UNDP-GEF Medium-Size Project (MSP)

Integrating multiple benefits of wetlands and floodplains into improved ' transboundary management for the Tisza River Basin

Pollution reduction strategy for the Tisza River Basin

Final Version
November 2009

ABBREVIATIONS

BAP	Best Agricultural Practice
BAT	Best Available Technique
BREF	Best Available Techniques Reference Documents
CP	Contracting Parties of the Danube River Protection Convention
DD	Dangerous Substances Directive (2006/11/EC former 76/464/EEC)
DRB	Danube River Basin
DRPC	the Danube River Protection Convention
daNUbs	Nutrient Management in the Danube Basin and its Impact on the Black Sea
EC	European Commission
EQS Directive	Environmental Quality Standards Directive
EPER	European Pollutant Emission Register
E PRTR	European Protocol on Pollutant Release and Transfer Registers
EU	European Union
GEF	Global Environmental Facility
GIS	Geographical Information System
GAP	Good Agricultural Practice
ICPDR	International Commission for the Protection of the Danube River
IWRM	Integrated water resources management
IPPC Directive	Integrated Pollution Prevention and Control Directive (96/61/EC)
JAP	Joint Action Programme
MS	Member States
MSP	Medium-Size Project
MONERIS	Modeling Nutrient Emissions into River Systems
MOU	Memorandum of Understanding
PoM	Programme of Measures
PRTR	Protocol on Pollutant Release and Transfer Registers
RR	Roof Report
TRB	Tisza River Basin
ToR	Terms of Reference
TAR	Tisza Analysis Report
SS Directive	Sewage Sludge Directive (86/278/EEC)
SWMI	Significant Water Management Issue
UWWT Directive	UWWTD Urban Wastewater Treatment Directive (91/271/EEC)
UNDP	United Nations Development Programme
WFD	Water Framework Directive

FORWARD

This document presents the Pollution Reduction Strategy (Strategy) for Tisza River Basin (TRB) as well as provides technical justification for its elements.
The Strategy represents one the main outcomes of the UNDP-GEF Medium-Size Project (MSP), "Integrating multiple benefits of wetlands and floodplains into improved ' transboundary management for the Tisza River Basin" and supports the Tisza Group of the ICPDR in the development of the Integrated Tisza River Basin Management Plan (ITRBMP).
It was developed through a collaborative process involving experts in the TRB in a recent finalized assessment of pollution and related program of measures. The process used to generate this Strategy places importance on the agreed Significant Water Management Issues and on the relevance of integration of water quality and water quantity issues in the TRB.

The Strategy itself addresses several areas for pollution reductions from point sources and diffuse sources, including accidental pollution, and it is designed to reduce pollution from organic, nutrients and hazardous substances loads from current and future developments.
The pressures assessment is based on the country specific emissions regarding organic, nutrient and hazardous substances pollution which is presented in this chapter, and should be seen in relation to the respective countries' share of the TRB.
It provides the basis for the Joint Programme of Measures that responds to all pollution related pressures in response to organic, nutrients and hazardous substances pollution, in order to achieve the agreed management objectives and vision on the basin-wide scale.
The Tisza Group will present the Strategy and recommend implementation of its elements to the TRB countries.

1. INTRODUCTION AND BACKGROUND

The ICPDR is the coordinating platform of the development of the Danube River Basin Management Plan as well for the Tisza River Basin Management Plan. All Tisza basin countries as Contracting Parties to the Danube River Protection Convention formulated their commitments to adopt and implement EU directives, including the EU Water Framework Directive (WFD) and other EU Directives.

The UNDP GEF MSP Project objectives and outcomes consist of two main objectives:
(1) To integrate water quality, water quantity, land use, and biodiversity objectives within integrated water resources/river basin management under the legal umbrella of the EU and ICPDR;
(2) To begin implementation of IWRM principles through the testing of new approaches on wetland and floodplain management through community-based demonstration projects.

The objective and expected outcome of Component 1 is the development of an integrated management plan for the Tisza River Basin that addresses water quality and water quantity.

The results of the demonstration projects as Component 2 will be transferred into the Tisza river basin management plan.

In the Tisza river basin, the MSP project implementation will result in improved approaches to the management of wetlands and floodplains through changes in national policies and legislation leading to a wide range of environmental and socio-economic benefits including: flood and drought mitigation, improved biodiversity, nutrient retention, improved amenity benefits, etc.

The Tisza River Basin is an important European resource, boasting a high diversity of landscapes which provide habitats for unique species of animal and plant life, with a significant number of protected areas and national parks. The Tisza River Basin is blessed with a rich biodiversity, including many species no longer found in Western Europe. The region has outstanding natural ecological values such as unique freshwater wetland ecosystems of 167 larger oxbow-lakes and more than 300 riparian wetlands.

The total area of TRB protected areas is 38,223 km^2, which is about a quarter of the total area for the DRBD protected area.

Table 1: Coverage of the states in the TISZA river basin and status within the EU

Country	ISO-Code	Tisza River Basin area in the country (km^2)	Share of the TRB (%)		Status in the European Union
			Per country	in the whole country	
Ukraine	UA	12,732	8.1	2.1	-
Romania	RO	72,620	46.2	30.5	Member State
Slovak Republic	SK	15,247	9.7	31.1	Member State
Hungary	HU	46,213	29.4	49.7	Member State

Country	ISO-Code	Tisza River Basin area in the country (km²)	Share of the TRB (%)		Status in the European Union
			Per country	in the whole country	
Serbia	RS	10,374	6.6	11.7	-[1]

The Tisza River, the longest tributary to the Danube River, flows through five countries and drains 157,186 km^2 and its basin is the largest sub-basin of the Danube basin (Table 1 and Table 2**).** It is home to 14 million people from Ukraine (UA), Romania (RO), Slovak Republic (SK), Hungary (HU) and Serbia (RS).

The Tisza River Basin provides livelihoods for many through agriculture, forestry, pastures, mining, navigation and energy production. The last 150 years of human influence, however, have caused serious problems for the basin's waters. The waters of the Tisza Basin are under the threat of pollution from organic substances from municipalities and urban settlements, nutrients from wastewater and farming and hazardous substances from industry and mining. Furthermore, changes in land-use and river engineering have modified the natural structure of the river and resulted in the loss of natural floodplains and wetlands. These changes have led to an increase in extreme events, such as severe floods (the most recent in the period from 1998 to 2006), periods of devastating droughts (particularly in Hungary and Serbia) as well as landslides and erosion in the uplands (in Ukraine and Romania).

