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Tisza River Basin Characterization Report on Surface Water

Deliverable 3.1.1: Tisza River Basin Characterization Report on Surface Water

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DANUBE REGION strategy

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Disclaimer

This Report is based on data delivered by the Tisza River Basin countries as of July 2018. Data were incorporated in to the Danube GIS database as well as into questionnaires send out in December 2017.

Sources other than project partners have been clearly identified in this report.

This report has been elaborated in line with the methodology for the Danube River Basin Management Plan – Update 2015. A more detail level of information is presented in the national river basin management plans in the Tisza River Basin countries.

Data in this report has been dealt with, and is presented, to the best of our knowledge. Nevertheless, cannot be ruled out.

1 Introduction

Tisza River Basin Characterization Report should serve as a baseline for updating the Integrated Tisza River Basin Management Plan (ITRBM Plan Update). Data provided by JOINTISZA project partners considers the reference period 2009-2013 and is in line with the National River Basin Managements Plans as well as the Danube River Basin Management Plan – Update 2015.

Data presented in this document developed in the frame of the JOINTISZA project are based on the Danube GIS information and were updated by the nominated experts of the Contracting parties to the Danube River Protection Convention which are sharing the territory of the Tisza River Basin, as well as on the other relevant information delivered by project partners from Ukraine, Romania, Slovakia, Hungary and Serbia. The background documents as Integrated Tisza River Basin Management Plan (2011), Analysis of the Tisza River Basin (2007), the Danube River Basin District Management Plan (update 2015) and the others are given in the references.

Tisza River Basin Characterization Report takes into account the rivers with catchment size larger than 1,000 km^2; lakes larger than 10 km^2 and the main canals of basin-wide importance.

2 Tisza River Basin Overview

The Tisza River Basin drains an area of 157,186 km². Five countries are sharing this the largest sub-basin of the Danube River Basin (Romania, Ukraine, Slovakia, Hungary and Serbia). The Tisza River is the longest tributary of the Danube (966 km), and the second largest by flow, after the Sava River.

The Tisza River Basin can be divided into two main parts:

- The mountainous Upper Tisza and the tributaries in Ukraine, Romania and the eastern part of the Slovak Republic,
- The lowland parts mainly in Hungary and in Serbia surrounded by the East-Slovak Plain, the Transcarpathian lowland in Ukraine and the plains on the western fringes of Romania.

The Tisza River itself can be divided into three parts:

- **The Upper Tisza** upstream from the confluence of the Somes/Szamos River,
- **The Middle Tisza** in Hungary which receives the largest right-hand tributaries: the Bodrog and Slaná/Sajó Rivers together with the Hornád/Hernád River collect water from the Carpathian Mountains in Slovakia and Ukraine, and the Zagyva River drains the Mátra and Bükk, as well as the largest left-hand tributaries: the Szamos/Somes River, the Körös/Crisuri River System and Maros/Mures River draining Transylvania in Romania,
- **The Lower Tisza** downstream from the mouth of the Maros/Mures River where it receives the Begej/Bega River and other tributaries indirectly through the Danube – Tisza – Danube Canal system.

The Tisza River Basin (Map 1) is an important European resource with a high diversity of landscapes which provide habitats for unique and rich biodiversity of species including endemic ones.

"Therefore, the one of the planet has been named Tisza as well as an asteroid is called Tisza"

2.1 States in the Tisza River Basin

Five states share territory in the Tisza River Basin District: Ukraine, Romania, Slovakia, Hungary and Serbia where less than 13 million people live (12,533,460 inhabitants). The highest population of the Tisza River Basin lives in Romania (4,972,912 inhabitants) and in Hungary (3,915,338 inhabitants). The coverage of the states in the Tisza River Basin is provided in Table II.1.

Romania, Slovakia and Hungary are the European Union members; Serbia is a candidate country for European Union (EU), while Ukraine has signed the Association Agreement with EU in 2014 and its implementation of is in process now.

The Tisza River Basin covers totally 157,186 km^2. The largest share on the Tisza River Basin is in Romania while the smallest is in Serbia.

Table II.1: The basic characteristics of the states in the Tisza River Basin

Country	Tisza River Basin area in the country (km²)	Share of the Tisza River Basin area (%)	Population in the Tisza River Basin (No. of inhabitants)
Ukraine	12,732	8.1	1,256,850
Romania	72,620	46.3	4,972,912
Slovakia	15,247	9.7	1,532,360
Hungary	46,213	29.5	3,915,338
Serbia	10,057	6.4	780,935
Total:	156,869	100	12,458,395

2.2 International coordination and cooperation

The Tisza River Basin Countries have a long history of cooperation including the agreement on the protection of the Tisza River and its tributaries in 1986.

The "Convention on Cooperation for the Protection and Sustainable Use of the Danube River" (Convention for protection of the Danube, Sofia 1994) forms the overall legal instrument for cooperation and trans-boundary water management in the Danube River Basin including Sub-basin of the Tisza River.

On the basis of the earlier activities and encouraged by a dialogue initiated by the EU Presidency of the International Commission for Protection of Danube River (ICPDR), the Tisza Countries signed the Memorandum of Understanding and agreed to prepare a River Basin Management Plan for the Tisza River Basin by the end of 2009, aiming at the objectives set by the EU Water Framework Directive 2000/60/EC (WFD).In 2011, five the Tisza River Basin countries Ukraine, Romania, Slovakia, Hungary and Serbia entered a new stage in joint water management to ensure good water quality. The ministers and high-level representatives signed in 2011 a Memorandum of Understanding towards the implementation of the Integrated Tisza River Basin Management Plan (ITRBM Plan), which has been proposed in full compliance with the EU Water Framework Directive.

The ICPDR served as the platform for coordination of the implementation of the WFD on issues of Danube Basin-wide importance. For the elaboration of the first Integrated Tisza River Basin Management Plan (2011) the ad hoc Tisza Group was created in order to prepare and coordinate the necessary activities in this field.

The draft Update of ITRBMP is prepared by the Project "Strengthening cooperation between river basin management planning and flood risk prevention to enhance the status of waters of the Tisza River Basin" (JOINTISZA) supported by the Transnational Danube Programme. All five Tisza countries (ERDF, IPA and ASP), ICPDR and NGOs are involved in the Project through partner organizations.

2.3 Competent authorities

Based on the Article 3 of the WFD also the Tisza River Basin countries have identified the competent authority for the implementation of the WFD. The list of competent authorities is given in following Table.

