, with considerable anthropogenic pressure, which calls for an essential improvement of the land management system.

The main polluters include large animal husbandry units, crop and fruit-tree farms, mechanical companies, and agricultural land and forest units. Disposal of animal waste on platforms or drying beds with inappropriate or no treatment (mainly at pig farms, which generate large volumes of wastewater) has prevented it from being reintroduced in the natural energy cycle through fertilization in the field and has resulted in its disposal beyond the safety capacities or - more seriously - in the drainage canals, from which it reaches the emissary.

The inappropriate land use, together with extensive deforestation, has led to soil erosion. The recently-developed private agricultural sector is very fragile, without sufficient support and laden with innumerable obstacles, which has resulted in substantial positive economic changes, benefiting the new owners, and in stopping or even decreasing pollution of water and soil as natural resources. This paradox is explained by the decrease in the amount of fertilizers and pesticides used in agriculture as a consequence of their excessive prices as compared to the financial power of the new farmers, as well as by quite frequent subsistence farming.

The expected results/outputs in relation to the Sector Objective include:

- **Application of integrated land and water management**
- **Adoption of adequate use of pesticides and fertilizers**
- **Proper treatment of wastewater discharged by farms**
- **Prevention of accelerated runoff and erosion**
- **Adequate protection and restoration of wetlands and floodplains**

4.2.3. Important Assumptions for the ICPDR Programme and Sector Objectives

Important Assumptions are essential for the implementation of policies and strategies of the ICPDR Action Programme (pollution reduction measures), but they lie outside the scope of the ICPDR rather than under its direct control. Therefore, they are external factors, which will ensure the success of the implementation of the policies, strategies and actions and the sustainability of its results.

The following important assumptions for the implementation of the ICPDR Programme objectives have been identified:

- **Guaranteed willingness for long-term implementation of sustainability principles in the governments policies**

  The diversity of economic, socio-cultural, and ecological needs and concerns suggests that there is no universally "right" or "wrong" policy path to achieve environmentally sustainable development. The governments have considerable knowledge and experience in designing environmental policies to make the world wealthier while at the same time preserving its environment for future generations. The excessive use of the ecosystem as a pollution sink is likely to undermine the health of ecosystems, impose constraints on economic development, and above all, jeopardize human health. The governments of the countries located in the Danube basin need to include environmental concerns among their top priorities and target with their efforts those activities that are likely to bring about the greatest health improvements at the lowest cost. Moreover, the national governments pursue a sound environmental policy by enacting environmental laws and regulations that support measurable environmental progress and include principles embraced at the 1992 Rio Earth Summit, such as "polluter and beneficiary pay," "intergenerational equity," "environmental impact assessment," "public participation," and the "precautionary principle." Finally, some measure is also needed as concerns the budgetary resources allocated for environmental protection.

- **Strengthened cooperation between the countries within the Danube basin**

  Given both the inadequate state of empirical evidence regarding the impact of human activities on natural resources and the need for technical experts to provide policymakers with advice about trade-off among competing long-term goals and actions, the policymakers, technical experts, and the public must all share both knowledge and responsibility. Effective cooperation and open discussions of the transboundary effects, impacts and priorities and countries' most pressing current concerns is therefore an essential first step toward achieving pollution reduction and environmentally sustainable development in the basin and to support cooperative work between riparian countries.

The following assumptions have been identified for the Sector Objectives of the ICPDR Action Plan:

Municipalities:

- **Achievement of higher levels of environmental compliance and pollution abatement**

  The main challenge for the countries in the Danube basin is to stimulate an optimal level of investment in environmental compliance and abatement. A lot of attention needs to be paid to the choice and design of economic instruments with the aim of “getting the price right” as to generate a more efficient allocation of environmental goods and services and reduce the society-wide costs of environmental compliance.

Industry and Mining:

- **Enforcement of BAT and BEP regulation in industrial sector by authorities remains priority**

  The adoption of BAT and BEP regulations, i.e. of modern production technologies that generate much less waste and consume minimum of energy is the most satisfactory long term solution and has economic as well as environmental benefits (win-win). The use of incentives for adopting technologies to increase efficiency of water allocation and distribution can encourage firms to adopt water saving technologies, including reuse systems.

Land Use - Agriculture:

- **Progressive implementation by the governments of adequate policies leading to sustainable land use (wetland restoration) and agricultural practices**

  Integrating land use policies and practices with water management in the Danube river basin plays an important role in the formulation of the countries' water strategies. The application of sustainable land use practices needs to be seen in the context of political structures and the newly-introduced privatization policies in the agriculture. The governments should intensify their efforts directed towards introducing a combination of market incentives and regulatory policies with a view to reducing pollution, soil erosion, waterlogging and runoff. The governments should commit to introducing economic incentives for the adoption of land use practices leading to a better protection of the environment and to a significant increase of social and economic stability.

4.2.4. Impact Indicators for the ICPDR Programme and Sector Objectives

Impact Indicators have been developed for both the ICPDR Programme Objective (implemented through the Action Plan) and the sector objectives. They define the contents of the objectives in operationally measurable terms (quantity, quality, target groups, partner institutions, time period and place) offering a realistic picture of the situation. Furthermore, they are measurable in a consistent way at an acceptable cost (follow-up and monitoring).

The impact indicators for the implementation of the Programme and the Sector Objectives of the ICPDR Action Plan have to be identified:

For the programme objectives:

- **Significant reduction of surface and groundwater pollution shall reduce health risks and enhance the preservation of biodiversity by the year 2005 in the Danube basin**

  Efforts at the national level related to pollution abatement and policy reform should focus on targeted enterprises and communities. Plants need to reduce emissions and improve occupational health and safety measures, while at the same time making communities adjacent to the pollution sources aware of the health hazards and assisting them in addressing these problems.

Municipalities:

- **Country-specific emission reduction of BOD achieved by the year 2010. Soil contamination and impact on natural water bodies controlled through appropriate solid waste management by the year 2010**

  There are large differences between the countries of the Danube Basin in the field of municipal public supplies. Because of the different development levels in the countries, it is not possible to use basin-wide overall impact indicators for measuring the extent to

which a sector objective has been met. Quantifiable indicator is considered in this respect as country specific indicators on emission load reduction percentages coming from the sector results in each Danube countries.

Industry and Mining:

- **Organic and inorganic effluents reduced up to 30% by the year 2010, and discharge permits for industrial and mining enterprises with regard to BAT/BEP examined and revised by the year 2005**

  Industry and mining represent the major sources of pollution in DRB, but efforts are being made to reverse this negative effect. It is of the utmost importance to achieve this impact indicator which can only be reached by introducing a system of issuing and continuously reviewing discharge permits for significant industrial and mining enterprises with regard to BAT/BEP.

Land Use - Agriculture:

- **A 15% and 20% increase in the application of good agricultural practices in large farms by the year 2005 and 2010 respectively**

  By establishing agricultural extension services (modern control systems for soil fertility, prevention and quarantine services and pest control services, ecological education of farmers, etc.) and by properly using the land, conditions will be created for producing high quality food products. The EU has been struggling to develop indicators, but has so far failed to agree to establish any additional statistical services. The Danube basin countries should start by following the lessons learned from the EU debate and its outcome. They should monitor the progress indirectly through the measurement of discharges and N, P and sediment concentrations and loads in the river as well as the concentrations of pesticides in the river and groundwater.

4.2.5. Impact Indicators for Nutrient Reduction in the Black Sea

Considering the results of the Joint Ad-hoc Technical Working Group of the ICPDR and the ICPBS and taking into account the limited historical data available on nutrient inputs to the Black Sea, it is difficult to set clear ultimate targets for the reduction of nutrient from the Danube River Basin. It seems that the collapse of the Black Sea ecosystems occurred rather abruptly, but it is difficult to establish a linear cause-effect relationship for the eutrophication process. However, the partial recovery of the Black Sea ecosystems is attributed to a reduced nutrient load in particular that coming from the Danube River. Due to the construction of modern waste-water treatment plants in the Danube upstream countries (Germany and Austria) and due to the social and economic changes leading to reduced agricultural and industrial activities in the middle and downstream Danube countries, nutrient loads have decreased since 1992. The effects are remarkable but still need to be further analyzed and confirmed.

In this context, the Joint Ad-hoc Technical Working Group has formulated a series of goals that can be expressed in the following indicators:

- **In the short and medium terms**, owing to the adoption of appropriate strategies, in particular in the transition countries, that will permit economic development while at the same time ensuring a recovery of the agricultural and industrial sector activities, the discharge of nutrient and hazardous substances into the Black Sea shall not exceed its 1997 level;

- **In the long term,** the Black Sea ecosystems shall recover to conditions similar to those observed in the 1960s through a progressive reduction in the loads of anthropogenically-applied nutrients and hazardous substances in all the countries of the Black Sea Basin.

Taking into account the measures and actions identified in the frame of the Pollution Reduction Programme (pollution reduction from point sources of pollution), it can be assumed that:

The nutrient load reaching the Black Sea from the Danube River Basin will by the year 2010 be reduced by 13,9 0% for nitrogen (from the current 566 kt/a to 487 kt/a) and by 27,4 % for phosphorus (from the current 48,8 kt/a to 35,4 kt/a).

Program Planning Matrix

Objectives and Results/Outputs	Impact Indicators	Important Assumptions
➢ **Overall Objective:** Achievement of sustainable development in the Danube River Basin		
➢ **Program Objective:** Protection and sustainable use of waters of the Danube River Basin ➢ **Black Sea Protection Objective:** Reduction of pollution loads, in particular nutrient transport to the Black Sea	➢ **Significant reduction of surface and groundwater pollution shall reduce health risks and shall enhance preservation of biodiversity by the year 2005 in the Danube basin** ➢ **In short and medium terms, owing to the adoption of appropriate strategies, in particular in the transition countries, that will permit economic development, while at the same time assuring a recovery of the agricultural and industrial sector activities, the discharge of nutrient and hazardous substances into the Black Sea shall not exceed its 1997 level** ➢ **In the long-term, the Black Sea ecosystems shall recover to conditions similar to those observed in the 1960s through a progressive reduction of the loads of anthropogenically applied nutrients and hazardous substances in all countries of the Black Sea Basin** ➢ **The nutrient load reaching the Black Sea from the Danube River Basin will be reduced by the year 2010, by 13,9 % for nitrogen (from current 566 kt/a to 487 kt/a) and by 27,4 % for phosphorus (from current 48,8 kt/a to 35,4 kt/a)**	➢ **1. The willingness for long-term implementation of sustainability principles in the governments policies guaranteed** ➢ **2. Strengthening cooperation between the countries within the Danube basin**
➢ Sector Objectives: 1. **Municipalities:** Improvement of the wastewater and solid waste management **2. Industry and Mining:** Introduction of BAT and BEP and abatement of water pollution **3. Land Use - Agriculture:** Implementation of good agricultural practices and mechanisms for sustainable land management	➢ **1. Country specific emission reduction of BOD by 2010 achieved. Soil contamination and impact on natural water bodies controlled through appropriate solid waste management, by the year 2010.** ➢ **2. Organic and inorganic effluents reduced up to 30% by 2010, and discharge permits for industrial and mining enterprises with regard to BAT/BEP examined and revised by the year 2005.** ➢ **3. Increased application of good agricultural practices by 15% in large farms by the year 2005 and by 20% by the year 2010**	➢ **1. Achievement of higher levels of environmental compliance and abatement** ➢ **2. Enforcement of BAT and BEP regulation in industrial sector by authorities remains priority** ➢ **3. Governments are progressively implementing adequate policies leading to sustainable land use (wetland restoration) and agricultural practices**
➢ Results / Outputs: **1. Municipalities:** 1.1 Extended and upgraded public sewer systems operated 1.2 Appropriate waste water treatment assured 1.3 Proper solid waste management applied	➢ **1.1. Extension and improved management of existing sewerage systems and establishment of new ones achieved by the year 2005 in 90 % of municipalities with population over 5000** ➢ **1.2. Integrated approach to sewer systems and treatment of waste waters applied by the year 2010 in 70% of settlements in DRB with population over 5000** ➢ **1.3. Separation of solid wastes by 3 components implemented by the year 2010 in 90 % of localities with population over 50 000**	➢ 1**.1. Implementation of strategy for urban sewerage** ➢ **1.2. Introduction of best available treatment technologies and implementation of polluter pays principle** ➢ **1.3. Implementation of solid waste management strategy**
2. Industry and Mining 2.1 Clean technologies and abatement for water pollution introduced 2.2 Pre-treatment facilities of industrial waste water implemented 2 3 Adequate management of the enterprises ensured 2.4 Hazardous substances treated and disposed in proper landfills	➢ 2**.1. Decreasing pollution (heavy metals and micropollutants) in line with the EU norms, at industrial plants with discharge bigger than 0.1 t COD/day, by using BAT/BEP by the year 2010** ➢ **2.2. Decreasing pollution in line with BAT and BEP, by the year 2010, by the construction of pre-treatment plants** ➢ **2.3. Adoption by industrial enterprises of internationally approved quality and environmental management systems (e.g. EMAS; ISO 9000/14000), by the year 2005** ➢ **2.4 Establishment of inventory of existing and abandoned landfills and application of appropriate measures to eliminate pollution of surface and ground water in old and newly constructed landfills, by the year 2010.**	➢ 2**.1. Favorable economic conditions in the country** ➢ **2.2. Continuation of cooperation with international financial institutions** ➢ **2.3 Implementation of environmentally sound industrial policy of the Governments** ➢ **2.4 Elimination of war effects**
3. Land Use – Agriculture 3.1 Integrated approach for land and water management applied 3.2. Adequate use of pesticides and fertilizers adopted 3.3 Waste waters discharged by animal farms properly treated 3.4 Accelerated run-off and erosion prevented 3.5. Wetlands and floodplains adequately protected and restored	➢ **3.1. By the year 2010, the integrated management of river basins has been achieved, in all DRB countries, through inter-sectoral and international cooperation and implementation of the EU directives** ➢ **3.2. By the year 2010, the number of certified organic farms will have increased by 20% and the N+P total fertilizer consumption on other farms will have stabilized at the 1998 level** ➢ **3.3. By the year 2005, 50% of all animal farms with over 500 livestock units will have been equipped with waste water treatment plants and by the year 2010 this figure will have reached 75%.** ➢ **3.4. In agricultural landscapes, lengths of hedgerows, forest belts and wind breaks will have increased by 25%, by the year 2010 and 2000 km of regulated rivers will have been restored in the DRB** ➢ **3.5 Through implementation of the wetlands priority projects, 110 000 ha of wetlands have been restored by 2005 and 140 000 ha by 2010.**	➢ **3.1. Increase intersectoral cooperation for capacity building in integrating environmental consideration in development planning and decision making** ➢ **3.2. Implementation of precautionary approach to achieve sustainable agriculture and rural development** ➢ **3.3. Governments's support for research, development and implementation of sustainable animal management methods** ➢ **3.4. Conditions for implementing policies and practices that reduce soil erosion and loss of fertility** ➢ **3.5 Commitment of the governments for securing, maintaining and restoring wetlands in the Danube River Basin**

5. Sector Strategies

5.1. Municipal Sector

5.1.1. Situation Analysis

5.1.1.1. Importance of the Sector, Analysis of Stakeholders and Activities Leading to Water Pollution and Environmental Degradation

Importance of the sector

The municipal sector has an important influence on the environmental quality of the Danube River Basin (DRB). A significant part of the pollution load entering the river systems originates from urban areas in the form of major point source discharges. The generated domestic and industrial wastewater, which is collected by the public sewer systems from the towns and urban settlements and discharged into the river basin usually contributes to a great extent to the nutrient load and microbiological pollution of the recipient water bodies. The rate of applied wastewater treatment varies widely between the Danube countries. Germany and Austria, the Upper Danube Basin (UDB) countries, have achieved a level of emission reduction and water pollution control. Countries in the Middle Danube Basin (MDB), and especially in the Lower Danube Basin (LDB) have been able to afford much less development in the field of municipal wastewater treatment facilities. Because of its close similarities with MDB countries in this respect, the Czech Republic, otherwise a UDB country, is herein discussed in the group of MDB countries.

The pollution load of the municipal sector originating from rural areas has had a much smaller impact on the river system, because much of the generated municipal wastewater is handled by individual treatment/disposal solutions. These methods involve the danger of soil and ground water contamination in the first place.

Municipal solid waste disposal sites are also a common cause of potential hazard for water resources, especially in cases which involve the application of improper technology or inappropriate location of the disposal site, often close to the river bank or watercourses and ground water aquifers.

Approximately 60 per cent of the overall amount of wastewater generated in the DRB comes from the municipal sector. This underscores the crucial role the sector has to play in the pollution reduction programme.

Sector policies

The main objectives of the general strategic approach adopted by the countries in the Danube Basin concerning the related municipal developments include:

- To increase sewerage and municipal wastewater treatment capacities;
- To reduce the pollution load of recipient water bodies in the DRB;
- To establish environmentally sound sectoral policy to protect the aquatic ecosystems and important water resources against pollution impacts;
- To establish efficient funding, legislation and control systems in compliance with the international standards for the implementation of development strategies.

The Danube countries are differently involved in the realisation of the above strategies, depending on the level of their economic development and their existing municipal infrastructure.

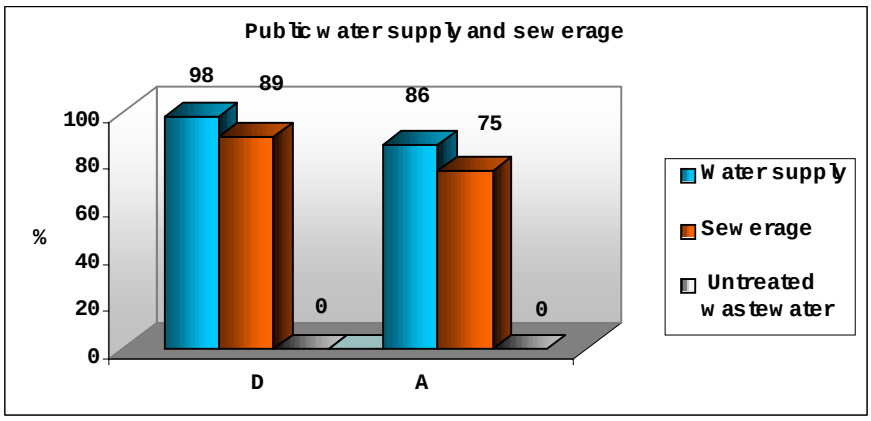
Provisions of the Convention

The provision on emission limitation for the municipal sector is contained in Article 7. of the Convention which states that the emission limits for municipal wastewater shall be based on the application of at least biological or an equivalent level of treatment. This provision is basically in accordance with the principles of the EU Council Directive 91/271/EEC concerning urban wastewater treatment. An important provision of the Convention requires the countries to define water quality objectives and apply water quality criteria for the purpose of preventing, controlling and reducing transboundary impact. Wastewater discharges should be based, without exception, on permits issued by the competent authorities. Another important provision, contained in Article 8, concerns the establishment of emission inventories and action programmes for the reduction of pollution loads and concentrations from both industrial and municipal point sources. The step-by-step implementation of these provisions in the Danube countries could substantially contribute to the reduction in the pollutant load in the river system.

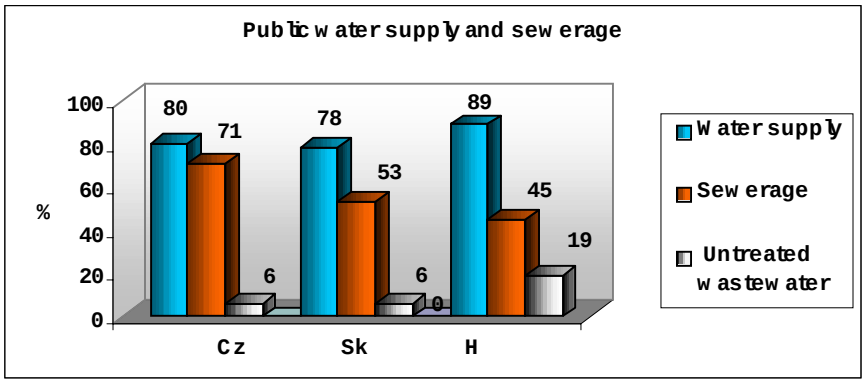
The provisions of the Convention are generally included in the municipal sector objectives and in the corresponding development objectives of the countries. However, the planned implementing schedules highly depend on the economic, legal and institutional capabilities of the different Danube countries.

Recent changes in the Danube countries.

Germany and Austria, upstream countries and members of the EU, have already reached a much higher level of municipal public supplies (drinking water supply, sewerage and wastewater treatment) than the middle and lower Danube countries. Their future development activities in the field of urban wastewater management will focus on activities geared towards meeting the specific requirements of the 91/271/EEC Directive on urban wastewater treatment. The graph shows the ratio in these two countries of the population in the territory of the Danube Basin connected to a central drinking water supply and a sewerage system. It also shows that all municipal wastewater is treated (biological treatment) before being discharged into the recipient**.**

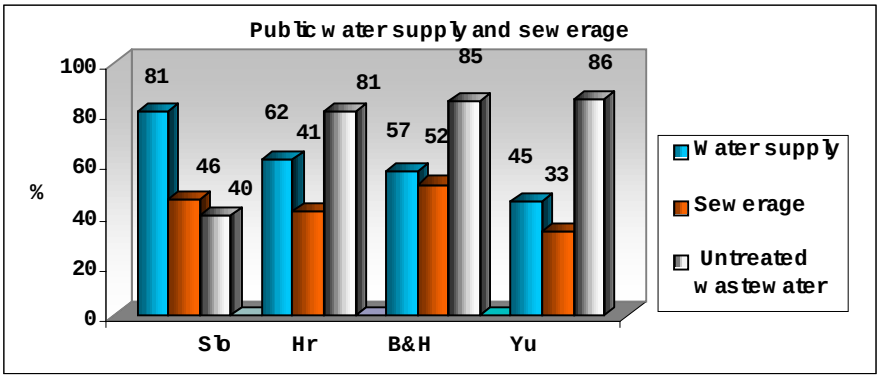


All other countries of the Danube Basin face some specific problems associated with the transition process triggered by the change of their political and socio-economic systems. The process of economic

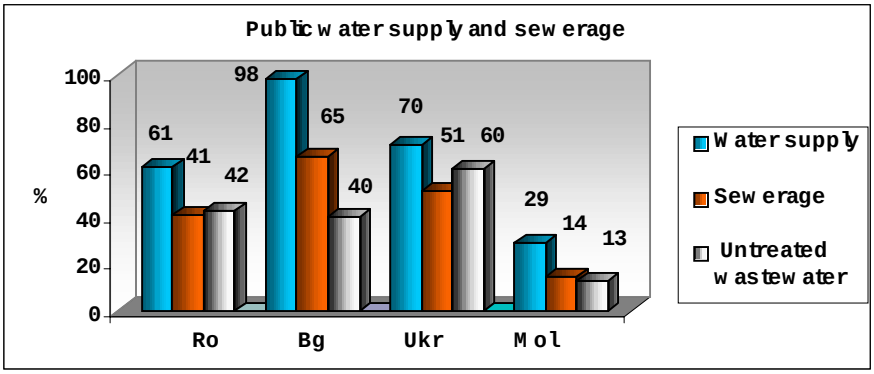


transformation has caused a significant decrease in industrial and agricultural production, resulting at the same time in a reduction in the related pollutant discharges. These countries have reached a different level of progress. At present, the countries located in the MDB (the Czech Republic, Slovakia, Hungary, Slovenia and Croatia) are in a more advantageous situation from the point of view of institutional and economic developments and municipal public supplies.

However, the relatively high ratio of the population supplied by central drinking water systems is coupled with a lower ratio of sewerage. The volume of untreated municipal wastewater is between 6-12 per cent of the total discharge, as illustrated, but in the case of Slovenia and Croatia it is higher than 40 per cent. All these countries are interested in joining the EU in the following decade. The Czech Republic and Hungary are priority candidates in this respect. These two accession countries are faced with difficulties in trying to meet the severe basic accession requirements, among others in the field of environmental protection and municipal wastewater treatment. Given the present situation in Bosnia-Herzegovina and Yugoslavia, also located in the MDB, pollution control is currently not high on the priority list of these two countries, in which the ratio of untreated municipal wastewater ranges between 85-86 %.



Countries of the LDB (Romania, Bulgaria, Moldova and Ukraine) are currently focusing on the essential questions of the transition process and are consequently placing much less emphasis on pollution control investments. The ratio of untreated municipal wastewater discharges is as much as 40-60 per cent, with the exception of Moldova, which reported about 14%.



Estimates regarding the prospects for population growth predict only minor changes in the next 15-20 years period compared to the present situation: 1-3 % growths in UDB countries, stagnant or decrease in MDB countries except the forecast 11 % increase in Slovenia. A slight increase is expected in LDB countries, except for a stagnant value in Bulgaria and a slight decrease in Moldova. Estimates on future (up to 2015-2020) municipal water demand show a decreasing tendency in UDB countries with a stagnant value of domestic per capita wastewater generation. The estimated municipal water demand provides a mixed picture in the countries of MDB and LDB; wastewater generation shows a general increase due to the planned intensive developments in sewerage systems and treatment plants.

Stakeholders

Sector stakeholders in the field of pollution impact are primarily those municipal sewerage and wastewater treatment systems in the Middle and Lower Danube Basin which supply only a limited portion of the population in urban areas, or which don't meet the required levels of pollutant load reduction. In many cases, untreated wastewater effluents have loaded the recipients in the MDB and LDB. Industrial discharges into the municipal sewer systems without proper pre-treatment have also generated pollution problems. In rural areas, the population itself could often be blamed for inadequate individual handling of domestic wastewater.

Authorities have a significant role to play in municipal pollution control. National government organisations should provide an effective legislative background and issue operating licences, while control of pollution belongs to district authorities (environmental, water and public health). Municipalities are responsible for local issues (sewerage, waste management). There is still a strong need in the countries of the Middle and Lower Danube Basin for further developments and harmonisation in these fields.