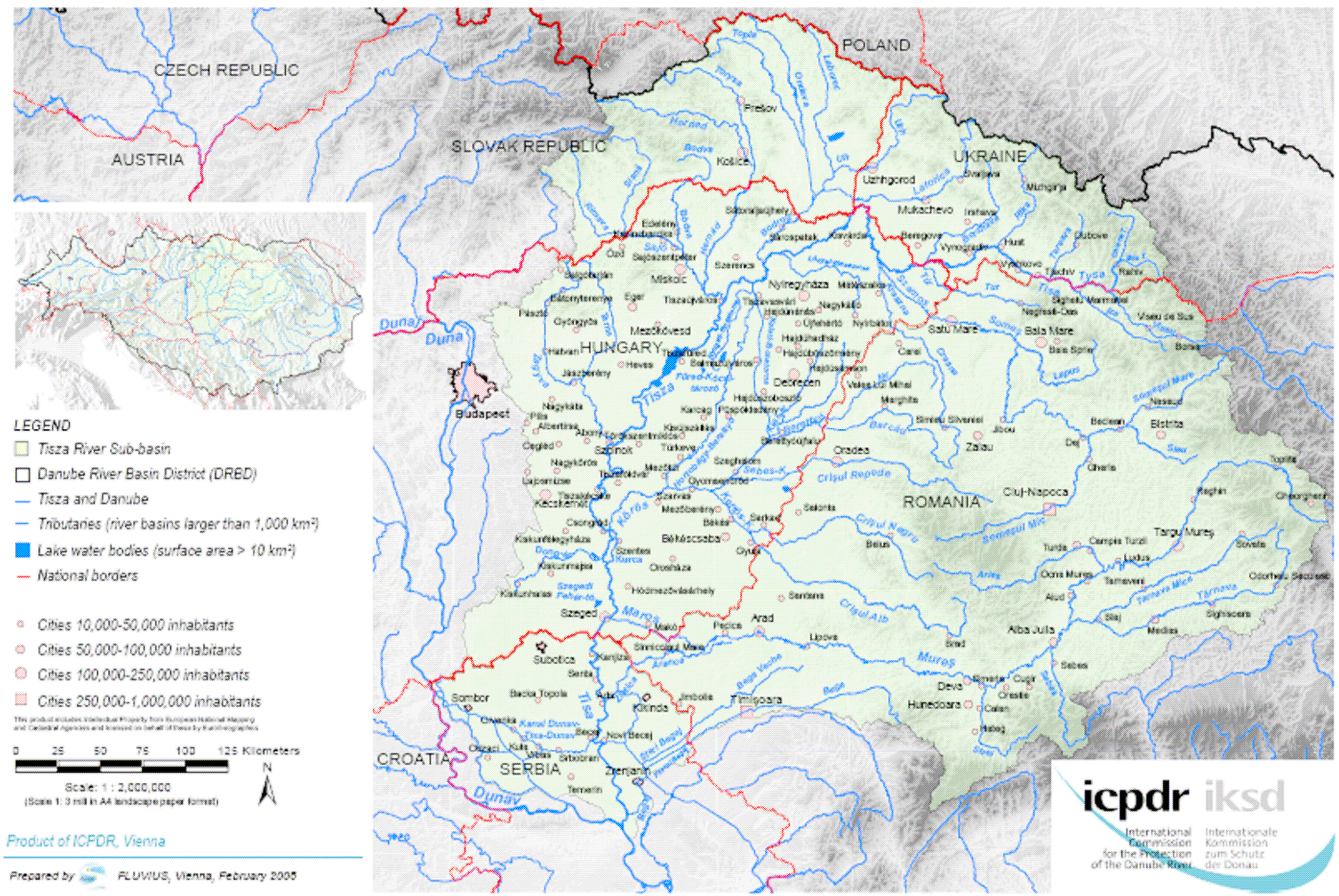
Table 2: Basic information about the Danube and Tisza River Basins

River basin	Length (km)	Size of catchment (km²)	Inhabitants (million)	Average discharge (m3/s)
Danube	2,780	801,463	81	6,460
Tisza	966	157,186	14	794

[1] In October 2005, Serbia initiated a formal process to join the EU.

Tisza River Sub-basin: Overview

MAP 1



2. POLLUTION CONTROL STRATEGY DEVELOPMENT PROCESS

Reducing pollution is a practical concern for Tisza countries. After all, what most people, governments and communities want for their rivers, ecosystems and regions is a good water quality, clean rivers and healthy environment. Meeting all those aspirations in a balanced way is one of the upcoming ITRBMP's challenges.

Full integration of the European Union policies into the national and basin wide pollution control strategies is a long-term challenge of the ICPDR. In the short term, the ICPDR proposes a gradual approach based on key priority objectives of the Water Framework Directive.

In response to the WFD requirements, a new system to collect and calculate emission data for the whole Danube river basin has been designed and starting to be implemented in line with EU regulations and bridging the efforts of the non-EU countries in the DRB that will use the agreed European Data Collection Systems and / or Methodologies.

The ICPDR's water pollution abatement activities continue to focus on the effective coordination of approaches to regional problems. The ICPDR has undertaken one stage of the characterization involving the assessment of pressures on the water bodies, including point and diffuse sources of pollution in the TRB. This assessment allows the identification of those water bodies, which are at risk of failing to meet relevant WFD objectives.
The following pollution related pressure categories have been considered in initial characterization for their impacts on water bodies in the Tisza Analysis Report (TAR), 2007:

- Organic pollution (point and diffuse sources of pollution)
- Hazardous substances
- Nutrient pollution

> The significant point sources criteria refer especially to substances mentioned in Annex VIII of the WFD, to the UWWT Directive, to the IPPC Directive and to the DS Directive. A number of 92 significant point sources (51 municipal, 39 industrial and 2 agricultural) were identified in TAR, contributing with 21,285 tonnes of BOD and, 48,234 tonnes of COD, at the level of TRB.

For the Tisza Analysis Report, the significance of pressures – in the sense of being of basin-wide importance – was identified and characterised using specific criteria based on the size of the pressure and/or the performance of treatment applied. The assessment of significant pressures in the Tisza River Basin was based on the ICPDR Emission Inventory for Tisza River Basin and a set of criteria was used to define what is significant at the Tisza basin level.

The results of the TAR are used to build up the further information about the pressures, impacts and the economic aspects of water uses. This is necessary for the development of measures and comparison of their likely effectiveness to support the achievement of WFD objectives in the TRB.

2.1. PRESSURES ASSESSMENT METHODOLOGY

For the development of the Tisza River Basin Management Plan, the pressures assessment followed a similar approach and methodology as for the Danube River Basin Management Plan.

