



Ministry of Environment of the Slovak Republic

Implementation of the Directive 2000/60/EC of the European Parliament
and of the Council establishing a framework for Community action in the field of water policy

Water Plan of the Slovak Republic

Danube River Basin District Management Plan
Vistula River Basin District Management Plan

Abbreviated version



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Title: Water Plan of the Slovak Republic – Abbreviated version
Author: Ministry of the Environment of the Slovak Republic
Published by: Slovak Environmental Agency
Edited by: Water Research Institute
Slovak Environmental Agency
Graphics by: Dolis, s. r. o., Bratislava
Printed by: Dolis, s. r. o., Bratislava
Front cover photo by: Marek Pechmann, www.infrastellar.net
Edition: 1st
Year of publication: 2011
Impression: 400 copies
Number of pages: 124
ISBN 978-80-89503-15-5



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List of abbreviations

As	Arsenic
AT	Atrazine
AWB	Artificial water body
BAT	Best available technology
BOD ₅	Biochemical oxygen demand
BOD ₅ (ATM)	Biochemical oxygen demand with suppressed nitrification
CCTIA	Central Control and Testing Institute for Agriculture
CEI SAŽP	Slovak Environmental Agency, Centre of Environmental Informatics
Cl ⁻	Chlorides
COD _{Cr}	Chemical oxygen demand (dichromate)
COD _{Mn}	Chemical oxygen demand (permanganate)
DRBD	Danube River Basin District
E-PRTR	European Pollutant Release and Transfer Register
EC	European Commission
EPER	European Pollutant Emission Register
ERDF	European Regional Development Fund
EQR	Ecological quality ratio
EQS	Environmental quality standard
EU	European Union
GDP	Gross domestic product
GEP	Good ecological potential
HMWB	Heavily modified water body
ICPDR	International Commission for Protection of the Danube River
IPPC	Integrated pollution prevention and control
MEP	Maximal ecological potential
MoA SR	Ministry of Agriculture of the Slovak Republic
MoD SR	Ministry of Defence of the Slovak Republic
MoE SR	Ministry of Environment of the Slovak Republic
MoF SR	Ministry of Finance of the Slovak Republic
MoTPT SR	Ministry of Transport, Posts and Telecommunications of the Slovak Republic
N	Nitrogen
NBS	National Bank of Slovakia
NCP	National Climate Programme of the Slovak Republic
O ₂	Dissolved oxygen
OPE	Operational Programme Environment
P	Phosphorus
p.e.	Population equivalent
PCB	Polychlorinated biphenyls
PCE	Tetrachloroethene
Q ₃₅₅	Average daily water discharge during the reference period, achieved or exceeded during 355 days in the year
Q _{assured}	Minimum average daily water discharge assured by regulation in the hydraulic constructions
RCS	Register of Contaminated Sites
RONI	Regulatory Office for Network Industries
SCI	Site of Community Importance
SHMI	Slovak Hydrometeorological Institute
SNC SR	State Nature Conservancy of the Slovak Republic
SO ₄ ²⁻	Sulphates
SR	The Slovak Republic
SS	Sewage system
SWME	Slovak Water Management Enterprise

■ List of abbreviations

TCE	Trichloroethene
VRBD	Vistula River Basin District
WB	Water body
SEA	Strategic Environmental Assessment
WFD	Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy
WR	Water reservoir
WRI	Water Research Institute
WW	Waste waters
WWTP	Waste water treatment plant

Foreword

Planning in the sector of water management has a long term tradition in Slovakia. Elaboration of complex conception and planning water management documents started as early as after World War II. Structure and content of these planning documents were developed in relation to the actual needs. State Water Management Plan (SWMP) is the first among those important documents that was adopted by the government of the former Czechoslovak Republic on January 8, 1954, being a general plan for each water management measure of the individual sectors of national economy, as well as for basic water management in the framework of spatial planning. SWMP served also as one of basic pillars for elaboration of development plans of the individual economy sectors, as long as they had requirements to water resources, or they otherwise influenced water management. SWMP comprised also a concept of water management development in all its sectors as the very first document.

Development Water Management Plan elaborated for the Slovak Republic territory built on the State Water Management Plan in year 1975, and it was detailed for the individual hydrological basins. This planning document had similar structure as SWMP. Development Water Management Plan was updated on a yearly basis in the framework of permanent conceptual work by so called Water Management Journal, and by Water Management Almanac every five years.

As a result of political changes at the end of eighties and the beginning of ninetieths, an opinion emerged that the Development Water Management Plan is obsolete to a certain extent, and that it is not applicable in the future from several reasons. Elaboration of planning documents with new content and structure therefore commenced in year 1991, namely hydroecological plans of the river basins, aimed at water quality and quantity protection and their efficient use, as well as the water management plans of river basins as a basis for management of economic activities exploiting water as a raw material. Particular hydrological river basin (or its part) served as a basic territorial planning unit for both planning documents. These planning documents were elaborated on five year basis, terminating in years 1995 and 2000, and they were roofed by a summary conception and strategic document entitled *Master Plan of Protection and Efficient Use of Waters*, 1st edition – 1995, 2nd edition – 2001).

The most important changes in elaboration of water management planning documents were introduced by the endeavour of the Slovak Republic to enter the European Union, as transposition of the *acquis communautaire* formed one of conditions of joining the EU, i.e. harmonisation of the national system of law and demonstration of its practical implementation. Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (shortly called Water Framework Directive, WFD) that brings the most complex collection of objectives, tools and obligations in the field of EU water policy, forms a basis for common water policy in the EU member states.

Legislative framework

An obligation arose to the EU member states by the WFD adoption to transpose it into national legislation until December 22, 2003, and further to ensure its implementation. This obligation for the Slovak Republic as an accession country that time was binding until date of accession, i.e. May 1, 2004, when the WFD was transposed into the Act No. 364/2004 Coll. on waters, amending the Act No. 372/1990 Coll. of the Slovak Parliament, as amended (Water Act) and its executive regulations.

WFD creates legal framework for the protection and improvement of the status of water ecosystems, and for the sustainable, balanced and equitable water use. It introduces a new approach of water management based on the river basins, natural geographical and hydrological units, and it imposes to EU member states specific deadlines for elaboration of the management plans for river basins including programmes of measures. The new water protection approach allows to create a harmonised system for evaluation of waters in the framework of the EU countries, resulting in the reliable and comparable results of the status of water bodies in any region of Europe, as well as identical procedures of setting out the objectives and implementation of necessary measures for the protection and improvement of water status. Surface waters (rivers, lakes), transitional, coastal and groundwaters, and under certain conditions also terrestrial ecosystems depending on water, and wetlands form subject matter of WFD. WFD introduces several innovative approaches into the water management, such as

public participation in the planning process, integration of economic approaches into the planning, and integration of water management and other economic sectors.

Achievement of good status of all waters till year 2015 or year 2027, at latest, forms the main environmental objective of WFD. Good status for the surface water bodies, represents mainly achievement of good ecological status and good chemical status or good ecological potential and good chemical status for the artificial and heavily modified surface water bodies, and for groundwater bodies it represents achievement of good chemical status and good quantitative status. The process and time schedule for reaching the objectives and other WFD requirements are set out in the management plan of respective river basin, including the programme of measures. The deadline for elaboration of river basin management plans for the first planning cycle is December 22, 2009.

Administrative capacities for the implementation of WFD requirements

WFD requires creation of river basin districts¹ and appointment of the competent authority responsible for its implementation in the framework of each river basin district. Pursuant to the Act No. 364/2004 Coll. on waters, amending the Act No. 372/1990 Coll. of the Slovak Parliament on violation, as amended (Water Act), as amended, as amended by the Act No. 384/2009 Coll. (hereinafter as the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll.), two river basin districts are designated on the national level under conditions of the SR. Namely, the Danube River Basin District (96 % of the SR territory), which belongs to the international Danube River Basin District, and which is determined by sub-basins of rivers Danube, Morava, Váh, Hron, Ipel', Slaná, Bodrog, Hornád and Bodva, and the Vistula River Basin District, determined by sub-basin of rivers Dunajec and Poprad (4 % of the SR territory).

River basin management plans are elaborated in compliance with the Water Act in force in the Slovak Republic for the following:

- a) sub-basins (Morava, Danube, Váh, Hron, Ipel', Slaná, Bodva, Hornád, Bodrog, Dunajec and Poprad),
- b) Water Plan of the Slovak Republic – consisting of management plans of the national districts of rivers Danube and Vistula².

In addition to the national management plans, SR contributes to the development of the international plans coordinated by the International Commission for Protection of the Danube River (ICPDR), namely:

- International Danube river basin district – addressing the issues relevant for Danube,
- International Tisza river basin – addressing the issues relevant for Tisza.

Elaboration of river basin management plans according to the Water Act in force is ensured by the Ministry of Environment of the Slovak Republic (hereinafter as MoE SR) by means of its subordinated organisations, as well as the administrator of water courses with water management significance, in cooperation with the state water administration bodies, self-government regions, other respective state administration bodies and other stakeholders, especially representatives of municipalities, industry, agriculture, water enterprises and other institutions.

Coordination of WFD implementation

Whole WFD implementation process is coordinated on the EC level in order to introduce harmonised approaches and procedures of achieving of requested objectives, where strategic documents and technical materials serving as a basis for the strategies on the level of international river basins and national strategies of the individual member states are jointly elaborated. The member states adopted the document *Common WFD Implementation Strategy* in May 2001. Common plan of activities for coming two years is prepared in the framework of common strategy update on biannual basis.

Water Framework Directive Implementation Strategy in the Slovak Republic was developed for the national level that was adopted by the resolution of the Government of the Slovak Republic No. 46/2004 of January 21, 2004, and that is annually updated, resulting in more detailed plan of tasks for next two years. This strategy is in full compliance with the EU strategy and strategy of ICPDR.

The cooperation with EU is in the MoE SR coordinated by the Division of Environmental Policy and Foreign Affairs. Water Division that is responsible for the implementation of obligations towards EC coordinates WFD implementation.

¹ River basin district is a terrestrial or marine territory composed by one or more neighbouring basins, together with corresponding groundwaters, that is defined as a main unit for river basin water management.

12 ² Management plan of Vistula River Basin District is identical with the management plan of sub-basins of rivers Dunajec and Poprad.

International cooperation

WFD implementation coordination in the framework of the international Danube River Basin District is ensured by ICPDR. WFD implementation in the boundary waters with the neighbouring states – EU members is performed in the framework of bilateral cooperation by commissions for transboundary waters.

Process of development of river basin management plans

Whole WFD implementation process is scheduled for the time period of years 2003 – 2027, with more detailed definition of tasks for fulfilment in the first planning cycle ending up in year 2015 by revision of the achievement of environmental objectives.

1 Introduction

Water plan of the Slovak Republic comprises the management plan of the national part of the Danube River Basin District (hereinafter as DRBD), integrating management plans of the sub-basins of this district, as well as management plan of the Vistula River Basin District³ (hereinafter as VRBD). Situation of these SR districts in parallel with the sub-basins is shown in the *Map 1.1* (see the *Annex*).

The Water plan of the Slovak Republic was elaborated in the framework of the first WFD planning cycle ending up in year 2015. Further two planning cycles will follow after year 2015, ending up in years 2021 and 2027.

The process of development of river basin plans was realised in four phases of WFD implementation, with the following tasks:

- Phase I: Determination of districts of river basins and identification of the institutional framework and coordination mechanisms according to the Article 3 WFD and Annex I (required deadline until year 2003, for SR until June 2004). The results are contained in the National Report 2004, submitted to EC.
- Phase II: Elaboration of characteristics of the river basin district, review of the impact of human activities to the status of groundwaters and surface waters and economic analysis of water use according to the Article 5 and Annexes II. and III., as well as Article 6 and Annex IV. WFD (required deadline until year 2004). The results are contained in the National Report 2005, submitted to EC.
- Phase III: Introduction of programmes for monitoring of surface water and groundwater status and of protected areas status according to the Article 8 and Annex V. WFD (required deadline until year 2006). The results are contained in the National Report 2006, submitted to EC.
- Phase IV: Preparation of management plans of the river basins including programmes of measures and publication of their draft versions in order to inform the publics, and public consultations according to the Article 13 and Annex VII. WFD (including required deadline until year 2009). Management plans of river basins will be submitted to EC in March 2010.

The chapters below represent an overview of outputs of the WFD implementation Phase II including supplements or updates, implementation Phase III and Phase IV.

2 Characterisation of the river basins districts

Characterisation of the river basin district, assessment of impacts of human activities on the surface and groundwater status, as well as economic analysis of water use was performed during WFD implementation Phase II, and it was updated during the processing of the first Water Plan for the Slovak Republic.

Characterisation of the river basin district comprised ranking of surface waters into categories, identification of water bodies under each category, identification of groundwater bodies, assessment of pressures of human activities and their impact onto the ground and surface water status. Identification of water bodies under risk or under potential risk of failure to achieve WFD environmental objectives until year 2015 resulted from this evaluation. Classification systems compliant with the WFD requirements were not available in the period of impact analyses, thus, preliminary objectives were used for evaluation of each human activity pressures.

Results of this phase served for further phases of the WFD implementation: proposal of monitoring programme, definition of significant water management issues, and compilation of programmes of measures.

Surface waters

Ranking of surface waters into categories – rivers, lakes, transitional or coastal waters, artificial or heavily modified water bodies, and subsequent separation of water bodies of each category into the types belong to the first steps on characterisation of river basin district according to WFD. As SR has not a direct access to the sea, identification of transitional or coastal waters is not relevant for SR. Definition of reference conditions for the individual water types form a part of district characterisation – as it is necessary for the ecological status assessment.

Category – rivers

All water courses with catchment area above 10 km² were subject of typology. The individual surface water types were determined on the basis of abiotic descriptors determined under system A of Annex II WFD, as follows:

- ecoregion: SR is a part of ecoregion the Carpathians and Hungarian Lowlands,
- type according to altitude: < 200 m above sea level, 201 – 500 m above sea level, 501 – 800 m above sea level, > 800 m above sea level,
- type according to catchment area: small: 10 – 100 km², medium: 101 – 1,000 km², large: > 1,000 km²,
- type according to geological composition – this descriptor is defined as a "mixed type" at present, therefore it does not *de facto* act as a water course typology descriptor.

Category – lakes

WFD requires setting out types for all lakes with surface area larger than 0.5 km². Natural lakes of this size are not located in the SR territory. 23 water reservoirs were classified into this category, that were identified as river water bodies with modified category. Obligatory descriptors determined under system A of the Annex II WFD were used for determination of their types:

- ecoregion: the Carpathians and Hungarian Lowlands,
- type according to altitude: < 200 m above sea level, 201 – 500 m above sea level, 501 – 800 m above sea level, > 800 m above sea level,
- type according to average depth: shallow: < 3.0 m, moderately deep: 3.1 – 15.0 m, deep: > 15.0 m,
- type according to geological composition: application of this descriptor is similar as for rivers,
- type according to the surface area size: small: 0.5 – 1.0 km², moderately large: 1.1 – 10.0 km², large: 10.1 – 100.0 km² and very large: > 100.0 km².

Modification of water body category was related to the selected water reservoirs and it was determined on the basis of two criteria – regulation of flow below the reservoir according to the capacity coefficient K1, and the size of flooded area above 0.5 km².

Reference conditions

Reference values reflect the environmental status without anthropogenic impact, or even with minimum impact. Setting out of reference values and limits for the individual categories of ecological status for biological

quality elements (benthic invertebrates, macrophytes, phytobenthos, phytoplankton and fish), physico-chemical and hydromorphological quality elements including their harmonisation forms a basis for the evaluation of surface water status.

The reference values for Slovakia were derived by a combination of several methods. Namely, analyses of data from the reference or best available sites. Modelling (phytobenthos, benthic invertebrates), expert opinion (phytoplankton and macrophytes), or a combination of thereof (benthic invertebrates) were applied for gathering of the reference value for types that were not represented by reference sites. Moreover, knowledge acquired from the process of intercalibration of biological methods and classification schemes was used.

Reference values for fish were not set out in the first planning cycle, as a new approach was selected in the framework of intercalibration process of biological methods and classification schemes in year 2009.

Identification of surface water bodies

A surface water body is a discreet and significant element that is determined as a basic WFD element. It means that each WFD evaluation and activity (e.g. evaluation of water status, final identification of heavily modified water bodies, measures for status improvement etc.) is related to the elemental unit of the water body.

Surface water bodies were delineated on the water courses with catchment area larger than 10 km². Methodical instruction that was developed in the framework of activities of the EC Common Implementation Strategy was used during their determination: *Identification of the water bodies – horizontal methodical guidance for application of term water body in the WFD context*. Water bodies on the water courses with catchment area smaller than 10 km² were not determined and they are considered a part of the water body in the basin of which they are located.

Identification of groundwater bodies

Groundwater body is a basic territorial unit for all evaluations requested by WFD. Water bodies in SR were delineated in 3 separate layers, based on the approach defined in the methodical instruction elaborated in the framework of CIS EC and basic data on groundwaters:

- groundwater bodies in quaternary sediments,
- groundwater bodies in pre-quaternary rocks,
- bodies of geothermal waters (geothermal structures) representing groundwaters of deep circulation with groundwater temperature above 15 °C.

2.1 Danube River Basin District

DRBD covers an area of 47,084 km² in SR and it represents 5.8 % of the international area of the DRBD, and 96 % of the total SR territory area. River basin district is drained into the Danube river or into its tributaries of higher order by means of the main water courses: Morava, Váh, Hron, Ipel', Slaná, Bodva, Hornád and Bodrog (commonly with Tisza). Agriculture forms a dominant landscape use category in DRBD (50.1 %), followed by forestry and semi-natural areas (43.6 %). Artificial surfaces cover 5.5 % of DRBD, wetlands 0.1 % and waters 0.6 %. This area offers a domicile to nearly 5.2 million inhabitants, the average population density reaches 110.3 citizens per km².

Surface waters

20 types of water bodies were delineated totally in DRBD territory (including sub-types) with characteristic of flowing water, and 14 types of river water bodies with modified category. Types of water bodies and pressures on the water bodies formed a basis of delineation of water bodies. Totally, 1,654 surface waters bodies were delineated with total length 18,144.2 km, including 23 bodies where water impoundment caused category alteration (from river to lake). Average length of water bodies corresponds to 10.8 km, minimum length 0.9 km and maximum length 169.1 km. Localisation in the SR territory is shown in the *Map 2.1* (see the *Annex*).

Groundwaters

97 groundwater bodies were delineated in DRBD. 15 out of them are groundwater bodies in quaternary sediments with the area of 10,226.4 km², 56 groundwaters bodies in pre-quaternary rocks with the area of 47,105.28 km² and 26 groundwaters bodies (geothermal waters – geothermal structures). 6 groundwaters bodies

out of mentioned 97 groundwaters bodies were identified as transboundary groundwaters bodies with Hungary, that were mutually agreed. 31 groundwater bodies with relation to the surface water ecosystems and terrestrial ecosystems were identified, 16 out of groundwater bodies in quaternary sediments with relation of the terrestrial ecosystems to the groundwater bodies, and 15 groundwater bodies in pre-quaternary rocks with relation of the terrestrial ecosystems to the groundwater bodies.

Their localisation in the SR territory is documented in the *Map 2.2* – for groundwater bodies in quaternary sediments, in the *Map 2.3* – for bodies in pre-quaternary rocks, and in the *Map 2.4* – for geothermal water bodies (see the *Annex*).

2.2 Vistula River Basin District

Slovak part of the VRBD with area 1,950 km² represents 0.9 % of the international area of the VRBD, and 4 % of the total SR territory. Catchment area is drained into river Vistula by river Dunajec and its tributary Poprad. In contrary to DRBD, landscape category forestry and semi-natural areas (53.8 %), followed by agriculture (42.0 %) dominate in the national part of VRBD. Artificial surfaces cover 4.0 %, and wetlands together with waters form negligible part of the area. This area offers a domicile to nearly 0.2 million inhabitants, the average population density reaches 104.6 citizens per km².

Surface waters

Similarly as in DRBD, individual surface water types were delineated on water courses with catchment area above 10 km² on the basis of abiotic descriptors defined according to the system A (Annex II WFD). In the VRBD territory, 5 types of water bodies were determined totally – all of them being part of ecoregion Carpathians, that are split into 83 surface water bodies with the total length 901.95 km. Average length of water bodies is 10.9 km, minimum length 4.6 km and maximum length 54.1 km. Their localisation is shown in the *Map 2.1* (see the *Annex*).

Groundwaters

4 groundwater bodies were delineated in VRBD. Out of them, 1 groundwater body in quaternary sediments with area 420.76 km², 3 groundwater bodies in pre-quaternary rocks with area 1,970.86 km². Their localisation in the SR territory is shown in the *Map 2.2* – groundwater bodies in quaternary sediments, in the *Map 2.3* – for bodies in pre-quaternary rocks, and in the *Map 2.4* – for geothermal water bodies (see the *Annex*).

2.3 Overview of significant water management issues

Identification of the most important water management issues in the sense of WFD is based on the outputs of activities related to the implementation of the Article 5, Annex II and Annex III, and Article 6, Annex IV, contained in the National Report 2005. Overview of significant pressures on water bodies, categorisation of water bodies from the point of view of risk to fail achieving of WFD objectives until year 2015, and identification of reasons of the foreseen failure form the output of this analytical report. National Report 2005 defined also data gaps and information that should be addressed in the next phase. In accordance with outputs of the National Report 2005, as well as other materials including public comments, the following main water management issues were identified (more detailed information – see document *An Overview of the Significant Water Management Issues*, 2008):

- in relation to WFD requirements:
 - organic pollution of surface waters,
 - pollution of surface waters by nutrients, risk of eutrophication,
 - surface water pollution by priority substances⁴ and chemical substances relevant⁵ for SR,

⁴ Priority substances are substances selected from pollutants or from the group of pollutants defined in the List III of the Annex No. 1 of the Act No. 364/2004 Coll. on waters, as amended by Act No. 384/2009 Coll., that represent significant risk for water environment or via water environment; priority dangerous substances belong to such substances that are toxic, persistent and bioaccumulative. Environmental quality standards were set out for these substances on the European level.

⁵ Relevant substances are substances with similar character as priority substances, but environmental quality standards for these substances are determined on SR level.

■ Characterisation of the river basins districts

- hydromorphological changes of the water bodies,
- deteriorated quantitative groundwater status,
- groundwater pollution,
- in relation to protection against harmful effects of waters:
 - protection against extreme hydrological situations,
- horizontal problems.

Management plans of river basins and programmes of measures serve as administrative tools for addressing the identified significant water management issues. Identified significant water management issues therefore form a main pillar of generation of the river basin management plans and programmes of measures. Measures are proposed in the programmes of measures in order to eliminate significant water management issues and to achieve the objectives as defined in the chapter 6.

3 Register of protected areas

Register of protected areas contains a list of protected areas as defined in the § 5 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll., including the areas intended for protection of biotopes or plant and animal species, for which preservation or improvement of water status is an important factor of their protection. Reference to the corresponding national or international legislation forming a basis for their definition is a part of the register. Register contains:

- protected areas designated for drinking water abstraction,
- protected areas designated for recreation including waters suitable for bathing,
- nutrient sensitive protected areas (sensitive areas and vulnerable zones),
- protected areas for protection of habitats or animal and plant species including respective Natura 2000 sites designated according to the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora and according to the Council Directive 79/409/EEC on the conservation of wild birds (European network of protected areas Natura 2000, National system of protected areas, Special type of protected areas - wetlands),
- protected areas designated for the protection of economically significant aquatic species

Localisation of protected areas in SR is shown in the *Map 3.1* (see the *Annex*).

Protected areas designated for drinking water abstraction

Subject to protection according to the § 7 of the Water Act are surface and groundwater bodies used for abstraction of water for the drinking water supply, or potentially usable as population supply for more than 50 persons, or they allow for water abstraction for such purpose in average volume higher than 10 m³ per day, in original status or after treatment. 3 types of protection are applied in SR as follows:

- protection zones of drinking water resources (safeguard zones) – according to the § 32 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll. they are determined by a decision of the State Water Authority on the basis of binding opinion of health protection authority, in order to protect capacity, quality and health safety of the water in the source,
- basins of drinking water supply courses – 102 drinking water supply courses were designated in SR that are used or can be used as water supplies for drinking water abstraction; they are enlisted in the MoE SR Regulation No. 211/2005 Coll. setting out the list of water courses with water management significance and water supply resources,
- protected water management areas – 10 protected water management areas designated in SR that are determined in accordance to the § 31 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll. They are enlisted in the Resolution of the Government of the Slovak Republic No. 46/1978 Coll. on protected area of natural water accumulation Žitný Ostrov, as amended, and in the Resolution of the Government of the Slovak Republic No. 13/1987 on certain protected areas of natural water accumulation.

An overview of number of exploited water resources that are subject to notification and abstracted water volumes, as well as protection zones are shown in the *Table 3.1*.

Table 3.1 Overview of water resources and their protection zones

River basin district	Number of water resources		Number of protection zones of water resources		Area of protection zones (ha)	
	groundwaters	surface waters	groundwaters	surface waters	groundwaters	surface waters
DRBD	1,688	34	1,210	70	356,472	473,708
VRBD	46	9	59	11	15,580	15,925
SR total	1,734	43	1,269	81	372,052	489,633

Protected areas intended for recreation and waters suitable for bathing

Protected areas intended for recreation are not defined nor designated in the territory of Slovakia. Bathing waters are determined pursuant to the § 8 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll.

36 sites with water suitable for bathing are designated as of year 2009 – all of them are located in the DRBD. These waters are monitored in defined time schedule and the results are delivered also to the European Commission.

Nutrient sensitive protected areas

Two types of areas sensitive to nutrients are defined in SR – vulnerable zones and sensitive areas.

Sensitive areas – surface water bodies in whole SR territory are sensitive areas.

Vulnerable zones – land used for agriculture in cadastral territory of municipalities enlisted in the Annex No. 1 of the Resolution of the Government of the Slovak Republic No. 617/2004 Coll., setting out sensitive areas and vulnerable zones.

Protected areas for conservation of biotopes or animal and plant species (Natura 2000)

Special Protection Areas for protection of birds, and Areas of Community Importance for protection of other rare and endangered plant and animal species and their habitats belong to this group of protected areas.

Protected Birds Sites

The Council Directive 79/409/EEC on the conservation of wild birds, transposed into the Act No. 543/2002 Coll. on nature conservation and landscape protection imposes to the member states (among other obligations) also to determine in their territories sufficient number of sites intended for protection of the selected bird species, so called bird sites. Bird sites are designated by governments of the member states, and the governments also assume the responsibility for the conservation of favourable status of the bird species population for conservation of which the site was designated.

38 Special Protection Areas were proposed in the SR territory with the total area 11,984.3 km², and they were agreed by SR government on July 9, 2003. 37 out of them are located in the DRBD. They are sequentially designated by the regulations of Ministry of the Environment SR. As of September 2009, 21 Special Protection Areas were already designated, the rest 17 were not designated, yet.

Protected Habitat Sites of European significance

Conservation of habitats – biotopes and species – is defined by the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, that was transposed into the Slovak law system by the Act No. 543/2002 Coll. on nature conservation and landscape protection. National list of proposed Sites of Community Importance (SCI) for Slovakia was designated by the Resolution of MoE SR No. 3/2004/5.1. of July 14, 2004. EC adopted the list of Sites of European significance in year 2008, where also 381 Slovak sites are enlisted, thus, these sites became a component of the European network Natura 2000 – with the total area 559.1 thousands ha. These sites will be designated by individual regulations of MoE SR as protected areas or zones of protected area.

Protected areas designated for protection of economically significant aquatic species

This category of protected areas was not introduced in the Slovak conditions. However, pursuant to the § 5 par. 1 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll., surface waters suitable for life and reproduction of domestic fish species were designated. They are aimed at protection or improvement of those flowing or standing freshwaters where autochthonous fish species ensuring natural diversity, or species that are suitable for water management purposes live or could live after pollution reduction or pollution elimination (transposition of the Directive 78/659/EEC, as amended by the Directive 2006/44/EC of the European Parliament and of the Council on the quality of fresh waters needing protection or improvement in order to support fish life).

Water courses with water management significance (basic water courses No. I) and water courses flowing into water courses with water management importance (basic water courses No. II) were determined as surface waters suitable for fish life. List of them was designated by a binding regulations of Regional Environmental Authorities.

43 basic water courses No. I were designated in Slovakia with the total length 2,856.4 km – 26 out of them being suitable for salmonid fish species, and 17 for cyprinid species. An overview of number of basic water courses No. I suitable for life and reproduction of autochthonous fish species, as well as their length according to the river basin districts is shown in the *Table 3.2*.

Table 3.2 Basic water courses No. I suitable for life and reproduction of autochthonous fish species

River basin district	Salmonids		Cyprinids		Total	
	number	km	number	km	number	km
DRBD	41	1,507.1	17	919.7	58	2,426.75
VRBD	8	159.6	0	0	8	159.6
SR total	26	1,666.7	17	919.7	43	2,586.35

4 Identification of significant pressures

4.1 Surface waters

WFD requires to collect and to administer information on the type and extent of significant anthropogenic pressures on surface water bodies, in each river basin district.

The first processing of data on the significant pressures pursuant to WFD (with data base for years 2002 and 2003) was performed in the framework of phase II of WFD implementation, and its results were delivered to EC in the National Report 2005. Uncertainties are identified by the end of a chapter, identification of impacts should therefore be updated. In relation to the chapter 2.3 *An overview of significant water management issues*, summary of identified significant pressures is shown in the sub-chapters below, structured into:

- organic pollution,
- nutrient pollution,
- pollution by relevant and priority substances,
- hydromorphological changes.

4.1.1 Organic surface water pollution

Organic pollution of waters is a result of water contamination by organic substances, originating from natural as well as anthropogenic sources. Organic substances naturally appearing in waters originate mostly from soil erosion, degradation processes of perished fauna and flora. This pollution is relatively insoluble and slowly degradable. Organic components generated by different human activities belong to the most frequent pollutants released to surface waters.

Organic pollution of surface waters is characterised by oxygen regime parameters, such as: dissolved oxygen (O_2), oxygen saturation, biological oxygen demand (BOD_5), chemical oxygen demand by potassium dichromate and permanganate (COD_{Cr} , COD_{Mn}). Information on impact of the organic pollution is given by analysis of biological quality elements.

The main organic pollution sources of water bodies are as follows:

- agglomerations,
- industry,
- agriculture (especially by diffuse pollution).

Surface water organic pollution is regulated especially by the following directives: Council Directive 91/271/EEC concerning urban wastewater treatment, Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture, and the Council Directive 96/61/EC concerning integrated pollution prevention and control. The requirements of these directives were transposed into SR legal system, namely to:

- Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll. and its executive regulations,
- Act No. 442/2002 Coll. on public drinking water supplies and public sewage systems, amending the Act No. 276/2001 Coll. on regulation of network industries, as amended (hereinafter as Act No. 442/2000 Coll. on public water supplies and public sewage systems),
- Act No. 245/2003 Coll. on integrated pollution prevention and control, amending certain acts (hereinafter as Act No. 245/2003 Coll. on IPPC).

The situation in organic surface water pollution in SR is shown in the *Figure 4.1*, describing the development trend of the discharged volumes of waste waters, and pollution characterised by parameter COD_{Cr} since year 1995 until year 2005.

This figure documents gradual decline of discharged waste water volumes into surface waters of Slovakia. This decline represents totally 25 % when compared with year 1995 in SR, the highest decrease being recorded for public sewage systems – by app. 19.0 %. The highest proportion of the total waste water volume (881,665 thousands m^3) discharged into recipients in the SR territory in year 2005, similarly as for the other time periods, relates to production activities (53.0 %) and urban waste waters (45.9 %).

Significant decrease of the released pollution represented by the parameter COD_{Cr} was recorded as well. 81,995.8 tonnes of pollution were emitted into recipients in SR in year 1995, 59,118.7 tonnes were released in

year 2002, and further decrease to 37,312.23 tonnes was recorded in year 2005. Decrease in comparison with year 1995 represents nearly 60.0 %. The highest proportion of the total released pollution according to COD_{Cr} in year 2005 related to public sewage systems (54.8 %), industrial sources 44.6 %, agriculture 0.1 % and other activities 0.5 %.

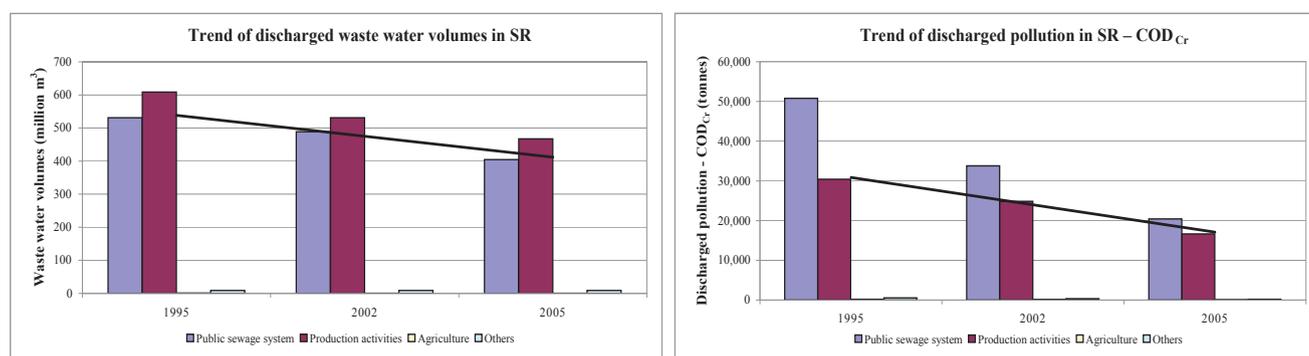


Figure 4.1 Trend of discharged waste water volumes and pollution in SR
Source: Summary Water Register

It is obvious from the above overview that discharged waste waters from industrial pollution decreased, in parallel with the burden by pollutants expressed as COD_{Cr} , but also BOD_5 . It is a long term tendency that continued also during years 2006 and 2007.

Despite of the lowered release of organic pollution into surface waters, the situation of water status is not satisfactory. It can be documented by the results of evaluation of water ecological status as shown in the chapter 5.1.3.

Summary of the significant pressures is shown in the sub-chapters below - structured according to the pollution as follows:

- from urban waste waters (agglomerations above 2,000 p.e.), and
- from industrial and other pollution sources.

4.1.1.1 Organic pollution from urban waste waters

The up-to-date situation in waste water collection and treatment in SR municipalities is not satisfactory. According to the *Water Management Report for Year 2005*, 3,100,500 of inhabitants was connected to the public sewage systems, that corresponds to 57.5 % SR citizens. The EC requirements for urban waste water collection and treatment are set out in the Directive 91/271/EEC on collection, treatment and discharge of urban waste waters, and treatment and discharge of waste waters from certain industrial sectors, and they were transposed into the Act No. 364/2004 Coll. on waters, and Act No. 442/2002 Coll. on public water supplies and public sewage systems. Agglomeration⁶ serves as a basic unit for evaluation of compliance with this directive and its requirements. 2,410 agglomerations were determined totally in Slovakia according to the instructions for the mentioned directive implementation, 356 out of them having size bigger than 2,000 p.e.⁷

Summary overview of agglomerations bigger than 2,000 p.e. according to the size categories is shown in the *Table 4.1*. 3,938,070 citizens inhabit agglomerations above 2,000 p.e., representing 73.1 % of SR inhabitants. It means, that nearly 30.0 % of SR inhabitants live in high number of small municipalities creating agglomerations below 2,000 p.e. Regarding the number of municipalities forming part of agglomerations above 2,000 p.e. in relation to the total number of SR municipalities, the situation is as follows: total number of municipalities (together with city districts of Bratislava and Košice) is 2,929, number of municipalities in agglomerations above 2,000 p.e. is 816, i.e. 28.0 % out of the total number of municipalities. The level of treatment in agglomerations above 2,000 p.e. by the end of year 2006 is shown in the *Map 4.1a* (see the *Annex*).

⁶ Agglomeration pursuant to Art. 2(4) of the Directive 91/271/EEC is defined as an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point. Existence of the agglomeration is independent from existence of sewage system, and it is also independent from existence of WWTP (Terms and Definitions, 2007).

⁷ p.e. (population equivalent) is an amount of biologically degradable organic pollution expressed as a value of parameter biochemical oxygen demand per 5 days ($\text{BOD}_5 - \text{ATM}$), that is equivalent to a pollution generated by a single inhabitant, i.e. 60 g BOD_5 (ATM) per day.

■ Identification of significant pressures

Table 4.1 Number of agglomerations in SR river basin districts

River basin district	Size category		Total
	2,000 – 10,000 p.e.	Above 10,000 p.e.	
DRBD	268	76	344
VRBD	8	4	12
SR total	276	80	356

The actual situation in waste water handling in agglomerations above 2,000 p.e. does not fully respect requirements of the directive. An overview of the amount of produced pollution expressed in p.e., as well as methods of its collection and removal in agglomerations above 2,000 p.e. is documented in the *Table 4.2*.

Table 4.2 Urban waste water handling in agglomerations above 2,000 p.e. – year 2005

Agglomeration categories	Number of agglomerations	Amount of generated pollution (p.e.)	Waste water handling method (%)		
			Public sewage systems	Individual systems	Without connection to public sewage system
<i>Danube River Basin District</i>					
2,000 – 10,000 p.e.	268	973,330	38.3	30.9	30.8
above 10,000 p.e.	76	3,878,450	84.6	7.5	8.0
<i>Vistula River Basin District</i>					
2,000 – 10,000 p.e.	8	33,310	83.5	9.9	6.6
above 10,000 p.e.	4	164,260	67.6	10.7	21.6
<i>SR total</i>					
2,000 – 10,000 p.e.	276	1,006,640	39.2	30.3	30.5
above 10,000 p.e.	80	4,042,710	84.6	7.6	7.8
Total	356	5,049,350	75.6	12.1	12.3

As shown in the *Table 4.2*, only 75.6 % of the generated pollution (expressed in population equivalents) of SR agglomerations above 2,000 p.e. have a waste water collection system and WWTP. The residual part has individual systems – cesspools (12.1 %) or no adequate waste water collection (12.3 %), becoming a diffuse groundwater and surface water pollution source.

Actual situation (year 2005) in surface water pollution by waste waters from agglomerations above 2,000 p.e. according to the individual river basin districts is shown in the *Table 4.3*. Data do not involve pollution from the agglomerations that are diffusely discharged into surface waters.

Table 4.3 Discharged pollution into surface waters from agglomerations above 2,000 p.e. – year 2005

River basin district	Discharged pollution from agglomerations above 2,000 p.e. in tonnes – year 2005	
	BOD ₅	COD _{Cr}
DRBD	6,330	21,120
VRBD	245	1,581
SR total	6,575	22,701

Production of treatment sludge and its handling

Handling of sludge from the urban waste water treatment is regulated by a legal act for waste management. Discharging of treatment sludge into groundwaters or surface waters is forbidden in SR (§ 36 par. 12 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll.). In the case of direct application of treatment sludge into agricultural or forest soil, this process is regulated by the Act No. 188/2003 Coll. on application of treatment sludge and bottom sediments into soil, and amendment of the Act No. 223/2001 Coll. on waste and on amendment of certain acts, as amended by the Act No. 364/2004 Coll., and amendment of the Act No. 136/2000 Coll. on fertilisers, as amended.

Quantitative sludge production, as well as the level of its contamination from urban waste water treatment plants (hereinafter as WWTP) is permanently monitored as required by the above mentioned acts.

Soil application comprises all methods of sludge utilisation in soil processes from composting, through direct application of treatment sludge, recultivation (e.g. recultivation of landfills, piles, line constructions etc.), or utilisation on forest soil.

Qualitative sludge analysis shown that app. 90.0 % of investigated sludge produced by urban WWTPs in SR meets the limits of concentration of risk substances set out in the legal regulation for processes of sludge application into soils pursuant to the Act No. 188/2003 Coll. on application of treatment sludge and bottom sediments into soil, and amending the Act No. 223/2001 Coll. on waste and on amendment of certain acts, as amended.