Pollution impacts from the municipal sector have adverse effects on the quality of surface and groundwater resources. Significant impact areas include difficulties in the sustainable use of water resources caused by an increase in chemical and microbiological pollutants in the recipient waters, health risk for the population, and a deterioration of the aquatic environment and biodiversity.

Main activities

The main activities (causes) contributing to water pollution in the municipal sector include:

- Untreated or inadequately treated municipal wastewater;
- Industrial discharges into public sewer systems without necessary pre-treatment;
- Unsuitable management/treatment of solid and liquid wastes;
- Operational and maintenance problems in the management of sewerage and treatment facilities.

5.1.1.2. Current Strengths/Assets

The most important strengths and assets currently available or under development for the pollution reduction in the Danube countries are as follows:

- **Know-how on wastewater treatment and waste reduction technologies.** The best available technologies are accessible for practical application as well as the best environmental practice. The Convention (Article 12) calls on the Parties to exchange information in this field for their own benefit.
- **Legislative tools for pollution reduction.** Efforts are made by the MDB and LDB countries to develop and harmonize the legislative and institutional support, considering among others the *polluter pays* principle (Article 2. of the Convention).
- **Financial resources for development and operation.** National action plans outlining financial resources are available in most of the countries. MDB and LDB countries have emphasized the importance of international financial assistance.
- **Public awareness raising activities**, which provide critical support in reaching the sector policy goals, are under way in all the Danube countries.

5.1.1.3. Analysis of Transboundary Effects

The major towns situated directly along the river system and discharging large amount of untreated wastewater (hot spots) may cause transboundary pollution effects in the municipal sector.

The transboundary effects include:

- **Deterioration of water and sediment quality, increase in pollutant load**
  The increased nutrient load has a special significance for the Danube Delta and the eutrophication process of the Black Sea.
- **Accidental spills from urban areas**
  Water pollution incidents having transboundary nature usually cause problems and damage for downstream water users.

The following transboundary effects lead to problems faced by the downstream countries:

- **Limited use of water resources**
  First of all, drinking water intakes are endangered.
- **Risk for human health and biodiversity**
  The microbiological pollution originating from untreated municipal wastewater causes health risk for the population. Toxic pollutants can negatively affect the aquatic environment and its biodiversity.

In accordance with the principles of the Convention – as expressed in Article 16 – the Danube Accident Emergency Warning System was set up to provide early information on transboundary accidental water pollution incidents in the Danube Basin affecting the downstream countries. The System, which involves the co-operation of nine Danube countries, has been in operation since April 1997.

5.1.2. Problem Analysis

5.1.2.1. Sector Core Problem

The countries of the MDB and LDB have defined the general core problem as follows:

"INADEQUATE MANAGEMENT OF WASTEWATER AND SOLID WASTE"

Due to the significant differences in the ratio of public supplies (primarily sewerage and wastewater treatment) between some of the countries in the Danube Basin, the consequences of the above core problem have varied. Efforts by the UDB countries Germany and Austria, for instance, have concentrated towards meeting the very strict requirements of the EU Council Directive 91/27/EEC on urban wastewater treatment.

5.1.2.2. Causes Leading to Environmental Problems

Direct causes of the above core problem, which have led to environmental problems, are similar in the countries of the MDB and LDB. Essential **direct causes** are as follows:

- **Improper drainage of waste water**
  Several major towns whose public sewer systems are not served by a treatment plant have been identified as hot spots in the MDB and LDB countries' pollution reduction programme. Moreover, the percentage of the population supplied by a public sewer system is low. The sewers are in a bad condition, which allows the runoff of urban wastewater into the recipients.

- **Discharge of municipal wastewater without pre-treatment**
  Treatment technology is either obsolete or short of the needed capacity. The applied technology is often not in compliance with the quality requirements of the recipient. Inadequate sludge treatment and disposal is a common problem. Additional problems are caused by insufficient pre-treatment of industrial wastewater discharged into public sewers.
- **Improper operator performance at treatment facilities**
  Insufficient budget to cover operation costs contributes to this cause.
- **Improper disposal of solid waste**
  Obsolete technologies used in the disposal of municipal solid waste, uncontrolled leaches and improper location of dumping sites and landfills leads to environmental problems.

Most important **root causes** of the sector's core problem in the countries of the MDB and LDB were identified as follows:

- **Economic recession accompanying the transition period**
  This has caused shortages of available funds to carry out the essential developments in sewerage, wastewater treatment and municipal waste management. However, in most of the MDB and LDB countries, the investments in these areas had been inadequate even prior to the transition period.
- **Incomplete legislation, regulations and planning**
  Pollution control and abatement programmes are generally not backstopped by strong regulatory-legal-institutional framework able to promote effective measures. The lack of a national strategy or regional master plans for municipal developments remains a prevailing problem to be addressed by the LDB countries.
- **Lack of economic instruments and incentives**
  The necessary economic/financial structures and incentive systems have either not been developed or have not yet entered into force.
- **Low public awareness**
  Low public awareness has impacted the allocation of environmental responsibilities, the integration of environmental considerations into municipal developments, the safety measures and institutional-managerial systems.

5.1.2.3. Environmental Effects

Direct environmental effects caused by the core problem of the municipal sector in the MDB and LDB are as follows:

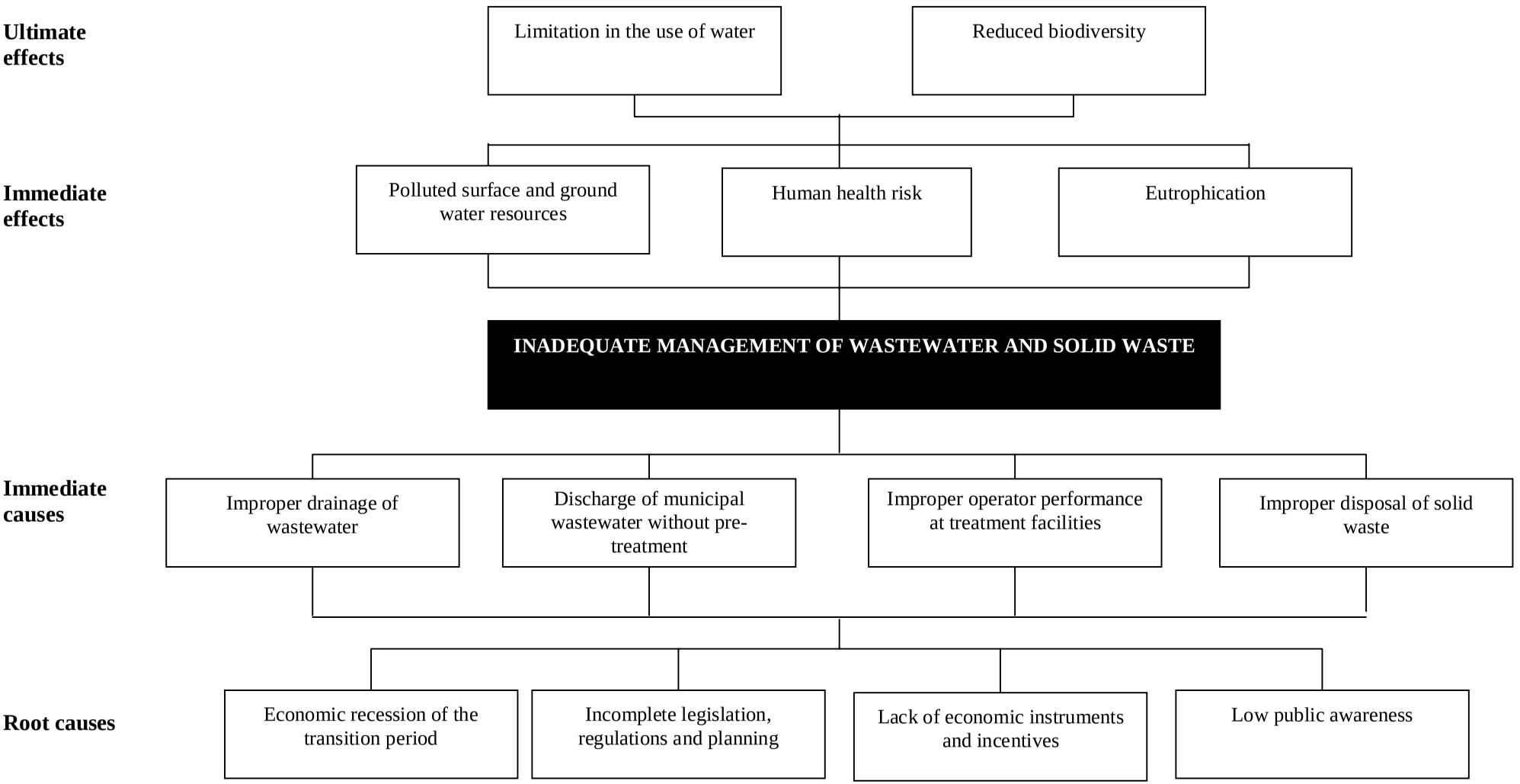
- **Polluted surface and ground water resources**
  Quality of life can be affected by water pollution causing poor quality of drinking water, water-born diseases, deteriorated aquatic environment and constraints for recreational activities.
- **Eutrophication**
  Increase in nutrient load results in increased eutrophication in surface waters. Untreated wastewater discharges cause increased nutrient levels in the river systems.
- **Human health risks**
  Human health risks arise along the river stretches downstream of wastewater spills without treatment and disinfection, due to the generally high microbiological pollution of municipal wastewater.

Ultimate effects of the core problem have been identified as:

- **Limitation in the use of water**
  Due to their deteriorated quality, the water resources fail to meet the water quality requirements set for water uses and cause problems in the operation and quality of products. The supply of drinking water to areas along the Danube is often jeopardised by the presence of nitrogen compounds and different micropollutants that increases the costs of drinking water treatment. Polluted water resources have resulted in reduced development potential of the affected areas.
- **Reduced biodiversity**
  Unfavourable changes caused by water quality deterioration can cause damage in the aquatic ecosystems and adversely affect biodiversity.

The general hierarchy of problems in the municipal sector faced by the countries located in the Middle and Lower Danube Basin is illustrated in Chart 6.

Chart 6. Problem Hierarchy of the Municipal Sector



5.1.3. Description of Sector Objectives

5.1.3.1. Description of SECTOR Objective

The development objective of the municipal sector is in accordance with the main goals of the Strategic Action Plan and has been formulated as:

"IMPROVEMENT OF WASTEWATER AND SOLID WASTE MANAGEMENT"

This specific sector objective should contribute to the ICPDR-Convention Objective:

"PROTECTION AND SUSTAINABLE USE OF THE WATERS OF THE DANUBE RIVER BASIN"

The sector objective is directly in line with the provisions of the Convention on municipal wastewater treatment (Article 7), and with the guidelines of the corresponding EU Directive 91/271/EEC. The Directive sets an important requirement to be met by the Danube countries aspiring to join the European Union in the future.

The core problem and the hierarchy of problems (Chart 6) in the municipal sector clearly indicate the direction the most important measures and actions in the different problem-areas of the sector need to take if the development objective is to be achieved. Once the sector objective has been attained, it will contribute in two main ways towards fulfilling the provisions of the Convention and the Strategic Action Plan:

- By ensuring that the quality of water in the Danube River Basin is improved and maintained,
- By ensuring that aquatic ecosystems and biodiversity in the Danube River Basin are improved and that the pollution loads entering the Black Sea are reduced.

5.1.3.2. Expected Results (Outputs) and Targets by Sector of Intervention

Article 2 of the Convention outlines the specific objectives and principles that are essential for achieving the ultimate objective, i.e.: "to improve the current environmental and water quality conditions of the Danube River system and prevent and reduce, to the highest possible degree, the adverse impacts and changes". Since a significant pollution load is caused by the present situation in the municipal sector, these objectives are of special importance for the sector's policy concerning the measures that need to be taken in order to realise the expected results/outputs of the municipal pollution reduction programme. Special issues underlying the objectives set forth in Article 2 of the Convention and taken into consideration in the programme developments are as follows:

- Water pollution abatement measures;
- *Polluter pays* principle;
- Precautionary principle.

The development objective of the municipal sector involves the improvement of wastewater and solid waste management. The expected basic results/outputs, which could ensure that the sector objective is met, include:

- **Operation of extended and upgraded public sewer systems.**

  A growing portion of the population connected to a public sewer system has facilitated an efficient collection of municipal wastewater in urban areas of the MDB and LDB countries. Keeping a balanced ratio between piped drinking water supply and sewerage systems is essential for decreasing uncontrolled disposal - mostly into groundwater

resources - of individual domestic waste. This task is faced primarily by the MDB countries such as Hungary, Slovakia and Slovenia, which have reported a substantial difference between the ratio of public water supply and sewerage.

Measures concerning the optimized operation and maintenance of sewer systems ensure the proper management of wastewater collection and stop wastewater spills through overflows into recipients. National Planning Workshop Reports generally do not indicate the planned increased ratio of population supplied by urban sewerage in the different countries, but significant developments are planned in all of the MDB and LDB countries. The Upper Danube countries - Germany and Austria - have less responsibility concerning the relevant output due to their already high ratio of public sewerage supply.

Projects (existing and planned) to support the achievement of the result generally depend on the development level of the related area in the countries and focus on extending and improving the management or establishing new sewerage systems in municipalities viewed as the national priorities.

- **Assurance of appropriate wastewater treatment**

Efficient wastewater management is planned in the MDB and LDB countries by upgrading the capacity, efficiency and maintenance of the existing treatment plants of the municipal sewer systems. New establishments of wastewater treatment plants will be based (as far as possible) on the application of the best available technologies.

Measures related to the improved wastewater management mostly eliminate those direct and untreated municipal discharges into recipients that currently constitute a significant pollution load for the Danube river and its tributaries. The implementation of appropriate pre-treatment of industrial wastewater discharges to protect treatment technology against harmful constituents is expected.

Application of proper sludge treatment and disposal methods, as well as the increase of sludge utilization is also necessary. An important feature of the planned activities in the MDB and LDB is that not only the accession countries (the Czech Republic and Hungary) but also most of the other countries seriously take into consideration the principles of the EU Directive 91/271/EEC on urban wastewater treatment in designing their development strategy. In rural areas, the introduction of improved individual wastewater management serves to protect the recipient groundwater resources.

Projects developed in MDB and LDB countries are geared towards the extension and upgrading/intensification of the existing treatment plants or the establishment of new ones depending on the known national priorities. Projects addressing adequate pre-treatment of industrial wastes have also been proposed.

- **Application of proper solid waste management**

The introduction of separated solid waste collection, use of environmentally sound disposal sites and the application of optimal solid waste management methods are the key elements and outputs. Ecological rehabilitation has been carried out at old disposal sites and landfills causing pollution. Control of pollution impacts coming from urban transportation and traffic is necessary.

Measures aimed at the development of optimal and applicable systems for solid waste management contribute to the achievement of the output, as well as the establishment of the supporting institutional-technical background.

Projects proposed by the Danube countries in this field mainly address the rehabilitation and re-cultivation of landfills and municipal solid waste disposal sites located in environmentally sensitive areas.

There are several common non-structural measures concerning the results/outputs discussed above, outlined by the Danube countries of the MDB and LDB during the National Planning Workshop series:

- Establishment of operation, maintenance and training possibilities for personnel dealing with up-to-date technological methods;
- Development of comprehensive monitoring and control methods;
- Harmonisation of legislation and applied standards with EU procedures;
- Public awareness raising.

These measures are essential prerequisites for the achievement of the above results.

5.1.3.3. Important Assumptions for the Sector Results

The basic assumption concerning the realisation of the municipal sector objective:

- **Achievement of higher levels of environmental compliance and abatement**

Several general assumptions play a significant role in assuring the realisation and success of the strategy in municipal pollution control developments. The following assumptions were outlined by the countries of the MDB and LDB, which are in coincidence with all the three sector results discussed previously:

- Existence of an effective legal-economic-institutional structure and support system that promote the necessary developments within the sector;
- Favorable economic conditions and availability of funds for the planned developments together with related effective and differentiated taxation and tariff policy;
- Effective international financing support mechanism in operation.

These assumptions are considered to be essential pre-conditions for the success of the planned development strategy in the municipal sector.

The most important assumptions corresponding to the sector results are:

- **Implementation of strategy for urban sewerage**
  Applied strategy on the best feasible development of urban sewerage, proportional to piped drinking water supply. Increased public awareness concerning the management of individual handling and disposal of wastewater in rural areas.
- **Introduction of best available treatment technologies and *polluter pays* principle**
  Enforced priority of environmental protection in setting priorities; introduction of the best feasible or available treatment technologies; improved pre-treatment of industrial discharges in practice; polluter-pays principle entered into force to promote environmental clean-up activities.
- **Implementation of solid waste management strategy**
  Effective co-operation of all stakeholders; integrated approach applied in decision making on solid waste management strategy; introduced separation technique; rehabilitated old landfills affected by pollution.

5.1.3.4. Impact Indicators for the Sector Results

The main objective of the Convention is the harmonised co-operation in the Danube Basin in order to achieve conditions of sustainable water management, including the improvement of the current environmental and water quality conditions. This objective can be met only by launching basin-wide, intensive pollution control activities. The municipal sector is currently a significant source of pollution loads entering the Danube river system. The measures planned by the countries of the MDB and LDB for the reduction of municipal pollution load and for the improvement of the aquatic environment were discussed and evaluated during the 11 National Planning Workshops.

Impact indicators related to the municipal sector objective:

- **Country-specific emission reduction of BOD by 2010 achieved. Soil contamination and impact on natural water bodies controlled through appropriate solid waste management by the year 2010**

  There are major differences between the countries of the Danube Basin in the field of municipal public supplies. Because of the countries' different development level, it is not possible to measure the extent to which the sector objective has been met by using basin-wide overall impact indicators. Only country-specific indicators on emission load reduction percentages coming from the sector results in a specific Danube country can be used as.quantifiable indicators in this respect.

Impact indicators related to sector results are as follows:

- **Extended and improved management of existing sewerage systems and establishment of new ones achieved by the year 2005 in 90 % of the municipalities with population over 5000**

  An increase in the percantage of the population connected to public sewer systems will be achieved by the countries, taking into account a balanced ratio between drinking water supply and sewerage systems.

  Special attention is given to the implementation of optimized operation and maintenance of the public sewer systems to ensure operational safety.

- **Integrated approach to sewer systems and treatment of wastewater applied by the year 2010 in 70% of the settlements in the DRB with population over 5000**

  Municipal sewer system and its wastewater treatment plant form an integral sanitation system. Extended sewerage programmes in the MDB and LDB countries increase the quantity of municipal wastewater to be treated. The increase of treatment capabilities has got a special consideration. Therefore in the development programme of the countries. The quantity of untreated wastewater discharges will be decreased to a possible minimum (for example in case of Hungary, in Budapest it will be only 10 % in 2010, and the ratio of properly treated wastewater in all the settlements above 2000 inhabitants will be 67 %). Several of the countries harmonise their development efforts in the field of wastewater treatment also with the regulations of the corresponding EU Directive. The decrease in emission loads in the Czech Republic, Slovakia, Slovenia and Romania is connected to selected quality parameters.

  Implementation of programme for environmentally sound individual wastewater management systems in rural areas could contribute to the decrease of pollution load at the recipients, being mostly groundwater resources.

- **Separation of solid wastes by 3 components implemented by the year 2010 in 90 % of areas with population over 50 000**

  Improved municipal waste management systems will be introduced in most of the MDB and LDB countries. Pollution impacts caused by leaching and inadequate management of solid waste disposal sites will be decreased up to 25-50 % in Slovakia, Czech Republic, Slovenia, Romania and Bulgaria. Separation of solid wastes by 3 components will be introduced in 90 % of the settlements having more than 50 000 inhabitants in the countries of the Danube River Basin

The time horizon of these indicators varies between 2005 and 2020 depending on the medium and long range planning methods of the countries. The impact indicator for the sewerage and wastewater treatment reflects the pollution load reduction effects mostly on surface water resources. The positive influences are represented by the lower level of harmful pollutants in the emissions, decrease of microbiological pollutants causing water contacted health risks for the population, better possibilities for water uses with higher quality requirements. The impact indicator for proper solid waste management implies the reduction of pollutants, most importantly those reaching the groundwater resources that are being primarily utilised for drinking water supply.

5.2. Industry and Mining

5.2.1. Situation Analysis

5.2.1.1. Importance of the Sector, Analysis of Stakeholders and Activities Leading to Water Pollution and Environmental Degradation

Importance of the sector

Industry[1] and mining represents, after services, a major economic sector throughout the region and its participation in GDP varies from 31% (Slovakia) to 42 % (Romania). Very similar is participation of this sector in the total structure of employment, from 29% (Austria) to 50% (Bulgaria). Nevertheless, there are quite important differences between upper, middle and lower Danube (UD, MD, LD) countries in connection with the sector itself and its impact on environment as a whole i.e. to water pollution.

The importance of the sector from an environmental point of view is evident from the following facts: the total volume of abstracted water from Danube River System is currently 12,7-billion m3/ year; for cooling purposes an additional 15, 4 billion m3/year are abstracted. Out of the first figure, 62% is abstracted for industrial and mining purposes (not including cooling water for power purposes).

Economic strength is in direct relation with industrial capacities and its performance and outputs. Moving from the upper towards the lower Danube countries, there are visible differences organized in a pattern between the EU member countries, the accession countries, and lastly, the transition countries. This pattern is also visible in the socio-economic and environmental relations. Better economic results are accompanied by better environmental performances.

[1] Under industry the energy generation is included

Since the beginning of the nineties, with the socio-economic changes in the whole CEE region and the shift from centrally to market-oriented economies, this sector has been passing through systematic reforms, including structural changes, privatization reform, foreign investment etc. After the initial problems that resulted in a great decline in production, some of these countries have been improving their industrial output, which has combined with legal, institutional and market developments to make a positive impact on the solution of major environmental problems.

General sector policies and policies and strategies in relation to the control and reduction of water pollution.

All the DRB countries actually have a more or less comprehensive system of environmental and water sector policies and strategies, which usually reflects:

- the capability of the country to contribute to the solution of TDA problems;
- the significance and evidence of country specific environmental problems;
- the importance and indication of environmentally related health hazards;
- the level of economic development of the country.

In this context, all the countries have developed a hierarchic system of medium and long-term objectives and principles that usually reflect the key environmental problems and the sector priorities on the national and regional level. Industry and energy, together with transport and agriculture, are key sectoral "Driving forces" that impact the environment. The industry and energy sectors are reasonably well covered by policies, but some areas still need attention (e.g. energy efficiency; renewable energy) particularly in the middle and lower Danube countries.

Provisions of the Convention relating to the sector objective *(Industrial water pollution reduced through the use of clean industrial technologies)*

Since the Convention supports, promotes and enforces, in legal and technical sense, the protection and sustainable use of the Danube river, it also responds to the needs of this sector. The Convention directly or indirectly deals with the issue of industrial end energy sector, from articles defining the objectives and principles of cooperation (art. 2), to those dealing with prevention, control and reduction of TDA impact (art. 5.), those introducing principles of the BAT and BEP in emission limitations (art.7.) to the very concrete parts that define the principles of BAT and BEP (Annex I, part 1 and 2), Industrial sectors and hazardous substances (Annex II, part 1 and 2) to General guidance on water quality objectives and criteria (Annex III).

Recent changes in upper, middle and lower Danube countries

Austria and Germany are implementing EU environmental legislation which has been developed over the last 30 years and today comprises some 300 legal acts, including directives, regulations, decisions, and recommendations. Included in this is a large number of communications and other policy documents of relevance for EU environmental policy.

However, the body of EU environmental legislation that the associated countries in Central and Eastern Europe will eventually have to align their national legislation and administrative practices with as a condition for their membership of the EU – the so-called *environmental acquis* - is considerably smaller, and most of it is encompassed in the Commission's White Paper.

Water is one of the most comprehensively regulated areas of EU environmental legislation. It covers, inter alia, Surface Water Directive; Drinking Water Directive; Dangerous Substance Directive and other Daughter Directives. But the impact of the industrial and mining sector on the quality of the water is in close relation with the directives in the field of industrial pollution control and risk management, waste management and chemicals.

The process of approximation, i.e. of alignment of national laws to those of the EU, is complex and challenging and the pre-accession approximation process has become an opportunity for the countries to organize their institutions and procedures and to train their staff for the daily processes and responsibilities of EU law making, implementation and enforcement.

Hungary, the Czech Republic and Slovenia are most likely to be the first of the CEE countries to become members of the EU. Together with Slovakia, Romania and Bulgaria, they are considered as accession countries, while Ukraine, Moldova, FRYugoslavia, Croatia and Bosnia and Herzegovina, all in the process of transition, are considered as a third "wave" accession countries. Harmonization of the legal systems, policy measures and instruments, accommodation of industrial and environmental infrastructure to EU standards and practices is common for all, but the results differ from country to country as a consequence of the specific socio-economic situation of each country.

Stakeholders of the sector

The stakeholders involved in the industrial and mining sector are:

- Polluters, economic actors that cause pollution (industrial and mining enterprises);
- State (central, regional and local) authorities responsible for legal measures and control;
- Affected by pollution.

The polluters pursuing the main activities leading to pollution and waste production include: industrial and mining production; industrial and mining waste dumping (and consequences of mining activities). Pollution from industry depends on the technologies applied and on the treatment of wastewater. The major part of industrial wastewater is treated in municipal WWTP, unfortunately with a small percentage of pre treatment before discharging. Dumping is the most frequent form of industrial waste disposal. Industrial wastes dumped both on special and municipal dumpsites endanger the ground water, as well as the surface water, particularly in the case of chemical and hazardous waste. Old dump sites with unknown locations and contents are potentially very hazardous. A variety of mining activities (coal, oil, gas, ore, radioactive ores etc.) also have very negative impacts on water quality and water regime. In addition, some other activities, differing from country to country, are identified as potentially important sources of pollution, such as: inland and water transport, hydraulic structures and its activities; sand and gravel excavations; abandoned military sites etc.

Typical **organizations responsible for environmental protection** are state ministries (for environment; water protection; energy and industry; public health etc.); regional or local authorities (organizations for water management or river basin authorities; inspectorates etc.) and management structures of industrial and mining enterprises responsible for making decisions in connection with investments, technological processes and production activities.

