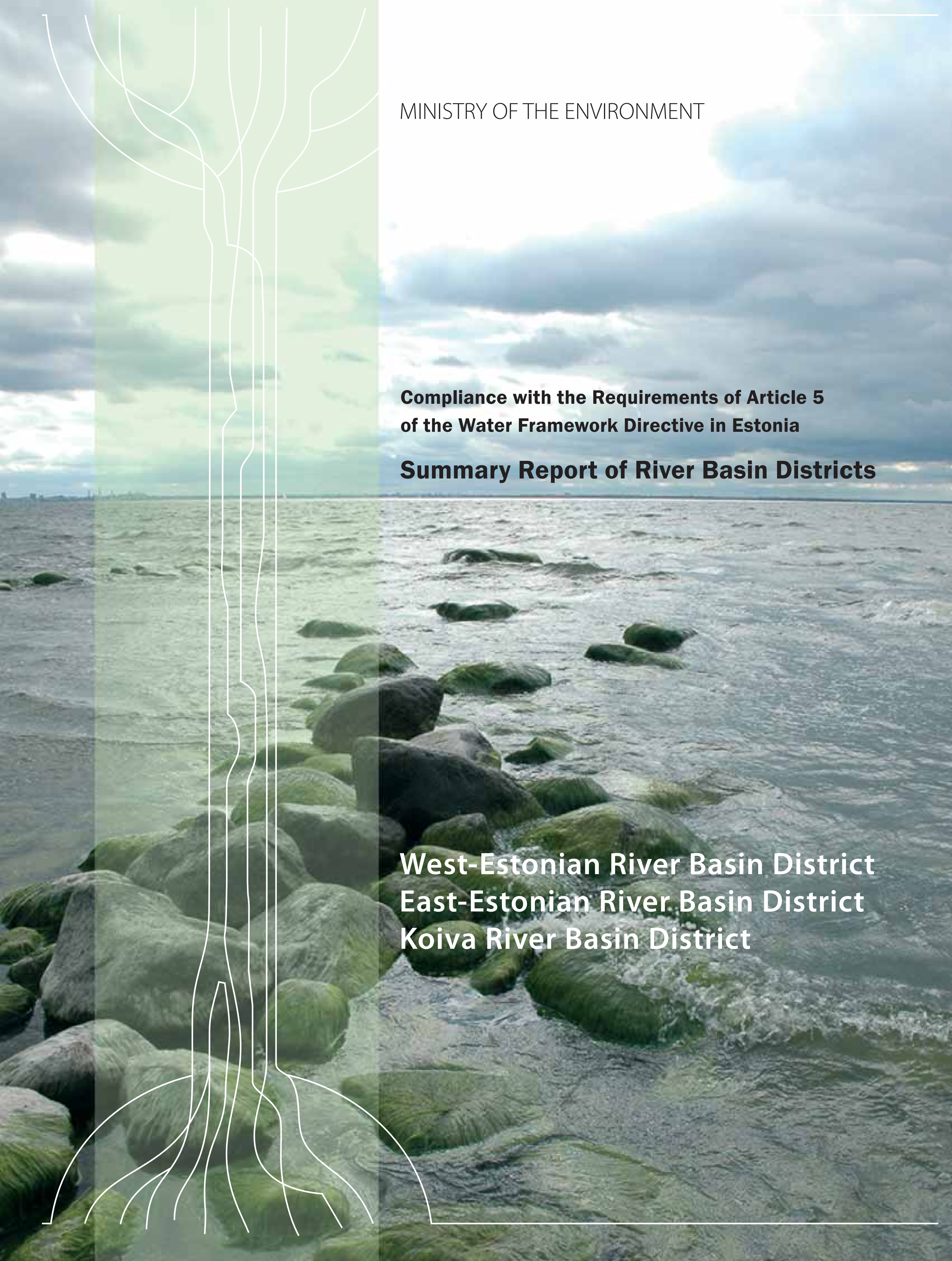

MINISTRY OF THE ENVIRONMENT

Compliance with the Requirements of Article 5 of the Water Framework Directive in Estonia

Summary Report of River Basin Districts

West-Estonian River Basin District
East-Estonian River Basin District
Koiva River Basin District

MINISTRY OF THE ENVIRONMENT

Compliance with the Requirements of Article 5 of the Water Framework Directive in Estonia

Summary Report of River Basin Districts

West-Estonian River Basin District
East-Estonian River Basin District
Koiva River Basin District

TALLINN

2005

Design by Art Industria

CONTENTS

page

contents

INTRODUCTION

Article 5 of the Water Framework Directive concerns the description of river basin districts, the analysis of the characteristics of river basin districts, preparation of the reviews of human activity affecting water status and economic analysis of water use. The analysis and reviews shall be prepared for every river basin district and the deadline of the work is 22 December 2004. Article 15.2 of the Water Framework Directive requires Member States to submit the report required under Article 5 to the European Commission by 22 March 2005 at the latest.

The report is based on the works carried out for the preparation of the water management plans of river basin sub-districts, investigations of the Department of Environmental Engineering of the Tallinn University of Technology, the Institute of Zoology and Botany of the Estonian Agricultural University, the Estonian Marine Institute of the University of Tartu and the Estonian Maritime Academy in the field of the typology, classification and the establishment of the reference conditions of water bodies, investigations made by Maves Ltd and the Geological Survey of Estonia for the identification and characterisation of groundwater bodies and the works carried out by the Estonian Water Company Ltd and OÜ EL Konsult for the economic analysis of water use.

The information and data used at the preparation of the report have been obtained from the Estonian Environment Information Centre, the Statistical Office of Estonia, the Population Registration Bureau of the Ministry of Internal Affairs, the Health Protection Inspectorate and the Estonian Agricultural Registers and Information Board (ARIB). All the maps presented in the report have been prepared by the Estonian Environment Information Centre. The report is intended for public use.
The Water Department of the Ministry of the Environment is responsible for the preparation of the report and the data presented and used in the report.

The structure of the report follows the guidance for preparing reports in the field of the Water Framework Directive. It is explained in the guidance, which information should the report contain and it is specified, whether the information shall be presented as a text, a data set or on maps. The report consists of four chapters: analysis of the characteristics of the river basin district, review of the environmental impact of human activity, economic analysis of water uses and the register of protected areas. The analysis of the characteristics of the river basin district comprises the description the river basin district, including the descriptions of surface water bodies and groundwater bodies. The review of the environmental impact of human activity includes also the review of the impact of human activity on surface water bodies and groundwater bodies. The economic analysis of water uses includes a summary of the economic aspects related to water use. The register of protected areas includes information about all the protected areas related to the Water Framework Directive. The chapters and the subjects dealt with in the chapters are numbered and the reporting sheet numbers marked in the Reporting Guidance have been added to the titles of the subjects in brackets.

Analysis of the Characteristics of the River Basin District

1

1.1. Surface water (rivers, lakes, transitional and coastal waters)

1.1.1 Typology of surface water bodies (SWB 1)

The typology of surface water bodies[1] is based on the classification of surface water body types presented in Annex II of the Water Framework Directive. The typology of rivers, lakes and coastal waters has been prepared on the basis of it. The typology of transitional waters has not been prepared, since there are no surface water bodies with the characteristics or features of transitional waters in Estonia. The typology has been prepared on the basis of the investigations carried out in Estonia for the establishment of the typology of surface water bodies and type specific reference conditions complying with the requirements of the Water Framework Directive.

The typology in all the categories of surface water bodies has been worked out pursuant to the alternative type description i.e. the characteristics of system B presented in the Directive.

The prepared typology of surface water bodies defines 22 types of surface water bodies in Estonia (table 1). Not all of the 22 types of surface water bodies are represented in every river basin district. The total number of surface water bodies identified mainly on the basis of the characterisation in all the river basin districts is 817. The identified surface water bodies are presented in table 2 by the types of surface water bodies in every river basin district.

û Compliance with the classification of Annex II of the Water Framework Directive

System B i.e. the use of alternative descriptors upon defining the type of a surface water body takes into account the definition presented in the Directive and the distinguishableness of a type at least pursuant to the descriptors of system A.

The typology of surface water bodies on the basis of system B in the part of rivers takes mainly the catchment area of the river and the geological characteristics into account as obligatory descriptors. According to the descriptors characterising river height all the Estonian rivers are lowland rivers flowing at the height below 200 m. Five categories of catchment areas have been distinguished on the basis of the catchment areas of rivers between 10–100 km^2, >100–1000 km^2, >1000–10000 km^2 and over 10000 km^2. From the geological characteristics soil conditions such as siliceous, organic and calcareous soil types have been considered. Optional descriptors have not been taken into account in the typology of rivers.

The typology of surface water bodies on the basis of system B in the part of lakes takes mainly geological characteristics into account as obligatory descriptors. Lake area is taken into account: the lakes have been divided into big and small lakes. Big lakes are with an area of over 100 km^2, all the rest are small lakes. According to the typology all the lakes are with medium depth of 3–15 m. All the lakes are also lowland lakes located at the height below 200 m.

The typology of surface water bodies on the basis of system B takes all the indicated characteristics into account as obligatory descriptors in case of coastal waters and is differentiated on the basis of the classification of system A as the ecoregion of the Baltic Sea. In the typology of coastal water differences in the salinity of coastal waters have been taken into account as obligatory descriptors. The exposure to waves, depth, mixing conditions, retention time, the character of the substratum and the duration of ice cover have been taken into account as optional descriptors.

û The approach selected for the identification of very small water bodies

• Rivers

The identification of very small watercourses is based on the minimum catchment area, which is 10 km^2. A description of the water body has been prepared for all the rivers and river sections, which catchment area is bigger than 10 km^2.

[1]The meaning of the term surface water body or water body in this report corresponds to the Water Framework Directive. Surface water body means a discrete and significant part of surface water like a lake, a reservoir, a stream, a river or a canal, part of a stream, river or canal, transitional water or a stretch of coastal water.

Watercourses, which are smaller than this minimum limit, are conditionally discussed together with a bigger surface water body, in which catchment area they are located. The status of a water body depends on the status of the whole catchment area. Since small rivers form a part of every catchment area, the achievement of a good status of a water body is connected with the achievement of the good status of all the small rivers, streams and ditches flowing into this water body.

- **Lakes**

The lakes, which area is bigger than 0.5 km^2 have been taken into account in the first place. Lakes, which are smaller than this, are identified as water bodies connected with the river, into which catchment area they belong (these can be small lakes from where or through which small rivers or streams flow, or even lakes with no outlet in the abovementioned catchment area). According to the definition, small lakes, which are connected with a bigger lake than 0.5 km^2, form a single water body with the bigger lake.

- **Coastal water**

No small water bodies were identified in coastal waters. The smallest water bodies in coastal waters are Pärnu Bay, Matsalu Bay and Haapsalu Bay.

- **Transitional water**

Transitional water was not discussed in the part of Estonian waters, since no water bodies having the features characteristic of transitional water have been identified in Estonia.

û Co-ordination of the description of the surface water bodies of interstate river basin districts

There are two international river basin districts on the territory of Estonia. The East-Estonian river basin district, including the catchment areas of Lake Peipsi and the river of Narva, forms an international river basin district, which eastern part belongs to Russia. The Koiva river basin district is formed by the Koiva river and its catchment area on the territory of Estonia. The southwestern part of the Koiva river basin district belongs to Latvia.

- **Koiva river basin district**

Upon the description of the surface water bodies of the Koiva river basin district co-operation has been carried out since the year 2001 mainly in the framework of the meetings of the experts. Upon the description of surface water bodies it has been attempted to identify common types of surface water bodies. There are no definite agreements for the identification of the types of surface water bodies so far. In order to harmonize the identification the parties have exchanged information, no co-operation has been carried out in the part of the use of common and harmonised methodology. The co-operation in the field of the management of the Koiva river basin district is based on the cooperation agreement concluded between the Ministry of the Environment of the Republic of Estonia and the Ministry of the Environment of the Republic of Latvia.

- **East-Estonian river basin district**

In the part of the East-Estonian river basin district also no co-operation has been carried out with the Russian Federation for the identification of water body types to be used upon the description of water bodies or for the preparation of common and harmonised methodology. The co-operation between the Republic of Estonia and the Russian Federation in the field of transboundary waters is based on the agreement of the protection and sustainable use of common transboundary water bodies concluded between the Governments. On the sides of both, Estonia and Russia projects have been launched for the organisation of the water management and the preparation of the water management plans of the catchment areas of Lake Peipsi and the river of Narva. Information has been exchanged at the meetings of experts in the framework of the projects.

û Activities planned to ensure future co-ordination

Encouraging of the future effective coordination has been planned in the part of both transboundary river basin districts on the basis of the works completed so far and the reviews prepared on the basis of Article 5 of the Water Framework Directive.