In relation to the increasing requirements to waste water treatment – implementation of the Council Directive 91/271/EEC concerning urban waste water treatment, it is necessary to expect increased sludge production. Increased sludge production depends on the number of newly connected inhabitants, as well as increased sludge production resulting from removal of nutrients, especially phosphorus.

As the sludge production increase comprise mostly small WWTPs without significant connection of industrial waste waters, sludge contamination level complying the requirements for soil application can be foreseen.

It is necessary to focus to further sludge contamination decrease in the framework of sludge management, i.e. organic contamination in the sense of Soil Protection Strategy to be developed by the EU.

4.1.1.2 Organic pollution from significant industrial and other sources

Generally, nearly each industrial sector produces organic pollution. Pulp and paper mills, chemical industry, textile production and agriculture and food processing belong to the largest producers. The following criteria were used for selection of the most important pollution sources:

- being subject to the Act No. 245/2003 Coll. on IPPC or Regulation (EC) No. 166/2006 of the European Parliament and of the Council concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC, or Act No. 205/2004 Coll. on collection, maintenance and distribution of environmental information, amending certain acts,
- pollution sources with permitted, or identified priority substance in their waste waters (resolution of the Slovak Government No. 296/2005 Coll. or 2006/0129 (COD)) – Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council
- pollution sources with permitted, or identified substance relevant for SR in their waste waters,
- ratio of waste water to the recipient water flow on the level $Q_{355} / Q_{\text{assured}} \geq 1:1$ and more.

In accordance with these criteria, 217 of significant industrial and other pollution sources were identified in SR. The proportion of pollution released from the significant pollution sources and pollution released from all registered industrial pollution sources expressed as COD_{Cr} represents 98.0 % in year 2006, and 92.3 % in year 2007.

Summary data on discharge of waste waters and pollution from significant industrial and other pollution sources for the individual river basin districts and for SR as total are shown in the *Table 4.4*. Their localisation in the SR territory is described in the *Map 4.2a* – illustration according to the source size, and in the *Map 4.2b* – illustration according to the classification of economic activities (see the *Annex*).

Table 4.4 Pollution from industrial and other sources discharged into surface waters

River basin district	Year	Significant pollution sources number	Discharged waste waters thous. m ³ /year	Pollution discharged into surface waters			
				BOD ₅	COD _{Cr}	N _{total}	P _{total}
				tonnes/year			
DRBD	2006	210	315,171.3	2,940.5	15,670.3	801.3	70.8
	2007	210	242,349.9	2,237.5	14,031.8	1,906.3	67.2
VRBD	2006	7	836.3	29.3	19.1	3.7	0.4
	2007	7	873.6	9.9	24.1	4.5	0.5
SR total	2006	217	316,007.6	2,969.8	15,689.4	805.0	71.2
	2007	217	243,223.5	2,247.4	14,055.9	1,910.8	67.7

It is obvious from the above overview that discharged volumes of waste waters decreased in industrial sources, as well as their pollution load expressed as COD_{Cr} but also BOD₅. It is a long term tendency, that continues also in years 2006 and 2007.

4.1.2 Pollution of surface waters by nutrients

Emissions of nutrients enter surface waters by different pathways: from point sources (agglomerations, industry, agriculture) and diffuse sources (erosion and surface runoff, from groundwater, atmospheric deposition). Diffuse sources are partially of natural origin and partially anthropogenic (mostly from agriculture). Nutrients in surface waters undergo broad spectra of transformation processes. Certain transformation processes result in losses, or permanent or partially degradable accumulations. Residual nutrients are transported by the water course into courses of lower order or even into sea. Water eutrophication⁸ forms the most important impact of high nutrient load.

Parameter of nutrients (total nitrogen and total phosphorus) are supporting parameters for evaluation of water ecological status. Insufficient status of surface waters in SR is documented by monitoring results, and also results of risk analysis of surface water bodies of year 2008.

The main polluters of surface waters by nutrients, similarly as for pollution by organic substances, are as follows:

- agglomerations,
- agriculture,
- forestry,
- industry.

4.1.2.1 Pollution from point sources

Surface water pollution from point sources results from discharge of insufficiently treated or non-treated waste waters produced by agglomerations, industry and agriculture. Type of particular WWTP is decisive from the point of view of nutrient reduction from waste waters. Summary balance of nutrient emissions from agglomerations expressed as total nitrogen and total phosphorus is shown in the *Table 4.5* and *Table 4.6*.

Pollution by nutrients from industry

Several industrial plants serve as significant pollution of water by nutrients. Chemical industry is one of the most important. Nutrient balance from industrial and other point sources are shown in parallel with organic pollution balance (see the chapter 4.1.1). *Table 4.4* shows that significant increase of total nitrogen was recorded in year 2007, however, it does not necessarily means increased pollution of water courses, but improved reporting of the operators of industrial pollution sources into the Summary Water Register in compliance with the requirements of revised permits for waste water discharge.

⁸ Definition of eutrophication: enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned (Directive 91/271/EEC).

Trend of pollution by nutrients expressed as total nitrogen or phosphorus can not be identified because of data gaps from the previous period.

Pollution by nutrients from agriculture

Only few significant point pollution sources from agricultural production are present in SR due to production decline. Diffuse sources are more important, and they are analysed by the MONERIS model – results are shown in the following chapter.

4.1.2.2 Estimated emissions of nutrients from diffuse and point pollution sources

Diffuse water pollution by nutrients results from different activities such as agriculture and others. The intensity of diffuse pollution depends not only on anthropogenic factors as landscape use and its intensity, but also on natural factors as climatic conditions, flow conditions and soil properties. These factors influence pathways of the diffuse pollution into the surface waters. As measurement of emission of substances from diffuse pollution sources is difficult, modelling is used for their quantification.

Estimate of nutrients from diffuse pollution sources for the international Danube river basin (96.0 % of the Slovak territory belong to it) was performed by MONERIS⁹ model (version March 2009). Application of MONERIS model to modelling of nutrient runoff was agreed by all Danube river basin states including SR. Sub-basins of rivers Dunajec and Poprad belong to the international Vistula river basin – results from modelling were took over from Vistula basin modelling - performed by an older MONERIS model version that does not offer so detailed structure of outputs as the actual version does, expert opinion was therefore necessary in several cases.

Model MONERIS was used for Danube basin for the first time in the framework of analytical report elaboration in year 2004, with input data representing the period of years 2001 – 2002. Data from diffuse pollution were updated, similarly as for other data representing significant pressures. Input data for the model MONERIS were therefore upgraded to the time level of years 2004 – 2005.

MONERIS – estimate model for emissions from diffuse and point pollution sources

Emissions of nutrients enter the river systems via seven input pathways:

1. direct atmospheric deposition to water surface,
2. surface runoff,
3. erosion,
4. tile drainage,
5. groundwater,
6. point pollution sources (predominantly agglomerations),
7. urban areas without public sewage system, or with discharge of rainwater.

The model results show that 41,564 tonnes of total nitrogen and 2,736 tonnes of phosphorus are emitted into the river system in the SR territory per year (under the condition of average flow represented by time period of years 2000 – 2005). Groundwater is the most important input pathway of the total nitrogen, as it donates surface waters, and discharged waste waters from point pollution sources (agglomerations) are most important for the total phosphorus.

Summary overview of total phosphorus and total nitrogen emissions into surface waters according to the individual pathways are illustrated by the *Table 4.5* and *Table 4.6*. The main sources of such pollution are shown in the *Figure 4.2*. The pictures demonstrate that municipalities are the dominant sources of nitrogen emissions (point as well as diffuse sources), they are followed by agriculture. Specific emissions of total nitrogen and phosphorus for the individual analytical units used for the modelling are demonstrated by *maps 4.3a* and *4.4a*.

⁹ Behrendt et al. (2007): *Model system MONERIS (2007)*, Institute for Freshwater Ecology and Inland Fisheries in the Forschungsverbund Berlin

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Table 4.5 Overview of total nitrogen emissions according to input ways – years 2005 – 2006

River basin district	Total nitrogen (tonnes/year)							
	atm. deposition	runoff	drainage	erosion	groundwater	point sources	urban areas without sewage	N _{total}
DRBD	517	3,271	6,188	967	19,355	6,441	2,988	39,727
VRBD	21	50	136	87	1,107	320	115	1,836
SR total	538	3,321	6,324	1,054	20,462	6,761	3,103	41,563

Table 4.6 Overview of total phosphorus emissions according to input ways – years 2005 – 2006

River basin district	Total phosphorus (tones/year)							
	atm. deposition	runoff	drainage	erosion	groundwater	point sources	urban areas without sewage	P _{total}
DRBD	15	65	48	639	220	938	610	2,535
VRBD	0	7	0	70	11	80	29	197
SR total	15	72	48	709	231	1,018	639	2,732

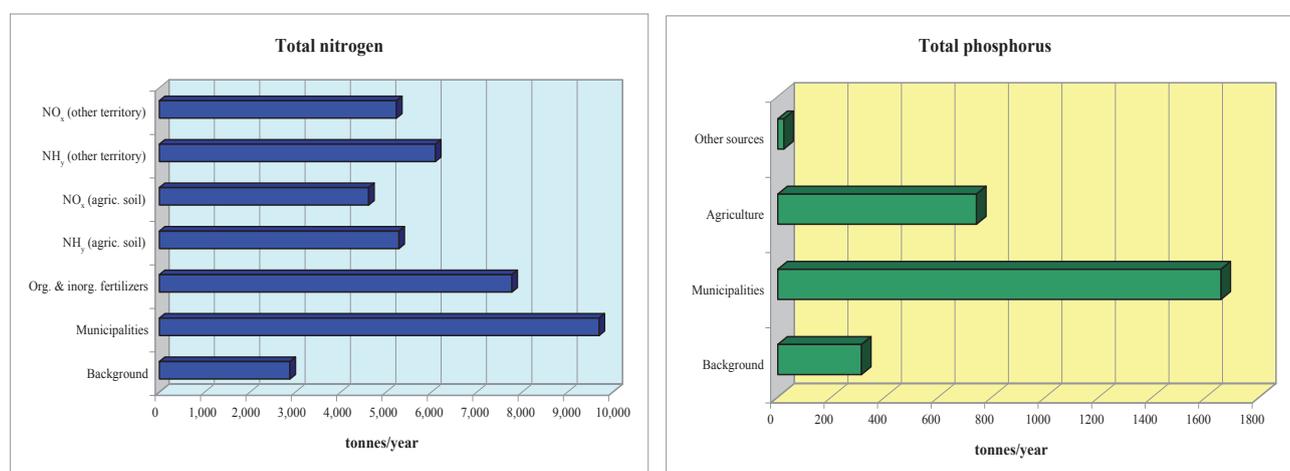


Figure 4.2 Sources of nitrogen and phosphorus emissions into river system of SR, 2005 – 2006 (MONERIS output)

Surface water pollution by phosphates from detergents

Phosphate emissions from household detergents into surface waters are significant in the Danube river basin. These emissions are involved in balance values for agglomerations. In the case when an agglomeration does not have public sewage system and WWTP, or when WWTP does not ensure increased phosphorus removal, phosphates enter the water environment. Several countries – in contrary to Slovakia – already implemented legislative measures for production of phosphate-free detergents for laundry washing. It can be concluded on the basis of an estimate that phosphorus emissions from washing detergents corresponds to app. 10.0 %.

Input of nutrients from inorganic and organic fertilisers

Application of inorganic and organic fertilisers contributes significantly to the water pollution by nutrients. Trends of application of nutrients of organic as well as inorganic origin are shown in the chapter 4.2.1.

Input of nutrients via atmospheric deposition

Contribution of water pollution from atmospheric deposition (NO_x and NH₃) is significant (see the Figure 4.2). Pollution from atmospheric deposition originates in anthropogenic activities such as transport, agriculture (animal production) and industry. It is partly transferred from sources located out of the SR territory.

4.1.3 Surface water pollution by priority substances and substances relevant for SR

Exceeded pollution of water by priority substances and substances relevant for SR can result in many undesirable effects to the river ecology and human population health. Substances relevant for SR and priority substances cause inhibition of physiological processes in water organisms (acute toxicity), or they can induce effects threatening the populations from long term point of view (chronic toxicity). When a substance is persistent, i.e. the degradation processes last for a longer period, such substance persists in the environment and it leads to continuous and/or long term exposition. Substances with high lipofilicity tend to accumulate onto the solid phase and into the living organisms. Synthetic chemicals, naturally occurring metals, oils and their compounds, endocrine disruptors and different pharmaceuticals belong to such substances.

Released waste waters from industry, discharge of rain water, chemicals applied in agriculture, waste waters from mining industries, as well as accidental pollution serve as a sources of priority and relevant substances. Moreover, atmospheric deposition can also be an important source of certain substances.

The market and use of chemical products in Europe is regulated by the following legislative documents:

1. Council Directive 91/414/EEC concerning the placing of plant protection products on the market, defining rules for authorisation of plant protection products.
2. Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market – regulation is aimed at harmonisation of the European biocide market and their active ingredients, and also at provision of high level of protection of human health, animals and the environment. Conditions for introduction of biocide formulations and their use in SR are set out by the Act No. 217/2003 Coll. on conditions of introduction of biocides onto the market, as amended.
3. Regulation (EC) No. 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No. 793/93 and Commission Regulation (EC) No. 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC. This regulation is aimed at ensuring of high level of protection of human health and the environment, including promotion of alternative methods for risk assessment of substances. This regulation came into force on June 1, 2007.

Priority substances (including additional pollutants for which environmental quality standards (hereinafter as EQS) were defined on the EU level by the Directive 2008/105/EC) and substances relevant for SR are classified into two groups of parameters in order to evaluate water status. Priority substances belong to the group of parameters that form a basis for assessment of the chemical status of surface water bodies. Substances relevant for SR belong to the group of parameters for the ecological status evaluation.

Industrial pollution sources

Data reported by polluters to European Pollutant Release and Transfer Register (hereinafter as E-PRTR) developed on the basis of Regulation (EC) No. 166/2006 of the European Parliament and of the Council concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC, served as a data resource for balancing of these substances. E-PRTR is a successor of European Pollutant Emission Register (hereinafter as EPER), developed in the framework of the Directive 96/61/EC and the Act No. 245/2003 Coll. on IPPC, pursuant to which data for years 2001 and 2004 were reported. E-PRTR will implement UN EEC Protocol on PRTR undersigned by the European Community and 23 member states in May 2003 in Kyjev, and that forms a protocol to the Aarhus convention¹⁰. Regulation (EC) 166/2006 on E-PRTR is aimed at improvement of public access to the environmental information by introduction of complex and integrated E-PRTR, contributing to the pollution reduction, delivery of data to policy makers, and creation of conditions for public participation on decision making related to the environmental issues.

Summary pollution balances for years 2006 and 2007 are shown below for:

- pollution characterised by priority substances (see the *Table 4.7*),
- pollution characterised by substances relevant for SR (see the *Table 4.8*).

It is not possible to award high reliability to the differences between balance values between years 2006 and 2007, they do not represent real decline nor increase of concentration of priority or relevant substances in waste

¹⁰ *Convention on access to information, public participation in decision-making and access to justice in environmental matters, Aarhus 1998.*

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waters – they are dominantly caused by number and quality of data reported by polluters to the register E-PRTR. The tables show that release of 18 substances into waste waters in SR is permitted for which EQS were determined on the EU level by the Directive 2008/105/EC. 16 out of these substances are priority ones (the number does not include sub-groups) – and 7 out of them are priority dangerous pollutants and additional 2 are other pollutants. It is necessary to adopt measures aimed at significant reduction of these substances in order to prevent water pollution by priority substances, and in the case of priority dangerous substances also measures for elimination or phasing out of their release, emissions and spills in a time schedule that will not exceed 20 years.

66 production units releasing waste waters with priority substances were identified in the SR territory. In addition to the pollution sources that discharge their waste waters directly into the recipients it is necessary to record also sources that are connected to public sewage systems and WWTP of other operators – so called indirect waste water discharges. Waste water permits for operators of such public sewage system and WWTP should respect also pollution characteristics of the connected industrial waste waters. Pursuant to the Act No. 245/2003 Coll. on IPPC, operating units with indirect discharge that exceed the limit set out by this act are obliged to report the annual discharges into the Integrated Register of the Information System managed by Slovak Hydrometeorological Institute (hereinafter as SHMI).

Table 4.7 Discharge of priority substances and certain additional pollutants into surface water – years 2006 and 2007

No.	Rel. SR	CAS	Substance name Number of permits	Priority dangerous	Year	Discharged pollution into surface water in kg/year		
						SR	DRBD	VRBD
1	3	120-12-7	Anthracene	X	2006	1.7	1.7	
			Number of permits: 2		2007	14.6	14.6	
2	6	71-43-2	Benzene		2006	137.1	137.1	
			Number of permits: 8		2007	201.5	201.5	
3	8	50-32-8	Benzo(a)pyrene	X	2006	6.3	6.3	
			Number of permits: 5		2007	4.5	4.5	
4a	9	205-99-2	Benzo(b)fluoranthene	X	2006	0.5	0.5	
			Number of permits: 1		2007	6.4	6.4	
4b	10	207-08-9	Benzo(k)fluoranthene	X	2006	0.4	0.4	
			Number of permits: 1		2007	6.2	6.2	
4c	11	191-24-2	Benzo(g,h,i)perylene	X	2006			
			Number of permits: 1		2007	5.9	5.9	
4d	31	193-39-5	Indeno (1,2,3-c,d) pyrene	X	2006	0.4	0.4	
			Number of permits: 1		2007	6.6	6.6	
5	15	117-81-7	Bis(2-ethylhexyl)-phthalate (DEHP)		2006			
			Number of permits: 3		2007	975.0	975.0	
6	20	107-06-2	1,2-dichloroethane		2006	3,972.8	3,972.8	
			Number of permits: 1		2007	3,590.1	3,590.1	
7	24	206-44-0	Flouranthene		2006	2.7	2.7	
			Number of permits: 2		2007	6.8	6.8	
8	27	118-74-1	Hexachlorobenzene (HCB)	X	2006	0.5	0.5	
			Number of permits: 1		2007	0.5	0.5	
9	33	7440-43-9	Cadmium and its compounds	X	2006	397.5	397.5	0.01
			Number of permits: 18		2007	395.0	395.0	0.02
10	39	91-20-3	Naphthalene		2006	21.5	21.5	
			Number of permits: 4		2007	37.8	37.8	

Continuation of the Table 4.7 Discharge of priority substances and certain additional pollutants into surface water – years 2006 and 2007

No.	Rel. SR	CAS	Substance name Number of permits	Priority dangerous	Year	Discharged pollution into surface water in kg/year		
						SR	DRBD	VRBD
11	40	7440-02-0	Nickel and its compounds		2006	185.4	173.5	11.89
			Number of permits: 30		2007	153.4	144.3	9.31
12	41	25154-52-3	Nonylphenols	X	2006	56.4	56.4	
			Number of permits: 0		2007	22.6	22.6	
13	45	7439-92-1	Lead and its compounds		2006	96.8	96.8	
			Number of permits: 26		2007	307.0	307.0	
14	46	7439-97-6	Mercury and its compounds	X	2006	629.5	629.5	0.01
			Number of permits: 21		2007	371.6	371.6	
15	51	12002-48-1	1,2,4-trichlorobenzene (1,2,4, TCB)		2006			
			Number of permits: 1		2007	17.9	17.9	
16	54	67-66-3	Trichloromethane		2006	267.6	267.6	
			Number of permits: 2		2007	296.2	296.2	
17	50	127-18-4	Tetrachloroethene		2006	50.7	50.7	
			Number of permits: 3		2007	29.1	29.1	
18	53	79-01-6	Trichloroethene		2006	471.5	471.5	
			Number of permits: 3		2007	197.1	197.1	

Note: Column 2 – number of the substance in the list of 59 relevant substances for SR as shown in the Pollution Reduction Programme for Harmful and Particularly Harmful Substances.

Table 4.8 Discharge of substances relevant for SR into surface water – years 2006 and 2007

No.	Rel. SR	CAS	Parameter	Year	Discharged pollution into surface water in kg/year		
					SR	DRBD	VRBD
1	2	62-53-3	Aniline	2006	4.2	4.2	
			Number of permits: 2	2007	2,334.0	2,334.0	
2	4	7440-38-2	Arsenic and its compounds	2006	169.3	169.3	
			Number of permits: 19	2007	105.4	105.4	
3	12	95-16-9	Benzothiazole	2006			
			Number of permits: 1	2007	36,319.4	36,319.4	
4	14	80-05-7	Bisphenol A	2006			
			Number of permits: 3	2007	2.3	2.3	
5	19	84-74-2	Dibutylphthalate	2006	5.5	5.5	
			Number of permits: 3	2007	115.4	115.4	
6	21	122-39-4	Diphenylamine	2006			
			Number of permits: 1	2007	699.4	699.4	
7	23	85-01-8	Phenanthrene	2006	7.1	7.1	
			Number of permits: 1	2007	15.4	15.4	

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Continuation of the Table 4.8 Discharge of substances relevant for SR into surface water – years 2006 and 2007

No.	Rel. SR	CAS	Parameter	Year	Discharged pollution into surface water in kg/year		
					SR	DRBD	VRBD
8	25	50-00-0	Formaldehyde	2006	44,131.5	44,131.5	
			Number of permits: 2	2007	10,688.5	10,688.5	
9	30	7440-47-3	Chromium and its compounds	2006	132.4	130.2	2.2
			Number of permits: 27	2007	531.0	530.9	0.1
10	34	74-90-8	Total cyanides	2006	19.8	19.6	0.2
			Number of permits: 17	2007	719.4	719.4	-
11	36	7440-50-8	Copper and its compounds	2006	878.0	878.0	
			Number of permits: 38	2007	560.0	560.0	
12	37	94-74-6	MCPA	2006			
			Number of permits: 0	2007	16,179.2		
13	38	128-37-0	4-methyl-2,6-di-tert butylphenol-0	2006	-	-	
			Number of permits: 0	2007	72.3	72.3	
14	44	140-66-9	4-(tert)-octylphenol	2006			
			Number of permits: 1	2007			
15	47	1336-36-3	PCB and its congeners	2006	10.2	10.2	
			Number of permits: 3	2007	0.6	0.6	
16	56	108-88-3	Toluene	2006	29.6	29.6	
			Number of permits: 1	2007	52.9	52.9	
17	58	1330-20-7	Xylenes	2006	33.4	33.4	
			Number of permits: 2	2007	872.4	872.4	
18	59	7440-66-6	Zinc	2006	5,531.6	5,509.7	22.0
			Number of permits: 47	2007	3,069.4	3,068.9	0.5

Note: Column 2 – number of the substance in the list of 59 relevant substances for SR as shown in the Pollution Reduction Programme for Harmful and Particularly Harmful Substances.

Application of pesticides in agriculture

Pesticides in rivers can originate from diffuse runoff from agriculture – via drainage, wind-caused drift during spraying and surface runoff. More detailed information on pesticide application in SR is shown in the chapter 4.2.1.

4.1.4 Significant hydromorphological changes

Hydromorphological changes and their effect to the water status became important in the water management as a result of the WFD requirements. Anthropogenic influences resulting from different impacts to the river systems can significantly change the natural structure of surface waters and substrate of river beds that are important for existence of suitable biotopes and conditions for natural sustainability of the water ecosystem. Changes of the natural hydromorphological structure and river bed substrate can have negative impacts to the aquatic population leading to deterioration of surface water body status.

The main driving forces of hydromorphological changes are as follows: energy production – hydroelectric power-plants, flood protection measures, water supplies and navigation. In many cases the significant hydromorphological changes are not related to a single activity, but they result from multiple functions (e.g. energy production and navigation). Other activities such as gravel extraction, recreation, fishery have a minor importance.

Preliminary identification of the hydromorphological changes was performed – similarly as in the other countries – in combination of available data (passports of water courses, technical documentation to the reclaimed segments) and local knowledge, mainly of SWME employees. The preliminary hydromorphological pressures identification comprised collection of information regarding ten applied criteria: No. 1 Stretch covering; No. 2 Course straightening; No. 3 Impoundment of stretches; No. 4 Length and type of river bank reinforcement; No. 5 Flood protection; No. 6 Urbanisation; No. 7 Combined evaluation (alternative for parameters 4, 5 and 6); No. 8 Transverse profile change; No. 9 Weirs and sills and, No. 10 Abstraction. Evaluation of hydromorphological changes was performed in 1,477 water bodies in total (the rest having no data, nevertheless, this group comprises solely small water bodies with catchment area below 100 km²).

Significance of identified changes of the individual criteria was quantified in accordance with the methodical instructions (Matok, 2007) – by scores from 1 to 10 (1 – the smallest change, 10 – the most significant change). Change reaching the value of more than 5 was considered significant. An overview of the number of water bodies with significant changes of the individual evaluated criterion is shown in the *Table 4.9*. Totally, 902 water bodies with significant changes were identified in SR.

Table 4.9 Overview of number of water bodies with significant hydromorphological changes

River basin district	With changes	Criterion					
		1	2	3	7	8	9
	Number						
DRBD	862	32	65	361	654	524	691
VRBD	40	0	0	10	26	16	33
SR total	902	32	65	371	680	540	724

Note: 1 – stretch covering; 2 – course straightening; 3 – impoundment of stretches; 4 – length and type of river bank reinforcement; 5 – flood protection; 6 – urbanisation; 7 – combined evaluation (alternative for parameters 4, 5 and 6); 8 – transverse profile change; 9 – weirs and sills.

Identified hydromorphological changes served as a basis for preliminary categorisation of the water bodies to natural water bodies, heavily modified water bodies (hereinafter as HMWB also), artificial water bodies (hereinafter as AWB also) ones, and further for the final identification of HMWB and AWB.

The significance of the individual changes was further individually examined for each water body in the framework of testing of HMWB and AWB candidates on the basis of photo documentation from monitoring barriers that was performed by State Nature Conservancy (hereinafter as SNC SR), expert opinion of biologists including fishermen and SWME technical personnel – employees of the individual branch offices. Many of the barriers identified in the early phases of the activity were re-categorised as unimportant or not existing ones.

Due to the high number of HMWB and AWB candidates, the process of final designation of HMWB and AWB is not terminated, the testing of water bodies on small water courses will continue also in the second planning cycle.

As regards the impact to the water status, the individual criteria were grouped into three main groups of significant hydromorphological changes:

- a) Interruption of longitudinal continuity of rivers and habitats,
- b) Disconnection of adjacent wetlands and floodplains and other morphological changes,
- c) Hydrological changes.

4.1.4.1 Interruption of longitudinal continuity of rivers and habitats

Table 4.9 reveals that 724 water bodies with significant changes were identified according to the criterion No. 9 (weirs and sills) in the framework of screening of hydromorphological changes. As mentioned above, identified transversal constructions were further evaluated in the framework of testing, and the results are shown in the *Table 4.10*. Localisation of transversal constructions for year 2009 is shown in the *Map 4.5b* (see the *Annex*). The table shows that 779 constructions disturbing longitudinal continuity of water courses exist in tested water bodies in SR, and only 84 out of them are passable for fish.

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Table 4.10 Barriers of longitudinal continuity of rivers and habitats in the tested water bodies – year 2009

River basin district	Number of barriers			
	Total	Without functioning fish-pass	With functioning fish-pass	Presence or function of fish-pass not known
DRBD	713	630	79	4
VRBD	66	61	5	0
SR total	779	691	84	4

4.1.4.2 Disconnection of adjacent wetlands and floodplains and other morphological changes

Wetlands and floodplains and their re-connection with surface water bodies play an important role in function of aquatic ecosystems, and it has a positive influence to their water status. According to WFD, pressures on wetlands are considered significant, and in the case they have negative impact to status of adjacent water bodies measures should be proposed. Re-connection of wetlands and floodplains has important role also as retention area during floods, and it can have positive effect to the reduction of nutrients.

Intensification of agricultural production, water course regulation in order to protect against floods, and exploitation of hydro-energetic potential were the main reasons of cutting off wetlands in the past. Moreover, drainage and irrigation contributed to the loss of wetlands as a result of groundwater level change. An overall loss of original wetlands and floodplains was not identified in SR.

Analysis of this category of pressures was based on the consideration that cut off of wetlands and inundations have potential impact to the aquatic ecosystems, and as many as possible areas should be re-connected to the water courses in order to support the achievement of environmental objectives. Pressure analysis was aimed at analysis of sites and areas of cut off branches and floodplains (with area higher than 500 ha) that still have a potential to be re-connected to the main stream.

As shown in the Table 4.9, 680 water bodies with significant changes according to the hydromorphological criterion No. 7 are identified in SR at present – combined assessment related to cut off of the original inundations and wetlands from the water courses.

4.1.4.3 Hydrological changes

The main types of impacts causing hydrological changes are: water impoundment, water abstraction and water level fluctuation. Changes resulting from these pressures, as well as criteria for evaluation of their significance are shown in the Table 4.11.

Table 4.11 Hydrological pressures and significance criteria for the individual pressures

Hydrological pressure	Induced changes	Pressure significance criteria
Impoundment	Change/reduction of water flow and flow regime of the water course	Length of the impoundment under low water flow: Danube: > 10 km Danube tributaries: > 1 km
Water abstraction/ residual water flow	Change in quantity and dynamics of river flow	Large water courses: Q downstream reservoir < 50 % avg. annual min. flow per reference period (comparable with Q_{95}) or 50 % of Q_{355} Medium and small water courses: Q downstream reservoir < Q_{355}
Water level fluctuation	Change in quantity and dynamics of river flow	Water level fluctuation > 1 m/day or less in the case of known or observed negative impact to biology

Impoundment

Impoundment is caused by transversal constructions that in addition to continuity interruption of river and habitats cause also alteration of flow characteristics above the construction. The river character can change to lake due to the flow velocity decrease. 23 water reservoirs were identified in SR with significant change and with foreseen category alteration (see the chapter 2).

Water abstraction

Energy production is the main water exploitation type causing significant change. The abstraction can importantly reduce the water flow and water volume, and it can also impact water status in the case when the minimum guaranteed flows are not ensured that safeguard ecological minimum in the water course.

Six segments of water bodies were identified in SR with significant reduction of water flow that are listed in the Table 4.12.

Table 4.12 Water bodies with significant water flow reduction

WB code	WB name		Impacted segment (r. km)		Significant reduction of Q
			from	to	
SKV0006	Váh	underneath WWrk Krpeľany	275.50	294.30	Yes
SKV0007	Váh	underneath WWrk Hričov	217.00	247.10	Yes
SKV0007	Váh	underneath WWrk Nosice	204.80	209.20	Yes
SKV0007	Váh	underneath weir Dolné Kočkovce	165.70	201.40	Yes
SKV0007	Váh	underneath weir Trenčianske Biskupice	120.50	163.10	Yes
SKV0019	Váh	underneath WR Slňava	101.30	114.60	Yes

Note: WB – water body, WWrk – waterwork, WR – water reservoir, Q – water discharge.

Water level fluctuation

This type of pressures was not identified in SR.

4.1.5 Other significant anthropogenic pressures

The following pressures belong to the other significant anthropogenic pressures:

- Invasive species – neozoes and neophytes,
- Accidental water pollution.

4.1.5.1 Invasive species

The international Danube river basin is extremely vulnerable to invasive species thank to the direct connection of the Danube river with the other large water bodies. Many of invasive species originate in Pont-Caspic region, Asia, Australia and North America. Danube river belongs to the South invasion pathway, one of four most important pathways for invasive species. Thus, Danube and its tributaries are exposed to colonisation by invasive species.¹¹

Neozoes

The results of international Danube survey in year 2007 (Joint Danube Survey 2) confirmed that it is necessary to concern invasive species, and that their analysis and incorporation them into the evaluation is important. Many theories to these issues emerged recently, however, a common opinion to their solution is still unavailable. Even the question whether the ecological status of the Danube is really significantly influenced by neozoes is not fully relevant. Certain neozoes dominate in the benthic invertebrate fauna in many sites of the Danube, therefore their classification is a key factor of ecological status evaluation. Many of them are dominant and they indicate β -mesosaprobity, meaning generally good ecological status. Species *Corbicula fluminea* appeared among the benthic invertebrates along the Danube most often during the international Danube Survey. Additional identified invasive species were *Corophium curvispinum* and *Dikerogammarus villosus*.

In the fish population along the upper Danube, several species of genus *Neogobius* were identified in high abundance along the regulated banks. These species originate in the Black Sea. In contrary, in the lower parts of Danube (downstream Iron Gate), i.e. in the original area of their appearance with significantly lower hydromorphological pressures, abundance of these fish species grows towards the Danube delta only slowly.

¹¹ List of invasive species in the Danube river basin was elaborated in the framework of FP6 of the European project DAISIE (SR did not participate), and it is available on the web page www.europe-aliens.org

Neophytes

The river banks belong to habitats, autochthonous vegetation of which is increasingly endangered by neophytes. They suppress autochthonous plant populations, decreasing ecosystem biodiversity. Mostly invasively spreading herbs in SR Danube basin territory are: *Solidago gigantea*, *S. canadensis*, *Aster novi-belgii*, *A. lanceolatus*, *Impatiens glandulifera* (= *I. roylei*), *I. parviflora*, *Iva xanthifolia*, *Ambrosia artemisiifolia*, *Artemisia annua*, *Bidens frondosa*, *Brassica nigra*, *Conyza canadensis*, *Echinocystis lobata*, *Helianthus tuberosus*, *H. decapetalus*, *Fallopia japonica* (= *Reynoutria japonica*), *Stenactis annua*. Among the wood species *Acer negundo* and *Ailanthus altissima* (Feráková, 1994(a), 1994(b), Banášová et al., 1999).

Neophyte of North American origin is known in SR among the aquatic macrophytes – *Elodea canadensis*, introduced to Europe in year 1836. North American species *E. nuttallii* was determined in year 1996 for the first time in Slovakia in the Danube inundation area (O’ahel’ová, 1996), and it is spreading invasively at present, suppressing also *E. canadensis* (O’ahel’ová, Valachovič, 2002, 2003).

4.1.5.2 Accidental pollution of waters

Accidental pollution of waters is recorded by the Slovak Environmental Inspection. The progression of accidents since year 1997 is shown in the *Table 4.13*.

Table 4.13 Progression of the accidental pollution of waters

Year	Number of recorded accidental cases	Accidental pollution of					
		Surface waters			Groundwaters		
		Total number	Drinking water resources	Transboundary water courses	Total number	Pollution	Endanger
1997	109	63	0	6	46	14	32
2000	82	55	2	9	27	3	24
2005	119	66	2	5	53	2	51
2006	151	94	0	3	57	6	51
2007	157	97	1	4	60	4	56
2008	102	49	0	6	53	4	49

The most frequent reasons of accidents in the year 2008 were as follows: transport (38 cases), human factor (10 cases), unacceptable status of facilities (19 cases) and transportation of substances harmful to waters (6 cases). In high number of cases the reason was not identified (12 cases). Oil substances and waste waters belong to the most frequent pollutants.

4.2 Groundwaters

4.2.1 Groundwater pollution

The main activities resulting in significant anthropogenic pressures influencing chemical status of groundwater bodies are as follows:

- agriculture,
- industrial production,
- mining,
- households – residential agglomerations without sewage system,
- tourism,
- transport.

Point and diffuse pollution sources of groundwater are distinguished regarding the extent of area surface. Significant pressures on surface water described in the chapter 4.1 act as significant pressures also for groundwater bodies in parallel.

Point pollution sources

Each source for which leakage of pollutants into soils and groundwaters can be foreseen, i.e. potential pollution source, or where the leakage was already determined can be considered a point groundwater pollution source, or local source. All activities in the river basin are potential groundwater pollution sources, i.e. all landfills, industrial activities, agricultural activities, municipal sector and others, in addition to contaminated sites (environmental loads).

Point pollution sources, i.e. potential or detected, are recorded by the three following databases:

- KV-ENVIRO (WRI, 2008), containing 13,004 potential point pollution sources. (This database is based on GEOENVIRON (WRI, 2006), containing 9,177 potential point pollution sources – 2,279 sites, 6,938 landfills and other pollution sources).
- Register of Contaminated Sites¹² (RCS), part of the information system (*Information system*, 2010) developed in the framework of project *Systematic identification of contaminated sites in the Slovak Republic* (Paluchová, 2009). It contains 1,819 sites, split into three sections:
 - probable contaminated sites (part A) – 878 sites,
 - contaminated sites (part B) – 257 sites,
 - remediated and rehabilitated contaminated site, i.e. pollution sources where measures for reduction of contamination and remediation of pollution were already performed or are performed at present (part C).
- Database Integrated Monitoring of Pollution Sources containing pollution sources comprising dangerous substances, for which the State Water Authority imposed an obligation to monitor their influence to the groundwaters. This database is under development since year 2007, and it contains more than 310 pollution sources at present, mostly landfills (WRI, 2008).

Diffuse pollution sources

Diffuse pollution sources are represented by application of numerous plant protection preparations (pesticides) and nitrogen fertilisers in the SR cadastral territories.

Contamination of groundwaters appears as a result of pressures from point and diffuse pollution sources to groundwaters by release to groundwaters or by infiltration of contaminant into groundwater. Pollution of groundwaters is classified according to the type of pollutant as follows:

- pollution by nitrogen substances,
- pollution by pesticides,
- pollution by other chemical substances.

4.2.1.1 Water pollution by nitrogen substances

Pollution from agricultural production and urban waste waters are the main sources of groundwater contamination by nitrogen substances – as described in the chapter 4.1.2.

Consumption of mineral fertilisers is the most important risk factor of penetration/input of nitrogen substances into groundwaters. It is assumed that annual consumption and application of mineral nitrogen was practically unchanged in SR during the last decade, and it fluctuated around app. 40 – 50 kg N/ha per year. Graphical illustration of inorganic nitrogen application development in SR is shown in the *Figure 4.3*.

Organic nitrogen consumption from fertilisers (i.e. from manure, liquid manure, dung-water) shown a decline from 54.2 thousands of tonnes per year to 51.78 thousand of tonnes per year, i.e. by 4.46 % during years 2004 to 2007.

¹² Contaminated site is represented by area polluted by human activity, that pose significant risk to the human health or rock substrate, groundwater and soil, except of environmental damage.

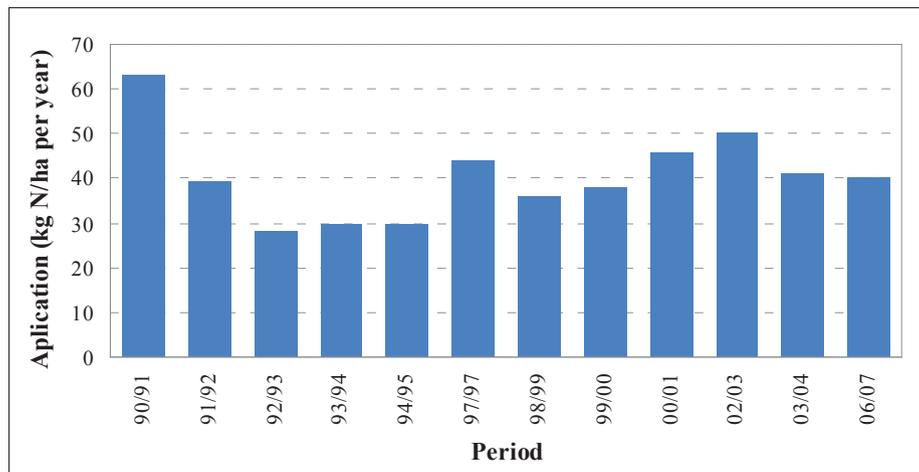


Figure 4.3 Trend in application of inorganic nitrogen fertilisers per 1 ha of agricultural soil

Altered proportion of winter crops in the total agricultural soil area (in compliance with implementation of the Action Agricultural Programme) serves as one of the measurable indicators for evaluation of impact of agricultural activities, documenting the decreased impact of nitrogen fertilisers application. The area of winter crops increased from 36.7 % in year 2004 up to 39.2 % in year 2007, indicating a positive development trend in releases of nitrogen (as nitrates) into the groundwaters during winter periods.