Data collections are primarily based on existing binding EU reporting schemes or on existing international conventions. For urban wastewater discharges, the evaluation is based on the methodology of the EU Urban Waste Water Treatment Directive (UWWTD) and uses the data model and information that are also reported to the European Commission. The UWWTD covers all agglomerations with ≥2000 p.e.[2]. The UWWTD concept is centred around the term "*agglomeration*" which means "an area where the population and/or economic activities are sufficiently concentrated for urban wastewater to be collected and conducted to an urban wastewater treatment plant or to a final discharge point".

For industrial emissions, the data and methodology of the "European Pollutant Emission Register" (EPER) was used. In future, the "Pollutant Release and Transfer Register" (PRTR), which supersedes the EPER, and which is currently being implemented in the Tisza countries, will be used.
Data from Serbia and Ukraine were collected in the same structure so that a basin-wide assessment is possible. Therefore, the new data collections and evaluations give a more complete picture on pollutant sources and emissions.

2.1.1. Interlinkage between organic and nutrient pollution

Excessive nutrients, i.e., nitrogen and phosphorus, are pollutants of concern for the TRB and cause violation of water quality standards. Removing these pollutants is the goal of this Strategy. Nutrient pollution is – as with organic pollution – mainly caused by emissions from the agglomeration, industrial and agricultural sectors. Furthermore, for agglomerations, the P emissions via household detergents play a significant role. Regarding nutrient emissions, respective pressures on water bodies can result from (i) point sources (in particular untreated/partially treated wastewaters), and/or (ii) diffuse sources (especially agriculture). The pressure assessment related to nutrient pollution took the synergies between organic and nutrient pollution fully into account. The same basic assumptions and facts regarding wastewater treatment for urban and industrial emissions for organic pollutions are also valid for nutrients. The findings of point source analysis have been combined with those related to diffuse sources. The MONERIS model integrates these components, including the wetlands reconnection potential, and reflects the overall nutrient input in the TRB in total and per Tisza country.

2.2. RESULTS OF PRESSURES ASSESSMENT

2.2.1. SWMI: Organic pollution

The major cause of organic pollution is insufficient or lack of treatment of wastewaters discharged by agglomerations,[3] industrial and agricultural point sources (animal breeding farms, manure depots, etc.).

[2] p.e. (population Equivalent) describes the average untreated biological load generated by one person per day and equals 60g of BOD_5/d.

[3] Emissions from agglomerations: all releases of substances originating from the agglomeration reaching the environment (soil, water, air).

Many agglomerations in the TRB have no, or insufficient, wastewater treatment and are therefore key contributors to organic pollution. Direct, as well as indirect, discharges of industrial wastewaters are also important. Very often industrial wastewaters are insufficiently treated or are not treated at all before being discharged into surface waters (direct emission) or public sewer systems (indirect emission).

A total of 1078 agglomerations ≥2000 p.e. are located in the TRBD. Out of these, 22 agglomerations (4,694 million p.e.) are larger than 100,000 p.e. (Figure 1).
There is still a high number of agglomerations ≥2000 p.e. that are neither connected to a sewage collecting system nor to a wastewater treatment plant (Figure 2). In total, wastewaters are not collected at all in more than 590 agglomerations (=2,242,595 which is 18 % of the total generated load). A number of 111 further agglomerations have collection systems that require treatment.

The construction of sewerage collecting systems for agglomerations ≥2000 P.E. will reduce the pollutants emitted directly and infiltrated to the ground; but at the same time this could also lead to a significant increase in organic pollutants if proper treatment is not applied before being discharged to surface waters.

The updated assessment shows that the COD & BOD_5 emissions to environment (water and soil) from large agglomerations (≥2,000 PE) in the TRB are respectively 230 kt/a and 129 kt/a.

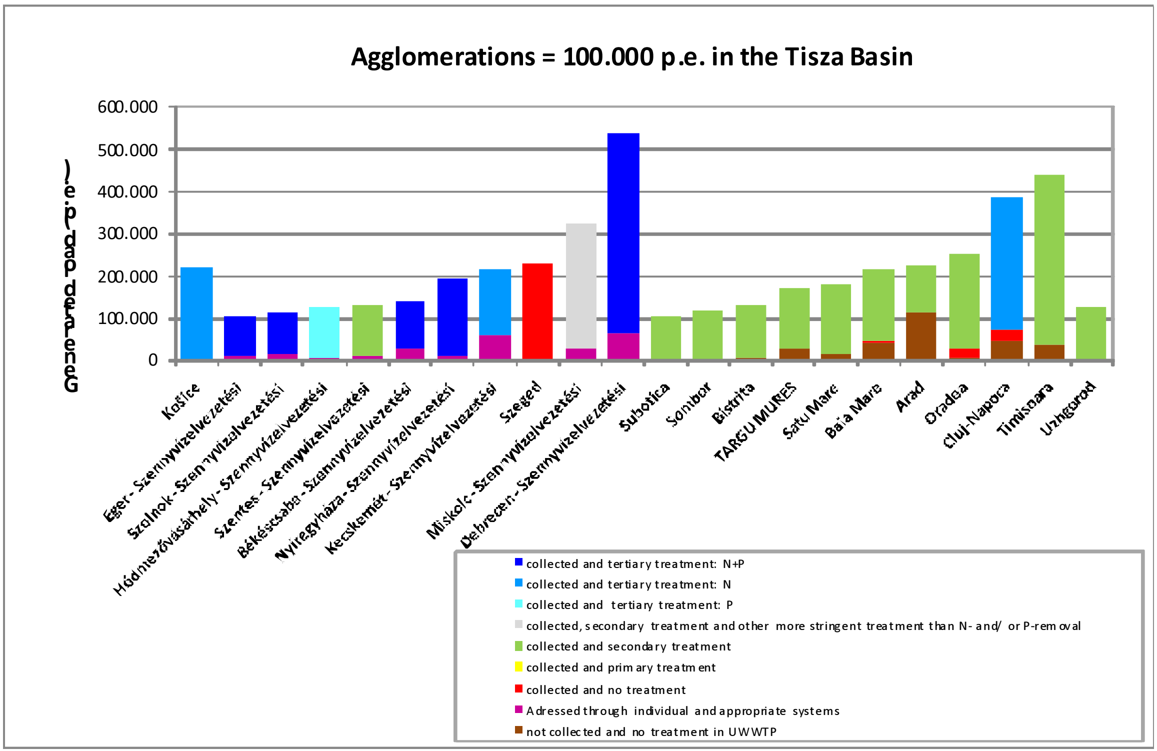


Figure 1: Existing wastewater treatment plants; existing treatment levels and degree of connection to wastewater treatment for agglo. >100.000 p.e. in the entire TRB.