Table II.2: The list of competent authorities

Country	Competent authority
Ukraine	Ministry of Ecology and Natural Resources of Ukraine, 35, Mytropolyta Lypkivskogo str., UA-03035 Kyiv, Web link: www.menr.gov.ua State Committee of Ukraine for Water Management, 8 Velyka Vasylkivska str., UA-01601 Kyiv, weblink: *http://www.scwm.gov.ua/*
Romania	Ministry of Waters and Forests Calea Plevnei, Nr. 46, Sector 1, RO- Bucuresti, web link: *http://apepaduri.gov.ro/* National Administration "Romanian Waters" Edgar Quinet, Nr. 6, Sector 1, Bucuresti, Romania, *www.rowater.ro*
Slovakia	Ministry of the Environment, Námestie Ľ. Štúra 1, SK-81235 Bratislava Web link: *http://www.minzp.sk/*
Hungary	Ministry of the Interior, József Attila utca 2-4, HU-1051 Budapest Web link: *http://www.kormany.hu/en/ministry-of-interior*
Serbia	Ministry of Agriculture, Forestry and Water Management, Republic Directorate for Water, Bulevar umetnosti 2a, RS-11000 Beograd Web link: *www.minpolj.gov.rs*

2.4 Public participation in the Tisza River Basin

Based on the Article 14 of the WFD, the active involvement of the interested parties in the implementation of the requirements of the WFD, in particular in the production, review and updating of the River Basin Management Plan should be assured.

Within the frame of the JOINTISZA Project the public participation is one of the important issues defined by the activities of work packages 2 and 6. The public involvement and participation strategy (PIPS) covering the aspects of information access and public participation and encompassing a comprehensive plan on whom, when and how to involve in the preparation of the updated ITRBM Plan. This developed is fully in compliance with Project Communication Plan and the relevant EU Directives and includes targeted communication activities, specific methods for access to information, tools for consultation and active involvement. The steps of the PIPS fit to work plan of the work packages in order to ensure that engagement takes place at points when there are real opportunities to influence the planning.

In the frame of the JOINTISZA Project, 2-day training on stakeholder involvement ("train the planners") was organized in order to support implementation of those activities for the planning experts from the Tisza countries. Outputs from the training have documented learning interaction improvement in the field of the knowledge of the planners on effective public involvement and its methodologies.

During the training the stakeholder involvement methods that best fit the needs of each country and each partner were identified and the follow-up process will continue to support the implementation of the selected tools on the national level. The goal on the national level follow-up is to make the public involvement to prepare of the draft ITRBMP Update as the most effective possible in all countries of the basin. It reflects the different social backgrounds of the Tisza basin and the heterogeneity of the problems and tasks in the water management.

All the activities are targeted to ensure a fair and transparent engagement approach which next to sufficient and timely information supply with the aim to generate and obtain stakeholders input on the identification of the significant water management issues overview and on the draft ITRBMP Update.

Concerning the updated ITRBMP, this process is built upon the lessons learned from the previous consultation processes in the Tisza basin, a basin-wide consultation event is planned, organized with the aim to learn more about stakeholders local knowledge, perception and concerns regarding proposed draft ITRBMP Update, including the planned Joint Programme of Measures. In addition, possibility to submit written comments on the draft ITRBMP Update will be provided with a pre-defined timeframe.

3 General characterization of the Tisza River Basin

3.1 Geographic characterization

The Tisza River Basin, the largest sub-basin of the Danube River Basin, is shown in Map 1. The Tisza River Basin is located in the Carpathian Mountains area in Romania, Ukraine and Slovakia, and Northern Mountains in Hungary. In Hungary, Serbia, Ukraine and Slovakia the area also includes low-lying and flat areas of Pannonian (Hungarian) lowlands. The hilly area is represented by the Plateau of Transylvania Unit, Western Hills and Depressions, Western Plain in Romania.

The Tisza River rises in the Carpathian Mountains in north-western Ukraine and is formed from the confluence of the Bila and Chorna Tisza Rivers. Further headwaters rise in the eastern mountains of the Slovak Republic. The Uzh/Uh and Latorytsia/Latorica tributaries flow from Ukraine into the Slovak Republic where they, together with Ondava, Topľa and Laborec Rivers form the Bodrog River before it enters Hungary. The Somes/Szamos and the Mures/Maros rise in the Romanian Carpathians, while the rivers forming the Cris/Körös system rise in the Apuseni Mountains.

In Romania, the Tisza River Basin relief shows a great variety from plain to mountains (the minimum altitude is 75 m in the Western Plain, and the maximum is 2,509 m in the Retezat Mountains).

In Slovakia the largest part of the basin area lies at altitude of 300-500 mabove BalticSea level and the smallest area takes up an altitude from 1,000 to 1,500 m above Baltic Sea level. Significant particularity in the southern part of the basin in Slovakia is Slovensky Kras, which is formed by a system of karst highlands separated by deep valleys that created an extensive system of over 1.000 caves and chasms.

In Hungary Tisza River Basin reaches the lowest altitude at Szeged-Gyálarét – 75.8 m and the highest altitude in Kékes – 1,014 m above Baltic Sea level.

The Tisza River Basin in Serbia is a part of Pannonian lowlands with different geomorphological elements in relief (as alluvial plains, loess plateaus, sandy areas). The elevation is between 74-143 m above Adriatic Sea level.

In Ukraine the largest part of the Tisza Basin is located in the Ukrainian Carpathian Mountains, which are middle-height Mountains of 1,000 to 1,200 meters above sea level - the highest peaks reach 2,000 meters. The main mountain ranges are located longitudinally from north-west to south-east and divided by transverse river valleys.

3.2 Climate

Tisza River Basin is situated in moderate continental climate with ocean, Mediterranean and Sub-Mediterranean influences. The mountainous climate is present as well.

The climate in Tisza river basin in the Ukrainian Carpathians is reasonably continental. The region experienced mild winters with thaws, a long, though unstable spring, a mild summer and warm autumn. The annual precipitation is between 1.750 mm in the mountains and 700 mm in the lowlands.

The annual average temperature in Romania varies between: 9-11°C in the Western Plain area, 8-10°C in the Western Hills, 6-9°C in intra-mountainous depressions, 6-8 °C in the Transylvanian Plateau, 0-6°C in the Western Carpathians, -2 and 6°C in the Eastern Carpathians, -2 and 0 °C in the Meridional Carpathians.

Annual average rainfall ranges are between 800-1,200 mm in the Oriental Carpathians and the Southern Carpathians, 700-1,200 mm in the Western Carpathians, 650-800 mm in the Western Hills, 600-800 mm in the Transylvanian Plateau and in the intramountain depressions, and 550-650 mm in the Western Plain.

In Slovakia long-term average annual air temperature in the Tisza River Basin is ranging from 4°C in higher and northern locations, up to 10 °C in lower southern locations. In the middle part of the basin, the long-term average annual temperature varies from 6 to 8°C. Total long-term average annual precipitation in the Tisza River Basin in Slovakia is ranging from 550 to 700 mm in the southern lower locations, 700-900 mm in the middle and 1,000 mm in the highest locations.

