APPROVED by
Resolution No. 1618
of the Government of the Republic of Lithuania
of 17 November 2010

LIELUPĖ RIVER BASIN DISTRICT MANAGEMENT PLAN

CHAPTER I. GENERAL PROVISIONS

1. While implementing the provisions of the Law of the Republic of Lithuania on Water (Žin.*, 1997, No. 104-2615; 2000, No. 61-1816; 2003, No. 36-1544), which has also transposed the requirements of Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ 2004 special edition, Chapter 15, Volume 5, p. 275) (WFD) – the key European Union (EU) legal act in the field of water policy, the Environmental Protection Agency (EPA), in cooperation with the Lithuanian Geological Survey (LGS), has drawn up this Lielupė River Basin District (RBD) Management Plan.

Upon Lithuania's accession to the European Union, water bodies have to be managed and protected according to the natural hydrological boundaries of river basins instead of the administrative ones. A river basin means the area from which all surface water flows into one river. The river water quality is affected by natural processes within the territory of its basin and the overall impacts of economic activities. For the purpose of implementing the requirements of legislation on water protection, Lithuania will have to achieve "good" status for all water bodies within the country by the year 2015.

Water management will be continued in administrative units (municipalities); however, in order to achieve the objectives in water bodies, measures aimed at improving water status will have to be coordinated by municipal institutions in the whole or part of their territory falling within the total area of the common river basin.

Seeking to facilitate management of water and water bodies, the Lithuanian river basins were combined into the following four RBD: Nemunas, Venta, Lielupė and Dauguva. River basin district management plans and programmes for implementing relevant measures have to be produced and approved by the Government of the Republic of Lithuania for each river basin district. The management plans will be implemented in the period from 2010 through 2015 and updated every six years, that is, in 2015, 2021, etc.

The management plans shall present an overview of the current RBD status and the results of the analysis of impacts of human activity thereon, provide information on water protection objectives and their justification, identify water bodies at risk of failing to achieve good status by 2015, foresee measures for achieving water protection objectives, and give other relevant information. RBD management plans are intended for the public, state and municipal institutions, the European Commission, and various interested parties in Lithuania.

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* *Valstybės žinios* [official gazette]

River basin management plans include both the identification of environmental priorities and the assessment of economic and social aspects. The management of water resources aims at balancing and coordinating water use for household, agricultural, industrial, recreational, and ecological purposes.

Striving for sustainable use of public, economic and natural resources and seeking a balance between water protection objectives and other public needs, legal acts provide for certain exceptions. One of them is the extension of the deadline for achieving the set objective (until 2027 at the latest), provided that the objective cannot be achieved in time for reasons of technical feasibility, disproportionate costs or natural conditions. When “good” status cannot be achieved even by 2027, another exception is allowed setting a lower objective, provided that a high objective cannot be achieved for reasons of technical feasibility, disproportionate costs, natural conditions, or high levels of pollution, and when the achievement of “good” status would lead to far-reaching negative socio-economic consequences that cannot be avoided by any significantly better environmental option.

When the achievement of water protection objectives is impeded by physical and morphological alterations by human activity to a water body, for example, construction of port facilities, dredging of the river bed, construction of a dam, the water body may be identified as “heavily modified” and less stringent water quality requirements may also be set for that body of water.

An important role in managing water resources is played by the public which has to take part in the process of the management of water bodies. The population has been informed about the most acute problems relating to water management and protection which were identified in the analysis of the characteristics of the RBD. Representatives of the general public and interested parties were twice invited to submit their comments and remarks on preliminary Lielupė RBD management plans, which were placed on the website of the EPA. The draft Lielupė RBD Management Plan and Programme of Measures were discussed at several meetings of the RBD Coordination Council and extended workshops. Reasonable written comments and remarks of interested parties were taken into account in amending the Management Plan.

Pursuant to the Procedure for the development of river basin district management plans and programmes of measures intended for achieving water protection objectives and agreement thereof with foreign states, which was approved by Order No. 591 of the Minister of Environment of the Republic of Lithuania of 25 November 2003 (Žin., 2003, No. 114-5170), the Environmental Protection Agency was appointed as the authority responsible for producing and coordinating RBD management plans across the Lithuanian territory, as well as for reporting to the European Commission.