Table 1. Number of the types of surface water bodies in Estonia

Category of the surface water body	Number of types in the category
Rivers	8
Lakes	8
Coastal waters	6
Transitional waters	0
Types in total	**22**

Additional information

The typology and the reference conditions of surface water bodies are based on the following investigations and reviews:

1. **Analysis of the seaside meadows in Lääne-, Pärnu-, Saare- and Hiiumaa significant for the Natura 2000 Network of conservation areas.** Expert Andres Kortel. Tallinn 2000.

2. **The condition of freshwater fishery resources in the Estonian coastal waters in 2000.** University of Tartu, Estonian Marine Institute. Tallinn 2000.

3. **Fish fauna of Estonian small lakes.** Institute of Zoology and Botany, Estonian Agricultural University. Tartu 2001.

4. **The use of small lakes for fishing industry.** Non-profit association Estonian Nature Protection Centre. Tartu 2004.

5. **National mapping and vision report on water resources management**. Clobal Water Partnership. Tallinn 2000.

6. **Basis of the assessment of the environmental state of Estonian coastal sea – type specific biological criteria for the classification of the water quality of coastal sea.** University of Tartu, Estonian Marine Institute. Tartu 2001.

7. **Inspection of the suitability of the system of water quality classes of coastal sea on the basis of biological parameters.** University of Tartu, Estonian Marine Institute. Tartu 2002.

8. **Quality elements conforming to the European Water Framework Directive for the classification of the biological state in Estonian watercourses.** Estonian Environment Information Centre. Tallinn 2002.

9. **Intercalibration of the ecological types of lakes.** Estonian Agricultural University, Institute of Zoology and Botany. Tartu 2003.

10. **Intercalibration of the ecological types of rivers.** Tallinn University of Technology, Department of Environmental Engineering. Tallinn 2003.

11. **Changes in the water quality of rivers. Peipsi river basin district.** Tallinn University of Technology, Department of Environmental Engineering. Tallinn 2003.

12. **Water classes of coastal sea, values of the quality indicators complying with the water classes and the procedure for the identification of water classes.** Estonian Maritime Academy. Tallinn 2003.

13. **Ecological quality of watercourses.** OÜ Ekoekspert. Tallinn 2003.

The abovementioned documents are available at the homepage of the Ministry of the Environment **(http://www.envir.ee)**.

Table 2. Number of identified surface water bodies by types in Estonian river basin districts

Category and type of the surface water body	Number of identified surface water bodies by types in every river basin district		
	West-Estonian	East-Estonian	Koiva
Rivers			
Type IA: Small rivers with high orgnic content	117	30	22
Type IB: Small rivers with low organic content	253	120	14
Type IC: Small and calcareous rivers	29	0	0
Type IIA: Medium-sized rivers with high organic content	18	6	1
Type IIB: Medium-sized rivers with low organic content	49	36	11
Type IIIA: Large rivers with high organic content	4	0	0
Type IIIB: Large rivers with low organic content	11	5	0
Type IV: Very lare rivers	0	2	0
Lakes			
Type 1: Lakes with hard water	0	1	0
Type 2: Lakes with medium-hard non-stratified water	14	15	1
Type 3: Lakes with medium-hard stratified water	4	11	3
Type 4: Lakes with soft and dark water	5	2	0
Type 5: Lakes with soft and clear water	1	2	3
Type 6: Lake Võrtsjärv	0	1	0
Type 7: Lake Peipsi	0	2	0
Type 8: Coastal lakes	8	0	-
Coastal waters			
Type 1: Coastal waters of Narva Bay	0	2	-
Type 2: Coastal waters of Pärnu Bay	1	0	-
Type 3: Coastal waters of the western part of the Gulf of Finland	4	0	-
Type 4: Coastal waters of the open sea of West-Islands	3	0	-
Type 5: Coastal waters of Väinameri	5	0	-
Type 6: Coastal waters of the Gulf of Riga	1	0	-
Transitional waters			
-	-	-	-
Surface water bodies in total	**527**	**235**	**55**

1.1.2. Identification of surface water bodies (SWB 2)

Surface water bodies were identified by following the guidance of the Common Implementation Strategy of the Water Framework Directive , on the basis of which the guidance for the identification of Estonian water bodies was prepared. Significant and discrete elements of surface water, i.e. rivers, which catchment area is 10 km^2 or more, lakes, which area is 0.5 km^2 or more and stretches of coastal waters have been identified as surface water bodies.

The total of 817 surface water bodies have been identified in Estonia. The identified surface water bodies of all the river basin districts are presented by types in table 2. The number of the identified surface water bodies in every surface water body category is presented by river basin districts in tables 3, 4 and 5. The highest number of surface water bodies is in the West-Estonian river basin district. The length of watercourses is also bigger there than in the East-Estonian river basin district. The smallest number of surface water bodies is in the Koiva river basin district, which is due to the small area of the river basin district.

- **Rivers**

The identification of the types of rivers was based primarily on the developed typology. The type of all the rivers with the catchment area of 10 km^2 and more was identified. The preliminary characterisation of the rivers was obtained on the basis of the typology. In addition, pressures, the impact of human activity, uses of the water body and additional objectives established for the water body were taken into account. The surface water bodies identified in rivers (significant and descrete of river sections) are presented in figure 1 (West-Estonian river basin) district, figure 3 (East-Estonian river basin district) and figure 5 (Koiva river basin district). The number of surface water bodies identified in rivers is presented by river basin districts in table 3.

- **Lakes**

Upon the identification of surface water bodies primarily the lakes, which are 0,5 km^2 and more were taken into account. The lakes of the same type and with the same impact of human activity were aggregated into a single water body. Lakes, which are significant in terms of nature conservation, which are used as recipients of effluent or as bathing water bodies, were taken into account as additional factors upon the identification of water bodies. The number of lakes identified as surface water bodies is relatively small as compared to the total number of lakes, which is due to the big number of small lakes in Estonia. It can be seen from the data presented in table 4 that the total number of lakes in Estonia is 1491 (on the basis of the base map of Estonia, with an area from 1 ha), but only 72 of them are bigger than 0.5 km^2. The lakes identified as surface water bodies are presented in figure 2 (West-Estonian river basin district), figure 4 (East-Estonian river basin district) and figure 6 (Koiva river basin district) and their numbers by river basin districts are presented in table 4.

- **Coastal waters**

Upon the identification of the water bodies of coastal waters the requirement of the Water Framework Directive to identify the area of coastal waters was taken into account. The water bodies of coastal waters were identified on the basis of pressure, the impact of human activity, data of environmental monitoring, uses and additional objectives established for the stretches of coastal waters. 14 water bodies were identified as surface water bodies in Estonia. The stretches of coastal waters identified as surface water bodies are presented in figure 2 (West-Estonian river basin district) and figure 4 (East-Estonian river basin district). The number of surface water bodies of coastal waters is presented by river basin districts in table 5.

Additional information

The typology and the reference conditions of surface water bodies are based on the following investigations and reviews:

1. **Analysis of the seaside meadows in Lääne-, Pärnu-, Saare- and Hiiumaa significant for the Natura 2000 Network of conservation areas.** Expert Andres Kortel. Tallinn 2000.

2. **Analysis of the occurrence of the sea-habitats mentioned in Annex I of the EU Nature Directive in Estonian coastal waters.** Expert Georg Martin. Tallinn 2000.

Additional information

3. **Natura 2000 national programme: the database of Estonian rivers.** University of Tartu J.Paal. Tartu 2001.

4. **The impact of barrages on biota. Investigation of the Estonian Nature Protection Centre.** Tartu 2001.

5. **The use of small lakes for fishing industry.** Non-profit association Estonian Nature Protection Centre Tartu 2004.

6. **Analysis of the socio-economic aspects of the use and measures for the protection of fish resources.** Tallinn 2000.

7. **Preparation of the final report of part C "Environmental Protection" of the Agricultural Project of the World Bank, including the assessment of the impact of land improvement on water bodies.** Estonian Environmental Research Centre. Tallinn 2001.

8. **Inspection of the suitability of the water quality classes of coastal sea on the basis of biological parameters.** University of Tartu, Estonian Marine Institute. Tartu 2002.

9. **Quality elements conforming to the European Water Framework Directive for the classification of the biological state in Estonian watercourses.** Estonian Environment Information Centre. Tallinn 2002.

The abovementioned documents are available at the homepage of the Ministry of the Environment **(http://www.envir.ee)**.

Table 3. Number of surface water bodies in rivers

River basin district	Number of surface water bodies	Area of the river basin district, km^2
West-Estonian river basin district	481	23 478
East-Estonian river basin district	199	19 047
Koiva river basin district	48	1 335
Total	**728**	**43 860**

Table 4. Number of surface water bodies in lakes

River basin district	Number of lakes	Number of lakes in the composition of a water body	Number of water bodies	Lake area
West-Estonian river basin district	670	0	0	< 0,5 km^2
	13	13	13	0,5–1 km^2
	19	19	19	1-10 km^2
	0	0	0	10–100 km^2
	0	0	0	> 100 km^2
East-Estonian river basin district	646	0	0	< 0,5 km^2
	14	14	14	0,5–1 km^2
	17	17	17	1–10 km^2
	0	0	0	10–100 km^2
	2	2	3	> 100 km^2
Koiva river basin distrct	103	0	0	< 0,5 km^2
	4	4	4	0,5–1 km^2
	3	3	3	1–10 km^2
	0	0	0	10–100 km^2
	0		0	> 100 km^2
Total	**1 491**	**72**	**73**	

Table 5. Number of surface water bodies in coastal water

River basin district	Number of water bodies	Total coastline length (km)
West-Estonian river basin district	13	3 110
East-Estonian river basin district	2	247
Koiva river basin district	-	-
Total	**15**	**3 357**

1.1.3 Provisional identification of artificial and heavily modified water bodies (SWB 3)

Heavily modified water bodies and artificial water bodies were identified primarily on the basis of the existing information about the significant impact of human activity. In addition to that the results of the environmental research carried out previously and the data of environmental monitoring were taken into account. Proceeding from this all the water bodies, about which it is clear that human activity has had a significant impact on the status of these water bodies, due to which the achievement of the environmental objectives for those surface water bodies by 2015 might not be feasible without the implementation of large-scale environmental measures, were provisionally identified as heavily modified water bodies and artificial water bodies.

Artificial and heavily modified water bodies were identified by following the guidance of the Common Implementation Strategy of the Water Framework Directive[3]. Proceeding from both, the Water Framework Directive and the abovementioned guidance, the main criterion upon the identification of artificial and heavily modified water bodies was the definition of these water bodies. Proceeding from that, mainly those watercourses, which have been regularly dredged and altered for the purpose of land improvement, were differentiated from among surface water bodies as heavily modified water bodies. Consequent to the above, heavily modified water bodies comprise mainly drainage systems (ditches, main ditches), water bodies known to be in a very poor condition and degraded by human activity, also water bodies used intensively for the purpose of the production of hydropower.

Primarily those water bodies, which have been established as a result of human activity: mainly the ditches, reservoirs, water storages, canals and other similar constructions, were identified as artificial water bodies.

In Estonia there are 302 heavily modified water bodies and 86 artificial water bodies, thus the total of 388 surface water bodies (table 6). The number of heavily modified water bodies and artificial water bodies in Estonia is presented in table 6 by river basin districts. The identified artificial and heavily modified water bodies are presented in figure 7 (West-Estonian river basin district), figure 8 (East-Estonian river basin district) and figure 9 (Koiva river basin district).

û Further activity

It is planned to start additional assessing of the provisionally identified artificial and heavily modified water bodies in 2005 in order to find out, on the basis of socio-economic indicators, whether the provisional identification was justified.

Additional information

The identification of artificial and heavily modified water bodies is based on the data of the Estonian Environment Information Centre **(http://www.keskkonnainfo.ee)** and the research carried out in the framework of the preparation of the water management plans of river basin sub-districts. Information about the preparation of the water management plans of river basin sub-districts is available at the homepage of the Ministry of the Environment **(http://www.envir.ee)**.

Table 6. Number of surface water bodies identified as artificial and heavily modified waterbodies in Estonia

River basin district	Number of heavily modified water bodies	Number of artificial water bodies
West-Estonian river basin district	148	49
East-Estonian river basin district	144	37
Koiva river basin district	10	0
Total	**302**	**86**

[3] Guidance Document No 4, Identification and Designation of Heavily Modified and Artificial Water Bodies. European Communities, 2003.

1.1.4 Type-specific reference conditions, maximum ecological potential and reference network (SWB 4)

The preparation of the types of surface water bodies and the type specific reference conditions was started in 2001. The Department of Environmental Engineering of the Tallinn University of Technology, the Estonian Marine Institute of the University of Tartu, the Estonian Maritime Academy and the Institute of Zoology and Botany of the Estonian Agricultural University participated in the research. In Estonia the reference network formed for defining type specific reference conditions consists of 10 reference rivers, 13 reference lakes and 2 reference water bodies of coastal water.