There are four climatic zones in Tisza river basin in Hungary: the Northern Mountains, the northeast part of the Great Plain, the middle part of the Great Plain, and the southeast part of the Great Plain. The Hungarian part of Tisza sub-basin has the warmest summer; the mean temperature is around 21°C in July. The average yearly amount of rainfall varies between 400 and 700 mm. The average annual temperature in the mountains is 8-9°C. In the middle of the Great Plain, the annual average temperature is between 10-11°C. In the south-eastern borderline it reaches 12°C.

The climate in the Serbian part of the Tisa river basin is moderate continental with average yearly precipitation of 570 mm and annual average temperature is 11.1°C.

3.3 Geology

Geology of Tisza River Basin is composed from crystalline and magmatic rocks, crystalline prehercinal shale, hercinic crystalline shale, ololytic magmatite, prelaramic sedimentary deposits, larmamagmat in the area of Carpathians.

In Ukraine the Tisza River is situated within the new Alpine folding of the Carpathians and covers the central part of the Ukrainian segment of the Folded Carpathians with the Zakarpattya internal trough. The central suture zone (Zakarpattya area or otherwise Perypeninskyi deep-seated fault) divides these two main longitudinal segments.

The Transylvanian Depression is an area of active sedimentation and subsidence that emerged at the end of the Lower Miocene. The Western Hills have a crystalline foundation, which is affected by different elevations and dives, represented by blocks at different depths, over which are sediment.

Pannonian Depression consists of a base made up of crystalline shale traversed of penetration and solidification of the magma and sedimentary shell.

Tisza River Basin geology in Slovakia consists of paleogene, neogene and neogeneous volcanites. Neogene is represented by deposits with young vulcanites, older palaeozoic rocks, medium triasma limestones and dolomites have a very low permeability. Quaternary deluvium of loamy-clay character

form an impermeable barrier and silty, respectively clayey loam with organic admixture in overburden are laying. Paleozoic rocks are represented by granite rocks, gneis and paragneis. The volcanic neogene rocks are formed by andesites, rhyolites, tuffs and tuffites that are only slightly waterlogged. Fluvial sandy gravel forms the bottom panel and low river terraces.

The territory of Hungary is divided into two main structural units by the large-construction line between Zagreb-Hernád and the North West-North East. A piece of plate north of this line was on the edge of the African plate, and the plate on the south was formed on the edge of the Eurasian plate. Approximately 25 million years ago (in the oligocene), the African plate fell from the southwest to the northern part of the Carpathian Basin, accompanied by andesite-riolite volcanic activity. As a result, active volcanic activity was started, at that time the North- the mountainous and volcanic rocks of Andez and Riol, located in this river basin: the Mátra and the Zempléni Mountains. In Hungary, the earthquake is thinner than average (compared to the 33 km average only 26-27 km), therefore the geothermal gradient is higher than the average.

The oldest rocks of Hungary can be found in this sub-basin: the 1100-million-year-old crystals in the depths of the Great Plain, and 900 million-year-old mulberry trees on the surface in the eastern front of the Zemplén Mountains (Vilyvitányi-rög) and the Ancient Plants in the Bükk and Cserehát area. At the beginning of the middle Ages, in the Triassic period, the territory of our country was flooded with sea. First, sandstone and marble layers, then massive limestone and dolomite layers were deposited. It builds part of the Bükk and North Borsod karst, whose world-famous dripstone cave was also formed in anointed limestone. The slowly descending basin was flooded by the Pannonian Sea, and thousands of feet of sand and clay were deposited. By filling the pool, the freshwater-water-puddled lake remained in the place of the interior. Their memories are preserved by lignites in the foothills of the Mátra and Bükk, but then the formation of crude oil and natural gas began. In the ice age, it did not cover our coherent ice-covered area, but the cold wind storms carried a lot of portions from the riverbed, which the steppe-like vegetation has made as loess layers in many areas of the Great Plain. Hajdúság, Körös-Maros. Then the rivers and the wind formed and shaped the surface. The rivers flooded their floodplains (resulting in plain flat planks such as Nagykunság), while the wind piled the sand into dunes and bucks where it was not vegetated (Kiskunság, Nyírség).

In Serbia the alluvial sediments are dominant in most of the basin. Central part of Banat is dominated by loesses - terrestrial sediments. North and central part of Bačka are dominated by loess and eolian sands, while the southern part of Bačka is dominated by loesses - terrestrial sediments and alluvial sediments. Salinized land covers small areas mainly in alluvial terrace in wider zone of Tisza River Basin in Banat and small isolated areas in zone of loesses - terrestrial sediments in Bačka.

4 Surface water bodies in the Tisza River Basin

4.1 The Tisza River and its tributaries

The original length of the Tisza River was 1,400 km from its spring in the north-eastern Carpathian Mountains in Ukraine to its mouth at the Danube. During the second half of the 19th century, extensive measures on the river and flood control were undertaken along the river. As a result of these works, the river's total length was shortened by approximately 30% and it is today 966 km.

The main tributaries rivers of the Tisza Riverare as follow:

- In Ukraine: Borzhava, Latorica, Rika, Teresva,Uzh (with catchment area of more than 1000 km^2);
- In Romania: Vișeu, Iza, Tur, Someș and its tributaries (Șieu, Someșul Mic, Lăpuș), Crasna, then Crișul Alb, Crișul Negru, Crișul Repede, Barcău and Ier which are tributary of the Hármas-Körös from Hungary, Mureș and its tributaries (Arieș, Târnava, TârnavaMică, Sebeș, Strei), Aranca, Bega, Bega Veche;
- In Slovakia: Bodrog, Uh, Laborec, Latorica, Topla, Ondava, Hornád, Torysa, Rimava, Slaná, Bodva;
- In Hungary: Túr, Szamos, Kraszna, Hernád, Sajó, Bódva, Zagyva, Hármas-Körös (and its tributaries:, Fehér-Körös, Fekete-Körös, Kettős-Körös, Sebes-Körös, Berettyó), Dong-éri-főcsatorna, Maros;
- In Serbia: Zlatica, Begej, Stari Begej.

For the basin-wide overview there were selected rivers and lakes (two WFD categories), distributed into three groups:

- All natural and heavily modified rivers with catchment size larger than 1,000 km^2,
- All natural and heavily modified lakes with area larger than 10 km^2,
- Artificial water bodies, mainly canals.

The delineation of the river water bodies according to the Annex II of the WFD depends, inter alia, on typology. Based on system A of the WFD, ecoregion, catchment area, altitude and geology are the main descriptors. However, all Tisza River Basin countries except Slovakia used additional descriptors as they are given in the system B of the WFD.

The Tisza River Basin covers two ecoregions, the Carpathians and Hungarian (Pannonian) Lowland (Map 2).

The following table shows the location of the Tisza River basin countries within both ecoregions.