CHAPTER II. CHARACTERISTICS OF THE LIELUPĖ RIVER BASIN DISTRICT

SECTION I. SURFACE WATER BODIES

2. The Lielupė RBD comprises the Lithuanian parts of the Mūša, Nemunėlis and Lielupė Small Tributaries sub-basins.

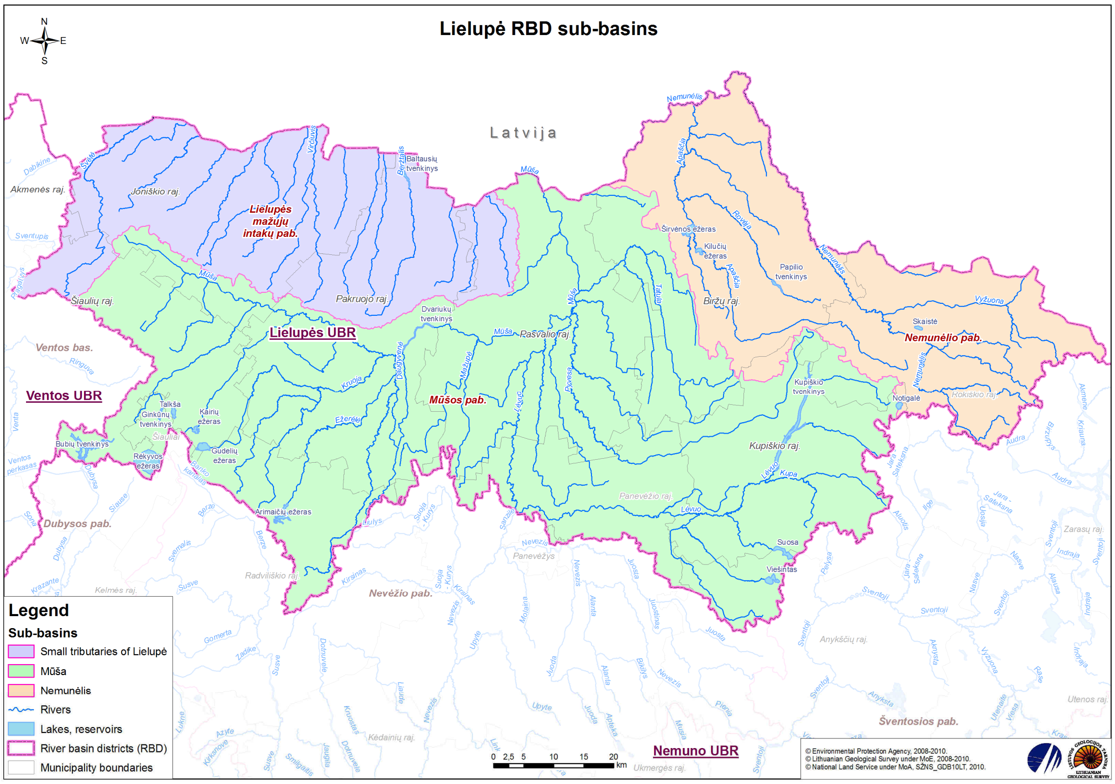


Figure 1. Sub-basins of the Lielupė RBD

In Lithuania, the Mūša, Nemunėlis and Lielupė Small Tributaries sub-basins lie at 55°36‘ - 56°27‘ N and 22°55‘ - 25°52‘ E. The total length of the Mūša is 157.3 km, its catchment area constitutes 5 462.6 km^2. A stretch of 133.1 km of the Mūša flows in Lithuania and the remaining part of its lower reaches – in Latvia. The Lithuanian part of the catchment covers the area of 5 296.7 km^2. The total length of the Nemunėlis is 199.3 km, the catchment area is 4 047.0 km^2. A stretch of the Nemunėlis in the length of 80.7 km from its springs flows in Lithuania, 79.4 km coincide with the Lithuanian-Latvian border, and the lower reaches of the river are situated in Latvia. The Lithuanian part of the catchment covers the area of 1 892.0 km^2. The Lielupė Small Tributaries Sub-basin comprises the upper parts of the catchments of the left tributaries of the Lielupė. The length of the Lielupė is 120.5 km, the whole of it flows in Latvia. The area of the catchments of the small tributaries of the Lielupė in Lithuania totals to 1 749.6 km^2. The resulting total area of the Lielupė RBD is 8 938.3 km^2.

Characterisation of water bodies

Mūša Sub-basin

3. The Mūša is the eleventh longest river in Lithuania. It rises on the western edge of the Mūšos Tyrelis bog, ca. 1.5 km southwest of Lake Miknaičių ežeras and 1 km north of Romutaičiai lone farmstead in Joniškis district. The major part of its catchment is situated in the Mūša-Nemunėlis Lowland (*Mūšos-Nemunėlio žemuma*), meanwhile its upper reach flows over the lowland of the Venta middle reaches, and its lower reaches – over Joniškis Lowland (*Joniškio žemuma*). In some places the Mūša Sub-basin can be hardly distinguished from the neighbouring catchments since at some intervals the watershed goes across upland bogs (Rėkyva, Notigalė), besides, there is an anthropogenic connection with the Nevėžis Basin through the Sanžilė Canal between the Nevėžis and the Lėvuo. The Mūša is one of the calmest rivers in Lithuania, with an

average bed slope of 0.047%. The Lithuanian part of the Mūša Sub-basin comprises 97% of its total catchment size.

The lake percentage of the Mūša Sub-basin is 0.5%, wood density – 14.1%, bogs, marshes and swamps occupy 5.1%, and wetlands – 87.4% of the territory. There are 38 lakes larger than 0.005 km^2, of which 7 are larger than 0.5 km^2. The average annual runoff rate in the Mūša Sub-basin is 5 l/s/km². The average annual discharge of the Mūša at the Lithuanian-Latvian border is 23 m^3/s (estimation of the part of the discharge of the Lėvuo transferred to the Nevėžis, which is 3.2 m³/s, included). The river network in the Mūša Sub-basin is comprised of 463 rivers longer than 3 km and 1 870 ones which are shorter than 3 km. The total length of the rivers is 7 869 km. The density of the network of the rivers longer than 3 km totals to 0.73 km/km² and that of the smaller ones (i.e. shorter than 3 km) is 0.76 km/km².

The longest and the largest tributaries of the Mūša according to their catchment areas in Lithuania are the rivers Lėvuo, Pyvesa, Tatula, Daugyvenė, and Kruoja. The length and the catchment size of the main rivers of the Mūša Sub-basin in Lithuania are given in the table below:

Table 1. Length and catchment size of rivers in the Mūša Sub-basin

River	Bank of inflow	Distance from the mouth, km	Length, km		Catchment size, km²	
			total	in Lithuania	total	in Lithuania
Noruta	r	152.5	15.9	15.9	19.3	19.3
Einautas	r	150.8	17.1	17.1	37.9	37.9
Kūra	r	147.5	18.9	18.9	43.5	43.5
Vilkvedis	r	144.2	15.2	15.2	69.5	69.5
Voverkis	r	139.5	19.0	19.0	65.7	65.7
Tautinys	r	134.8	17.3	17.3	32.0	32.0
Kulpė	r	128.9	30.8	30.8	263.3	263.3
Šiladis	r	119.9	28.3	28.3	123.1	123.1
Pala	r	104.0	19.3	19.3	87.3	87.3
Kruoja	r	93.8	50.5	50.5	361.4	361.4
Daugyvenė	r	91.4	61.1	61.1	487.8	487.8
Lašmuo	r	90.3	18.1	18.1	66.9	66.9
Plautupis	r	77.0	17.8	17.8	27.1	27.1
Mažupė	r	72.0	37.5	37.5	162.3	162.3
Lėvuo	r	50.5	140.1	140.1	1628.8	1628.8
Pyvesa	r	48.4	92.6	92.6	501.6	501.6
Piešmuo	r	47.3	27.1	27.1	67.1	67.1
Tatula	r	45.0	64.7	64.7	453.4	453.4
Kamatis	l	33.5	16.7	16.7	63.0	63.0

Source: Gailiušis, B., Jablonskis, J., Kovalenkovienė M. 2001. Lietuvos upės. Hidrografija ir nuotėkis.