Type specific reference conditions were defined on the basis of the existing information from the national monitoring programme. Additional investigations have been carried out in reference water bodies, primarily in Peipsi and Viru river basin sub-districts of the East-Estonian river basin district in the framework of the *Life Environment* project "Viru-Peipsi *CAMP*" in order to find out type specific reference conditions and to specify the data characterising the status.

Water quality models have been used for defining the type specific reference conditions of coastal water and rivers. The water quality model of Narva Bay was prepared for defining the type specific reference conditions of coastal waters, which was used also upon the assessment of the quality of the coastal waters of Matsalu river basin sub-district. The impact of pollution load on the status of coastal water was assessed on the basis of the quality model of coastal water.

Models of the assessment of diffuse source pollution load have been used for the defining of the type specific reference conditions of rivers and calculations have been made on the basis of the existing reference catchment areas. The guidance for the calculation of pollution loads prepared by the Baltic Sea Marine Environment Protection Commission was followed upon the use of models and calculations for the assessment of the impact diffuse source pollution and point source pollution load.

Additional information

The type specific reference conditions of surface water bodies have been defined on the basis of the following investigations and reviews:

1. **Basis of the assessment of the environmental state of Estonian coastal sea – type specific biological criteria for the classification of the water quality of coastal sea.** University of Tartu, Estonian Marine Institute.

2. **Inspection of the suitability of the system of water quality classes of coastal sea on the basis of biological parameters.** University of Tartu, Estonian Marine Institute. Tartu 2002.

3. **Quality elements conforming to the European Water Framework Directive for the classification of the biological state in Estonian watercourses.** Estonian Environment Information Centre. Tallinn 2002.

4. **Intercalibration of the ecological types of lakes.** Estonian Agricultural University, Institute of Zoology and Botany. . Tartu 2003.

5. **Intercalibration of the ecological types of rivers.** Tallinn University of Technology, Department of Environmental Engineering. Tallinn 2003.

6. **Changes in the water quality of rivers. Peipsi river basin district.** Tallinn University of Technology, Department of Environmental Engineering.

7. **Water classes of coastal sea, values of the quality indicators complying with the water classes and the procedure for the identification of water classes. .** Estonian Maritime Academy. 2003.

8. **Ecological quality of watercourses. .** OÜ Ekoekspert. Tallinn 2003.

The abovementioned documents are available at the homepage of the Ministry of the Environment **(http://www.envir.ee)**.

1.2 Groundwater

1.2.1 Identification and initial characterisation of groundwater bodies (GWB 1)

Groundwater bodies were identified primarily on the basis of hydrogeological characteristics, the amount of water abstraction and administrative and water management considerations.

Estonian groundwater bodies are listed in the Regulation of the Minister of the Environment No 47 of 10 May 2004 "Water classes of groundwater bodies, values of the quality indicators complying with the water classes of groundwater bodies and the procedure for defining water classes".

Groundwater bodies were identified on the basis of the hydrogeological map prepared by the Geological Survey of Estonia (Tallinn 1998, GIS-map at a 1:400000 scale), the hydrogeological model of Estonia (Tallinn 2002, report text with figures), also the reports of geological and hydrogeological mapping of different areas of Estonia at a 1:50000 scale. The GIS-database of the bore wells of the groundwater cadastre of the Geological Survey of Estonia as of the end of the year 2001 and the existing reports of groundwater resources were used upon the identification of groundwater bodies.

The total of 15 groundwater bodies have been identified in Estonia. 4 groundwater bodies remain completely into the East-Estonian river basin district. The Silurian-Ordovician groundwater body of the West-Islands lies to the full extent in the West-Estonian river basin district. From among the rest of the ten groundwater bodies 8 lie in both, the East- and West-Estonian river basin districts. The Upper Devonian groundwater body expands in both, the East-Estonian and the Koiva river basin district. The Middle-Devonian groundwater body is divided between all the three river basin districts. In addition, the Quaternary aggregated groundwater body is divided into several separately defined areas, from which two lie in the West-Estonian river basin district and the rest of the seven in the East-Estonian river basin district.

In Estonia the Cambrian-Vendian Voronka groundwater body and the Ordovician-Cambrian groundwater body have been identified as transboundary. The two groundwater bodies connected with the ecosystems of surface water or land lie in the East-Estonian river basin district. The location of groundwater bodies in Estonia is presented in figure 10 (West-Estonian river basin district), figure 11 (East-Estonian river basin district) and figure 12 (Koiva river basin district).

Table 7. Groundwater bodies identified in Estonia

Name and code of the groundwater body or its partgumi	West-Estonian river basin district		East-Estonian river basin district		Koiva river basin district	
	distri-bution	respon-sibility	distri-bution	respon-sibility	distri-bution	respon-sibility
Cambrian-Vendian Gdov groundwater body (1)	+	-	+	YES	-	-
Cambrian-Vendian Voronka groundwater body (2)	+	-	+	YES	-	-
Cambrian-Vendian groundwater body (3)	+	YES	+	-	-	-
Ordovician-Cambrian groundwater body (4)	+	YES	+	-	-	-
Ordovician groundwater body of Ida-Viru county (5)	-	-	+	YES		
Ordovician groundwater body of the oil shale basin of Ida-Viru county (6)	-	-	+	YES	-	-
Silurian-Ordovician groundwater body of the West-Islands (7)	+	YES	-	-	-	-
Silurian-Ordovician groundwater body under Devonian strata, West-Estonian area (8.1)	+	YES	-	-	-	-
Silurian-Ordovician groundwater body under Devonian strata (8.2), East-Estonian area	-	-	+	YES	-	-
Silurian-Ordovician aggregated groundwater body, West-Estonian area (9.1)	+	YES	-	-	-	-
Silurian-Ordovician aggregated groundwater body (9.2), East-Estonian area	-	-	+	YES	-	-
Middle-Lower-Devonian groundwater body (10))	+	-	+	YES	-	-
Middle-Devonian groundwater body (11)	+	-	+	YES	+	-
Upper Devonian groundwater body (12)	-	-	+	-	+	YES
Quaternary Vasavere groundwater body (13))	-	-	+	YES	-	-
Quaternary Meltsiveski groundwater body (14)	-	-	+	YES	-	-
Quaternary aggregated groundwater body, Männiku-Pelguranna area (15.1)	+	YES	-	-	-	-
Quaternary aggregated groundwater body, Kuusalu area (15.2)	+	YES	-	-	-	-
Quaternary aggregated groundwater body, Võru area (15.3)	-	-	+	YES	-	-
Quaternary aggregated groundwater body, Piigaste-Kanepi area (15.4)	-	-	+	YES	-	-
Quaternary aggregated groundwater body, Otepää area (15.5))	-	-	+	YES	-	-
Quaternary aggregated groundwater body, Elva area (15.6)	-	-	+	YES	-	-
Quaternary aggregated groundwater body, Saadjärve area (15.7)	-	-	+	YES	-	-
Quaternary aggregated groundwater body, Laiuse area (15.8)	-	-	+	YES	-	-
Quaternary aggregated groundwater body, Sadala area (15.9)	-	-	+	YES	-	-

Review of the Environmental Impact of Human Activity 2

2.1 Surface water

2.1.1 Summary of significant pressures on surface waters in the river basin district (SWPI 1)

The significance of the pressures on surface water bodies is assessed on the basis of three categories: less important, important and very important. All the known pressures were observed in order to identify significant pressures. All the pressures, as a result of the impact of which the quality objectives of the surface water body will be failed, were identified for every surface water body. All such pressures were considered to be important.

Less important pressures are those existing in the river basin district, but which, on the basis of the facts available, do not have a noticeable impact on the status of the relevant surface water body. It is possible to identify less important pressures, to define their location, but it is not possible to define their direct connection with the status of the surface water body. Less important pressures are rather as a potential threat to the surface water body.

Important pressures are pressures, which, on the basis of the facts available, have an impact on the status of the surface water body by putting the achievement of the good status of the surface water body at risk. Therefore the pressures, which presume the existence of an environmental permit or compliance with the requirements set by legislation, are important pressures. The impact of important pressures can be connected with the impact on the status of surface water bodies.

Very important pressures are the pressures, which, on the basis of the facts available, have an impact on the status of the surface water bodies, by being expressed in exceeding the requirements established by an environmental permit or the occurrence of pollution incidents of surface water bodies and the deterioration of the status of a water body. Very important pressures prevent the achievement of the good status of surface water bodies and are partially a basis for identifying surface water bodies as heavily modified water bodies.

Pursuant to the reporting guidance pressures were analysed on the basis of the list of pressures of surface water bodies, according to which the pressures have been divided into five groups – point sources, diffuse sources, water abstraction, regulation of water flow rates and morphological changes and other pressures. Water treatment plants, stormwater overflows, facilities for the processing of wastewater sediments, companies having integrated environmental permits and other enterprises, which direct the pollution directly into a recipient, have been discussed under point sources. Mainly the pollution generated in the fields as a result of agricultural activity, pollution from sewerage, the objects, which have not been connected to the sewerage, and from the objects of residual pollution are taken into account as diffuse sources. Water abstraction for the use of different types of activity, including for cooling-water, for the operation of hydroelectric power stations, for the use of enterprises or industries and agriculture and fish farming is considered to be water abstraction. Dams and blocking structures, the dredging and redesigning of water bodies, harbour facilities, activities connected with land improvement are considered as regulation of water flow rates and morphological changes. Other pressures mean for example the use or removal of the flora of a water body, recreational activities, recreational fishing, introduced species, climate changes, soil drainage. Data about the importance of the assessed significant pressures are presented in tables 8, 9 and 10.

Table 8. Significant pressures in the West-Estonian river basin district

Pressure	Per cent of the surface water bodies of the West-Estonian river basin district, which significant pressure is:		
	less important	important	very important
Point sources	17	13	5
Diffuse sources	11	13	1
Water abstraction	2	1	1
Regulation of water flow rates, morphological changes	9	6	4
Other pressures	9	9	4

Table 9. Significant pressures in the East-Estonian river basin district

Pressure	Per cent of the surface water bodies of the East-Estonian river basin district, which significant pressure is:		
	less important	important	very important
Point sources	6	30	14
Diffuse sources	63	64	37
Water abstraction	3	3	0
Regulation of water flow rates, morphological changes	12	33	6
Other pressures	11	33	4

Table 10. Significant pressures in the Koiva river basin district

Pressure	Per cent of the surface water bodies of Koiva river basin district, which significant pressure is:		
	less important	important	very important
Point sources	0	4	1
Diffuse sources	80	5	2
Water abstraction	0	0	0
Regulation of water flow rates, morphological changes	5	20	7
Other pressures	0	0	2

2.1.2 Identification of surface water bodies at risk (SWPI 2)

Surfaces water bodies at risk were identified on the basis of the descriptions prepared about all the water bodies. On the basis of the existing data of environmental monitoring of all the river basin districts and the results of the analysis of pressures it was found out, how big is the likelihood to achieve the good status of water bodies by 2015. Water bodies at risk were identified, about which it is clear without additional research that the achievement of the objective might not be possible, since the pressures may prevent the achievement of the good status. The good status of a water body was defined on the basis of the developed typology and the reference conditions of the water bodies.

Water bodies, where it was not possible to ascertain that the good status of the water body is not at risk and where additional research shall be carried out for finding out the status, were identified as water bodies in need of further investigation.

Water bodies, which status was good and about the pressures of which it could not be claimed that the good status of the water body might be at risk, were identified as water bodies not being at risk.

It was explained additionally, which are the status indicators that make every water body at risk a water body at risk. The indicators of the chemical and ecological status of the water body at risk and the indicators dependent on the volume of water were assessed. It has been identified for every status indicator, what puts the indicator at risk: point source pollution, diffuse source pollution, water abstraction, regulation of water flow rates, morphological deviations.

On the basis of risk estimation there are 107 water bodies at risk in the West-Estonian river basin district. These are all rivers. In the East-Estonian river basin there are the total of 59 water bodies at risk, including 12 lakes. In the Koiva river basin district there are 3 water bodies at risk. The surface water bodies at risk requiring further investigation and those not being at risk in Estonia are presented in figures 13-18.

2.1.3 Significant point source pollution (SWPI 3)

Upon the identification of significant point source pollution the primary criterion is the existence of an environmental permit. All the point sources, which are authorised to direct pollution into the environment, are considered to be point sources.