Table IV.1: Location of the Tisza River Basin countries in the relevant ecoregions

Ecoregion	Number of ecoregions	Countries with territory in the Tisza River Basin
The Carpathians	10	Ukraine, Romania, Slovak Republic
Hungarian (Pannonian) Lowland	11	Ukraine, Romania, Hungary, Slovak Republic, Serbia

The overview of the obligatory descriptors for river water bodies used within Tisza River Basin countries is given in the Table IV.2.

Table IV.2: Obligatory descriptors used in river typologies in the Tisza River basin

Descriptor	Country	Class boundaries				
Altitude	Ukraine	<200 m	200-500 m	500-800 m		
	Romania	0-200 m	200-500 m	>500 m		
	Slovakia	<200 m	200-500 m	500-800 m	>800 m	
	Hungary	0-200 m	200-500 m	>500 m		
	Serbia	0-200 m	200-500 m	>500 m		
Catchment area	Ukraine	10-100 km^2	100-1,000 km^2	1000-10,000 km^2	>10,000 km^2	
	Romania	10-100 km^2	100-1,000 km^2	1000-10,000 km^2	>10,000 km^2	
	Slovakia	10-100 km^2	100-1,000 km^2	1000-10,000 km^2	>10,000 km^2	
	Hungary	10-100 km^2	100-1,000 km^2	1,000-10,000 km^2	>10,000 km2	Danube size
	Serbia	10-100 km^2	100-1,000 km^2	1,000-4,000 km^2	4,000 km^2-10,000 km^2	>10,000 km^2
Geology	Ukraine	siliceous	calcareous	organic		
	Romania	siliceous	calcareous	organic		
	Slovakia	mixed				
	Hungary	siliceous	calcareous			
	Serbia	siliceous	calcareous	organic		

The Tisza River has been delineated into 17 water bodies based on the criteria given by the CIS (Common Implementation Strategy for the WFD) Guidance Document No. 2 Identification of water bodies in the most of the Tisza countries. 8 water bodies of the Tisza River water bodies were identified as trans-boundary river bodies.

There have been identified 221 water bodies on tributaries of the Tisza River with catchment areas larger than 1,000 km^2.

Table IV.3: Overview of the river water bodies in the Tisza River basin

Country	Number of water bodies	Number of natural water bodies	Number of HMWB water bodies (including possibly HMWB*)	Number of AWB water bodies	Number of transboundary water bodies
Ukraine	30	29	1	0	5
Romania	101	58	42	1	0
Slovakia	31	29	2	0	2
Hungary	48	18	25	5	0
Serbia	27	1**	5	21	0

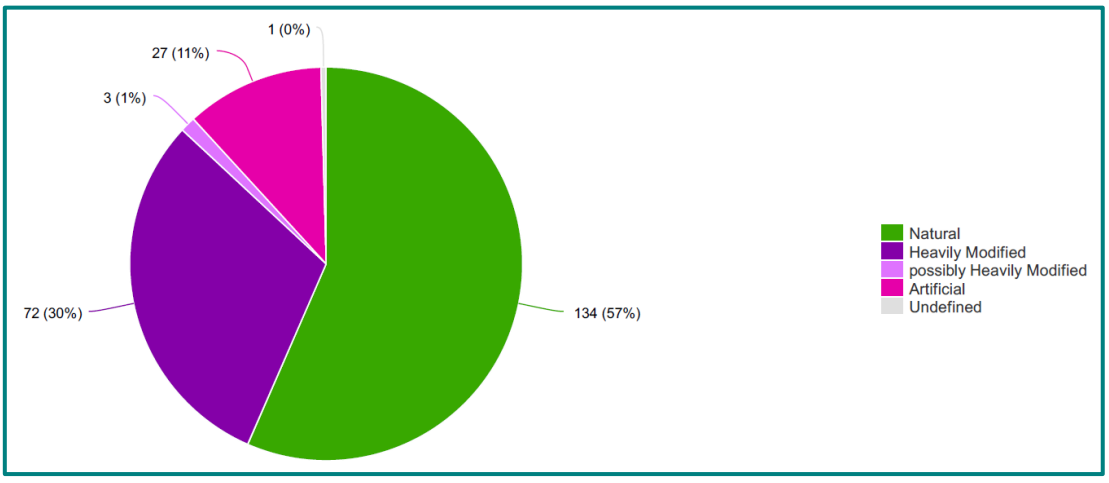
**The term "possibly modified" water body is used for two water bodies of non-EU members (Serbia and Ukraine) exclusively*

***One water body in Serbia has not been defined*

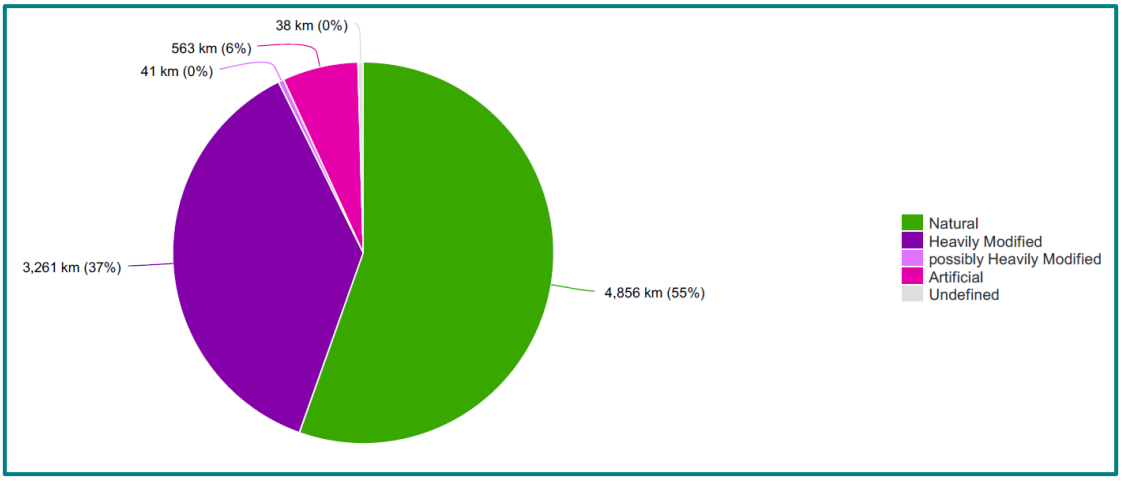
Among the all 237 surface water bodies of the Tisza River Basin, 134 (57 %) water bodies have been identified as a natural, while 75 (31 %) were designated as heavily modified, resp. possibly heavily modified water bodies (3). 27 water bodies (11 %) belong to artificial water bodies. One water body has not been defined.

The length of natural water bodies in the Tisza River Basin is 4,856 km which is 55 % of the total length of the water bodies; 3,302 km belong to the heavily modified or possibly modified water bodies (37 %) and 563 km of water bodies (6 %) belong to the artificial character. Undefined water body has length 38 km.

The map of the delineated river surface water bodies is given on the Map 3 and the list of surface water bodies is in the Annex 1. The Figure IV.1 shows proportion of the number of water bodies in the Tisza River Basin among their character. The Figure IV.2 shows proportion of the length of water bodies in the Tisza River Basin among their character.