Table 2. Largest lakes in the Mūša Sub-basin

Lake	Inventory number	Direct stream	Depth, m		Area, ha		Volume, thou. m³	Catchment size, km²
			max	average	in the plan	on the list		
Rėkyva	15-4	T-1	4.80	2.04	1179.2	1179.2	24000.0	19.4
Arimaičių ežeras	16-2	Ežerėlė	18.70	2.00	290.0	289.6	2050.0	33.6
Gudelių ežeras	15-18	Kruoja	15.00	4.00	233.0	272.5	9186.0	14.4
Suosa	18-7	Suosa	4.48	2.13	200.2	208.7	4264.6	13.0
Viešintas	18-10	Viešinta	7.65	2.85	196.2	198.4	5587.5	15.8
Kairių ežeras	15-15	Šiladis	10.50	2.20	86.0	77.5	1862.5	6.6
Mituva	19-9	Mituva	4.50	1.87	73.7	-	1378.2	32.5
Talša	15-11,	Kulpė	8.20	3.58	72.8	56.2	2606.0	33.2

Source: Information obtained from the geographical information system (GIS) of the EPA.

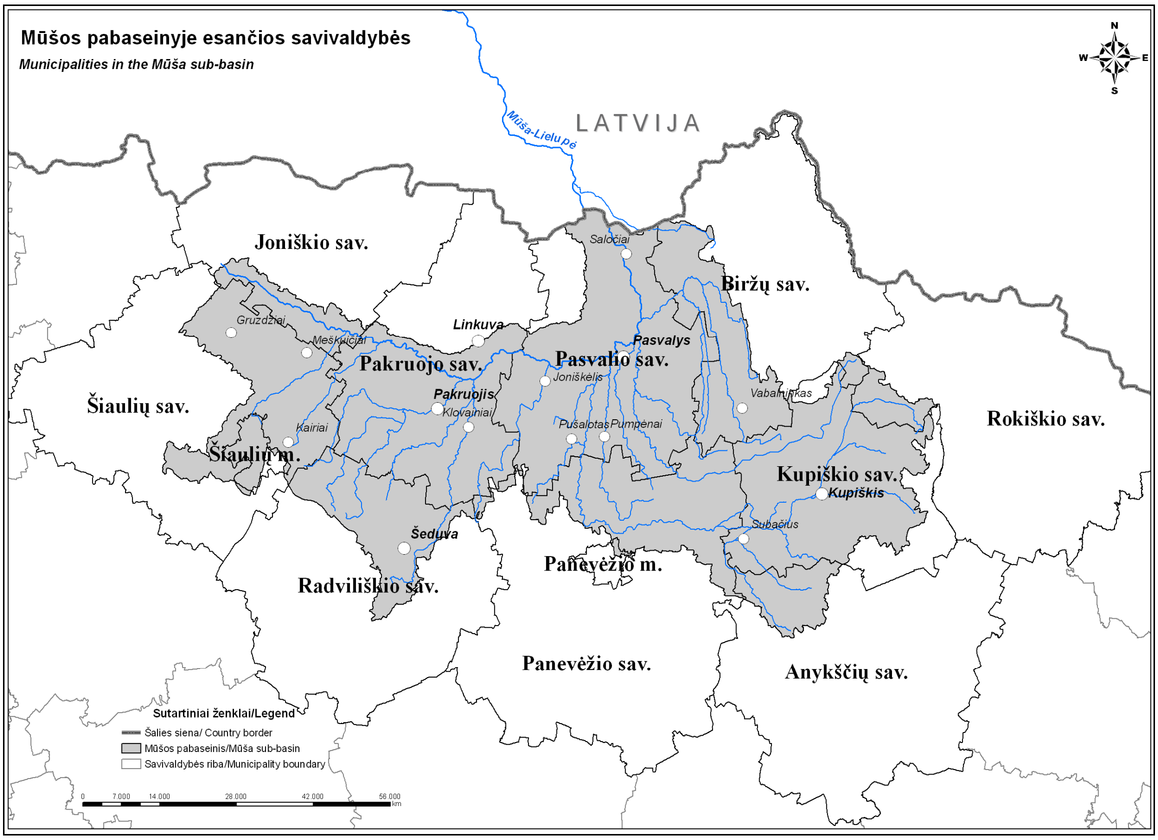


Figure 2. Municipalities in the Mūša Sub-basin

Nemunėlis Sub-basin

4. The Nemunėlis is the ninth longest river in Lithuania. It rises in Lake Lūšna south of Rokiškis, in Šventoji Plateau (*Šventosios plynaukštė*) in the Baltic Highlands (*Baltijos aukštumos*). Further, the river flows over the Mūša-Nemunėlis Lowland (*Mūšos-Nemunėlio žemuma*). Its large section (79.4 km) coincides with the Lithuanian-Latvian border. The average bed slope of the Nemunėlis is 0.07 % (reaching 0.12% in the border zone). The Lithuanian part of the Nemunėlis Sub-basin comprises 47% of its total area.

The lake percentage of the Nemunėlis Sub-basin is 0.4%, with 40 lakes larger than 0.005 km^2, of which 4 are larger than 0.5 km^2. Also, there are 7 ponds in the sub-basin, with the head higher than 3 m. The average annual runoff rate in the Nemunėlis Sub-basin is 7 $l/s/km^2$. The average annual discharge of the Lithuanian part of the river is 13.2 m^3/s. The river network in the Nemunėlis Sub-basin is comprised of 165 rivers longer than 3 km and 670 ones which are shorter than 3 km. The total length of the rivers is 2 887 km. The density of the network of the rivers longer than 3 km totals to 0.75 km/km^2 and that of the smaller ones (i.e. shorter than 3 km) is 0.78 km/km^2.