Affected groups are the most numerous, from the population as a whole, to downstream industrial enterprises; (aquatic ecosystems) river basin authorities in charge of river water quality; water and sewerage companies responsible for drinking water quality and public sewerage and WWTPs; special target groups such as farmers; fisheries; tourists etc.

Prospects for social and economic development

Unlike EU members Germany and Austria, the countries of the DRB have not participated in the process of structural adjustment that was being implemented in developed market economies during the 1970s and 1980s, and have instead continued to implement a traditional industrialization strategy and the concept of central planning. (The only exception was former Yugoslavia, in which the concept was based on a semi-developed market.) Therefore, the structure of these countries' economies remained unchanged and unfavourable, with a high proportion of primary and secondary sector in the generation of the GDP, and a prominent share of energy and raw materials

costs in the industrial sector. Raw material and energy expenditures per product unit remained high, while product quality and the utilization of modern technology become secondary concerns, thus resulting in decreased competitiveness and negative impact on the environment.

The history of the transition period started at the beginning of the 90s. The steady and often difficult application of new macro-economic instruments, traditionally called ”structural adjustment” has been a necessary part of the adaptation process. Since economic indicators in almost all the countries of the DRB started to improve around 1994-1996, the falling GDP trend started to be reversed, and many countries started to realise their true potential.

Main activities (causes) contributing to water pollution

The main activities in this sector contributing to water pollution are to a great extent shared by the whole region, with the exception of the two upper Danube countries. There is a long list of activities contributing to water pollution, such as: obsolete industrial and mining technologies producing large amounts of liquid and solid waste; inadequate treatment of industrial solid and liquid waste; discharge of industrial wastewater into municipal sewers without any or adequate treatment; inadequate closure of industrial sites and plants: improper management of industrial hazardous waste; inefficient operation of industrial cooling systems; construction and operation of big dams and hydropower systems. Some countries, which define this sector in a broader way, point out some additional activities, such as: pollution of water and soil due to transportation (shipping); inadequate road infrastructure; inadequate behavior of tourists and transport organizations.

5.2.1.2. Current Strengths/Assets

As a result of the analysis of industrial and mining activities leading to water pollution, a number of strengths/assets have been identified as critical in mitigating the negative effects on the environment. These strengths/assets should be used by appropriate legal, technical, economic and public/NGO authorities and entities to set up priorities which will help to identify appropriate policies and strategies to meet the goal of prevention and control of pollution.

Although numerous, all the legal, institutional, technological, physical and geographical strengths/assets could be structured as follows:

In relation to the provisions of the Convention

- **Existing monitoring system**: water quality is monitored under a fairly developed inspection and control system that will help in the prevention, control and reduction of transboundary pollution;
- **Environmental legislation**: the process of harmonizing the legislation with the EU directives has either already started or has been adopted at the policy level;
- **Mutual cooperation:** the countries of the region have established regular contacts based on a number of bilateral and multilateral agreements concerning water regime, water quality and information systems, including emergency systems.

In relation to the main activities leading to water pollution

- **Formulation of sustainable industrial and mining strategies:** Benefiting from the latest, state-of-the-art insight into the issues affecting the environment, the countries have developed short and medium-term sustainable industrial and mining strategies as key elements for pollution reduction in this sector of the economy;
- **Local technical knowledge and capabilities for technology transfer**: A significant number of experienced professionals and scientists, familiar with the latest achievements of industrial practice and science, have been engaged in this field

- **Existence of research programmes for the development of new methods for waste treatment, processing and disposal:** State (universities, institutes, academia) and industry (R&D programmes) have been supporting research & development projects in this field;
- **Physical plans and legislation for the exploitation of natural resources**: Large and small-scale physical plans, developed at both national and regional level, are a factor limiting the misuse of land. Environmental impact assessment is required and exploitation of natural resources is subject to legal supervision;
- **Implementation of environmental management system:** There is a system of standards in place that define criteria for environmentally sound operations.

In relation to sector objective and expected results /outputs

- **Change in production patterns:** The socio-economic transition process does not favor inefficient industrial enterprises that are in many cases the big polluters and/or energy users. In spite of the negative economic consequences, from an environmental point of view, this change in production patterns will lead to a substantial decrease in water pollution;
- **Industrial pre-treatment facilities and municipal WWTP:** The existing industrial pre-treatment facilities and municipal WWTP represent an important asset for further improvement of industrial wastewater and, at the same time, reduce the impact of industry on the environment;
- **Economic mechanisms in favor of clean technologies:** A number of economic instruments has been introduced (water use and polluted water charges; penalties for water degradation; supplementary taxation for environmentally dangerous technologies and tax reduction for "clean" technologies) to favor environmentally friendly technologies
- **Implementation of international conventions dealing with hazardous substances:** The readiness of the countries to become parties to the appropriate international conventions dealing with hazardous substances provides a legal and technical background for a proper disposal of such substances.

5.2.1.3. Analysis of Transboundary (TDA) Effects

Analysis of TDA effects of pollution coming from Germany and Austria[2] were not taken into consideration since these two UD countries have not identified any hot spots that could cause significant TDA effects, except in the case of accidental pollution. Inadequate management of industrial and mining facilities and of the waste they generate, combined with an overall unsatisfactory environmental protection, have significantly influenced water quality conditions in terms of TDA, both in MD and LD countries. Out of the total of 51 Significant Impact Areas, more than 20 are affected by the industrial activities with TDA consequences (11 in the MD region, 5 in the LD region and 6 in the area that is shared by the MD and LD countries). This corresponds with the results of situation analysis concerning the industrial and mining hot spots. There is evidence that the Black Sea and the wetlands have also been affected by TDA pollution, as a cumulative effect of the pollution from a number of different industries in the whole region. Most often, the sources of pollution come from basic industries (iron and steel works, pulp and paper mills, metallurgy, machine tool, electrical, wood-processing, chemical, oil industry, tanneries etc.), food industry and mining activities.

[2] In the later stage Germany and Austria contributed each, two industrial sites for inclusion in PRP

The most important effects include:

- **Surface and ground water polluted with toxic substances**

  This effect has been observed in the whole DRB, but it is much more pronounced in the MD and LD countries. The presence of heavy metals, mercury and oil products, has been observed in the Morava river basin with TDA effects from Slovakia to Hungary endangering the Zahorie Ramsar site.

  This effect has been reported all along the Sava river which is shared between four former republics of Yugoslavia, with TDA effects from Slovenia to Croatia, Croatia to Bosnia-Herzegovina and vice versa, and Croatia and Bosnia-Herzegovina to Yugoslavia. In the upper, Slovenian part, the hot spots include: Vrhnika (leather industry) and Krsko (pulp and paper industry and nuclear power plant). The middle part is suffering pollution from the highly-industrialized areas of Bosnia-Herzegovina (textile, food, leather, chemical, wood, metal processing and mining industries located in Banja Luka, Prijedor, Jajce and Bihac) and of Croatia (chemical, oil refinery, metal works, fertilizers, and food industry located in Zagreb, Sisak, Kutina and Vrbovec). In the lower part of the Sava river, the pollution originates from similar types of industries with hot spots located in Bosnia-Herzegovina in the cities of Tuzla, Maglaj, Zenica, Doboj, Teslic, Brcko and Foca, with TDA effects reaching Croatia and Yugoslavia. In this region, important SIAs exposed to pollution include the Kupa floodplane, Mokro Polje, the mouth of the Vrbas and the mouth of Drina river with Bosut forests. TDA consequences are also very much pronounced in the LD countries. Industrial activities (wood processing, metal processing, metalwork, oil and chemicals etc.) with hot spots in Yaremcha, Kolomya and especially Chernevica in the Prut river catchment area which is divided between Ukraine, Romania and Moldova, endangering a number of priority wetlands in the region, such as the Lower Prut Wetland and the Liman Lakes. A similar situation is found in the Tisa catchment area that extends across five countries.

  Industrial hot spots in Ukraine (Rakhiv, Velyky Byckhiv and Tresva), Romania (Terepia, Clusana, Baia Mare), Hungary, Slovakia (Bukocel Hencovce), Hungary (Miskolc), and Yugoslavia produce TDA effects leading to a limited water supply, increased water and soil pollution and reduced biodiversity as a result of cumulative impact of the hot spots located upstream. Priority wetlands endangered by these TDA pollution effects include the Calarasi floodplain and the Lower Tisa.

- **Accidental pollution events**

  The existence of a large number of industrial facilities near the borders means a constant threat of industrial accidents that can produce negative TDA effects, such as water supply interruptions, poisoning of the flora and fauna and others. Due to a high concentration of industrial hot spots, this effect is present throughout the MD and particularly in the LD region.

- **Deterioration of water quality due to continuous discharges**

  Uncollected and improperly disposed industrial waste represents a threat to public health and impedes surface drainage. The consequences of untreated or partially treated wastewater from industry pose a constant risk to human and environmental health. Moreover, the performance of most of the treatment facilities in the region is far below the design specifications due to inadequate capacity, poor maintenance and a lack of spare parts. The resulting cumulative effect could have TDA consequences in the whole region.

- **Deterioration of ecological equilibrium**

  The presence of hazardous wastes has long-term consequences for human health and for regional flora and fauna, particularly in the wetlands. In spite of the variety of habitats and the efforts to protect them, the rich bodiversity of the DRB suffers, especially in the MD and LD regions, with many species being endangered or threatened with extinction.

- **Changes in the water regime**

  Considerable industrial consumption of water (including cooling water) that is not returned in the water streams, as well as landscape changes produced by mining and quarrying, have changed the complex water regime. The quantity of water in the streams is closely connected with its quality because it influences the self-purification ability of water.

- **Limited water use**

  Limited water use is a negative consequence of TDA importance. The river streams and infiltrates transfer pollution into alluvial zones. As a consequence, surface and ground water use becomes limited because of their high pollutant content.

5.2.2. Problem Analysis

5.2.2.1. Sector Core Problem

In spite of the many differences between the UD, MD and LD countries, which mainly originate in their different socio-economic, historical and cultural development, the core problem for the industry and mining sector has been identified as:

"ECOLOGICALLY UNSUSTAINABLE INDUSTRIAL AND MINING ACTIVITIES"

Industrial and mining activities and their consequences negatively impact water quality and water regime. Water pollution and unfavorable changes in the water regime can cause a disruption of ecosystems, pose a health risk and limit the possible use of water. All this ultimately leads to a decrease in the quality of life.

Socio-economic changes and the process of privatisation are of vital importance for overcoming the environmental consequences of past activities. In order to achieve the sector objective, it is necessary to reduce the impact of past pollution, undertake measures for improving management at all levels and ensure funds for eliminating the consequences of past pollution.

Furthermore, it is necessary to implement appropriate measures to limit the discharge of wastes by introducing efficient technologies, constructing treatment facilities and improving the operation and maintenance of the existing ones. Another sector objective is to adopt sustainable industrial practices through appropriate stakeholder involvement, establishment of programmes aimed at a reduction in the use of hazardous materials and prevention of the risk of accidents, introduction of environmental management in enterprises and implementation of modern manufacturing strategies.

5.2.2.2. Causes Leading to Environmental Problems

Although there are numerous main causes and their cause effect-relations leading to degradation of the environment, they may be roped around four key causes, which include:

(i) Use of dirty and obsolete technologies

The existence of obsolete technologies as a legacy of the past is one of the most important causes of pollution.

a. Use of outdated technologies

Large investments are necessary in order to replace the obsolete, energy-demanding and raw material-demanding technologies with modern, environmentally sound ones.

b. Excessive deterioration of the environment

High energy consumption has a worsening effect on the environment, and raw material demand technologies usually produce high amounts of waste, either solid or discharged into water or air and usually with a high content of harmful substances. These technologies very often have a low safety level and the likelihood of accident and operational failures occurring is higher.

In order to eliminate this problem, it is necessary to focus on the following activities:

- Research the possibility of financial support,
- Define instruments for control and inspection,
- Impose penalties and introduce measures for preventing production in case of violation of regulation.

(ii) Discharge of wastewater without pre-treatment

Discharge of wastewater without pre-treatment is the result of a number of factors. The primary cause is the insufficient number of WWTPs for industrial pre-treatment.

The first concern when building industrial plants should be to meet the legal obligation that state-of-the-art wastewater and solid waste treatment system should be installed. The relevant legal obligations should be urgently defined and set down along the *polluter pays* principle. This would at least partially provide sources of financing the construction of new treatment plants and the maintenance of the existing ones.

a. Lack of WWTPs

In most DRB countries, there is a relatively small number of WWTPs built in the existing industrial facilities in the region.

b. Existing treatment plants not used

A large number of the existing treatment facilities are not used, for a variety of reasons including shortage of maintenance resources, outdated technologies, negligence, inadequate motivation and lack of market.

c. Inadequate compliance with legislation

Although legal regulations are in place, the instruments for their enforcement are not strong enough to ensure implementation. Fines for non-observance of the regulations are low, and inspections are rare and inefficient. Besides the weak inspection services, it is necessary to underline in this context the low penalties.

(iii) Shortcomings of the management system

The absence of an appropriate self-monitoring system, based on an internal control system, and the lack of interest of beneficiaries in enforcing the environmental regulations and compliance with legislation, is important in creating favourable conditions for pollution to take place. Many companies are still benefiting from not complying with the set standards at the expense of those that did change their industrial behavior and practice in order to comply.

a. Negligence on the part of some managers and employees

A negligent attitude towards production and pollution is also a result of the unresolved question of ownership. Since the process of privatization has not yet been completed, the personnel - unlike the personnel in most of today's privately-owned enterprises - is not motivated for profitable and successful operations or for the procurement of financial incentives.

b. Financial constraints (costly treatment)

Lack of funds is an element that appears most frequently among the observed causes. Shortage of financial resources is understandable in view of the fact that there is a high competition for available resources. Under such conditions, the building of expensive WWTPs and their costly maintenance sometimes meet with resistance, both on the part of management structures and employees.

(iv) Inadequate disposal of solid hazardous substances

Most of the disposal sites for hazardous industrial and chemical waste are not appropriately located, organized or managed. Most of the toxic industrial waste is stored at industrial sites while waiting for an appropriate solution. A very low percentage of industrial waste is sent to proper sites and most of it is dumped on communal sites together with municipal waste. Monitoring data on leachate emissions from landfills are missing. There are many concerns over illegal and uncontrolled dumping of industrial wastes at numerous locations, particularly in the LD region.

a. Lack of landfills for hazardous substances

There is currently a very limited number of properly organized landfills for disposal of hazardous and toxic substances. Many countries in the region do not have a single landfill designed for this purpose. Therefore, these substances are inadequately and unprofessionally disposed using city dumps, or simple green-field dumps. These circumstances combine to create conditions for potential soil pollution and – indirectly - for ground and surface water pollution.

b. Absence of classification of industrial waste

The first step in overcoming this problem is to pass the relevant legal regulations requiring a proper disposal of such waste, in accordance with a prescribed methodology. Another problem that needs to be addressed is the lack of classification of types of waste and the absence of designated, suitable disposal sites for special types of hazardous solid waste.

5.2.2.3. Environmental Effects

Immediate and ultimate environmental effects as a result of unsustainable industrial and mining activities have affected a number of SIAs as well as the Black Sea ecosystem. The effects on individual SIAs are more pronounced and visible in the LD than in MD regions, as a result of the higher concentration of activities focused on mineral and energy resources (heavy, chemical and petrochemical industry and mining activities) with a very negative effect on the environment. The Black Sea area is also damaged by the activities of this sector. However, this is the result of a cumulative, long-term pollution by substances present in amounts that by far exceed those found in the natural ecosystem.

The industry and mining sector is responsible for a significant portion of air, soil and water pollution. Besides the negative impact on human health via worsening of the drinking water quality, the pollution of air, soil, surface and ground waters have led to the degradation of ecosystems and the reduction of biodiversity.

All these effects involve a high social and economic cost, despite the fact that some of these costs are difficult to estimate. Unsustainable practices in industry, and especially in mining, lead to significant changes of the physical environment .The activation of landslides and soil erosion, the degradation of the natural landscape, the changes of the riverbeds and bank erosion have led to an irreversible destruction of habitats and amenity loss, entailing high social and economic risks.

Immediate environmental effects identified in this sector include:

- **Pollution of surface and ground water**

  All industrial and most mining activities generate wastewater, resulting in the deterioration and pollution of the nearby surface and ground waters. In some cases, the pollution is caused by a single pollutant and, in others, by a combination of different types of industrial waste such as chemical, thermal, mineral, sediment, oil, hazardous substances etc.

- **Pollution of soil and air**

  Soil and air pollution is mostly the result of unsustainable industrial and mining activities and particularly of accidental events. Contamination of soil from regular industrial activities present a diffuse source of pollution caused by the uncontrolled use of protective means as well as by the presence of ashes, SOx and NOx compounds generated by thermal power plants, cement plants and some other industries. Concentrated pollution is caused by flue gases such as heavy metals, or by flooding of polluted rivers. Local pollution is the result of accidents, incidental situations or disaster situations (natural, or man-caused such as wars) when harmful and hazardous substances uncontrollably released or spilled from plants, sewerage, dump sites or landfills are discharged into the soil or the air.

- **Reduced availability of water for different purposes**

  The surface and groundwater are affected by pollution from the inefficient pre-treatment of toxic and specific waters released from industry. Inadequate storage, handling and especially transportation, are the main causes of pollution from industrial chemicals.

- **Erosion**

  Erosion is caused by industrial, mining, hydro-technical, transportation, and military activities in combination with natural processes (floods, winds, riverbed changes). Powerful erosion processes are triggered by deposit exploitation and by sand and gravel extraction in the river basins, in combination with mineralized mining waters discharged into the rivers. This process can aggravate the situation in the Danube riverbed and its tributaries, and can even lead to processes in watersheds such as karst phenomena. A massive deterioration of the landscape is another result of erosion.

Ultimate environmental effects identified in this sector are:

- **Depletion of natural resources**

  The results of environmental pollution are disturbances in biodiversity and in the functioning of all ecosystems. Discharging of the wastewater into the river streams has resulted in deterioration of the physical, chemical and biological quality of the water. This, in turn, has led to the degradation of species and the loss of some varieties in favor of those less sensitive to pollution. Specific pollutants are very dangerous once they enter the food chain and their long-term consequences still remain unknown.

- **Limited water use**

  Changes in hydrological regime as a result of the existing hydraulic works and increased levels of chemical pollutants have raised serious concerns over various water supply sources, both in terms of their quality and accessibility. Deterioration of the ground waters may be irreversible and may prove to have high social and economic consequences. In some areas of the DRB ground water has been abandoned as a potential source of drinking water or for specific industrial use.

- **Landscape degradation and biodiversity reduction**

  Landscape degradation, reduction of biodiversity and destruction of ecosystem are environmental effects observed as a result of both improper locations of industrial sites and non-sustainable industrial practices. Deforestation and erosion processes triggered by industrial and mining activities and hydraulic structures, both direct and in combination with natural processes, represent significant ultimate effects of the pollution.

- **Reduced development potential**

  Environmental destruction, caused by industrial and mining pollution, has significantly influenced the well being of the local communities, reducing the development potential of many affected regions.

- **Population migration**

  The deterioration of the whole ecosystem, the reduction of available water and soil resources impacts the socio-economic development of the region and contributes to the population migrations. The existence of real and potential hazards in the professional and living environment poses a serious threat to the welfare of the population in contaminated areas, which sometimes leads the local inhabitants to decide to migrate to less polluted areas.

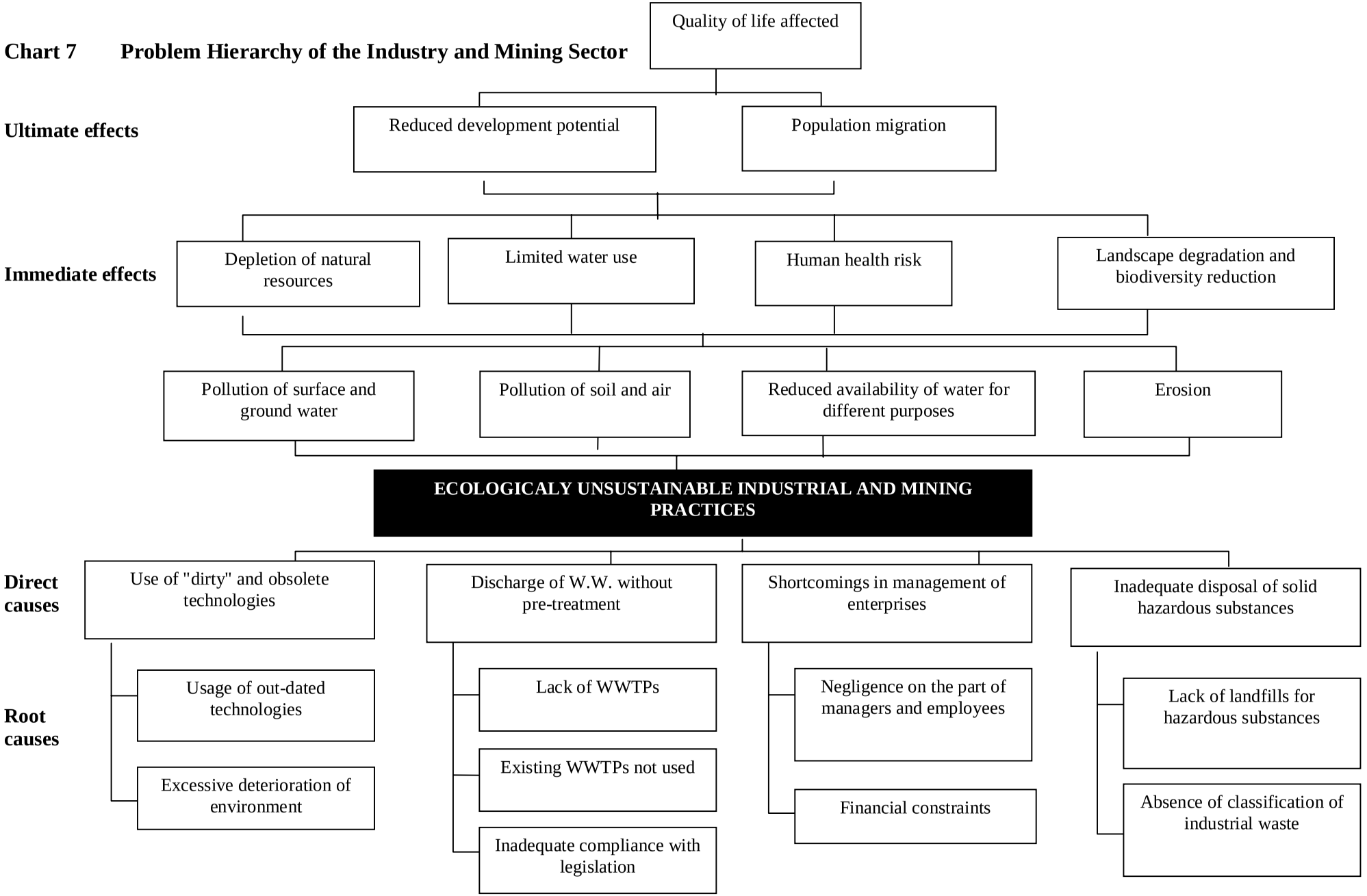
- **Quality of life affected**

  Pollution from industrial activities has a direct negative impact on the quality of potable water and the food chain, which creates health risks for the population. Consequences could be reflected in a reduced birth rate, reduced life expectancy, genetic changes, etc.

- **Human health risk**

  The consequences of pollution are reflected in the reduction of life expectancy, genetic changes and increased health cost. Health risk is a direct environmental effect of the deterioration of water quality and water regime.

Chart 7 Problem Hierarchy of the Industry and Mining Sector



5.2.3. Description of Sector Objective

5.2.3.1. Description of the SECTOR Objective

The development objective of the industry and mining sector has been defined as:

"INTRODUCTION OF BEST AVAILABLE TECHNIQUES (BAT) AND BEST ENVIRONMENTAL PRACTICES (BEP) AND ABATEMENT OF WATER POLLUTION"

This Sector objective, as well as the result, fully and naturally contributes to the realization of ICPDR Convention objective that has been defined as:

"PROTECTION AND SUSTAINABLE USE OF WATERS OF THE DANUBE RIVER BASIN"

The SAP that supports and complements the Convention and contributes to the implementation of EAP for Central and Eastern Europe has four equally important goals that are derived from the objectives of the convention and the principles of integrated water management:

- Improvement of aquatic ecosystem and biodiversity in DRB and reduction of pollution loads entering the Black Sea;
- Maintenance and improvement of the quantity and quality of water in the DRB;
- Control of damage from accidental spills;
- Development of regional cooperation in water management.

In order to achieve these goals, common strategies and policies have been adopted by the Convention. In view of the problems identified by problem analysis, the following policies and strategies have been identified.

It is necessary to develop industrial and economic policies that integrate environmental considerations. Such policies should enable the conservation of natural resources, avoidance of irreversible damage to the environment and achievement of long-term economic development and growth on a sustainable basis. The underlying message is that environmental protection, industrial development and competitiveness can be compatible provided the right policy, technological and institutional measures are adopted at the national and regional level.

5.2.3.2. Expected Results (Outputs) and Targets by Sectors of Intervention

The Convention sets out that all parties shall strive to achieve, to the greatest possible degree, the goals of sustainable and equitable water management, including the conservation, improvement and rational use of surface and ground waters in the catchment area. In order to attain that goal, emission limits will be set, applicable to individual industrial sectors or industries in terms of pollution loads and concentrations and based in the best possible way on low and no-waste technologies at source. Where hazardous substances are discharged, the emission limits shall be based on the best available techniques for the abatement at the source and/or for wastewater treatment.