The Figure IV.1: Proportion of the number of water bodies in the Tisza River Basin based on their character



The Figure IV.2: Proportion of the length (km) of water bodies in the Tisza River Basin based on their character

4.2 Lakes

Based on the updated information there are 4 lakes identified for the Tisza River Basin as a lake water bodies and they all belong to Hungary. All of them have been designated as heavily modified with total area of 162.02 km^2.

As for typology, the 6 basic descriptors were used for lakes which are ecoregion, altitude class, depth class, size class and the geology and temporality.

The details about the lake water bodies in the Tisza River Basin are given in the Table IV.4.

Table IV.4: Lakes water bodies in the Tisza River Basin.

Country	Lake water body name	Lake water body code	Lake water body character	Area (km^2)
Hungary	Hortobágyi-öregtavak	HUAIG967	HMWB	16.48
Hungary	Csaj-tó	HUAIH054	HMWB	10.23
Hungary	SzegediFehér-tó	HUAIH127	HMWB	14.48
Hungary	Tisza-tó	HUANS560	HMWB	120.83

4.3 Designation of heavily modified and artificial water bodies

Heavily modified water body (HMWB) refers to a body of surface water that is substantially changed in character as a result of physical alteration by human activity. An artificial water body (AWB) is a surface water body created by human activity.

As you can see above (Table IV.3), 31 % of all Tisza River Basin water bodies were designated as heavily (or possibly heavily) modified water bodies (75). Six water bodies with length of 530.2 km are on the Tisza River itself while the others (69 water bodies) with length of 2,771.8 km belong to the tributaries.

6 % of total number of the Tisza River Basin water bodies (27 water bodies) belongs to artificial water bodies, which create length of 563 km.

All lakes water bodies (Table IV.4) in the Tisza River Basin have been designated a heavy modified with the total area of 162. 02 km^2.

5 Protected areas

At the Tisza River Basin scale, information has been compiled on protected areas>100 ha for the Natura 2000 areas, designated under EU Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitat Directive) and the Directive 79/409/EEC on the conservation of wild birds (Bird Directive) and other protected areas for water dependent species and habitats.

Other types of protected areas according to WFD Article 6 & 7 and Annex IV (areas designated for the water abstraction intended for human consumption; areas designated for the protection of economically significant aquatic species; water bodies designated as recreational and bathing waters under Directive 76/160/EEC and nutrient - sensitive areas including areas designated as vulnerable zones according to Directive 91/676/EEC and areas designated as sensitive areas according to Directive 91/271/EEC) are not addressed at the Tisza River Basin level but they are integral parts of the national river basin management plans.

The total area of protected areas in the Tisza River Basin (62,068.43 km^2) corresponds to about a quarter of the total area for the protected areas in the Danube River Basin District.

Out of all 649 protected areas in the Tisza River Basin, 425 protected areas with area of 23,750.04 km^2 have been designated according to the EU Habitats Directive and 76 protected areas with area of 25.675,99 km^2 belong to the protected areas designated based on EU Bird Directive. Other 148 water depended protected areas represents 12,642.40 km^2.

Protected areas >100 ha designated for the protection of habitats or species where maintenance or improvement of the water status is an important factor in their protection, including Natura 2000 sites, designated under EU Directive 92/43/EEC and Directive 79/409/EEC are given on the Map 4 and in the Annex 2.

Table V.1: Distribution of the protected areas in the Tisza River Basin.

Country	Total number of PA	PA under Bird Directive		PA under Habitat Directive		Other water dependent PA	
		number	km^2	number	km^2	number	km^2
Ukraine	11	0	0	0	0	11	1,784.07
Romania	237	41	15,000.30	121	16,260.91	75	5,947.52
Slovakia	84	8	2,302.61	76	1,543.96	0	0
Hungary	305	27	8,373.08	228	5,945.17	50	4,691.46
Serbia	12	0	0	0	0	8	155.18

6 Summary of socio-economic aspects

Less than 13 million inhabitants live on the territory of the Tisza River Basin. The main economic activities in the Tisza River Basin are agriculture, forestry, pastures, mining, industry, navigation and energy production. Hungary, the Slovak Republic and Romania have been integrated with the European Union, Serbia is a candidate country and Ukraine is participating in the Association process with EU.

Global EU processes influence the socio – economic development in all European countries. The strongest average annual growth rates were observed in some central and eastern EU Member States, from the Tisza countries namely Romania (7.4 %) and Slovakia (6.2 %). In contrast, real GDP per capita in some Member States grew by less than 2 % per year on average. Economies of the central and eastern Member States, which had more stable balance sheets before the crisis, grew more strongly after 2007, despite the spill-over effects of more troubled economies. Between 2007 and 2014, Poland and Bulgaria had the fastest average growth rates per year, followed by Lithuania and Tisza countries as Romania (1.8 %) and Slovakia (1.7 %).

Ukraine has growing economy lasting to 2008, when the economy was affected by the worldwide economic crisis. Official GDP registered modest growth in 2010, reaching an estimated $137 billion, but remained below its pre-1991 level. During 2010-2014, GDP started to grow but much slower comparing to the previous period.

Based on the information on country economy GDP of Serbia grew from 24.743 mil USD in 2004 up to 40.734 mil USD in 2012 (https://countryeconomy.com/gdp/serbia?year=2012).

General socio-economic indicators of the Tisza River Basin countries and their development in the period of 2004-2012 are presented in Table VI.1.

*Table VI.1: General socio-economic indicators aggregated on TRB level, 2012**

Country	Number of inhabitants in the ITRB	GDP (million EUR)	GDP per capita (EUR per capita)	Change of GDP 2012/2004	change of GDP per capita 2012/2004
Ukraine[2]	1,256,850	139,740	3,065	0.97	0.91
Romania[4]	4,972,912	33,150	6,666	1.60	1.67
Slovakia[1]	1,532,360	14,852	9,226	1.86	1.93
Hungary[3]	3,915,338	25,734	6,573	1.16	1.20
Serbia[5]	780,935	31,683	4,400	1.58	1.64

Note: [1]https://slovak.statistics.sk/wps/portal/ext/themes/regional/
[2]http://www.ukrstat.gov.ua/
[3]*Based on estimation from county level data of Hungarian Central Statistical Office*
[4] *Data according to National Statistical Institute*
[5] *GDP for whole territory of R. Serbia*

6.1 Land use overview

Land in the Tisza River Basin is mainly used for agriculture, forestry, pastures (grassland), nature reserves, as well as urbanized areas (Table VI.2). The higher parts of the catchment, particularly in the Slovak Republic and Ukraine and the higher altitudes in Romania, are covered with (mainly deciduous) forest. The lower parts and floodplains are used for intensive agriculture, except where larger wetlands and traditional grazing areas exist.