The longest and the largest tributaries of the Nemunėlis according to their catchment size in Lithuania are the rivers Vyžuona and Apaščia. The length and the catchment size of the main rivers of the Nemunėlis Sub-basin in Lithuania are given in the tables below.

Table 3. Length and catchment size of rivers in the Nemunėlis Sub-basin

River	Bank of inflow	Distance from the mouth, km	Length, km		Catchment size, km²	
			total	in Lithuania	total	in Lithuania
Laukupė	r	176.5	23.9	23.9	60.4	60.4
Vingerinė	r	158.1	22.9	22.9	124.7	124.7
Vyžuona	r	142.3	34.1	34.1	320.9	273.4
Nereta	r	118.6	24.6 (18 km – along the border)	6.6	88.9	54.3
Apaščia	l	60.1	90.7	90.7	894.1	894.1

Source : Gailiušis, B., Jablonskis, J., Kovalenkovienė M. 2001. Lietuvos upės. Hidrografija ir nuotėkis.

Table 4. Largest lakes in the Nemunėlis Sub-basin

Lake	Inventory number	Direct stream	Depth, m		Area, ha		Volume, thou. m³	Catchment size, km²
			max	average	in the plan	on the list		
Širvėnos ežeras*	8-6	Apaščia	3.45	2.22	334.7	325.4	7419.2	388.0
Notigalė	19-4	-	5.71	3.00	91.2	92.9	2731.9	20.9
Kilučių ežeras	8-9	Apaščia	3.52	2.10	86.0	88.4	1800.0	296.0
Ilgys (Garajis)	10-1	Minava	3.44	2.40	82.4	-	1975.9	7.2
Skaistė	9-4	N-14	13.08	4.94	59.9	59.0	2960.7	7.5

* Lake Širvėnos ežeras has originated from a pond
Source: GIS of the EPA

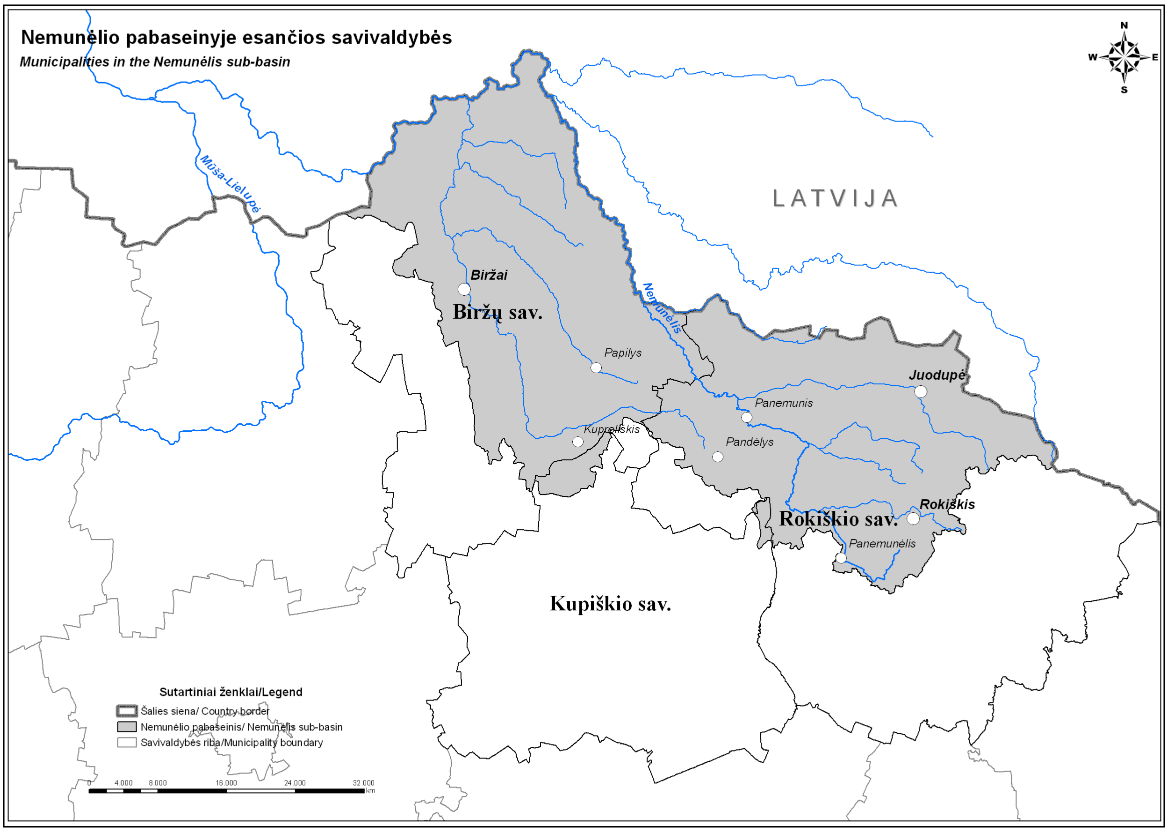


Figure 3. Municipalities in the Nemunėlis Sub-basin

Lielupė Small Tributaries Sub-basin

5. Formally, the Lielupė rises in Latvia (at the confluence of the Mūša and Nemunėlis), however, as much as 51% of its catchment area is situated in Lithuania. Even without the sub-basins of the larger tributaries of the Lielupė – the Mūša and Nemunėlis, the Lithuanian parts of the catchments of the small tributaries of the Lielupė make up a significant share of the total basin of the Lielupė - 10%. Except for the Švėtė, all small tributaries of the Lielupė rise at the northern foot of the Linkuva Ridge (*Linkuvos*

kalvagūbris) and flow over Joniškis Lowland. The Švėtė rises in the lowland of the middle reaches of the Venta, crosses the Linkuva ridge and continues over Joniškis Lowland. Consequently, the majority of the rivers of this sub-basin are slow, with regulated beds and low bed slopes. The average bed slope varies between 0.066 % (the Yslikis) and 0.176% (the Platonis).