Based on the Sector Problem analysis following Sector Objective has been identified:

"INTRODUCTION OF BEST AVAILABLE TECHNIQUES (BAT) AND BEST ENVIRONMENTAL PRACTICES (BEP) AND ABATEMENT OF WATER POLLUTION"

In order to achieve this objective (significant reduction of pollution generated from industry and mining), the following results/outputs are foreseen:

- **Introduction of clean industrial technologies and abatement of water pollution**
- **Implementation of pre-treatment of industrial wastewater**
- **Ensuring adequate management of the enterprises**
- **Treatment and disposal of hazardous substances in proper landfills**

(i) Introduction of clean industrial technologies and abatement of water pollution

The implementation of the principle adopted – to select and introduce clean technologies, both in the existing and newly-planned industries, and the adoption of legal regulations that would ensure that the above principle is respected, either through enforcing the closing down of plants or imposing penalties at the corporate or individual level in case of non-observance, would either result in a decrease in the level of pollution or preservation of the situation.

In order to achieve this result, it is necessary to:

- **Eliminate hot spots**. In order to eliminate hot spots it is necessary to define and adopt legal regulations that will set the rules and conditions for obtaining certificates for commissioning particular industrial facilities. It is necessary to pass the legislation defining priorities and guidelines regarding the elimination of hot spots. The priorities should involve the introduction of new technologies and the replacement of obsolete technologies with new ones, incorporating at the same time in all production processes the norms recognized and recognizable worldwide.
- **Replace old technologies with new ones.** In order to replace the old technologies with new ones, it is necessary to design and pass consistent laws mandating the elimination of outdated processes or the closing down of certain plants, providing at the same time the financing instruments that would encourage producers to adopt state-of-the-art solutions. Within the framework of these laws, priorities should be established concerning the introduction of new technologies, in harmony with EU standards and acceptable from the point of view of environmental protection.

To obtain this result, the following measures and activities have been identified:

- **Measures**: Introduction of new economic and financial instruments for water, air and solid wastes, that will include solutions for the introduction, use and enforcement of this incentive scheme; legislative harmonization Aquis Communautarie according to the stages imposed by the EU; preparation of environmental impact studies and case studies for all hotspots; creation of clean technology centers and their networking to ensure the flow of information and transfer of lessons learned from success stories.
- **Activities**: Development of institutional framework for implementation as a consequence of the introduction of the legal framework; projects for reconstruction and modernization on up-to-date technologies in existing industrial and mining enterprises using “dirty” technologies: chemical industry; iron and steel works; petrochemical; metalwork; pulp and paper; ore extraction and mineral processing, etc.

(ii) Implementation of pre-treatment of industrial wastewater

In order to successfully start building WWTPs, a registry of polluters will be prepared that would serve to rank hot spots on the basis of their impact on the environment, and a list of priorities will be developed, that would locate the industrial facilities in need of an urgent intervention.

In order to achieve this result, it is necessary to:

- **Install waste treatment plants**
- **Put in operation the existing treatment plants**
- **Enforce legal regulations**, by adopting the *polluter pays* principle and cost efficient operation
- **Employ monitoring system**, installed at the wastewater outlet in all the industrial plants that have proved to be of extraordinary importance

To obtain this result, the following necessary measures and activities have been identified:

- **Measures**: Preparation of studies that will register all localities that do not have WWTPs or are inadequately operating, analyze reasons for such situations and prepare a basis for decision on the priority actions to be taken.
- **Activities**: Completion and achievement of all optimum operational parameters of WWTPs at the economic agents; realization of projects for the construction of new WWTPs at the most vulnerable sites, rehabilitation and modernization of existing ones, i.e. improvement of operational parameters, extension of capacities or adding another stage in the treatment process.

(iii) Ensuring adequate management of enterprises

Following the privatisation, i.e. after changes had been made in the ownership structure of the companies which were previously state or socially owned, adequate management of enterprises was ensured through the introduction of technological discipline by means of incentive measures. Training and education of employees has been performed, whereby the level of responsibility of staff has been raised, incentive funds have been provided and modern management instruments have been applied in practice.

In order to achieve this result, the following should be undertaken:

- **Adapt the status of enterprises to market economy policies**
- **Upgrade the performance of enterprises**
- **Make available financial resources**

To obtain this result, the following measures and activities have been identified:

- **Measures**: Strengthening of institutional and management capacities in the industry and mining; preparation of instructions and guidelines for proper management of industrial plants; training of managers on introduction of environmental management system in industrial enterprises;
- **Activities**: Setting up a legal framework encouraging capital investment in environmental protection facilities; development of standardization programme of methodologies and of equipment for environmental quality control.

(iv) Treatment and disposal of hazardous substances in proper landfills

Through a consultation process, an agreement has been reached on the location and building of environmentally appropriate landfills for hazardous substances, which represents a safe and long-term solution to the problem of industrial waste. Substantial progress has been made in the overall efforts to protect water from pollution.

In order to achieve this result, the following should be undertaken:

- **Ensure landfills for hazardous and harmful substances,**
- **Classify industrial waste**
- **Enforce of regulations**

To obtain this result, the following measures and activities have been identified:

- **Measures**: Development of national physical plans defining land use; creation of national registers of toxic wastes
- **Activities**: Rehabilitation and/or closing of the abandoned industrial dumpsite areas; planning and construction of new, environmentally friendly landfills for hazardous and useful substances.

5.2.3.3. Important Assumptions for the Sector Results

Important assumptions are essential for the implementation of policies and strategies of the ICPDR Action Plan, but they are external factors, outside the scope of the ICPDR rather than under its direct control. They will ensure the success of the implementation of policies, strategies and actions and the sustainability of the results.

Important assumptions described in the national reports and essential for the implementation of the ICPDR policies and strategies focus on: economic issues (transition, free market, economic stability) legal issues (harmonization with EU, legal and institutional frame implemented) and environmental issues per se (environmental management, environmentally friendly policies, sustainable economy and policies; state of environment improved). These assumptions, which are of great importance for the realization of expected results, will in turn make an important contribution towards the realization of the goals of the ICPDR. Most of these assumptions are in close connection with the creation of a sound institutional and policy framework that involves modern environmental laws, environmental management practices and efficient administrative arrangements. All this could be achieved if the sector-level assumption is approved and realized in practice, that is:

- **Enforcement of BAT and BEP regulation in industrial sector by authorities remains a priority**

  The adoption of BAT and BEP regulations, i.e. of modern production technologies that generate much less waste and consume a minimum amount of energy is the most satisfactory long-term solution and has economic as well as environmental benefits (win-win). The use of incentives to promote the switch-over to technologies to increase efficiency of water allocation and distribution can encourage firms to adopt water saving technologies, including reuse systems.

The important assumptions for achieving results and outputs that are necessary to achieve the sector objectives include:

- **Favorable economic conditions in the country**

  In much of the region, and particularly in some MD and LD countries, the economic situation makes it impossible for business organizations to finance from their own sources the process of transition and the process of replacement of outdated technologies with modern ones and to realize, in that way, the objectives of the industry and mining sector. Since the industry does not posses sufficient financial means that could be earmarked for this purpose, favorable economic conditions need to be created.

- **Continuation of cooperation with international financial institutions**

  Favorable economic conditions could be realized by promoting cooperation with international financial institutions and continuing the cooperation over a longer period of time. This would serve as a support to the processes of transition to a market-oriented economy.

- **Implementation of environmentally sound industrial policy of the Governments**

  For successful implementation of the ICPDR, it is necessary to design at the government level an environmentally sound policy of industrial development, while continuously attempting to raise the awareness and responsibility of the staff regarding industrial production and environmental protection.

- **Elimination of war effects**

  The elimination of war effects is a basic prerequisite for the realization of the ICPDR objective. None of the above objectives can be reached without a prior elimination of war consequences.

5.2.3.4. Impact Indicators for Sector Results

Important indicators at the sector level outlined in the national reviews involve attempts to establish very direct connections between the implementation of national environmental standards, harmonised with or upgraded to the EU level, with the improved quality of the water, while at the same time enhancing or scaling up the achieved level of production activity, within an appropriate time frame. If these indicators are approved in real situation they will directly indicate that two out of four goals of the Convention have been realised i.e.

- Negative impact of activities in the DRB and on the riverine ecosystem and the Black Sea is reduced; and
- Availability and quality of water in DRB is maintained and improved.

Impact indicator for the whole sector have been defined as follows:

- **Organic and inorganic effluents reduced up to 30% by 2010, and discharge permits for industrial and mining enterprises with regard to BAT/BEP examined and revised by the year 2005**

  Industry and mining represent the most important sources of pollution in the DRB, but efforts are being made to reverse this negative effect. It is of the utmost importance to achieve this impact indicator which can only be reached by introducing a system of issuing and continuously examining discharge permits for significant industrial and mining enterprises with regard to BAT/BAP.

Impact indicators for the implementation of the results/targets necessary to achieve the sector objective, have been identified as follows:

- **Decreasing pollution (heavy metals and micropollutants) in line with the EU norms, at industrial plants with discharge bigger than 0.1 t COD/day, by using BAT/BEP, by the year 2010**

  It is expected that through the introduction of BAT and BEP regulations and taking into account EU norms in identified hot spots, the pollution will be reduced by the year 2010. Successful implementation of BAT/BAP will be assessed through the established system of monitoring of effluents and registering the values of pollution parameters.

- **Decreasing pollution in line with BAT and BEP, by the year 2010, by the construction of pre-treatment plants**

  Results obtained by building and using the WWTPS in line with BAT and BEP will be evaluated through the established control system against the monitoring standards and specific pollution parameters.

- **Adoption by industrial enterprises of internationally approved quality and environmental management systems (e.g. EMAS; ISO 9000/14000), by the year 2005**

  Through the policy of adoption and application of internationally approved quality and environmental management systems, enforced through legal regulations, successful production in line with principles of sustainable development will be achieved, and consequently, required level of protection of DRB secured.

- **Establishment of inventory of existing and abandoned landfills and application of appropriate measures to eliminate pollution of surface and ground water in old and newly constructed landfills, by the year 2010**

  Resolving the problem of hazardous and harmful industrial waste leads to a decrease in pollution of ground water. Through periodic monitoring of water quality and control of potable water sources, particularly on localities where toxic and hazardous substances were observed, the effect of achieved results will be determined.

5.3. Land Use - Agriculture

5.3.1. Situation Analysis

5.3.1.1. Importance of the Sector, Analysis of Stakeholders and Activities Leading to Water Pollution and Environmental Degradation

The whole Danube river basin has an important fraction of the world's agricultural resources, agriculture having a long and well-known tradition. Fertile areas along the middle and lower parts of the Danube rank among the **most important agricultural regions** in Europe. Agriculture, a traditionally prominent branch of economy, covers different activities, including crop production, livestock, fish farming and forest management. Intensification of land use was made possible through conversion of large parts of wetlands. Except for Germany and Austria, the countries of the Danube basin entered transition in 1989-1990 with a common heritage in agriculture: exceptionally large cooperative-size state-owned farms and collective production.

In the middle and lower Danube countries, size and production were under the former communist regime the only measures of success in the agricultural sector philosophy, known as conventional farming. The consequences of too little attention being paid to sustainable agricultural practices, waste management or water pollution, were the creation of very large intensive pig farms that produced large quantities of waste. Wastewater containing pollutants were discharged directly into the rivers and contaminated solid wastes were dumped in landfills close to water courses where leachate polluted soil and groundwater. Discharges to rivers contaminated sediments. Pollutants damaged the ecosystems and contaminated drinking water sources ultimately endangering human health. Collective farms destroyed trees and created extensive fields where the same crop was grown repeatedly. This approach to farming was not sustainable and large quantities of cheap fertilizers and pesticides were used, polluting rivers and groundwater, while the absence of windbreaks encouraged soil erosion. The pesticides were dumped on land with minimum protection. A consequence of the reduction in the use of mineral and organic fertilizers is a negative humus balance resulting in a decrease in soil fertility and agricultural crop productivity. The collapse of historical markets has reduced the price of products. The return of the land to private owners, who could not afford newly expensive agrochemical, had improved the situation but there is still an urgent need to return to land use patterns which will be sustainable in the long run.

The goals of **the sector policies** aim to permanently reduce the use of agrochemical, reduce soil erosion and ensure effective management of manure from intensive animal farms. The awareness-raising campaign and training of the farmers focus on good agricultural practices, ways to reduce erosion from agricultural land and the reduction in pollution from large pig farms by adopting innovative technologies and using nutrient rich manure as fertilizers.

The concepts of sustainable development and sustainable agriculture have been identified as long-term goals of the Danube River Protection Convention having a world-wide perspective, some of which have found a permanent place in the national and international policy making of the countries in the Danube river basin. The first significant step in the agrarian reform supported by all the parties involved in the middle and lower parts of Danube was made when privatisation started in 1990-1991. The process was accompanied by changes in the ownership configuration, crop structure, animal production and technologies applied.

The most important essential elements of the reform process in the macro-agrarian economy of the whole Danube basin included (1) price and trade liberalisation, (2) land privatisation, (3) the establishment of the institutional structures required by transition economy and (4) considerably improved agrarian financing since 1994. The region's agrarian economy is still struggling to reconcile the requirements of transition with the overall economic situation, with most progress

being made by the EU candidate countries (CEFTA countries) in particular. However, the agriculture reform is still incomplete in the countries of the Danube basin aspiring to EU accession in the next few years, the largest gaps being in the institutional framework and in rural financial systems.

Since the beginning of 1990, as a result of the economic transition to a market-oriented economy, a significant reduction in the total agricultural production and livestock has been observed (see Annex IV).

The relatively rapid decrease in agricultural production had already stopped in 1993-1994 and continued to decrease from 1995 on, as presented in table 5.3.1-1.

Table 5.3.1-1 Production indices for agriculture 1989-1991 = 100

Country/ year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Austria	97.4	103.2	99.2	100.0	100.7	99.4	100.3	104.1	104.7	99.6	100.7	99.9
Bulgaria	106.2	105.4	110.2	101.7	88.1	87.4	69.9	69.0	78.0	63.8	60.5	60.6
Croatia						64.7	61.2	56.6	58.2	60.0	54.3	55.2
Czech Republic							98.7	81.4	85.9	84.7	80.1	80.2
Germany	101.1	101.2	101.1	101.6	97.3	94.0	90.1	88.2	89.9	91.8	103.4	93.9
Hungary	100.1	105.1	102.7	96.7	100.6	78.5	71.0	71.7	70.8	79.7	61.4	79.8
Moldova Republic						74.6	79.9	62.7	65.9	59.4	62.8	61.4
Romania	105.8	110.9	108.0	94.7	97.3	79.3	96.8	93.8	101.7	91.9	99.5	93.6
Slovakia							81.4	77.2	73.1	75.9	77.2	66.9
Slovenia						75.7	85.9	93.6	98.1	102.7	98.3	101.3
Yugoslavia						94.6	89.3	92.5	96.4	101.9	100.5	101.2

The **recent change** has resulted in substantial positive economic corrections, helping the new owner and stopping the pollution of natural resources. The switch to sustainable agricultural practices is a long-term target of the Strategic Action Plan and Danube River Protection Convention. The Convention was one of the first initiatives taken by the Danube countries towards the conservation, improvement and rational use of surface and ground water, control of hazards and contributing to the reduction of polluting loads of the Black Sea from the sources in the Danube basin. A significant change has occurred in the market behavior of agrochemical producers: they have started providing their products on credit, thus creating opportunities for an increased use of agrochemical by farmers, with a direct effect on pollution. The recently- developed private sector is very fragile and lacks sufficient support. Finally, the institutional reforms have been accelerated since 1995, spurred by the challenges of the prospective EU accession. However, due to the general economic recession, the actual institutional structures of agriculture still call for substantial improvements.

Since 1989, the countries have oriented their commercial priorities and adopted the line of integration into European economic structures. The process started in 1993 with the signing of the European Agreement for the accession to the European Communities, which aims at the gradual establishment of free commercial zones. The foreseen process of EU integration greatly depends on the approximation and harmonisation of the agricultural legislation with EU legislation in several main areas: veterinary medicine, plan protection, quarantine and agrochemistry, standards and metrology and agrarian policy. One main point of reference is the White Paper for preparation of associated CEE states for integration into the uniform EU market developed by the European Commission. The White Paper contains a list of approximately 200 main agricultural acts of primary significance for the harmonisation process. In 1998, positive trends became visible in the sector. The private sector faces serious obstacles due to unfavourable legislative, financial and

organisational conditions. The new owners have still no experience in the field of agricultural technology and land management. The countries preparing for EU membership introduced the EU Common Agricultural Policy. Moreover, the land privatisation is largely moving closer to completion in all the regions of the Danube basin. A particular task facing all the countries located in the Danube basin is the harmonisation of their national water and environmental legislation with EU regulations and standards. The legal framework for environmental management of water resources and ecosystems established by both Germany and Austria, the only EU members in the Danube basin, is perceived as fully adequate and compatible with the EU provisions.

The pressure on water resources resulting from the intensification of agricultural practices and the intensity of inorganic nitrogen fertilizer use have contributed to the extension of the controlling agricultural water pollution policies. In the EU member countries located in the Danube basin, Germany and Austria, with market-oriented economies and high level of economic development, policies for controlling agricultural water pollution incorporated a mix of voluntary regulatory and incentives based measures. A recent Agreement on Agriculture, along with the planned enlargement of the EU to include countries of the middle and lower Danube regions, paves the way for the introduction of efficient supplementary incentives for agricultural pollution abatement.

The legislation is mainly harmonized with the regulations of the EU, but economic situation caused by economic sanctions (Yugoslavia) or transition period (the other Danube countries) has greatly disrupted its implementation. Those countries in which the general economic restoration has also been instituted have made the greatest progress in reforming the sector.

The **stakeholders** responsible for the agricultural sector are the key players in the implementation of the Strategic Action Plan and the National Action Plans. The key change agents include the public authorities, public and private enterprises, NGOs and the general public, all acting as both citizens and consumers. The stakeholders can be classified in three groups of organizations, (1) decision -makers (2) polluters and (3) affected stakeholders.

(1) The organizations in charge of the development and implementation of policy guidelines and legislation and their enforcement include ministries such as ministry of the environment, of natural resources, of agriculture and forestry and – in some countries – the ministry of regional development. The governments of the countries are responsible for creating favorable conditions supporting intersector co-operation. Municipalities, environmental and water inspectorates, scientific and professional bodies, research and educational institutions, river basin committees, project sponsors and funding agents, mass media and NGOs belong to the same group of organizations having a role in promoting pollution reduction measures.

(2) The group of polluters consists of large public and private farms, household crops and animal and fish farms that are based on intensive production and lack the knowledge of the appropriate use of agrochemicals.

(3) The affected parties include population exposed to high health risks, living in intensively used agricultural areas and the farmers themselves, all relying on the contaminated local drinking water sources. The ecosystem is also adversely influenced by the environmental consequences of inappropriate agricultural activities. The water supply and sanitation utilities and the water users (including forest and farmland owners) may be also negatively influenced by the absence of cost coverage and high water prices.

The impact of the agricultural sector on the surface and groundwater quality mostly originates from non-point sources - particularly farming and intensive crop production in the lowlands - and point sources - primarily large livestock and fish farms.

The **main activities** contributing to water pollution include **inappropriate land and water resources management** (large-scale production farming, improper inland water management, environmentally unfriendly exploitation of forests, inappropriate wetlands management, inefficient

flood prevention and control hydraulic structures; elimination of buffering and self-purification elements; soil erosion); **improper fish farm management** (fish farming through inadequate use of piscicol ponds); **inadequate use of pesticides and fertilizers** (plant cultivation, viticulture, fruit growing); **inadequate treatment of animal farm wastes** (unsuitable manure disposal, improper storage of wastes from livestock farming, discharge of liquid waste without pre-treatment); **transport** through waste oil from agricultural machinery; the **war** effects and the changes in **ownership and the economic conditions.**

5.3.1.2. Current Strengths/Assets

The use of natural resources, trade liberalization, the development and the use of knowledge, and the role of the governments represent important policy issues in sustainable agriculture. There is a general agreement that the implementation of the concepts must involve not only ecological aspects, but also economic and socio-cultural circumstances. The countries have been paying increasing attention to human health effects when setting regulations for the use of pesticides and their trade. In many countries of the basin, the regulators have banned the import and use of pesticides classified as potentially toxic.

In addition, several successful integrated pest management programmes are under way, especially in the countries of the upper and middle parts of the Danube basin.

- **Macroeconomic framework development for agricultural sector**

  Some features of the macroeconomic framework facilitates the creation of private market institutions, market information systems, viable financial institutions serving the agricultural sector efficiently and adequate infrastructure and logistics. The national policies of self-sufficiency at any cost or of growth with no regard to environmental costs are of the past. In view of the significant damage done by agricultural activities to the natural environment, the governments of the Danube basin are committed to a development policy that integrates environmental considerations. Such a policy enables the conservation of natural resources, the avoidance of irreversible damage to the environment and the achievement of long term economic growth on a sustainable basis. The introduction of policies in some countries during transition, that force producers to compete in open markets leads to restructuring away from conventional farming and towards less polluting agricultural practices. Favorable impacts on the water resources quality protection came from price liberalization and removal of subsidies, privatization, competitive agroprocessing and services for agricultural markets, reform of taxation, interest and exchange rates in some countries. The impacts of these policy changes include the downsizing of operations in a number of large farms, outright closures for reasons of unacceptably high inefficiencies, low competitiveness and pollution impacts. Besides the removal of subsidies, the elimination of barriers to both domestic and foreign trade has played an important role in attaining and maintaining input prices at their economic levels in some countries of the region.

- **Qualified training and scientific centers**

  There are qualified training and scientific centers for implementing a sustainable and integrated approach to agriculture and land use management. They represent a nucleus of knowledge and technical competence necessary for promoting sustainable agriculture. The transition has provided a unique opportunity for farmers to improve their knowledge on farming that uses low agrochemical input or extensive biological farming. There is a sufficient level of scientific expertise that easily translates into advice on the rational use of pesticides and fertilizers and the preservation of genetic diversity. There is a large body of qualified experts able to develop educational and informational programmes on successful models for sustainable land use or on adjusting agricultural methods to avoid

excessive fertilization due to the overuse of nitrates. Applied research programmemes provide the scientific information needed by both farmers and policy makers in order to manage and improve the quality of the environment throughout the river basin by focusing on the national priorities of the Danube countries.

- **Agricultural extension services**

  In some countries of the basin, the agricultural extension services represent a valuable asset required for reducing the negative influences of agricultural practices, improving the farmers' knowledge and providing them with training in new technologies and advice on technical and management issues. Sustainable farming methods involving input, investment and cost reduction have already been elaborated. Integrated plant protection, implementation of biological protection in agriculture, introduction of crop rotation, organic farming and forecasting services are all in place and have the ability to encourage sustainable farming and good agricultural practices. The organization of institutionalized co-operation between water suppliers and agricultural sector in order to ensure an adequate provision of safe drinking water is a very successful tool for sustainable farming.

- **Environmental legislation**

  Environmental legislation in support of adequate agricultural practices was developed after 1990. The ongoing streamlining process toward EU accession is a major asset in the region. Existing national laws and legislation that define goals and establish priorities, clear standards for setting safe limits for pollutants being discharged and regulatory regime and consistent enforcement of these standards, are important possessions of the governments of the Danube countries. Transport, handling and storage of hazardous substances are regulated. Adequate provisions for monitoring and enforcement of international, national and local standards, conventions and programs reinforce the credibility of the environmental authorities and governments. Open access to environmental and health information is a prerequisite for public participation accepted and ensured by adequate legislation in the whole Danube basin.

- **Restored ownership of agricultural land**

  Land reform introduced measures to facilitate a speedy consolidation of land ownership and changes in farm sizes. The agricultural transition agenda after 1990 started with the transfer of land tenure to individuals, which included the transfer through assignment of use right without ownership. Through privatization of land, the restitution to former owners and distribution to workers were adopted by most of the countries of the basin. Legislated after 1990, the land reform is close to completion and agriculture is now largely individualized in all the countries of the Danube region. Privately-owned smaller and larger viable farms are the outstanding features of the farming system in some countries, with services and transferable ownership rights.

- **Cost recovery**

  Cost recovery represents the most important tool in promoting sustainability and obtaining investment funds needed to finance water pollution reduction projects in the basin. The newly-adopted legal framework has facilitated the use of several policy instruments, including environmental permits and licenses, user charges, pollution charges, subsidies, legal environmental liabilities and other appropriate market based economic instruments. The governments of the Danube countries recognize the challenges involved in implementing economic instruments aimed at addressing environmental problems and the responsible ministries approved their environmental action programmes and plans that provide the guidelines for the targeted national strategies and the policy actions of greatest benefits in the short and long run. The countries of the Danube basin are at a crossroad in their efforts to promote environmentally sustainable development and introduce market economy into the agricultural sector.

5.3.1.3. Analysis of Transboundary Effects

The physical (size of the drainage area and the river discharge) and geographical features, and the economic, social and political dimensions influence the transboundary relationships that relate to water quality and pollution in the basin. Numerous problems related to human health are of significant transboundary importance, as the occurrence and spread of water related diseases do not respect the basin boundaries. Agricultural activities also result in transboundary effects of high importance for the whole region of the Danube River Basin. One of the consequences is the process of eutrophication of surface throughout the basin and in the Black Sea. The most serious agricultural and land use related pollution problems have been identified at the national and basinwide levels as hot spots which were evaluated and ranked on the basis of their impact on significant impact areas identified in the basin. The transboundary effects might primarily reflect on surface water and in some parts on groundwater as well, causing pollution and thereby presenting a threat to the health of the people who mainly use this water for drinking. This also affects the water used for irrigation of agricultural crops and leads to pollution of soil and plants, ultimately damaging human and animal organisms. The implementation of the identified alternative measures aimed at reducing pollution causing transboundary effects in the Danube countries will significantly contribute to the protection of the Danube Delta and other wetlands as well as the Black Sea ecosystems. The following transboundary effects have been considered for the countries included in the Danube basin:

- **Effects on surface and ground water**

  In some parts of the basin, heavy pollution of surface and groundwater as a result of the excessive application of agrochemicals has caused health problems involving high treatment costs. An adequate supply of safe drinking water is a basic human requirement. The contamination of drinking water sources by microorganisms and chemicals, including crop protection products exceed levels, which constitutes a hazard to human health in many locations of the basin. The pollution from pesticides and nitrate, the overexploitation and intensified drainage, leading to lowering of groundwater levels and salt water intrusion and the point pollution from improper dumping of agricultural wastes have adversely impacted the multifunctional use of groundwater ecosystems. The pollution of waters, their mud silting and increased erosion of soil will increase the negative impact on agrophytocenosis that will be considerably changed due to the soil deterioration. This will in turn affect the structure of agricultural production.