The urban environment and related issues are gaining importance in the Tisza River Basin. Rapid urbanization within the region is putting additional pressure on the surrounding rural and natural environment, including biodiversity and traditional landscapes.

The biggest cities in the Tisza River Basin are from the point of view of inhabitants Timisoara (304,000), Cluj - Napoca (320,000) and Oradea (206,000) in Romania; Debrecen (203,000) and Miskolc (160,000) in Hungary; Kosice (234,000) in the Slovak Republic; Subotica (141,000) in Serbia; Uzhgorod (118,000) and Mukachevo (82,000) in Ukraine.

Land use types in the Tisza River Basin were taken from the CORINE land cover layer. Landscape mapping is coordinated by the European Environment Agency (EEA) with a 6-year update cycle. This document relates to the data from 2012.

Table VI.2: Types of land use (the first hierarchy) in the Tisza River Basin

Land use (km^2)	CLC N*	Ukraine	Romania	Slovakia	Hungary	Serbia	TRB total (km^2)
Urbanized and artificial areas	11-14	473.6	3,380.45	826.4	2,496	537.36	7,713.81
Agricultural areas	11 - 14	4,774.4	37,812.03	7,003.7	29,088	8,696.61	87,374.74
Forest and semi natural areas	21 - 24	7,360.0	29,482.94	7,882.6	13,891	552.70	59,169.24
Wetland areas	31 - 33	-	113.08	17.4	315	114.70	560.18
Waters	41	192.0	417.76	71.3	592	155.48	1.428.54

**CLC N- CORINE Land Cover nomenclature*
(Source: http://www.igeo.pt/gdr/pdf/CLC2006_nomenclature_addendum.pdf)

Based on the data in the Table VI.2 it is evident that in the Tisza River Basin the most abundant were agriculture areas (87,375 km^2) and forest and semi natural areas (59,169 km^2). Urbanized and artificial areas occupy the area of 7,714 km^2. Among all wetlands (560 km^2) the most of them are in Hungary (315 km^2) and in Romania (113 km^2).

6.2 Main economic sectors in the Tisza River Basin

6.2.1 Agriculture

Intensive agriculture is still practiced in the Pannonian Plain, which includes both the middle and lower Tisza regions. This has been made possible after many rivers were canalized for irrigation purpose, and wetlands were drained. Flora and fauna diversity is affected by the disconnection and drainage of floodplains along the Tisza River and its tributaries. An overview of main types of agricultural land use in the Tisza River Basin is presented in Table VI.3.

Table VI.3. Main types of agricultural land use in the Tisza River Basin

Country	Arable land (ha)	Fruit trees, berries plantations (ha)	Grassland, pasture (ha)	Vineyard (ha)	Heterogeneous agricultural areas (ha)
Ukraine	200,200	3,732	225,300	23,268	18,500
Romania	19,678	956	9,138	525	7,515
Slovakia	474,260	4,373	83,730	1,245	135,800
Hungary	2,604,100	47,300	737,200	37,000	220,400
Serbia	759,931	2,414	27,704	700	42,913

Although the Pannonian Plain is very suitable for cultivation, the average precipitation on this area is not enough for intensive cultivation, and evaporation consumes too much water. Due to this, natural water deficiency/scarcity occurs regularly and resources have to be substituted by man-made means.

The sharp decline in agricultural production in the 1990s in all Tisza River Basin countries was accompanied by a decrease in the use of pesticides and fertilizers and the use of them despite of increasing of agricultural production in the next decades remained very low.

Also, there has been a general decline in the livestock (Table VI.4), particularly in cattle, pigs and sheep stocks. In the Ukrainian part of the Tisza River Basin, agriculture has limited importance owing to unsuitable natural conditions. Livestock breeding based on seasonal pasturing of mountain meadows is well preserved in the Carpathians. In Serbia, fishponds and pig and cattle farming are still important for the local economy.

Table VI.4. Tisza River Basin livestock breeding

Livestock, 2012/ Country	1-Cattle (pcs)	2-Pigs (pcs)	3-Sheep (pcs)	4-Goats (pcs)	5-Horses (pcs)	6-Poultry (pcs)	Total MEC* (1-6)	Livestock density** MEC/100 ha
Ukraine	140,700	275,300	138,800		-	3,282,000	-	-
Romania	571,562	1,074,306	994,568	54,799	119,811	7,349,283	2,169,212	57,37
Slovakia[1]	122,155	124,311	142,473	11,189	2,038	1,846,230	163,637	23.36
Hungary	395,000	1,727,000	918,000	11,735	35,000	30,218,000	1,081,000	37.16
Serbia	154,713	807,611	147,606	26,667	3,639	6,386,556	608,933	75.27

**MEC - mature equivalent cow units*
***Livestock density, MEC/100 ha of the agricultural area*
[1]Source: Súpis hospodárskych zvierat k 30. 11. 2012, Statistical office of the Slovak Republic, www.statistics.sk/Produkty/Publikácie

Employment in agriculture in 2012[1]remains high in Romania (28.3%) and Serbia[2] (2.46%) while the least agrarian countries in employment are Hungary (5 %) and the Slovak Republic (3.2%). Compared to the year 2003 the employment decreased considerably in Romania (fell by 7.7%) and Serbia[2] (fell by 1.09%) while in the other Tisza River Basin countries have decreased less (up to 2.6%).

[1]Source: http://www.indexmundi.com/facts, Ecostat)
[2]Statistical Office of Republic of Serbia (employment in agriculture, forestry and fishing)

6.2.2 Industry and mining

In the Tisza River Basin, the main industrial regions are located in Romania and Hungary, although there are also some important industrial facilities in Ukraine, the Slovak Republic and Serbia. Industrial sectors are now mainly oriented towards local resources. The mining and metallurgical industries have an important share in the regional economy of the Tisza River Basin, as well as chemical, petrochemical, cellulose and paper, food, textile, and furniture industries.

The mining industry is well developed in the Tisza River Basin, mainly in Romania. Precious metals and metals are mined in the Somes and Mures sub-basins and there is important hydrocarbon production in Romania as well. 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 polymetallic ore and its processing mining of salt and construction materials and the Hungarian mining industry produces hydrocarbons, coals, industrial minerals and construction materials.

The manufacture of basic metals is an important sector in the Slovak Republic with a steel industry in Kosice.

The chemical industry operates mostly in the Upper and Middle Tisza in Hungary (Miskolc and Szolnok regions) and in the southern part of the Slovak Republic (Prešov region). In the northern Romania (Cluj-Napoca) the pharmaceutical industry is located. Recently, 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 the cellulose industry in 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.

The textile industry was developed quickly in the Tisza River Basin due to the rapid transfer of technology and expertise, mainly in Romania. 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 and shares an important part of the industrial output in the Romanian and Ukrainian parts of the Tisza River Basin.

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.