4.2.1.2 Water pollution by pesticides

Diffuse transport from agricultural production resulting from application of plant protection products serves as a source of groundwater contamination by pesticides, by precipitation infiltration, drainage (app. 90.0 %), or to a lesser extent by impacts from point sources (storage and handling facilities, storage of obsolete pesticides etc.).

Application of plant protection products in SR is regulated by the Act No. 193/2005 Coll. on plant protection care, as amended, and Resolution of the Government of the Slovak Republic No. 373/2008 Coll., setting out the requirements for introduction of plant protection products to the market, as amended, as well as the Regulation of the Ministry of Agriculture of the Slovak Republic (MoA SR) No. 256/2008 Coll., setting out details on plant protection products and other preparations, and its amendment – Regulation No. 310/2009 Coll. Council Directive 91/414/EEC concerning the placing of plant protection products on the market is implemented by the above mentioned legislation. Registered plant protection products are enlisted in the Journal of MoA SR on the annual basis.

Application of pesticides is significantly lower when compared with the other EU member countries (lower than EU average). An overview of pesticide consumption since year 1991 is illustrated by the Figure 4.4.

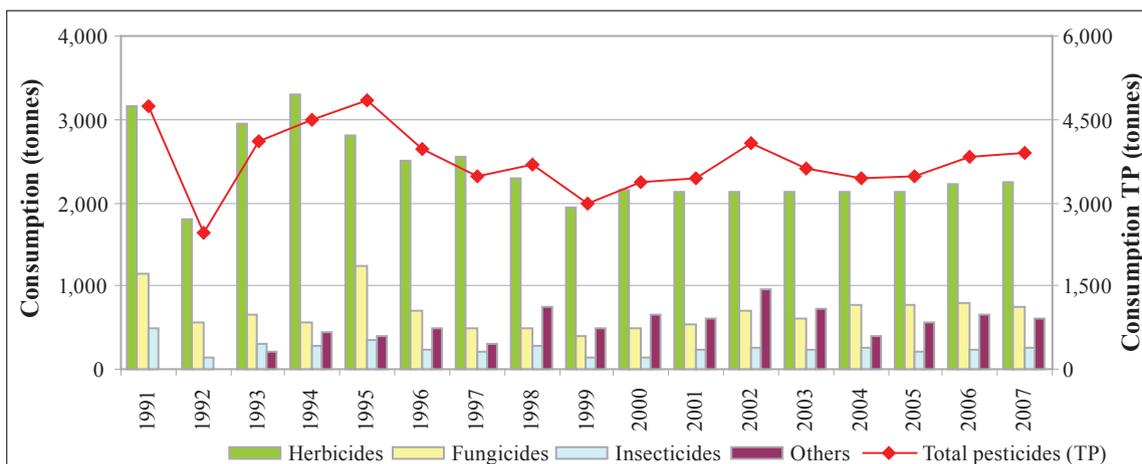


Figure 4.4 Overview of consumption of pesticide active ingredients for plant protection in the agricultural production in SR

Source: CCTIA, Enviroportál

Application of plant protection products reached 0.5 – 1.5 kg per ha (maximum up to 2.0 kg per ha) in SR during years 2002 – 2007.

4.2.1.3 Water pollution by other chemical substances

Groundwater contamination by the other chemical substances is caused mostly by point pollution sources (landfills, handling areas, industrial enterprises, contaminated sites etc.), only in the case of large areas of certain enterprises a diffuse source can be considered. Potential and detected pollution sources are recorded in the databases listed in the chapter 4.2.1. List of real contaminated sites (part B of the Register of Contaminated Sites).

The following contaminants polluting groundwaters in SR were identified in the framework of risk analysis: sulphates (SO_4^{2-}), chlorides (Cl), arsenic (As), atrazine (AT), trichloroethene (TCE), tetrachloroethene (PCE).

4.2.2 Groundwater quantity

Pursuant to the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll., all waters located under the earth surface in the saturation zone and in the direct contact with soil or subsoil, including groundwaters serving as medium for accumulation and transport and exploitation of earth energy from rock layers are considered groundwaters.

Generally, the following can be considered as the most significant potential pressures from their impact to the quantitative groundwater status point of view:

- groundwater abstraction,
- water transfers,
- artificial recharge,
- discharge of waters into groundwaters.

Groundwater abstraction

Exploitation of groundwaters in Slovakia in accordance with the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll., and pursuant to the executive regulation of MoE SR No. 221/2005 Coll., setting out the details on determination of appearance and evaluation of surface water and groundwater status, on their monitoring, keeping of evidence and water balance data is subject to reporting obligation in the case when groundwater abstraction from a single water resource exceeds 15,000 m³ per year, or 1,250 m³ per month. Those, who uptake groundwater above the mentioned limit value are obliged to report data on groundwater abstraction, that form a basis for national evidence of groundwater exploitation and processing of water balance. Each recorded groundwater abstraction was assigned to groundwater bodies of quaternary sediments and groundwater bodies of pre-quaternary rocks, for the needs of inventory of the pressures to the groundwater bodies.

Exploitation of groundwaters in the bodies of geothermal waters was not evaluated in the framework of processing of the first plan of the river basins, because the central register of users and exploitation of geothermal waters is not developed.

1,517 of legal bodies using groundwater of 5,468 groundwater resources in Slovakia were recorded during year 2007. Total abstraction of groundwaters reached 11,438.26 litre per second during year 2007. Specification of abstraction by the individual groups of users is illustrated in the *Figure 4.5*. History of changes in groundwater abstraction is documented in the *Table 4.14*.

■ Identification of significant pressures

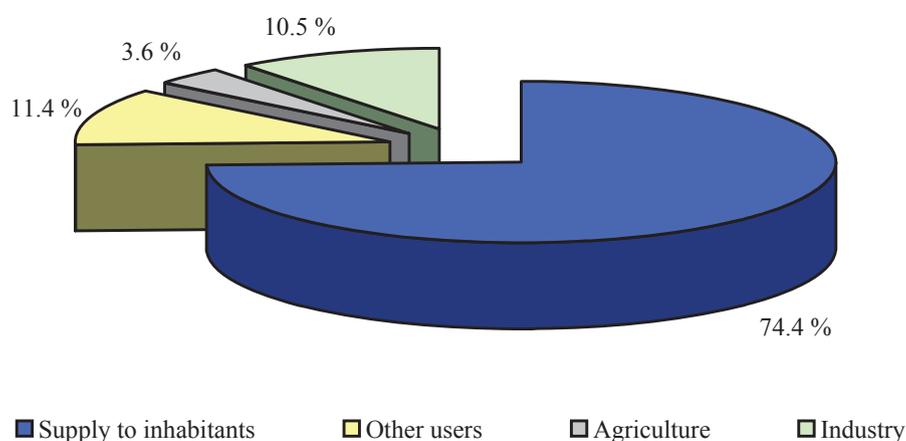


Figure 4.5 Share of abstracted groundwater according to the groups of users – year 2007

Table 4.14 History of groundwater abstraction in SR in the period of years 1989 – 2007

Year	Public water supplies	Food production industry	Other industries	Agriculture, animal production	Agriculture, plant production	Social needs	Other uses	Total
	litre per second							
1989	16,498.80	590.40	3,335.20	1,131.00	58.80	386.20	216.20	22,216.60
1990	17,555.10	560.70	3,059.80	1,237.10	48.30	467.90	146.80	23,075.70
1995	14,547.39	384.27	2,033.53	680.68	18.13	370.95	261.47	18,296.42
2000	11,188.38	321.23	1,177.18	446.78	18.12	432.99	632.66	14,217.34
2005	9,159.87	288.25	856.75	308.82	95.07	279.72	878.98	11,867.46
2006	8,836.13	295.62	852.34	275.80	94.96	340.15	970.20	11,665.20
2007	8,513.87	311.59	891.32	267.84	146.25	333.44	973.95	11,438.26

Artificial recharge

Artificial recharge does not represent a significant anthropogenic pressure that could influence the quantitative status of groundwater bodies in the territory of Slovakia.

Discharge of waters into groundwater

No discharge of waters into groundwater that could influence the quantitative status of groundwater bodies was recorded.

5 Monitoring network, ecological status/potential and chemical status

Programme for Monitoring of Water Status in Slovakia forms a basic planning document for performance of water status monitoring in order to meet the WFD requirements.

Legislative framework for proposals of monitoring programmes was created by adoption of MoE SR Regulation No. 221 of April 29, 2005, setting out the details on determination of appearance and evaluation of surface water and groundwater status, on their monitoring, keeping of evidence and water balance data. Pursuant to this regulation, monitoring programmes cover also monitoring of amounts of surface water and groundwater since year 2006.

Programme for Monitoring of Water Status in Slovakia for Period of Years 2008 – 2010 in accordance with the WFD requirements was elaborated during year 2007, and it is published on WRI web page, folder WFD. It is updated by amendments. Pursuant to the MoE SR Regulation No. 221/2005 Coll., monitoring programmes are compiled for each river basin district, in the following structure:

- surface water,
- groundwater,
- protected areas.

Monitoring programme is approved by the operative meeting of minister of environment of the Slovak Republic.

5.1 Surface waters

5.1.1 Monitoring network

Surveillance and operational monitoring – surface waters – rivers

The principles of monitoring network proposals are on a general level described in the document Methodology for proposals of water monitoring programmes in accordance with the WFD in the territory of Slovakia and they are further developed in the documents:

- Water Status Monitoring Programme in Year 2007,
- Water Status Monitoring Programme for Period of Years 2008 – 2010.

Surveillance and operational monitoring – 2007

Due to insufficient financial resources for the water monitoring purposes, a principle was adopted that the surveillance monitoring will be spread to the time period of minimum three years (2007 – 2009), using rotational monitoring approach.

In summary, 85 sampling sites were investigated in year 2007, 57 out of them belonging to the surveillance monitoring and 67 to the operational monitoring (part of sampling sites were monitored in parallel for the purposes of surveillance and operational monitoring). The number of sampling sites for both, surveillance and operational monitoring in the DRBD and in the VRBD are shown in the *Table 5.1*.

Surveillance and operational monitoring – 2008

Monitoring network of the surveillance and operational monitoring in year 2008 when compared with year 2007 expanded to 241 sampling sites, 102 out of them being monitored in the framework of surveillance monitoring, and 199 in the framework of operational monitoring. Part of sampling sites was monitored in parallel for the purposes of both, surveillance and operational monitoring in that year. Number of sampling sites of the surveillance and operational monitoring in the river basin districts of Danube and Vistula are shown in the *Table 5.1*.

List of investigated parameters is shown in the Annex 3 to the Water Status Monitoring Programme for the Period of Years 2008 – 2010.

Monitoring for the purpose of identification of reference conditions is understood in relation to its scope as a component of the surveillance monitoring. As not all quality elements are monitored in this category for the individual sampling sites, they are determined as a separate group of sampling sites for the purposes of the river basin district management plans that fall under the surveillance monitoring. Monitoring for the purpose of determination of reference conditions was performed in year 2008 in 68 sampling sites. The list of investigated parameters is shown in the Annex 4 to the Water Status Monitoring Programme for the Period of Years 2008 – 2010.

Table 5.1 Overview of number of sampling sites in the framework of surveillance and operational surface water monitoring during period of years 2007 and 2008 (without reference sites)

River basin district	Monitoring type	Number of monitored sampling sites in year		
		2007	2008	2007-2008*
DRBD	Surveillance	54	96	97
	Operational	62	190	190
	Total			230
VRBD	Surveillance	3	6	6
	Operational	5	9	9
	Total			11
SR total	Surveillance	57	102	103
	Operational	67	199	199
	Total			241

Note: *Part of sampling sites was monitored for the purposes of both, surveillance and operational monitoring in parallel.

Surveillance and operational monitoring – surface waters – water bodies with modified category

Principles for proposals of monitoring network are defined in the Water Status Monitoring Programme in Year 2007 – monitoring of lakes. Monitoring was performed according to the reduced version of Monitoring Programme in Year 2007 – only 12 surface water bodies with modified category were monitored out of the total number of 23 water bodies. Surveillance monitoring was performed in all 23 surface water bodies with modified category in year 2008 in the extent and frequency described in the Annexes 9, 10 and 11 to the Water Status Monitoring Programme for the Period of Years 2008 – 2010.

Surveillance and operational monitoring – surface water quantity

Monitoring network of the surface water quantity comprises water measurement stations where the following quantitative parameters are recorded: water level, water temperature, ice related phenomena during the winter period, water flow is calculated (by means of discharge curves), water is sampled for investigation of water turbidity (content of suspended sediments), and direct measurements are performed that are necessary for creation and updating of measurement curve.

Monitoring of surface water in the network of 413 measurement stations was performed in year 2007 where water level was observed, and in 398 stations also water flow was recorded, in 394 stations water temperature was measured and in 18 stations samples were taken and water turbidity was evaluated (content of suspended sediments).

Localisation of sampling sites of the surveillance and operational monitoring for the purposes of water status and quantity of surface water evaluation, including reference sites is illustrated in the *Map 5.1* (see the *Annex*).

5.1.2 Ecological status, ecological potential and chemical status of surface water

Evaluation of status of surface water bodies is based on the investigation of their ecological status or ecological potential, and of their chemical status.

Biological quality elements that have a priority position in compliance with the basic principle and idea of WFD are the basis of evaluation of ecological status of the surface water bodies – aquatic communities sensitively and synergically adopt all changes of the water environment. Reaction of the organisms to the changes of the environment is reflected in the change of their structure and function.

Physico-chemical quality elements and hydromorphological quality elements serve as a supporting elements for water based organisms. Physico-chemical quality elements are split into general physico-chemical parameters (12) and specific synthetic and non-synthetic substances (29) relevant for Slovakia.

Classification schemes on the national level were prepared for biological quality elements as well as for supporting quality elements. Biological classification schemes are type specific and they involve also potential pressures (stressors). The extent of affection is expressed by metrics (indices) for the individual biological quality elements, their number fluctuates and the metrics (variable number for the individual types) are transformed to the ecological quality ratio (EQR) for the individual limits of ecological status classes. Fish were not included into the evaluation of ecological status, as classification schemes on the national level nor European level were not elaborated, yet. The ecological status is assessed in the relation to the reference value (i.e. to the status of surface water body of certain type, without or with only minimum anthropogenic affection).

Classification of ecological status/potential will be issued in a resolution of the Government of the Slovak Republic that will contain all information needed for the classification.

Specific pollutants serve as a basis for assessment of chemical surface water status that are defined as pollution caused by priority substances. EQS are applied during their assessment in compliance with the Directive 2008/105/EC. Moreover, requirements of the Commission Directive 2009/90/EC laying down, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, technical specifications for chemical analysis and monitoring of water status were considered during the assessment.

Ecological potential was determined according to the principles of WFD for HMWB and AWB. The basic principle of determination of ecological potential is based on type specificity and estimate of significance of modifications in comparison with the maximum ecological potential that represents reference value in the case of HMWB/AWB. Determined ecological potential is further compared with the limit values shown in the classification schemes.

Evaluation of the ecological status/potential

1,760 surface water bodies were evaluated totally in Slovakia (including water bodies with changed category - from flowing to stagnant waters, 53 out of them being classified as heavily modified (30 flowing waters and 23 with changed category), and seven as AWB. Evaluation of ecological status or potential of surface water bodies was performed on the basis of monitoring results from years 2007 – 2008 in 217 water bodies. Other water bodies were evaluated only on the basis of updated risk analysis.

Total number of water bodies classified into the individual ecological status categories in the river basin districts of SR is shown also in the *Table 5.2*.

Table 5.2 Classification of ecological status/potential of surface water bodies in SR – years 2007 – 2008

River basin district	Water body status				
	high	good	moderate	poor	bad
	Number				
DRBD	426 25.4%	630 37.6%	563 33.6%	51 3.0%	7 0.4%
VRBD	61 73.5%	5 6.3%	16 19.3%	1 1.2%	0 0%
SR total	487 27.7%	635 36.1%	579 32.9%	52 3.0%	7 0.4%

More objective evaluation of the ecological status/potential is based on the length of water bodies (see the *Table 5.3*).

Table 5.3 Length of water bodies of the individual classes of ecological status/potential in SR

River basin district	Ecological status (km)				
	high	good	moderate	poor	bad
DRBD	576.60	68.70	202.55	54.10	0
VRBD	3,205.85	6,414.29	7,398.23	995.45	130.40
SR total	3,782.45 19.9%	6,482.99 34.0%	7,600.78 39.9%	1,049.55 5.5%	130.40 0.7%

It is obvious from the above mentioned results that high or good ecological status or potential was determined in 63.8 % of the total number of water bodies in SR. As regards the length of water bodies it represents 53.8 % (10,265.44 km). Relatively high number of water bodies was determined as having moderate status/potential – 32.9 %, representing length 7,600.78 km. Poor and bad status was recorded in 3.4 % of water bodies – with length 1,179.95 km.

Moderate status/potential of water bodies was determined in up to 32.9 % (579 water bodies). In 485 water bodies the moderate status/potential was determined according to the risk analysis (in sites where monitoring was not performed during years 2007 – 2008). In 95 water bodies the moderate status/potential was determined on the basis of monitoring.

Moderate status/potential was determined in 16 water bodies according to the exceeded EQS for relevant non-synthetic substances (Cu, Zn, As), and in three water bodies exceeded EQS for relevant synthetic substances (bisphenol A; 4-methyl-2,6-di-tercbutylphenol). In additional 83 water bodies the moderate ecological status/potential was determined according to the biological quality elements (benthic invertebrates, macrophytes and phytobenthos).

Poor ecological status/potential was determined totally in 52 water bodies. In 15 water bodies such ecological status/potential was determined on the basis of risk analysis, in the others due to the results of monitoring (biological quality elements, only in two water bodies according to the relevant synthetic (4-methyl-2,6-di-tercbutylphenol) and non-synthetic substances (Zn).

Bad ecological status was determined in 7 surface water bodies. Two of them were determined according to the risk analysis, the other water bodies were evaluated on the basis of monitoring results, mostly on the basis of benthic invertebrates and macrophytes.

Evaluation of chemical status

Monitoring of priority substances in 132 water bodies was performed in years 2007 and 2008. The extent of monitored parameters and monitoring frequency varied. All priority substances according to the Directive 2008/105/EC were not monitored in most of monitored water bodies.

Evaluation of chemical water status comprised the assessment of presence of priority substances in the surface water bodies. The compliance of monitoring results with EQS represents compliance with the requirements for good ecological status. In the case of absence of 2008 monitoring results, results from year 2007 were accepted. When measured data were not available, evaluation of water body was left as it was performed on the basis of risk analysis. When results from multiple sampling sites of the same water body are available, representative sampling sites were preferably used for evaluation of chemical status. Moreover, results of chemical status evaluation gained in the framework of bilateral agreements for transboundary waters were considered.

It can be stated on the basis of the performed evaluation that good chemical status was identified in 1,674 water bodies (95.0 %) out of the total number of 1,760 water bodies, and in 86 water bodies water did not achieve good chemical status.

Good chemical status was reached in 17,033.8 km, representing 89.4 % out of the total length of 19,046.2 km of surface water bodies. An overview of chemical status evaluation results of the surface water bodies per individual river basin district in SR is shown in the Table 5.4.

Table 5.4 Evaluation of chemical status of water bodies in SR

River basin district	Water bodies achieving good chemical status		Water bodies not achieving good chemical status	
	number	length (km)	number	length (km)
DRBD	1,594	16,246.95	83	1,897.49
VRBD	80	786.85	3	115.10
SR total	1,674	17,033.80	86	2,012.59
	95.0 %	89.4 %	5.0 %	10.6 %

36 out of the total number of 86 water bodies not achieving good chemical status were determined on the basis of risk analysis. For the other 20 water bodies monitoring results of priority substances were available. It can be stated on the basis of the results that in 19 water bodies good chemical status was not achieved due to exceeding of EQS for non-synthetic priority substances (metals). In 22 water bodies non achievement of good chemical status was caused by increased concentrations of synthetic organic substances with most frequent appearance of bis(2-ethylhexyl)-phthalate (DEHP). Moreover, metals and organic substances are present in 11 water bodies in increased concentrations (exceeding EQS values).

Good chemical status was determined on the basis of risk analysis in 1,593 water bodies, and on the basis of monitoring only in 79 water bodies.

5.1.3 Evaluation of water volume in surface water courses

Evaluation of water volumes in surface water courses is based on monitoring of quantitative parameters in water flow measurement stations. It serves as a basis for evaluation of hydrological regime, water balance, identification of modification extent, identification of significant pressures, evaluation of water status etc.

Total precipitation reached the value of 854 mm, representing 112.1 % of the average value in SR during year 2007, and this year is considered a wet year. Precipitation totals during the individual months of calendar year 2007 are documented by the Table 5.5.

Table 5.5 Average precipitation totals in the SR territory during year 2007

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
Mm	101.1	58.0	70.0	6.0	82.3	92.0	58.4	94.4	132.5	53.7	66.2	39.3	854.0
% of standard	220	138	149	11	108	107	65	117	210	88	107	74	112.1
Surplus (+) Deficit (-)	55	16	-49	6	6	-32	13	0	70	-7	4	-14	92
Character of precip. Period	MV	V	VV	MS	N	N	S	N	MV	N	N	S	V

Note: S – dry, MS – extremely dry, N – normal, V – wet, VV – very wet, MV – extremely wet.

The individual months had different precipitation character. January (220.0 % of respective standard) and September (210.0 % of respective standard) belonged to extremely wet months. April was an extremely dry month – when only 6 mm of rain fall was recorded in SR territory, representing only 11.0 % of the standard. Precipitation surplus of 92 mm was recorded in general assessment of year 2007.

Water balance of SR during year 2007 was positive. With the only exception of balance profile Turiec – mouth (sub-basin of river Slaná), the balance situation was active during whole year – it means that the water flow in the water courses were higher than the demands minimally by 10 %.

General water abstraction decrease was recorded in year 2007 when compared with year 2006, both in surface water abstraction as well as discharge to surface waters. The abstraction decreased from 24.193 m³.s⁻¹ to 21.868 m³.s⁻¹ and discharge decreased from 23.837 m³.s⁻¹ to 19.923 m³.s⁻¹. Decreased abstraction of surface water represents 16.6% (from 12.528 m³.s⁻¹ to 10.448 m³.s⁻¹), and 2.1% in groundwaters.

Number of surface water users during year 2007 (1,012) was lower than in the previous year (1,038). Out of them, number of realised exploitations – so called active users increased from 970 to 975, and the number of passive users decreased from 68 to 37. Detailed information on hydrological balance evaluation are shown in Hydrological Yearbook 2007 and in the Annual Report of Water Management Balance 2007. These documents are publicly available.

5.1.4 Final designation of heavily modified water bodies

Surface water bodies classified as having poor ecological status due to hydromorphological changes caused by human activities can be under certain conditions (specified in the two identification tests) defined as HMWB or AWB, with inherent classification system.

Preliminary identification of HMWB and AWB was performed in the framework of phase II of WFD implementation works (see the chapter 1). Hydromorphological modifications of the water bodies were identified in the framework of this phase, and on the basis of their screening they were categorised to potentially heavily modified (HMWB candidates), heavily modified, natural and artificial ones.

Testing process was applied to all surface water bodies preliminary defined as HMWB, as well as HMWB and AWB candidates – 876 water bodies in total. According to the expert demands and time requirements of the process of final HMWB determination, due to high number of surface water bodies (app. 50 % of surface water bodies), as well as due to filling of data gaps for small water courses the following were tested during the first planning cycle:

- All surface water bodies preliminary delineated as HMWB in large and medium water courses with catchment area higher than 100 km²,
- Surface water bodies preliminary delineated as HMWB in small water courses that are significant water management courses according to the MoE SR Regulation No. 211/2005 Coll., and in small water courses significant for fish life. Resulting list of small water courses was subject to expert ichthyologic assessment resulting in categorisation of water courses from the point of view of necessity of their testing and prioritisation into three groups: priority No. 1, priority No. 2 and priority No. 3. This categorisation resulted in testing of only those surface water bodies in small water courses that were classified as priority No. 1, and part of surface water bodies from priority No. 2 during the first planning cycle.

Totally 203 water bodies were tested in the whole SR territory during the first planning cycle. The other surface water bodies, preliminary delineated as HMWB in small water courses will be considered as natural surface water bodies with significant hydromorphological pressures for the first planning cycle. Nevertheless, they will be tested during the second planning cycle on the basis of revised hydromorphological modifications and monitoring results.

An overview of final identification of surface water bodies as HMWB and AWB for the first planning cycle (as of October 2009) in the framework of river basin districts is shown in the *Table 5.6*. Water bodies marked as HMWB and AWB candidates that were not tested in the first planning cycle are considered as natural water bodies for this cycle – it means that they will be evaluated as natural water bodies.

Water bodies identified as HMWB and AWB candidates are considered as water bodies where a potential risk of failure to achieve WFD objectives exists until year 2015 due to the hydromorphological modifications. Also tested water bodies will remain as the risk ones unless measures proposed during the testing procedure will not be implemented.

Table 5.6 Overview of preliminary and final HMWB and AWB determination

River basin district	WB total	Preliminary identification		Tested water bodies		Final identification for the 1 st planning cycle		
		HMWB	AWB			HMWB	HMWB with changed category	AWB
	Number	Number	Number	Number	%	Number	Number	Number
DRBD	1,677	836	50	195	22	30	23	7
VRBD	83	40	0	8	20	0	0	0
SR total	1,760	876	50	203	22	30	23	7

Note: Status as of October 2009.

53 water bodies were delineated as HMWB and 7 water bodies as AWB during the first planning cycle, all of them being localised in the DRBD.

Hydromorphological changes in the water bodies identified as HMWB were performed in order to implement flood protection measures – in 40 water bodies, the second specific use pattern is ensuring an easy

abstraction for drinking purposes or industrial and agricultural purposes (32 water bodies). The third pattern is electric energy production – 15 water bodies.

AWB mostly provide flood protection and electric energy production. Navigation is provided by only one AWB – inlet channel – discharge channel (waterwork Gabčíkovo).

Total length of HMWB and AWB in the SR territory equals – 1,014.94 km, i.e. 5.3 % from the total length of water bodies in SR. The highest proportion of HMWB and AWB is documented in sub-basin of river Váh (DRBD).

Ecological potential was defined for each water body delineated as HMWB/AWB (see the chapter 5.1.3). Reference conditions and classification schemes characteristic for the given water body type are usually used for its definition. While this method can not be used, maximal ecological potential (MEP)/good ecological potential (GEP) is derived from the detected water body status, as well as from the foreseen response of mitigation measures to the water status.

5.2 Groundwaters

5.2.1 Monitoring network

Groundwater quality monitoring

Groundwater quality was monitored in 541 sites during year 2007, surveillance monitoring was performed in 130 and operational monitoring in 411 locations. Groundwater samples were taken mostly in observation bore-holes. In addition, samples were taken also from springs in order to complement the data on groundwater status, mainly in pre-quaternal groundwater bodies. The list of monitored sites and extent, as well as monitoring frequency are shown in Annexes 6a, 6b, 6c, 6d of the Water Status Monitoring Programme for the Year 2007 (reduced version). Localisation of sampling sites is shown in the *Map 5.2* (see the *Annex*).

Groundwater quantity monitoring

Groundwater quality was monitored in 1,505 observation sites during the year 2007. 360 spring sites and 1,145 observation bore-holes were monitored out of the mentioned total number. Monitoring in the year 2007 was performed in accordance with the original (optimal) monitoring programme proposal. The principles of monitoring network proposal are described in the Water Status Monitoring Programme for the Year 2007. List of monitored sites and measured parameters for the individual measurement points is shown in the Annex 8 Proposal of groundwater quantitative monitoring structure for the year 2007 of the mentioned monitoring programme. Localisation of sampling sites is illustrated in the *Map 5.2* (see the *Annex*).

5.2.2 Chemical status of groundwaters

As requested by the Directive 2006/118/EC of the European Parliament and of the Council on the protection of groundwater against pollution and deterioration, groundwater chemical status evaluation should be performed for those water bodies that have been identified as a risk ones from the point of view of failure to achieve good chemical status until year 2015 in the framework of characterisation performed in compliance with the Article 5 WFD. Uncertainties were defined during identification of such risks in the National Report 2005, especially incomplete information/data gaps and uncertain assessment, therefore chemical status of groundwater was necessarily performed in all 75 groundwater bodies – 16 quaternary and 59 pre-quaternal. Geothermal water bodies were not evaluated.

Each groundwater body was evaluated from the point of view of achievement of good chemical status as a whole. This evaluation was performed on the regional level. Chemical status of groundwater bodies was evaluated by a procedure adjusted to the conditions of existing input data, conceptual model of groundwater bodies (including characteristics of permeability, hydrogeochemical properties of rock substrate circulation, vulnerability of groundwater and general groundwater flow direction in the water body), potential point and diffuse pollution sources. Quaternary groundwater bodies were evaluated on the basis of groundwater quality monitoring results of the year 2007, as well as risk assessment of groundwater bodies performed in the framework of characterisation of groundwater bodies from the year 2004. Pre-quaternal groundwater bodies were evaluated on the basis of groundwater quality monitoring results of the year 2007.

The mentioned evaluation is based on the comparison of (calculated) average value of measured data for each monitored site with quality standards for nitrates and pesticides determined at the EU level, and the threshold values determined on the national level for each pollutant and pollution parameters – detected in the individual groundwater bodies in more significant amount causing more extensive groundwater contamination. The threshold values were determined as a median between background and reference value for the following parameters of pollution/groundwater components: NO₃⁻, Na, Fe, Mn, Cr, Cu, Se, As, Cd, Pb, Hg, NH₄⁺, Cl⁻ and SO₄²⁻. Data from standard/norm for drinking water were used as reference values. Threshold values for synthetically produced organic substances – trichloroethene and tetrachloroethene – were defined at the half-level of the reference value of the standard/norm for drinking water. An overview of particular threshold values in parallel with determined background and reference values for quaternary and pre-quaternary groundwater bodies in SR introduced D. Bodiš et al. (2008) in his report and they will be issued as a resolution of the Government of the Slovak Republic.

Water bodies where exceeded quality standards and threshold values were not measured in any of monitoring sites (except of natural levels of Fe and Mn) were classified as having good chemical status. In the case when the quality standards or threshold values were exceeded in one (or more) monitoring sites, additional evaluation (testing) of the water bodies was performed in order to investigate whether the pollution was significant. The result was subject to additional hydrogeochemical analysis that revealed decision on classification to the water bodies with good or poor chemical status.

The following classification resulted from the evaluation of groundwater chemical status of the total number of 75 groundwater bodies in Slovakia:

- 13 groundwater bodies are in poor chemical status – 7 quaternary bodies and 6 pre-quaternary bodies,
- 62 groundwater bodies are in good chemical status.

Good chemical status was determined in 82.7 % groundwater bodies, representing an area of 45,527.00 km², i.e. 76.4 % out of the total area of both, quaternary and pre-quaternary water bodies.

Poor status was classified in 17.3 % of groundwater bodies, i.e. 14,101.00 km² – 23.6 % of the total area of water bodies.

Summary of chemical status evaluation in the groundwater bodies in SR is presented by the *Table 5.7*.

Table 5.7 Summary of chemical status evaluation in the groundwater bodies in SR

SR water bodies	Chemical status classification				Total area
	good		poor		
	km ²	%	km ²	%	
Quaternary	6,081	57.1	4,565	42.9	10,646
Pre-quaternary	39,446	80.5	9,536	19.5	48,982
SR Total	45,527	76.4	14,101	23.6	59,628

In spite of the fact that 62 groundwater bodies were classified as having good chemical status as a whole, potential point pollution sources/contamination or polluted/contaminated areas were detected in these water bodies on the basis of updated chemical analysis of pollution sources. It is necessary to prevent or to reduce input of pollutants into the groundwaters in order to avoid deterioration of good chemical status in these groundwater bodies. It is necessary to perform the assessment of groundwater pollution on the local level in the pollution source itself, as well as evaluation of potential and/or existing leaks of pollutants into soil and groundwater for this purpose. Such assessment, that should be ensured by the potential/existing polluter (by means of state water administration authority or on the legal basis) according to the EC document *Guidance on the Application of the Term Direct and Indirect Inputs in the Context of the Groundwater Directive 2006/118/EC* was not performed during the first planning cycle.

Testing of pollution impacts to the surface waters, impact of pollution to the terrestrial ecosystems, impact of pollution to the exploited water resources or other penetration into the groundwater bodies was not performed due to data gaps, missing information and missing methodical instructions and criteria. Moreover, as the criteria for identification of significant and sustained upward trends and for definition of starting points for trend reversals were not determined, evaluation of significant and sustained upward trends of pollutant, group of pollutants or pollution indicator in the groundwater bodies was not performed. These works will be done in the next planning cycle.

5.2.4 Quantitative status of groundwaters

Evaluation of quantitative status of groundwater bodies is an assessment of impacts of documented pressures (as described in the chapter 4.2.2) to the groundwater body as a whole. It represents solely the assessment of groundwater abstraction in the territory of Slovakia. The assessment process of groundwater bodies quantitative status evaluation in Slovakia respects the requirements of EU guidance on groundwater status and investigation of trends as published in the year 2008. It is based on the basic requirement of the WFD, setting out the stabilised groundwater level regime, or spring capacity as a basic parameter of quantitative status, and it broadens the assessment process by the following testing criteria:

- groundwater volume balancing,
- evaluation of groundwater regime changes (application of monitoring programme results),
- evaluation of impact of groundwater abstraction to the status of surface water bodies,
- evaluation of the extent of groundwater abstraction to the terrestrial ecosystems dependent on groundwaters.

Groundwater bodies (geothermal structures) were not evaluated in the first river basin management plan due to the absence of data on their exploitation potential.

Final evaluation of quantitative status of groundwater bodies

Results of preceding 4 evaluations were summarised in order to evaluate quantitative status of groundwater bodies in quaternary sediments and in pre-quaternary rocks. Five groundwater bodies were classified as having poor quantitative status in SR (see the *Table 5.8*).

Table 5.8 Final evaluation – poor quantitative status of groundwater bodies

Water body code	Water body name	Evaluation of groundwater				
		A	B	C	D	E
SK1001200P	Body of intergranular groundwaters of quaternary sediments in Hornád river basin area		●	●		●
SK200030FK	Body of fissure and carst-fissure waters of Pezinok Carpathians in the sub-basin of river Váh	●				●
SK200220FP	Body of fissure and intergranular groundwaters of northern part of Central Slovakia neovolcanites of Hron river basin			●		●
SK200360FK	Body of fissure and carst-fissure groundwaters of north-eastern part of Nízke Tatry, Váh river basin			●		●
SK200380FP	Body of fissure and intergranular groundwaters of neovolcanites of Pokoradzská Table, Hron river basin	●				●

Note: A – balance, B – regime changes, C – impact to the surface water bodies, D – impact on terrestrial ecosystem, E – final evaluation – poor quantitative status.

5.3 Protected areas

Additional requirements for monitoring of their status are defined for the surface water bodies and groundwater bodies included to the protected areas, as needed. These requirements especially comprise the protected areas intended for drinking water abstraction, and the protected areas for protection of animal and plant species and their habitats, as the directives on the basis of which these areas are designated – in contrary to the other directives designating protected areas – do not contain requirements for their monitoring.

Surface water and groundwater bodies intended for abstraction of drinking water, and drinking water quality

In protected areas of surface water and groundwater bodies intended for drinking water abstraction providing more than 100 m³ of water per day all priority substances released into the water body, and all other substances

released in significant quantities than could affect the status of water body (controlled under provisions of the Council Directive 98/83/EC on the quality of water intended for human consumption) should be monitored (in compliance with Annex V WFD). As the monitoring requirements are identical with the other risk water bodies, additional requirements were not included in the monitoring of their status.

Monitoring of surface waters intended for drinking water abstraction falls under operational monitoring that is managed by water course administrator.

Water quality control is performed by public water supply operators according to the Regulation of MoE SR No. 636/2004 Coll., setting out requirements to raw water quality and to investigation of water quality in public supplies. Quality is controlled in the resources (raw water), than during the treatment process, and final drinking water quality in the distribution network.

Drinking water quality control is performed according to the Resolution of the Government of the Slovak Republic No. 354/2006 Coll., setting out the requirements to water intended for human consumption, and water quality control of water intended for human consumption, that determines water quality parameters and their limit values (transposition of the Council Directive 98/83/EC on the quality of water intended for human consumption). Public Health Authorities control water quality in the end user. Information on drinking water quality in public supplies in selected region can be delivered by the operator, respective regional public health authority or MoE SR.

SR reported to the EC by submission of the Drinking Water Quality Report of Years 2005 to 2007 in February 2009. The report was elaborated by Public Health Authority SR and Water Research Institute on the basis of operation data from water works companies, and data from Ministry of the Health of the Slovak Republic. Data on water quality were reported according to the large (supplying more than 5,000 inhabitants) and small water supply zones (50 to 5,000 inhabitants). 94 large water supply zones were designated in SR for period of reported years 2005 to 2007. More than 97.8 % of samples complied in microbiological parameters during years 2005 to 2007. More frequent exceeding of limit values for microbiological parameters was related to reasons of insufficient water treatment and reasons related to insufficient protection of accumulation area. The reasons resulted in request of corrective measures lasting not longer than 30 days. More than 99.85 % of samples complied in parameter arsenic during years 2005 to 2007, more than 99.4 % of samples in parameter antimony, more than 94.5% of samples in parameter iron, in parameter manganese more than 99.1% samples and in parameter nitrates more than 99.7 % of samples. Parameters benzene, benzo(ap)ylene, boron, bromates, cadmium, chromium, copper, cyanides, dichloroethane, fluorine, mercury, pesticides, polycyclic aromatic hydrocarbons, selenium, trihalomethanes and chlorides did not exceed limit values in any supplied areas during years 2005 – 2007. The total indicative dose was below the limit value in more than 97.9 % of samples.

Vulnerable zones

Development of monitoring network complying with the monitoring programme of protected areas according to the Article 8 WFD and according to the § 5 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll. started in year 2007, and supplement of 702 new observation sites was proposed in order to reach 1 monitoring point in each municipality cadastre in vulnerable zone as a minimum requirement. Localisation of sampling sites is shown in the *Map 5.2* (see the *Annex*).

As the implementation of monitoring system was finalised in the year 2008, results of groundwater quality investigation by this system could not be used for re-evaluation of the extent of vulnerable zones (they will be involved in report of year 2012), nor for evaluation of chemical status.

In addition to the mentioned sites also sites aimed at investigation of groundwater level regime were incorporated into the monitoring network (380 sites) and of groundwater quality (310 sites), that are administered by the SHMI. Results of this monitoring will be completed by data from groundwater quality monitoring of water from app. 1,500 wells used for drinking abstraction by the water works companies.

Protected areas of waters suitable for bathing

Monitoring of bathing waters is performed by the Public Health Authority SR in compliance with the Council Directive 76/160/EEC concerning the quality of bathing water, as amended by the Directive 2006/7/EC of the European Parliament and of the Council concerning the management of bathing water quality and repealing Directive 76/160/EEC. This directive sets out the requirements to the quality and monitoring of waters suitable for bathing that are harmonised in all EU countries.

Habitat and species protection areas

Water bodies forming habitat and species protection areas should be involved into the operational monitoring as far as they were identified as a risk ones (on the basis of risk analysis and surveillance monitoring) from the point of view of failure to achieve the environmental objectives. No requirements for complementary monitoring were exerted by the SNC SR for these protection areas during year 2007. Monitoring of surface water and groundwater bodies that form these areas was performed only on the basis of monitoring programme for surface waters and groundwaters.

Water courses suitable for life and reproduction of autochthonous fish species

Monitoring of such waters is involved in the surveillance and operational monitoring of surface water bodies. Pursuant to the Directive 2006/44/EC (and the Resolution of the Government of the Slovak Republic No. 296/2005 Coll.), the acceptable level of water pollution for life and reproduction of fish is assessed according to the guide values (G) and mandatory values (I) – determined individually for the zones of salmonid and for cyprinid fish species.

According to the instructions of the *Technical Support in Relation to the Implementation of the Water Framework Directive 2000/60/EC – User Guide to the WFD Reporting Schemas* (EC – DG Environment, June 2009), the water status is “high” regarding suitability for life and reproduction of autochthonous fish species when the detected concentration of the individual parameters comply with G value and I value, it is “good” – when only I values are met. In the case when water does not comply in any of these criteria – water is not suitable for life and reproduction of autochthonous fish species.