- **Reduction in biodiversity in the Danube basin and the Danube Delta**

  About half of the loads of nutrients discharged within the borders of the Danube basin are from agriculture. Toxic micropollutants damage ecosystems and eutrophication is a problem in many parts of the Danube network. Sediments have become contaminated and their transport through the Danube to the Black Sea is considerably intensified by the increased runoff coefficient in the surface waters, due to bad forest and land management. Once in the aquatic ecosystems, these substances alter the water quality and biodiversity. Moreover, the Danube flood plains and Delta represent also a permanent regeneration (spawning) space for many marine fish species (such as sturgeons and mackerels) which might be disturbed. Degradation of biodiversity caused by the inadequate management of forests and animal breeding within the private sector is also found in several parts of the basin. Flora and fauna in river basins is also affected, because the misbalance in biocenosis led to a misbalance in the structure of flora and fauna of the Danube basin. The pollution of water will inevitably lead to a misbalance in the plant and animal world, both in water and in riparian zones. Inadequate farming practices in the Danube flood plains and the Delta as well as in inland river flood plains, together with the inappropriate management of animal husbandry units have resulted in the transport of important polluters into the Danube River and further on into the Danube Delta (mainly NPK compounds and pesticide residues).

- **Tourism activities affected**

  The possibilities for the development of recreational tourism in the Danube basin will be reduced, this in turn affecting the utilization of agricultural potentials. The consequences of water pollution will be reflected on fishing and fish breeding, contamination of drinking water sources that threaten human health or landscape features and in reducing the use potential of the water (water supplies, tourism and leisure).

- **Increased sedimentation in water reservoirs**

  Due to stronger effects of erosion processes, enhanced by the cutting of forests, the waters of the Danube basin will be mud silted, this in turn leading to increased sedimentation in Danube water reservoirs. Some of these sediments accumulated in the reservoirs will influence the floods routing capacity and some are mobilized during floods and high flows through Danube network to the Black Sea.

- **Risk of soil contamination**

  Wastewater containing toxic contaminants were discharged directly into the rivers and contaminated solid wastes were dumped in landfills close to watercourses where seepage pollutes the soil and groundwater. The negative impact, i.e. the damage done to agriculture may be seen as direct damages arising from erosion of the soil, flooding of farming land, i.e. destruction of material goods, and as indirect ones, arising from the decrease in the crop yield and a consequent decrease in income, due to pollution of waters and impossibility to use them for irrigation. This negative impact will also reflect in the pollution and destruction of the land itself.

- **Changes in flow regime**

  Changes in flows and canal capacities result from various activities such as embankment, drainage or irrigation works, hydraulic structures and deforestation. The cumulative effect of all these activities is leading to important changes in the flow capacity regime, widening on the one side the gap between minimum and maximum flowing capacities, and hence either non-compliance with minimum admissible regime for downstream users, even restricting the sanitary regime on inland rivers, and on the other side triggering extreme overflows, resulting in non-compliance with international conventions related to high water levels. Mostly affected by this unfavourable balance is the Danube Delta - an area still in the process of formation and extremely sensitive to any distortions caused by hydrological and soil balances diverting the natural evolution course.

5.3.2. Problem Analysis

5.3.2.1. Sector Core Problem

In the eleven National Planning Workshop reports (the Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Yugoslavia, Bosnia-Herzegovina, Bulgaria, Romania, Moldova and Ukraine) the sector problem identified in relation to the relevant national problems is:

"INADEQUATE LAND MANAGEMENT AND IMPROPER AGRICULTURAL PRACTICES IN THE DANUBE RIVER BASIN"

Growing evidence shows that due to intense demand and poor land management, the cropland in many parts of the basin is in a state of rapid decline. Once-productive land is either washed away by rain or has become dry and infertile. Intense fertilizer and pesticide use is contaminating drinking wells and nearby lakes and watercourses. Poor land management results in excessive soil loss from erosion. Competition for water in several sectors of agriculture reduces the amount of land that could be irrigated, resulting in lower food production, higher prices and economic decline. In addition to being eroded or salinized, farmland is being rapidly converted to non-productive

uses, through expanding cities or new highways. Finally, the use of subsidies in much of the basin is an underlying cause of creating a massive unsustainable agriculture system. The recent dramatic changes in government policies aim to promote sustainable farming practices and meet the need to protect and enhance the soil and the environment. One component of a sustainable agriculture - the cornerstone of a sustainable community - is self-sufficiency and sustainability of farms. This can be complemented by providing technical and financial resources needed to transform the current agricultural systems and build them around the biological principle of sustainability. The principle implies protection of the environment parallel with high-quality food production, conservation of soils, energy, and water; recycling of soil nutrients, renewable energy for farm machinery, and restoration of damaged land.

5.3.2.2. Causes Leading to Environmental Problems

A. Immediate causes (hot spots, diffuse sources of pollution)

The following immediate causes of point and diffuse sources discharges, integrated from the basin-wide point of view, were identified:

- **Inadequate use and application of pesticides and fertilizers**

  In most of the Danube basin the excess fertilizers wash into lakes and water bodies disturbing the natural balance while irrigated agriculture faces several constraints, most importantly groundwater depletion and tight competition for water supplies. Only partially used in the upper Danube region, the organic farming system relies on alternative, less environmentally harmful means to control pests, excluding synthetic fertilizers, pesticides, growth regulators and livestock additives. On these farms, crops depend only on crop rotation, green manure, and animal wastes and off-farm organic wastes to fertilize their fields and maintain soil quality.

- **Discharge of liquid waste from farms without pretreatment**

  Many areas of the basin are strongly affected by large-scale intensive farming that are significant point sources of microbiological pollution. Most of the livestock enterprises do not have satisfactory wastewater treatment facilities and discharge their untreated liquid manure directly into the nearby water bodies or the environment. However, in some cases, livestock has been reduced considerably (up to 70%) between 1985 and 1992, especially pigs and poultry.

- **Leakage of on-site septic tanks**

  Soil is the receiver of natural but also man-made pollution coming from polluted agricultural practices and incautious disposal of agrochemical and wastes. In many areas of the Danube basin, the leakage of on-site septic tanks is dispersed over an area, leached into groundwater or distributed to consumer with the crop producing environmental health hazards

- **Inappropriate forest management and land use**

  Forests cover more than 35% of the Danube river basin. A sharp rise in the prices of fuel and energy resources (due to elimination of subsidies) has led to the growth of both planned and illegal cutting that has aggravated the situation in the forest fund. The situation has become aggravated, in some parts of the Danube with the increase of livestock head, illegal pasturage and elimination of sensitive forests or extensive forestry management. When harvested trees were not replaced, sediments from increased erosion polluted streams and erosion have delayed the recovery of the forests.

B. Root causes

- **Agrarian reform**

  The reform of the agricultural sector has prevented the farmers from immediately adjusting to environmental, social and economic conditions. The governments direct or indirect subsidies of chemical pesticides and fertilizers still exist while the practices that sharply reduce soil erosion and loss of soil fertility by sustainable soil and forest resources management are still missing in the middle and lower Danube countries.

- **Weakness of the legal framework**

  The recent shift from chemical-intensive, environmentally damaging agriculture to alternative pest management solutions has called for the implementation of precautionary measures. Most of the countries of the middle and lower Danube regions have not yet been able to redefine their policies and programmes in a way that would address the needs of the consumers. Alternatively, they have failed to support the basic land reform to ensure more equitable access to productive resources and to facilitate the achievement of a sustainable agriculture.

- **Absence of agricultural education of farmers**

  The limited knowledge and ignorance of farmers in using chemicals without considering the human health hazards facilitated the use of inadequate agricultural practices that produced severe water quality and soil pollution. There is an urgent need to shift the farmer's best mix of available pest control strategies towards a greater reliance on environmentally sound non-chemical methods. There is still a strong need in almost the entire Danube basin for support to research, development and implementation of integrated non-chemical pest control, soil fertility, and animal management methods.

5.3.2.3. Environmental Effects

The immediate effects of pollutant discharges from point and non-point sources that were identified considering the pollution influence on identified Significant Impact Areas, wetlands and on the Black Sea ecosystems include the following immediate and ultimate effects:

Immediate effects

- **Surface and groundwater pollution**

  The chemical applied to the fields, the accidental spilling, the use of herbicides to control weeds in irrigation canals have all contributed to the worsening of surface and groundwater in whole areas of the Danube basin. The value of the wetlands in reducing polluting inputs from agriculture has often been underestimated. Many of the wetlands have been lost or degraded by land drainage to create new farmland and by regulating river flows so as to eliminate periodic flooding.

- **Change of soil structure**

  In many parts of the basin, pollution has irreversibly affected the soil structures. Soil is exposed to the erosion forces of water and wind. Inappropriate livestock production and agricultural practices have affected the soil fertility and are responsible for the deterioration of soils in the middle and lower Danube regions.

Ultimate effects

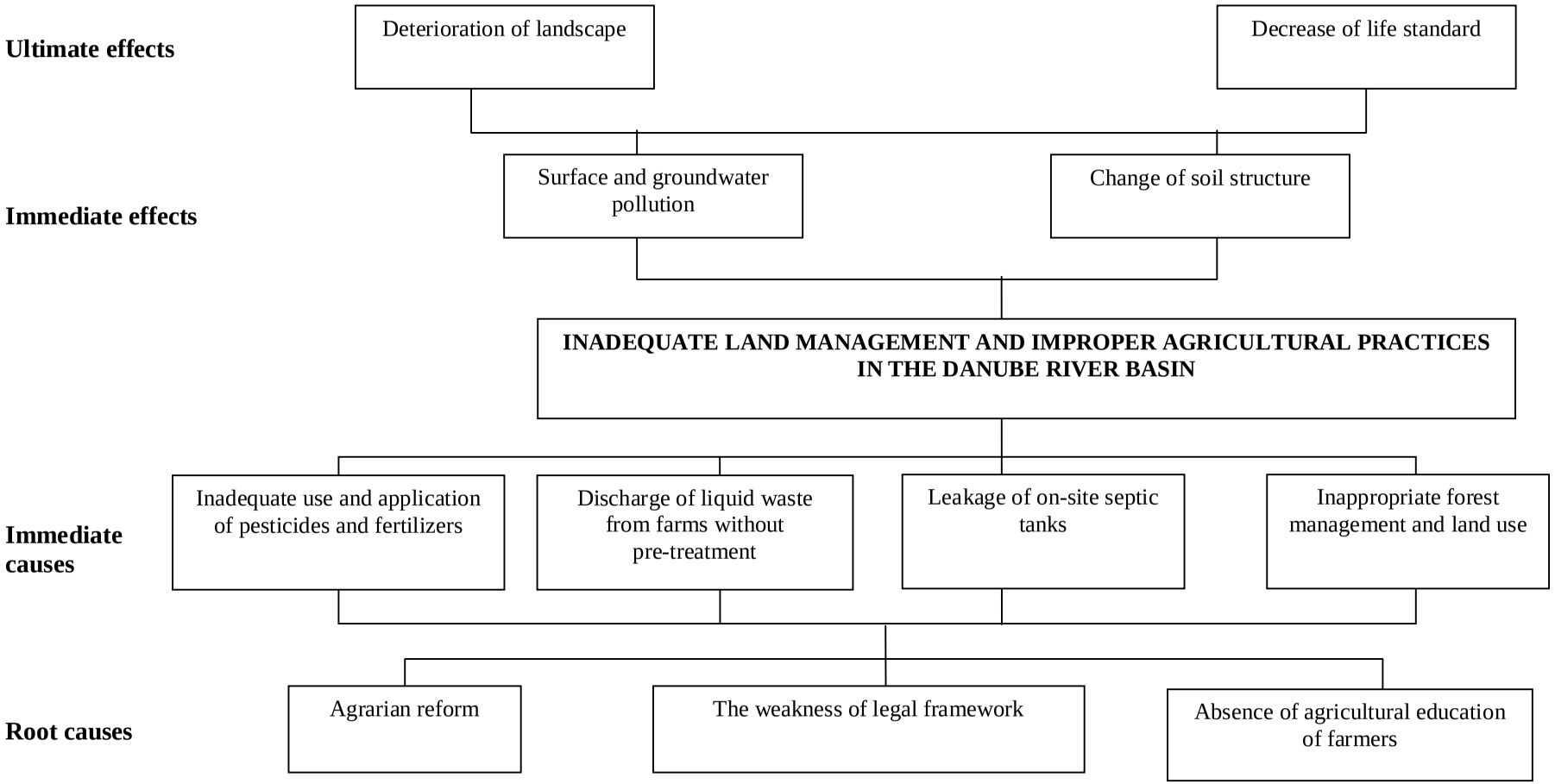
- **Deterioration of landscape**

  Unacceptable concentrations of various pollutants in receiving waters and unsound land management practices developed a chain of repercussions having adverse effects on biodiversity. The species richness, the ecosystem complexity and genetic diversity are significantly affected especially in the lower areas of Danube basin.

- **Decrease of life standard**

  The present farming systems do not ensure a long-term sustainability of agricultural (soil, water, energy) or biological resources for future generation. The current agricultural policies neither ensure the welfare of population nor eliminate the public health burden the agrochemicals place - through residues in food, direct exposure, soil and groundwater contamination - on farmers, farm workers, consumers and the community at large.

Chart 8 **Problem Hierarchy Land Use - Agriculture**



5.3.3. Description of Sector Objectives

5.3.3.1. Description of SECTOR Objective

Considering the vital goals of the Strategic Action Plan derived from the objectives of the Danube River Protection Convention for improving the aquatic ecosystem and biodiversity and the reduction of pollution loads entering the Black Sea, the development objective of the sector Land Use – Agriculture is**:**

"IMPLEMENTATION OF GOOD AGRICULTURAL PRACTICES AND MECHANISMS FOR SUSTAINABLE LAND MANAGEMENT"

This specific sector objective should contribute to the ICPDR-Convention Objective:

"PROTECTION AND SUSTAINABLE USE OF WATERS OF THE DANUBE RIVER BASIN"

To achieve the sustainable and environmentally sound development of water resources in the Danube basin, greater attention should be paid by the countries to the formulation and implementation of a national policy, whose specific sector objectives are:

i. to develop and utilize water resources in an environmentally sound, economically efficient and equitable manner,
ii. to implement the precautionary action approach by switching from chemical-intensive agriculture to alternative pest management solutions,
iii. to implement policies and practices that reduce soil erosion and loss of fertility caused by unsustainable soil and forest resources management, and
iv. to ensure long-term sustainability of agricultural resources for future generations.
v. to protect and restore the wetlands and their biodiversity.

5.3.3.2. Expected Results (Outputs) and Targets by Sectors of Intervention

Agriculture is now largely individualized in the countries in the region. Despite the diversity of problems, interests and priorities across the Danube river basin, the countries have agreed on principles that emphasize the goals and actions of the SAP and have developed, during the last 5-10 years, comprehensive concepts for the sustainable use of the environment according to the specific objectives of the Danube River Protection Convention. Agriculture is the worst cause of pollution in many areas and therefore, the change to more sustainable, ecologically sound agricultural management practices is a long-term target of the Strategic Action Plan.

The governments can implement this solution by:

i. creating predictable and consistent systems of various government policy instruments, liberal incentives and market systems,
ii. introducing measures to facilitate a rapid consolidation of land ownership and changes in farm size,
iii. supporting competitive, privately-owned agroprocessing and input supply,
iv. substantially increasing support for research, development and implementation of ecologically sound agricultural management practices, soil fertility and animal management methods, including biological pest control, cultural control, plant breeding for resistance, and organic fertilization,
v. ensuring the long-term sustainability of agricultural resources,
vi. initiating inter-sectoral co-operation, and
vii. creating viable financial institutions for privatized agriculture.

Therefore, for achieving sustainability in agricultural development and land use, the following expected results/outputs have to be accomplished in relation to the Sector Objective:

(i) Application of integrated land and water management

The holistic management of water as a finite and vulnerable resource and the integration of sustainable land use principles should be of great importance to the Danube countries for determining their future actions. The national governments should adopt integrated management of water and land based on comprehensive ecosystem assessment, seriously taking into consideration the introduction of sustainable agricultural practices, drawing policy plans and feasibility frameworks for designing financial implications and changes in operational elements, monitoring, planning and management structures. In addition, they should improve co-operation between the various sectors.

The existing / on-going projects are already running in all the countries of the Danube river basin that deal with the preparation of relevant legislation and policy which include the intersectorality of water management, agriculture and land use. For practical implementation of legislation and policy measures, the goals and priorities have been defined and the structures for decisions have been established. The policy makers in the basin are preparing adequate provisions to ensure a consistent enforcement of national and local standards for the implementation of integrated land and water resources management.

The proposed projects that can contribute towards improving the situation include:

- reviewing and improving the current policies and programme objectives that promote an integrated approach to water resources and land use management,
- preparing training courses for catchment management planning, and
- developing demonstration pilot projects to encourage the integrated approach to water management and consideration related to the use of land.

(ii) Adoption of adequate use of pesticides and fertilizers

Several activities are required in order to achieve the appropriate use of pesticides and fertilizers, including: the development and implementation of a suitable set of regulations and economic incentives to promote the introduction of sustainable agricultural services; the implementation of various pilot projects involving sustainable farming and the introduction of trade marks for products of integrated agricultural production. The results of applied research should be evaluated before a follow-up to such pilot projects is considered for future development. It will be necessary to encourage the research, development and use of organic farming techniques adapted to local conditions. Over the past years, farmers in the basin have gained experience in farming with low agrochemical input because they didn't have the money to buy these substances. Thus, a good basis of knowledge exists, which can be improved with alternative methods for minimizing inputs. Raising public awareness is also an important process contributing to the development of sustainable agriculture and appropriate pesticide use.

The following project(s) have been identified for this activity:

- The existing/on-going projects include the preparation of local Agenda 21 and demonstration and pilot projects in several areas of the basin.
- The proposed projects aim at introducing sustainable agricultural production on pilot farms, monitoring the ecological impacts of fertilizers and pesticides in irrigated areas, completing warning and laboratory systems, including systems for the exchange of information, and urgently developing training systems for training farmers in the use of sustainable methods.

(iii) Proper treatment of wastewater discharged by farms

Until recently, the livestock farming sector has to a large extent been exempted from regulations. This is reflected by the general lack of wastewater treatment plants or sufficient storage capacities for manure for large animal husbandry units and by the significant air pollution in some regions with extremely high numbers of animal stock. In order to achieve the objective of adequate wastewater treatment, the government can contribute by mobilizing public opinion for setting priorities for the remediation of the impacts in the main activities: sustainable livestock breeding, wastewater discharges from farms and regulations in manure management.

The existing /on-going projects in the basin are concentrated on training farmers and agricultural advisors in ways to assist small farms with the introduction of sustainable livestock breeding, identifying solutions on management of animal waste produced by pig farms, and enhancing monitoring and control activities.

The planned projects aim to develop a system of economic incentives and legal regulations for sustainable livestock breeding and implement standards for good agricultural practices. The establishment of information systems, rehabilitation of inappropriate manure deposits and construction of wastewater treatment plants at animal farms can greatly improve the presently critical situation. The completion of pilot and demonstration projects for manure handling, storage, disposal and application, represents a vital element. Other projects in preparation aim to define eligibility criteria for subventions and subsidies for the sustainable breeding of livestock, preparation of an inventory (register) of polluters, implementation of. programme for raising the farmers' awareness and knowledge abut the introduction of good agricultural practices on pilot farms. Most of the proposed projects are geared towards reducing the pollution from big animal farms by adopting innovative technologies and using nutrient-rich manure as fertilizer. These projects play an important role due to the effects of large animal farms on nutrient loads in the Danube and consequently on the eutrophication of the Black Sea.

(iv) Prevention of accelerated runoff and erosion

One of the highest priorities must be to end excessive soil erosion in all the Danube countries. Governments can promote land conservation through a variety of programmes and laws. Soil erosion controls help not only to preserve farmland, but also protect soil nutrients vital to soil fertility that is essential for increasing its productivity. Soil fertility can be enhanced by the use of fertilizers and crop rotation and by human wastes for sewage treatment plants.

The existing and planned projects in the Danube basin aim to reduce extreme conditions of hydrological regimes, through various hydraulic structures, forestation and other land use measures. The accumulated bedload and suspended matters containing toxic pollutants are carefully addressed through planned operational techniques practised by most of the dam operators. As the inadequate agricultural routines practised in the croplands can be also responsible for accelerated erosion, the proposed projects look at the introduction of sustainable land practices and to the introduction and use of the most effective economic instruments to control the adverse effects of accelerated run-off.

(v) Adequate protection and restoration of wetlands and floodplains

Wetlands play a valuable role in contributing to pollution reduction and sustainable management of the Danube River Basin. It is therefore necessary to secure the size and functioning of the existing areas through better legal protection and resource management. In addition, degraded wetlands should be restored throughout the basin in order to increase their performance, including selfpurification (uptake of nutrients), flood retention, gene pool (habitat and species diversity).

Respective projects include:

- designation of new protected wetlands and upgrading of the existing protection status of the already protected areas
- establishment of restoration programmes for former wetlands along the entire river courses
- establishment of species protection programmes aimed at maintaining the genetic diversity

5.3.3.3. Important Assumptions for the Sector Results

There are several assumptions of vital importance for the implementation of policies and strategies of the Danube basin and the achievement of the identified sector objectives and expected results as defined by the present SAP.

The most important assumption for the implementation of the sector objective include:

- **Governments are progressively implementing adequate policies leading to sustainable land use (wetland restoration) and agricultural practices.**

  Integrating land use policies and practices with water management in the Danube river basin plays an important role in the formulation of the countries' water strategies. The application of the sustainable land use practices need to be seen in the context of political structures and newly introduced privatization policies in the agriculture. Governments should intensify their efforts to introduce a combination of market incentives and regulatory policies to reduce pollution, soil erosion, water logging and runoff. Governments should commit to introducing economic incentives and adopting land use practices leading to a better protection of the environment and to a significant increase in social and economic stability and living standard.

The important assumptions for achieving the expected results and outputs leading to the achievement of the sector objectives have been identified as follows:

- **Increase intersectoral cooperation for capacity building in integrating environmental considerations in development planning and decision making**

  This important assumption relates to the substantial increase in intersectoral cooperation for strengthening capacity building in integrating environmental consideration in development planning and decision for water and land use.

- **Implementation of precautionary approach to achieve sustainable agriculture and rural development**

  This relates to the success of the implementation of the precautionary action approach in the policies and practices of governments to achieve sustainable agriculture and rural development. A further obstacle to change is reflected by the existence of aggressive marketing strategies of the agrochemical industries in some of the Danube countries that significantly contributed in several parts to increasing the problem of eutrophication.

- **Governments's support of research, development and implementation of sustainable animal management methods**

  This includes the government's support of research, development and implementation of sustainable animal management methods.

- **Conditions for implementing policies and practices that reduce soil erosion and loss of fertility**

  This includes the creation, by the governments, of necessary conditions for implementing policies and practices that reduce soil erosion and the loss of soil fertility caused by unsustainable soil and forest management measures.

- **Governments' commitment to securing, maintaining and restoring wetlands in the Danube River Basin**

  This relates to the need to expand the existing legal framework in order to better protect and restore wetlands, in addition to enlarging the institutional capacity to implement wetland management and restoration measures.

5.3.3.4. Impact Indicators for the Sector Results

Based on the elements outlined in the 11 National Workshop reports and the connection to the identified results of the actual Strategic Action Plan, the important impact indicators have been identified. They define the contents of the objectives and results in operationally measurable terms (quantity, quality, target groups, partner institutions, time period and place). They provide an accurate picture of the situation and are measurable in a consistent way at an acceptable cost.

The impact indicators necessary to achieve the sector objective include:

- **Increased application of good agricultural practices by 15 % in large farms by the year 2005 and by 20% by the year 2010**

  Through incentives and control systems for soil fertility, prevention and quarantine services and pest control services, intensive ecological education of farmers, and by properly using the land, conditions will be created for producing high-quality agricultural products, protecting water quality and achieving sustainable agriculture. The EU is struggling to develop indicators, but has to date not reached an agreement to establish any additional statistical services. The Danube countries should initially follow the lessons learned from the EU debate and its outcome, and monitor the progress indirectly, through measurement of discharges and N, P and sediment concentrations, loads in the river, and concentrations of pesticides in the river and groundwater.

  The impact-related result can be assessed by measuring the percentage of increase during the previous year, as measured by the annual number of permits issued for the large agricultural units.

  As a next step, middle-sized agricultural farms should also be included in the enforcement programme for applying good agricultural practices and should be assessed by environmental authorities.

The following impact indicators have been identified for sector results:

- **By the year 2010, the integrated management of river basins has been achieved in all DRB countries, through inter–sectoral and international co-operation and implementation of the EU directives**

  Integrating land use and water resources management considerations in inter-sector planning and decision-making process for the entire catchment will contribute to a more efficient use of water, allocation of development and improvement of natural ecosystems.

- **By the year 2010, the number of certified organic farms will have increased by 20%, and the N+P total fertilizer consumption on other farms will have stabilized at the 1998 level**

  Decreasing the application of chemical substances in agriculture and supporting the switch to organic farming and sustainable agriculture will contribute towards the improvement of lowland ecosystems (particularly wetlands and waters) and the environment in general.

  In other farms, those where organic farming has not been introduced yet, fertilizer consumption needs to be stabilized.

- **By the year 2005, 50% of all animal farms with over 500 livestock units will have been equipped with wastewater treatment plants, and by the year 2010 this figure will have reached 75%**

  Livestock farming is one of the main point sources of pollution from agricultural activities. To reduce the pollution, the development, implementation and enforcement of the regulation should also be achieved. The assessment of efficiency of intervention in ensuring capacity and creating new WWTP, different from those operating in the reference year 1998, will allow the progress to be measured.