The pollution load in river basin districts from point sources has been identified on the basis of the database “Water use” of the State Water Cadastre, which receives annual reports about the previous year of the companies holding a permit for the special use of water and which have passed the inspection of the environmental authorities of the counties. Pursuant § 8 (2) 4) of the Water Act it is necessary to hold a permit for the special use of water, if effluent or other water pollutants are released into a recipient (both, into a water body or into ground). Proceeding from the natural specificity of Estonian water bodies, the companies, which have obtained a permit for the special use of water, have been considered to be significant point sources. The volume of effluent and the pollution load of organic matter (BOD_7), nitrogen ($N_{general}$) and phosphorus ($P_{general}$) have been calculated on the basis of the national annual report “Water Use” of 2003. In 2003 the 360 water users of the West-Estonian river basin district, whose total volume of effluent was approximately 100 million cubic metres, had 537 releases of effluent, including 16 industrial cooling water, 11 mine water, 36 rainwater and 4 fish farming releases. 432 of them were directed into rivers, 4 into lakes and 101 into coastal water. In 2003 the 278 water users of the East-Estonian river basin, whose total volume of effluent was a little over 1.5 billion cubic metres, had 438 releases of effluent, including 13 cooling water, 30 mine water, 26 rainwater and 9 fish farming releases. 399 of them were directed into rivers, 26 into lakes and 13 into coastal sea.

Industrial cooling water, mine water and the part of fish farming water, which is conventionally considered clean, form less than 30% of the effluent generated in the West-Estonian river basin district. The effluent, which requires purification, is purified depending on the place from where it originates. Domestic wastewater and industrial wastewater are purified biologically or biological-chemically. Less than 0.3% of the effluent requiring purification is directed into water bodies without purification. From the effluent generated in the East-Estonian river basin district 80% is formed by the cooling water of power industry, which is conventionally considered to be clean. The effluent requiring purification is purified in accordance with the origin: the mine water generated upon the mining of oil shale mechanically, domestic waste water biologically or biological-chemically. Less than 1% of the effluent requiring purification is directed into water bodies without purification. The pollution load of every separate release is calculated on the basis of documented measurements, analyses performed by recognised or accredited laboratories, or calculations made on the basis of the calculation methods established by the Minister of the Environment. According to the reports of 2003 the pollution load of over 70% of the volume of effluent generated in the West-Estonian river basin district has been defined by measurement. 78% of the effluent requiring purification has been defined by measurement and 22% by calculation. According to the reports of 2003, 90% of the pollution load the volume of effluent generated in the East-Estonian river basin district has been defined by measurement. 93% of the effluent requiring purification has been defined by measurement and 27% by calculation. Pursuant to Regulation of the Government of the Republic No 269 of 31 July 2001 ”Procedure for releasing effluent into a water body or into ground” a special user of water shall ensure sampling from the places determined in the permit for the special use of water and organise the analysis of the samples. The frequency of sampling, excluding for the identification of the content of the dangerous substances listed in the Regulation, shall be at least 12 times a year, if the pollution load from the pollution source is 2000–50000, and 24 samples a year, if the pollution load from the pollution source is bigger than 50000 population equivalents (hereinafter *pe*). If the pollution load from the pollution source is 2000 pe or bigger, the samples shall be averaged proportionally with the flow rate or temporally averaged with a 24-hour sampling time. If the pollution load from a pollution source is below 2000 pe or if the dangerous substances listed in the Regulation are studied in industrial effluent or polluted rainwater, the requirements and frequency of sampling shall be determined by a permit for the special use of water or any other permit regulating release in water.

There are the total of 994 significant point sources in Estonia (table 11), from which 537 lie in the West-Estonian river basin district, 438 in the East-Estonian river basin district and 19 in the Koiva river basin district. There are altogether 107 significant point sources threatening the achievement of the good status of water bodies, from which 72 are in the West-Estonian river basin district and 35 in the East-Estonian river basin district (table 12). The review of the total pollution originating from all the significant point sources is presented in table 13 by river basin districts.

Table 11. Number of significant point sources in river basin districts

River basin district	Estimated number of point sources in the river basin district
West-Estonian river basin district	537
East-Estonian river basin district	438
Koiva river basin district	19
Total	**994**

Table 12. Water bodies, the achievement of the objectives of which is threatened by the pollution from significant point sources

River basin district	Estimated number of water bodies, the achievement of the objectives of which is put threatened by point sources
West-Estonian river basin district	72
East-Estonian river basin district	35
Koiva river basin district	0
Total	**107**

Table 13. Pollution load from point sources in Estonian river basin districts

Pollutant	Quantity (tons/a year) in the river basin district		
	West-Estonian	East-Estonian	Koiva
Organic pollution load (BOD_7)	567,4	1074,4	1,5
Pollution load of nitrogen ($N_{general}$)	1079,4	1258,3	1,5
Pollution load of phosphorus ($P_{general}$)	90,6	81,9	0,9
Priority hazardous substances, phenols	-	7,9	-

2.1.4 Significant diffuse source pollution (SWPI 4)

Diffuse source pollution load is calculated on the basis of the instructions of the Helsinki Committee for the calculation of the diffuse source pollution load from agriculture. The data presented in the tables are based on the calculations of pollution loads made in the framework of the *PLC*-4 project.

The assessment of the pollution load of diffuse sources is based on the presumption that the diffuse source pollution from agriculture is the most significant risk factor of water bodies. The used calculation principle has been recommended in the instructions of the North Sea Convention (*HARP*) and the Baltic Marine Environment Protection Convention *PLC*-4 instructions. The method is based on the pollution load values actually measured in the estuaries of rivers within the framework of monitoring, whereto retention and the load of other sources (nature, anthropogenic point sources) is added.

The anthropogenic pollution load from diffuse sources is calculated by the following equation:

$$LO_D = L_{river} - D_P - LO_B + R$$

where

LO_D – anthropogenic pollution load from diffuse sources (agriculture, forest management, etc);
L_{river} – pollution load in the estuary of the river;
D_P – pollution load released in the river from point sources (domestic waste waters, industrial waters, etc);
R – retention

In table 15 there are the numbers characterising the load from diffuse source pollution of the year 2000, which was an ordinary average year from the point of view of hydrology. In the table figures are presented about the pollution loads generated by the main pollutants (P and N), which may put the achievement of the good status of water bodies at risk. The pollution load generated by significant diffuse sources were assessed on the basis of the abovementioned information about the assessment of the diffuse source pollution load and the analysis of pressures, on the basis of which the water bodies threatened by the impact of diffuse sorce pollution were identified. As a result of it data are presented in table 14 about the water bodies threatened by diffuse sources. Altogether there are 77 such water bodies in Estonia, from among these 48 water bodies in the West-Estonian river basin district and 29 in the East-Estonian river basin district. Since diffuse soure pollution is generated mainly by agriculture, background information is presented in table 16 about agricultural land use.

Table 14. Surface water bodies threatened by diffuse source pollution

River basin district	Number of threatened water bodies
West-Estonian river basin district	48
East-Estonian river basin district	29
Koiva river basin district	0
Total	**77**

Table 15. Pollutants from diffuse source pollution, which threaten water bodies in the river basin districts

Pollutant	Load in the river basin district		
	West-Estonian	East- Estonian	Koiva
Organic load (TOC, BOD or COD)	-	-	-
Nitrogen	12 900 t/y	30 600 t/y	1350 t/y
Phosphorus	120 t/y	400 t/y	21,3 t/y

Table 16. Generators of diffuse source pollution load in the river basin districts

Indicator	Characteristic quantity per the river basin district		
	West-Estonian	East- Estonian	Koiva
Existing agricultural land, which is fertilised, including (km^2):	3 620	4 130	217
permanent grassland (km^2)		435	26
land used for grain growing (km^2)	3 166	3 695	191
Annual used amount of N per a ha, including:	150,7	148,3	108,9
mineral N, kg/ha	67,7	79,4	49,1
organic N, kg/ha	83,0	68,9	59,8

2.1.5 Significant water abstractions from surface water (SWPI 5)

The abstracted surface water volume in river basin districts has been determined on the basis of the database "Water Use" of the State Water Cadastre. Annual reports of the companies holding a permit for the special use of water, which have passed the inspection of the environmental authorities of the counties, about the previous year are received by the database. Pursuant to §8(2)1) of the Water Act a permit for the special use of water is necessary, if water is abstracted from a surface water body, including if ice is abstracted in a volume of more than 30 m^3 per day. The water abstraction of the companies holding a permit for the special use of water for water abstraction has been assessed as significant. Pursuant to § 9(2)1) of the Water Act the allowable amounts and time for abstraction of water and the requirements for determination of the amount of water abstracted from a body of water, quality control of water and maintaining records of the abstracted water shall be specified in the permit for special use of water. Pursuant to § 21(3) of the Water Act water users are required in the case of the special use of water, to estimate the amount and characteristics of the water used and to submit, at least once a year, a report on the amount of used water to the issuer of the permit for the special use of water. A number of peculiarities of the morphometry of rivers and the distribution of water resources proceed from the geographical position and the natural conditions of Estonia. The distribution of the flow of rivers in a year and between years is very variable. During the ebb period there are relatively small, in the upper courses of rivers minimum flow rates close to zero, to which the ecosystem is sensitive. In order to characterise the pressure a human being is exerting on surface water resources, the water use index (WUI) has been calculated. WUI has been obtained by comparing the surface water abstraction of the year 2003 with the average annual flow of a long period. In 2003 the total amount of abstracted surface water was 1.3 billion m^3 and WUI was 11.5. In EU countries the average WUI at the same time was 10, whereas the interval 10–20 is considered to be low pressure on surface water resources. The surface water resources of EU are 3500 km^3 a year on the average. The data characterising significant water abstractions are presented in table 17. The WUI of the West-Estonian river basin district and the East-Estonian river basin district are presented in table 18.

û Water use in the West-Estonian river basin district

The biggest surface water abstractor of the West-Estonian river basin district is Tallinn, where water abstractions in 2003 formed over 27 million m^3, from which a little over 15 million m3 was consumed for the drinking and domestic water of the inhabitants. In the West-Estonian river basin district as a whole most of the water was abstracted from rivers, 3 abstractions take place from lakes. In addition, approximately 15 million m^3 of seawater was used in one fish farm. Pursuant to the report of 2003 the water volumes abstracted in the West-Estonian river basin district have been measured by water meters, except in fish farms, where the water volumes have been determined on the basis of calculations and estimations. The long-term average annual flow of the West-Estonian river basin district – 6072 million m^3 – has been calculated on the basis of the flow module characteristic of the area (Ресурсы поверхностных вод СССР, том 4, выпуск 1. Эстония. Edit. T.Eipre; Gidrometeoizdat, Leningrad 1972, lk 68–69). WEI of the Western Estonia was below 1 in 2003.

û Water use in the East-Estonian river basin district

In the East-Estonian river basin district the biggest user of surface water is power industry. The Estonian Power Station of Narva Power Plants Ltd abstracts water from the river of Narva. Water, which chemical composition has not changed and, which does not need purification, is released back in the river. Downstream Balti Power Plant uses partially the same water and directs it through a canal into Narva reservoir. Pursuant to the report of 2003 the water volumes abstracted in the East-Estonian river basin district have been measured by water meters, except in fish farms, where the water volumes have been determined on the basis of calculations and estimations. The long-term average annual flow of the East-Estonian river basin district – 4935 million m^3 – has been calculated on the basis of the flow module characteristic of the area (Ресурсы поверхностных вод СССР, том 4, выпуск 1. Эстония. Edit. T.Eipre; Gidrometeoizdat, Leningrad 1972, lk 68–69). WEI of the East-Estonian river basin district was 26.0 in 2003

û Water use in the Koiva river basin district

No significant surface water abstraction is carried out in the Koiva river basin district.

Table 17. Indicators characterising significant water abstractions in river basin districts

Indicator	Figure in the river basin district		
	West-Estonian	East-Estonian	Koiva
Number of water abstraction points	26	39	-
Quantity of abstracted water, m^3	52 000 000	1 282 864 581	-
Significant water use by categories, including:	46 212 133	1 279 039 411	-
agriculture	174 411	19 016	-
public water supply, drinking water	15 322 058	2 527 600	-
industry	14 820 804	12 962 076	-
energy production	4 407 402	1 222 768 177	-
fish farming	10 051 090	37 458 780	-
other	1 436 368	3 303 762	-
Water losses in water use	5 787 867	3 825 170	-

Table 18. Other indicators in river basin districts connected with water abstraction and water use

Indicator	Figure in the river basin district		
	West-Estonian	East-Estonian	Koiva
WEI	< 1	26,0	-

2.1.6 Significant water flow regulations and morphological alterations (SWPI 6)

At the time of the preparation of the report there is no methodology for the assessment of significant water flow regulations and morphological alterations of water bodies in Estonia. Therefore only those areas of activity, which on the basis of the analysis prevent the achievement of the good status of the water bodies at risk, have been considered significant. On the basis of the data of table 19 there are altogether 29 water bodies in Estonia, which are at risk due to water flow regulations or morphological alterations.