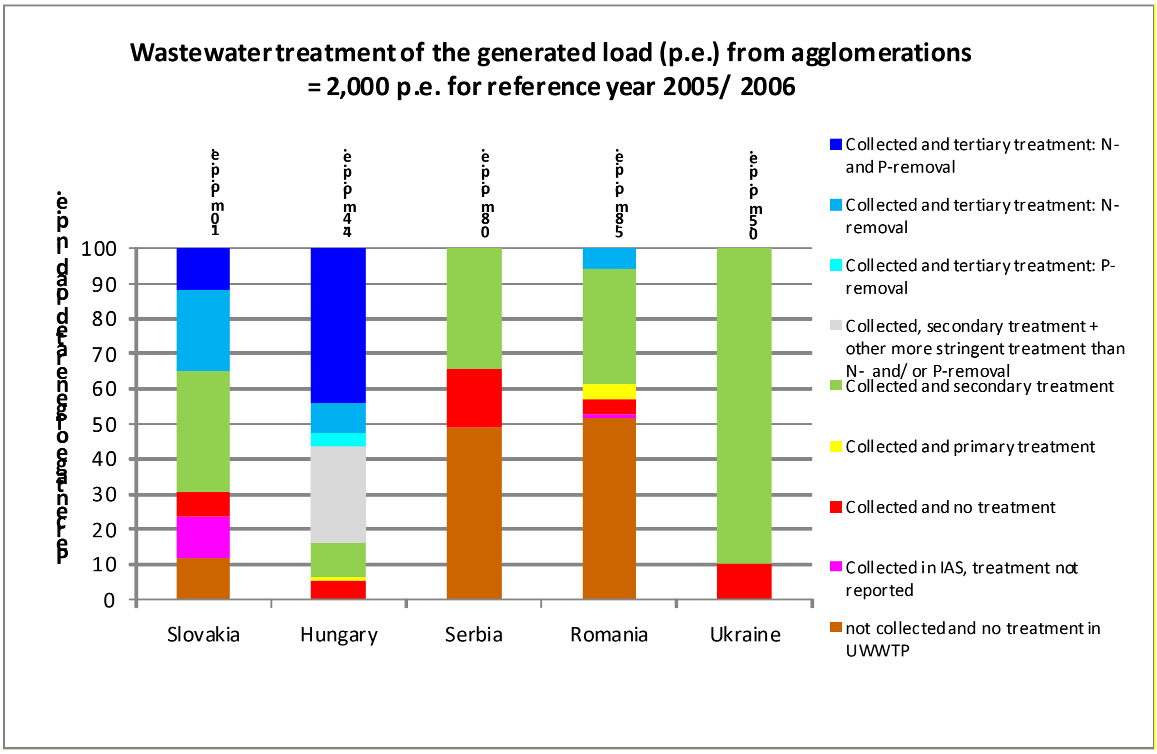


Figure 2: Existing wastewater treatment plants; existing treatment levels and degree of connection to wastewater treatment for the entire TRB by country.[4] (IAS: individual and appropriate systems e.g. Cesspools, septic tanks, domestic wastewater treatment plants).

In the TRB, the main industrial regions are located in Romania and Hungary, although there are also some important industrial facilities in Ukraine, Slovakia and Serbia. The manufacture of basic metals is an important sector in the Slovak Republic with a steel company in Kosice.
The chemical industry operates mostly in the Upper and Middle Tisza in Hungary (Miskolc and Szolnok regions), in Romania (Targu Mures) - and in the southern part of the Slovak Republic (Presov region). In recent years, production has been reduced because of the lack of market demand in Eastern Europe.

The petrochemical industry, including oil refinery, storage and transport (pipelines), is an important sector in the Hungarian and Ukrainian parts of the Tisza River Basin. The cellulose and paper industry is present in the Upper Tisza River Basin in the Slovak Republic, Romania and Ukraine. The food industry is mainly located in the Middle Tisza, although it is also a locally important sector in Ukraine and Serbia. Production has also been reduced in the last decade.
The textile industry has developed quickly in the Tisza River Basin due to the rapid transfer of technology and expertise. Since 1999, Romania has been the Central and Eastern European leader in textile exports to EU countries. The increasing demand for textile products represent an opportunity to augment the land surfaces cultivated with flax and hemp, crops that are well adapted to the climatic conditions of the Tisza River Basin. Use of modern technology reduces the textile industry’s impact on the environment.
The furniture industry is one of the few economic sectors that maintained a positive trade balance after 1990 and shares an important part of the industrial output in the Romanian and Ukrainian parts of the Tisza River Basin. Important investments are needed in order to implement integrated production cycles to avoid the degradation of the environment due to subsidiary products, such as

[4] For some countries a collection rate of less than 100% does not indicate that the remaining percentage is not treated at all.

sawdust. A number of related industries are represented in the Tisza River Basin, such as leather goods, porcelain and pottery, which is a large energy consumer.

The closure of many heavily polluting industrial activities since the 1990' contributed to a decrease in organic pollution. The industrial wastewaters are still being discharged without any, or with insufficient, pre-treatment into the public sewerage network in many areas and several industrial installations require measures to meet the IPPC requirements. Animal breeding and manure disposal are key agricultural point sources of organic pollution (pig and poultry farms). Although many of these facilities have in recent years reduced the numbers of animals they maintain or made other improvements, this remains a pressure.

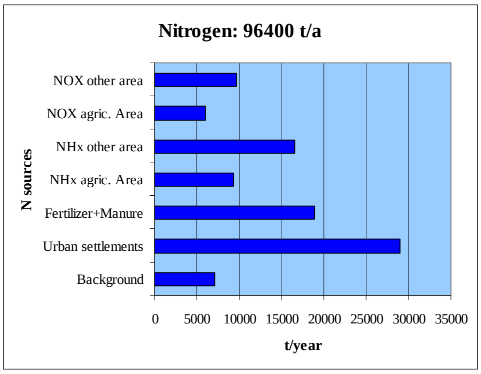
2.2.2. SWMI: Nutrient pollution

Nutrient pollution from point sources is mainly caused by emissions from insufficiently or untreated wastewater into surface waters. The levels of diffuse pollution are not only dependent on anthropogenic factors such as land use, and land use intensity, but also on natural factors such as climate, flow conditions and soil properties. The main contributors for both N and P emission are agglomerations not served by sewerage collection and wastewater treatment. For N pollution, the input from agriculture (fertilisers, manure, NOx and NHx) is the most important (totalling 39% of total emissions). For P, emissions from agriculture (area under cultivation, erosion, intensity of production, specific crops and livestock densities) are the second largest source after input from urban settlements. The share of agricultural emissions differs significantly between countries.