- **In agricultural landscapes, lengths of hedgerows, forest belts and wind breaks will have increased by 25% by the year 2010 and 2000 km of regulated rives will have been restored in the DRB**

  In arable lands, the liquidation of hedgerows and forest belts in favour of agricultural production, has resulted in accelerated runoff and wind erosion of the top soil. As a mitigating measure, the length of these hedgerows, forest belts and wind breaks will be increased.

  The restoration of regulated rivers will create more natural conditions (reduction of accelerated runoff) to facilitate the development of riverine habitats (rehabilitation of in-stream habitats and river banks).

- **Through the implementation of wetland priority projects, 110 000 ha of wetlands will have been restored by 2005 and 140 000 ha by 2010**

  A study conducted as part of the GEF PRP has defined priority sites for initial restoration of wetlands throughout the basin. 250 000 ha of such areas will have been restored by 2010.

6. Financing Mechanisms for Implementation of the ICPDR Action Plan

6.1. Existing Financing Mechanisms and Resources

6.1.1. Funding Mechanisms at National Level

All DRB countries have, to a certain extent, a system of specified funding sources and procedures according to which typical water sector projects (such as small or medium size municipal WWTP) are actually funded by a more or less "standard funding mix".

Except for Germany and Austria (and with some reservations Hungary and Yugoslavia) the DRB countries do not really dispose of "standardised funding mechanisms" in the sense that a potential public or private investor or project sponsor has a legal claim to a certain amount of public subsidies which would constitute a reliable basis for the elaboration of an appropriate funding schedule. Thus, in most of the countries, the elaboration of a project-specific funding schedule is usually a long lasting process of negotiations and bargaining, especially for projects with small equity contribution and need for high public subsidies or international funding assistance. The main problem in this context is the prevailing "planning uncertainty" due to the fact that the probability and extent of any public support for a particular project are usually not in the decision sphere of the project investor.

Since 1992 eight of the DRB countries have established National Environmental Funds, and Romania is currently in the process of installing a "Draft Environmental Fund". Income and expenditure data for the particular funds are compiled for the most recent year for which data are available in Table 6.1.1-1:

Table 6.1.1-1 National Environmental Funds in the Danube River Basin Countries

Country	Year	Annual Income	Annual Expenditures	Surplus /Deficit
		Million USD	Million USD	Million USD
Bulgaria (NEPF):	1997	9.1	4.2	4.9
Czech Republic (SEF):	1997	26.8	59.7	- 32.9
Hungary (CEPF):	1998	114.7	114.2	0.5
Moldova (NEF):	1996	0.3	0.3	0.0
Slovakia (SEF):	1997	30.8	29.6	1.2
Slovenia (Eco Fund)	1997	20.0	18.0	2.0
Romania (NEF):	1999			
Ukraine (State Fund of Env. Protection)	1998	4.0	4.0	0.0
Yugoslavia (NEPF):	1998	0.2		

The annual budgets of the particular National Environmental Funds vary between about USD 0.3 million (Moldova) and about USD 115 million (Hungary). Apart from Hungary the budgets of the National Environmental Funds are rather small compared to the prevailing capital requirements, and cannot, from this point of view, be considered as substantial and efficient funding sources or mechanism in the particular DRB countries.

6.1.2. National Funding Resources

There is a common understanding in all DRB countries that long-term financing needs have to be met primarily from within the countries themselves. Consequently, there is a broad variety of public funding sources for water quality and water management programmes and projects which can be categorised as follows:

- **National budget funds of the relevant ministries;**
  (grants, concessional loans, guarantees);
- **Regional budget funds;**
  (grants, concessional loans);
- **Municipal budget funds;**
  (grants, concessional loans, operating subsidies);
- **Revenues from charges;**
  (for normal use of water and natural resources, discharge of wastewater, disposal of solid waste);
- **Revenues from penalties and fines;**
  (for misuse of resources, environmental pollution, violation of legislation, etc.);
- **Revenues from concessions;**
  (for use or handling of water, wastewater, solid waste, natural resources, etc.);
- **Revenues from tied taxes and import duties;**
  (on land use, "harmful" commodities such a s fuels, cars, etc.);
- **Revenues from public services;**
  (water supply services, wastewater services, solid waste services);
- **Equity of public and private investors;**
  Commercial bank loans;
- **Others;**
  (donations, revenues from privatisation, etc.);
- **Economic and financial incentives improving net income or profit of project sponsors;**
  (incentives on income tax , import tax , VAT, special transaction taxes, preferential treatment of environment friendly investments and depreciation, goods and production processes, credits, etc).

The importance of the particular categories of funding sources for particular purposes varies greatly from country to country; some of the funding sources are either applied by all or the majority of the DRB countries, others are applied by only a few countries.

The revenues from charges, fines, concessions and tied taxes are either used as direct funding sources in a way that the local governments/municipalities can retain a certain portion for environmental funding purposes, or indirectly, via public budgets or special funds, such as National Environmental Funds or Water Management Funds. The actual practice of collecting these funding sources is often not efficient and consequent, and it is sometimes hampered by inappropriate administrative and institutional structures.

In general terms, most of the DRB countries do not, for the time being, dispose of a rational mix of funding sources which is really suited to achieve the utmost provision of funds for water sector investments.

6.1.3. International Funding Resources

Constraints on the availability of domestic funding means, and the need for foreign exchange, make the use of external financial resources very important in the short and medium term.

International financial assistance is provided by international financing institutions (IFIs), country specific funds, international foundations or NGOs and by bilateral agreements as well as by private foreign investors or commercial banks. The assistance is provided either directly or by means of national financial intermediaries, either for particular projects or in the form of programmes. The main funding organisations and sources for international co-funding of water sector programmes and projects in the DRB countries can be summarised as follows:

- **World Bank** (IBRD, IDA, IFC);
- **EBRD;**
- **European Investment Bank;**
- **EU-organisation and programmes** (EU PHARE, PHARE-CBP, TACIS, ISPA);
- **UN-organisations and programmes** (UNDP, UNEP, GEF, etc.);
- **Country-specific funds and assistance organisations;**
- (such as Japanese Grant Fund, Saudi Arab Fund, USAID, GTZ, etc.);
- **Country-specific development banks** (such as KFW, NIB, etc);
- **International foundations and NGOs;**
- **Bilateral assistance;**
- **Foreign private investors** (usually by joint venture investment capital);
- **Foreign commercial banks.**

The most essential instruments of international financial assistance available for structural and non-structural projects, i.e., programmes on the various administration levels of the recipient countries are:

- **Grants** (in the form of financial or technical assistance, donations from foundations, trust funds, etc);
- **Concessional loans** (with preferential terms regarding interest rate, maturity period, grace period, subsidisation of interest payments, guarantees);
- **Loans at commercial terms** (either in form of stand-alone loans, or senior, i.e., subordinated loans);
- **Guarantees** (to facilitate equity investment or commercial bank financing);
- **Private investment capital** (usually in the form of joint venture capital);
- **Debt-for-environment-swap;**
- **Twinning arrangements** (usually not in the form of fund transfer, but in the form of know-how transfer between parties of similar interests).

6.2. Appraisal of Financial Requirements for the Implementation of the ICPDR Investment Programme

6.2.1. General

The types of actions dealt with in the framework of this SAP include: (i) policy and regulation, (ii) public awareness, (iii) institutional strengthening and capacity building, (iv) public and private sector investments in water pollution control and water management. Accordingly, the financing needs fall into three categories:

- **Funds for preparatory technical activities**, including: (i) preparatory studies, planning, training, institutional strengthening and capacity building; (ii) programme design and implementation; (iii) project identification, prioritisation and preparation (feasibility level); (iv) demonstration and pilot projects;
- **Funds for capital investments** related to water pollution control and water management;
- **Funds for project implementation**, including: (i) operational training; (ii) institutional strengthening; and (iii) programme and project follow up and monitoring.

6.2.2. Financial Requirements by Sector and Priority

From the evaluation of the project data dealt within the framework of the DRPRP the total capital requirements of all selected projects in the DRB amount to about USD 5664 million.

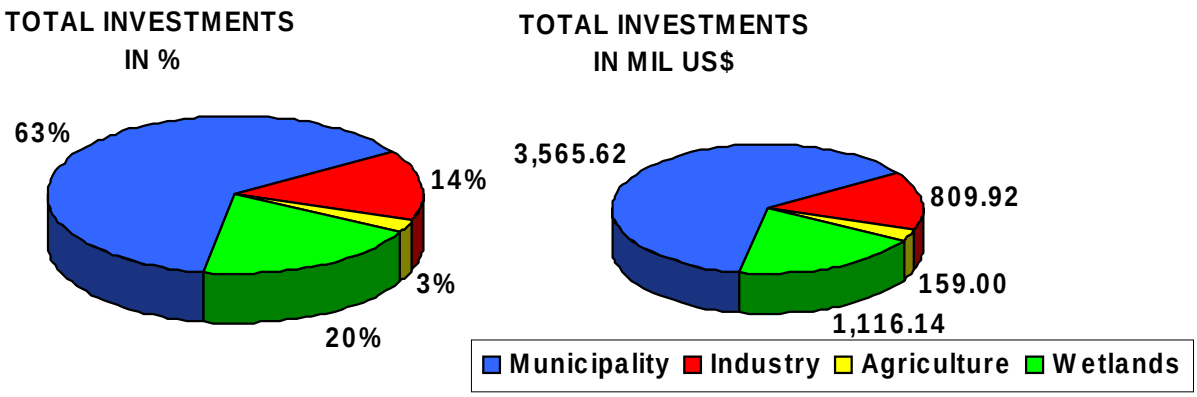
The overwhelming portion of these capital requirements are dedicated to the municipal sector (63%). The capital requirements for the industrial sector are in a range of 14% and for wetland restoration (including cost of land) in the range of 20%; the requirements for agriculture, land use and other projects are less than 3%.

The detailed capital requirements are compiled in Table 6.2.2-1 and illustrated in Figure 6.2.2-1.

Table 6.2.2-1 Financial Requirements for the Implementation of the ICPDR Investment Programme by Sectors

Sector	Total Projects	
	Mil USD	%
Municipal	3566	63
Industrial	810	14
Agriculture	159	3
Wetlands	1116	20
General	14	0
Total	5664	100

GRAPH 6.2.2 -1: COMPOSITION OF TOTAL INVESTMENT COSTS BY



6.2.3. Financial Requirements by Effects

The capital requirements of the particular DRB counties for the implementation of the proposed ICPDR investment programme are compiled on sector basis in Table 6.2.3-1. The countries with the highest capital requirements of more than USD 500 million are Croatia, Bosnia &Herzegovina, Yugoslavia, Romania and Austria.

Table 6.2.3-1 Financial Requirements of the Particular DRB Countries for the Implementation of the ICPDR Investment Programme (by Sectors)

Country	Municipal	Industrial	Agriculture	Wetlands	General	Total
	(Mil USD)	(Mil USD)	(Mil USD)	(Mil USD)	(Mil USD)	(Mil USD)
Germany	101	6	0	127	0	233
Austria	576	81	0	43	0	700
Czech Republic	106	3	31	71	0	211
Slovakia	104	75	0	9	1	188
Hungary	90	58	0	313	0	460
Slovenia	280	55	7	0	0	342
Croatia	729	6	0	175	5	915
Bosnia-Herzegovina	222	48	15	80	0	365
Yugoslavia	681	4	2	124	3	905
Bulgaria	199	97	0	22	0	318
Romania	360	255	40	101	3	759
Moldova	54	38	45	24	0	161
Ukraine	64	11	1	28	2	107
Total	3566	735	141	1116	14	5664

The financial requirements for the implementation of the ICPCR investment programme on Sub-River Basin areas are compiled in Table 6.2.3-2. The Sub-River Basin with the significantly highest capital requirements of more than USD 1200 million is the Sava river basin, followed by the Drava-Mura basin with capital requirements of about 790 USD million.

Table 6.2.3-2 Financial Requirements for the Implementation of the ICPDR Investment Programme on Sub-River Basin Areas

Sub-River Basin	Municipal	Industrial	Agriculture	Wetlands	General	Total
	(Mil USD)	(Mil USD)	(Mil USD)	(Mil USD)	(Mil USD)	(Mil USD)
1 Upper Danube	95	1		127		223
2 Inn	5	87				92
3 Austrian Danube	526					526
4 Morava	106	3	5	113		227
5 Vah – Hron	44	24		0		68
6 Panonian Central Danube	136	67		32		235
7 Drava – Mura	333	7	7	446		792
8 Sava	983	100	15	133		1232
9 Tisa	225	63	5	90		382
10 Banat - Eastern Serbia	260	0	3			263
11 Velika Morava	218	0	0			218
12 Mizia – Dobrudzha	199	96		22		317
13 Muntenia	340	67	2	63		473
14 Prut – Siret	69	117	23	28		237
15 Delta – Liman	26		0	62		88
Total	3565	632	59	1116		5372

Out of the total investment requirements of about USD 5521 million for the whole DRB a portion of about USD 5023 million or about 91% of the total capital requirements are dedicated to projects which are directly related to one of the 51 “Significant Impact Areas” (SIA) determined in the course of the transboundary analysis.

6.3. Concepts and Actions for Financing Implementation

General Concepts and Principles

Since the domestic and external financial resources are limited and obviously not sufficient to cover even the high priority requirements in the short term, it is necessary to establish long-term sustainable funding concepts and innovative financial mechanisms.

Common basic principles should be:

i. Domestic financial resources should be used primarily on external resources wherever possible, to avoid pressure on the usually unfavourable countries' balance of payments.

ii. The restricted domestic funding sources should be allocated to the competing projects of a particular sub-sector in utmost accordance with the results of the basin-wide project priority ranking, carried out in the framework of the DRPRP.

iii. Given the present constraints on public sector budgets, emphasis should be placed on meeting funding requirements from revenues generated at the project level (e.g. charges for municipal water and wastewater services) before seeking national or international sources of funding.

iv. Domestic private investment is currently constrained by historical barriers to private ownership, a limited domestic banking and financial sector, and the inexperience of potential investors with the types of activities required. Therefor it is essential to modernise and adjust the legal, regulatory and institutional

framework to international standards, in order to enable and attract utmost private participation in project funding and operation. This could include, for instance, public-private partnership on the basis of BOT (build-operate-transfer) or concession models.

Short-term Actions

In the short term, the following actions should be taken on a basin-wide, i.e., national level:

i. Confirm, at the governmental level, the high-priority projects identified in the framework of the basin-wide priority ranking process, by taking into account:
   - environmental effectiveness at the sub-basin, national and transboundary level,
   - technical and economic feasibility,
   - cost effectiveness in relation to pollution load reduction, and
   - financial viability of the project, i.e., project sponsor.

ii. Specify the overall capital requirements of the high priority projects selected for the particular sub-sectors at the national levels.

iii. Initiate internal discussions on governmental level, including the Ministry of Finance and all the relevant ministries, in order to establish the agreed investment portfolios dealing with the most urgent and short-term priorities (defining potential domestic base line contribution and type and amount of international funding portions).

iv. Gradually establish, within the existing legal and regulatory framework, cost-covering tariffs for public services and adequate charges for the utilisation of natural resources, in order to improve the project investors' net income and internal cash generation.

v. Establish a reasonably structured set of economic and financial incentives:
   - to promote a rational utilisation of natural resources;
   - to prevent or reduce environmental pollution and the degradation of the natural environment; and
   - to improve the potential project sponsors' net income, i.e., internal cash generation.

vi. Establish, at least for standard projects (such as small, medium or large size municipal or industrial WWTP), country-specific "standard funding schemes" in order to improve the "planning certainty" of potential investors and to accelerate project implementation. If international funding assistance is needed these funding schemes have to take into account the requirements and procedures of the particular IFIs.

   The country specific "standard funding schemes" to be established for typical "standard projects" should clarify:
   - the priority of the particular project in relation to competing projects in the same sub-sector
   - the eligibility of the project for potential national and international funding sources,
   - the sequence of source applications;
   - the basic funding procedures and guarantee requirements;
   - minimum equity contribution, i.e., internal sources of the project sponsor;
   - potential range for public grants;
   - potential range for public loans;
   - potential range and specific requirements for the contribution of relevant public funds, (such as Environmental Fund, Water Management Fund, etc.);

- potential range for international co-funding, taking into account the standard requirements of the particular IFI, (if the project is eligible for international assistance from the national point of view);
- particular funding components (technical assistance, donations, etc.);
- commercial bank loans as residual funding component.

vii. Develop within the existing framework of the ICPDR initial components of innovative financing mechanisms, as outlined in Section 6.4

Medium and Long-term Actions

In the medium and long term the following actions should be taken on a basin-wide, i.e., national level:

i. Review and update project data and project priority ranking, by taking into account revised country specific standards (e.g. effluent standards) and changes in the economic development of the particular countries.
ii. Adjust legislation and regulatory framework in order to enable a legalized claim on public financial support for specified environment related investments (as for example municipal or industrial WWTP with improved/advanced effluent standards).
iii. Adjust legislation in order to enable the introduction of full cost covering tariffs for public services and charges for the utilization of natural resources.
iv. Initiate steps and actions required for an amendment of the legal basis of the Convention in order to enable the establishment of a DEFF which is able to hold its own money, contract with donors and recipients, and deal with grant money for purposes other than its own operations.

6.4. Development of Funding Mechanisms

Within the framework of the DRPRP, the Kreditanstalt fuer Wiederaufbau, a German Development Bank, was appointed to prepare a study on a multilateral financial facility for environmental investments in the transition countries of the Danube River Basin (DEFF). Actually, it turned out that it would be difficult to raise the contributions for the administrative costs, which are a constitutive part of such a facility, and that the creation of the necessary legal base by an amendment to the Convention ("Article 18 a") would take too long and that a general consent could therefore not be expected.

In view of these restrictions, representatives of UNDP have made an ad hoc proposal for continued donor support of the work of the IC and its organs in the field of investment planning, project preparation and advising the transition countries; according to this proposal it can be expected that GEF funds would be available for the financing of incremental investments in line with the objectives and principles of GEF.

On this basis. the Consultant has elaborated a proposal for the establishment of a “Programme Implementation Facility” and a “Project Appraisal Group”.

6.4.1. Programme Implementation Facility (PIF)

The main characteristics of the proposed "Project Implementation Facility" can be outlined as follows:

i. **Institutional approach:**
   - Agreement between ICPDR and UNDP as leading agency of GEF, on the basis of the existing Convention;

ii. **Personnel:**
   - Under Executive Secretary of ICPDR;
   - Technical Assistance Staff in the Secretariat;
   - Financed with donor support (for 3 - 4 years);

iii. **Mandate:**
   - Supporting work of ICPDR with regard to investment programmes;
   - Assisting member countries in preparation of projects for IFIs (Trust Fund Missions);
   - Preparing projects with global, i.e., transboundary environmental benefits (incremental costs) for GEF;
   - Monitoring of results;

iv. **Financial requirements for the PIF:**
   - Technical assistance for 3 to 4 years (USD 2.5 million)

v. **Exit strategies:**
   - Installation of a DEFF
   - PPC assignment
   - Additional PMTF tasks (METAP model)

It is expected that the proposed PIF can positively contribute to the work of the IC and its Secretariat although the essential features of a financing facility, i.e. to receive and handle grant money for the benefit of the Danube environment, cannot be met. The PIF, as it is proposed now, would basically be an extension of the donor support, having been granted to the co-operation of the Danube countries in the field of the environment for over 6 years now. The next step in actually setting up the PIF would be to give a mandate to the President of the ICPDR - and possibly one member from a contracting party in the middle or lower Danube Basin - to approach the GEF via UNDP, by submitting an application for a GEF-eligible project of PIF character.

6.4.2. Project Appraisal Group (PAG)

In addition to the PIF it is suggested that the IC installs an expert group for project appraisals, in order to have the possibility to examine and endorse investment proposals from the member states which otherwise might not gain the attention of multilateral donors or IFIs. The greater part of the environmental investment projects will gain the interest of multilateral donors who are able to help in preparation and appraisal of projects. This may leave out certain projects which are outside the scope of interest of the donors - e.g. clean-up of contaminated sites. By its mandate and composition, the PMTF concentrates on financing issues and must rely on the judgement of the investors, the individual states and the donors as to the quality of the technical and management planning.

Therefore, a member state looking for financing should be given the opportunity to present a priority project to the IC, which, after confirmation of the priority, will pass it on to a permanent group of experts selected by the IC to perform such tasks. The mandate of such a Project Appraisal Group would be:

- to examine whether the proposal complies with the relevant environmental performance standards;
- to check whether the technical design is state-of-the art;
- to examine whether the cost calculations are complete and realistic;
- to inspect the management plans, including the provisions for raising fees and for operation and maintenance.

If this expert group gives the project its "seal of approval", the proposing state or the sponsor could then present the project to the PMTF or directly to financing institutions with the endorsement of this expert group of the IC.

The PAG should consist of experts in the field of water pollution control with experience in the design, construction and operation of such installations. The CEC, Austria and Germany, should nominate one member each to be confirmed by the IC. The other contracting parties would nominate members and the IC would choose four to become members of the PAG. The chair of the PAG would rest permanently with the expert from either Austria or Germany, because these two countries are not recipients of donor money and currently lead the Danube countries in terms of technology. The PAG would take up projects at the request of the president of the IC or the chairman of the PMTF. Once the PAG has established its working procedures, it could reduce the number of meetings and could also use written procedures. Analogously to the procedures of the IC, the reports of the PAG should be elaborated in consensus, and - if this is not possible - by a majority of at least five members. In the case that the PAG cannot approve a project as technically and economically sound, it must indicate its deficiencies and make suggestions as to how they could be improved; requests for appraisal should be answered within a period of 8 weeks.

The contracting parties nominating members for this committee shall do so with the understanding that the members use the expertise in their respective institutions at no charge.

7. Institutional and Policy Issues

7.1. Introduction

Institutional instruments, including supportive tools and flanking policies are identified in order to assure the efficient implementation of the DRPC and the present SAP.

The methodology used for building up the revision was essentially shaping this SAP. In the framework of the UNDP/GEF supported Danube Pollution Reduction Development, national reports and planning workshops have generated a complete inventory on national policies, strategies, problems and planned or ongoing activities. In addition, the need for basin-wide joint action was specified through a "Transboundary Analysis" including the issue of Black Sea protection.

This has ensured that the SAP is tailored to reflect the conditions and requirements at both the national and the basin-wide level. It combines the prevailing policies and strategies and further developments at both levels. This is intended to facilitate Danubian cooperation with the key objective being the protection and sustainable use of the Danubian waters. To achieve this, specific objectives and targets have been derived; the expected results have been formulated in terms of the progress to be made and the timeframe to be kept.

The chapeau for this SAP is the DRPC, which provides for all these issues of policy, decision making and implementation. As the International Commission (ICPDR) is mandated with implementing the DRPC, the same applies to the SAP.

The ICPDR, implementing the DRPC:

- decides to take action along the lines of this SAP, which forms its policy plan;
- takes up the planned action and the proposed activities to become subject to its Action Programme for preparation and execution;
- adopts the SAP by recommendation and submits it to the Conference of the Parties for confirmation, with a view to obtaining backing for its implementation.

7.2. Policy Making Tools and Processes

As an instrument of international law, the DRPC forms a standing framework with some flexibility achievable through wide interpretation. This is why developing issues are contained only generally or implicitly; variable specification, such as quantified targets and fixed timeframes, can not be stipulated. Besides enforcement, this is an additional reason why the DRPC's implementation has to rely on policy making. As a policy tool, the SAP allows the region's developing and changing conditions and requirements, including the local ones, to be reflected. This can be achieved through modifying objectives and targets or even revising policies and strategies.

The policy making processes under the DRPC are stimulated through a mutual exchange of experiences and initiatives between the joint and the national/local levels of co-operation. They start either at a broad basis or at a high level and develop further via the ICPDR and its institutional arrangements. The task of finalizing policies and strategies, analysing their feedback and revising them based on the experiences gained lies with the ICPDR and the Conference of the Parties. According to Article 22, paragraph (2) DRPC the Conference of the Parties upon the report and the recommendation of the ICPDR "shall review policy issues concerning the implementation of the DRPC and adopt appropriate recommendations or decisions."

For enhancing the policy making processes under the DRPC, whose outputs include the present SAP revision, the ICPDR:

- encourages its institutional arrangements, such as its Expert Bodies, to contribute to the policy making processes through proposals for policy initiatives and planned activities;
- urges Contracting Parties to actively join this process through their inputs at all institutional levels;
- recommends to the Contracting Parties that a first Conference of the Parties should convene, which may wish to confirm this Revised SAP and define policy direction for further developing the SAP, including the date of its next revision.

7.3. Criteria and Mechanisms of Implementation

Aiming at the efficient implementation of the DRPC, backed by realistic policies and strategies, the following set of criteria and approaches, tailor-made for the Danubian region, should be emphasised through this SAP:

- the river basin management approach both for the entire Danube basin and for its major sub-basins;
- integrated implementation of all environmental protection and water quality management issues including related aspects of sustainable use;
- a step by step approach allowing for the reduction of the intensity of actions and/or the extension of the time frames for achieving the set targets;
- due account of limited implementation capacities at the national level; appropriate support for Countries in Transition and in Accession to ensure the active participation of all Contracting Parties;
- balanced responsibilities and interaction between the two main levels of implementation, the joint and the national; emphasis given to the latter concerning priority setting, preparation and realization of action planned, based on mobilized political willingness;
- co-ordination for increasing efficiency and avoiding duplication both within the institutional structure under the DRPC as well as outside; utilization of experience, capacities and know how, wherever available, as an input to implementation.

As already introduced in Chapter 1, there are six main pillars supporting implementation and enforcement. In order to mobilize and activate them and bring them together for combined action, the ICPDR will make all efforts to:

- make full use of the legal capacity of the DRPC;
- mobilize the political capacity of policies and strategies jointly declared by the Contracting Parties and supported by relevant GOs and NGOs, including, in particular, the policies and strategies put forward by this SAP;
- activate the domestic capacity, both legal and political, of Danubian governments and their competent authorities at the national and local level including priority setting, project preparation and financing;
- mobilize the public awareness and participation through the involvement of the NGO community, e.g. granting observer status to the International NGOs mandated to represent others;
- mobilize financial support and economic incentives granted to Countries in Transition (CiTs) and Countries in Accession (CiAs) regarding investments and technical assistance and regarding the assistance they need in order to join all activities of the ICPDR in a proactive way;
- enhance the implementation of the EU Water Framework Directive (EU/WFD) and take an active role in the basin-wide coordination provided for the river basin management.