An exceptional feature of this sub-basin relates to its drained fertile and densely populated cultivated land, which occupies nearly the whole of its area. There are no lakes in this part of the Lielupė RBD, except for Žvelgaičių pond (0.27 km²), which is included in the cadastre of lakes. Besides, there are a few other ponds: Buivydžių pond (0.25 km²), Joniškio pond (0.1 km²), Kamojų pond (0.14 km²), etc. The average runoff rate in the sub-basin is 5.4 l/s/km², and the aggregate average annual discharge of the Lithuanian parts of the small tributaries of the Lielupė is 9.5 m^3/s. In summer time, however, the average runoff rate is less than 0.5 l/s/km² therefore small streams go dry at this time of the year. The river network in the Lielupė Small Tributaries Sub-basin is comprised of 172 rivers longer than 3 km and 700 ones which are shorter than 3 km. The total length of the rivers is 2 886 km. The density of the network of the rivers longer than 3 km totals to 0.81 km/km² and that of the smaller ones (i.e. shorter than 3 km) is 0.84 km/km².

The longest and the largest tributaries of the rivers according to their catchment size in the Lielupė Small Tributaries Sub-basin in Lithuania are the rivers Švėtė, Virčiuvis and Yslikis. The length and the catchment size of the main rivers within the sub-basin in Lithuania are given in the table below.

Table 5. Length and catchment size of rivers in the Lielupė Small Tributaries Sub-basin

River	**Bank of inflow**	**Distance from the mouth, km**	**Length, km**		**Catchment size, km²**	
			total	**in Lithuania**	**total**	**in Lithuania**
Yslikis	l	98.2	60.7	19.5	620.5	404.1
Švitinys	l	82.2	68.6	28.3	417.9	255.7
Šešėvė	l	78.0	52.9	13.7	245.7	57.5
Virčiuvis	l	73.3	72.0	35.4	440.6	289.4
Platonis	l	72.1	67.4	26.2	490.0	259.9
Švėtė	l	60.9	118.0 (3.1 km – along the border)	46.4	2274.0	483.0

Source: Gailiušis, B., Jablonskis, J., Kovalenkovienė M. 2001. Lietuvos upės. Hidrografija ir nuotėkis.

Figure 4. Municipalities in the Lielupė Small Tributaries Sub-basin

6. Table 6 below provides data on the municipal areas that belong to individual basins and sub-basins, meanwhile Table 7 gives information on the share of the relevant basins in individual municipalities.

Table 6. Areas of municipalities in the Lielupė RBD

Municipality	Area, km^2	Share of the municipal area (%)		
		Lielupė RBD		
		Mūša Sub-basin	Lielupė Small Tributaries Sub-basin	Nemunėlis Sub-basin
Biržai distr.	1 475.9	32		68
Joniškis distr.	1 151.7	13.7	86	
Pasvalys distr.	1 288.8	90	10	
Šiauliai city	81.1	81		
Akmenė distr.	843.5		2	
Pakruojis distr.	1 315.2	62	38	
Šiauliai distr.	1 807	31	6	
Rokiškis distr.	1 806.4	5		47
Kupiškis distr.	1 080.1	79		3
Panevėžys distr.	2 177.0	26		
Radviliškis distr.	1 634.0	24.5		
Panevėžys city	50.2	9		
Anykščiai distr.	1 764.0	9		

Table 7. Share of the sub-basins in individual municipalities

Municipality	Lielupė RBD, %		
	Mūša Sub-basin, 5296.4 km^2	Lielupė Small Tributaries Sub-basin, 1750.7 km^2	Nemunėlis Sub-basin, 1902 km^2
Biržai distr.	9		53%
Joniškis distr.	3	57	
Pasvalys distr.	22	7.5	
Šiauliai town	1		
Akmenė distr.		1	

Municipality	Lielupė RBD, %		
	Mūša Sub-basin, 5296.4 km^2	Lielupė Small Tributaries Sub-basin, 1750.7 km^2	Nemunėlis Sub-basin, 1902 km^2
Pakruojis distr.	15	28.5	
Šiauliai distr.	11	6	
Rokiškis distr.	2		45
Kupiškis distr.	16		2
Panevėžys distr.	11		
Radviliškis distr.	7		
Anykščiai distr.	3		

Source: experts' estimations

7. As shown in Table 7, most of the municipalities (11) are situated on the territory of the Mūša Sub-basin. Individual municipalities contain 3-22% of the total area of the sub-basin. The largest part (22%) of the sub-basin area is located in the municipality pf Pasvalys district. Smaller parts, 16% and 15%, lie in the municipalities of Kupiškis and Pakruojis, respectively.

Only three municipalities are located in the Nemunėlis Sub-basin. Almost equal parts of the Nemunėlis Sub-basin lie in the municipalities of Biržai district (53%) and Rokiškis district (45%). The remaining district of Kupiškis contains only 2% of the territory of the Nemunėlis Sub-basin.

Four municipalities are situated on the territory of the Lielupė Small Tributaries Sub-basin. The major part of this sub-basin (57%) lies in the municipality of Joniškis district. 28.5% of the sub-basin area are located in the municipality of Pakruojis district.

Typology of water bodies

8. Water bodies in the Lielupė RBD are assigned to the following categories: rivers, lakes and heavily modified water bodies (HMWB). Water bodies differ in their natural characteristics, such as the size and bed slope of rivers, or the depth of lakes. The variety of such natural characteristics also affects aquatic communities: the species composition of aquatic organisms, as well as relative indicators of various species in communities, largely depends on natural conditions. Therefore, rivers, lakes and HMWB were further differentiated according to type taking into account the variety of natural characteristics of surface waters and the resulting differences in aquatic communities. A whole of certain characteristics typical of each type of water bodies when a water body in question has not been affected by human activities is called reference conditions of such body of water. A degree of deviation of characteristics from the reference conditions serves as a basis for identifying the actual ecological status of the water body (magnitude of human impact), i.e. determining which differences between the communities exist due to natural factors and which have been caused by anthropogenic pressures. Thus, the differentiation of water bodies with different natural characteristics into types is a mandatory condition for correct identification of the ecological status of these water bodies.