It can be concluded on the basis of surveillance and operational monitoring of surface water bodies that in most cases the water of the basic water courses No. I (listed in the *Table 3.2*) is not suitable for life and reproduction of autochthonous fish species as a result of increased concentrations of N-NO₂ and N-NH₄, or the suitability could not be evaluated due to data lack.

6 Environmental objectives and exemptions

This chapter describes the environmental objectives and exemptions that form inseparable part of the environmental objectives determined according to the Article 4 WFD. Both these institutes were derived from the framework WFD requirements and instructions for their application that were developed in the framework of the EU common implementation strategy. Unequivocal procedure for definition of the objectives and exemptions, nor a manual is not defined by WFD. Environmental objectives and exemptions reflect the regional specificities, data availability and knowledge of the effectiveness of proposed measures.

6.1 Environmental objectives

Environmental objectives of WFD are the core EU legislative documents that allow for sustainable water management with a high level of water environment protection. WFD transposed into the Water Act requires achievement of the environmental objectives until year 2015 for:

- surface water bodies,
- groundwater bodies,
- water dependent protected areas.

6.1.1 Environmental objectives for surface water bodies

Environmental objective for surface water bodies is represented by implementation of measures in order to:

- a) prevent deterioration of surface water body status,
- b) protect, enhance and restore surface water bodies with an objective to achieve good status of surface waters until December 22, 2015,
- c) protect and enhance artificial and heavily modified surface water bodies with an objective to achieve good ecological potential and good chemical status until December 22, 2015,
- d) progressively decrease pollution by priority substances, and to cease or phase out emissions, discharges and losses of priority hazardous substances.

Achieving of good status for surface waters means achieving of good ecological and good chemical status of waters. In order to define the objectives until year 2015 it is necessary to perform the following:

- transformation of normative definitions of the directive to the numerical limit values of good status categories, that is performed on the basis of scientific knowledge; numerical limit values for biological quality elements and for physico-chemical and hydromorphological quality elements will be defined by governmental resolution containing all information necessary for ecological status classification,
- recognition of present situation (described in the chapter 5) and estimate of effectiveness of measures proposed until year 2015,
- consideration of socio-economic impacts of achieving of the objectives that respects the institute of exemptions in the process of proposal of most cost-effective combination of measures – this part relates to the chapters 7 and 8.7, showing the respective analyses.

AWB and HMWB are specific categories of water bodies with their own classification systems and objectives, with different type of exemptions in relation to the requirement of ensuring certain socio-economic services during the process of identification of water bodies as heavily modified or artificial. The objective for such water bodies is to achieve at least good ecological potential and good chemical status. Moreover, traditional exemptions can be applied for AWB and HMWB – postponing of deadlines etc.

6.1.2 Environmental objectives for groundwater bodies

Environmental objective for groundwater bodies is represented by the implementation of measures in order to:

- a) prevent or limit the input of pollutants into groundwater and to prevent deterioration of groundwater body status,
- b) protect, enhance and restore groundwater bodies and to ensure the balance between abstraction

and recharge of their volume with the objective to achieve good groundwater status until December 22, 2015,

- c) reverse significant and sustained upward trend in the concentration of pollutant resulting from human activity with the objective to progressively reduce pollution of groundwater.

6.1.3 Objectives for protected areas

Designated protected areas defined in the § 5(c) of the Water Act including areas intended for protection of habitats and plant and animal species protection – for which maintaining or even improvement of water status are important protection factors – are listed in the chapter 3. Objectives for protected areas are specified by the Article 4(1) WFD as achieving of compliance with all standards and objectives in year 2015 at latest, unless Community legislation determining the individual protected areas does not contain other requirements. It is necessary to respect the objectives resulting from legislative requirements of the individual protected areas during the management of groundwater and surface water bodies that are located in the protected areas or that are functionally interconnected. Generally, while there is no specification of particular requirements for water quality in particular protected area – the objectives are derived from good water quality criteria according to WFD. Improvement of water status in compliance with WFD will basically support also the protection objectives specific for the given protected area. The following chapters illustrate the objectives for the individual protected areas.

Areas intended for water abstraction for human consumption

Pursuant to the Article 7(1) and Article 6(2) WFD, it is necessary that each water body from which water is abstracted for drinking purposes in the volume higher than 10 m³ per day, or it serves for more than 50 persons, will be determined as protected area. Moreover, the Article 7(3) WFD requires ensuring inevitable protection of such water bodies in order to avoid deterioration of their quality and decrease of extension of treatment needed for the drinking water production. Member states can establish safeguard zones for such water bodies. Safeguard zones of water resources intended for human consumption are determined by the § 32 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll. They are defined by the State Water Authority on the basis of binding opinion of the Public Health Authority. The following safeguard zones are distinguished:

- safeguard zone type I. – serves for protection in close vicinity of water abstraction site, or accumulation facility,
- safeguard zone type II. – serves for protection of water resource against threats from more distant locations.

State Water Authority can determine also safeguard zone type III in order to increase the protection of a particular water resource.

Each safeguard zone has defined its own management regime aimed at drinking water protection. The objectives pursuant to the Article 7(3) WFD are met at present, no measures are requested.

Waters suitable for bathing

The Directive 2006/7/EC of the European Parliament and of the Council concerning the management of bathing water quality and repealing Directive 76/160/EEC (revision of the Directive 76/160/EEC) is aimed at the protection of human health and at maintaining or improving of the bathing water quality and of the environment. The requirements for bathing water quality are set out by the Resolution of the Government of the Slovak Republic No. 87/2008 Coll. in compliance with the Act No. 355/2007 Coll. on protection, support and development of public health, as amended.

No serious complications from the point of view of public health requirements leading to health injury of recreants were recorded during recent years. Limit values of bathing water quality parameters were met in vast majority of cases – exceeding was noticed only exceptionally, occasionally and for a short time period.

Revised Directive 2006/7/EC tightens obligatory microbiological standards for bathing waters, and it updates system of management and monitoring. It will allow better prediction of microbiological risks and achievement of high protection degree. Bathing water profiles that should be elaborated for the individual or multiple adjacent waters intended for bathing until March 24, 2011 will contribute to the more complex understanding of relationships between water quality and its potential pollution.

Nutrient sensitive areas

Determination of nutrient sensitive areas is aimed at decreasing of ground and surface waters pollution by nutrients, and at prevention of further pollution increase. These objectives will contribute also to achieving the objectives of surface water and groundwater bodies in accordance with WFD.

Sensitive areas

Determination of a sensitive area results from the implementation of the Council Directive 91/271/EEC concerning urban waste water treatment. Surface water bodies in whole SR territory are sensitive areas. Decrease of surface water pollution by nutrients by means of increased requirements to the treatment of waste waters from agglomerations and agro-food industry is the main objective of this type of protected areas. WWTP of agglomerations with more than 10,000 p.e. in the sensitive areas must ensure increased removal of nitrogen and phosphorus, or the total efficiency of 75 % of phosphorus and nitrogen removal in all WWTPs in the sensitive area should be reached.

Vulnerable zones

Vulnerable zones are agriculturally exploited areas that drain rain waters into surface waters, or they infiltrate into groundwaters where the nitrate concentration is higher than 50 mg/l, or it can be exceeded in a near future. Special management should be applied in designated vulnerable zones – as defined by the MoA SR Regulation No. 199/2008 Coll. on programme of agricultural activities in designated vulnerable zones.

Both types of nutrient sensitive areas can be re-evaluated every 4 years.

Habitat, animal and plant protection areas – Natura 2000 network

Special Protection Areas aimed at bird protection, and Sites of Community Importance aimed at protection of the other rare and endangered plant and animal species and their habitats belong to this group of protected areas.

Protected Birds Sites

Areas for bird protection are designated by the Government of a member country that also assumes the responsibility for maintenance of favourable status of bird species for which this area was designated. 38 proposed Protection Birds Sites are located in the SR territory that were approved by the Slovak Government on July 9, 2003. These sites are sequentially designated by MoE SR regulations. As of September 2008, 21 Special Protection Sites were designated, the rest (17) were not designated yet.

Protected Habitat Sites of European significance

Contribution to the insurance of biodiversity by protection of natural habitats, wild fauna and wild flora on the territory of member state is the main objective. EC approved 381 Slovak sites under European Natura 2000 network in year 2008. These areas will be designated by the individual MoE SR regulations as protected areas or zones of a protected area.

No specific requirements were raised by the SNC SR for water quantity or quality. The measures proposed in the programme of measures for achievement of WFD requirements – especially for pollution reduction and elimination of hydromorphological pressures will support also the objectives of Natura 2000 network.

Surface waters suitable for life and reproduction of autochthonous fish species

Surface waters suitable for life and reproduction of autochthonous fish species were designated by generally binding regulations of the Regional Environmental Offices. The requirements for quality of these waters are set out by the Directive 2006/44/EC of the European Parliament and of the Council on the quality of fresh waters needing protection or improvement in order to support fish life, that will be transposed into the update of the Resolution of the SR Government No. 296/2005 Coll. (under preparation), setting out requirements for quality and qualitative objectives for surface waters, as well as limit values for pollution parameters of waste waters and special waters.

In the case that water does not correspond to required criteria it is necessary to determine whether this finding is a random result, result of a natural phenomenon (flood or another natural disaster), or of a pollution, and to adopt appropriate measures.

6.2 Exemptions

This chapter offers an overview of water bodies that are subject to exemptions – for bodies of surface and groundwater. The exemptions can result from the Article 4(4) WFD – extended deadline, Article 4(5) WFD – less stringent objectives, Article 4(7) WFD – new infrastructure projects. The exemptions should be applied also in cases when the effectiveness of implemented measure(s) will not be expressed in improved status immediately after its (their) implementation. Water bodies are usually affected by multiple effects in parallel, thus, the solution of some of them may not be sufficient for the achievement of requested targets.

6.2.1 Surface waters

An approach to creation of the proposal of measures and the proposal of measures for solving of the individual significant water management problems is described in the chapters from 8.1 to 8.5. Basic measures needed for meeting of requirements of other water directives, basic measures directly resulting from WFD, and supplementary measures necessary for achieving of good water status are proposed in the framework of measures.

Considering the high number of measures requested for solving of the individual water management problems, and for achieving the WFD objectives, it is not possible to implement all of them till the required deadline – from both, technical and economic reasons. Implementation of supplementary measures and measures for improvement of lateral and longitudinal continuity of water courses should be extended to a longer time period.

Exemptions according to the Article 4(4) WFD will be applied for the surface water bodies in the first planning cycle (2009 – 2015) in SR due to above facts, i.e. extending of achievement of good status deadline. Such exemptions can be applied in the case when technical realisation of measures is not possible in the given time period, costs for measure in such short time period would be not feasible, or natural conditions do not allow to achieve the improvement in required time period. In the case of Slovakia a combination of technical unfeasibility of measures in the given time period with economic reasons was applied – financial resources for the implementation of necessary measures during the first planning cycle were not secured. Implementation of the measures will therefore be extended for the next planning cycles (2021, 2027).

Application of exemptions pursuant to the Article 4(4) is necessary also due to the fact that solving of one of the problems in the given water body does not necessarily means achievement of the objective – as the water bodies are usually exposed to multiple pressures. Uncertainties in the present planning cycle form an additional factor underlining necessity of exemptions from the deadline year 2015 – they comprise the following:

- evaluation of present water status that was dominantly performed with low confidence level,
- knowledge of interrelationships between the individual groups of parameters: hydromorphological – biological, biological – chemical, hydromorphological – chemical is not enough explored.

An overview of water bodies for which the exemption is required and the respective reasons are shown in the *Table 6.1*, and they are illustrated in the *Map 6.1* (see the *Annex*). Totally, time exemption is requested for 640 (36.0 %) water bodies in SR with the total length of 9,029.77 km (47.4 %).

Table 6.1 Exemptions from the environmental objectives – year 2015 for the surface water bodies

River basin district	Number of water bodies		Length of water bodies		Type of exemption	Reason
	total	with exemption	total	with exemption		
DRBD	1,677	623	18,144.22	8,773.12	Art. 4(4)	TN + E
		37 %		47 %		
VRBD	83	17	901.95	256.65	Art. 4(4)	TN + E
		20 %		29 %		
SR total	1,760	640	19,046.17	9,029.77	Art. 4(4)	TN + E
		36 %		47.4 %		

Note: TN – technical feasibility of measure exceeds the given time period, E – economic reasons.

6.2.2 Groundwaters

The situation in groundwater bodies is as follows: 13 water bodies do not achieve the objectives of good chemical status and 5 groundwater bodies do not achieve good quantitative status.

Despite the fact that in addition to the basic measures (implemented in agglomerations, agriculture – plant and animal production, industry) supplementary measures will be realised in the water bodies with poor chemical status during the first planning period, it is assumed that the objectives will be achieved after year 2015. This assumption is linked with physico-chemical properties of contaminants, especially degradation rate and sorption capacity, as well as behaviour in the natural environment, pathways of infiltration into groundwaters and delayed impact of their use to the groundwater. It is an extremely lengthy process that will extend year 2015 with a high probability. Necessary application of exemptions from achievement of the environmental objectives until year 2015 result from this fact.

The time exemption according to the Article 4(4) WFD is requested for 13 water bodies in poor chemical status (7 quaternary and 6 pre-quaternary groundwater bodies) for substances: nitrates, and for 1 water body in combination with pesticides (simazine, atrazine) (see the *Table 6.2*).

Also possible impacts of potential pollution sources to the chemical groundwater status based on risk analysis were considered in the evaluation of chemical status. Potential pollutants of the water bodies in poor chemical status are: SO_4^{2-} , Cl^- , As, TCE, PCE, Cd. It is necessary to check the extent of actual contamination by monitoring that will be performed in the second planning cycle. It will be possible to determine the necessity of exemptions from achievement of the objectives for certain of listed substances on the basis of monitoring results, or exemptions from implementation of measures.

It is assumed that the measures for improvement of quantitative status will improve the situation until year 2015 to the extent that will allow to avoid request for exemptions for the achievement of objectives till year 2015.

Table 6.2 Exemptions from the environmental objectives – year 2015 for the groundwater bodies

ID of water body	Area (km ²)	Pollutants relevant to exemption according to Art. 4(4) WFD	Pollutants for potential exemptions applied for 2nd planning cycle
SK1000400P	1,943	NH_4^+ , AT, SIM	SO_4^{2-} , Cl^- , As
SK1000600P	515	NH_4^+	SO_4^{2-} , Cl^-
SK1000700P	724	NH_4^+ , NO_3^-	Cl^- , SO_4^{2-} , As
SK1000800P	198	NH_4^+ , NO_3^-	SO_4^{2-}
SK1000900P	111	NH_4^+	SO_4^{2-} , Cl^-
SK1001100P	140	NO_3^-	SO_4^{2-} , Cl^-
SK1001200P	934	NH_4^+	Cd, TCE, PCE
SK2000500P	1,031	$\text{NO}_3^-(a)$	–
SK2001000P	6,250	NO_3^-	Cl^- , SO_4^{2-}
SK2003100P	564	NO_3^-	$\text{SO}_4^{2-}(a)$
SK2003700P	807	NH_4^+	As(a)
SK200170FP	336	$\text{NO}_3^-(a)$	Cl^-
SK2001300P	548	$\text{NO}_3^-(a)$	–

7 Economic analysis of water use and cost recovery of the water services

WFD (pursuant to the Article 5 and Annex III) requires elaboration of economic analyses of water use for each river basin district on the basis of sufficient and detailed information that must contain:

- economic analysis of water use (economic significance of water use),
- trends of key economic parameters and tendencies (driving forces) until year 2015,
- recovery of the cost of water services.

Economic analysis has an important role also for compilation of the programmes of measures, as WFD requires:

- estimation of potential costs of programmes of measures that might be implemented until year 2015, and
- assessment of the most cost-effective combination of measures for water bodies in the framework of the individual sub-basins,

that form a part of the chapter 8 of the Programme of measures.

The first processing of economic analysis according to WFD (with data base for year 2004) was performed in the framework of phase II of WFD implementation works, results of which were delivered to the EC in the National Report 2005. However, data base of year 2004 did not provide input data needed for the calculation of cost recovery of water management services in required structure, i.e. structured to the costs of water management services, revenues from provided water services from users, and subsidies, therefore the economic analysis was updated. The following chapters sum up the results of economic analysis.

7.1 Economic significance of water use

Economic significance of water use should be seen in the context of socio-economic importance of water use that should be investigated by means of socio-economic parameters and related technical data in relation to the main types of water use. Data structure used for the assessment of water use economic significance is given by EC.

Data that are not tracked according to the river basins in SR were transformed to the river basin districts of the rivers Danube and Vistula by geographical information system (GIS), as well as by direct recalculations. Percent proportion of inhabitants accommodating the river basin was used for this recalculation. Actually gained data were used in the analysis for parameters for the individual patterns of water use that are collected according to the sub-basins.

Significance of water use was analysed for the following water use patterns:

- drinking water supply,
- collection and treatment of waste waters,
- industrial water use (different sectors including energy production and hydropower),
- agricultural water use (for irrigation and animal production),
- water transportation,
- fisheries,
- water related tourism,
- flood protection.

Assessment of the individual water use patterns is facilitated by the data on water abstraction, water discharges in parallel with the additional technical information. Summary data on water use are shown in the *Table 7.1.*

Table 7.1 Summary data on water use in SR according to the river basin districts – year 2004

Water use sector	River basin district	Significant pressures		Socio-economic data			
		Water abstraction (thousand m ³)	Water discharge (thousand m ³)	Gross production (million SKK/year)	Contribution to GDP (%)	Number of employees (thousand persons)	Contribution to employment (%)
Households	SR total	352,130	389,018				
	DRBD	344,048	366,987				
	VRBD	8,082	22,031				
Agriculture	SR total	94,309	3,926	60,722	3.63 %	109.8	
	DRBD	90,786	635	58,433		105.7	
	VRBD	3,523	3,291	2,289		4.1	
Industry	SR total	638,849	523,668	1240,726	24.52 %	559	
	DRBD	632,222	518,605	1193,950		537.9	
	VRBD	6,627	5,063	46,775		21	
Energy production	SR total	371,804	293,863	228,327	4.67 %	43	
	DRBD	373,943	293,863	219,719		41.4	
	VRBD		8,608			1.6	
Transportation in thousand tons	SR total	1,584		1,636			
	DRBD	1,584		1,636			
	VRBD						

Note: GDP – Gross domestic product.

Source: SHMI, Statistical Yearbook SR of the Year 2004, Water management reports SR of year 2004

7.2 Trends in the key economic parameters and tendencies

The document *Future trends in the key economic factors until year 2015, basic scenario*, elaborated before the global economic crisis was based on the national objectives related to the necessity of improvement of the SR environment, and on strengthening of environmental infrastructure to the level of EU member states, with a special emphasis to: ensuring of sufficient amount of drinking water and broadening of sewage systems and WWTP, waste production prevention and reduction, decreasing of waste environmental risks and implementation of more effective waste handling, removal of contaminated sites, preservation of biological and landscape diversity, and conservation of natural habitats of endangered animal and plant species.

With the perspective of year 2015, the most difficult challenges in the environmental issues can be expected in relation to the achievement of compliance with the EU environmental legislation. Achievement of legislative compliance in the water sector related to the strengthening of respective infrastructure will be highly cost demanding (water supplies, sewage systems, WWTP).

Economic tools (taxes, fees etc.) that might have a positive impact to the achievement of change in recent water production and consumption trends, will play a role with increasing importance in the solving of environmental problems in the future. New economic model according to the *National Sustainable Development Strategy* (adopted by the Resolution of the Government of the Slovak Republic No. 978/2001 Coll.) should be based on the global structural change of economy, on the production and consumption patterns, minimisation of inputs and effective recovery of resources, transition from exploitation of non-renewable resources to renewable ones, from serial and mass production to diversified production, etc. Application of the post-industrial economy development model should ensure transition to the models ensuring sustainable development that integrates socially and environmentally favourable approaches and technologies. Integrated solution of living conditions in Roma communities forms a special challenge.

The basic development scenario until year 2015 for the purposes of economical analysis was based on the status of main factors, having substantial impact to the future water use and related water management services.

Such basic scenario is understood also as a prognosis taking into consideration possible external autonomous development (demography, economy etc.). Prognoses of development of general socio-economic factors such as population, GDP, employment, unemployment were based on the situation before the global economic crisis, thus, they cannot be fully taken into consideration at present. Nevertheless, it can be considered that the perspectives until year 2015 relates to expected and foreseen technological changes in industry, agriculture – from the point of view of irrigation and soil management, fisheries, and also the perspectives in the sector of households – from the point of view of specific water consumption and its perspective until years 2010 and 2015.

Another part of the economic analysis related to trends until year 2015 was oriented in foreseen trends in the framework of the individual sector policies of the national economy, without inclusion of the impacts of the global economic crisis, involving important changes that should be reflected in the trends. The analysis examined trends in the industrial policy, the policy of energy production, agricultural policy, water transportation policy, tourism, and recreation related to water. Special attention is paid to the flood protection programme (including estimate of the total costs of flood protection measures for years 2006 – 2010 and for years 2011 – 2015), as well as trends in the water management policy until year 2015. As the original assumptions did not reflect the impacts of the global economic crisis that influences the global development, these trends were revised.

Long-term official prognoses of development for the individual national economy sectors until year 2015 are not available at the national level at present. Only short-term prognoses of the National Bank of Slovakia (hereinafter as NBS) and Ministry of Finance of the Slovak Republic (hereinafter as MoF SR) are available, and the *Concept of Renewed Economic Growth of the Slovak Republic*. These documents available at present (August 2009) signalise certain recovery of economy that starts to express especially in the automobile industry; however, it is impossible to foresee with certainty whether this trend will continue only to the end of year 2009, or it will persist. All three important automobile producers in SR (Volkswagen, PSA Peugeot Citroën, Kia Motors) recorded production increase in comparison with the preceding significant decline; moreover, production of a new model was approved. (Economic development as of June 30, 2009 documents state budget deficit of SR amounting 1 billion 108 millions EUR that was predicted as the state budget deficit by the end of year 2009. However, NBS claimed slight increase of certain economic parameters on June 30, 2009). Statistical Office of the Slovak Republic estimated the total GDP fall by 3.5 % by the end of year 2009 in August 2009, NBS only 4.2 % and MoF SR 6.2 %.

7.3 Recovery of costs of water services and incentive price policy

7.3.1 Present situation

Expression of present value of recovery of the cost of water services relates to the implementation of the Article 9 WFD that requires payment of water management service costs. WFD requires to perform the estimate of recovery rate (return) of costs (as well as incentive price policy for which the estimated recovery rate serves as a basis) on the level of river basin districts, namely for each category of water services, and also for the sectors of industry, agriculture and households as a minimum requirement. Considering the present availability (collection) of data it is necessary to aggregate or disaggregate data from the other levels. For example, financial costs and revenues are monitored at the level of administrative areas for which the water services are provided, and this level does not correspond to the level of sub-basins or river basin districts. According to WFD the estimated recovery of costs of water management services should contain not only financial costs, but also environmental costs and resource costs, however, this is not a strict requirement for the first estimate of the present value of recovery; nevertheless, it should be sequentially incorporated into the recovery of costs of the water management services estimate in order to become a basis for incentive price policy in the field of water management, that the EU member states should implement until the year 2010. Environmental costs and resource costs are not investigated separately in SR at present; moreover, methodology (on the EU level) for their quantification was not developed yet. But these costs are reflected in the performed estimate to a considerable extent as “internalised” costs in the traditional financial expenses that enter the prices of waste water and drinking water (fees for discharge of waste water, payments for groundwater abstraction). The results of assessment of the present value of recovery of water management costs on the national level are shown in the *Table 7.2*.

Table 7.2 Present value of cost recovery of water management services on the national level

Sector/year	2004	2005	2006	2007	2008
Drinking water supply (%)	97.27	103.53	98.81	92.71	96.28
Discharge and treatment of waste water (%)	104.92	105.99	89.67	86.81	94.74
Public water supplies and sewage systems, total (%)	100.40	104.56	95.00	90.19	95.62
<i>River basin districts</i>					
Water management services related to exploitation of water course*					
- hydropower potential (%)	-	46.39	47.74	-	-
- energetic water %)	-	150.37	39.86	-	-
- surface water abstraction (%)	-	87.96	80.58	-	-
<i>Industry</i>					
National level** (%)	-	75.86	64.67	-	-

Note:

- 1) Vast majority of water companies does not have specification of costs, revenues and subsidies to provided water services separately for households, industry and agriculture, therefore the cost recovery for these individual sectors was not expressed.
- 2) * No subsidies are provided for the listed water services related to the exploitation of the water course. Subsidies are available only for so called services of public interest.
- 3) ** All three services in total: hydropower potential, energetic water and surface water abstraction
- 4) Hydropower potential is understood as utilization of water courses by means of water constructions with nominal capacity above 100 kW, operated by the water course administrator.
- 5) Energetic water is understood as water abstraction from water courses by means of water constructions with nominal capacity above 10 MW, owned by the hydropower potential user.

7.3.2 Implementation of the Article 9 WFD – Recovery of costs for water services

Application of three key terms in practice forms the basic requirement of the Article 9 WFD:

- Incentive price policy (that should motivate water users to its effective exploitation),
- Adequate contribution of different water use, disaggregated into at least to industry, agriculture and households to the recovery of the costs of water services including environmental costs and resource costs,
- “User and polluter pays” principle.

Compliant with WFD requirements, expression – estimate of the present value of recovery of provided water services costs was performed as a preparatory step for fulfilment of the Article 9 provisions, as this WFD article requires recovery of costs of these services.

Concerning the requirement of the Article 9 WFD to implement water price policy pursuant to its provisions until year 2010, it is necessary to state that such price policy in the water management sector was already implemented in SR to a considerable extent (sectors concerned are listed in the chapter 7.3.3).

It means that the requirement of the Article 9 WFD concerning recovery of costs of water services was already applied in SR. However, the answer to the question whether the actual water price policy is sufficiently incentive as a key economic tool for application of the “user and polluter pays” principle should be reached by a deeper economic analysis. Thus, it can be concluded that the Article 9 requirements are implemented in SR by step-wise approach of practical measures that reflects mainly the incentive dimension of water price policy.

Requirements of the Article 9 WFD are transposed into the Act No. 364/2004 Coll. on waters as amended by the Act No. 384/2009 Coll., as an unavoidable precondition of their due and thorough application, and also as rigorous WFD requirement.

7.3.3 Price policy pursuant to the Article 9 WFD – Proposal of financial mechanism ensuring recovery (return rate) of the costs for provided water services

Water price policy applied in SR that should respect the requirements of the Article 9 WFD relates to:

- a) costs of water services: production, distribution and supply of water by public drinking supply systems and collection and treatment of waste water by public sewage systems (regulated prices),
- b) fees and payments for water use
 - b1) non-regulated payments for services: maintenance of navigability of water ways and demarcation of shipways and other services of public interest (flood protection),
 - b2) regulated payments for water services: surface water abstraction from water courses, exploitation of hydropower potential of water courses and abstraction of energetic water from water courses,
 - b3) fees for groundwater abstraction,
 - b4) fees for waste water discharge into surface waters.

The estimate of present value of costs for water services serves as a basis for further particular steps towards meeting of requirements for cost recovery of water services, as well as the obligation of a member state to implement price policy in the water sector that should ensure an adequate contribution of different types of water use to recovery of the listed services until year 2010.

Present situation in exploitation of economic tools in the water sector

Economic tools such as prices of drinking water from public supplies and of collection and treatment of waste water, as well as fees and payments set out by the Resolution of the Government of the Slovak Republic No. 755/2004 Coll., determining the amount of non-regulated payments, amount of fees and details of charging for water use, as amended were already applied in the water of SR. The mentioned governmental regulation entails the obligation to pay the costs for groundwater and surface water abstraction, for discharge of waste waters into surface water courses, for exploitation of hydropower potential of water course and for abstraction of energetic water. In addition to the proposal of more intensive application of this regulation also additional new mechanisms are proposed that should ensure recovery of costs for water services, or for water use in the sense of the “user and polluter pays” principle.

These proposals will serve as a basis for intensification of the price policy in the water management sector, i.e. establishment of concept of price generation of water resources pursuant to the Article 9 WFD, especially to the principle “user and polluter pays”. This concept of price policy as a form of price policy making principles will be adopted by the Government of SR.

The second sentence of par. 1 Article 9 WFD says that *a member state is enabled to adopt its own national strategy of new price policy, i.e. financing of the water services; nevertheless, it is necessary to investigate the social, ecological and economic impacts of cost recovery, as well as geographical and climatic conditions of the region or regions in question.*

An adequate contribution of the different water use patterns, disaggregated into at least to industry, agriculture and households to recover costs – return rate of water services, including environmental costs and resource costs is not yet a final one, as deeper analysis is needed for potential intensification of existing economic tools (fees and payments) or application of new ones are still missing.

An adequate contribution to recovery of the costs of water services should comprise also environmental costs and resource costs, pursuant to the Article 9 WFD. Methodology for quantification of such costs was not elaborated yet (on the EU level). Therefore deeper sophistication of the basic opinions on the potential forms of environmental costs and resource costs should be considered, as well as additional terms related to the Article 9 WFD implementation mentioned above (see chapter 7.3.2). This issue should be solved during coming years.

Sequential steps in the Article 9 WFD implementation should be discussed, as the proposed new financial – price – mechanisms must be based on targeted economic analyses that are still missing. Such economic analyses must be elaborated in the near future, and the final version of new financial mechanisms can be proposed on their basis that will be adopted by the SR Government. Adopted new financial mechanisms will pass practical testing phase that will exhibit its viability during the process of WFD implementation.

In addition to the missing analyses, the present state policy in the field of water price is a reason of lacking implementation of full meaning of second sentence, paragraph 1, Article 9 WFD during the first planning cycle at present, as this policy will not lead to price increase during coming years – on the contrary, it is interested in

maintenance of the stable (present) prices. Recently, after four years of significant price increase, the development of water prices in SR is stabilised. In particular, price stabilisation and protection of the most vulnerable water users and waste water producers is one of the main objectives of the regulatory price policy implemented by the Regulatory Office for Network Industries.

Legal preconditions of pricing in water services

Pursuant to the Article 9 WFD, the prices of water services should cover the costs of the provided water services. The prices of regulated water services in SR are approved by the Regulatory Office for Network Industries (hereinafter as RONI): drinking water supply from public supplies and collection and treatment of waste waters by public sewage systems, but also water services related to the exploitation of hydropower water course potential, to the abstraction of energetic water and abstraction of surface water. The Act on regulation of network industries No. 276/2001 Coll., as amended, and the Regulation Policy of RONI – the basis for implementation of price regulation of the listed water services – form the legal basis for these activities. The actual regulation policy respects to a maximum extent the changes and amendments resulting from the Act No. 107/2007 Coll., amending the Act No. 276/2001 Coll. The rules of price regulation provide a platform for the recovery of costs of water services by determination of the range and structure of economically eligible costs for such services, the method for determination of the amount of fair profit. The rules and procedures, as well as economically eligible costs are determined and defined by a resolution issued by the Regulatory Office for Network Industries on an annual basis.

Adequate contribution of the individual water use sectors to the recovery of costs

The role of state regulation of water prices was played by MoF SR until year 2002, using the system of so called cross-subsidies between the individual groups of users. RONI had taken over this role in year 2002 which phased out these cross-subsidies between the individual groups of users: in the drinking water sector during year 2006, in the waste water sector during year 2007. This process was completed by definition of uniform prices for all drinking water consumers as well as waste water producers in the framework of a single regulated subject for year 2007.

The payment for drinking water from public water supplies depends on the abstracted water volume given by measurement for all groups of consumers (households, industry, agriculture), and the water price is determined per 1 m³. Thus, all groups of users (sectors) contribute adequately to the recovery of costs of drinking water supply according to the consumed volume of water with identical quality.

However, degree of load by pollutants in the waste water sector is distinguished for the individual groups of producers (households, industry, and agriculture). Although the cross-subsidies between the individual groups of consumers were recently removed in the sector of waste water, there are certain possibilities to reconsider the actual general uniform price of waste water – as regards the requirements of the Article 9 WFD in order to achieve status when the polluter contribute differently to recovery of costs according to the extent of pollution. General uniform price of waste water is determined per m³, in relation to the volume of collected waste water determined by means of measurement of consumed drinking water. For example, separate fee for heavy waste water pollution or tax for waste water could be introduced in the future that will be different in the individual sectors according to the pollution extent.

Water supplier charges in the water supply contract also precipitation (rain) water drained into the public sewage system (waters from the surface runoff pursuant to the Act No. 442/2002 Coll.). Expert calculation is used during determination of the volume of such waters according to the respective regulation that is based on the data of SHMI. The unit price per m³ represents the price of collection and treatment of waste water as determined by RONI. The payment is a result of multiplication of price and calculated rain water volume. The inhabitants of residential houses pay for the rain water according to the area of apartment in m². The owners of single family houses also pay for the rain water collection, because everyone who owns paved surfaces with an outlet into the sewage system on its ground is obliged to do so (the payment is calculated from the dimensions of roof and drained surfaces on the grounds of single family houses that are drained by the sewage system; SHMI data on the monthly precipitation volumes in the given region are used for the particular price calculation). Payments for rain water are covered in addition to households also by the other sectors – i.e. industrial plants, different administrative institutions and others according to the built-up area.

Payments for rain waters represent a contribution to recovery of costs of waste water treatment and they are covered by the particular producer; these costs are calculated per each separate unit according to the size of

paved areas connected to the public sewage systems. Payments for rain waters do not represent recovery of particular costs of treatment of these waters, because they are incorporated into the total costs of waste waters collection and treatment, i.e. they are also reflected in the total waste water volume.

Drinking water and waste water price

The price is determined per 1 m³ of consumed drinking water from public supplies and per 1 m³ of collected and treated waste water. The prices of drinking water and waste water are regulated by RONI that determines the extent of price regulation, method of its realisation, extent and structure of eligible costs, method for definition of fair profit by a legislative regulation (resolution) since year 2003.

As the prices are calculated per m³, the total amount of payment depends on the volume of consumed drinking water or collected and treated waste water. Such direct relationship to the volume of consumed or collected water volume acts as a significant stimulus for the effective water use. The consumed water volumes are measured.

Covering of costs of water services

WFD, Article 9 requests the application of principle of covering water service costs expressed in incentive price policy that should be implemented by the member states until year 2010. Such incentive price policy should link WFD ecological objectives with economic and social ones. Especially, the principle of the cost recovery is expected to contribute to the effective and economical use of water resources; moreover, it might prevent water wasting and pollution of resources. It might also ensure more or less constant incomes of water service providers by their prices. Social acceptability of water service prices related to the payment ability of the users of such services, as well as eligibility of distribution of costs among the individual public water use types forms an unavoidable factor of the price policy. An important role related to this price policy is played also by the structure of calculation formula of the water services such as drinking water supply and collection and treatment of waste water, understandability and transparency of which is strictly required. Prices of these two water services are approved by RONI that follows the principle of cost recovery in such prices in its regulation policy, and also the “polluter pays” principle to a certain extent (the payments for discharge of waste waters into surface waters are internalised in the waste water prices).

Demand elasticity related to the price expressed massively during the period of last app. 13 years. The water consumption decreased significantly in relation to the price increase. Also installation of flow measurement equipment contributed to the decreased water consumption. The specific water consumption in households decreased from 142.4 litre per person per day to 89.9 litre per person per day in year 2007 when compared with year 1995 (public supplies). The decrease was seen also in the average specific water consumption comprising not only households, but also industry and agriculture; the consumption reached 192.1 litre per person per day in year 2007, compared with year 1985 when it reached up to 414.2 litre per person per day (public supplies). An overview of decreasing specific water consumption per person per day for households (years 1995 – 2007) and decreasing average specific consumption during years 1985 – 2007 is shown in the *Table 7.3*.

Table 7.3 An overview of specific drinking water consumption in households and average specific water consumption – years 1985 – 2007

Year	Specific drinking water consumption by households (litre per person per day)		Average specific water consumption (litre per person per day) (households, industry, agriculture)	
	WSP	municipalities	WSP	Municipalities
1985			414.20	157.40
1990			433.00	156.00
1995	142.40	83.40	321.50	166.60
2000	123.50		266.60	
2005	94.90		204.70	
2006	89.50		199.60	
2007	89.90		192.10	

Note: WSP – water supply provider.

Concerning the agricultural water use for irrigation, the volume of water is negligible in SR during recent years.

The following should be added to the issues of water services cost recovery:

Pursuant to WFD, financing of water services should be based mainly on the “user and polluter pays” principle, i.e. the costs for the provided water services should be covered by their users. However, it is possible – i.e. not in contradiction with WFD, Article 9 - that state financial support will be provided for construction of facilities necessary for ensuring of drinking water supplies, and for collection and treatment of waste water; whereby it should be emphasised that such support pursuant to the Article 9 WFD can not be provided for covering of the operational costs of the above mentioned water services. The main objectives of the state financial support to the investment proposals in the field of drinking water supplies and collection and treatment of waste waters are as follows:

- support to measures in water management facilities of public interest that could not be mostly implemented to a required extent without the state support and
- prevention of high burden to inhabitants by payments and contributions to the water sector.

Price policy in the sector of water services

Price policy in the sector of drinking water and waste water is regulated by RONI. This legitimate regulation, the resulting calculation of water prices based on economically eligible costs, as well as the structure of price tariffs creation itself contribute to the effective water use.

8 Programme of measures

The structure of programme of measures corresponds to the identified significant water management issues (organic surface water pollution, surface water pollution by nutrients, water pollution by priority substances and substances relevant for SR, hydromorphological alterations and groundwater quantity and quality problems). The programme of measures is proposed in relation to the objectives until year 2015 determined on the national level and on the level of the international Danube river basin for the individual significant water management issues.

The sub-chapters below describe briefly the national objectives, the approach for their achieving, the proposed of measures themselves, and evaluation of effectiveness of measures for the individual categories of significant water management issues, structured to the individual river basin districts.

Surface waters

Rivers and bodies with altered category

8.1 Organic pollution

Achieving of decreased organic surface water pollution minimally to the level compatible with the criteria of good ecological status/potential forms the environmental objective.

8.1.1 Approach to the proposal of programme of measures

The wording of the chapter 4 reveals that despite of sequential decrease of discharged pollution (by 60 % when compared with year 1995 in the parameter COD_{Cr}) and the waste water volumes (by 25 % compared to year 1995) into surface waters, the situation in waste water handling is not satisfactory. From the total volume of discharged pollution expressed as COD_{Cr} (37,312.23 tonnes), the highest proportion belonged to the public sewage systems in year 2005 (54.8 %), to the industrial sources 44.6 %, to agriculture 0.1 % and to other activities 0.5 %. Pollution discharged from the agglomerations with more than 2,000 p.e. expressed as BOD_5 represents 7,814 tonnes, as COD_{Cr} - 27,744 tonnes.

Such unfavourable situation is a result of failure to meet the requirements of approximation agreements with the European Community and the national legislation.

Hence, the approach to proposition of the programme of measures was based on the analysis of fulfilling the Directive 91/271/EEC requirements on the urban waste water treatment, the Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture, and the Directive 96/61/EC on IPPC. These directives represent the basic binding measures, rigorous implementation of which will ensure solution of point sources and partially also diffuse pollution sources.

It is necessary to know the perspective of discharged pollution in year 2015 in order to analyse good water status.

The perspective for year 2015 was elaborated on the basis of assumption that the requirements of the Treaty of Accession of the Slovak Republic to the EU on implementation of the Council Directive 91/271/EEC concerning urban water treatment will be met. Pursuant to the agreement, the requirements the Directive 91/271/EEC should be met until December 31, 2015, which is the same deadline as the term for achieving the objectives of the WFD. The required situation in discharges of waste waters from agglomerations until year 2015 is illustrated in the *Map 4.1b* (see the *Annex*).