The recent investigations show that the ecological situation in the North Western Black Sea coastal area has improved significantly since the early nineties due to the lower discharges of N and P to the Black Sea. This is due to the political as well as economic changes resulting in (i) the closure of nutrient discharging industries, (ii) a significant decrease of the application of mineral fertilisers and (iii) the closure of large animal farms (agricultural point sources). Furthermore, the application of economic mechanisms in water management (e.g. the polluter pays principle) and the improvement of wastewater treatment contributed to this decrease.

However, economic recovery in the future, which would potentially result in increasing nutrient loads to the Black Sea (industry, agriculture and increased connection to sewerage), would put the achievement of environmental objectives at risk if not combined with a set of effective measures to be implemented in the TRB, especially as required by EU legislation.

The latest investigations for TRB made use of MONERIS (MOdelling Nutrient Emissions in RIver Systems) model for assessing nutrient emissions into the river system through individual pathways and for calculating scenarios for possible changes of nutrients loads within the river systems and different options of development. The MONERIS results show that altogether 96.4 kt of N and 8.5 kt of P in total are annually emitted into the TRB, of which 27.1 kt/year of N and 4.6 kt/a of P emissions are discharged by agglomerations ≥2000 PE in the TRB (Figure 3). The main contributors for both N and P emission are agglomerations not served by sewerage collection and wastewater treatment. For N pollution, the input from agriculture (fertilisers, manure, NOx and NHx) is the most important (totalling 39% of total emissions). For P, emissions from agriculture (area under cultivation, erosion, intensity of production, specific crops and livestock densities) are the second largest source after input from urban settlements.



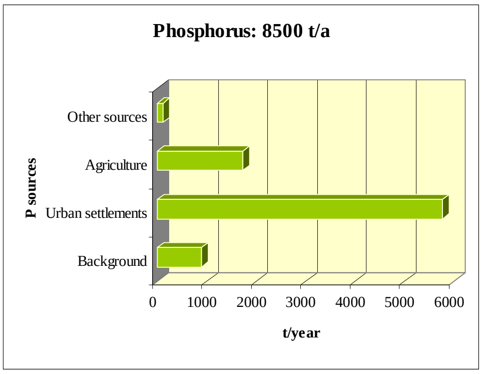


Figure 3: Sources of nitrogen and phosphorus emissions (EU MS and Non EU MS) in the TRBD (MONERIS results 2009).

Diffuse source pollution is caused by widespread activities such as agriculture and other sources (Figure 4). The levels of diffuse pollution are not only dependent on anthropogenic factors such as land use, and land use intensity, but also on natural factors such as climate, flow conditions and soil properties. These factors influence pathways that are significantly different. For N, the major pathway of diffuse pollution is groundwater while for P it is erosion.

The emission of phosphates via household detergents is significant in the TRB and it is included in the agglomerations contribution to total emissions. Currently, none of Tisza countries have introduced a phosphate ban for laundry detergents. In case of no wastewater treatment or treatment without a tertiary treatment the respective P loads find a direct way into the aquatic environment. Total P emissions due to laundry detergents are estimated at 8,2 t/a and for laundry and dishwasher detergents in the TRB are estimated at 8 t/a.

In the TRB, the share of nutrient pollution from atmospheric deposition is less significant.
The share for N is 0.14% (1,390 t/a) and even much less for P 0.06% (54 t/a) of the total P emissions of 96,400 t/a N emissions, respectively 8,500 t/a P emissions. Contributions to atmospheric nutrient pollution stem from human activities including transportation, agriculture (livestock farming) and industry.

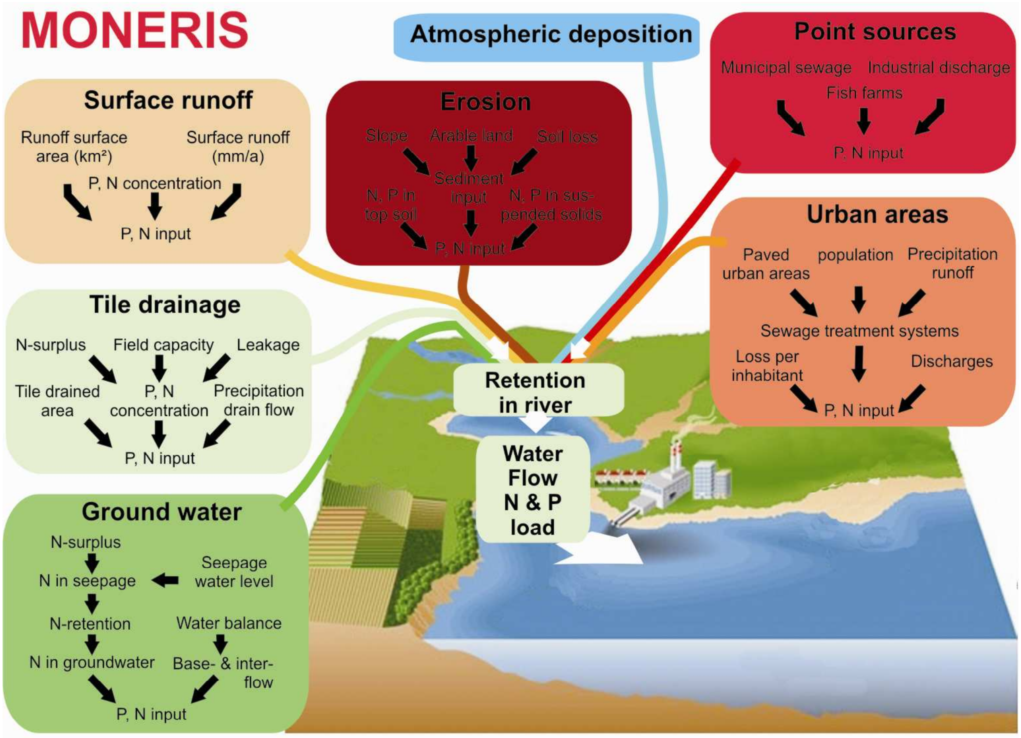


Figure 4: Schematic picture of main processes in relation to sources and pathways of nutrient inputs, including retention, into surface waters (MONERIS model).

While nutrients are only completely removed from the system during harvest or by denitrification, long-term storage within wetlands can lead to reduced pollution loads in the main channel. In most riverine wetlands, sedimentation and denitrification are the dominant process influencing, respectively, P and N cycling. These processes and the hydrogeomorphological factors that govern them (i.e. flooding) therefore determine whether specific wetlands are functions as a nutrient sink or source. To predict the role that a wetland will play in the nutrient reduction, a specific assessment has been performed for the TRB which demonstrated the reduced potential of wetlands to contribute to the reduction of nutrient pollution in the main river.