Table 19. Water bodies threatened by water flow regulations or morphological alterations

River basin district	Number of water bodies in the river basin district
West-Estonian	19
East-Estonian	7
Koiva	3
Total	**29**

2.1.7 Assessment of the impact of the significant pressures on surface water bodies (SWPI 7)

The assessment of the impact of the significant pressures on surface water bodies is primarily based on the monitoring data obtained in the framework of the national environmental monitoring programme, supplemented by the data of the works carried out in the framework of different impact researches.

Human activity, which has caused the deterioration of the status of water bodies, is considered to be a significant impact on surface water bodies. On the basis of the environmental research carried out and the analysis of the pressures and risks the ecological and chemical status of the water bodies of the West-Estonian river basin district deteriorates primarily due to diffuse source pollution. In rare cases the deterioration of the ecological and chemical status of waters is caused by water treatment plants. The deterioration of the ecological and hydromorphological status of watercourses is caused also by numerous impediment structures built on small rivers and the production of hydroelectric energy.

In the East-Estonian river basin district the deterioration of the indicators of the amount of surface water is caused by the use of cooling water upon the production of electricity. The deterioration of the ecological status is caused mainly by impediment structures on small rivers and effluent, both from water treatment plants and mines.

There is no significant impact on surface water bodies in the Koiva river basin district.

2.1.8 Uncertainties and data gaps (SWPI 8)

The report is prepared on the basis of the works carried out for the preparation of the water management plants of river basin sub-districts, investigations of the Department of Environmental Engineering of the Tallinn University of Technology, the Institute of Zoology and Botany of the Estonian Agricultural University, the Estonian Marine Institute of the University of Tartu and the Estonian Maritime Academy in the field of the typology, classification and the establishment of the reference conditions of water bodies, investigations made by Maves Ltd and the Geological Survey of Estonia for the identification and characterisation of groundwater bodies and the works carried out by the Estonian Water Company Ltd and OÜ EL Konsult for the economic analysis of water use.

The information and data used at the preparation of the report have been obtained from the Estonian Environment Information Centre, the Statistical Office of Estonia, the Population Registration Bureau of the Ministry of Internal Affairs, the Health Protection Inspectorate and the Estonian Agricultural Registers and Information Board (ARIB). All the maps presented in the report have been prepared by the Estonian Environment Information Centre. The report is intended for public use.

The used data are included in the databases administered by the Estonian Environment Information Centre. The quality, reliability and sufficiency of the data can be increased in future by connecting those databases with the other databases of the state in such a way that all of the information necessary at the level of a whole river basin district would be available and could be processed. Most of the databases used at present have been compiled proceeding primarily from the boundaries of rural municipalities and counties.

The gaps in data are connected with numerous small lakes. Therefore primarily the lakes, which area is more than 0.5 km^2, have been discussed in the report. There is insufficient information for identifying the type and significance of the pressures of smaller lakes. For better organisation of the protection and use of small lakes it is planned to connect those with the identified surface water bodies by the methodology in chapter 1.1.1. By doing this it will be possible to increase the reliability of data upon the assessment of the significance of pressures and at a later stage also upon the assessment of the impact of human activity.

The gaps in data have been mentioned also in chapter 2.1.6: it is not possible to provide more exact assessment of significant water flow regulations and morphological alterations on the basis of the existing data.

The Ministry of the Environment is responsible for the preparation of the report and the data presented and used in the report.

2.1.9 Recommendations for surveillance monitoring (SWPI 9)

The recommendations for surveillance monitoring are based on the results of the preparation of analysis and characterisations and proceed from the need to obtain better overview of the situation of water management in Estonia.

û Monitoring of water bodies

The monitoring of water bodies in Estonia is carried out on the basis of the monitoring programme of the state of Estonia. The aim of the state monitoring programme is to provide sufficient information about the water status of Estonian water bodies in such a way, which would enable to adopt resolutions and direct the development of water management in Estonia. Surveillance monitoring has not been defined in Estonia as an activity at present. Most of the propositions for the organisation of surveillance monitoring in the framework of common monitoring of water bodies have been made in the water management plans of river basin sub-districts and they are connected with the need for supplementary investigations for the identification of the status of water bodies. There is no sufficient information at present for determining the status of a water body. The assessment of the status of water bodies is hindered also by inadequate or too general information about the use of models and other methods. Since the monitoring of water bodies is a costly activity, it is reasonable to prepare at first a surveillance monitoring plan, which would support the establishment of the types of water bodies and type specific reference conditions.

û Water bodies requiring supplementary investigation

Within the framework of surveillance monitoring special attention shall be paid to the water bodies, which have been identified as water bodies requiring supplementary investigation in the course of the analysis of water bodies at risk, since the existing environmental monitoring data, also the results of the analysis of pressures and impact evaluations cannot identify the status of the water body. In many cases these are the water bodies, which have been polluted 10-15 years ago and where the ecological balance has not recovered by today. Supplementary investigation is necessary in order to find out the possibilities for the achievement of the good status of these water bodies.

2.2 Groundwater.

2.2.1 Summary of pressures on groundwaters (GWPI 1)

The initial characterisation of significant pressures on groundwaters has been prepared by river basin districts. Every significant pressure has been identified as a less important, important and very important pressure by groundwater bodies in tables 20–22. The evaluation of the significance of pressures is based on the existing information, taking into consideration both, the activity regulated by an environmental permit and the assessments given by experts.

Table 20. Assessment of the pressures having an impact on the groundwater bodies of the West-Estonian river basin district

Pressures	Assessment of the pressure (less important/important/very important)
Diffuse source pollution, incl.:	
agricultural activity (the use of fertilisers, pesticides, live stock-farming)	Important pressure to the first groundwater bodies from the ground: the West-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.1), Silurian-Ordovician groundwater body of West-Islands (7); Middle-Devonian groundwater body (11); Middle-Lower-Devonian (10) groundwater body. There is a very important risk in West-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.1) in the part covered with nitrate -sensitive area.
non-sewered population	Important pressure in Männiku-Pelguranna area of the Quaternary aggregated groundwater body (15.1). Less important pressure to the first groundwater bodies from the ground 9.1, 7, 11 and 10.
urban land use	Important pressure in Männiku-Pelguranna area of the Quaternary aggregated groundwater body (15.1). Less important pressure to the first groundwater bodies from the ground 9.1, 7, 11 and 10.
Point source pollution, incl.:	
leakages from contaminated sites	Important pressure in the West-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.1) and to the first groundwater bodies from the ground 7, 11, 10 and 15.1.
leakages from waste disposal sites(landfill disposal, agricultural waste)	Less important pressure to the first groundwater bodies from the ground 9.1, 7, 11 and 10.
leakages associated with oil industry infrastructure	Less important pressure to first groundwater bodies from the ground 9.1, 7, 11, 10 and 15.1.
discharge of sewage into the ground, impregnation	Less important pressure in the West-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.1).
Water abstraction, incl.:	
water abstraction for public water supply	Very important pressure especially to the Cambrian-Vendian groundwater body (3) in the city of Tallinn and its vicinity and to the Silurian-Ordovician groundwater body under Devonian strata (8.1) in the city of Pärnu and its vicinity.

Pressures	Assessment of the pressure (less important/important/very important)
water abstraction for industry, incl.:	Less important pressure to the Cambrian-Vendian groundwater body (3) in the city of Tallinn and its vicinity.
companies operating without holding an integrated environmental permit	Less important pressure to the Cambrian-Vendian groundwater body (3) in the city of Tallinn and its vicinity.
dewatering of mines	Less important pressure to Männiku-Pelguranna area of the Quaternary aggregated groundwater body (15.1).
Artificial groundwater recharge	
flooding of mines	Less important pressure to Männiku-Pelguranna area of the Quaternary aggregated groundwater body (15.1).
Intrusion of sea water, incl.:	
Impact of sea water on groundwater	Important pressure to the Cambrian-Vendian groundwater body (3). Important pressure to the Silurian-Ordovician groundwater body under Devonian strata (8.1) in the city of Pärnu and its vicinity. Important pressure in Western Estonia by the sea in the Silurian-Ordovician aggregated (9.1) and the Silurian-Ordovician groundwater body of West-Islands (7).
Impact of other waters on groundwater	Important in the Cambrian-Vendian groundwater body (3), where salty water can be found at places in the basement rocks forming the base. In case of the absence of aquitard in the areas with intensive water abstraction the saltier water may endanger the present water quality of the groundwater body, especially in the city of Tallinn and its vicinity. Important in the city of Pärnu and its vicinity in the Silurian-Ordovician groundwater body under Devonian strata (8.1). The increase of the salinity in the seventies-eighties could have been caused by both, seawater and the inflow of saltier water from deeper strata in the area of intensive abstraction, or it was due to a naturally saltier lens in the groundwater body.

Table 21. Assessment of the pressures having an impact on the groundwater bodies of the East-Estonian river basin district

Pressures	Assessment of the pressure (less important/important/very important)
Diffuse source pollution, incl.:	
agricultural activity (the use of fertilisers, plant protection products, live stock-farming)	Important to the following first groundwater bodies from the ground: the Ordovician groundwater body of Ida-Viru county (5); the Ordovician groundwater body of the oil shale basin of Ida-Viru (6); the East-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.2); the Middle-Devonian groundwater body (11); the Middle-Lower-Devonian groundwater body (10); the Upper Devonian groundwater body (12); Sadala (15.9), Laiuse (15.8) Saadjärve (15.7), Elva (15.6), Otepää (15.5), Piigaste-Kanepi (15.4) and Võru (15.3) areas of the Quaternary aggregated groundwater body. The biggest risk is in the East-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.2) in the part covered with a nitrate vulnerable zone.
non-sewered population	Very important pressure to the Quaternary Meltsiveski groundwater body (14). Important in Elva (15.6) and Võru (15.3) areas of the Quaternary aggregated groundwater body. Less important pressure to the following first groundwater bodies from the ground: 5; 6; 9.2, 10; 11; 12 and in Sadala (15.9), Laiuse (15.8), Saadjärve (15.7), Otepää (15.5) and Piigaste-Kanepi (15.4) areas of the Quaternary aggregated groundwater body.
urban land use	Important to the Quaternary Meltsiveski groundwater body (14). Less important pressure to the following first groundwater bodies from the ground: 5; 6; 9.2, 10; 11 and in Elva (15.6), Otepää (15.5) and Võru (15.3) areas of the Quaternary aggregated groundwater body.
Point source pollution, incl.:	
leakages from contaminated sites	Very important pressure in the Ordovician groundwater body of the oil shale basin of Ida-Viru (6). Important pressure in the Quaternary Meltsiveski groundwater body (14); Ordovician groundwater body of Ida-Viru county (5); in the East-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.2); in the Middle-Devonian groundwater body (11); in the Middle-Lower-Devonian groundwater body (10); in Võru area (15.3) of the Quaternary aggregated groundwater body.
leakages from waste disposal sites (landfill disposal, agricultural waste)	Important pressure in the Ordovician groundwater body of the oil shale basin of Ida-Viru (6). Less important pressure to the following first groundwater bodies from the ground: 5, 9.2, 10, 11, 12, 15.3.
leakages associated with oil industry infrastructure	Important pressure in the Ordovician groundwater body of the oil shale basin of Ida-Viru (6). Less important pressure to the following first groundwater bodies from the ground: 5, 9.2, 10, 11, 12, 14, 15.3, 15.5 and 15.6.
pollution discharged from mines into groundwater	Very important pressure to the East-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.2). Important pressure in the Ordovician groundwater body of the oil shale basin of Ida-Viru (6), to the Quartenary Vasavere groundwater body (13).

Pressures	Assessment of the pressure (less important/important/very important)
Impregnation of discharge into the ground	Less important pressure to the East-Estonian area of the Silurian-Ordovician aggregated groundwater body (9.2).
Water abstraction, incl.:	
water abstraction for public water supply	Important pressure especially in Ida-Viru county in the towns of Sillamäe, Kohtla-Järve, Jõhvi and Kiviõli and their vicinity to the Cambrian-Vendian groundwater bodies of Voronka (2) and Gdov (1), to the Quaternary Vasavere (13) and Meltsiveski (14) groundwater bodies.
Water abstraction for industry, incl.	
companies holding an integrated environmental permit (IPPC)	Important pressure in the towns of Kohtla-Järve, Sillamäe, Kiviõli and Jõhvi to the Cambrian-Vendian groundwater bodies of Voronka (2) and Gdov (1).
companies not holding an integrated environmental permit	Less important pressure in Ida- and Lääne-Viru county to the Cambrian-Vendian groundwater bodies of Voronka (2) and Gdov (1).
dewatering of mines	Very important pressure in the Ordovician groundwater body of the oil shale basin of Ida-Viru (6). The quantitative status of the Ordovician groundwater body of the oil shale basin of Ida-Viru (6) has an impact also on the Quaternary Vasavere (14) groundwater body.
Artificial groundwater recharge, incl.	
flooding of mines	Very important pressure in the Ordovician groundwater body of Ida-Viru (5) and the Quaternary Vasavere groundwater body (14).
Intrusion of sea water, incl.:	
impact of sea water on groundwater	Important pressure in the coastal regions in Cambrian-Vendian groundwater bodies of Voronka (2) and Gdov (1).
impact of other waters on groundwater	Important pressure in the Cambrian-Vendian groundwater bodies of Voronka (2) and Gdov (1). Salty water can be found at places in the basement rocks forming the base of the Cambrian-Vendian Gdov groundwater body. In case of the absence of aquitard in the areas with intensive water abstraction the saltier water may endanger the present water quality of the groundwater body. Since salinity in the Cambrian-Vendian Gdov (1) groundwater body is higher than in the Cambrian-Vendian Voronka (2) groundwater body, the groundwater of Gdov may have an impact on the qualitative status of Voronka groundwater body in a situation, where due to intensive water abstraction the potentiometric surface of Voronka is lower than the potentiometric surface of Gdov.