The results of calculated perspective until year 2015 for the foreseen scenario are shown in the *Table 8.1*, that comprises also the comparison (see the *Figure 8.1*) with the baseline situation described in the chapter 4 (in the *Table 4.3*).

Table 8.1 Expected discharge of organic pollution from agglomerations with more than 2,000 p.e. – year 2015

River basin district	BOD ₅			COD _{Cr}		
	Year 2005 – 2006	Scenario until year 2015	Change	Year 2005 – 2006	Scenario until year 2015	Change
	tonnes/year	tonnes/year	%	tonnes/year	tonnes/year	%
DRBD	6,330	6,624	5	21,120	26,496	25
VRBD	245	258	5	1,581	1,031	-35
SR total	6,575	6,882	5	22,701	27,528	21

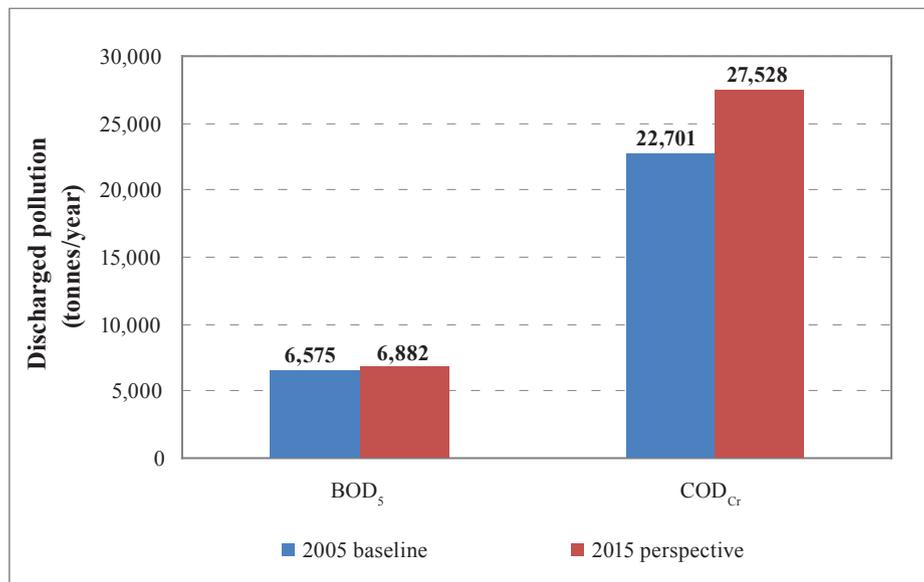


Figure 8.1 Comparison of the perspective of discharged pollution volumes from agglomerations with the baseline situation

The comparison of perspective for year 2015 with the baseline situation reveals that pollution input into surface waters in average, expressed by the investigated pollution parameters will increase. The pollution increase characterised by the parameter BOD₅ represents 5 %, by COD_{Cr} 21 %.

The results of comparison should be considered indicative, as the diffuse pollution from agglomerations was not involved into the calculations of pollution for reference year (2005) – only balance pollution values based on real measurements of recorded waste water outlets from WWTPs. In contrary, the perspective is based on theoretical coefficients. The perspective values should be understood as maximum allowable limits or maximum possible discharged pollution preconditioned by meeting the conditions of the SR accession treaty to the EU, that involves the steps for intensified waste water collection and treatment including implementation of technologies for increased nitrogen and phosphorus reduction. Nevertheless, the real situation in discharged pollution in the individual parameters and in the individual river basin districts will every time below these indicative values, because minimum limit requirements for reduction of the individual pollution parameters are used for the calculations.

Positive effect to groundwaters was not quantified.

8.1.2 Proposal of measures for organic pollution reduction

The list of measures resulting from the obligation to meet the requirements of the *Treaty of Accession of the Slovak Republic to the EU* on implementation of the Directive 91/271/EEC on urban waste water treatment is in compliance with the National Programme of the Slovak Republic for Adoption of the Council Directive 91/271/EEC Concerning Urban Waste Water Treatment, as Amended by the Commission Directive 98/15/EC and the Regulation (EC) 1882/2003 of the European Parliament and of the Council. An overview of number and types of measures in the individual river basin districts is shown in the *Table 8.2*.

It is obvious from this overview that 157 WWTPs should be intensified, 54 new WWTPs should be constructed and public sewage systems should be installed in 277 municipalities in order to harmonise the waste water discharges in agglomerations with more than 2,000 p.e. in Slovakia. These measures – pursuant to the Accession Treaty – should be implemented until year 2015.

Table 8.2 Number and types of measures according to the Directive 91/271/EEC

River basin district		Number of agglomerations/industrial enterprises requiring			No. of municipalities requiring construction of new sewage systems
		WWTP cancellation	WWTP construction	WWTP intensification	
DRBD	A	11	54	154	271
	B	0	38	0	0
	C	0	0	5	0
VRBD	A	4	0	3	6
	B	0	2	0	0
	C	0	0	0	0
SR total	A	15	54	157	277
	B	0	40	0	0
	C	0	0	5	0

Note: A – agglomerations with more than 2,000 PE, B – agglomerations with less than 2,000 p.e. with existing public sewage system, C – agro/food-processing industry.

Supplementary measures

Waste water handling in additional municipalities that are not involved in the National Programme of the Slovak Republic for Implementation of the Council Directive 91/271/EEC Concerning Urban Waste Water Treatment, as Amended by the Commission Directive 98/15/EC and the Regulation (EC) No 1882/2003 of the European Parliament and of the Council should be solved in order to achieve the WFD objectives. The list of such municipalities contains those municipalities that belong to agglomerations with more than 2,000 p.e. according to the Development Plan of Public Water Supplies and Public Sewage Systems but in the sense of the latest EC instructions they were removed from these agglomerations. Summary overview of number of such municipalities in the individual river basin districts is shown in the Table 8.3. Due to the combination of technical unfeasibility in the given time period and economic reasons – lack of financial resources for implementation of the necessary measures during the first planning cycle – postponing of their implementation to year 2027 was proposed.

Table 8.3 Number of municipalities out of the Directive 91/271/EEC requirements on measures for waste water collection and treatment

River basin district	Number of municipalities	Number of municipalities requiring		Number of municipalities requiring s construction of sewage system	Implementation until year			Reason of delay
		WWTP intensification	WWTP construction		2015	2021	2027	
DRBD	448				N	N	Y	TN + E
VRBD	13				N	N	Y	TN + E
SR total	461				N	N	Y	TN + E

Note: N – no, Y – yes, TN – technical feasibility of the measure is beyond the given time period, E – economic reasons.

Further legislative measures:

- complex solution of small household WWTPs – including development of mechanism of fees for discharges from such sources,
- legislative solution of warmed and heavily mineralised waters from geothermal water parks.

Other measures:

- increased control,
- education and increased environmental public awareness.

8.2 Surface water pollution by nutrients

Decreased surface water pollution by nutrients to the level compatible with the criteria of good ecological status/potential forms a minimum requirement of the environmental objectives.

8.2.1 Approach to proposal of programme of measures

Nutrients in parallel with organic substances released into surface waters represents a risk of failure to achieve the WFD objectives until year 2015 in 35.0 % of water bodies in SR. Nutrients in surface waters originate from point as well as diffuse pollution sources. 6,761 tonnes of total nitrogen and 1,018 tonnes of total phosphorus entered surface waters from the agglomerations with more than 2,000 p.e. according to an estimate during year 2005 (see *Table 4.5* and *Table 4.6*).

The amount of nutrients from the diffuse sources represents 34,802 tonnes of nitrogen and 1,714 tonnes of phosphorus per year (reference period of years 2005 – 2006). The highest proportion of the total nitrogen emissions to the surface water is formed by entry from groundwater, and erosion and municipalities without public sewage systems and WWTP are the main pollution source of phosphorus.

Approach to proposal of programme of measures is similar as in the case of organic water pollution, with a difference in incorporation of nutrient infiltration from agriculture into the programme of measures. These measures result from the obligation of the Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources transposed into the § 35 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll. and Action Programme elaborated for its practical application.

Perspective of nutrient emissions until year 2015

The situation in general nutrient run-off in the sub-basins and SR territory until year 2015 can be simulated by modelling. Model MONERIS (version 2.14vba) was used for this purpose. Basic developmental assumptions of the driving forces influencing run-off of the nutrients from the territory should be developed in order to elaborate the perspective. The following assumptions were used:

- application of mineral fertilisers – slight increase in comparison with the reference status (110 %) – soil nitrogen surplus in the level of reference year (2005),
- number of livestock – steady state (no changes),
- waste water discharge from agglomerations in compliance with the requirements of the Directive 91/271/EEC (when 100 % of inhabitants of the SR agglomerations are connected to public sewage systems with WWTP).

The output of modelling of nutrients' emissions until year 2015 for the individual river basin districts, as well as comparison with the values representing the reference status are shown in the *Table 8.4*. Expected pollution by nutrients in the individual analytical units for the basic scenario until year 2015 is illustrated in the *Map 4.3b* – Pollution by nutrients from point and diffuse sources – basic scenario until year 2015 for total N, and in the *Map 4.4b* – Pollution by nutrients from point and diffuse sources – basic scenario until year 2015 for the total P (see the *Annex*).

Table 8.4 Perspective of emission of nutrients until year 2015

River basin district	N _{total}			P _{total}		
	Y. 2005-6	Scenario until 2015	Change	Y. 2005-6	Scenario until 2015	Change
	tonnes/year	tonnes/year	%	tonnes/year	tonnes/year	%
DRBD	39,727	39,418	- 0.8	2,536	2,784	+ 9.8
VRBD	1,837	1,837*	- 0.0	200	200*	0.0
SR total	41,564	41,255	- 0.7	2,736	2,984	+ 9.1

Note: *Scenario until year 2015 for Visla river basin district was not involved.

The overview reveals that significant emission reduction into surface waters will not be achieved by the measures of the basic scenario. In average total nitrogen emissions will decrease by less than 1 % in SR, phosphorus in contrary will raise by 9.1 %. The reasons are as follows:

- high number of agglomerations in the size category below 10,000 p.e. during the reference period of years (2005 – 2006) in SR; without obligation of increased removal of N and P by the WWTPs in such agglomerations,
- waste water handling in agglomerations during the reference period by the individual systems or it is not performed at all in high number of p.e., in contrary to the basic scenario,
- soil phosphorus retention during waste water handling in agglomerations below 10,000 p.e. without public sewage systems is higher than retention ensured by the requested treatment technology.

Introduction of phosphate-free washing detergents would allow to achieve reduction of the total phosphorus emissions by app. 300 tonnes per year according to the MONERIS estimate, that represents additional reduction by app. 10 % when compared with the scenario until year 2015. It means that this measure would be very efficient.

8.2.2 Proposal of measures for nutrient pollution reduction

Basic measures

As the surface water pollution by organic substances and pollution by nutrients is mostly parallel, measures for agglomerations listed in the chapter 8.1.2 concern also nutrient pollution reduction.

Additional basic measures

In the agricultural sector for the designated vulnerable zones – they result from implementation of the Directive 91/676/EEC on nitrates (transposed by § 35 Article 3 and 4 of the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll.) by the Programme of Agricultural Activities in Designated Vulnerable Areas, elaborated for this directive.

In the nature and landscape protection sector – pursuant to the Slovak Parliament Act No. 543/2002 Coll. on nature conservation and landscape protection – to determine and to complete the basic elements of ecological network of cultural landscape, defined by projects of territorial systems of ecological stability or landscape/ecological plans, of which the surface water bodies are also a component.

Supplementary measures

- application of codex of good agricultural practise,
- advisory services for farmers,
- introduction of phosphate-free detergents – on the basis of agreement between ICPDR and AISE (International Association for Soaps, Detergents and Maintenance Products, joining 37 associations from 42 European countries),
- education for increased public ecological awareness,
- financial subsidies for organic farms, compensation payments for landscape exploitation alterations,
- increased control.

8.3 Pollution by priority and relevant substances

Decreased surface water pollution by priority substances including certain other substances relevant for SR minimally to the level compatible with the criteria of good ecological status/potential and good chemical status form the environmental objective.

8.3.1 Approach to proposal of programme of measures

Chapter 4 reveals that 66 enterprises discharge waste waters containing priority substances directly to surface waters, and 26 enterprises with indirect discharge (by means of WWTP of another operator) – were recorded in SR during year 2007.

18 substances are permitted to be discharged in waste water in SR totally, EQS for which were determined on the EU level by the Directive 2008/105/EC. 16 substances out of them are priority ones, 7 of them priority hazardous and additional 2 other pollutants. Measures should be implemented against pollution of waters by the priority substances, aimed at significant reduction of such pollution, and measures for elimination or phase-out of discharge, emissions and leaks of priority hazardous substances in a time schedule that will not exceed period of 20 years.

Perspective until year 2015

Development of industrial and economic activities is foreseen in both river basin districts. Despite of this fact, the increase of waste water discharge from industrial enterprises is not expected, reduction of pollution characterised by parameters of priority substances and substances relevant for SR is assumed in contrary. This statement is based on assumptions until year 2015, namely:

- harmonisation of waste water discharges with the Resolution of the Slovak Government No. 296/2005 Coll. amendment (under preparation) that is transposing the Council Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community, and the "daughter" directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC and 86/280/EEC, as amended by the directives 88/347/EEC and 90/415 EEC (EC accepted a transition period for implementation of this directive in the framework of EU accession process for three sources – NCHZ, a. s., Nováky (Cu, benzopyrene, organohalogene compounds), Duslo, a. s., Šaľa (tetrachloroethylene, trichloroethylene, tetrachloromethane), Chemko, a. s., Strážske (PCB) until December 31, 2006;
- harmonisation of waste water discharges with the requirements of the Act No. 245/2003 Coll. on IPPC (Council Directive 96/61/EC concerning integrated pollution prevention and control of the environment). EC accepted transition period for 10 enterprises in the framework of the EU accession process. The latest transition deadline relates to 5 enterprises until December 31, 2011;
- issuing of legislative document specifying requirements for good chemical status and good ecological status (imission limits for priority and relevant substances);
- practical application of the *Water Pollution Reduction Programme for Harmful and Particularly Harmful Substances in SR* elaborated in compliance with the Article 11 of the Directive 76/464/EEC (as amended).

It can be stated on the basis of the above mentioned facts that all listed significant pollution sources will use technologies comparable with BAT technologies in their production processes with minimal environmental impacts until year 2015.

8.3.2 Proposal of measures for pollution reduction by priority and relevant substances

Basic measures

- Update of Resolution of the SR Government No. 296/2005 Coll.
- Harmonisation of waste water discharges from all pollution sources releasing waste waters containing priority and relevant substances with legislation in force – i.e. re-evaluation of issued water permits and integrated permits in order to meet EQS for the priority substances and substances relevant for SR.

Supplementary measures

The following is proposed for the first planning cycle:

- upgrade of the Pollution Reduction Programme pursuant to the Directive 76/464/EEC and Article 16 WFD.
- tighter control.

8.4 Measures for elimination of hydromorphological pressures

Hydromorphological changes in the sense of water management issues are split into 4 basic types:

- interruption of longitudinal continuity of rivers and habitats,
- disconnection of adjacent wetlands and floodplains and other morphological changes,
- hydrological changes,
- future infrastructure projects.

Proposal of programme of measures for the individual types of pressures is shown in the following sub-chapters.

8.4.1 Measures for ensuring longitudinal continuity of rivers and habitats

Elimination of disturbance of longitudinal continuity of rivers and habitats to the level consistent with the criteria of good ecological status/potential forms the environmental objective.

8.4.1.1 Approach to proposal of programme of measures

As results from the chapter 4, 724 water bodies are identified at present with the score higher than 5 in the parameter 9 – weirs and sills, being considered a significant change in the sense of applied methodology. In 23 cases these constructions are a reason for altered category of the water body – from river to lake.

The main driving forces acting as reasons of the anthropogenic impacts to the river system are as follows: flood protection, energy production – water power plants, navigation, water abstraction – for drinking water preparation, industry and agriculture.

The proposal of measures was developed during the testing period of HMWB candidates on the basis of photo documentation from monitoring of barriers performed by SNC SR, expert opinions of biologists including fishermen, and technical employees of the Slovak Water Management Enterprise, s.e. (hereinafter as SWME) – the individual branch units.

An overview of number of hydraulic constructions disturbing longitudinal continuity in recently tested water courses of the individual river basins is shown in the *Table 4.10*, revealing that 779 hydraulic constructions are present in the tested water courses that disturb their longitudinal continuity, most of them (691) without installed functional fish-pass.

8.4.1.2 Proposal of programme of measures

Four types of measures were proposed for ensuring continuity of water courses and habitats as follows:

- continuity insurance by functional fish-pass or biocorridor,
- reconstruction of existing barriers to slips and ramps,
- update of operation manuals,
- removal of existing hydraulic construction,
- others.

The number of proposed measures in the river basin districts according to their type is shown in the *Table 8.5*. 232 fish-passes or biocorridors are proposed for the SR territory up to now, reconstruction of existing 378 hydraulic constructions to slips and ramps allowing fish to pass, 9 constructions to be removed, and in 34 cases updating of operation manual. The number of measures is not final – the final status will be known after finalisation of testing of HMWB and AWB candidates (in the 2nd planning cycle).

The implementation of measures will be prolonged to a longer time period due to the financial resources – until year 2027. Economic reasons of implementation postponing to the next planning cycle were formulated in a close contact with the implementing bodies, taking into consideration all possible available

financial resources. Regarding the recent conditions of economic crisis, as well as the resulting reduction of state budget resources necessary for implementation of all measures proposed as a result of testing of water bodies to be implemented until year 2015, these common efforts resulted in priority setting for measures, rated into the priority list. Continuity insurance in 59 barriers is expected in SR during the first planning cycle totally, i.e. 7.0 % of identified significant disturbances of the longitudinal continuity. SWME, s.e. is the main implementing body, other subjects are considered only to a minimum extent: private bodies, water companies.

In the case of measures where SWME, s.e. is a procuring or implementing body, continuity assurance of migration barriers and other proposed measures form an investment for which state budget can serve as a resource, but also EU funds or others.

Table 8.5 Overview of measures for longitudinal continuity improvement of water courses

River basin district	Number of barriers	Type of measure – number						
		fish-pass/ biocorridor	slip/ramp	changed operation	removal	others	none	unknown
VRBD	61	7	41	2	2	1	8	2
DRBD	634	225	337	32	7	2	39	5
SR total	695	232	378	34	9	3	47	7

8.4.2 Measures for ensuring connection of adjacent wetlands and floodplains and other morphological changes

The environmental objective is formed by elimination of disturbed lateral continuity of wetlands and inundations and other morphological changes to the level consistent with the criteria of good ecological status/potential.

8.4.2.1 Approach to proposal of programme of measures

As shown in the chapter 4, 680 water bodies with significant changes of the hydromorphological criterion 7 are identified – combined assessment relating to the disconnection of the original inundations and wetlands from the water courses.

The main driving forces that enforced the anthropogenic changes to the river system of such type are: energy production – water power plants, navigation, food protection, urbanisation and agricultural land use.

The approach to proposal of measures is identical with the approach described in the chapter 8.4.1.1. It was done during testing of HMWB candidates, taking into consideration existing potential of disconnected areas to become connected to the water bodies again.

8.4.2.2 Proposal of programme of measures

The following measures were proposed in order to ensure the lateral continuity of wetlands and inundations with the water course:

- interconnection of dead channels with the water course,
- other morphological measures.

These measures are aimed at connection of habitats and increased species diversity of water organisms resulting in improved ecological status of water bodies. These measures will have positive effect also to the nutrient reduction and flood protection.

The list of all water bodies with proposed measures for improved lateral connectivity of wetlands and inundations with water course is shown in the *Table 8.6*. Implementation of measures will be spread to a longer time period – until year 2027. The main implementation body is SWME, s.e.

Table 8.6 Overview of water bodies with measures for insurance of lateral connectivity and other morphological changes.

No.	WB code	WB name	Type of measure – note	Reason of delay
1	SKM0006	Myjava	Exchange of bank embankment	TN + E
2	SKM0010	Rudava	Exchange of bank embankment	TN + E
3	SKD0017	Danube	Connection with system of branches	TN + E
4	SKH0004	Hornád	Connection of left bank branch	TN + E
5	SKB0001	Bodrog	Connection of 3 branches	TN + E
6	SKB0152	Čierna voda	Operation procedures – measures specified by separate project	TN + E
7	SKB0150	Uh	Connection of 4 branches	TN + E
8	SKB0140	Latorica	Connection of 1 branch	TN + E
9	SKT0001	Tisza	Connection of 1 branch	TN + E
10	SKB0161	Okna	Connection of 1 branch	TN + E

Note: TN – technical feasibility of the measure exceeds given time period, E – economic reasons.

8.4.3 Measures for improvement of hydrological conditions

Elimination of hydrological changes to the level corresponding to criteria of good ecological status/potential forms the environmental objective.

8.4.3.1 Approach to proposal of programme of measures

The approach to the proposal of measures is identical with the approach described in the chapter 8.4.1.1. It was done during the testing of HMWB candidates.

8.4.3.2 Proposal of programme of measures

The following measure is proposed for hydrological regime improvement in the problematic water bodies:

- re-evaluation of operation manuals in hydraulic constructions in the Váh river (see Table 8.7).

Table 8.7 Overview of water bodies and their parts with measures for improvement of hydrological regime

WB code	WB name		Influenced river stretch - river km		Significant water flow reduction	Measure until year 2015
			from	to		
SKV0006	Váh	underneath WWrk Krpeľany	275.50	294.30	yes	MP
SKV0007	Váh	underneath WWrk Hričov	217.00	247.10	yes	MP
SKV0007	Váh	underneath WWrk Nosice	204.80	209.20	yes	MP
SKV0007	Váh	underneath weir Dolné Kočkovce	165.70	201.40	yes	MP
SKV0007	Váh	underneath weir Trenčianske Biskupice	120.50	163.10	yes	MP
SKV0019	Váh	underneath WR Sĺňava	101.30	114.60	yes	MP

Note: WB – water body, WWrk – waterwork, WR – water reservoir, MP – change of operation manual.

8.4.4 Future infrastructural projects

The following future infrastructure project proposals exist at present:

- Flood protection proposals listed in the Priority Development Programme for the Years 2008 – 2010 and in the Summary Programme of Public Works, developed by SWME, s.e.,
- Flood Protection Programme of the Slovak Republic (upgraded for the years 2008 - 2015),
- Concept of Water Management Policy of the Slovak Republic until 2015,
- Development Concept of Small Water Power Plants.

The particular technical constructions will be subject to environmental impact assessment procedure where the impacts of planned constructions to water environment will be considered, and meeting of the Article 4 WFD will be ensured.

Additional perspective constructions can be proposed in the framework of Gabčíkovo – Nagymaros system of hydraulic constructions, implemented in the framework of the international Agreement on construction and operation of Gabčíkovo – Nagymaros system of hydraulic constructions of year 1977. The implementation works in the Danube section Sap – Budapest are not performed at present. The ongoing negotiations of governmental delegations of SR and Hungary on implementation of the International Court of Justice sentence are aimed at searching ways how to meet the 1977 agreement objectives in this Danube section. Strategic Environmental Assessment (SEA) elaboration for the Danube agreed section between Bratislava and Budapest is involved in these negotiations. On the basis of disputes of governmental delegations, the resulting implementation of the outputs into the mutual contract is considered, with project implementation and its involvement into the next management plan of river basin.

Groundwaters

8.5 Groundwater quality

8.5.1 Approach to proposal of programme of measures

It is possible to project the approach to proposition of measures, as well as the particular proposal of measures for surface waters relevant also for groundwaters due to the hydraulic continuity and interactions between groundwater and surface water. The applied approach for surface waters is complemented by the analysis of meeting of requirements for prevention or reduction of direct and indirect inputs of pollutants into groundwaters in order to eliminate their pollution. The proposed measures have the following characteristics:

- preventive – implementation of such measures results from the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll.,
- curative – remediation of contaminated sites developed before the Act No. 359/2007 Coll. on prevention and removal of environmental damages, as amended, came into force.

8.5.2 Proposal of measures

The individual measures are proposed on the basis of evaluation of groundwater bodies chemical status and exploitation of pressure analysis.

Measures for reduction of groundwater pollution by nitrogen substances

Basic measures

- Meeting of requirements of the Action Programme pursuant to the MoA SR Regulation No. 199/2008 Coll., setting out the Programme of Agricultural Activities in Designated Vulnerable Zones – in vulnerable zones.

Supplementary measures

- Application of Code of Good Agricultural Practice in the whole SR territory
- Financial subsidies (CAP – paying agency) – financial stimuli supporting the ecological agriculture and supporting the application of best available ecological technologies and products,
- Monitoring of nitrogen substances according to the monitoring programme,
- Development and filling of databases of diffuse pollution sources for cadastral territories or production blocks,
- Application of economic or fiscal tools – penalties, fees by means of application of the "polluter pays" principle,
- Education and increased ecological awareness.

Measures for reduction of groundwater pollution by pesticides and other chemical substances

Basic measures

- Legislative – to constitute in the Water Act an obligation to monitor the groundwater quality to those who handle dangerous substances in determined volumes (§ 39 Article 3 of the Water Act), as well as to those who handle dangerous substances in smaller volumes (§ 39 Article 4 of the Water Act), if it is related to elevated risk of groundwater quality deterioration;
- Legislative – to constitute an obligation for all who are obliged to monitor impacts of dangerous substances to groundwaters in the case of detected leaks resulting in threat to groundwaters to implement the following measures:
 - to evaluate the extent of pollution,
 - to detect regularly concentration of a pollutant in groundwaters and to report the results to State Water Authority on a yearly basis, and to authorised persons on request,
 - to elaborate risk analysis of contaminated sites if a risk for impairment of water status and increasing trends of pollutants in groundwater are determined,
 - to implement measures for improvement if the risk analysis will confirm a risk for human health or the environment;
- Legislative – to determine details on monitoring of dangerous substances pressures to the groundwater quality;
- To re-evaluate the permits of the State Water Authority that issued an obligation to those who handle dangerous substances to monitor their impacts to groundwaters;
- To re-evaluate the permits of State Water Authority setting out the conditions of handling dangerous substances (§ 39 Article 2 of the Water Act) in relation to achieving of defined environmental objectives;
- To re-evaluate the permits for discharging of waste waters or special waters into groundwater in relation to the Article 6 of the Directive 2006/118/EC on groundwaters in relation to prevention or reduction of release of pollutants into groundwaters, especially any dangerous substances (see Annex 1, List I., paragraphs 1, 2, 3, 4, 7, 8 of the Act No. 364/2004 Coll. on waters), as well as other pollutants (see Annex 1, List I., paragraphs 5, 6 and List II, paragraphs 1 and 2 of the Act No. 364/2004 Coll. on waters), if they are considered dangerous;
- Remediation of contaminated sites, selected from the Register of Contaminated Sites (RCS – part B – contaminated sites) listed in the Information System of Contaminated Sites (*Information system*, 2010). List of contaminated sites, i.e. contamination sites located in the water bodies with poor chemical status recommended for measures during whole planning cycle (until year 2027), in mutual cooperation with the State Programme of Remediation of Contaminated Sites,
- Investigation and monitoring of the priority probable contaminated sites (RCS – part A – probable contaminated sites), and investigation and monitoring of priority contaminated sites (RCS – part B), located in water bodies with poor chemical status recommended for priority measures in compliance with the State Programme for Remediation of Contaminated Sites;
- Elaboration of contaminated sites risk analyses for priority contaminated sites in mutual coordination with the State Programme of Remediation of Contaminated Sites;
- Remediation of contaminated sites, selected from the Register of Contaminated Sites (RCS – part B – contaminated sites) listed in the Information System of Contaminated Sites (*Information system*, 2010). List of priority contaminated sites, i.e. contaminated sites located in water bodies with good chemical status recommended for measures during whole planning cycle (until year 2027), in mutual cooperation with the State Programme of Remediation of Contaminated Sites;
- Management of pollution sources – elaboration of methodology for its implementation and practical application.

Supplementary measures

- Preparation of the action plan for sustainable use of pesticides.
- Monitoring of pesticides in groundwaters.
- Application of economic and fiscal tools – penalties, fees by means of application of the “polluter pays” principle.
- Education and increased ecological awareness.

8.6 Groundwater quantity

8.6.1 Approach to proposal of programme of measures

Programme of measures aimed at reversion of the poor quantitative status of groundwater bodies (described in the chapter 5.2.4) represents the proposal of action procedures oriented in the achieving of good quantitative status in all groundwater bodies until year 2015. As excessive abstraction of groundwaters from the groundwater bodies form the key factor of poor quantitative status of groundwater bodies in Slovakia, the measures in this field should be oriented primarily into the reduction/regulation of existing abstractions of groundwater, or to changed strategy of groundwater abstraction in the identified problematic sites from the water management point of view.

Proposal of measures for the individual groundwater bodies in poor quantitative status results from the reasons of their incorporation among water bodies with poor quantitative status, and it is described below.

SK1001200P – Intergranular groundwaters of the quaternary sediments of river Hornád. This water body was categorised as having poor quantitative status due to the documented long term decline of groundwater level and significant influence of groundwater abstraction to the status of surface water bodies. On the basis of the evaluation, poor quantitative status of this water body was determined in more sites, therefore the proposed measures should consider the water body as a whole. It is obvious that from the point of view of groundwater abstraction influence to the surface water this negative impact is most significant in the southern part of the groundwater body. Complex re-evaluation of water management of the groundwater exploitation is required for the whole groundwater body, especially groundwater resources in the sites with extensive exploitation.

Water abstraction reduction is required in the whole groundwater body:

SK200030FK – Fissure and carst-fissure groundwaters of Pezinské Karpaty, river Váh sub-basin. The reason of incorporation between the water bodies with poor quantitative status is based on the balance evaluation of groundwaters. Abstraction reduction is required especially in the significantly exploited sites Pezinok, Doľany and Píla with groundwater abstraction exceeding 70 litre per second.

SK200220FP – Fissure and intergranular groundwaters of the northern part of Central Slovakia neovolcanites – poor quantitative status is caused by the influence of groundwater abstraction to the status of surface water bodies. Reduction of abstraction is required especially in the sites Očová, Dobrá Niva, we suppose that also abstractions in the sites Kremnica and Krahule should be considered during reduction.

SK200360FK – Fissure and carst-fissure groundwaters of the north-eastern part of Low Tatras. Poor quantitative status of this groundwater body is caused by groundwater abstraction influence to the status of surface water bodies. It comprises especially abstraction of the springs Malý and Veľký Brunov and the group of boreholls in significantly exploited site Liptovská Teplička.

SK200380FP – Fissure and intergranular groundwaters of the Pokoradzská Table. Poor quantitative status is caused by the balance evaluation of groundwater. Abstraction reduction is required in the site Vyšný Skálnik.

8.6.2 Proposal of measures

The programmes of measures in the field of achievement of good quantitative status of groundwater body until year 2015 represent a battery of action plans, practical implementation of which is a prerequisite of reversion of present or prognosed poor quantitative status of the groundwater bodies. They are determined with maximum target-orientation of their effectiveness. They comprise basic and supplementary measures.

Local excessive groundwater abstraction in a groundwater body is a key anthropogenic factor causing rarely appearing poor quantitative status of groundwater bodies in Slovakia in general. The basic measure in this field is therefore decrease/regulation of the existing water abstraction, or changed strategy of groundwater exploitation in the identified sites with water management problems.

The following fields of orientation in the programmes of measures (beyond the mentioned abstraction regulation) were defined during the determination of measures aimed at improvement of poor quantitative status of the groundwater bodies until year 2015:

- integrated water management of water resources (cross-connection of water systems, synergic action of groundwater and surface water resources etc.),
- construction of new and improvement of technical parameters of existing water distribution systems,

- economic and fiscal tools (penalties) for illegal abstractions,
- control of the abstracted water volumes,
- payments from small users,
- education and increased public ecological awareness.

The following procedure for the improved quantitative status of groundwater bodies is expected:

- a) identification of resource or group of exploited groundwater resources causing groundwater level decline, or failure to meet the requested balance status, or causing significant impact to the surface water course flow,
- b) refining and classification of identified sites of groundwater resources into lists of resources requiring application of measures, or group of measures from the list of measures (possibly needed complementary investigation activities),
- c) selection of measure (or group of measures) from the list of measures that will ensure reversion of trend to approach poor quantitative status of the groundwater body, or achievement of good quantitative status of groundwater body that is in a poor status at present, while ensuring maximum effectiveness of allocated costs for their implementation,
- d) legislative or technical specification of practical implementation of selected programme (programmes) of measures,
- e) definition of legal subject responsible for practical implementation of measure, and responsible for performance of control of selected measure effectiveness,
- f) state Water Authority is expected to become a key body of the procedure for change of water management permit for groundwater abstraction.

The implementation success will be displayed by the expected improvement of the quantitative status, and basic and operational monitoring of the state hydrological network will be primarily used as a control mechanism.

8.7 Costs of measures

Cost estimates were performed for the following measures proposed in the chapters 8.1 to 8.5:

- basic measures, resulting from the requirements of regulations and directives of the European Community and from WFD requirements, Article 11 (3) (a) and its Annex VI, section A, and from WFD requirements, Article 11 (3) (b) – (l),
- supplementary measures specified in the Annex VI WFD, section B.

The list of basic and supplementary measures to be implemented in the programmes of measures is requested also by the MoE SR Regulation No. 224/2004 Coll.

8.7.1 Costs of the basic measures for meeting the requirements of WFD Article 11(3) (a) and Annex VI, section A

Types of measures and cost estimate for measures according to the individual EU directives are described below.

Directive 76/160/EEC on the quality of bathing water, as amended by the Directive 2006/7/EC on the management of bathing water quality

The following measures will be implemented in order to meet the requirements of the Directive 76/160/EEC on the quality of bathing water, as amended by the Directive 2006/7/EC on the management of bathing water quality:

- monitoring,
- technical measures are not required at present.

Note: the effect of technical measures proposed in the framework of directives 91/271/EEC on urban waste water treatment and 91/676/EEC on nitrates will have a positive impact also to the bathing water quality.

Costs of the water sampling will be covered by Ministry of Health of the Slovak Republic.

Directive 80/778/EEC on the drinking water, as amended by the Directive 98/83/EC

No technical measures were required, costs were therefore not estimated.

Note: the measures proposed in the framework of the Directive 91/271/EEC on urban waste water treatment, Directive 91/676/EEC on nitrates, Directive 96/61/EC on IPPC will have a positive effects also to the quality improvement of water intended for drinking water production.

Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances (Seveso)

No technical measures were required, costs were therefore not estimated.

Directive 85/337/EEC on the environmental impact assessment

Measures proposed in the programme of measures will be subject to the environmental impact assessment after elaboration of realisation projects, as these assessments will form a component of the construction realisation preparation. Therefore the cost estimate is not relevant at present.

Directive 86/278/EEC on the waste water treatment sludge

- monitoring of the sludge production and contamination.
- Monitoring costs are involved in the WWTP operational costs.

Directive 91/271/EEC on the urban waste waters treatment

The following measures are proposed in the programme of measures:

- construction and reconstruction of sewage systems (SS),
- construction and reconstruction of WWTPs.

Cost estimate is shown in the *Table 8.8*.

Directive 91/414/EEC on the plant protection products

The following types of measures will be implemented:

- application of registered plant protection products only,
- adherence to directives, regulations and decisions approved by EC as a amendment of directive 91/414/EC.

As the above measures result from the act, costs are not estimated.

Directive 91/676/EEC on nitrates

The following types of measures will be implemented:

- monitoring,
- application of the Programme of Agricultural Activities in the designated vulnerable zones (MoA SR Regulation No. 199/2008 Coll.),
- completion of the storage capacities for animal waste with sufficient volume.

Cost estimate is shown in the *Table 8.8*.

Natura 2000 network

Re-evaluation of the Natura 2000 network.

Cost estimate is shown in the *Table 8.8*.

Directive 79/409/EEC on birds

The following types of measures will be implemented:

- bird population monitoring and management,
- technical measures are not required at present.

Note: The measures proposed in the framework of the Directive 91/271/EEC on urban waste water treatment, Directive 91/676/EEC on nitrates, Directive 96/61/EC on IPPC and measures for improvement of hydromorphology of water bodies will have positive effect also to the status of bird population.

Cost estimate is shown in the *Table 8.8*.

Directive 92/43/EEC on habitats

The following types of measures will be implemented:

- monitoring and management of biotopes.

Note: the technical measures for monitoring are not required at present. The measures proposed in the framework of the Directive 91/271/EEC on urban waste water treatment, Directive 91/676/EEC on nitrates, Directive 96/61/EC on IPPC and measures for improvement of the hydromorphology of water bodies will have positive effect also to the status of water dependent biotopes.

Cost estimate is shown in the *Table 8.8*.

Directive 96/61/EC on integrated pollution prevention and control

The following types of measures will be implemented:

- upgrade of the information system EPER to E-PRTR and its filling,
- regular update of permits pursuant to the legislation in force.

Information system was updated in year 2007; only administrative costs of the system filling will be comprised, as these were not estimated. Moreover, the costs of updating of permits that results from the act were not estimated.

Technical measures related to the implementation of BAT technologies in order to achieve compliance with the legislation in force are proposed by the polluters themselves (private sector) who are at the same time responsible for their financial coverage. Such information was not retrieved.

8.7.2 Costs of basic measures for meeting of the WFD requirements, Article 11(3) (b) – (l)**Measures for the Article 9 WFD compliance, i.e. measures for the return of costs of water services**

The following will be implemented:

- proposal of financial mechanism as a component of the price policy pursuant to the Article 9 WFD – as a background for political decision.

The costs were not estimated until now, as the proposal of financial mechanism pursuant to the Article 9 WFD is only in phase of research project that analyses already implemented economic tools in the water sector, and in the next phase it will allow to issue a proposal for their potential intensification, or for introduction of new economic tools.

Measures to promote an efficient and sustainable water use

The following will be implemented:

- water monitoring.

Costs of monitoring for whole SR until year 2015 are shown in the *Table 8.8*.

In order to ensure protection of water used for drinking water abstraction (meeting of the requirements of the Article 7 WFD), including measures to reduce the level of purification treatment for drinking water production

The following will be implemented:

- protection (safeguard) zones of water resources are designated – they are approved by the state water authorities (continuous activity),
- technical measures for decreased proportion of treatment were not specified.

Note: The measures proposed in the framework of the Directive 91/271/EEC on urban waste water treatment, Directive 91/676/EEC on nitrates, Directive 96/61/EC on IPPC and measures for the improvement of hydromorphology of water bodies will have positive effect also to the status of water bodies.

As the above measures result from the act, their costs are not estimated.

In order to ensure regulation of fresh surface water and groundwater, as well as impoundment of fresh surface water, including the register or registers of water abstraction and requirements of the previous abstraction and impoundment permits

The following is implemented at present:

- no particular measures are required except those which result from the act.

As the above measures result from the act and they represent continuous activity, their costs are not estimated.

In order to ensure regulations, including the requirement for prior authorisation of artificial groundwater body recharge

The following types of measures will be implemented:

Artificial groundwaters recharge in order to improve the quantitative status of groundwater bodies is not proposed. The following measures are proposed for the improvement of the quantitative status:

- limiting of groundwater abstractions by use of surface water resources (partial replacement of water abstraction of groundwater bodies by abstraction of surface waters related to the changed permits),
- construction of new water management systems and interconnection of the existing systems,
- regulation of groundwater abstraction by the revision of permits in order to ensure balanced status of groundwater abstraction and natural refilling of groundwater resources and reserves,
- proposal of exploitation concept for the new water resources (complementary and reserve resources),
- refining of assessment of groundwater resources and reserves in the groundwater body,
- improved records of used groundwater resources and control of abstracted volumes of groundwaters.

Regulation of abstraction for exploitation of groundwater and surface water relates to the administrative costs for regular revision and re-evaluation of permits that result from the act. These costs were not estimated.

The measure *Proposal of exploitation concept for the new water resources (complementary and reserve resources)* is aimed at the groundwater body (or its part, particular site) where excessive exploitation of groundwater resources occurs and when it is in a poor quantitative status:

- measure should ensure determination of the new – complementary, not exploited groundwater resources with economic effectiveness of their connection to the existing water system in a given site, and
- development of concept – understood mainly in the level of operational procedure for exploitation of existing resources (where the abstraction will be reduced in order to prevent excessive abstractions in the future), as well as in the level of exploitation of new – complementary resources, so that the summary abstraction will cover existing and prognosed needs of water in a given site.