The following paragraphs provide information on types of water bodies in the categories of lakes and rivers within the Lielupė RBD and on the natural factors characterising these types.

Water bodies in the category of rivers

9. The category of river water bodies comprises all rivers with a catchment area larger than 50 km^2. Rivers with catchment areas smaller than 50 km^2 are not categorised into individual water bodies because they are included into larger drainage basins, which serve as the basis for the management of water bodies. Such management principle ensures not only good ecological status/potential of water bodies but also the quality of smaller rivers situated in respective basins.

10. 124 river water bodies with the total length of 2 257 km have been identified in the Lielupė RBD. The total length of 74 river water bodies in the Mūša Sub-basin is 1 314 km. 28 rivers with the total length of 515 km are situated in the Nemunėlis Sub-basin. 22 river water bodies have been identified in the Lielupė Small Tributaries Sub-basin, their aggregate length totals to 429 km.

The aggregate length of small rivers which have not been distinguished as distinct water bodies within the Lielupė RBD totals to 15 088 km: 8 792 km are situated in the Mūša Sub-basin, 2 749 km – in the Lielupė Small Tributaries Sub-basin, 3 547 km – in the Nemunėlis Sub-basin.

11. Five river types differing in the characteristics of their aquatic communities have been identified within the Lielupė RBD. The river types are characterised by two main natural factors which determine the major differences between the communities: catchment size and bed slope. The characterisation of types also involves the elements which, pursuant to the Description of the Types of Surface Water Bodies, Description of the Indicators of Reference Conditions of the Quality Elements for Surface Waters, and the Description of the Criteria for the Identification of Artificial, Heavily Modified Water Bodies and Water Bodies at Risk, which were approved by Order No. D1-256 of the Minister of Environment of the Republic of Lithuania of 23 May 2005 (Žin., 2005, No. 69-2481), are obligatory in the typology of water bodies: absolute altitude and geology. On the basis of the latter factor, almost all rivers in Lithuania belong to one single type, meanwhile by the catchment size rivers fall within three groups. Rivers with a catchment area larger than 100 km^2 were additionally sub-divided into types by the criterion of the bed slope. The river types within the Lielupė RBD and the corresponding characterising factors are provided in Table 8 below.

Table 9 gives the number and length of water bodies of different types within the Lielupė RBD. Figure 5 demonstrates the territorial distribution of rivers of different types.

Table 8. Typology of rivers in the Lielupė RBD

Descriptors	Types				
	1	2	3	4	5
Absolute altitude	< 200 m				
Geology	calcareous				
Catchment size, km^2	<100	100-1000		>1000	
Bed slope, m/km	-	<0.7	>0.7	<0.3	>0.3

Source: experts' analysis results

Table 9. Number and length of river water bodies of different types in the Lielupė RBD

Type	Water bodies in the category of rivers					
	Mūša Sub-basin		Nemunėlis Sub-basin		Lielupė Small Tributaries Sub-basin	
	Number	Length, km	Number	Length, km	Number	Length, km
1	55	900.7	20	276	19	388.7
2	4	115.8	6	209.9	1	8.2
3	11	146.5	1	8.9	2	31.9
4	1	16.9	0	0	0	0
5	3	132.6	1	20.6	0	0
Total:	**74**	**1 312.5**	**28**	**515.4**	**22**	**428.8**

Source: experts' analysis results

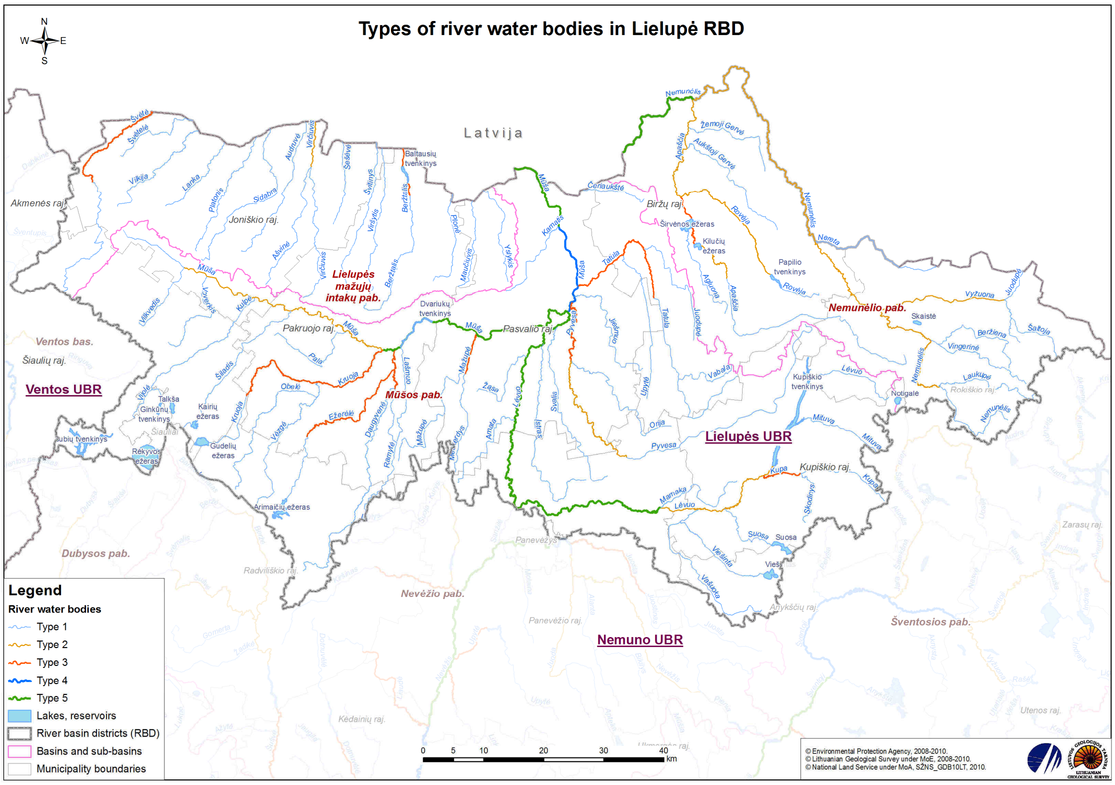


Figure 5. Types of river water bodies in the Lielupė RBD

The figure above and other figures given in the Management Plan are also provided in an interactive map at http://gis.gamta.lt/baseinuvaldymas.