Table 22. Assessment of the pressures having an impact on the groundwater bodies of the Koiva river basin district

Pressures	Assessment of the pressure (less important/important/very important)
Diffuse source pollution, incl.:	
agricultural activity (the use of fertilisers, plant protection products, live stock-farming)	Less important pressure in the Upper Devonian groundwater body and the Middle-Devonian groundwater body.
non-sewered population	Less important pressure in the Upper Devonian groundwater body and the Middle-Devonian groundwater body.
Point source pollution, incl.:	
leakages from contaminated sites	Less important pressure in the Upper Devonian groundwater body and the Middle-Devonian groundwater body.
leakages from waste disposal sites (landfill disposal, agricultural waste)	Less important pressure in the Upper Devonian groundwater body and the Middle-Devonian groundwater body.

2.2.2 Less important pressure in the Upper Devonian groundwater body and the Middle-Devonian groundwater body.

The criteria established by the Regulation of the Minister of the Environment No 47 of 10 May 2004 "Water classes of groundwater bodies, values of the quality indicators complying with the water classes of groundwater bodies and the procedure for defining water classes1" were used upon the assessment of the threat to groundwater bodies due to pressures. All the pressures, which alone or together may change the groundwater status into a poor water class pursuant to the criteria of the abovementioned Regulation, have been considered as significant. If it was assessed that some pressure was able to deteriorate the status of a groundwater body alone, it was not taken into account in the assessment of the combined effect of pressures. The possibility of the potential impact of pressures on more than 10% of the area of a groundwater body was used as an additional criterion upon the assessment of the significance of pressures. Pursuant to the Regulation of the Minister of the Environment No 47 of 10 May 2004 the water classes expressing the qualitative and quantitative status of a groundwater body are:

good – natural water and close to natural water;

poor – water polluted or polluted strongly as a result of human activity.

According to the values of physico-chemical quality indicators, the water class of a groundwater body is poor, if less than 90% of the values of quality indicators obtained from the observation points of the monitoring network of the groundwater body comply with the values of the quality indicators of the good groundwater body water class.

û Quality indicators of the good water class:

• human activity or saltwater intrusion has not caused the elevation of the concentration of solutes (as measured by conductivity);

• human activity or saltwater intrusion has not caused elevated of chloride ion content;

• nitrate ion content does not exceed 50 mg/l and the elevation tendency of the content of nitrates does not cause significant deterioration of the ecosystems dependent on groundwater;

• ammonium ion content in naturally aerobic groundwater does not exceed 0.5 mg/l or in naturally anaerobic aquatic environment does not exceed 1.5 mg/l or if, in case of exceeding the value of the quality indicator the natural origin of ammonium ion in groundwater has been proved;

• the content of plant protection products does not exceed 0.1 μg/l;

• pH is between 6–9;

dissolved oxygen content does not indicate decreasing tendency caused by human activity or the oxidizability of water is <= 5 mg/l O_2;

• there are no hazardous substances to the aquatic environment or their content does not exceed the limit values of hazardous substances to the aquatic environment established by the Regulation of the Minister of the Environment No 12 of 2 April 2004 “Maximum Limits for Hazardous Substances in Soil and Groundwater” (RTL 2004, 40, 662) or, if in case of the occurrence of the hazardous substances to the aquatic environment mentioned in this Regulation the natural origin of these substances has been proved.

û **The quantitative status of a groundwater body belongs to the good water class of groundwater bodies by the values of quantity indicators, if a groundwater complies with all the following values of quantity indicators:**

• the use of groundwater is smaller than the confirmed groundwater resources or the natural resources of groundwater identified in the course of the preparation of the management plan of a river basin district;

• alterations of the direction of the flow of groundwater caused by alterations in groundwater levels do not cause saltwater intrusion into a groundwater body;

• there is no long-term lowering tendency of groundwater level and the lowering of groundwater level does not cause significant deterioration of the ecosystems dependent on groundwater;

• the lowering of groundwater level caused by human activity occurred in less than 10% of the observation points of the monitoring network of groundwater bodies.

In the course of the identification of groundwater bodies at risk only one groundwater body in East-Estonian river basin district has been identified as being at risk. There are no groundwater bodies being at risk in the East-Estonian river basin district and the Koiva river basin district. The groundwater body of the oil shale basin of Ida-Viru (6) being at risk in the East-Estonian river basin district is presented in figure 17. On the basis of the initial characterisation of groundwater bodies two groundwater bodies will definitely achieve good status by the year 2015. The risk of failing to achieve the good status of the rest of the groundwater bodies shall be investigated further.

2.2.3 Significant diffuse source pollution (GWPI 3)

From diffuse sources agriculture, transport, conurbations and industrial territories (including quarries) were observed upon the assessment of the impact of diffuse source pollution on groundwater. Transport was considered to be a significant pressure only in the territory of towns. At present there are insufficient data for the assessment of the impact of agriculture in the part of nitrogen and plant production products and the impact caused by conurbations on the chemical status of the superficial aquifer. No numerical models were used upon the assessment of the impact of diffuse source pollution. The expert assessment is prepared primarily on the basis of 15-year-old water protection schemes (including nitrogen balances), groundwater surveys (including surveys of water resources) several reports on the nitrate vulnerable zone and the data of long-term groundwater monitoring, taking thereby the protection of the groundwater bodies against pollution into account. The sources of pollution, which alone or together with some other diffuse source may cause the exceeding of the quality threshold values on more than 10% of the area of a groundwater body or in more than 10% of boreholes, wells or springs, were identified as significant diffuse sources. Review of the groundwater bodies being at risk due to the impact of diffuse source pollution is presented in table 23. Review of the pollutants of diffuse source pollution threatening groundwater bodies, is presented in table 24.

- **West-Estonian river basin district**

According to expert assessment the diffuse sources having a significant impact on groundwater bodies in the West-Estonian river basin district are agriculture and conurbations.

- **East-Estonian river basin district**

The operating and closed oil shale quarries with large areas located in the East-Estonian river basin district are observed as point source pollution objects, since their impact can be better characterised by water abstraction and the size of the polluted area. According to expert assessment the diffuse sources having a significant impact on the groundwater bodies in the East-Estonian river basin district are agriculture and conurbations and industrial territories.

- **Koiva river basin district**

The observed diffuse source upon the assessment of the impact of diffuse source pollution on groundwater was agriculture.

Table 23. Groundwater bodies of river basin districts being at risk due to diffuse source pollution

River basin district	Groundwater bodies at risk
West-Estonian	There is no groundwater body in the West-Estonian river basin district, which would be at risk due to diffuse source pollution. There is only a potential risk.
East-Estonian	The Ordovician groundwater body of the oil shale basin of Ida-Viru (6) is at risk due to diffuse source pollution.
Koiva	There is no groundwater body in the Koiva river basin district, which would be at risk due to diffuse source pollution. There is only a potential risk.

Table 24. Significant indicators and pollutants from diffuse source pollution threatening groundwater bodies in the East-Estonian river basin district

Indicator and pollutants	Content in groundwater
Organic load (COD)	In all the groundwater bodies the average COD is below 5 mg/l O_2 and less than 10% of groundwater information points have COD values above 5 mg/l.
NH_4^+ and NO_3^-	In all the groundwater bodies the average NO_3^- content is below 30 mg/l, the content of NH_4^+ is below 0.5 mg/l in aerobic groundwater and below 1.5 mg/l in naturally anaerobic groundwater. The limit values in the part of the observed nitrogen compounds are exceeded in less than 10% of the groundwater information points.
Hazardous substances	Pursuant to the Regulation of the Minister of the Environment No 44 of 21 August 2001 "Lists 1 and 2 of hazardous substances to aquatic environment" the content of hazardous substances should not exceed the maximum limits established by the Regulation of the Minister of the Environment No 12 of 2 April 2004 "Maximum Limits for Dangerous Substances in Soil and Groundwater". The maximum limits of the content of these hazardous substances have been exceeded in polluted areas in the Ordovician groundwater body of the oil shale basin of Ida-Viru (6), in other groundwater bodies only in the immediate vicinity of the sources of pollution.

2.2.4 Significant point source pollution (GWPI 4)

There are no big point sources in the West-Estonian river basin district, which alone could deteriorate the status of a whole groundwater body. The potential risk of altering the status exists only in case of the combined effect of all the point sources. The significance of a point source is defined separately about every source of pollution on the basis of inventories, surveys and assessments or on the basis of analogy.
The significant point sources are:

• from the four known direct discharges the effluent discharge of the town of Tamsalu (> 100 m^3/d) into Savalduma turlogh;

• all the 35 residual pollution sources of national importance;

• from the 53 known impregnations of effluent into soil the effluent discharge of the town of Märjamaa (> 100 m^3/d);

• the closed phosphate rock quarry in Maardu.

According to the assessments, up to 50 of the old closed landfills and the landfills in the closing state may turn out to be potential point sources. Also, approximately 300 bigger farms may turn out to be potential point sources in the West-Estonian river basin district, mainly due to manure storage facilities, which do not comply with the requirements.

In the East-Estonian river basin district there are big point sources only in the areas of the Ordovician groundwater body of the oil shale basin of Ida-Viru (6) and Quaternary Meltsiveski groundwater body, which can deteriorate the status of the groundwater body. The status of the groundwater body of the oil shale basin of Ida-Viru (6) has been influenced also by 15 flooded or operating oil shale mines. In case of other groundwater bodies there is a potential risk of alteration of the status, if a combined effect of all the point sources should occur. The significance of a point source is defined separately about every source of pollution on the basis of inventories, surveys and assessments or on the basis of analogy. All the 38 residual pollution sources of national importance are definitely significant point sources. Direct discharges and impregnations are not significant point sources of pollution for groundwater bodies. According to the assessments, up to 50 of the old closed landfills and the landfills in the closing state may turn out to be potential point sources. Also, approximately 200 bigger farms may turn out to be potential point sources in the East-Estonian river basin district, mainly due to manure storage facilities, which do not comply with the requirements.

On the territory of the Koiva river basin district wastewater is impregnated into soil on the basis of a permit in four cases. Its impact on the quality of groundwater bodies on the territory of the river basin district is insignificant. It is primarily a potential risk in case of a combined effect of all the point sources. The significance of a point source is defined separately about every source of pollution on the basis of inventories, surveys and assessments or on the basis of analogy.

Review of point sources significant to groundwater bodies in the river basin districts is presented in table 25, according to which there are altogether 918 significant point sources in Estonia. Point source pollution threatens one groundwater body in the East-Estonian river basin district (table 26). The list of the main pollutants directed into groundwater from direct discharge and through impregnation and the estimated amount of every known pollutant directed into groundwater is presented in table 27. The data are partially based on the inventory of hazardous substances carried out in Estonia in 2000-2002.

Table 25. Number of significant point sources in the river basin districts

River basin district	Estimated number of significant point sources
West-Estonian	500
East-Estonian	400
Koiva	18
Total	**918**

Table 26. Groundwater bodies in the river basin districts being at risk due to point source pollution

River basin district	Number of groundwater bodies at risk
West-Estonian	-
East-Estonian	1
Koiva	-

Table 27. List of the main pollutants directed into groundwater

Indicator	Main pollutants	
	West-Estonian river basin district	East-Estonian river basin district
Organic load (on the basis of TOC, BOD or COD)	Total BOD from direct discharges is 1.7 tons a year. Total BOD from impregnation into soil is below 8.5 tons a year.	Total BOD from direct discharges is 0.11 tons a year. Total BOD from impregnation into soil is below 7.2 tons a year.
Nitrogen compounds	Total $N^{general}$ from direct discharges is 2.8 tons a year. Total $N_{general}$ from impregnation into soil is below 3 tons a year.	Total $N_{general}$ from direct discharges is below 2 tons a year, but it is not an additional load for groundwater, since only 0.05 tons of the nitrogen of direct discharges does not come from the groundwater accumulated in the Nordkalk limestone quarry. Total $N_{general}$ from impregnation into soil is below 2.8 tons a year.