Development of the new water systems and interconnection of existing ones could be induced by the measures that will require investments. In the sense of WFD, such costs represent costs of resources.

In order to ensure the regulation of any other significant negative influences to the water status, especially hydromorphological impacts

The following types of measures will be implemented:

- measures for insurance of the longitudinal continuity of rivers and habitats,
- measures for insurance of the lateral continuity (connection of adjacent wetlands/inundations with the water course),
- measures for improvement of the hydrological regime.

Cost estimate is shown in the *Table 8.8*.

In order to decrease the groundwater pollution by harmful and particularly harmful substances aimed at achieving of the environmental objectives set out in the Article 4 WFD

Costs of solution of contaminated sites defined in the State Programme of Remediation of Contaminated Sites – cost estimate is shown in the *Table 8.8*.

Other basic measures according to the Article 11 (3) points (b) to (l) have a legislative character, or the implementation of them already results from the act, therefore the costs were not estimated.

8.7.3 Total expected costs

The costs of measures incorporated into the programme of measures of the management plans of river basins are summarised in the following *Table 8.8*.

Table 8.8 Cumulative cost estimate and financial resources for the programme of measures in SR for years 2010 – 2015

Group of measures	Years	Cost estimate (million Eur)	Financial resource			Note
			EU funds ¹⁾	State budget ²⁾	Public resources ³⁾	
Construction and reconstruction of public sewage systems and construction and reconstructions of WWTPs in agglomerations falling under the Directive 91/271/EEC	2010 – 2015	793.219	689.756	79.32	24.143	1) OPE – operation objective 1.2, priority axis 1 3) budget chapter of MoE SR 4) beneficiary (municipalities of water companies) * deficit from year 2007 – 2009
		+ 1,172.816*		+1,172.816*		
Directive 91/676/EEC on nitrates – completion of storage capacities	2010 – 2015	150.00	0	0	150.00*	4) private enterprises * amount of own costs can be decreased relating to approved projects in PRV 2007 – 2013
Directive 92/43/EEC on habitats						
Preparation and introduction of monitoring of habitats and species, and improvement of information availability to publics	2010 – 2015	17.841	17.841	0	0	1) OPE – priority axis 5
Investigation of appearance of species and habitats marked by EC	2011 – 2015	0.23	0	0	0.23	3) MoE SR – Environmental fund, costs estimated by SNC SR
Directive 79/409/EEC on birds						
Processing of data for ensuring of favourable status of selected bird species and their habitats	2010 – 2015	2.088	2.088	0	0	1) OPE – priority axis 5
Monitoring and management of cormorant species (<i>Phalacrocorax carbo</i>)	2010 – 2015	1.521	1.521	0	0	1) OPE – priority axis 5
Re-evaluation of the Natura 2000 network	2011 – 2014	8.392	8.392	0	0	1) OPE – priority axis 5
For the protection of effective and sustainable water use – monitoring according to WFD	2010 – 2027	10.00	10.00	0	0	1) OPE – operation objective 1.3, priority axis 1
	2010 – 2015	10.00	10.00	0	0	

Continuation of the Table 8.8 Cumulative cost estimate and financial resources for the programme of measures in SR for years 2010 – 2015

Group of measures	Years	Cost estimate (million Eur)	Financial resource				Note
			EU funds ¹⁾	State budget ²⁾	Public resources ³⁾	Own resources ⁴⁾	
Hydromorphological measures	2011 – 2027	64.900	55.165	6.490	0	3.245	1) OPE – operation objective 2.1., priority axis 2 2) budget chapter of MoE SR 4) beneficiary (SWME s.e., or construction owner)
	2011 – 2015	2.278	1.936	0.228	0	0.114	
Costs of solving of contaminated sites (defined in the State Programme of Remediation of Contaminated Sites)	2010 – 2027	503.00	116.40*	33.00**	0	3.60***	* OPE – operation objective 4.4, priority axis 4 ** Budget chapters of MoE SR, MoD SR, MoA SR, MoTPT SR ***cofinancing
	2010 – 2015	153.00	116.40*	33.00**	0	3.60***	* OPE – operation objective 4.4, priority axis 4 ** Budget chapters MoE SR, MoD SR, MoA SR, MoTPT SR ***cofinancing
Construction of SS and WWTPs in municipalities below 2,000 p.e. – supplementary measure	2016 – 2027	Costs were not calculated	-	-	-	-	Will be calculated in the next planning period 2016 – 2021 during upgrade of Water Plan of the Slovak Republic
TOTAL COSTS	2010 – 2027	2,724.007*	901.163	1,291.626	0.23	180.988	* costs of contaminated sites issues amounting 350 million EUR are not specified
Deficit out of the total costs		1,172.816**		1,172.816**			** deficit from years 2007 – 2009 (Directive 91/271/EEC)

9 Uncertainties in the Slovak plan for the first planning cycle

Table 9.1 *Uncertainties in the Slovak plan for the first planning cycle*

Progress until year 2009	Plan of further activities
Chapter 4 – Identification of significant pressures	
Municipal pollution sources were not assessed as agglomerations in line with the Directive 91/271/EEC. Designation of agglomerations in line with the Directive 91/271/EEC – assessment of pressures is performed for the individual agglomerations.	Improved quality of data collection, databases and evaluation
	Investigation of household waste water handling in small municipalities (out of Directive 91/271/EEC scope)
	Updating of the Pollution Reduction Programme for Dangerous Substances
	Identification – investigation of amount and quality of storm water overflow from public sewage systems
	Refining of information on pollution originating from diffuse pollution sources
Identification of hydromorphological pressures on the water courses with catchment area below 100 km ² was not finalised. Identification is finalised in 90% of water bodies.	Continuing identification
	Verification of continuity of hydromorphological pressures disturbing longitudinal continuity of rivers in small water courses
Uncertainties in the field of groundwaters pressures on surface waters (issues of minimum water flow and interaction of surface and groundwaters)	Continuing development of methods and quantification of minimum balance flows. Hydrometrical measurements oriented in identification of hidden infiltrations of groundwaters into surface waters and transfers of surface waters into groundwaters
Chapter 5 – Monitoring network, ecological status/potential and chemical status – surface waters	
Intercalibration of biological elements for status evaluation is not finalised (except of intercalibration for benthic invertebrates in selected types of water courses).	Continuing intercalibration of water flora and fish
Missing biological validation of typology	Biological validation will be performed during the second planning cycle.
Missing methodology for evaluation of operational monitoring of water status	Development of method proposal
Missing classification of rivers with altered category (water reservoirs) for evaluation of ecological potential	Continuing methodological development
Uncertainties in determination of background concentrations of heavy metals. Problem is solved by Water Status Monitoring Programme – years 2010 – 2015	Revision of background concentrations of heavy metals for evaluation of ecological and chemical water status
Uncertainties in evaluation of relevant substances (synthetic and non-synthetic specific substances) for SR	Updating of the Water Pollution Reduction Programme for Dangerous Substances
Uncertainties in expected response of aquatic fauna and flora to implemented measures proposed under Programme of Measures	Problem is solved by water status monitoring programme.
Determination of HMWB and AWB is not finalised.	Continuation of task in the next planning cycle.

■ Uncertainties in the Slovak plan for the first planning cycle

Continuation of the Table 9.1 *Uncertainties in the Slovak plan for the first planning cycle*

Progress until year 2009	Plan of further activities
Chapter 5 – Monitoring network, chemical and quantitative status – groundwaters	
Criteria for identification of significant and sustained upward trends of pollutant in groundwater were not determined.	Activity will be performed during the 2 nd planning cycle.
Criteria for definition of starting points of trend reversals were not determined.	Activity will be performed during the 2 nd planning cycle.
Trend analysis was not performed for any pollutant.	Activity will be performed during the 2 nd planning cycle.
Evaluation of trends was not performed – environmentally significant increase of pollutant concentration, group of pollutants or pollution indicator in groundwater bodies.	Activity will be performed during the 2 nd planning cycle.
Inaccuracies in determination of water management potential of groundwaters in the individual groundwater bodies (hidden transfers of groundwater between groundwater bodies in both, horizontal and vertical directions)	Continuous activity
Uncertainties in groundwater sampling issues (accuracy of measurement, recording of abstracted resources, respecting of permits for groundwater abstraction)	Continuous activity, personal strengthening and increased emphasis to control activities in accordance with legislation in force
Uncertainties in monitoring of changed regime of groundwaters pressures to terrestrial ecosystems	Investigation and evaluation of terrestrial ecosystems, targeted monitoring
Total absence of measurement and evaluation of quantitative status of groundwater bodies in geothermal structures	State management of geothermal waters
Chapter 7 – Economic analysis of water use	
Undissolved issue of adequate contribution from different patterns of water use, respecting the “user and polluter pays” principle.	Activities will be performed during coming years
	Practical application of the principle in the field of water price policy in compliance with the Article 9 WFD, contained in the document <i>Price policy</i> that will be approved by the Government.
Environment and resource costs are not defined.	Elaboration of the method for quantification of the environmental and resource costs
	Necessity to introduce legislative obligation to record data according to the sub-basins for the needs of economic WFD analysis (SWME s.e., water companies, Regional Environmental Offices, etc.)
Chapter 8 – Programme of measures	
Analysis of interrelationship between pressures to surfacewater bodies and their status was not performed.	This task will be solved during coming years.

10 Protection against harmful effects of water and the climate change

10.1 Climate change

The *UN Framework Convention on Climate Change* adopted in Rio de Janeiro in year 1992 forms an international legal tool for climate change issues. The Slovak Republic accessed the Framework Convention in year 1994. Kyoto Protocol was adopted to the convention in year 1997 that came into force in February 2005 after ratification by the Russian Federation. Slovakia ratified the Kyoto Protocol on May 31, 2002.

National Climate Programme of the Slovak Republic (hereinafter as NCP) is implemented in Slovakia since year 1993, as well as the *National Programme of Greenhouse Gases Emissions into the atmosphere* by means of projects financed from the State Environmental Fund and under supervision of MoE SR. SHMI is a main implementing body of both programmes. SHMI started to issue a new edition of the NCP in order to ensure broad communication and accessibility of the results. The main objectives of the NCP are as follows:

- development of activities in compliance with the objectives of Global Climatic Programme coordinated by the United Nations Organisation (via World Meteorological Organisation and United Nations Environment Programme),
- preparation of background documents for the state bodies and other institutions concerning the meeting of international obligations related to the climate change issues (UN Framework Convention on Climate Change, 21st Century Agenda),
- coordination of activities and tasks related to the climate change, their reasons and impacts on the national level.

The main results of the NCP implementation are as follows:

- proposed network of climatologic and hydrological stations for the climate change monitoring,
- analysis of changes and variability of the hydrological elements in selected water measurement sites in Slovakia,
- analysis of changes and variability of the climate elements in selected climatologic sites,
- potential impacts of the climate changes to plant production in agricultural sector,
- potential impacts of the climate changes to forest ecosystems,
- proposed framework adaptation measures for the mitigation of negative climate change impacts in the water management sector etc.

The individual outputs are shown in the references of the twelve NCP issues published so far.

10.2 Flood protection

Flood risk reduction does not belong to the main objectives of the WFD. Therefore the European Parliament and the Council adopted the Directive 2007/60/EC on the assessment and management of flood risks on October 23, 2007, that came into force on November 26, 2007. Reduction of the unfavourable flood impacts to human health, environment, cultural heritage and economical activities are the objectives of the effective flood management risks. The Directive 2007/60/EC lays down an obligation to elaborate, regularly re-evaluate and to update if necessary the following basic documents of the flood risk management:

1. Preliminary flood risk assessment in order to determine the territories with existing potentially significant flood risks, or where their probable appearance can be assumed. Moreover, only the identified threatened territories will be further processed in the flood risk management. The first preliminary flood risk assessment will be finalised until December 22, 2011, and its results will be re-evaluated and updated, if necessary, until December 22, 2018, and further every six years. This approach allows for incorporation of the territories that were originally considered relatively safe sites after re-evaluation.
2. Flood hazard maps and flood risk maps illustrating the geographical areas possibly flooded during the flood events with different probabilities of appearance up to extreme situations, probable flood extent and potential negative impacts. Flood hazard maps and flood risk maps will be elaborated until

December 22, 2013, and their content will be further re-evaluated and updated, if necessary, until December 22, 2019, and further every six years.

3. Flood risk management plans with determined flood protection objectives and measures for mitigation of the negative flood impacts. Flood risk management plans will be elaborated until December 22, 2015, re-evaluated and updated, if necessary, until December 22, 2021, and further every six years.

Directive of the European Parliament and of the Council 2007/60/EC on the assessment and management of flood risks requires close international cooperation for solving of flood protection problems in the whole river basins. Thus, the EU member states should mutually coordinate their activities in order to elaborate a single international flood risk management plan or collection of flood risk management plans, coordinated on the international river basin district.

On the basis of convention of states that accessed Danube Protection Convention and that are ICPDR members, a collection of flood risk management plans will be developed for the Danube river basin. The collection of plans will comprise 17 coordinated plans, developed for hydrological-geographical units on the level of sub-basins of river tributaries of order II, and inter-basins of the main course. Flood risk management plans will be elaborated for the following territories of the Slovak Republic:

1. Slovak part of the river Morava basin: plan will be incorporated into the joint international flood risk management plan for the Morava river basin in cooperation with the Czech Republic and Austria,
2. zone adjacent to the river Danube from the river Morava mouth to the river Ipel' mouth and basins of Malý Dunaj and Čierna Voda tributaries: the plan will be incorporated into the joint international flood risk management plan for Pannonic middle Danube (inter-basin from Morava to Drava) in cooperation with Croatia, Hungary, Austria and Serbia,
3. Vah river basin, Hron river basin and Slovak part of Ipel' river basin: plans will be incorporated into the joint international flood risk management plan for the river basins of three water courses of order II, in cooperation with Hungary,
4. Slovak part of the river Bodrog basin including respective zone adjacent to the main course of the river Tisza, Slovak part of the Bodva river basin, Slovak part of the Hornád river basin, Slovak part of the Slaná river basin: plans will be incorporated into the joint international flood risk management plan in cooperation with Hungary, Romania, Serbia and Ukraine, coordinated by the work group for the river Tisza basin established by ICPDR,
5. Slovak part of the Dunajec river basin and Slovak part of the Poprad river basin: plans will be incorporated into the joint international flood risk management plan for the Vistula river basin elaborated in cooperation with Poland.

Directive 2007/60/EC is transposed into the Act No. 7/2010 Coll. on flood protection and its executive regulations. Methodological issues up to the level of practical procedures of the Directive 2007/60/EC implementation will contain the results of the national pilot project the implementation of which started in year 2008 and that will be terminated in year 2010.

10.3 Drought and water scarcity

Low rate of discharge is one of manifestations of the hydrological drought. Hydrological drought expresses in addition to the long lasting decline of surface water flow also decreased groundwater levels, decreased levels of lakes, wetlands and water reservoirs.

Hydrological drought is one of the drought manifestations. Drought, generally very uncertain but frequently used term, basically means scarcity of water in soil, plants and atmosphere. However, a uniform criterion for the quantitative definition of drought does not exist thank to the different opinions – meteorological, hydrological, agricultural and many others, regarding the damages in different sectors of the national economy (Bednář, 1993). WFD declares in the Article 1, par. e) mitigation of drought impacts as one of its main objectives.

Knowledge of drought manifestations in the nature is necessary for achievement of this objective, i.e. also the low rate of discharge of the surface water courses. Historical droughts are occasional natural events that are inscribed into mankind history and that stigmatise human life in each segment. They meant hunger, fires, and economical regression. Historical events of low rate of discharge as one of the expressions of heavy drought – are also linked to the serious impacts to the society and the environment. Moreover, their knowledge is important for assessment of vulnerability of water resources in the basin, as well as during application of

measures mitigating drought consequences. During the historical drought we can study its manifestations and impacts to the nature and human society in the natural „laboratory“. The requirement of determination of historical drought parameters appears also in the documents related to WFD, that concern mitigation of drought consequences (WS&D – Council Conclusion, Lisabon 2007).

A rich register of hydrological characteristics is available that expresses hydrological drought or helps to define the drought. Positional hydrological characteristics (M-daily water flow), statistical characteristics (minimum water flow for the individual years, periods, months, seasons etc.), probabilistic hydrological characteristics (N-annual minimum water flow, 7-daily centurial flows), as well as non-flow characteristics (insufficient volumes, duration of periods of low rate of discharge) belong to such parameters.

Water management balance, connecting hydrology with water management, offers also tools that evaluate and express the status and options of exploitation of the water resources during drought period on a monthly basis.

In addition to the hydrological and water management characteristics themselves, also evaluation of rate of discharge trends is important for the drought assessment (in the field of average rate of discharge as well as for characterisation of the minimum water flows). Trends for the following parameters were developed for this purpose:

- average monthly flows in the water measurement sites where the water flow is evaluated since year 1971 or earlier,
- minimum monthly flows in the water measurement sites where the water flow is evaluated since year 1971 or earlier (contained in the final report of SHMI project No. 3311 – Implementation of WFD – Surface water quantity – water scarcity and hydrological drought),
- selected M-daily flows (10, 30, 90, 180, 270, 330, 355 and 364 days flow) in water measurement stations where the water flow is evaluated since year 1971 or earlier.

11 Register of more detailed plans and programmes

National strategies:

- Concept of the Water Management Policy of SR until Year 2015,
- Development Plan for the Public Water Supplies and Public Sewage Systems for the Slovak Republic Territory,
- Development Plans for the Public Water Supplies and Public Sewage Systems for the Individual Regions,
- Amendments to the Development Plan for Public Water Supplies and Public Sewage Systems for the Slovak Republic Territory, October 2007,
- Amendments to the Development Plan for Public Water Supplies and Public Sewage Systems for the Slovak Republic Territory No. 2, September 2008,
- Proposal of the Concept of Hydropower Potential Exploitation of SR Water Courses – not approved yet,
- Complex Programme of Erosion Protection and Proposal of Measures for Increased Retention Capacity of SR Territory according to the Individual River Basins.

Watermanagement plans of the sub-basins: Morava, Danube, Váh, Hron, Ipel', Slaná, Bodva, Hornád, Bodrog, Dunajec and Poprad.

12 Public information and consultations

12.1 Public information

Information on WFD implementation process in the Slovak Republic were actually published on the web site reserved for this purpose <<http://www.vuvh.sk/WFD/index.php>>. The main site of the MoE SR was linked to this site. In addition to the legislative and strategic documents and manuals also draft versions of documents and outputs (for most of them also expert opinions) of the individual working groups were published on this site. The web site was announced to the participants of many workshops and conferences and other events.

Additional events were organised for a broader public on a yearly basis in the framework of the Water Day in March and the Danube Day in June (oriented also to the youth). The cruise of three special boats during the Danube investigation project JDS2, and information on survey of appearance of flora and fauna species along whole river Danube by a team of specialists was broadly promoted in the dominant media. The Danube Day 2009 was organised in cooperation with the International Workshop on River Danube Basin Management Plan, managed by the ICPDR SR Presidency and Secretariat on 29 and 30 June, 2009. Several press conferences and usual ministry channels, press materials and web site were used in order to inform the public.

Different events served for informing of the expert public and the stakeholders, especially:

- Conference *WFD Implementation Process in Slovakia* in Rajecské Teplice in April 2006,
- Conference *Towards the Integrated River Basin Management* in Častá – Papiernička, May 29 to June 2, 2006, with international participation.

Activities of all working groups were presented during year 2007 also in relation to the discussion on the content and the time schedule during the event *National Dialogue* on June 18, 2007. Meeting of non-governmental organisations acting in the field of water protection and related ecosystems was held on June 14, 2007.

The second *National Dialogue* oriented in information on significant water management issues was organised during year 2008 (October 21, 2008).

Workshops *Role of wetlands in the integrated river basin management* in ten sub-basins covering whole Slovakia during October and November 2006 were organised on the local level, with participation of many representatives of state authorities, self governments and other stakeholders. *River basin workshops* were organised in November and December 2007, where the main results of the implementation process were presented in six river basins covering whole Slovakia (designation of river basins and competent authorities, characterisation of water bodies, economic analyses, protected areas, monitoring programmes). Moreover, this event was aimed at information and mobilisation of people on the local level to facilitate the consultation process on significant water management issues – January to June, 2008.

The activities in Slovakia on the level of the international Danube river basin were fully coordinated with the ICPDR activities. These activities are described in the “umbrella report” of the Danube River Basin Management Plan, <<http://www.icpdr.org/>>.

The activities towards public participation on the level of the international Vistula river basin were organised by the bilateral commission. Slovak side joined the national consultation process in Poland for the local level of river Dunajec in Nowy Targ on June 5, 2008.

Many other activities of the individual organisations in the environmental sector or out of its scope served for information of public and other stakeholders. Moreover, multiple projects aimed at problem solving of the implementation comprised many activities oriented in the information on WFD.

Especially, activities of SWME, s.e. and SHMI in the framework of the projects Interreg MOSES and UNDP/GEF Laborec-Uh contained numerous public related activities that resulted in creation of the Čierna Voda River Basin Management Plan. Elaboration of the plan for Čierna Voda was fully coordinated with the ministry and the implementation team on the national level. Many public related activities were performed in the framework of the twinning project *Determination of values of environmental standards for water quality and strengthening of regional and district environmental offices during the implementation of water quality and water monitoring*, and three trainings were organised in Košice, Banská Bystrica and Bratislava with participation of industry representatives and representatives of other stakeholders.

12.2 Consultations

The consultation process was organised as follows:

- Materials to be consulted was accessible on the implementation web site.
- Any additional possibilities, workshops and other events in a given time period were used for further information, the potential stakeholders were invited to participate in the consultation process.
- The comments were collected by electronic or surface mail.
- The comments were evaluated and published on the web site, their authors received the response by e-mail.

Consultation were organised for the following topics:

Time table and work programme for the production of the river basin management plan

Published: December 2006

Consultations: January to June 2007

Comments from public and stakeholders: few formal ones, not substantial.

Interim overview of the significant water management issues

Published: December 2007

Consultations: January to June 2008

Comments from public: few not substantial ones.

Comments from stakeholders including non-governmental organisations (nine subjects): significant comments, solution of which was processed also during the preparation of plans.

A brochure on the water management issues was published in order to inform and involve the public – available on WRI web site.

Draft river basin management plan

Published: January 2009

Consultations: the original deadline January to June 2009 was prolonged.

Slovak Environmental Agency in cooperation with WRI, SHMI, SWME and under responsibility of the MoE SR organised three workshops in Košice, Banská Bystrica and Nitra in May 2009, where the draft plans were presented and discussed.

Three brochures were issued in order to inform and involve the public: 1. Water planning and river basin management plans, 2. Environmental objectives of the water policy, 3. Water status and water management issues in the river basins in Slovakia.

The discussions and works on the finalisation of the river basin management plans on the national level were finalised in December, 2009. The comments were incorporated into the final planning document entitled Water Plan of the Slovak Republic.

Water Plan of the Slovak Republic

Water Plan of the Slovak Republic containing the Danube River Basin District Management Plan and the Vistula River Basin District Management Plan was adopted by the SR Government on February 10, 2010.

13 Overview of competent authorities

Pursuant to the Act No. 364/2004 Coll. on waters, as amended by the Act No. 384/2009 Coll., Ministry of Environment of the Slovak Republic is the designated competent authority for the application of WFD rules in the SR territory.

Legal position of the competent authority

MoE SR is a central body of the state administration for creation and protection of the environment including water management, protection of water quality and quantity and its effective exploitation, fishery except economic fish farming pursuant to the Act No. 139/2003 Coll., amending the Act No. 575/2001 Coll. on organisation of the operation of the Government and organisations of central state administration, as amended, amending the Act No. 312/2001 Coll. on civil service, as amended, amending certain acts, as amended.

MoE SR responsibilities

MoE SR responsibilities is defined by the Act No. 364/2004 Coll. on waters, amended by the Act No. 384/2009 Coll. The roles resulting from this act are ensured by the MoE SR in cooperation with subordinated organisations:

- Slovak Hydrometeorological Institute – water status monitoring programmes, assessment of the surface water ecological status, assessment of the surface water ecological potential, identification of groundwater bodies, evaluation of groundwater quantitative status, drought issues, public information. SHMI has installed, maintained and functioning quality management system compliant with the requirements of the ISO 9001:2000 standard.
- Water Research Institute – identification of surface water bodies, intercalibration sites, definition of the reference conditions, identification of heavily modified and AWB, identification of protected areas, elaboration and completion of the register of protected areas, review of impact of human activities, evaluation of the surface water status and potential, assessment of the groundwater chemical status. WRI Bratislava has a certified quality management system compliant with the STN EN ISO 9001:2001 standard. In addition to the certified system, the institute has also two accredited laboratories according to the STN ISO/IEC 17025 standard, namely:
 - National reference laboratory for waters in Slovakia,
 - Calibration laboratory for water gauging stations.
- Slovak Water Management Enterprise, s.e., Banská Štiavnica – flood issues, cooperation in the economic analyses of water use, cooperation in identification of the heavily modified and AWB, and cooperation in the monitoring and evaluation of surface water status and potential. SWME, s.e., has a national competence with four branch units, established on the basis of the natural river basins. Testing laboratories of the department of ecology, and the water management laboratories of SWME, s.e., branch units in Bratislava, Piešťany, Banská Bystrica and Košice are accredited.
- Slovak Environmental Agency - reporting. Slovak Environmental Agency had developed integrated management system that involves quality management system according to the STN EN ISO 9001:2001 standard, and environmental management system according to the STN EN ISO 14001:2005 standard.

International relationships

Slovakia is a signatory to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, and the Convention on Cooperation for the Protection and Sustainable Use of the River Danube. An International Commission for the Protection of the Danube River was established on the basis of the Convention on Cooperation for the Protection and Sustainable Use of the River Danube that plays a role of coordinator of WFD implementation in this international river basin.

So called Commissions for transboundary waters serve as a platforms for the WFD implementation at the international level, that were established on the basis of bilateral agreements between the Slovak Republic and the neighbouring countries. These commissions cover mainly the issues of bilateral significance. Broader issues are solved at the level of the ICPDR.

■ Overview of competent authorities

In addition to the above conventions, Slovakia concluded bilateral intergovernmental agreements on transboundary waters and on cooperation in the field of environmental protection with neighbouring EU member states, but also with the non EU member states.

SR cooperation in the framework of the international Vistula river basin is realised by the Ministry of Environment SR by means of the agreement between the Government of the Slovak Republic and the Government of Poland on water management of transboundary waters.

13.1 Contact address for accessing the documents

Ministry of Environment of the Slovak Republic
Division of Waters
Nám. L. Štúra 1
812 35 Bratislava
Slovak Republic

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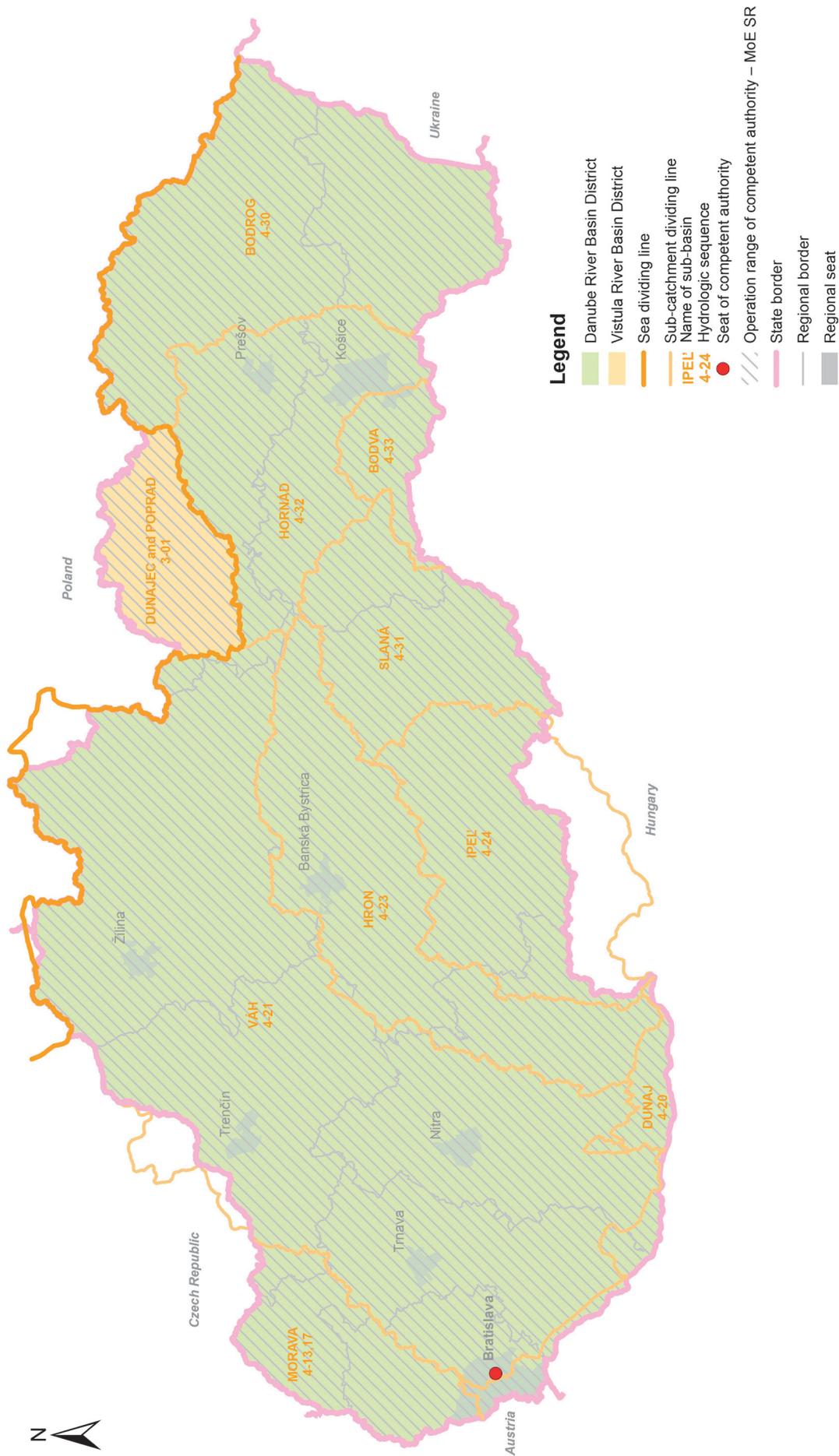
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River basin districts of the Slovak Republic and responsibility of the competent authority

Map 1.1

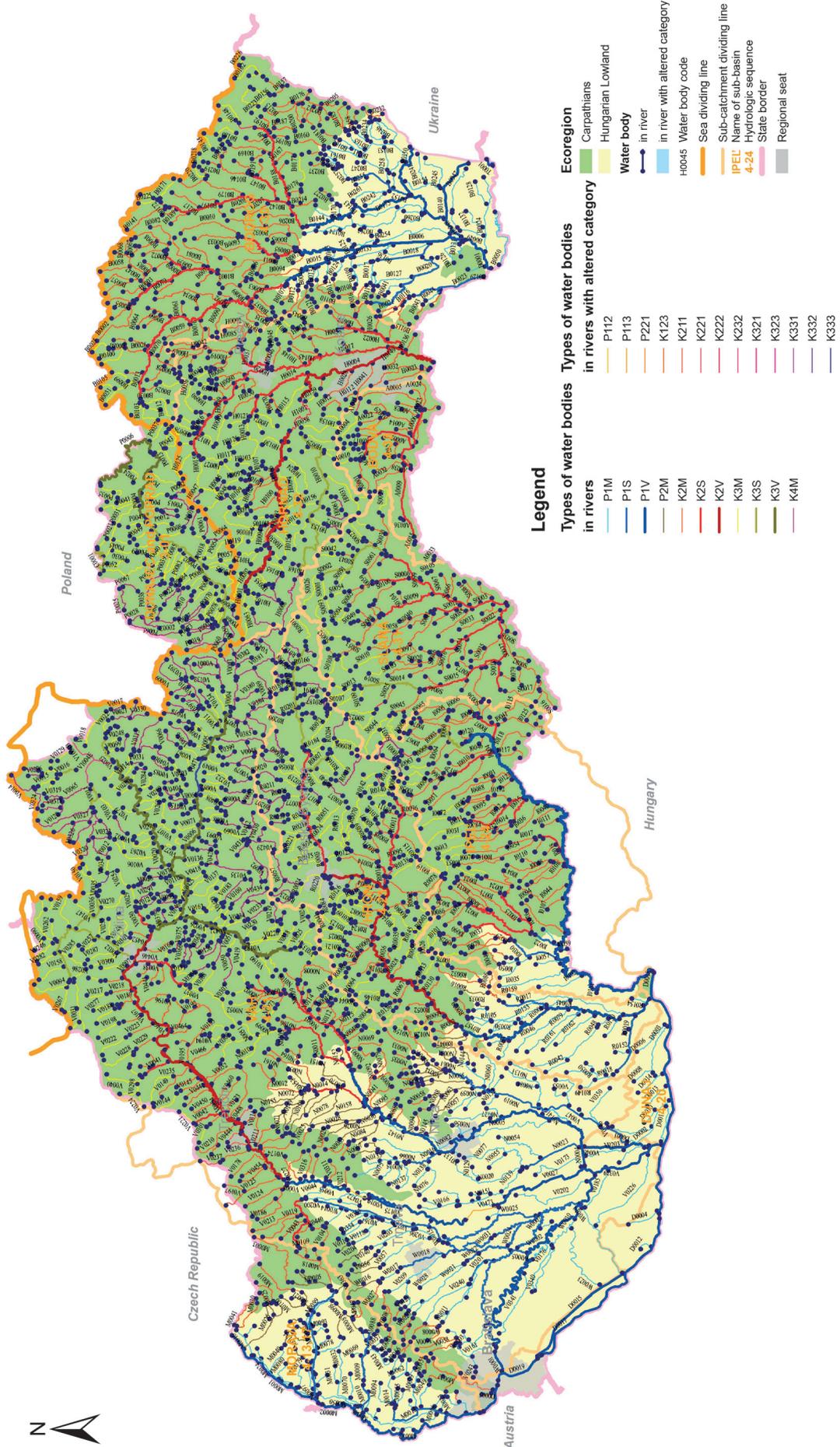


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Surface water bodies and their types

Map 2.1



Scale 1:1 600 000
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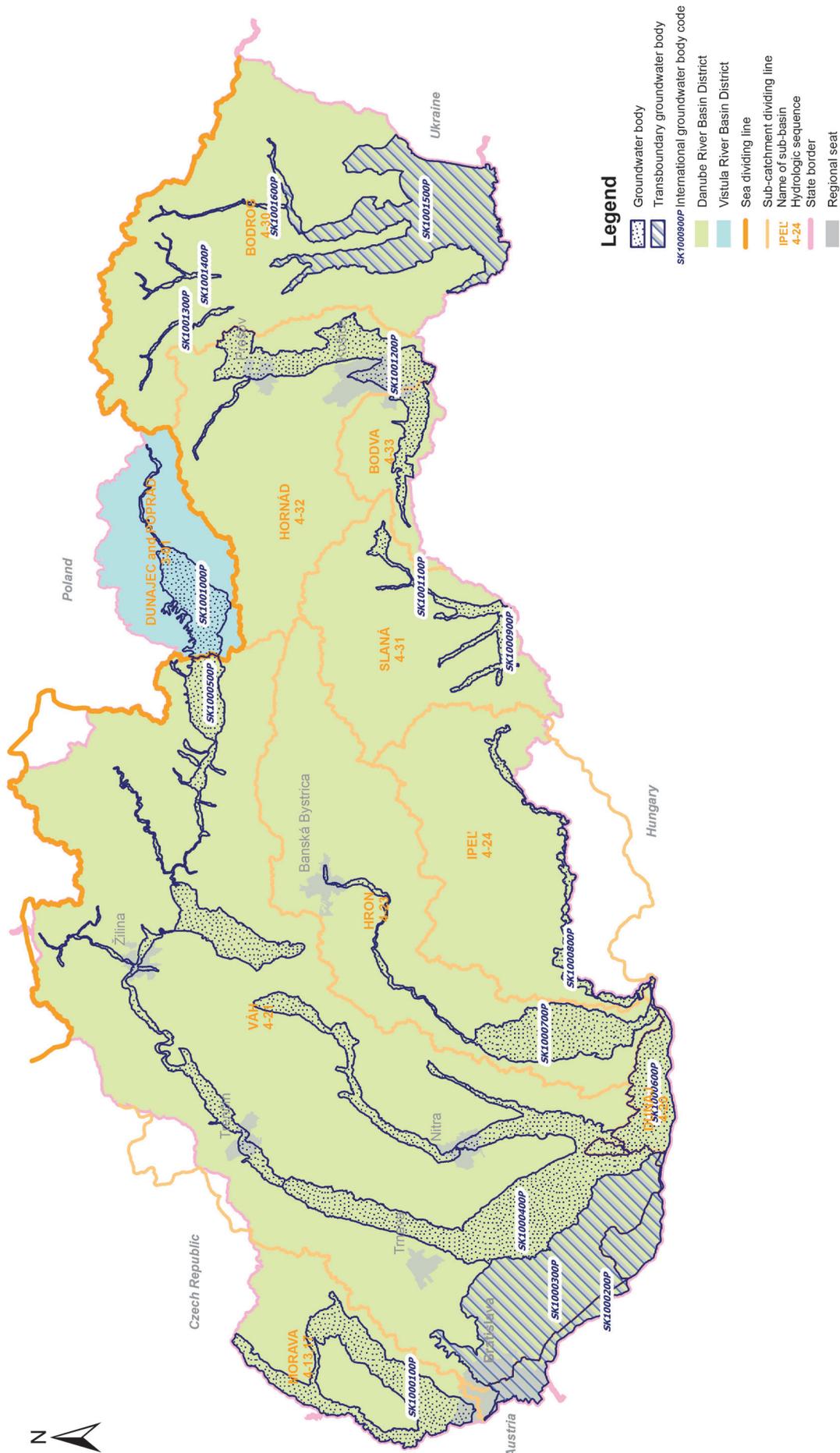


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Groundwater bodies in quaternary sediments

Map 2.2



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Groundwater bodies in pre-quaternary rocks