Water bodies in the category of lakes and ponds

12. Two main types of lakes have been identified in the Lielupė RBD. The major factor that determines the most significant differences between the communities of aquatic organisms is the average depth of lakes. As in the case of rivers, the characterisation of the types of lakes also involves other obligatory factors, such as absolute altitude, geology, and surface area. By absolute altitude (obligatory factor), all Lithuanian lakes belong to one type. By geology, almost all lakes are classified as calcareous, i.e. also belong to one type. The only two exceptions are Lake Rėkyva, which is an organic lake by geology, and Lake Notigalė, which is a low-alkalinity lake. Since there is no data on the characteristics of these lakes under reference conditions, they have not been distinguished into individual types yet. In addition, Lake Rėkyva has been designated as

a HMWB due to hydromorphological changes as a result of anthropogenic economic activities. All lakes are classified into one group of lakes larger than 0.5 km^2 (50 ha) (pursuant to the Description of the Types of Surface Water Bodies, Description of the Indicators of Reference Conditions of the Quality Elements for Surface Waters, and the Description of the Criteria for the Identification of Artificial, Heavily Modified Water Bodies and Water Bodies at Risk, only the lakes with an area >0.5 km^2 shall be classified) because the differences in the aquatic communities in lakes larger than 0.5 km^2 within the Lielupė RBD are determined by the depth and not by the size of the lake. By average depth, lakes are differentiated into two groups: lakes with an average depth less than 3 m and those with the depth between 3 and 9 m.

In ponds with an area larger than 0.5 km^2, the conditions typical of rivers have changed into the characteristics typical of lakes due to the impact of the head, hence such ponds are comparable to natural lakes and thus subject to the same depth criteria for the type identification.

The types of lakes within the Lielupė RBD and the factors characterising the types are presented in Table 10. Table 11 gives the number of water bodies in the category of lakes and ponds within the Lielupė RBD. Figure 6 demonstrates the territorial distribution of lakes and ponds of different types.

Table 10. Typology of lakes in the Lielupė RBD

Descriptors:	Types	
	1	2
Average depth (m)	< 3	3-9
Absolute altitude (m)	< 200	
Geology	calcareous (>1.0 meq/lg (Ca >15mg/l))	
Size (km^2)	>0.5	

Source: experts' analysis results

Table 11. Number and area of lakes and ponds in the Lielupė RBD

Type	**Mūša Sub-basin**		**Nemunėlis Sub-basin**		**Lielupė Small Tributaries Sub-basin**	
	Number of water bodies	**Area, km^2**	**Number of water bodies**	**Area, km^2**	**Number of water bodies**	**Area, km^2**
1	7	21.85	5	6.31	1	0.80
2	4	15.19	-	-	-	-
Total	**11**	**37.04**	**5**	**6.31**	**1**	**0.80**

Source: experts' analysis results

Also, there are 360 lakes with an area smaller than 0.5 km^2 within the Lielupė RBD. Their aggregate area totals to 15.3 km^2. These lakes were not categorised into individual water bodies because most of them are included in larger drainage basins, which serve as the basis for the management of their status. Therefore, status improvement measures applied in the drainage basins of larger (with an area >0.5 km^2) lakes will also affect the quality of the smaller ones situated in the respective basins.

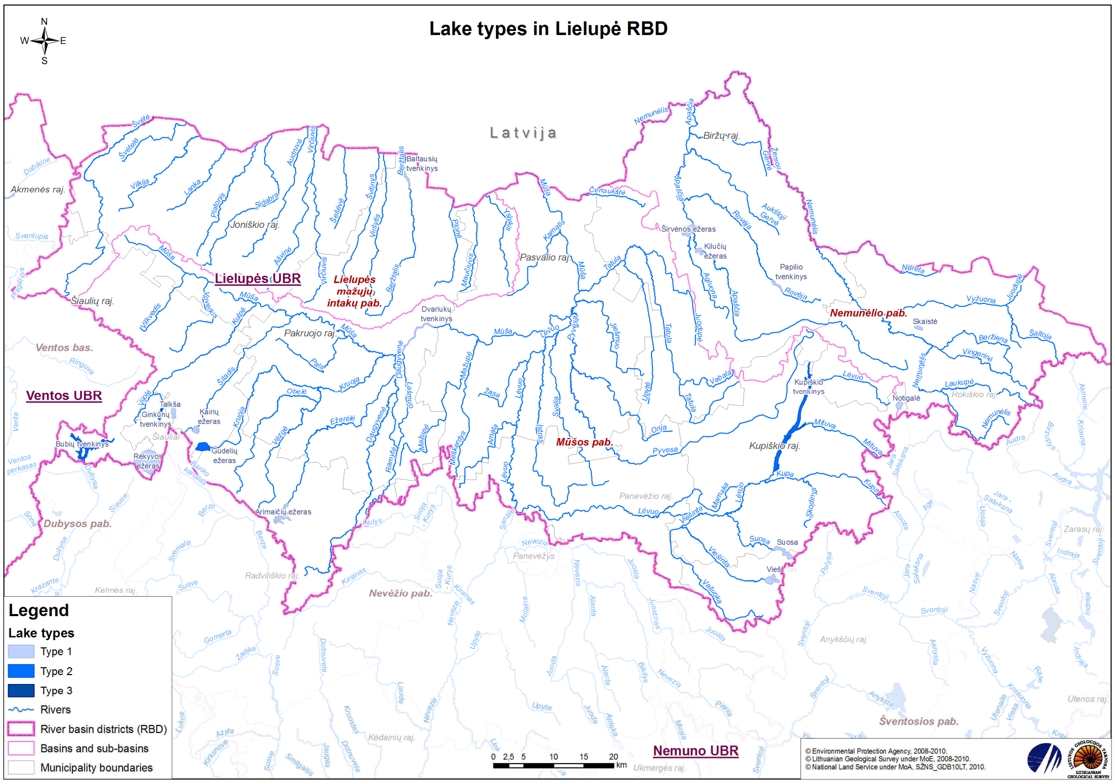


Figure 6. Types of water bodies in the category of lakes and ponds in the Lielupė RBD