There are several additional supporting mechanisms contributing towards meeting the designed criteria, and thus enhancing implementation. The ICPDR will:

- activate its information management and dissemination in order to involve interested GOs and NGOs and to benefit from their political weight and possible input;
- develop cooperation with relevant international organizations, i.e. through joint institutional arrangements such as the ad-hoc Technical Working Group in the Black Sea cooperation context; by granting observer status to candidates promising essential input to the DRPC´s implementation; intensify the exchange of experience and know-how;
- activate the reporting obligations of the Contracting Parties so as to get feedback on the progress of implementation achieved and an overview of the related activities planned or in progress in the Danubian Region;
- ensure that the executive preconditions, legal, technical, financial and administrative, are provided for at the national level for realizing planned action;
- ensure its effective preparation and realisation (basics; planning; project preparation including financing; efficient operation);
- develop technical guidelines to be elaborated and tailor-made by its Expert Bodies, e.g. by the EMIS/EG concerning pollution reduction in the three main sectors of polluters:
  - for wastewater discharge monitoring and for wastewater treatment, including sludge digestion and disposal (municipal and industrial sector);
  - for applying the best available techniques (BAT) (industry) and the best environmental practice (BEP) (good agricultural practice);
  - for developing accidental pollution prevention and control concerning risk inventory and assessment;
  - for further developing guidelines in the water quality monitoring sector.

7.4. Specific Institutional Components Carrying Implementation

A structure of competent bodies and specialized systems has been established and planned to be further developed. With a minimum number of components, all the main functions of co-operation and implementation under the DRPC have to be covered. This is already advanced as to the part of the DRPC dealing with environmental protection and water quality management, in which predominant emphasis is placed on the early phase of implementation. Provided that the institutional components deriving from the GEF/UNDP supported Danube Pollution Reduction Development are integrated, this structure becomes rather complete.

A brief description of this organizational framework under the DRPC, together with the resulting Organization Chart, is given in the Annex to this SAP. It is an extended version, comprising both the existing institutional components and those proposed and planned to be established through this SAP.

For selected institutional components and their close co-operation, specific development proposals and planned activities have been put forward. The ICPDR will provide for and arrange:

1. **as to the ICPDR and its Expert Bodies;**
   - strengthened proactive participation and input by all Contracting Parties as to all activities under the DRPC; mobilized incentives and support given to CiTs and CiAs to join them;
   - result-oriented and well-coordinated work of the existing technical Expert Groups through well-structured annual and triennial Work Plans indicating their related costs; feedback reporting and proposals for further action;

- strengthened Strategic Expert Group (S/EG), with its flexible ToRs, to become a standing expert group which supports the ICPDR;
- the "Data and Information Management Expert Group (DM/EG)" established in the context of the ICPDR´s Information Management System;
- the establishment of a "Project Appraisal Group (PAG)" cooperating with the Project Implementation Facility (PIF), provided the financial support to this PAG is available for the next three or four years. Its tasks involve: project preparation to promote implementation (preparing sufficient projects ready for realization); this includes technical optimization, administrative preparation and conformity with supporting conditions set by particular IFIs and donors;
- close cooperation and coordination between all Expert Bodies and with other institutional components under the DRPC, in particular with those engaged with financing and investment-oriented tasks.

2. as to the Permanent Secretariat (PS):

- well-coordinated technical and administrative support given by the PS to the ICPDR, its Expert Bodies and other institutional components under the DRPC;
- emphasis placed on mobilizing various inputs for the implementation of the DRPC expected through close cooperation with national and international organizations and bodies;
- particular efforts made to strengthen the role of the Project Management Coordinator supporting well coordinated PMTF action as well as the PIF staff in particular regarding project preparation;
- sufficient working capacity available to the PS, i.e. augmented by in-kind input, allowing for completely fulfilling its tasks in the interest of all institutional components involved.

3. as to institutional components linked with financing mechanisms:

- activating the **Project Management Task Force (PMTF)** together with all IFIs and donors, being the co-founders of the PMTF and to be kept on board;
- joining the build-up of **a Project Implementation Facility (PIF)** in particular regarding its cooperation with the PMTF in order to reinforce support from IFIs and donors as well as regarding the support for the implemention of the ICPDR's Action Programme.

4. as to the Information Management System of the ICPDR (DANUBIS):

This tool will cumulate several previous sectoral approaches in order to develop the optimal effectiveness and avoid duplication. In addition to data and information aggregated under the ICPDR, it combines a lot of other information sources. Its major objective is to provide access to consolidated information, which should be duly updated and kept free of misleading and contradictory information. The ICPDR starting and operating the system will:

- speed up the development of the technical basis of the system including the appropriate hard- and software at the seat of the Permanent Secretariat;
- intensify and coordinate the internal flow of project data and information within the ICPDR, its Expert Bodies, the PMTF, the PIF and the PAG;
- prepare consolidated pieces of evaluated data and information as input to DANUBIS and for other dissemination purposes (e.g.: the ICPDR Water Quality Yearbook);

- provide for integration and access to information, while all the time maintaining a certain level of confidentiality (e.g. new data; internal information flow);
- make all efforts to prevent other organizations from developing systems parallel to the DANUBIS and avoid duplication in joining other Information Networks both for reasons of clarity and efficiency.

7.5. System of Plans and Programmes under the DRPC

The **overall objectives** to be achieved regarding the system of Plans and Programmes under the DRPC are defined as:

- **one Policy Plan** which provides for the political momentum and direction to guide the development and the planned activities for implementing the DRPC;
- **one Action Programme** designed as an executive framework integrating all specific programmes under the DRPC as appropriate for managerial reasons and for the purpose of preventing duplication.

A clear distinction should be made in this context between the **"Plan"** and the **"Programme"** so as to demonstrate their complementary functions and the need for having both instruments operational:

- the Plan declares what is intended to be achieved through the implementation (perspectives, strategies, further development, planned activities; etc.);
- the Programme comprises all actions, those in progress and those planned within a given time frame, in terms of particular preparation and execution.

Generally, the international Danubian cooperation is based on three main tools:

- the **Convention (DRPC**) as the legal instrument;
- the **Strategic Action Plan (SAP)** as the policy instrument;
- the **Action Programme (DPRP)** as the executive framework instrument.

Before presenting policy options, an inventory of both the existing and the expected plans and programmes is provided, specifying their terms, character and substance:

- **"Environmental Programme for the Danube River Basin (EPDRB);** IFI and donor-supported Danubian activities primarily on a policy basis; it continues as far as it has been transferred under the DRPC umbrella covering all water-related issues;
- **"Strategic Action Plan (SAP);** developed and endorsed in the EPDRB context (Bucharest Ministerial Declaration 1994); a policy plan and an action programme; to be periodically revised;
- **"Strategic Action Plan Implementation Programme (SIP);** intensified programme performed since 1995, comprising technical assistance with introducing and implementing new demonstration projects and activities for transboundary issues;
- **"Danube Pollution Reduction Programme (DPRP);** supported by UNDP/GEF in the EPDRB context; a measure-oriented framework programme to be a substantial component of the ICPDR Action Programme;
- **"Programmes of Work (annual and triennial);** to be performed by the ICPDR´s Expert Bodies based on their specific work plans; integrating work activities and part of an over all ICPDR Action Programme;
- **"Action Programme for Pollution Reduction";** launched by the ICPDR´s Emission Expert Group (EMIS/EG) based on its specialized technical work according to its ToRs;

- **"Specific Programmes";** included in the PMTF-ToRs to be linked with a portfolio of environmental priority investments and technical assistance, contains projects ready for funding (derived from ICPDR´s/ EMIS/ EG Action Programme);
- **"ICPDR Investment Programme";** proposed in the framework of the UNDP/GEF DPRP development together with specific financing mechanisms and project preparation tools; comprises projects ready for funding and realization within a given frame (integrating "Specific Programmes PMTF" and GEF-funded Programmes);
- **"River Basin Management Plans";** Concern the entire Danube basin and its subbasins; plans to be of informal and coordinative concern for DRPC implementation i.p. as to action programmes included, in particular in the case of transboundary relevance; also relevant concerning the role of the ICPDR in the context of the EU/Water Framework Directive (EU/WFD).

This overview shows that there is a series of plans and programmes in the Danube basin in the field of environmental protection and water quality management. On the other hand, the important field of water resources quantity management is seriously under-represented; it can only be to some degree covered in the river basin management plans. Appropriate tools, policy plans and action programmes, should be developed in this field. They should emphasise the aspect of sustainable use, which again is an input to environmental protection and water quality management.

Concluding criteria and proposals regarding a system of plans and programmes under the DRPC are presented. Implementing the DRPC and the SAP as well as carrying out its responsibilities the ICPDR will:

- carefully analyze all the existing and planned instruments regarding their functions and interaction in order to identify possible duplication and gaps, in particular under the DRPC umbrella;
- make all efforts to cooperate with the concerned partners in order to further develop and streamline the instruments and create an efficient system of plans and programmes; the forum for this should be the PMTF;
- strive to achieve a final stage of development at which two framework instruments - one Policy Plan and one Action Programme - integrate all the specific plans and programmes and are complementary to their functions.

7.6. Cooperation with the Black Sea Convention Countries

The "*Convention on the Protection of the Black Sea (Bucharest Convention)*" was signed in 1992, two years earlier than the DRPC (*Sofia Convention*), and entered into force before it. However, executive protocols to the Convention have not yet been yet realised. The decision-making and steering body is the International Commission for the Protection of the Black Sea (ICPBS) corresponding to the Danube International Commission (ICPDR). Between the ICPBS and the ICPDR a Joint Ad-hoc Technical Working Group has been established, primarily responsible for examining the actual eutrophication problems and proposing remedial actions as to the relevant pollution shares.

As regards the share of land-based pollution originating from the Danube Basin, the DRPC provides for such remedial action. It addresses - broadly in its preamble and more specifically in its objectives and scope (Articles 2 and 3 DRPC) - the contribution to the protection of the marine environment, and commits the Contracting Parties to contribute through their co-operation under the DRPC to reducing the pollution loads reaching the Black Sea from sources in the Danube catchment area.

The joint work of the ad-hoc Technical Working Group, summarizing the findings achieved by several specific studies and by the specialized exchange of experience, has resulted in the proposed consolidated policies and strategies to be brought to the attention of all Parties concerned and mandated for policy and decision making. These Black Sea-oriented policies and strategies literally read:

Short and long-term objectives:

- The long-term goal for all States in the Black Sea Basin is to take measures to reduce the loads of nutrients and hazardous substances to the levels that would allow the Black Sea ecosystems to recover to conditions similar to those observed in the 1960s.
- As an intermediate goal, urgent control measures should be taken by all States in the Black Sea Basin in order to prevent the discharges of nutrients and hazardous substances reaching the Seas from exceeding those of 1997. It is recognized that these 1997 discharges are only incompletely known and that further work has to be undertaken to substantiate the size of the loads.
- The inputs of nutrients and hazardous substances into the Black Sea have to be assessed in a comparable way and to this very end a common AQC system and a thorough discussion about the necessary monitoring, including the sampling procedures, has to be set up.
- The ecological status of the Black Sea has to be further assessed, and the comparability of the data basis further increased.
- Both the reported input loads as well as the assessed, ecological status will have to be reported annually to both the ICPBS and the ICPDR.
- The States within the overall Black Sea Basin have to adopt strategies that will permit economic development, whilst ensuring appropriate practices and measures to limit the discharge of nutrients and hazardous substances, and to rehabilitate ecosystems which assimilate nutrients.
- Based on the annual reports and on the adopted strategies for the limitation of the discharge of nutrients and hazardous substances, a review shall be undertaken in 2007. It will focus on the further measures that may be required in order to meet the long-term objective.

Corresponding actions required to attain the short and long-term objectives can be classified into the following areas:

- Reform of agricultural policies.
- Improvement of wastewater treatment, where applicable also by alternative technologies.
- Rehabilitation of essential aquatic ecosystems.
- Changes in consumer practices (including use of phosphate-free detergents).
- Establishment of a legal frame.

The ICPDR is willing to contribute to attaining the set objectives and perform the actions necessary for the implementation of the DRPC and of this SAP. Joint cooperation and coordination between the ICPDR and the ICPBS is envisaged to be continued and further developed as appropriate.

The ICPDR supports the idea of developing a joint Black Sea Resolution to be adopted at a high level. It should be based on the experience and results achieved through the joint co-operation at the expert level.

Annexes

1. **Organizational and Institutional Components for Implementing the DRPC**
2. **High and Medium Priority Hot Spots in Sub-River Basins**
3. **Sector Planning Matrix:**
   - **Municipality**
   - **Industry and Mining**
   - **Land Use - Agriculture**
4. **Livestock and Cereal Statistics**

Annex 1.

Organizational and Institutional Components for Implementing the DRPC

Organizational and Institutional Components for Implementing the DRPC

1. The Organizational Framework as an Overview:

The implementation of the DRPC and of the ICPDR's SAP is backed by a specific organizational structure comprising the following institutional components:

- Conference of the Parties;
- International Commission for the Protection of the Danube River (ICPDR);
- Permanent Secretariat;
- Expert Groups;
- Ad-Hoc Groups;
- Programme Management Task Force (PMTF);
- Project Implementation Facility (PIF);
- Project Appraisal Group (PAG).

This structure, together with the main tasks of the particular institutional components, is shown in the **Organization Chart attached to this Annex**. This structure is incomplete in that its operative components, i.e. the Expert Groups, do not presently cover water resources quantity management.

2. The Particular Institutional Components and Their Mandate

As the Organization Chart indicates, some of the institutional components have not been established yet and are not yet operational. All the components are briefly described as to their mandate and their main task as follows:

2.1. Conference of the Parties

The Conference of the Parties is the highest-level body under the Danube River Protection Convention (DRPC). A Conference of the Parties is held on recommendation of the ICPDR in order to provide an overall policy framework for work under the Convention.

2.2. ICPDR

The International Commission for the Protection of the Danube River (ICPDR) is the main decision-making body under the Convention. It meets either in a 'Plenary' or as the 'Steering Group' (Heads of Delegation).

The ICPDR Plenary deals with the major policy and strategic issues and it adopts decisions and recommendations. A key task for the Plenary is to approve the annual work programme and the budget. A Plenary session will usually be held once a year.

The Steering Group provides for the management and coordination of activities under the Convention on a regular basis. Its receives from the Plenary the mandate to participate in decision making.

The President chairs the meetings of the Plenary and the Steering Group. The President represents the ICPDR.

2.3. Secretariat

The main role of the Permanent Secretariat located in Vienna is to support the ICPDR and other bodies established in the framework of the Convention. The Secretariat is also the focal point for information and enquiries about the implementation of the Convention.

The Executive Secretary reports to the ICPDR.

2.4. Expert Groups

Standing (permanent) Expert Groups are established. The main role of an Expert Group is to develop and oversee the implementation of action on a topic under the Convention where specialist expertise is required. Each Expert Group is provided with Terms of Reference for its work and reports to the ICPDR.

The Expert Groups established to date are:

- Emission Issues (EMIS/EG);
- Monitoring Laboratory and Information Management (MLIM/EG);
- Accident Emergency Prevention and Warning System (AEPWS/EG);
- Strategic Expert Group (S/EG)

The establishment of a Danube Information System linked with a Data and Information Management Expert Group (DM/EG) is under consideration as well as the transfer of the expert work performed under the Bucharest Declaration to the framework of the Convention.

The EMIS/EG is responsible for developing action to control pollution from point and diffuse sources. It establishes action programmes to reduce pollution, for example, from municipalities, industry and agriculture. It facilitates the preparation and exchange of information on these topics among the Contracting Parties.

The MLIM/EG is responsible for steering and evaluating the Trans-National Monitoring Network for water quality in the Danube River Basin. It is responsible for setting up programmes aimed at improving the laboratory analytical quality assurance. It facilitates the preparation and exchange of (in-stream) water quality and quantity information among the Contracting Parties.

The AEPWS/EG is responsible for steering and evaluating the effectiveness of the Accident Emergency Warning System for the Danube River Basin. The system communicates messages among Contracting Parties about the emergency situations that may have a transboundary effect. Accident emergency prevention and control is the second main set of tasks this Group is responsible for, in particular for developing tools and measures.

The Data and Information Management Expert Group (DM/EG) is under development together with the ICPDR's Information Management System (DANUBIS). It will be responsible for operating and further developing the system. It will hold and update a register of available information including consolidated pieces deriving from the work of the ICPDR and its related bodies under the DRPC. In this context, it has to manage the dissemination of information to interested partners and to the public.

The Strategic Expert Group (S/EG) is established as a multifunctional body. It is convened and charged with specific preparatory work by the Commission's Plenary or Steering Group responding to the actual requirements of policy-oriented, strategic, legal and administrative nature. With its composition of experts from different fields, it represents an equivalent to the technical Expert Groups.

2.5. Ad-Hoc Expert Groups

Ad-Hoc Expert Groups may be established by the ICPDR to undertake specific tasks.

2.6. PMTF

The Project Management Task Force (PMTF) is a special supporting body established by the ICPDR together with International Organizations, Financing Institutions (IFIs), Donors and NGOs in the framework of the Convention. The key role of the PMTF is to support the practical implementation of the action programmes, promote priority environmental investments and help secure technical assistance required by the Danube countries. Close cooperation and coordination between the PMTF and the ICPDR is ensured through the Programme Management Coordinator (PMC), who is both a secretary to the PMTF and a staff member of the Permanent Secretariat.

2.7. Programme Implementation Facility (PIF)

The PIF is designed to support the ICPDR and PMTF in particular concerning project preparation which is critical for programme implementation including the bankability of the projects. Particular attention is paid to facilitating links to IFIs, GEF and other donors. The PIF is supported by UNDP/GEF with the intention within the next three to four years of assistance to create a self-sustained facility which can be combined with improved financing mechanisms.

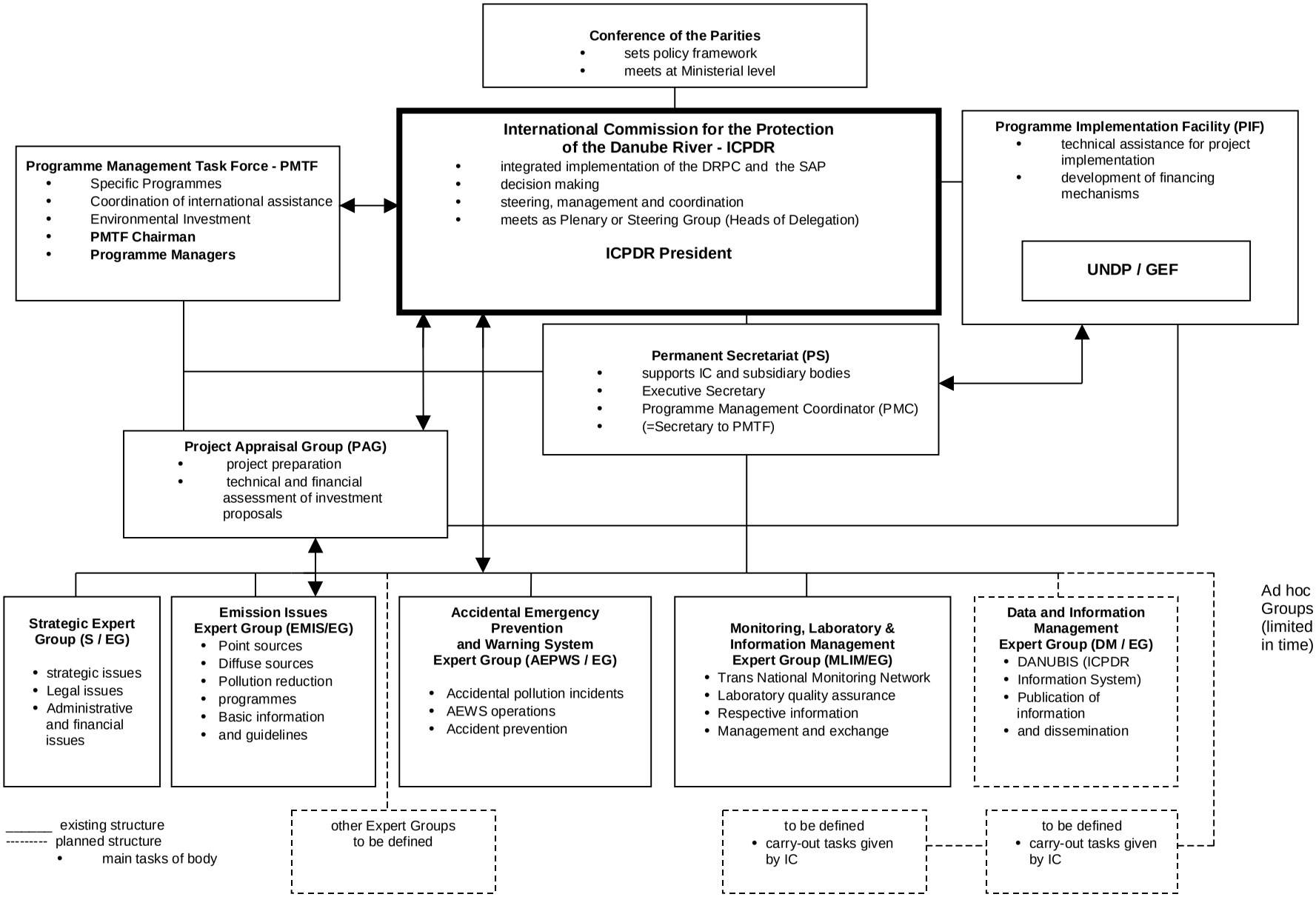
2.8. Project Appraisal Group

This Group is proposed to be a small consultative body under the ICPDR, composed of seven experts from selected Contracting Parties, four of them being Countries in Transition. Its task is technical and financial assessment of particular investment proposals. Through this, it supports both the PIF and the ICPDR regarding project preparation. A mixed composition involving technical and financing experts is recommended.

3. The Organization Chart Attached

This Chart shows the organizational structure of particular institutional components and implicitly their interaction regarding coordination, cooperation and task-sharing including technical, administrative and operative support. The main tasks deriving from the particular Terms of Reference are marked with black bullets. Components that are planned to be developed, but not yet operational, are inserted in boxes marked with little lines, their links to other components with dotted lines. This type of a flow chart does not necessarily express the hierarchical interdependencies; it shows primarily the flow of steering and coordination, cooperation capacities, mutual support and information.

Organization Chart - Danube River Protection Convention (DRPC)



Annex 2.