Map 2.3

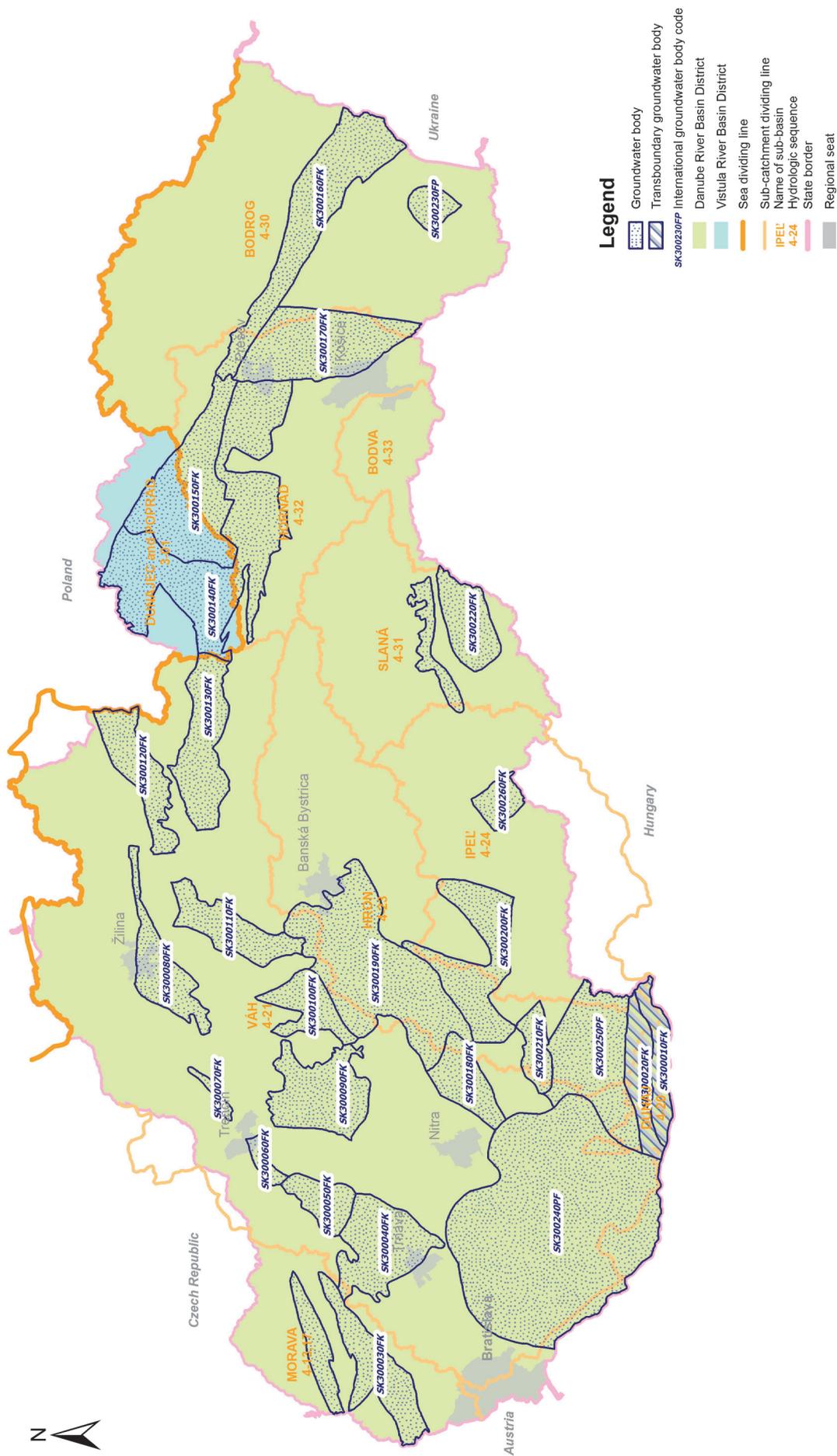


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Groundwater bodies in geothermal structures

Map 2.4



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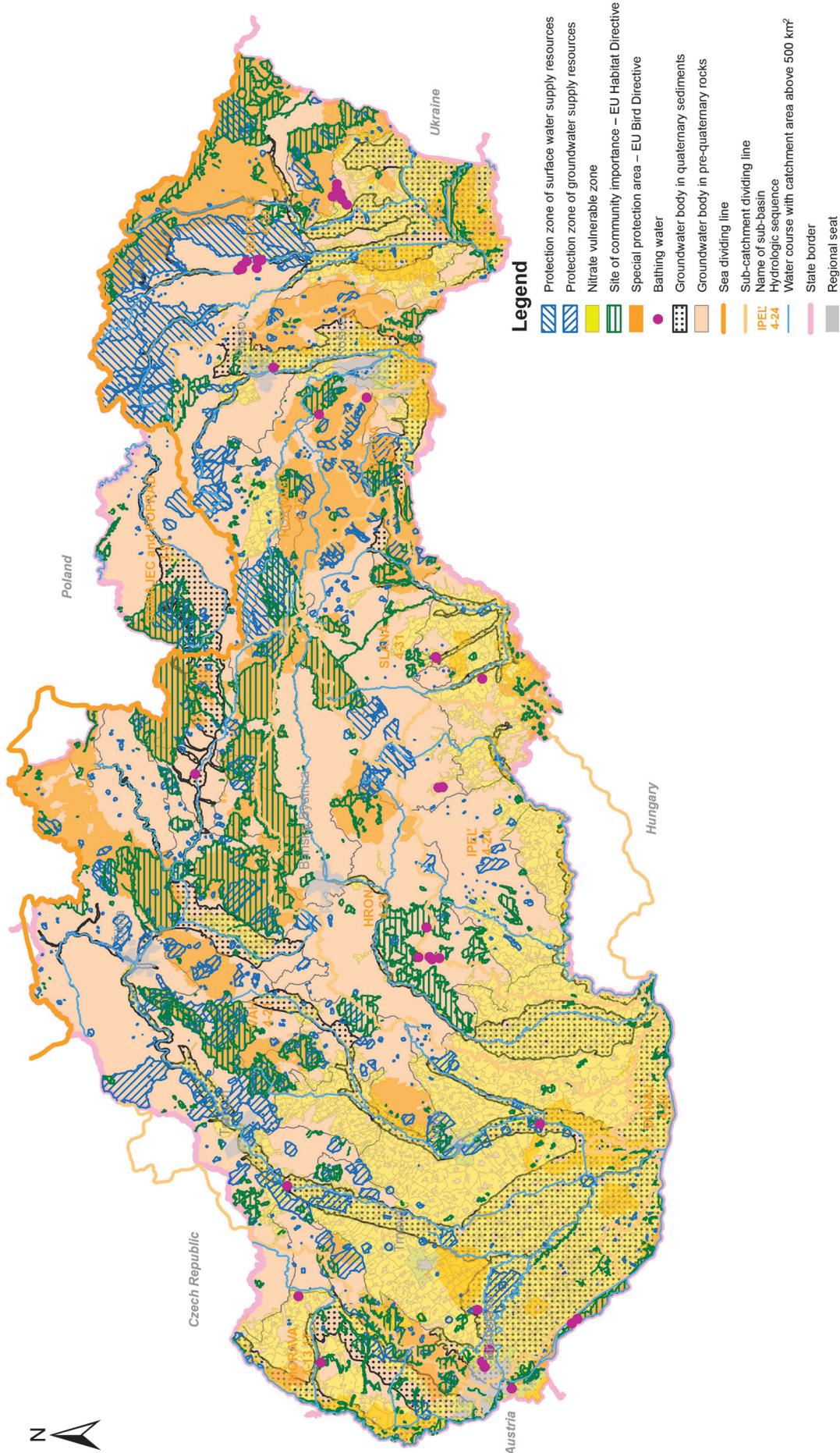
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 0 7.5 15 30 45 60 km

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Protected areas

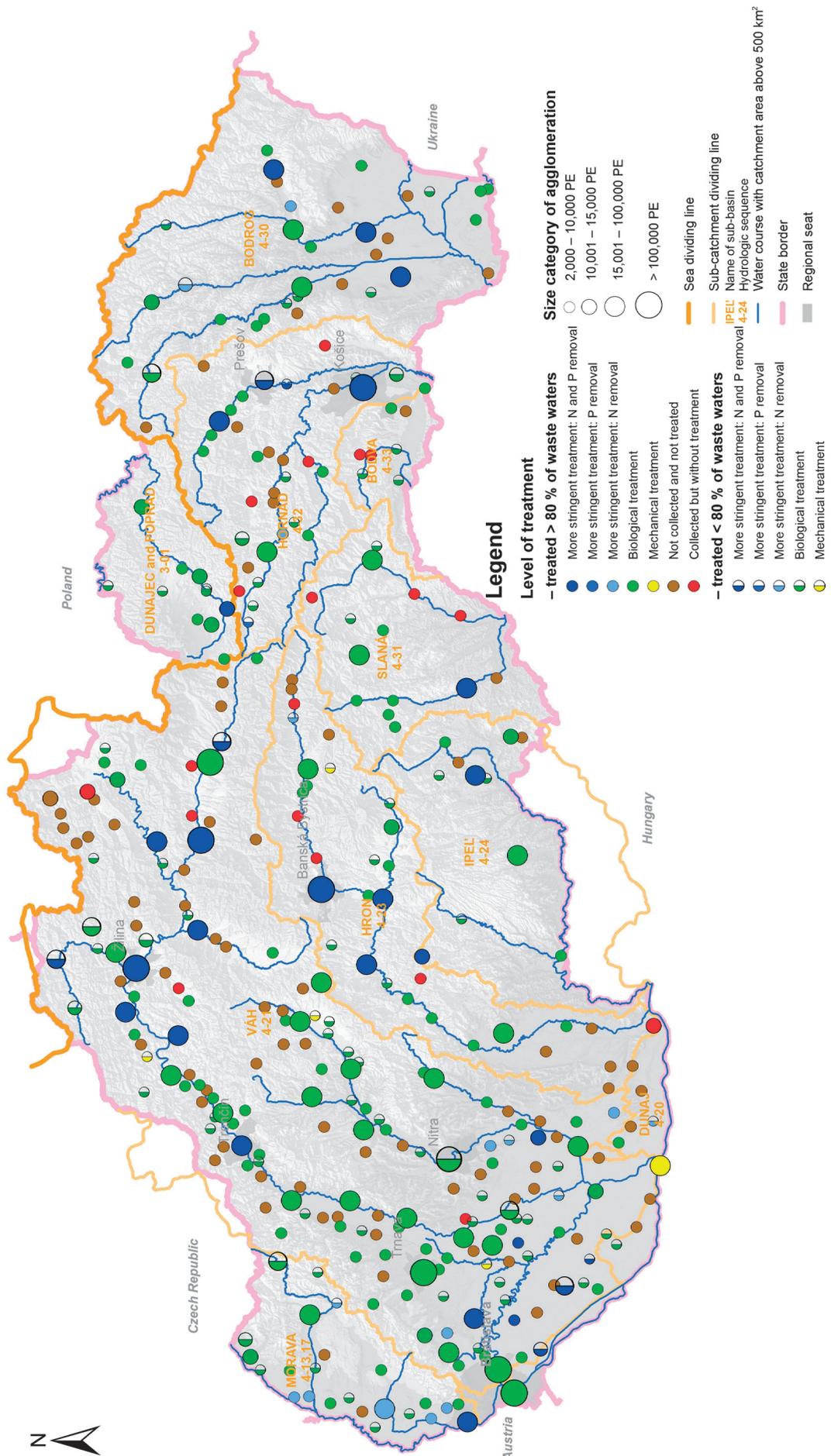
Map 3.1



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Discharge of waste waters from agglomerations – year 2006

Map 4.1a



Scale 1:1 600 000
1 cm = 16 km

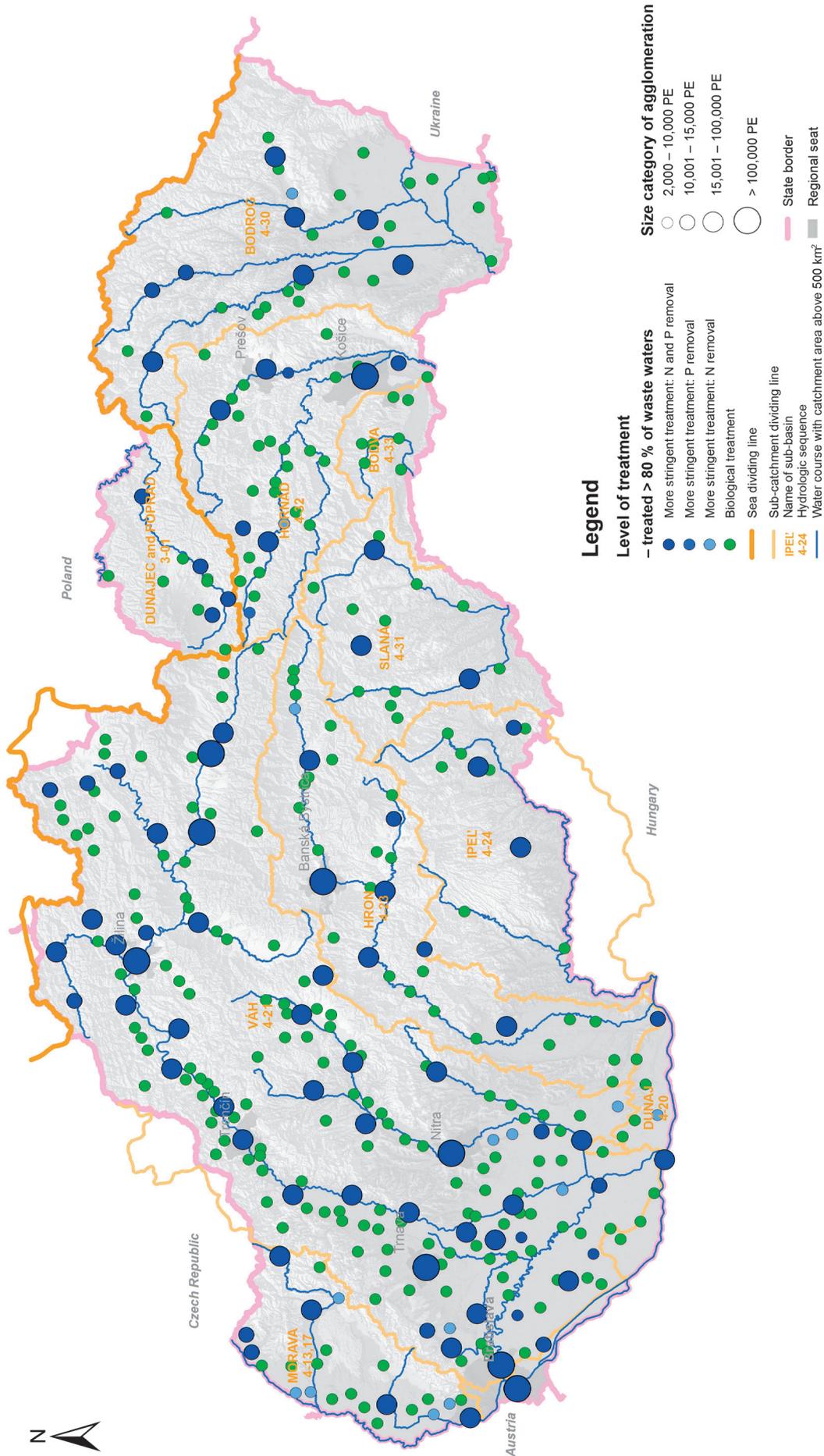


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Discharge of waste waters from agglomerations – perspective until year 2015

Map 4.1b



Scale 1:1 600 000
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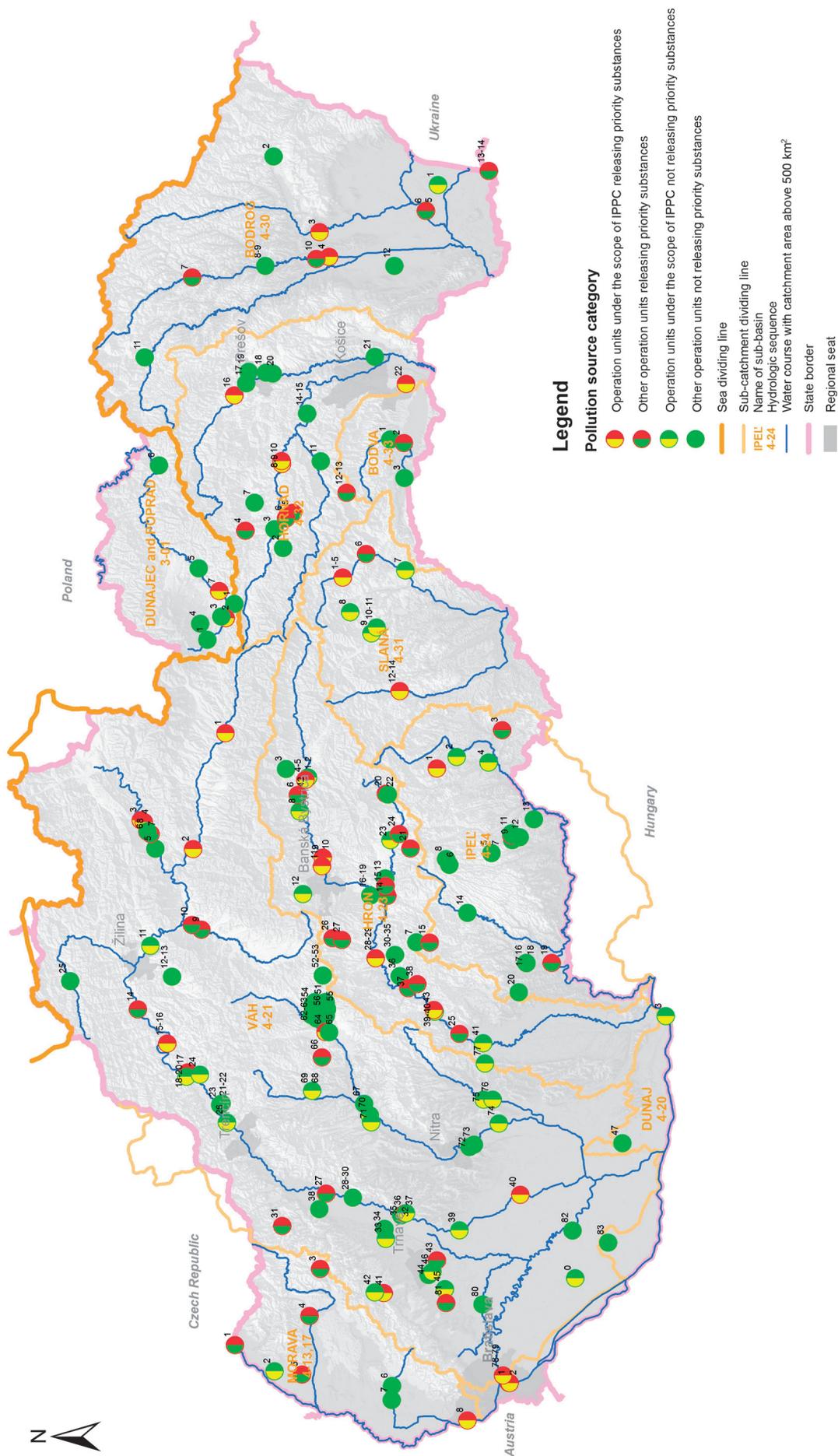


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Categories of significant industrial and other surface water pollution point sources – year 2006

Map 4.2.a



Scale 1:1 600 000



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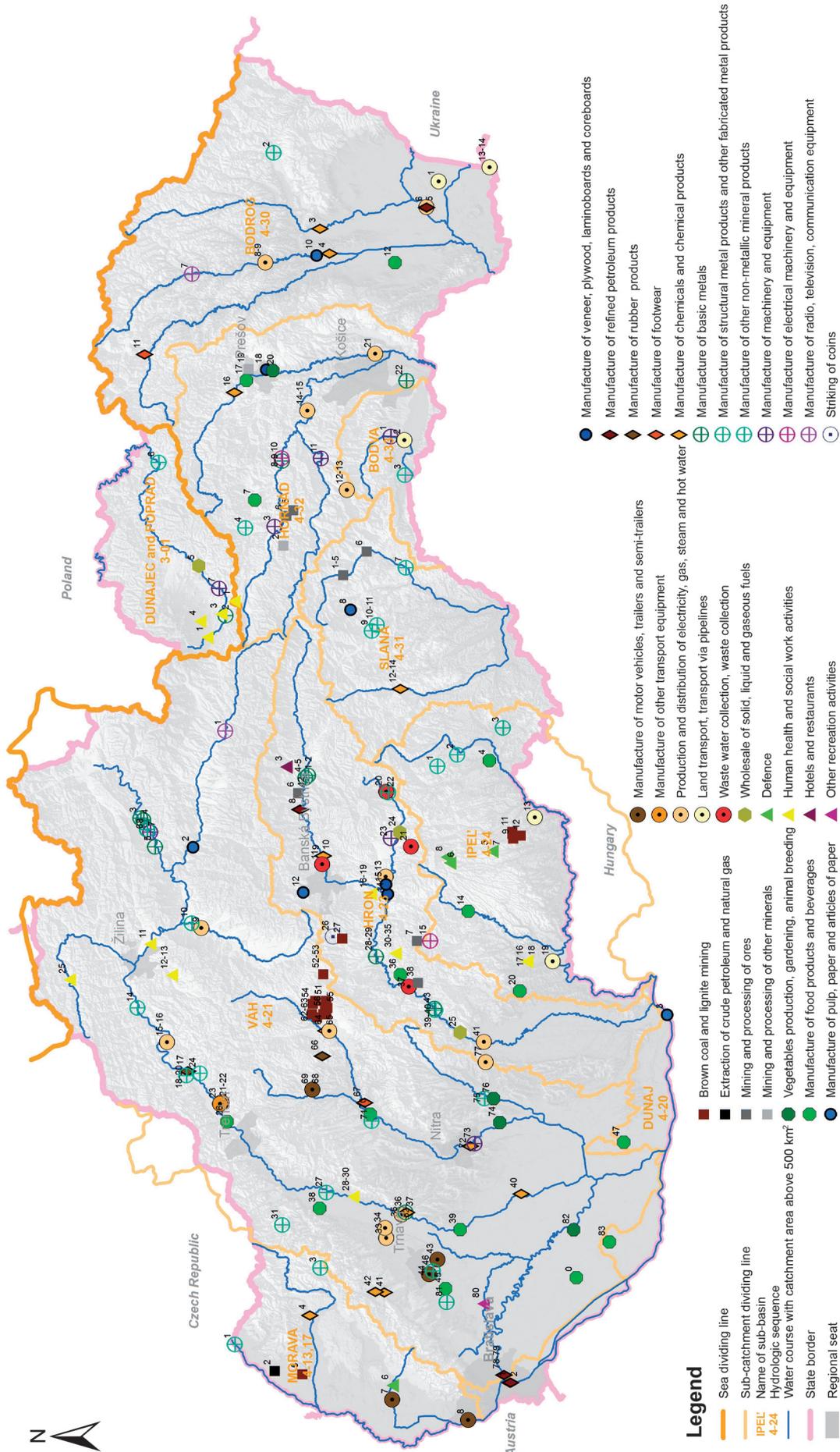


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Significant industrial and other surface water pollution point sources – year 2006

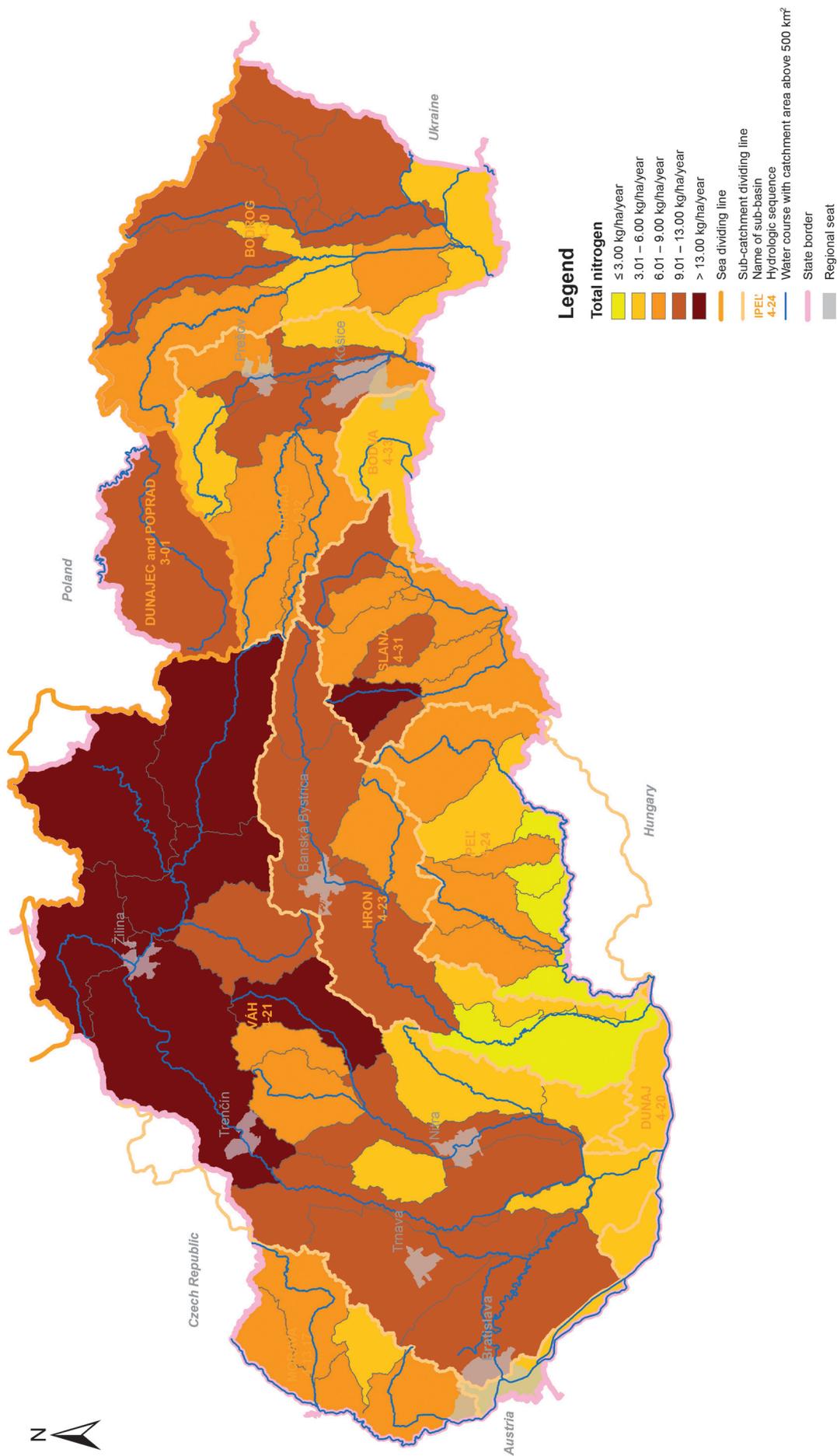
Map 4.2b



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Pollution by nutrients from the point and diffuse sources – years 2005 – 2006 for total nitrogen

Map 4.3a



Scale 1:1 600 000



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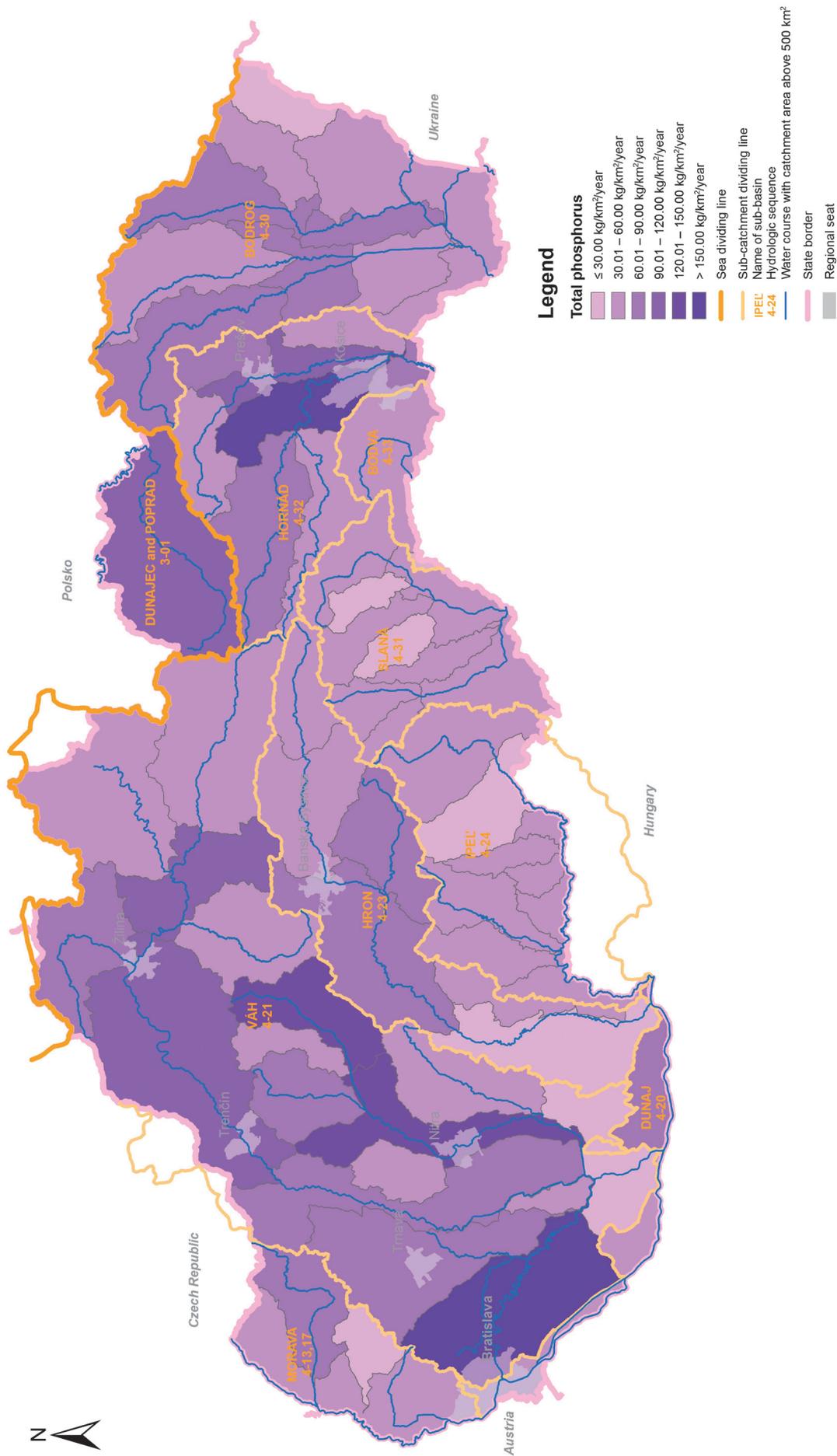


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Pollution by nutrients from the point and diffuse sources – years 2005 – 2006 for total phosphorus

Map 4.4a

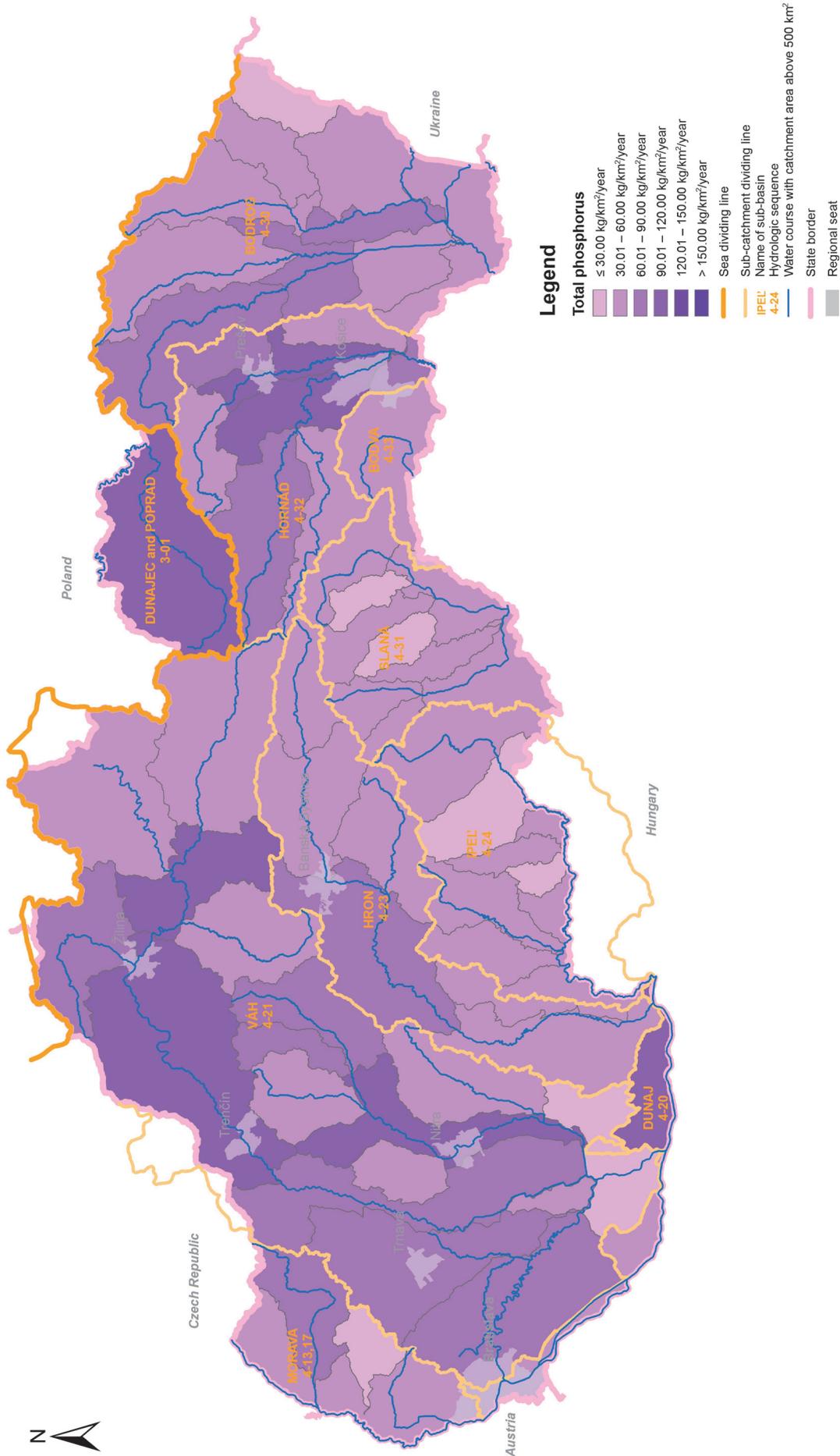


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Pollution by nutrients from the point and diffuse sources – perspective until year 2015 for total phosphorus

Map 4.4b



Scale 1:1 600 000
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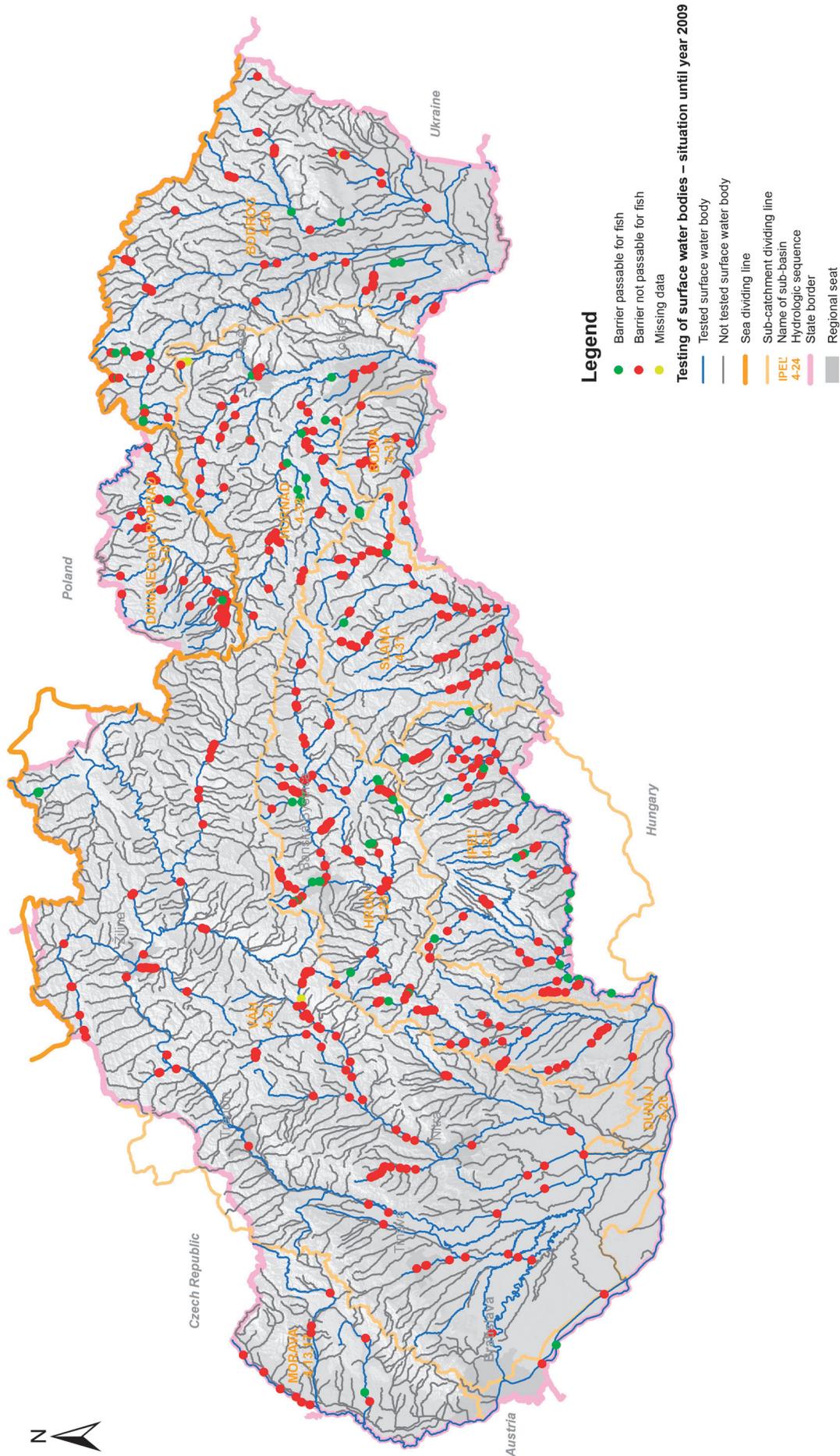


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River and habitat longitudinal continuity interruptions – year 2009

Map 4.5a



Scale 1:1 600 000
1 cm = 16 km



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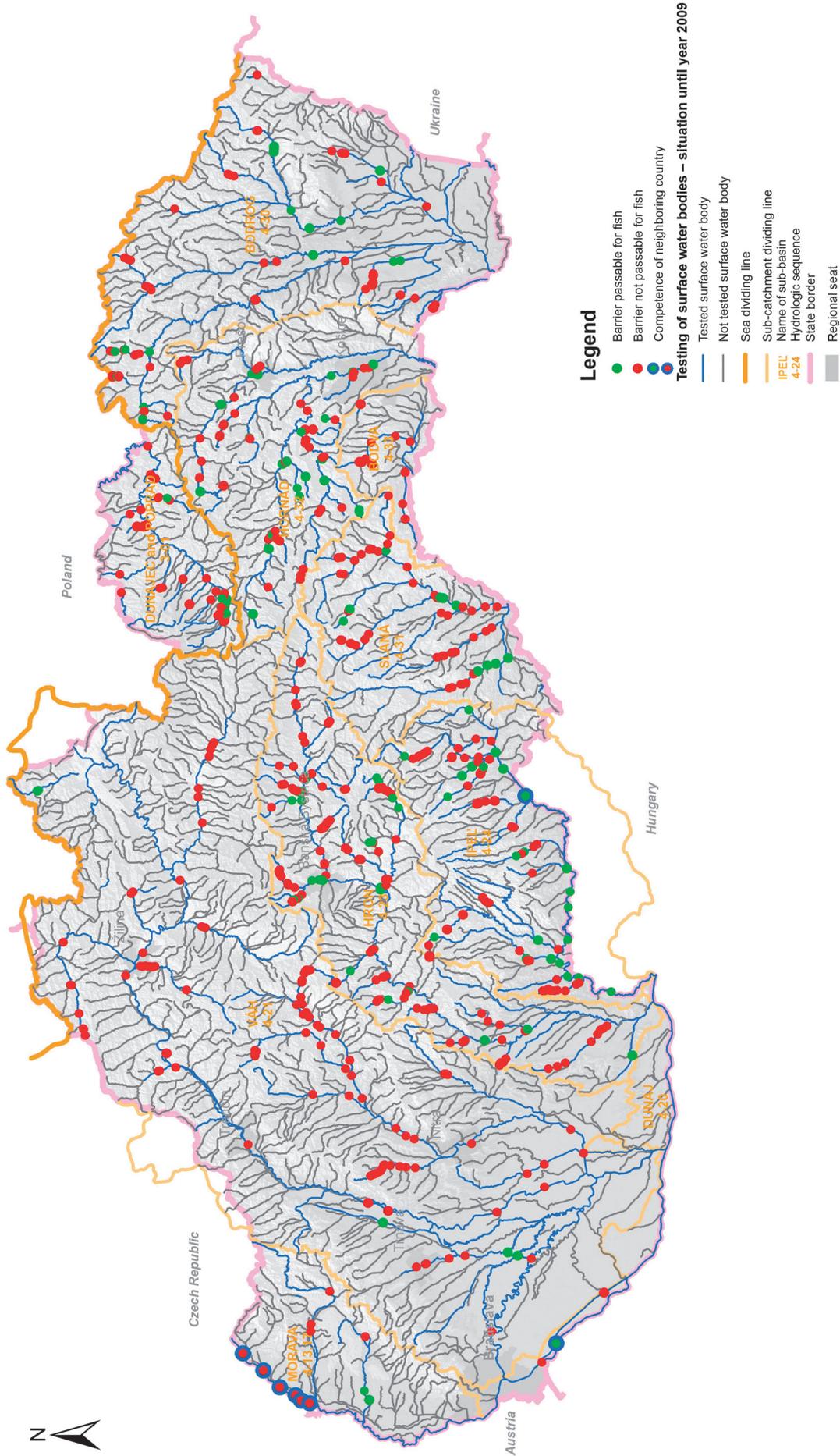