Indicator	Main pollutants	
	West-Estonian river basin district	East-Estonian river basin district
Phosphorus compounds	Total $P_{general}$ from direct discharges is approximately 0.3 tons a year. Total $P_{general}$ from impregnation into soil is below 0.7 tons a year.	Total $P_{general}$ from direct discharges is below 0.1 tons a year. Total $P_{general}$ from impregnation into soil is below 0.6 tons a year.
Hazardous substances	oil products < 1 kg/a year, cadmium 0.15 kg/a year, phenols 14 kg/a year, PAH < 0.01 kg/a year, chromium 2 kg/a year, nickel 0.6 kg/a year, zink 1.6 kg/a year, lead 0.3 kg/a year, molybdenum 1.9 kg/a year, cobalt 0.4 kg/a year, barium 5 kg/a year, arsenic 0.2 kg/a year.	The total emission of phenols and lead into groundwater did not exceed 0.2 kg/a year.

2.2.5 Significant groundwater abstraction (GWPI 5)

All the groundwater abstractions carried out in compliance with the terms and conditions of the permits for the special use of water (i.e. over 5 m^3/d) were identified as significant groundwater abstraction. The dewatering of mines and quarries have been left out from the water abstraction indicators presented in the tables, since 3⁄4 of the water pumped out is formed by rainwater and water filtrating from the pumped-out water back into a quarry or a mine. Pursuant to the Regulation of the Minister of the Environment No 47 of 10 May 2004 "Water classes of groundwater bodies, values of the quality indicators complying with the water classes of groundwater bodies and the procedure for defining water classes1" the quantitative status of a groundwater body is good, when the following conditions are met:

• the use of groundwater is smaller than the confirmed groundwater resources or the natural resources of groundwater identified in the course of the preparation of the management plan of a river basin district;

• alterations in the direction of the flow of groundwater caused by alterations in groundwater levels do not cause saltwater intrusion into a groundwater body;

• there is no long-term lowering tendency of groundwater level and the lowering of groundwater level does not cause significant deterioration of the ecosystems dependent on groundwater;

• the lowering of groundwater level caused by human activity occurred in less than 10% of the observation points of the monitoring network of groundwater bodies.

All the water abstractions from over 500 m^3/d single wells or well groups are carried out in the registration areas of groundwater resources (the abstractions permitted in the area are identified on the basis of research). The number of significant groundwater abstractions, the number of groundwater bodies influenced by significant groundwater abstraction and the estimated volume of significant groundwater abstraction is presented in tables 28–30.

Table 28. Number of significant groundwater abstractions in river basin districts

River basin district	Number of groundwater abstractions
West-Estonian	1377
East-Estonian	961
Koiva	33
Total	**2371**

Table 29. Number of groundwater bodies with significant groundwater abstraction in river basin districts

River basin district	Number of groundwater bodies with significant groundwater abstractions
West-Estonian	2
East-Estonian	2
Koiva	0
Total	**4**

Table 30. Significant groundwater abstraction from groundwater bodies in the river basin districts

River basin district	Significant groundwater abstraction
West-Estonian	40 594m^3/d
East-Estonian	20 968 m^3/d
Total	**61 562 m^3/d**

2.2.6 Significant artificial groundwater recharge (GWPI 6)

There is no significant artificial groundwater recharge in Estonia; the existing infiltration basins in the East-Estonian river basin district are regarded as measures of mining technology.

2.2.7 Significant saltwater intrusion (GWPI 7)

The potential risk of saltwater intrusion is caused primarily by the decrease of pressure level in the areas of intensive water abstraction. In the course of the calculations of the groundwater resources of the areas the impact of saltwater has been assessed as not having a significant impact on the water quality of water intakes during the period of validity of the resources, which, as a rule, is 20-30 years. Although there is no immediate threat to groundwater bodies in the nearest decades, there is still a potential risk of the intrusion of saltier water. The main inspected indicators are Cl, Na, K, Ca, Mg SO_4 (at random also oxygen isotopes). Since the increase of salinity may be caused by both, the naturally saltier water in the lower part of the groundwater body (or in lenses), the inflow of water in some places from basement cracks or from lower aqueous layers, and also submarine saltier water, a groundwater expert shall assess the situation in case of the occurrence of warning signals on the basis of research by using all the existing long-term observation data and the numerical models of substance transport concerning groundwater.

2.2.8 Review of the impact of human activity on groundwater (GWPI 8)

• West-Estonian river basin district

Attention shall be paid mainly to more densely populated areas in order to avoid the risk of the pollution of water intakes. It is unlikely that the assessment of any of the used groundwater bodies would turn from good into poor in the course of the first two cycles of the water management plan. Despite of it the occurrence of negative trends and signs in groundwater bodies cannot be excluded. No groundwater body or ecosystem is at risk due to the alterations in the groundwater level of a groundwater body. The water quality of the upper courses of rivers may be at risk due to the alteration of the chemical composition of groundwater bodies, since in the periods of minimum water level the inflow of groundwater forms most of the runoff of groundwater bodies. The alteration of the status of groundwater bodies does not bring about the need to relocate the population and the industry.

• East-Estonian river basin district

The status of the Ordovician groundwater body of the oil shale basin of Ida-Viru (6) is directly dependent on human activity and it is hopelessly poor due to its impact, it cannot be improved significantly within the nearest thirty years. The poor status of this groundwater body (6), which has lasted for decades, has been caused by dewatering due to oil shale mining and the combined effect of several big residual pollution sources. In the rest of the groundwater bodies of the East-Estonian river basin district attention shall be paid primarily to the more densely populated areas in order to avoid the pollution of water intakes. It is unlikely that the status of any groundwater body (excluding the Ordovician oil shale basin of Ida-Viru) would turn from good to poor in the course of the first two cycles of the water management plan. The occurrence of negative trends and signs in the groundwater bodies cannot be excluded. The qualitative status of the Ordovician groundwater body of Ida-Viru (5) and the Quaternary Vasavere groundwater body (13), also the surface water bodies located in the area of the groundwater bodies or their near vicinity and the ecosystems dependent on water may be at risk due to the changes in the groundwater level of Ordovician groundwater body of the oil shale basin of Ida-Viru (6) (the polluted water may be carried into the abovementioned groundwater bodies). Lake Martiska and Lake Kuradi included in the Natura areas are at risk near Vasavere water intake due to changes in the groundwater level of the Quaternary Vasavere groundwater body (13). No surface water bodies and ecosystems are at risk due to the changes of the groundwater level in the rest of the groundwater bodies. The water quality of the upper courses of rivers may be at risk due to the alteration of the chemical composition of groundwater bodies, since in the periods of minimum water level the inflow of groundwater forms most of the runoff of groundwater bodies there. The qualitative status of the surface water bodies being the recipients of the water pumped out is directly threatened due to dewatering connected with oil shale mining from the Ordovician groundwater body of the oil shale basin of Ida-Viru (6).

The alteration of the status of the groundwater bodies does not bring about the need to relocate the population and the industry. The poor status of the Ordovician groundwater body of the oil shale basin of Ida-Viru (6) has resulted in the construction of complicated drinking water supply systems for the low density area and has favoured relocation of people into towns and settlements.

• Koiva river basin district

Due to low population concentration it is unlikely that there will be rapid changes influencing the status of the whole river basin district. The occurrence of negative trends and signs in the groundwater bodies cannot be excluded. At present no surface water bodies and ecosystems are at risk due to changes in the groundwater level of groundwater bodies.

2.2.9 Further characterisation of groundwater bodies at risk (GWPI 9)

There is one groundwater body at risk in Estonia located in the East-Estonian river basin district. The Ordovician groundwater body of the oil shale basin of Ida-Viru (6) in the East-Estonian river basin district will definitely not achieve good status. Carbonate rocks of the Ordovician formations with the thickness of 20–80 m form the aquifers. In the outcrop area the groundwater body recharges from the rainwater filtrating through Quaternary cover and in the east also from the water of the Middle-Lower-Devonian groundwater body (10). Groundwater is mainly without pressure and unprotected from pollution. Limestones and dolomites form the aquifers, the upper 30-m thick part, is severely karstic and cracked at places and water runs in the cracks of the aquifers. In the upper up to 20 m thick part of the carbonate rocks of the groundwater body the filtration coefficient is 5–30 m/d, in the depth between 20–50 m 3–5 m/d and deeper than 50 m 1–2 m/d. Groundwater infiltrates to a small extent into the Ordovician- Cambrian groundwater body (4), moves at places as transit flow also into the Ordovician groundwater body of Ida-Viru (5) and the Quaternary Vasavere groundwater body (13). At present the direction of water flow in the groundwater body is determined by dewatering in oil shale mining. Surface water bodies will become outflow areas after the closing of mines and the swamps, which have disappeared for now, may be restored due to the dewatering of oil shale mining (the former swamp areas are populated, in the populated areas problems might occur due to excessive moisture).

The water-bearing layers of the Ordovician groundwater body of Ida-Viru lie on the regional Silurian-Ordovician aquitard, formed by the limestones, marls, aleurolites, clays and argillites of the Lower-Ordovician Volhov (O1vl), Latorp (O1lt), Varangu (O1vr) and Pakerord (O1pk) regional stage. In the outcrop area of the groundwater body there is predominantly a 2-10 meters thick surface layer above with glacial, fluvioglacial and limnoglacial genesis, which thickness in old valleys may reach up to 80 meters. In the upper part at some places in the eastern part of the groundwater body lies the Middle-Lower-Devonian groundwater body. The actual groundwater resources of the groundwater body concerned has not been determined exactly, by estimation it is up to 500 000 m^3/d.

The characteristic indicators of the chemical composition of the groundwater body are presented in the report "Assessment of the status of the groundwater of Viru and Peipsi river basin sub-districts for the preparation of water management plans" (Tallinn 2003). In the groundwater body, where there is predominantly natural anaerobic aquatic environment and there is an extensive impact of swamps, the water is characterised by elevated Fe^{2+} and NH_4^+ content and elevated PHT.

Elevated SO_4^2 content, mineral content and hardness caused primarily by drainage accompanying oil shale production and the formation conditions of groundwater in closed mines differing from the natural one are significant anthropogenic components. Hazardous substances (primarily phenols) have also been found in groundwater due to the impact of oil shale chemical industry and mine waste heaps.

The qualitative and quantitative status of the groundwater body has become poor as a result of human activity and the achievement of a good status is not feasible in the course of the first cycles of the water management plan, as long as oil shale is mined. Alterations in the groundwater body have an impact primarily on the surrounding Ordovician groundwater body of Ida-Viru (5).

2.2.10 Uncertainties and data gaps (GWPI 10)

The existence of hazardous substances outside pollution sources, which would characterise the status of a groundwater body, have not been identified much. Only in the East-Estonian river basin district 57 thorough water analysis (Viru-Peipsi *CAMP*-project) including 90% of the substances hazardous to the aquatic environment have been carried out in the part of all the groundwater bodies altogether. The content of plant protection products used in Estonia in groundwater has been identified especially little.

The old (> 15-year-old) results of the analysis of aquatic chemistry in the groundwater database are of uneven quality; due to changes in sampling and laboratory methods these can, in the part of some components, be used only with allowances. The old data of aquatic chemistry have not been recalculated. Most of the information in the field of aquatic chemistry in the groundwater database comes from water analysis carried out after the erection of a bore well, which sometimes does not reflect the situation correctly. Most of the information concerning the first groundwater bodies from the surface is about their deeper part; this information does not reflect the status of the superficial part of groundwater truthfully.

Groundwater databases are a part of the Estonian Environmental Register and it is planned to add an Internet-based data entry module to the Environmental Register in order to improve the receipt and reliability of data. A consistent random check of up to 10% of the received data is planned in order to check the reliability of the data received in compliance with the requirements of the permits for the special use of water.

2.2.11 Recommendations for monitoring (GWPI 11)

Pursuant to the Regulation of the Minister of the Environment No 50 of 30 July 2002 “Identification of national environmental monitoring stations and sites” there are 439 groundwater observation points in Estonia, which include both manholes constructed specially for monitoring and operating water-abstraction wells (wells for consumption), springs and karsts.

The Estonian groundwater monitoring system consists of the groundwater monitoring sub-programme of the national monitoring programme and the monitoring results submitted pursuant to the terms and conditions of the permits for the special use of water to the issuer of the permit, which have not been used much so far, since all of the data have not been entered into the environmental register (only the data of single, mainly big water-abstractors are received).