High and Medium Priority Hot Spots in Sub-River Basins

Hotspots in the Sub-basin Areas

Sub Basin Area	Sector	Priority	No	Name	Country
1. Upper Danube (D)	**Municipal**	*Medium*	1	Upper Laucher Municipalities	D
			2	Mergelstetten	D
			3	Leutkirch	D
			4	Upper Iller Municipalities	D
			5	München I	D
			6	MünchenII	D
			7	Starnberger See Municipalities	D
	Industrial	*Medium*	1	ESSO Ingolstadt	D
2. Inn (D,A)	**Municipal**	*Medium*	1	Chimsee Municipalities	D
	Industrial	*Medium*	1	Biochemie Kundl	A
			2	Hallein PCA Fine Paper	A
			3	WNC-Nitrochemie Aschau	D
3. Austrian Danube (A)	**Municipal**	*Medium*	1	Linz-Asten	A
4. Morava (CZ,SK,A)	**Municipal**	*High*	1	Brno - Svratka	CZ
			2	Zlin - Little Drevnice	CZ
			3	Uherske Hradiste - Morava	CZ
			4	Hodonin - Morava	CZ
		Medium	5	Prerov - Becva	CZ
			6	Breclav - Dyje	CZ
	Industrial	*High*	1	Otrokovice - Morava	CZ
		Medium	2	Tanex Vladislav - Jihlava	CZ
	Agriculture	*High*	1	Milotice (pig farm) - Kyjovka	CZ
			2	Gigan Dubnany - Kyjovka	CZ
		Medium	3	Kunovice - Morava	CZ
			4	Vel. Nemcice - Svratka	CZ
5. Váh - Hron (SK,CZ,H)	**Municipal**	*High*	1	Nitra - Nitra	SK
		Medium	2	Banska Bystrica	SK
			3	Topolcany	SK
			4	Severage Trencin	SK
	Industrial	*High*	1	Novaky Chemical Plants - Nitra	SK
		Medium	2	Povazske Chemical Plants Zilina	SK
6. Pann. Central Danube (A,SK,H,HR,YU)	**Municipal**	*High*	1	Györ	H
			2	Budapest North	H
			3	Budapest South	H
			4	Dunaujvaros	H
			5	Novi Sad	YU
			6	Indjija - Pazova	YU
		Medium	7	Wien HKA	A
			8	Sopron	H
			9	Szombathely	H
			10	Zalaegerszeg	H
			11	Keszthely	H
			12	Balaton Region	H
			13	Veszprem	H
			14	Kaposvar	H
			15	Tatabanya	H
			16	Szekesfehervar	H
	Industrial	*High*	2	Szazhalombatta (oil refinery)	H
			1	Balatonfuzfo (chemical Industry)	H
		Medium	3	Istrochem Bratislava	SK
			4	Szeszip Györ	H
			5	Labatlan Piszke Paper RT	H
			6	Nyergesujfalu Viscosa	H
			7	Budapest Buszesz	H
			8	Budapest Csepel	H
			9	Dunaujvaros Dunaferr	H
			10	Dunaujvaros Dunapack	H
			11	Petfurdo Nitrogen Works	H
	Agricultural	*Medium*	1	Agr. Co-op.Mocsa	H
			2	Agroindustry Környe	H
			3	Dunakekt Budapest Csepel	H
			4	Balaton Fishery Hévitz	H
			5	Dalma Transdanubia	H
			6	Hildpuszta - Hajosvin	H
7. Drava - Mura (A,SLO,HR,H)	**Municipal**	*High*	1	Maribor	SLO
			2	Ptuj	SLO
			3	Murska Sobota	SLO

Hotspots in the Sub-basin Areas

Sub Basin Area	Sector	Priority	No	Name	Country
			4	Lendava	SLO
			5	Ljutomer	SLO
			6	Varazdin	HR
			7	Osijek	HR
		Medium	8	Klagenfurt	A
			9	Graz	A
			10	Nagykanizsa	H
			11	Koprivnica	HR
			12	Pécs	H
			13	Belisce	HR
	Industrial	*High*	1	Paloma pulp & paper plant	SLO
			2	Pomurka Murska Sobota food industry	SLO
			3	Belisce paper industry	HR
			4	IPK Osijek sugar factory	HR
	Agriculture	*High*	1	Farm Jezera - Rakican	SLO
			2	Farm Podgrad	SLO
			3	Farm Nemscak - Isakovci	SLO
		Medium	4	Farm Senkovac (pig farm)	HR
8. Sava (SLO,HR,BIH,YU)	**Municipal**	*High*	1	Domzale	SLO
			2	Ljubljana	SLO
			3	Celje	SLO
			4	Rogaska Slatina	SLO
			5	Zagreb	HR
			6	Karlovac	HR
			7	Banja Luka	BIH
			8	Tuzla	BIH
			9	Sarajevo	BIH
			10	Sabac	YU
			11	Valjevo- Kolubara	YU
			12	Ostruzmiciki sewer system	YU
			13	Pljevlja - Cehotina	YU
			14	Mojkovac - Tara	YU
			15	Kolasin - Tara	YU
			16	Gusinje - Plavsko Lake	YU
		Medium	17	Kranj	SLO
			18	Skofja Loka	SLO
			19	Krsko	SLO
			20	Brezice	SLO
			21	Crnomelj	SLO
			22	Metlika	SLO
			23	Bjelovar - Cesma	HR
			24	Sisak	HR
			25	Slavonski Brod	HR
			26	Gornji Vakuf - Vrbas	BIH
			27	Sarajevo Visoko regional system	BIH
			28	Sremska Mitrovica	YU
			29	Ruma	YU
			30	Lazarevac - Kolubara	YU
			31	Sjenica - Vapa	YU
			32	Bijelo Polje - Lim	YU
			33	Berane - Lim	YU
	Industrial	*High*	1	Vrhnika leather industry	SLO
			2	ICEC Krsko paper factory	SLO
			3	Pliva Savski Marof	HR
			4	Celpak Prijedor - Una/ Sava	BIH
			5	Incel Banja Luka - Vrbas	BIH
			6	Natron Maglaj	BIH
			7	Koksara Lukavac	BIH
			8	HAK Tuzla	BIH
			9	Sugar factory Zupanja	HR
			10	HI Zarka - Sabac	YU
		Medium	11	Pivovarna Lasko/ Brewery	SLO
			12	Radece papir	SLO
			13	Pik Vrbovec	HR
			14	Gavrilovic Petrinja - Kupa	HR
			15	Ina - Oil Refinery Sisak	HR
			16	Petrokemija Kutina	HR
			17	Zenica - Bosna	BIH
			18	Sodium factory Lukavac	BIH
	Agricultural	*High*	1	Farm Ihan	SLO
			2	Nova Topola (pigs)	BIH

Hotspots in the Sub-basin Areas

Sub Basin Area	Sector	Priority	No	Name	Country
			3	Luzani (pig farm)	HR
			4	Surcin pig farm	YU
			5	Dragan Markovic (pigs) Obrenovac	YU
		Medium	6	Farm Spreca - Tuzla	BIH
			7	Farm Brcko	BIH
			8	Padinska Skela	YU
9. Tisa (UA,SK,RO,H,YU)	**Municipal**	*High*	1	Kosice - Hornad	SK
			2	Uzhgorod	UA
			3	Oradea	RO
			4	Zalau - Crasna I	RO
			5	Zalau - Crasna II	RO
			6	Deva - Mures	RO
			7	Szeged	H
			8	Timisoara - Bega/ Timis I	RO
			9	Timisoara - Bega/ Timis II	RO
			10	Subotica - Palic & Ludos lakes	YU
			11	Senta - Tisa	YU
			12	Vrbas/ Kula/ Crvenaka - DTD Canal	YU
			13	Zrenjanin - Begej	YU
		Medium	14	Svidnik	SK
			15	Humenne	SK
			16	Michalovce	SK
			17	Mukachevo - Latorita	UA
			18	Eger	H
			19	Miskolc	H
			20	Nyiregyhaza	H
			21	Debrecen	H
			22	Kecskemet	H
			23	Bekescsaba	H
			24	Hodmezovasarh	H
	Industrial	*High*	1	Bukocel Hencovce - Ondava	SK
			2	Kazicbarcika Borsodchem - Sajo	H
			3	Phoenix Baia Mare (mine)	RO
			4	Somes Dej (chemicals)	RO
			5	Sinteza SA Oradea - Crisul Repede	RO
			6	Metal Works Oradea	RO
			7	Petrom Suplac de Barcau (oil)	RO
			8	Manpel - Tg. Mures	RO
			9	Clujana SA Cluj	RO
			10	Azomures Tg. Mures	RO
			11	Sometra Copsa Mica (non-ferrous metal)	RO
			12	Favior Orastie	RO
			13	Indagrara Arad (food)	RO
			14	Uranium Mining Stei Bihor	RO
			15	Non ferrous Metals Mining	RO
			16	N. Knezevac	YU
		Medium	17	Chemko Strazske	SK
			18	Sajobabony (Waste Management)	H
			19	Tiszaujvaros	H
			20	Szolnok	H
			21	Velyky Bychkiv (Timber Processing Plant)	UA
			22	Terapia Cluj	RO
			23	E.M. Borod-Borod	RO
			24	Sarmei Campia Turzil	RO
			25	Nutrimur Iernut - Mures	RO
			26	Stratus Mob - Blaj	RO
			27	Certej	RO
			28	Siderurgica Huneduvara	RO
			29	Abrud	RO
	Agricultural	*High*	1	DD Carnex-Farmakop Vrbas	YU
			2	DD IM Neoplanta (pig farm) Sirig	YU
			3	PDP Galad (pig farm) Kikinda	YU
		Medium	4	Comsuin Moftin	RO
			5	Avicola Satu Mare	RO
			6	Agrocomsuin Bontida	RO
			7	Zagyvaréka - Conavis	H
			8	Folddéak Agr. Co-op.	H
			9	Orosháza Agr. Co-op.	H
			10	Pobeda Gunaros - Subotica	YU
			11	PD Halas Jozef - Ada	YU
			12	PIK Becej	YU

Hotspots in the Sub-basin Areas

Sub Basin Area	Sector	Priority	No	Name	Country
			13	DP Elan - Srbobran	YU
			14	Comsuin Beregsau - Bega/ Timis	RO
			15	PK Coka	YU
10. Banat - Eastern Serbia (RO,YU)	**Municipal**	*High*	1	Banatski sewer systems Beograd	YU
			2	Central sewer systems Beograd	YU
			3	Batajnicki sewer systems Beograd	YU
			4	Pancevo	YU
			5	Resita - Barzava Bega- Timis I	RO
			6	Resita - Barzava Bega- Timis II	RO
			7	Bor - Borska	YU
			8	Zajecar - V. Timok	YU
		Medium	9	Smederevo	YU
			10	Knjazevac - B. Timok	YU
	Industrial	*High*	1	RTB Bor - Majdanpek	YU
			2	RTB Bor	YU
			3	IHP Prahovo	YU
	Agricultural	*High*	1	DP Petrovac	YU
		Medium	2	Zajecar	YU
			3	PP Panonija - Secanj	YU
			4	DD Stari tamis - Pancevo	YU
11. Velika Morava (YU,BG)	**Municipal**	*High*	1	Uzice	YU
			2	Cacak - Z. Morava	YU
			3	Krusevac - Z. Morava	YU
			4	Nis - Nisava	YU
			5	Priot - Nisava	YU
			6	Blace - Blatasnica	YU
			7	Novi Pazar	YU
			8	Pristina - Sitnica	YU
			9	Vranje	YU
			10	Leskovac	YU
			11	Rozaje - Ibar	YU
		Medium	12	Gnjilane - Bin. Morava	YU
			13	Lipljan - Sitnica	YU
			14	K. Mitrovica - Ibar	YU
			15	Vladicin Han	YU
			16	Pozega	YU
			17	Kraljevo	YU
			18	Prokuplje	YU
			19	Cuprija	YU
			20	Pozarevac	YU
	Industrial	*High*	1	Vladicin Han, paper mill	YU
			2	TE Obilic	YU
			3	Trepca - Flotacija	YU
			4	Trepca - Topionica	YU
	Agricultural	*High*	1	DP 1. Decembar - pig farm Zitoradja	YU
			2	DP Pik Varvarinsko Polje Varvarin	YU
		Medium	3	DP. IM Farma Svinja - Velika Plana	YU
12. Mizia - Dobrudzha (BG)	**Municipal**	*High*	1	Sofija - Iskar	BG
			2	Vratza - Dabnika Leva	BG
			3	Landfill Pleven	BG
			4	Troyan -Ossam	BG
			5	Lovec - Ossam	BG
			6	Sevlievo - Rossitza	BG
			7	Gorna Oriahovitza & Liaskovets	BG
		Medium	8	Kostinbrod & Bojurishte	BG
			9	Montana - Ogosta	BG
			10	Popovo Russenski Lom River	BG
	Industrial	*High*	1	Chimco Vratza fertilizer plant	BG
			2	Gorna Oriahovitza sugar and alcohol factory	BG
			3	Antibiotic Razgrad pharmaceutics plant - Beli Lom	BG
		Medium	4	Kremikovtzi (metallurgical plant)	BG
13. Muntenia (RO)	**Municipal**	*High*	1	Craiova - Jiu	RO
			2	Campolung Muscei - Targului/ Arges	RO
			3	Bucharest-Dambovita/ Arges	RO
			4	Braila	RO
			5	Galati	RO
		Medium	6	Rm. Valcea - Olt	RO
			7	Targoviste-Lalomita	RO
	Industrial	*High*	1	Doljchim Craiova (chemicals) - Jiu	RO

Hotspots in the Sub-basin Areas

Sub Basin Area	Sector	Priority	No	Name	Country
			2	Oltchim RM. Valcea	RO
			3	UPS Govora (chemicals)	RO
			4	Arpechim Pitesti (petrochamicals)	RO
			5	Colorom Codlea - Vulcanita	RO
			6	Petrobrazi Ploiesti	RO
			7	Sidercaa Calarasi	RO
			8	Celohart Donanis Braila	RO
		Medium	9	Tr. Severin Romag	RO
			10	Dacia Pitesti	RO
			11	Nitramonia Fagaras	RO
			12	Celohart Zarnesti	RO
			13	Romacril Rasnov - Ghimbasel	RO
			14	Romfosfochim Valea	RO
			15	Petrotel Teleajen	RO
			16	Astra Romana Ploiesti	RO
			17	Tr. Magurele CICH	RO
			18	Giurgiu Verachim	RO
			19	Comcem SA Calarasi	RO
			20	Ukom Slubotzic	RO
			21	Beta Tandarei	RO
			22	Tulcea Alum	RO
	Agricultural	*High*	1	Romsuin test Peris - Vlasia/ Lalomita	RO
			2	Comsuin Ulmeni	RO
		Medium	3	Combil Gh. Doja - Lalomita	RO
			4	Braigal Braila	RO
14. Prut - Siret (UA,RO,MD)	**Municipal**	*High*	1	Kolomyia - Prut	UA
			2	Chernivtsy - Prut	UA
			3	Ungeni	MD
			4	Iasi - Prut	RO
			5	Cantemir	MD
		Medium	6	Briceni (sugar plant)	MD
			7	Edinet	MD
			8	Comrat	MD
			9	Cahul	MD
			10	Taraclia	MD
	Industrial	*High*	1	Pergodur P Neamt (pulp & paper) - Bistrita	RO
			2	Fibrex Savinesti (chemicals) - Bistrita	RO
			3	Letea Bacau	RO
			4	Antibiotice Iasi (chemical) Prut	RO
			5	Sidex Galati	RO
			6	Vulcanesti dump	MD
		Medium	7	Sofert Bacau - Bistrita/ Siret	RO
			8	Carom Onesti - Trotus/ Siret	RO
			9	Chimcomplex Borzesti	RO
			10	Spirt Ghidiceni - Barlad	RO
	Agricultural	*High*	1	Comtom Tomesti - Bahluet/ Prut	RO
			2	Suiprod Independenta - Birladet/ Siret	RO
		Medium	3	Edinet pig farm	MD
15. Delta - Liman Region (UA,RO,MD)	**Municipal**	*Medium*	1	Izmail	UA
	Industrial	*Medium*	1	Tulcea	RO

Annex 3.

Sector Planning Matrix:

- Municipality

- Industry and Mining

- Land Use - Agriculture

SECTOR PLANNING MATRIX - MUNICIPALITY

Objectives and Results/Outputs	Impact Indicators	Important Assumptions
➢ **Overall Objective:** Achievement of sustainable development in the Danube River Basin		
➢ **Program Objective:** Protection and sustainable use of waters of the Danube River Basin ➢ **The Black Sea Protection Objective:** Reduction of pollution loads, in particular nutrient transport to the Black Sea	➢ Significant reduction of surface and groundwater pollution shall reduce health risks and shall enhance preservation of biodiversity by the year 2005 in the Danube basin ➢ In short and medium terms, owing to the adoption of appropriate strategies, in particular in the transition countries, that will permit economic development, while at the same time assuring a recovery of the agricultural and industrial sector activities, the discharge of nutrient and hazardous substances into the Black Sea shall not exceed its 1997 level ➢ In the long-term, the Black Sea ecosystems shall recover to conditions similar to those observed in the 1960s through a progressive reduction of the loads of anthropogenically applied nutrients and hazardous substances in all countries of the Black Sea Basin ➢ The nutrient load reaching the Black Sea from the Danube River Basin will be reduced by the year 2010, by 13,9 % for nitrogen (from current 566 kt/a to 487 kt/a) and by 27,4 % for phosphorus (from current 48,8 kt/a to 35,4 kt/a).	➢ The willingness for long-term implementation of sustainability principles in the governments policies guaranteed ➢ Strengthening co-operation between the countries within the Danube basin
➢ **Sector Objective:** Improvement of the wastewater and solid waste management	➢ Country specific emission load reduction percentage of BOD by 2010 achieved. Soil contamination and impact on natural water bodies controlled through appropriate solid waste management, by the year 2010	➢ Achievement of higher levels of environmental compliance and abatement
➢ **Results / Outputs:** 1.1 Extended and upgraded public sewer systems operated 1.2 Appropriate wastewater treatment assured 1.3 Proper solid waste management applied	➢ 1.1. Extension and improved management of existing sewerage systems and establishment of new ones achieved by the year 2005 in 90 % of municipalities with population over 5000 ➢ 1.2. Integrated approach to sewer systems and treatment of wastewater applied by the year 2010 in 70% of settlements in DRB with population over 5000 ➢ 1.3. Separation of solid wastes by 3 components implemented by the year 2010 in 90 % of localities with population over 50 000	➢ 1.1. Implementation of strategy for urban sewerage ➢ 1.2. Introduction of best available treatment technologies and implementation of polluter pays principle ➢ 1.3. Implementation of solid waste management strategy
➢ **Activities** 1.1.1 Extend public sewer systems and connect houses with public water supply to sewer systems 1.1.2 Optimise operation and maintenance of sewer systems 1.2.1 Eliminate direct discharges without appropriate treatment 1.2.2 Upgrade treatment capacity 1.2.3 Improve operation and maintenance of existing wastewater treatment plants 1.2.4 Apply appropriate sludge treatment and disposal 1.2.5 Implement program for environmentally sound individual wastewater management systems in rural areas 1.3.1 Introduce separated solid waste collection 1.3.2 Rehabilitate old disposal sites according to ecological demands		

SECTOR PLANNING MATRIX - INDUSTRY AND MINING

Objectives and Results/Outputs	Impact Indicators	Important Assumptions
➢ **Overall Objective:** Achievement of sustainable development in the Danube River Basin		
➢ **Program Objective:** Protection and sustainable use of waters of the Danube River Basin ➢ **The Black Sea Protection Objective:** Reduction of pollution loads, in particular nutrient transport to the Black Sea	➢ Significant reduction of surface and groundwater pollution shall reduce health risks and shall enhance preservation of biodiversity by the year 2005 in the Danube basin ➢ In short and medium terms, owing to the adoption of appropriate strategies, in particular in the transition countries, that will permit economic development, while at the same time assuring a recovery of the agricultural and industrial sector activities, the discharge of nutrient and hazardous substances into the Black Sea shall not exceed its 1997 level ➢ In the long-term, the Black Sea ecosystems shall recover to conditions similar to those observed in the 1960s through a progressive reduction of the loads of anthropogenically applied nutrients and hazardous substances in all countries of the Black Sea Basin ➢ The nutrient load reaching the Black Sea from the Danube River Basin will be reduced by the year 2010, by 13,9 % for nitrogen (from current 566 kt/a to 487 kt/a) and by 27,4 % for phosphorus (from current 48,8 kt/a to 35,4 kt/a).	➢ The willingness for long-term implementation of sustainability principles in the governments policies guaranteed ➢ Strengthening co-operation between the countries within the Danube basin
➢ **Sector Objective:** Introduction of BAT and BEP and abatement of water pollution	➢ Organic and inorganic effluents reduced up to 30% by 2010, and discharge permits for industrial and mining enterprises with regard to BAT/BEP examined and revised by the year 2005	➢ Enforcement of BAT and BEP regulation in industrial sector by authorities remains priority
➢ **Results / Outputs:** 2.1 Clean technologies and abatement for water pollution introduced 2.2 Pre-treatment facilities of industrial wastewater implemented 2 3 Adequate management of the enterprises ensured 2.4 Hazardous substances treated and disposed in proper landfills	➢ 2.1. Decreasing pollution (heavy metals and micropollutants) in line with the EU norms, at industrial plants with discharge bigger than 0.1 t COD/day, by using BAT/BEP by the year 2010 ➢ 2.2. Decreasing pollution in line with BAT and BEP, by the year 2010, by the construction of pre-treatment plants ➢ 2.3. Adoption by industrial enterprises of internationally approved quality and environmental management systems (e.g. EMAS; ISO 9000/14000), by the year 2005 ➢ 2.4 Establishment of inventory of existing and abandoned landfills and application of appropriate measures to eliminate pollution of surface and ground water in old and newly constructed landfills, by the year 2010	➢ 2.1. Favorable economic conditions in the country ➢ 2.2. Continuation of cooperation with international financial institutions ➢ 2.3 Implementation of environmentally sound industrial policy of the Governments ➢ 2.4 Elimination of war effects
➢ **Activities:** 2.1.1 Development of institutional framework for implementation as a consequence of the introduction of the legal framework; 2.1.2 Development of projects for reconstruction and modernisation on up-to-date technologies in existing industrial and mining enterprises using ”dirty “ technologies. 2.2.1 Completion and achievement of all optimum operational parameters of WWTPs at the economic agents; 2.2.2 Realisation of the projects for the construction of new WWTPs at the most vulnerable sites, 2.2.3 Rehabilitation and modernisation of existing WWTPs i.e. improving of operational parameters, extension of capacities or adding another stage in the treatment process. 2.3.1 Setting up a legal framework encouraging capital investment in environmental protection facilities; 2.3.2 development of the standardisation program of methodologies and of equipment for environmental quality control 2.4.1 Rehabilitation and/or closing of the abandoned industrial dumpsites areas; 2.4.2 planing and construction new environmentally friendly landfills for hazardous and useful substances.		

SECTOR PLANNING MATRIX - LAND USE-AGRICULTURE

Objectives and Results/Outputs	Impact Indicators	Important Assumptions
➢ **Overall Objective:** Achievement of sustainable development in the Danube River Basin		
➢ **Program Objective:** Protection and sustainable use of waters of the Danube River Basin ➢ **The Black Sea Protection Objective:** Reduction of pollution loads, in particular nutrient transport to the Black Sea	➢ Significant reduction of surface and groundwater pollution shall reduce health risks and shall enhance preservation of biodiversity by the year 2005 in the Danube basin ➢ In short and medium terms, owing to the adoption of appropriate strategies, in particular in the transition countries, that will permit economic development, while at the same time assuring a recovery of the agricultural and industrial sector activities, the discharge of nutrient and hazardous substances into the Black Sea shall not exceed its 1997 level ➢ In the long-term, the Black Sea ecosystems shall recover to conditions similar to those observed in the 1960s through a progressive reduction of the loads of anthropogenically applied nutrients and hazardous substances in all countries of the Black Sea Basin ➢ The nutrient load reaching the Black Sea from the Danube River Basin will be reduced by the year 2010, by 13,9 % for nitrogen (from current 566 kt/a to 487 kt/a) and by 27,4 % for phosphorus (from current 48,8 kt/a to 35,4 kt/a).	➢ The willingness for long-term implementation of sustainability principles in the governments policies guaranteed ➢ Strengthening co-operation between the countries within the Danube basin
➢ **Sector Objective:** Implementation of good agricultural practices and mechanisms for sustainable land management	➢ Increased application of good agricultural practices by 15% in large farms by the year 2005 and by 20% in 2010 (SOLUA)	➢ Governments are progressively implementing adequate policies leading to sustainable land use (wetland restoration) and agricultural practices
➢ **Results / Outputs:** 3.1 Integrated approach for land and water management applied 3.2. Adequate use of pesticides and fertilisers adopted 3.3 Wastewater discharged by animal farms properly treated 3.4 Accelerated run-off and erosion prevented 3.5. Wetlands and floodplains adequately protected and restored	➢ 3.1. By the year 2010, the integrated management of river basins has been achieved, in all DRB countries, through inter-sectoral and international cooperation and implementation of the EU directives ➢ 3.2. By the year 2010, the number of certified organic farms will have increased by 20% and the N+P total fertilizer consumption on other farms will have stabilized at the 1998 level ➢ 3.3. By the year 2005, 50% of all animal farms with over 500 livestock units will have been equipped with wastewater treatment plants and by the year 2010 this figure will have reached 75%. ➢ 3.4. In agricultural landscapes, lengths of hedgerows, forest belts and wind breaks will have increased by 25%, by the year 2010 and 2000 km of regulated rivers will have been restored in the DRB ➢ 3.5 Through implementation of the wetlands priority projects, 110 000 ha of wetlands have been restored by 2005 and 140 000 ha by 2010	➢ 3.1. Increase intersectoral cooperation for capacity building in integrating environmental consideration in development planning and decision making ➢ 3.2. Implementation of precautionary approach to achieve sustainable agriculture and rural development ➢ 3.3. Governments's support for research, development and implementation of sustainable animal management methods ➢ 3.4. Conditions for implementing policies and practices that reduce soil erosion and loss of fertility ➢ 3.5 Commitment of the governments for securing, maintaining and restoring wetlands in the Danube River Basin
➢ **Activities** 3.1.1. Review the current policies that promote the integrated approach to water resources and land use management 3.1.2 Preparation of training courses for catchment management planning 3.1.3 Development of demonstration pilot projects 3.2.1. Introduction of sustainable agricultural production on pilot farms 3.2.2 Monitoring the ecological impacts of fertilisers and pesticides in irrigated areas 3.2.3 Completion of warning and laboratory systems 3.2.4 Training systems for farmers 3.3.1 Stabilisation of the downstream water regime through various hydraulic structures and forestation measures 3.3.2 Introduction of sustainable land practices 3.3.3 Introduction and use of the most effective economic instruments to control accelerated run-off adverse effects 3.4.1 Eliminate all human activities from the wetlands 3.4.2 Remove the embankments where appropriate to accept low flows flooding		

Annex 4.
Livestock and Cereal Statistics

A) Cereal statistics

Country	Area harvested (1000 ha)				Yield (kg/ha)				Production (1000 MT)			
	1989-91	1996	1997	1998	1989-91	1996	1997	1998	1989-91	1996	1997	1998
Austria	940	832	846	839	5443	5400	5903	5525	5115	4493	4994	4633
Bosnia Herzegovina		290	140F	140F		2904	2120	2120		842	297	297F
Bulgaria	2152	1729	2078	1839	4121	1957	3026	2992	8872	3383	6289	5503
Croatia		612	634	691F		4512	5015	4990		2762	3179	3447
Czech Republic		1585	1690	1647		4197	4137	4225		6651	6690	6960
Gerrmany	6864	6708	7023	7073	5534	6282	6477	6311	37910	42136	45487	44642
Hungary	2818	2813	2952	2910	5173	4025	4797	4670	14592	11320	14160	13592
Moldova Republic		864	963	973F		2289	3294	2693		1979	3172	2620
Romania	5927	5841	6319	6310F	3084	2431	3497	2957	18286	14191	22097	18660
Slovakia		837	859	898		4009	4391	4225		3355	3774	3796
Slovenia		100	96	107		4863	5608	5540		487	541	593
Yugoslavia		2263	2409	2387		3223	4277	3759		7295	10303	8973

B) Livestock statistics

Country	Cattle - 1000 head				Pigs - 1000 head			
	1989-91	1996	1997	1998	1989-91	1996	1997	1998
Austria	2546	2272	2198	2198F	3762	3664	3680	3737
Bosnia Herzegovina		314	260F	260F		165	60F	60F
Bulgaria	1548	632	582	590F	4219	2140	1500	1700F
Croatia		462	451	451F		1196	1175	1175F
Czech Republic		1989	1866	1690		4016	4080	3995
Germany	20048	15890	15760	15222	33350	23737	24283	24782
Hungary	1619	928	909	871	7996	5032	5289	4931
Moldova Republic		726	646	519		1015	950	772
Romania	6029	3496	3435	3431	12675	7960	8235	7273
Slovakia		929	892	840		2076	1985	1900
Slovenia		496	484	484F		592	559	559F
Yugoslavia		1926	1899	1899F		4446	4216	4216F

F = FAO estimates

Source: FAO Quarterly Bulletin of Statistics, vol. 11, no. 3-4 (1998)