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River and habitat longitudinal continuity interruptions – perspective until year 2015

Map 4.5b



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Scale 1:1 600 000

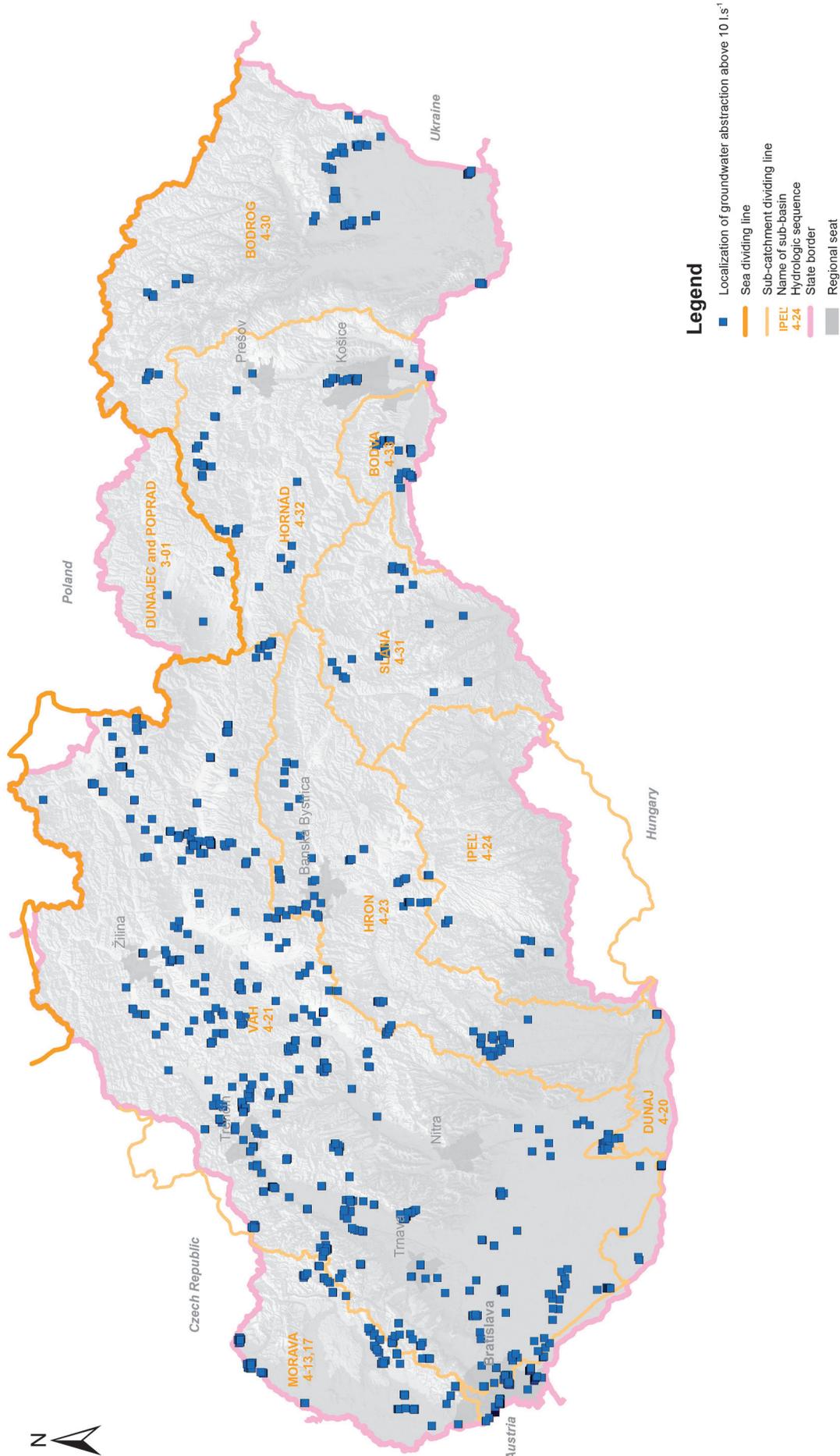
0 7.5 15 30 45 60 km



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Significant groundwater abstractions – documented impacts on quantitative status of groundwater bodies

Map 4.6

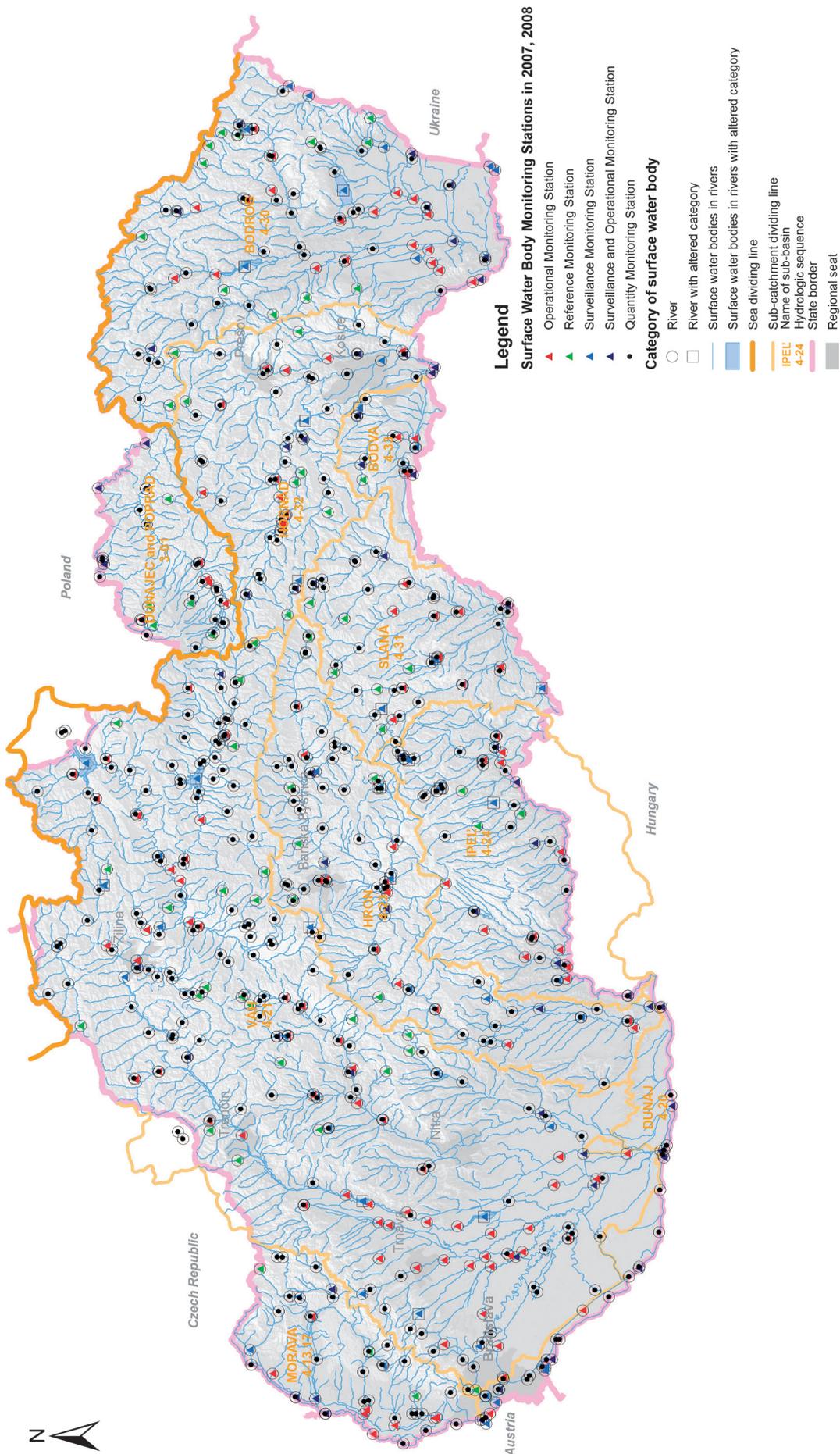


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Monitoring sites for the surveillance and operational surface water monitoring – years 2007 and 2008

Map 5.1



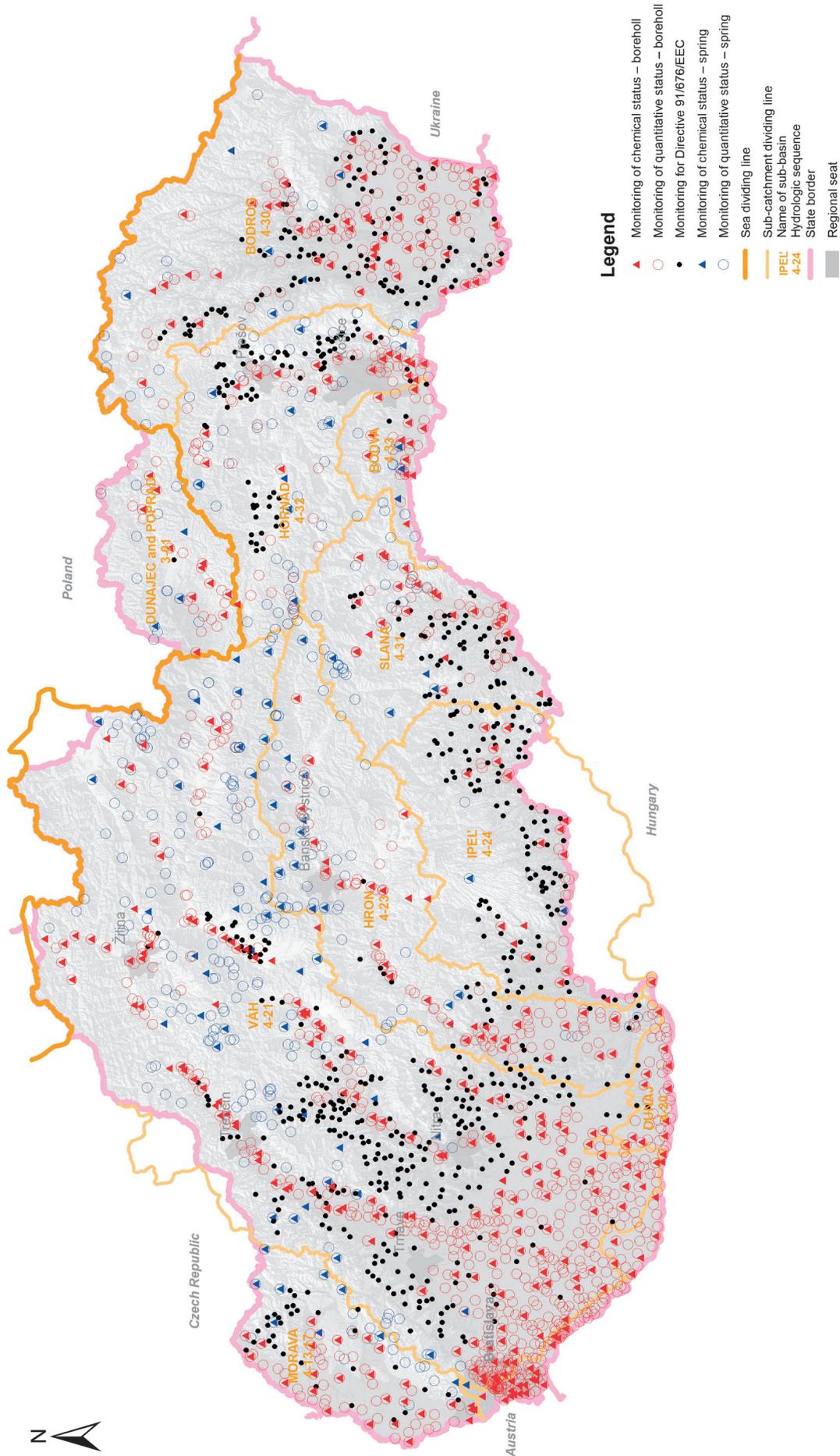
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Scale 1:1 600 000
 1 cm = 16 km
 0 7,5 15 30 45 60 km

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Monitoring sites for the monitoring of quantitative and chemical status of groundwaters – year 2007

Map 5.2



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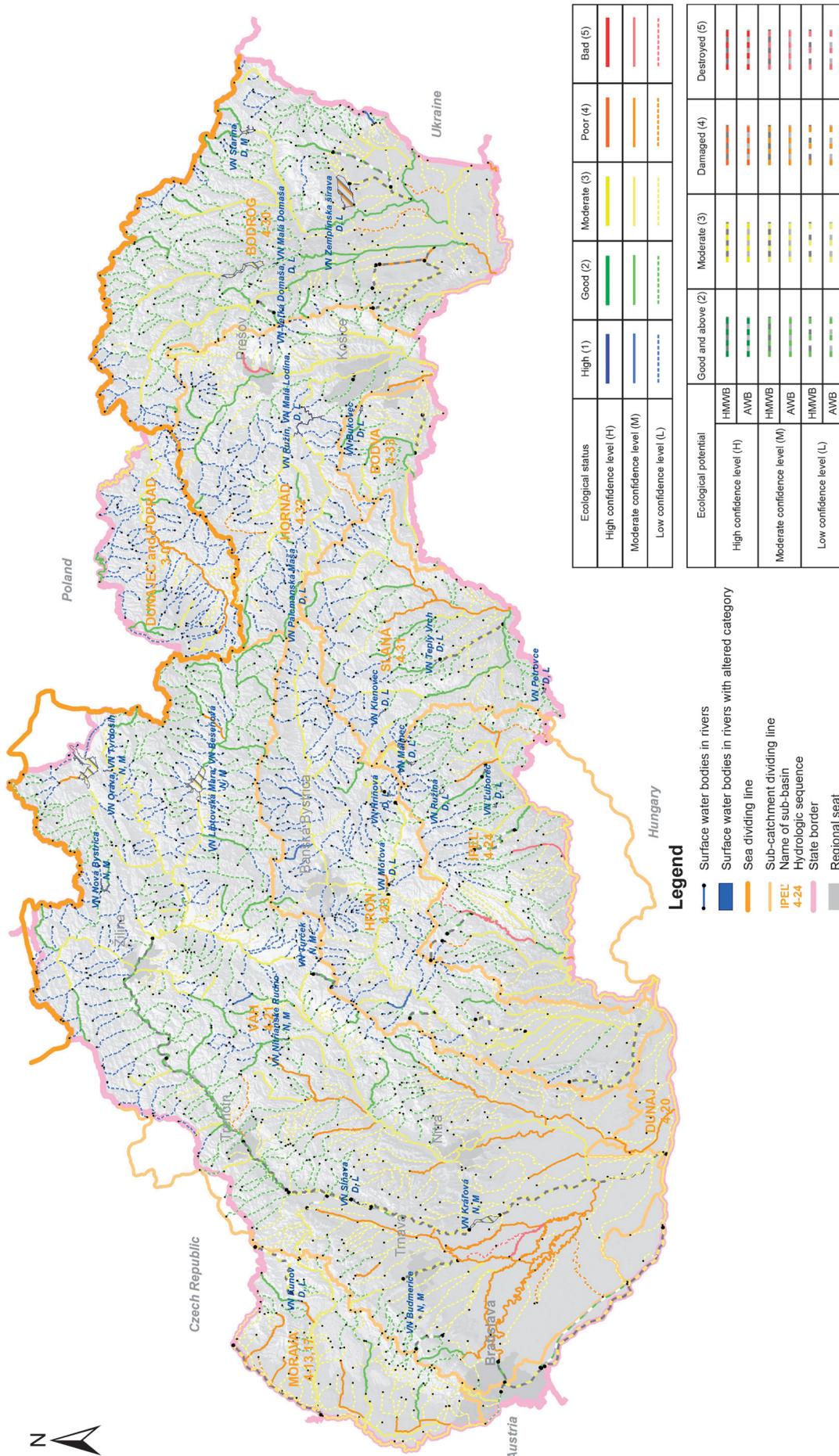
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Ecological status/potential of surface water bodies – years 2007 – 2008

Map 5.3



Scale 1:1 600 000
1 cm = 16 km

0 7.5 15 30 45 60 km

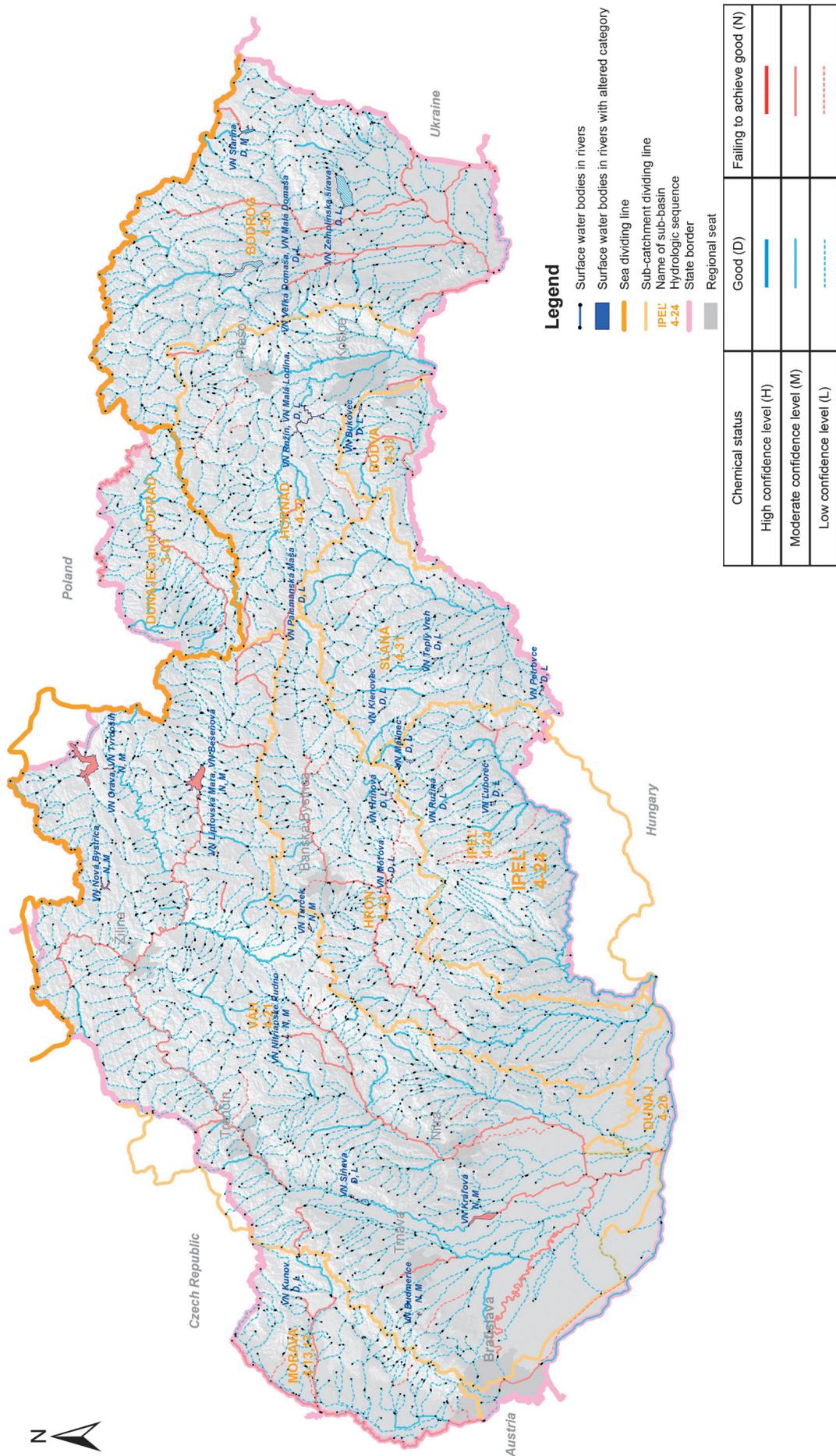
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Chemical status of surface water bodies – years 2007 – 2008

Map 5.4



Scale 1:1 600 000



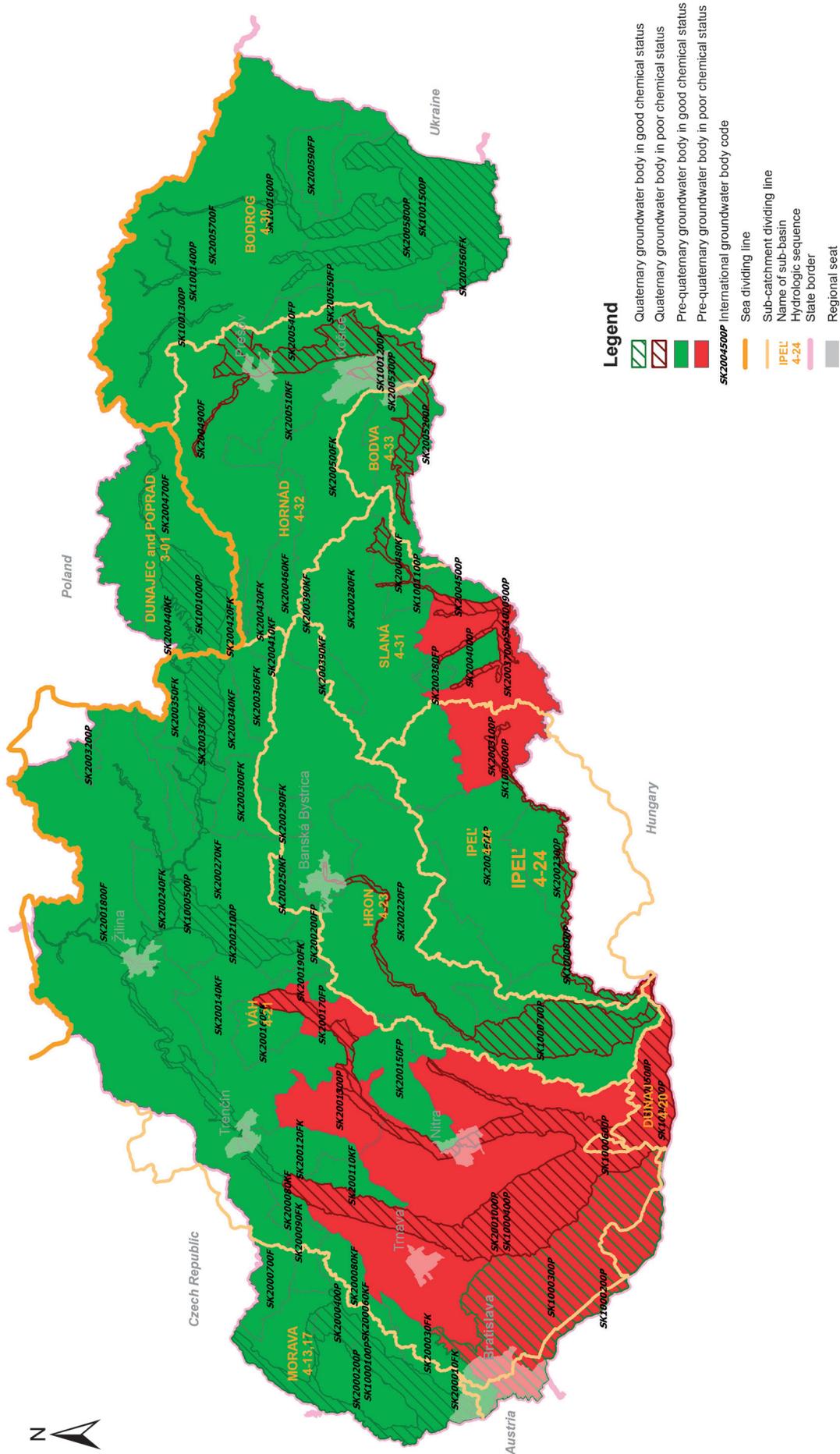
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Chemical status of groundwater bodies – year 2007

Map 5.5



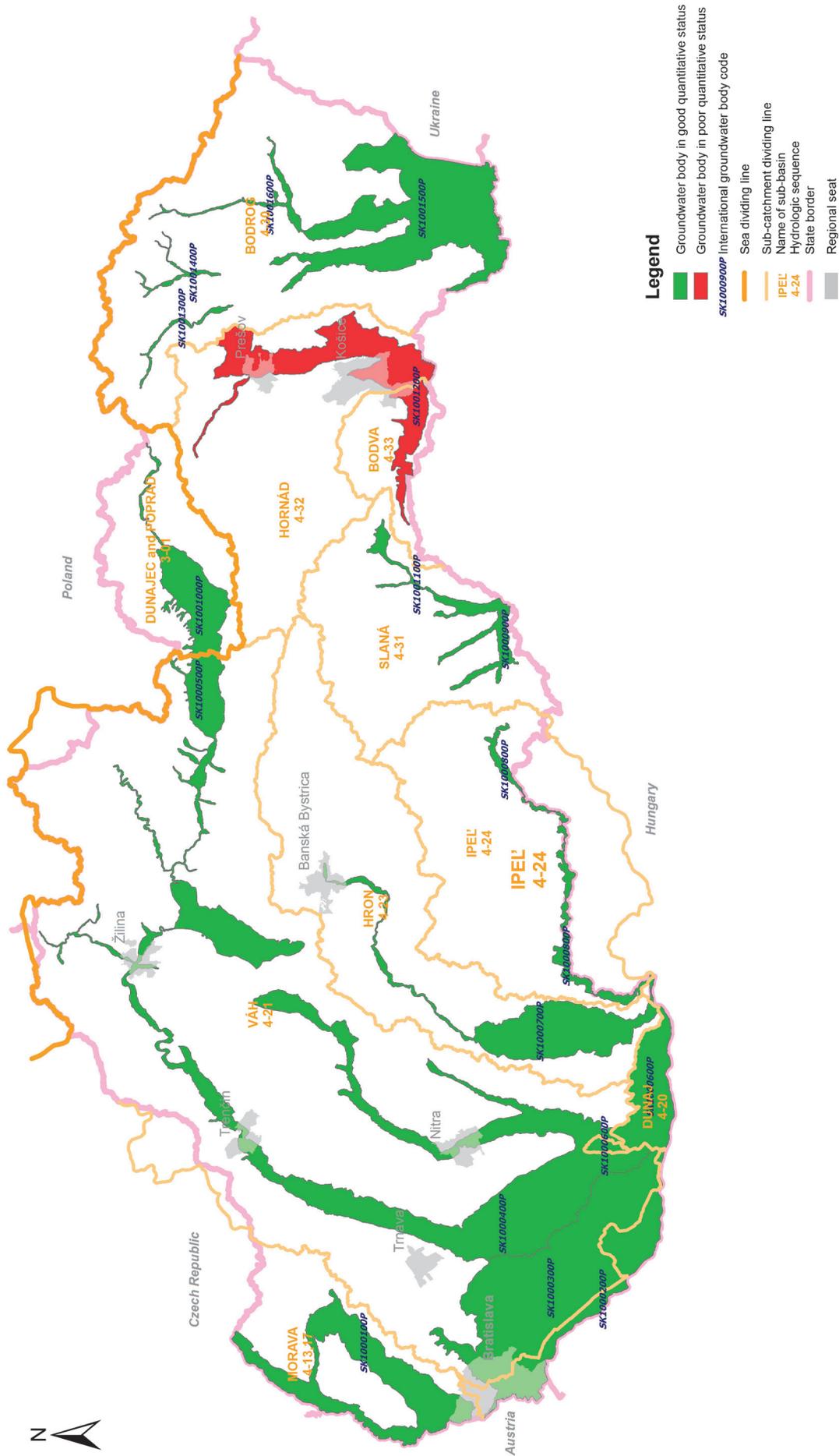
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Quantitative status of groundwater bodies in quaternary sediments – year 2007

Map 5.6



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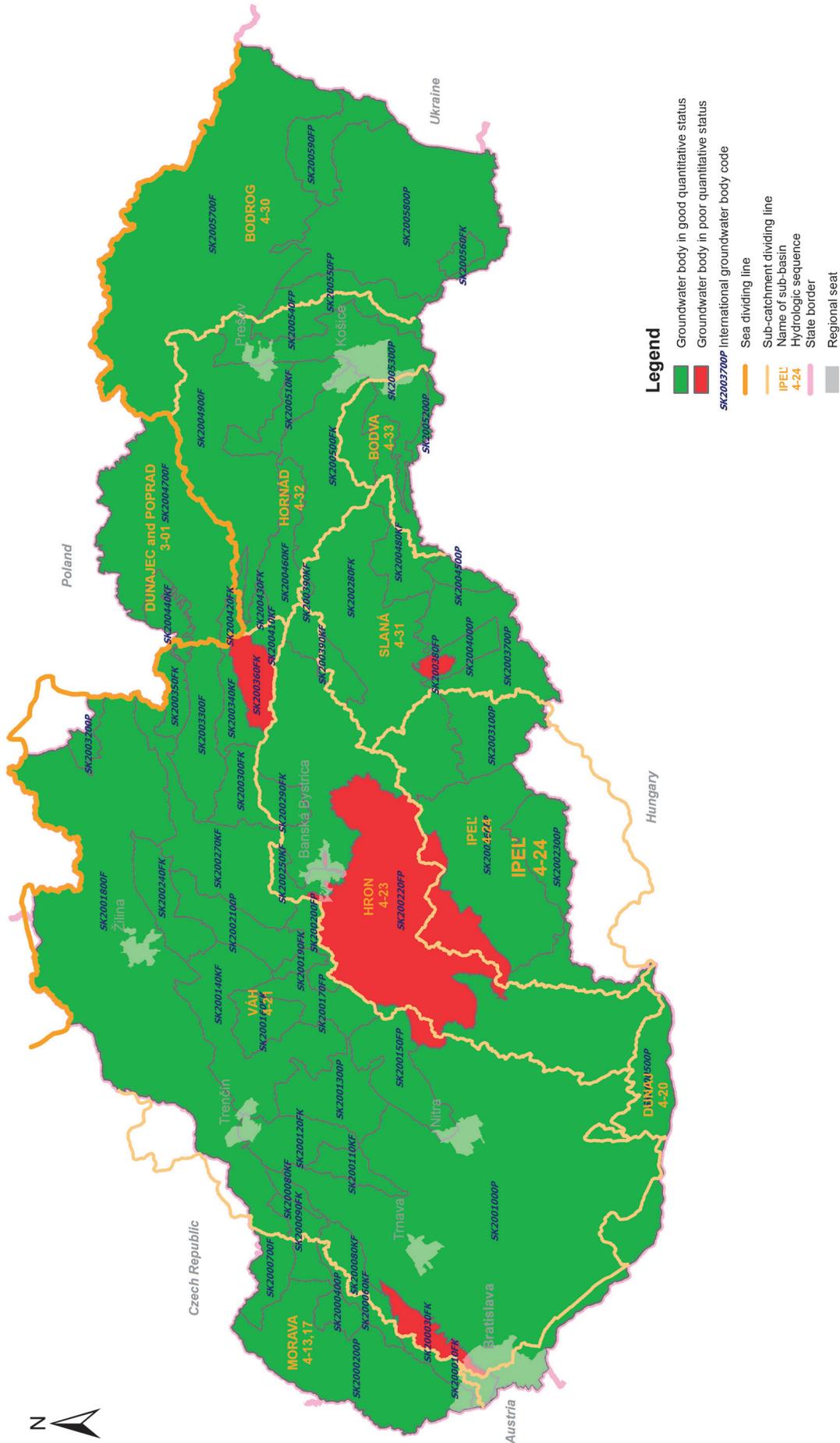
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Quantitative status of groundwater bodies in pre-quaternary rocks – year 2007

Map 5.7



Scale 1:1 600 000
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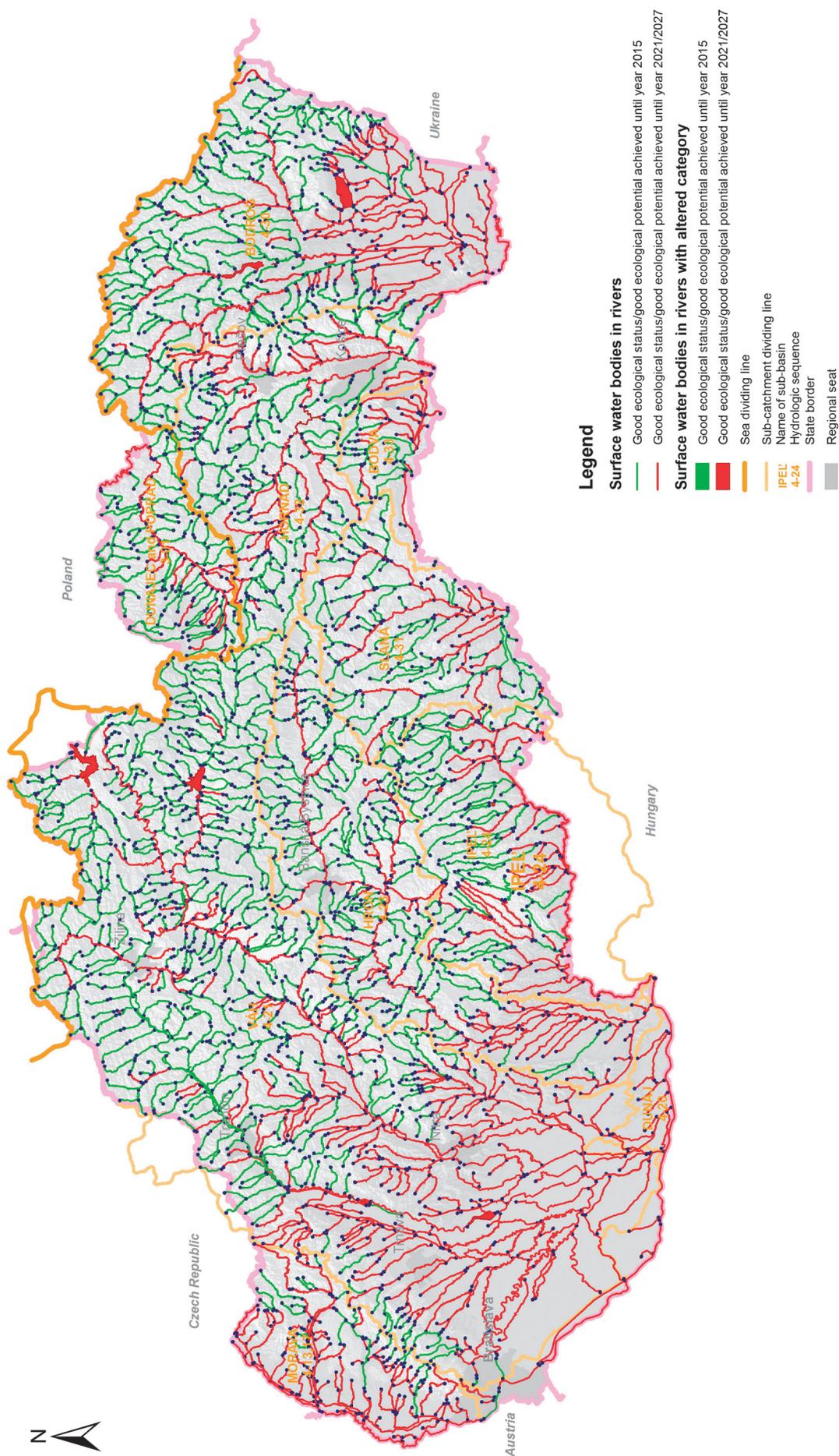


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Exemptions according to the Article 4(4) WFD for surface water bodies

Map 6.1

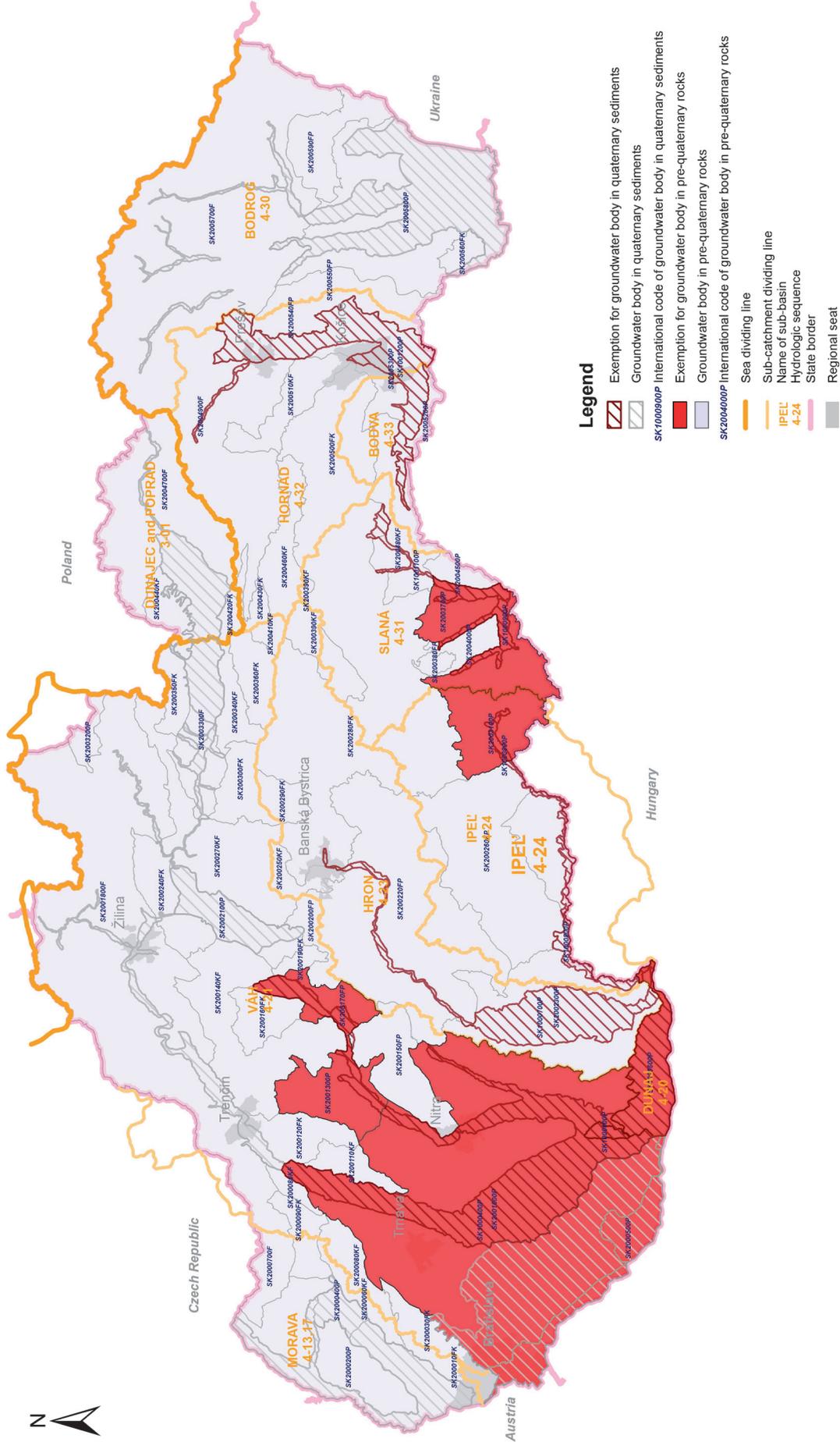


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Exemptions according to the Article 4(4) WFD for groundwater bodies

Map 6.2



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ISBN 978-80-89503-15-5



Worked-out within a project of the Operational Programme Environment financed by EU/ERDF



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