6.2.3 Navigation

The Tisza River is used as a waterway from the Ukrainian-Hungarian border to the confluence withthe Danube – over 70% of the river's total length.

No navigation is possible in Ukrainian part of Tisza; however, it is planned from Vilok to Zahony. In Slovakia a short section on Bodrog River is use for navigation. The main Bega Channel in Romania has a navigation potential of (44.4km) from which 15.5 km are practically navigable in the present.

The following river sections of Tisza and its tributaries in Hungary are fulfilling international navigability conditions. Tisza in Hungary is navigable from the Serbian border up till Csongrád (160-254 rkm, impounded by the Novi Becej dam) as a class IV waterway. From Csongrád to Kisköre (254-403 rkm, not impounded) only class II navigability conditions are fulfilled. From Kisköre to Tuzsér (403-612 rkm, impounded by the Kisköre and Tiszalök dams) it is class III again, and finally from Tuzsér to Vásárosnamény (612-685 rkm, not impounded) the Tisza is a class I waterway. Bodrog is navigable up till Sárospatak (0-39 rkm) as class III. Hármas-Körös is navigable between the mouth and Mezőtúr (0-91 rkm) and its upper section, Kettős-Körös from Mezőtúr until Békés (0-23 rkm), both as class II. Sebes-Körös is also class II from the mouth till Körösladány (0-10 rkm).

In Serbia Tisza River, upstream of Novi Bečej dam (with ship lock), belongs to the class IV of navigable waterways and downstream to the VI class (over 2,500 tons). The Tisza navigation regime is not based on certain flows, but at the water levels upstream and downstream of the Novi Bečej dam. Whole Danube Tisza-Danube hydro system channel network is based on water levels, so water catchment and discharge depend on required water levels on specific share of channel network. Each of the channel network shares and channels has unique restriction and roles regarding to vessel dimensions (e.g. width, depth, weight). More of the other canal network shares belong to the class IV of internal

waterways. Other channels have sufficient width, but insufficient navigation depth, so they belong to the navigation class III or II.

6.2.4 Hydropower generation

In the Tisza River Basin there are 30 hydropower stations with an output of greater than 10 MW. The details are given in the Table VI.5.

A few large hydropower stations (>10 MW) are in Ukraine (1), in Hungary (7) and in Slovakia (3) in the Tisza River Basin. No hydropower plants are in Serbia in the Tisza River Basin. Romania has 19 hydropower stations with the highest installed capacity.

Table VI.5. Hydropower station (>10 MW) and energy production in the Tisza River Basin

Country	Number of hydropower stations	Installed capacity (MW)	Average yearly production in last 3 years (GWh/year)
Ukraine	1	27	0,22
Romania	19	1,589.1	-
Slovakia	3	94.4	197.6
Hungary	7	48.8	85.73
Serbia	0	-	-

Source of data: Country reports of the WP4 of the JOINTISZA Project

6.2.5 Forestry

Tisza River Basin territory is covered by forests on the area of 47,967 km^2 which represents 33.55 % of forestation in the basin (Table VI.6). Forests spread out on the upper parts of the river basin although the lower part of the basin is occupied by the Pannonian lowland.

Forests have been very devastated in the past. Currently deciduous trees represent about 30.372 km^2 and coniferous ones approximately 6,684 km^2.

Of the total area of forests, most of them belong to economical forests with a predominant production function and a smaller part to protective forests (protective in exceptionally unfavourable habitats).

Significant parts of forest are forests with special designation (in protection zones of water sources, forest parks, state nature reserves, spa forests, etc.).

Table VI.6: Forest conditions in the Tisza River Basin countries

Country	Area (km^2)	Forest area (km^2)	Forest cover in the countries (%)	Representation of woody plants (km^2 of forest area)	
				coniferous	deciduous
Ukraine[3]	12,800	7,360	15.9	1,808	4,672
Romania[1]	71,206	25,266	35.5	4,075	18,995
Slovakia[2]	12,737	7,923	40.8	23	78
Hungary[2]	46,213	7,302	15.8	774	6,528
Serbia[2]	10,057	116	1.2	4	99

[1] *Source: Corine Land Cover 2016*
[2] *Source Corine Land Cover 2012*
[3] *Source: http://carpaty.net/?p=13468&lang=uk*

7 Overview of significant water management issues

This part is focused on the general overview of the significant water management issues for surface water only. The detail analysis and evaluation will be done within a separate report under the activity 3.5.1 of the JOINTISZA Project.

Based on the ITRBMP (2011), DRBMP (2015) as well as on national RBMPs of the Tisza River Basin countries (EU members) the Tisza River Basin-related significant water management issues were identified and confirmed.

Four significant water management issues (SWMIs) have been identified for the Tisza River Basin, which can directly or indirectly affect the status of surface water:

- Pollution by organic substances,
- Pollution by nutrients,
- Pollution by hazardous substances,
- Hydromorphological alterations.

Additional relevant issues in the Tisza River Basin are:

- Water quantity issues (floods and excess water, drought and water scarcity, climate change).

Interlinkage between the water quality and quantity related management issues are shown in the Figure VII.1

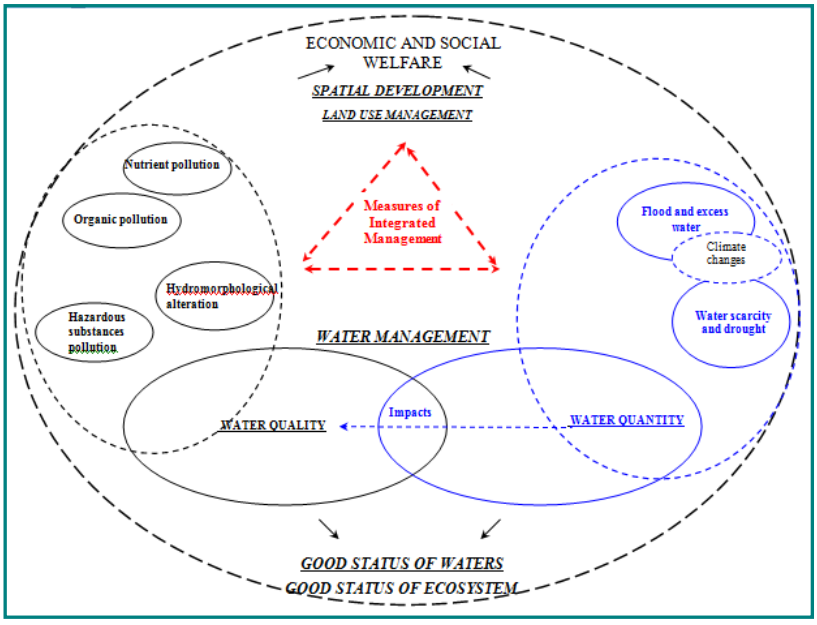


Figure VII.1: Inter-linkages between the water quality and quantity related management issues identified in the Tisza River Basin (ITRBM Plan, 2011).