There is an additional surveillance requirement of a drinking water source (groundwater) upon the use of groundwater for the production of drinking water (>10 m^3/d) (Regulation of the Minister of Social Affairs No 1 of 2 January 2003 “Quality and inspection requirements to the surface and groundwater used or intended to be used for the production of drinking water”). Also, the data of the surveillance monitoring of a drinking water source shall be submitted to the issuer of the permit for the special use of water and it is planned to enter these in the environmental register. The biggest task of the nearest years is the inclusion of the results of the monitoring of groundwater established by the permits for the special use of water in the environmental register, also the harmonisation, avoiding the overlapping and the use of the results of the surveillance monitoring programmes of drinking water sources. The requirement of the inspection of the content of plant protection products in groundwater shall be added to the sub-programme of groundwater monitoring in the nitrate vulnerable zones of Pandivere and Adavere-Põltsamaa, which reflects best the impact of agriculture on groundwater.

Already at present, pursuant to the terms of the permits for the special use of water, all the significant factors influencing water status of the Ordovician groundwater body of the oil shale basin of Ida-Viru (6), which is in a poor status, have been switched in the monitoring network. In connection with the transfer of the closed mines and mine waste heaps to the local governments the receipt of the monitoring data of the local government in the environmental register shall also be guaranteed in the near future.

It is planned to use the monitoring pursuant to the permits for the special use of water primarily for assessing the chemical status of groundwater bodies. Since only the level boreholes constructed separately can be used for the assessment of the quantitative status of groundwater, the importance of the monitoring in compliance with the permits for the special use of water will be small.

Economic Analysis of Water Uses

3

The summary of the economic analyses of water uses covers the whole of Estonia and has been prepared on the basis of the data of the economic analysis of the water uses of all the river basin districts.

û Assessment of the recovery of costs

Recovery of costs has been assessed both, about Estonia as a whole and separately about the West-Estonian, the East-Estonian and the Koiva river basin districts in three different fields – private households, agriculture and industry. Upon the analysis of the recovery of costs it is taken into account how big a share of the costs is covered by the user of water and how big a share is covered by the state. The data about the recovery of costs in Estonia as a whole are presented in table 31.

û Assessment of the socio-economic importance of water use

The economy sectors connected with water use are of significant importance in Estonia, both as the creators of added value and as employers. In 2004 the turnover of economically significant water users in Estonia formed 12% of the turnover of all the enterprises and on the average 12% of the employees working in all of the enterprises worked in these sectors of economy. The economically significant water users are power production, agriculture, textile industry, mines, food industry, pulp and paper industry, effluent and water management and manufacturing of products from non-metallic minerals. The division of the analysed economy sectors is based on *NACE*-classifications.

The biggest share of the significant turnover of the economy sectors connected with water consumption is provided by food industry (3.91% of the total business turnover), followed by power production and distribution (2.31%) and textile industry (1.69%). Information about the turnover of enterprises in Estonia and for comparison the turnover of economically significant water users is presented in table 32.

Table 33 shows that, proceeding from turnover, the East-Estonian river basin district, where the turnover of the economy sectors with significant water use forms 26.6% of the total business turnover, has a strategically significant role in water use. In West-Estonia food industry and textile industry form a higher percentage and in East-Estonia power production forms a significant percentage in the turnover of the enterprises with significant water use.

û Information used for economic analysis

The river basin districts do not follow the established administrative borders. Also, a big number of enterprises dealing with water use do not follow the administrative or river basin district borders in their activity. Thus, the collection of sufficiently exact and adequate information requires either a very detailed from the bottom to the top approach or approximate aggregation of the existing economical and administrative data. The use of the first method is extremely time- and energy consuming and it requires thorough preparation. The other method does not exclude the formation of significant errors and misinterpretations, since it is complicated to check the correctness of results upon the implementation of business and administrative information on a river basin district. Taking into consideration the fact that Estonia is a small country and therefore the amount of information is not big, it is, as a rule, rational to use the from-the-bottom-to-the-top approach, which means the collection of significant information on the basis of the settlements located in different river basin districts. However, such a method of the collection of information will also enable the occurrence of relatively big inaccuracies. Direct data have been collected about 124 settlements or local government units. The information about other administrative units has been found by extrapolation of the data about water uses, which means the approximate aggregation of data. The existing system of the collection of information concerning river basin districts is not focussed on the collection of economic and social indicators, which is why it has become necessary to use the data of several information sources – the Statistical Office, the Estonian Waterworks Association, the Ministry of

Agriculture, the Ministry of Justice Centre of Registers, water undertakings and local governments and a uniform picture about the economic aspects of water uses has been formed on the basis of these data. Different institutions collect and process data proceeding from different principles, which is why an even consolidated database does not necessarily reflect the significant areas of water uses and the indicators connected with them in the most exact way. At present the forecasting system of the alteration of water use does not function in a way, which would enable to forecast water use by different areas of water use (private households, industry, agriculture). Updating of the existing information collection system and making amendments to it enables still to collect and process a significant part of the economic and social information required in the Water Framework Directive.

û Use of economic and technical information

The characterisation of water bodies, the review of the impact of human activity and the economic analysis of water uses are based on the data obtained mainly from the databases of water uses of the Estonian Environment Information Centre.

û Further economic analysis

For further economic analysis of water uses it is planned to start socio-economic assessment of artificial and heavily modified water bodies in 2005. The identification of problems significant from the point of view of water management will be started as the next stage. In 2006 the collection of supplementary information necessary for the economic assessment of the data collected and the measures planned on the basis of Article 5 of the Water Framework Directive will be started in 2006 in order to prepare an operational programme.

û Method used for the calculation of the recovery of costs

A model is used for the calculation of the recovery of the costs of water services, on the basis of which the amount of the recovered costs related to water services are assessed. Total water management costs include operating, maintenance, administrative, capital and tax costs (tax costs consist of value added tax and environmental taxes – fee for the special use of water and pollution charge for effluent). The result of the calculation is the distribution of the recovery of costs between different fields and by the ones, who cover the costs. The indicators of the recovery of costs can be presented in terms of monetary value and as a proportion. The monetary value of the recovery of costs indicates the absolute amount of the costs of water use to be recovered in a specific sector, which are covered by a water undertaking (or in case of the absence of a public water supply and sewerage system a generalised water user) and the amount of costs covered by the state The proportion of the recovery of costs characterises the one, who covers the specified costs, by indicating the share of the one, who covers the costs, in the recovery of the total cost of water management. The proportion of the recovery of costs shall be calculated by the following formula:

$$\text{PROPORTION OF THE RECOVERY OF COSTS} = \frac{\text{COSTS TO BE COVERED}}{\text{TOTAL COSTS}}$$

It has been presumed upon the calculation of the recovery of costs that the amount of the costs to be covered by the state corresponds to the total amount of water service costs, which are not covered by an undertaking providing water services or a water user. Among these all the costs connected with the causing of damages to the environment, which are not compensated for by a water user, shall be considered as costs to be covered by the state. The calculation of the recovery of costs is based on formulas applied to the database of the costs of the water use and water services of Estonian river basin districts.

û Assessment of the recovery of the costs of private households

The results of the analysis of individual cases have been used for the calculation of the costs related to water use in private households. Calculations of the total costs of a water undertaking and a private household were made in the course of the analysis of every individual case. The selection of water undertakings and private households is based on the necessity to ensure the reliability of the results of analysis. The amount of water users observed in the analysis of individual cases is sufficiently representative for the characterisation of the water service costs of the three Estonian river basin districts. Upon the collection of data necessary for individual case analysis the unit costs of water undertakings (and private households) with a definite profile have been used for the calculation of water service costs by extrapolation. The financial and water management data of 6 private households and 11 water undertakings have been analysed upon the assessment of the costs of the water use of private households. In addition, the population density and the used water resources of the area were taken into account. The database of the costs of water use and water service prepared for the economic analysis of water uses includes indicators about Estonian settlements, including villages, rural municipalities and towns. The database characterises those settlements with over 500 inhabitants, where there is a public water supply system and a public sewerage system or only a public water supply system. The data of 124 settlements or local government units covering 62% of the population of Estonia have been taken into account upon the assessment of the recovery of costs. The database characterises the data of 64 settlements or local government units in the West-Estonian river basin district and the data of 60 settlements or local government units in the East-Estonian river basin district. The database does not include the data of the settlements belonging to the Koiva river basin district.

The database of the settlements of the East-Estonian river basin district describes the water use of approximately 317,000 inhabitants (59% of the population of the river basin district) and the database of the settlements of the West-Estonian river basin district the water use of approximately 547,000 inhabitants (64% of the population of the river basin district). The characterisation of the water use of the rest of 38% of the inhabitants of Estonia (the inhabitants of the settlements not included in the database) has been extrapolated on the basis of the existing data by taking these data into account also in the assessment of the recovery of costs. The unit costs obtained from individual case analysis, the number of the inhabitants of the settlement and the ratio of the recovery of the costs calculated for the level of the same county have been used upon the calculation of the recovery of costs of the settlements with over 100 inhabitants not included in the database. It is presumed that in the settlements with less than 100 inhabitants there is no public water supply and sewerage system. Thus the calculation of the recovery of costs is based on unit costs from the suitable results of individual case analysis, the number of the inhabitants and the ratio of the recovery of costs with the amount of 100%, since in private households the recovery of the costs of water supply and sewerage is presumably 100%. Upon the use of extrapolation, the costs of the inhabitants living in these settlements, who do not use a public water supply and sewerage system, have also been taken into account.

û Water use and water service costs of industries

The data of the water use of industry include water use of the industries being the clients of water undertakings and water use of the undertakings holding a permit for the special use of water. Water use of the industrial undertakings holding a permit for the special use of water forms 99% of the water use of industries.

û Water use and water service costs of agriculture

The costs of the water use in agriculture and the recovery of costs have been determined by the capital costs made for decreasing the pollution from agricultural point sources and the operating costs made for providing water service to agricultural water users. Upon the determination of the capital costs of point sources it has been presumed that these costs will help to achieve and preserve the good water status in a situation, where manure is handled as required. Upon the assessment of capital costs the number of significant cattle (pigs, bovine animals) by regions (by local governments) and the estimated investment necessity in manure storage facilities – 8000 kroons per one head of cattle - have been taken into account. The construction of manure storage facilities or bringing them in compliance with the relevant requirements is presumably one of the means to achieve the good water status, which necessity is directly connected with agricultural water use and covers the decrease of water pollution generated by agriculture to a sufficient extent. The costs related to manure storage facilities are defined to the full extent as water protection costs, proceeding from the approach used in the previous relevant works.

û Assessment of the development tendencies of water management

In order to assess the development tendencies of water management only the main factors, which have and may have an impact on the development of water management, have been taken into account in the course of economic analysis. Upon carrying out economic analysis mainly the changes in the number of people living in river basin districts, the general economic tendencies, the impact of economic growth, the increase of power production and the increase of water use related to it and the existing investment programmes and the investment programmes to be launched for the implementation of the measures connected with water protection and use have been taken into account. It is planned analyse the factors influencing the development tendencies even more thoroughly in the course of the preparation of the operational programmes of water management plans in order to forecast the likelihood of the achievement of the good status of all waters.

Table 31. Recovery of costs in Estonia on the basis of the data of 2004.

Area	Costs covered by water user, %	Costs covered by the state, %
Private households	68	32
Industry	101	-1
Agriculture	<1	100

Table 32. Business turnover and the turnover of significant water users

River basin district	Total business		Economic sectors with significant water use	
	Turnover, million kroons	Percentage in total business turnover, %	Turnover, million kroons	Percentage in total business turnover, %
West-Estonian	178 535	79	14 861	8,2
East-Estonian	47 307	21	12 583	26,6
Koiva	791	0	0	0

Table 33. Percentage of significant water users by sectors

NACE-codes	01	05	10 14	15	17	21	26	40	90	
River basin district	Agriculture	Fish farming	Mines	Food industry	Textile industry	Pulp and paper industry	Production of other products from non-metallic minerals	Production and distribution of power energy	Treatment of effluent and waste	**TOTAL** (sectors with significant water use)
West-Estonian	0,6	0,2	0,2	3,1	1,4	0,5	1,1	0,9	0,3	8,2
East-Estonian	1,7	0	4,5	7,2	2,9	0,2	2,3	7,5	0,4	26,6

Register of Protected Areas

4

For the purpose of the Water Framework Directive, the areas and regions, which need additional protection and measures in order to achieve the established objectives, shall be considered as protected areas. The register of protected areas in Estonia is based on the environmental register formed on the basis of the Environmental Register Act and the databases connected with it. In the environmental register the areas, to which the protection requirements from the following Directives extend, are regarded as protected areas:

Directives

1. Council Directive 98/83/EC on the quality of water intended for human consumption;

2. Council Directive on the quality of fresh waters needing protection or improvement in order to support fish life (78/659/EEC);

3. Council Directive concerning the quality of bathing water (76/160/EEC);

4. Council Directive concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC);

5. Council Directive concerning urban wastewater treatment (91/271/EEC);

6. Council Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC);

7. Council Directive on the conservation of wild birds (79/409/EEC).

The areas protected on the basis of the listed Directives have been determined by Estonian legislation. Review of all the protected areas is presented in figure 18.

Figures

5