2.2.3. SWMI: hazardous substances pollution

Sources of hazardous substances in the TRB are: industrial effluents; storm water overflow; pesticides and other chemicals applied in agriculture; discharges from mining operations and accidental pollution.

The mining industry is well developed in the Tisza River Basin, notably in Romania. Non-ferrous metals are mined in the Somes and Mures sub-basins, the major Romanian tributaries to the Tisza. Small-scale mining also occurs in the Ukrainian Tisza River Basin section, with the extraction of salt, kaolin, mercury, gold, complex ores, zeolites and rocks used as construction material. In the Slovak Republic there are two mining sites of polymetalic ore and its processing mining of salt and construction materials and the Hungarian mining industry produces hydrocarbons, coals, industrial minerals and construction materials.

Within the TRB, there have been accidental spills of hazardous substances that have severely affected the aquatic environment and water quality. Accidents are concentrated in time and space and often have severe immediate as well as localized ecological consequences. The environmental risks involved in these activities continue to raise concerns throughout the region as many mining sites are significant sources of pollution and the development of additional mines is envisaged.

An estimation of the real risk at a particular site in the TRB was prepared and a set of checklists elaborated for prevention of accident risk.5 In addition to accidental pollution from operating industrial facilities, pollution from sites contaminated by former industrial activities or waste disposal has been identified as significant. It is of specific importance for sites contaminated by hazardous substances to identify those substances that can be mobilised and enter water bodies in the event of a flood. The updated inventories of accidental risk spots in the TRB provides a clear picture on potential risk sites[6,] as well as possible targets for reducing and controlling accidental pollution[7].

3. POLLUTION REDUCTION STRATEGY IN LINE WITH WFD REQUIREMENTS

The Pollution Control Strategy (Strategy) for Tisza River Basin is developed based on the recent findings of the pressures assessment, in connection with the existing and future obligations of Tisza countries towards international agreements, in line with the UNDP GEF MSP objectives, but also within the framework of the Joint Program of Measures resulted from the WFD process in the TRB.

The Pollution Control Strategy (Strategy) is divided into four sections. The first outlines the general principles on which the Strategy is based. The second outlines the management objectives agreed by Tisza country towards reaching the vision for each of the pollution related issues in the TRB, and details measures needed to achieve the pollution reductions under different scenarios. The third section introduces the selected scenarios designed to address reduction of organic pollution. The final section describes the results of scenario calculations and estimates of effects of the measures addressing pollution in the TRB.

3.1. GENERAL PRINCIPLES

Some general principles that are considered within the policy making process are as follows:

- The Strategy should be seen as part of a coherent policy framework ranging from overall statements about the agreed visions in response to the Significant Water Management

[5] For the classification of potential risk spots, a common procedure was elaborated considering the findings of the International Commission for the Protection of the Elbe; the EU Seveso II Directive and the UN/ECE Convention on the Transboundary Effects of Industrial Accidents.

[6] UNDP GEF DRP: M1 & M2 Methodology on Risk Assessment for Contaminated Sites (2006) – www.icpdr.org.

[7] Based on that estimation it is possible to elaborate a list of necessary immediate measures to enhance the safety level of a site. The selected M1 methodology for risk identification considers the properties of substances used or stored at a site and the quantity of the given substances. The properties of the substances determine the Water Risk Class (WRC) which – in combination with the amount of used/stored substances – determines the Water Risk Index (WRI), the quantitative indicator of the risk.

issues, to specific policy statements defined as management objectives, as well as for particular sector developments as concrete measures addressing industrial, municipal or agricultural sectors as part of the Joint Programme of Measures..

- ⇨ The Strategy is developed and adapted to changes in scientific knowledge due to recent data collection and evaluation tools, increase understanding of the significant water management issues in the region, as well to the international obligations of Tisza countries.
- ⇨ Policy development and implementation of Joint Program of Measures require expert and professional input and community participation
- ⇨ Political commitment is important in accomplishing Pollution Reduction Strategy in the TRB.

3.2. VISION AND MANAGEMENT OBJECTIVES

3.2.1. Organic pollution: Vision and management objectives

The results of the recent pressures analysis with regard to organic pollution in the TRB are reasons for concern. Across the Tisza River Basin a high proportion of surface water bodies are at risk of failing to meet the Water Framework Directive's objectives due to the impact caused by **organic pollution.**

The measures within the TRB addressing organic pollution will built on the agreed management objectives to enable the achievement of good ecological and chemical status in all affected surface waters.

Vision	**Management Objectives**	
	EU Member States	**Non EU Member States**
The ICPDR's basin-wide vision for organic pollution is zero emission of untreated wastewaters into the waters of the Tisza River basin	Phasing out – by 2015 at the latest – all discharges for untreated wastewater from towns with >10.000 p. e. and from major industrial and agricultural installations	Specification of number of wastewater collecting systems (connected to respective WWTPs), which are planned to be constructed by 2015
	Implementation of the UWWT Directive[8].	Specification of number of municipal and industrial wastewater treatment plants, which are planned to be constructed by 2015.
	Implementation of the SS Directive and the IPPC Directive	
	Reduction of total amount of organic pollutant discharged into the Tisza river system to levels consistent with the achievement of the good ecological status/chemical status/good ecological potential in the TRB by 2015	

By 2015 not all emissions of untreated wastewater from agglomerations with >10,000 PE will be phased out. For the reference year 2005/2006, 172 wastewater treatment plants serve a total of 186 agglomerations (>10,000 PE) in the TRB. However, 111 agglomerations ≥ 2.000 p.e. with sewerage collecting systems are still lacking wastewater treatment plants which need to be realized by 2015.

[8] For RO the implementation year is 2018 regarding agglomerations 2.000 - 10.000 p.e.

590 agglomerations ≥ 2,000 PE are not equipped with sewerage collecting systems and no wastewater treatment is in place for the entire generated load.
The building of collecting systems is recommended to be combined with the implementation of appropriate wastewater treatment techniques, which include nutrient removal as the entire Danube Basin is a catchment of sensitive area under the UWWTD.

In comparison with the Reference Situation, a reduction of emissions regarding organic pollution will be achieved by the implementation of any of the three scenarios.

3.2.2. Nutrients pollution: Vision and management objectives

The recent assessment of nutrient pollution sources is a valuable source of information for targeting the areas of high nutrient pollution and setting the objectives of the measures in the TRB. Nutrient removal is required to avoid eutrophication in many surface waters and the Black Sea North Western Shelf, in particular taking into account the character of the receiving coastal waters as a *sensitive area* under the UWWTD. The nutrient loads discharged from the TRB are as well an important factor responsible for the deterioration and eutrophication of parts of the Black Sea ecosystem.