7.1 Pollution by organic substances

Organic pollution refers to emissions of non-toxic organic substances that can be biologically decomposed by bacteria to a high extent. The key emitters of organic pollution are point sources like untreated or not sufficiently treated municipal waste water from households, industries and major agricultural farms.

The primary impact of organic pollution on the aquatic environment is dissolved oxygen depletion due to biochemical decomposition of organic matter. In the most severe cases this can lead to anaerobic conditions, to which only some specific organism can accommodate. The pollution with organic substances can therefore cause changes in the natural composition of the aquatic flora and fauna. It can also be associated with health hazards due to possible microbiological contamination of waters.

7.2 Pollution by nutrients

Nutrient pollution is caused by releases of nitrogen (N) and phosphorus (P) into the aquatic environment.

Nutrient emissions can originate from both point and diffuse sources. Point sources of nutrient pollution are similar to those of the organic pollution.

Diffuse pathways such as overland flow, urban runoff, soil erosion, tile drainage flow and groundwater flow can remarkably contribute to the emissions into surface waters transporting nutrients from agriculture, urban areas and atmosphere and even from naturally covered areas.

Impacts on water status caused by nutrient pollution can be recognized through substantial changes in water ecosystems. In case of nutrient enrichment, water bodies can turn to eutrophic state where the growth of algae and/or macrophytes is substantially accelerated. Eutrophication severely impairs water quality and ecosystem functioning (e.g. oxygen depletion, toxicity, overpopulation of species) and might limit or even hinder human water uses as well (e.g. recreation, fisheries, drinking water supply).

7.3 Pollution by hazardous substances

Hazardous substances pollution involves contamination with priority substances and other specific pollutants with toxic effects on aquatic organisms and humans. Hazardous substances can be emitted from both point and diffuse sources. The most important sources of hazardous substances pollution are industrial facilities, municipal waste water, urban run-off (deposited air pollutants, litter, combined sewer overflows), agriculture (pesticide and contaminated sludge application), contaminated and mining sites.

Hazardous substances can pose serious threat to the aquatic environment. Depending on their concentration and the actual environmental conditions, they can cause acute (immediate) or chronic (latent) toxicity. Some of the hazardous substances are persistent, mostly slowly degradable and can accumulate in the ecosystem.

Improving waste water treatment and industrial technologies, regulating market products and closing knowledge gaps on hazardous substances via emission inventories are the most important recent activities to address hazardous substances pollution. Based on the scarce information available on the hazardous substances emissions, 33 compounds given by Directive 2008/105/EC have been reported. Out of these substances eight organic pollutants, eight heavy metals, three pesticides, eleven chlorinated organic substances and three inorganic pollutants have been identified.

7.4 Hydromorphological alterations

Anthropogenic pressures resulting from various hydro-engineering activities like for instance on flood protection, hydropower generation, or inland navigation can significantly alter the natural structure and dynamics of surface waters. Since this structure is essential to provide adequate habitats and conditions for self-sustaining aquatic species, modifications can have impacts on the abiotic sphere as well as on the ecology and ecological status of the river system.

Three key pressures of hydromorphological alterations are:

- The interruption of river and habitat continuity,
- The disconnection of adjacent wetlands/floodplains,
- The hydrological alterations (impoundment, hydropeaking, water abstraction).

7.5 Integration issues

The Joint Programme of Measures (JPM) has been developed for each SWMI as well as for water quantity based on the defined visions and management objectives in Tisza River Sub-basin. The basin-wide measures of the JPM are firmly based on and were coordinated with the national programmes of measures and also with Danube Basin-wide measures.

Regarding the JPM, special attention needs to be paid to the identified measures, their basin-wide importance, to the identification and implementation of priority measures and to measures that lack adequate funding. Any issues related to financing which emerge during the implementation of the JPM need to be followed up (e.g. available financial mechanisms).

Overall, the visions and management objectives of the ITRBM Plan reflect the joint approach among all Tisza River Basin countries and support the achievement of the WFD objectives in this very large, unique and heterogeneous European river basin.

Abbreviations

AEWS	Accident Emergency Warning System
AGR	Agriculture
ARS	Accidental Risk Spots
AQC	Analytical Quality Control
AWB	Artificial Water Body
DRBMPlan	Danube River Basin Management Plan
EPER	European Pollutant Emission Register
EU MS	EU Member State(s)
Non EU MS	Non EU Member State(s)
GDP	Gross Domestic Product
GEP	Good Ecological Potential
GES	Good Ecological Status
HMWB	Heavily Modified Water Bodies
ICPDR	International Commission for the Protection of the Danube River
ITRBM Plan	Integrated Tisza River Basin Management Plan
JAP	Joint Action Programme
JPM	Joint Programme of Measures
MEC	Mature equivalent cow units
MONERIS	MOdelling Nutrient Emissions in RIver Systems
MS	Member State(s)
PA	Protected areas
PRTR	Pollutant Release and Transfer Register
RBM	River Basin Management
rkm	River kilometre
SWMI	Significant Water Management Issue
WFD	Water Framework Directive (2000/60/EC)

References

ICPDR Ad hoc Tisza Group (2007): Analysis of the Tisza River Basin – 2007
https://www.icpdr.org/main/sites/default/files/Tisza_RB_Analysis_2007.pdf

ICPDR: The Danube River Basin District Management Plan – Part A – Basin wide overview, 2009
https://www.icpdr.org/main/sites/default/files/DRBM_Plan_2009.pdf

ICPDR: Integrated Tisza River Basin Management Plan - 2011
https://www.icpdr.org/main/sites/default/files/Uploaded%20-%20ITRBM%20PLan%20-%20Jan%202011_V2GWcomprev%20Okt2011.pdf

ICPDR: The Danube River Basin District Management Plan –Update 2015
http://www.icpdr.org/main/sites/default/files/nodes/documents/drbmp-update2015.pdf

Plány manažmentu čiastkových povodí Bodrog, Bodva, Hornád, Slaná. Aktualizácia 2015 (RBMPs of the sub-basins Bodrog, Bodva, Hornad, Slana. Update 2015).
http://www.vuvh.sk/rsv2/default.aspx?pn=PMCP2

Vodný plan Slovenska. Plán manažmentu správneho územia povodia Dunaja. Aktualizácia 2015 (The Slovak RBMP of the Danube Basin. Update 2015)
https://www.minzp.sk/sekcie/temy-oblasti/voda/koncepcne-aplanovacie-dokumenty/vodny-plan-slovenska-aktualizacia-2015/

The updated national management plan of the Romanian territory which is included in the international Danube river basin district

The updated management plan for Somes-Tisa hydrographical area

The updated management plan for Crisuri hydrographical area

The updated management plan for Mures river basin

The updated management plan for Banat hydrographical area

The update of Hungarian River Basin Management Plan
https://www.vizugy.hu/index.php?module=vizstrat&programelemid=149

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