The measures within the TRB addressing nutrient pollution will built on the agreed management objectives to enable the achievement of good ecological and chemical status in all affected surface waters.

Vision	**Management Objectives**	
	EU Member States	**Non EU Member States**
The ICPDR's basin-wide vision for nutrient pollution is the balanced management of nutrient emissions via point and diffuse sources in the entire Danube River Basin District that neither the waters of the DRBD nor the Black Sea - via TRB - are threatened or impacted by eutrophication	Implementation of the management objectives described for organic pollution with additional focus on the reduction on nutrient point source emissions.	Implementation of the management objectives described for organic pollution with additional focus on the reduction on nutrient point source emissions.
	Implementation of the EU Nitrates Directive (91/676/EEC) taking vulnerable zones into account in case natural freshwater lakes, other freshwater bodies of the TRB are found to be eutrophic or in the near future may become eutrophic.	
	Reduction of the total amount of nutrients entering the Tisza and its tributaries to levels consistent with the achievement of the good ecological status/potential in the Tisza River Basin by 2015.	Reduction of the total amount of nutrients entering the Tisza and its tributaries to levels consistent with the achievement of the good ecological status/potential in the Tisza River Basin by 2015
	Implementations of best environmental practices (BEP) regarding agricultural practices linked to EU Common Agricultural Policy (CAP).	Implementations of best environmental practices (BEP) regarding agricultural practices for reduction of non-point sources.
	Reduction of discharged nutrient loads in the Black Sea Basin to such levels, which permit the Black Sea ecosystems to recover to conditions similar to those observed in the 1960s.	Reduction of discharged nutrient loads in the Black Sea Basin to such levels, which permit the Black Sea ecosystems to recover to conditions similar to those observed in the 1960s.
	Reduction of phosphates in detergents preferably by eliminating phosphates in detergent products.	Reduction of phosphates in detergents preferably by eliminating phosphates in detergent products.

	Create baseline scenarios of nutrient input by 2015 taking the respective preconditions and requirements of the Tisza Countries (EU Member States, Non EU Member States) into account.	Create baseline scenarios of nutrient input by 2015 taking the respective preconditions and requirements of the Tisza Countries (EU Member States, Non EU Member States) into account.
	Definition of basin-wide, sub-basin and/or national quantitative reduction targets (i.e. for point and diffuse sources) taking the respective preconditions and requirements of the Danube Countries into account.	Definition of basin-wide, sub-basin and/or national quantitative reduction targets (i.e. for point and diffuse sources) taking the respective preconditions and requirements of the Danube Countries into account.

For the assessment regarding the effects of measures to reduce nutrient pollution by 2015 the MONERIS model has been applied. The model takes into account both nutrient point sources as well as diffuses emissions. In addition, for the Tisza RBM plan supplementary investigations have been performed considering the wetlands role in the reduction of nutrient pollution, in support of meeting the management objectives.

On the basin-wide level, basic measures (fulfilling the UWWTD and EU Nitrates Directive) for EU MS and the implementation of the ICPDR Best Agricultural Practices Recommendation for Non EU MS are the main measures contributing to nutrient reduction.

The implementation of the UWWTD by EU MS and the reported measures of Non EU MS (18 agglomerations for which wastewater treatment plants will be constructed / rehabilitated by 2015) significantly contribute to the reduction of nutrient point source pollution. An additional measure to decrease phosphates in detergents would further contribute to the P emission reduction.

3.2.3. Hazardous substances pollution: Vision and management objectives

The Water Framework Directive sets out a "Strategy against pollution of water" which demands specific measures aiming at the cessation or phasing out of discharges, emissions and losses to the aquatic environment within 20 years for the priority hazardous substances and at the progressive reduction for the priority substances.

The measures within the TRB addressing nutrient pollution will built on the agreed management objectives to enable the achievement of good ecological and chemical status in all affected surface waters.

Vision	Management Objectives	
	EU Member States	Non EU Member States
The ICPDR's basin-wide vision for hazardous substances pollution is no risk or threat to human health and the aquatic ecosystem of the waters in the Tisza River Basin as well in the Danube River Basin	Implementation of the Integrated Pollution Prevention Control Directive (96/61/EC), which also relates to the Dangerous Substances Directive 76/464/EEC, Priority Substances Directive (will come into force), Mining Waste Directive 2006/21/EC	
	Reduction/Elimination of the total amount of priority/priority hazardous substances (specially arising from industrial, agricultural and mining activities) entering the Tisza and its tributaries to levels consistent with the achievement of the good chemical status by 2015.	Reduction/Elimination of the total amount of priority/priority hazardous substances (specially arising from industrial, agricultural and mining activities) entering the Tisza and its tributaries to levels consistent with the achievement of the good chemical status by 2015

District and Black Sea waters impacted by the Tisza River discharge.	Implementation of Best Available Techniques and Best Environmental Practices including the further improvement of treatment efficiency, treatment level and/or substitution	Implementation of Best Available Techniques and Best Environmental Practices including the further improvement of treatment efficiency, treatment level and/or substitution.
	Explore the possibility to set up quantitative reduction objectives for pesticide emission in the Tisza River Basin.	Explore the possibility to set up quantitative reduction objectives for pesticide emission in the Tisza River Basin.

Reducing hazardous substances emissions is a complex task that requires tailor made strategies as the relevance of different input pathways is highly substance-specific and generally shows a high temporal and spatial variability. Although there is insufficient information on the magnitude and implications of problems associated with hazardous substances at a basin-wide level, it is clear that continued efforts are needed to ensure the reduction and elimination of discharges of these substances.

The Dangerous Substances Directive, the IPPC Directive and UWWTD implementation by EU MS, as well as widespread application of BAT/BEP throughout the DRB, will improve but not solve problems regarding hazardous substances pollution. Other relevant measures for substances being released to the environment include chemical management measures. These are mostly based on EU regulations such as REACH (EU regulation on Registration, Evaluation, Authorization and Restriction of Chemicals) or the Pesticides Directive and involve e.g. bans/substitution of certain substances or measures which ensure the safe application of products (e.g. pesticides) - often referred to as Best Environmental Practices (BEP).
With regard to accidental pollution, the most important measures are prevention of accidents and ensuring effective contingency planning in the case of an incident.

3.3. SELECTED SCENARIOS FOR ASSESSING THE ANTICIPATED REDUCTION OF POLLUTION

In order to estimate the effectiveness of specific measures regarding the reduction of organic pollution on the basin-wide scale a scenario approach has been developed.

3.3.1. Scenarios for urban wastewater treatment development in the TRB

The scenario approach describes - as a starting point - the status-quo regarding wastewater treatment in the TRB (Reference Situation) and further its potential future development (three scenarios) using different assumptions.
The **Reference Situation-UWWT 2005/2006** (RefSit-UWWT) gives an overview of the current situation regarding wastewater treatment and treatment efficiency in the TRB.
The Baseline Scenario-UWWT 2015 (BS-UWWT) describes the agreed measures for the first cycle of the WFD implementation on the Tisza basin-wide scale until 2015. Measures that are legally required for EU MS and other measures that are realistic to be taken by the Non EU MS have been taken into account (18 urban wastewater treatment plants).
Midterm Scenario-UWWT (MT-UWWT):

This scenario is based on the BS-UWWT. In addition it assumes for Non EU MS, P removal for agglomerations >10,000 PE in order to achieve management objectives. This measure would clearly be a major step towards achieving the vision.

Vision Scenario-UWWT (VS-UWWT):

This scenario goes beyond the BS-UWWT as well as the MT-UWWT and therefore far beyond the requirements of the UWWTD. It is based on the assumption that the full technical potential of wastewater treatment regarding the removal of organic influents and nutrients is exploited for both EU and Non EU MS. If such a scenario is to be realised, it is assumed that agglomerations >10,000 PE are equipped with N and P removal (secondary/tertiary wastewater treatment), whereas all agglomerations >2,000 PE are equipped with secondary treatment.

3.3.2. Scenarios for nutrient reduction

MONERIS[9] considers seven pathways regarding inputs into surface waters via pathways. In addition, the retention of nutrients in rivers (divided in main rivers and tributaries) and the wetlands role is calculated.

The **Reference Situation-Nutrients 2000-2005** (RefSit-Nut) describes (as a starting point) the status-quo regarding nutrient emissions in the TRB. Furthermore, four nutrient scenarios have been calculated from the data provided by the countries and using some assumptions, in order to draw a picture of potential future developments.

Baseline Scenario – Agriculture 2015 (BS-Agri-Nut):

This reflects a moderate development of agriculture and builds upon agreed measures to reduce nutrient emissions in the TRB. This scenario forecasts the future NO_x deposition and incorporates changes in agriculture.

Agricultural Scenario-Nutrients 1 2015 (I-Agri-Nut-1):

This assumes that the N surplus of Tisza countries will be the same as for the EU 15 in the year 2000 (i.e. 57 kg/ha/a). Further, it is assumed that no change in atmospheric deposition will occur.

Agricultural Scenario-Nutrients 2 2015 (I-Agri-Nut-2):

This assumes that the N balance for the Tisza countries will be same for SK, RS, HU, RO and UA as the upstream countries in the Danube basin DE, AT and SI. Further, it is assumed that no change in atmospheric deposition will take place and N surplus in the remaining countries stays unchanged.

Phosphate Ban Scenario-Nutrients (PBan-Nut):

This explores the reduction potential of an introduction of reduction of phosphates in laundry detergents and dishwashers as recommended by the Resolution of the 10th ICPDR Ordinary Meeting, December 2008.

Wetlands Scenario (Wetlands):

This assumes the multiple benefits of wetlands in the nutrient reduction in the TRB.

[9] Behrendt et al. (2007): The Model System MONERIS (2007) – User Manual; Leibniz Institute for Freshwater Ecology and Inland Fisheries in the Forschungsverbund Berlin e.V., Müggelseedamm 310, D-12587 Berlin, Germany.

3.4. ESTIMATED EFFECTS OF NATIONAL MEASURES ON THE BASIN-WIDE SCALE

3.4.1. SWMI: organic pollution

In comparison with the Reference Situation-UWWT 2005/2006 (RefSit-UWWT), a reduction of emissions regarding organic pollution will be achieved by the implementation of any of the three scenarios.

The Baseline Scenario-UWWT 2015 implements the management objectives but will not ensure the achievement of the WFD environmental objectives on the basin-wide scale for organic pollution by 2015.

The Midterm Scenario-UWWT goes beyond the 2015 management objectives. However, the Midterm Scenario-UWWT will not ensure the achievement of the WFD environmental objectives on the basin-wide scale for organic pollution by 2015. The measures proposed are not fully able to be implemented by 2015 for economic, administrative and technical reasons.

The Vision Scenario-UWWT goes beyond the 2015 management objectives (beyond the BS-UWWT and MT-UWWT and therefore beyond the requirements of the UWWTD) and would ensure the achievement of the WFD environmental objectives on the basin-wide scale by 2015 for organic pollution. However, the measures proposed within this scenario are not fully able to be implemented by 2015 for economic, administrative and technical reasons.

3.4.2. SWMI: nutrient pollution

For the assessment regarding the effects of measures to reduce nutrient pollution by 2015 the MONERIS model has been applied. The model takes into account both nutrient point sources as well as diffuses emissions.

On the basin-wide level, basic measures (fulfilling the UWWTD and EU Nitrates Directive) for EU MS and the implementation of the ICPDR Best Agricultural Practices Recommendation for Non EU MS are the main measures contributing to nutrient reduction.

The implementation of the UWWTD by EU MS and the reported measures of Non EU MS (18 agglomerations for which wastewater treatment plants will be constructed / rehabilitated by 2015) significantly contribute to the reduction of nutrient point source pollution. An additional measure to decrease phosphates in detergents would further contribute to the P emission reduction.

Locally the reconstruction of wetlands has a very limited effect on the nutrient emissions to the surface waters. The positive effect of wetlands on the nutrient emissions is equaled out by higher emissions via direct atmospheric deposition on the larger surface waters.

3.4.3. SWMI: hazardous substances pollution

The Dangerous Substances Directive, the IPPC Directive and UWWTD implementation by EU MS, as well as widespread application of BAT/BEP throughout the DRB, will improve but not solve problems regarding hazardous substances pollution. The reduction/elimination of the amount of hazardous substances entering the Danube and its tributaries to levels consistent with the achievement of *good chemical status* may not be possible by 2015 and further efforts are needed.

4. CONCLUSIONS

The pollution related significant water management issues (organic, nutrients and hazardous substances) will be in focus for the further management steps within the WFD implementation to develop the Integrated Tisza Basin Management Plan by 2010. All measures described in the Strategy are necessary if the waters of the TRB are to meet the WFD objectives and achieve water quality standards.

There will be a considerable shared challenge in the next years to address these issues and ensure sustainable water management through a correct and timely implementation of the WFD.