Heavily modified water bodies

13. The characteristics (hydrological, morphological) of certain natural bodies of water have been strongly modified due to an impact of human economic activities, such as straightening and impoundment of rivers, intake of water affecting the hydrological regime, construction of port embankments, dredging, or alteration of the water level.

Good status of aquatic organisms in water bodies with significantly altered hydromorphological characteristics as a result of human economic activity often cannot be achieved, unless the activity is terminated and natural physical characteristics are restored. Should restoration of natural physical characteristics to such water body have far-reaching negative socio-economic consequences, or if the benefits of such altered characteristics of water bodies cannot be achieved (due to technical or economic reasons) by way of other measures which are a significantly better environmental option, such body of water is deemed to be a heavily modified water body.

Such water bodies include ponds with the area larger than 0.5 km^2, where the conditions typical of rivers have changed into the characteristics typical of lakes due to the impact of the head. Such ponds include one reservoir included in the National Cadastre of Lakes – Lake Širvėnos ežeras. This lake emerged around 1580 after building a dam down the confluence of the rivers Agluona and Apaščia. When the water level rose about 3 m, a territory of 3.3 km^2 was flooded, and the reservoir formed in meadows with sinkholes was later named Lake Širvėnos ežeras. Thus by origin, this lake is in fact a pond.

The available data of studies on aquatic communities show that the ecological status of straightened rivers is worse than good according to biological quality elements though the parameters of physico-chemical quality elements do conform to the good ecological status criteria. If straightened stretches are not consistently maintained, in the long run they tend to re-meander naturally. However, the process of natural restoration of river beds to a very large extent depends on the slope, substratum of the bed, and riparian vegetation, for instance, tree branches and similar obstacles that impede the flow of the river and otherwise affect the restoration and effectiveness. Straightened rivers with higher slopes as well as those flowing over forested areas have higher potential of natural restoration than straightened rivers with low slopes (lower than 1.5 m/km) and destroyed natural riparian vegetation. In addition, a high river bed slope naturally ensures a larger variety of habitats (changes in flow rate, depth of the river bed and soil composition) and hence the ecological status of straightened rivers with higher slopes by biological quality elements is often higher than that in straightened rivers with low slopes. The majority of straightened rivers or stretches with a low slope are situated in the areas of intensive agriculture and urbanised areas in the plains of the Lielupė RBD. Artificial restoration of the river beds is hardly possible, especially in urbanised territories where remeandering possibilities are very limited. Therefore, straightened rivers with low bed slopes flowing over urbanised territories of the Lielupė RBD have been designated as HMWB.

Heavily modified water bodies also include Lake Rėkyva. Its hydro-morphological indicators have been heavily modified by anthropogenic economic activities: the area of the lake has been reduced, its hydrological regime has been changed, which has resulted in shore abrasion and sinking of the lake. According to an analysis of macrophytes, the ecological status of the lake by the macrophyte parameters is very bad. To be able to restore the status of the lake, any surface runoff from the lake should be stopped. However, there is a pass from Lake Rėkyva to lakes Prūdelis and Talkša which maintains the water level of these water bodies. Rules of use of Lake Rėkyva specify the environmental flow of the outflow. In addition, part of the former basin has become lower than the lake level after the exploitation of peat deposits, which makes it impossible to incorporate it into the basin under natural conditions.

Restoration of the original characteristics of the lake is hardly possible, therefore Lake Rėkyva should be attributed to the category of heavily modified water bodies.

The final designation of water bodies as HMWB within the Lielupė RBD was conducted following the Guidance Document for the Common Implementation Strategy for the Water Framework Directive and some feedback from foreign experience.

The HMWB designation process aims at justifying the reason of why the pre-designated HMWB should be finally classified as HMWB and therefore should have less stringent objectives in terms of ecological status improvements. Indeed, a significant hydromorphological alteration is not sufficient to justify that a water body should be designated as HMWB. It has to be shown that the restoration measures needed to achieve good ecological status would significantly affect the users of a water body in question or the wider environment and that the users do not have any alternative means to achieve the same benefits as those offered by a respective water body in the category of HMWB.

The HMWB designation process consisted of the following steps:

13.1. Pre-designation: identification of the location, size, etc. of the water body, description of the hydromorphological changes and ecological alteration(s);

13.2. Characterisation of the user(s) benefiting from the changes;

13.3. Identification of measures to restore good ecological status of the water body (hydromorphological characteristics);

13.4. Description of the impacts of the measure(s) on the user(s) and on the wider environment;

13.5. Test: Are the impacts significant?

13.6. Identification of potential alternative means for the user to achieve the same function;

13.7. Test: Are these alternatives feasible technically, economically and environmentally?

14. The following HMWB have been identified within the Lielupė RBD taking into account hydromorphological changes caused by anthropogenic economic activities:

14.1. ponds with an area larger than 0.5 km^2 the main uses of which are generation of energy in hydropower plants (HPP) and recreation. There are six such water bodies in the Lielupė RBD: four in the Mūša Sub-basin, one in the Nemunėlis Sub-basin and one in the Lielupė Small Tributaries Sub-basin;

14.2. Lake Rėkyva the hydromorphological characteristics of which have been altered as a result of the regulation of the water level and peat extraction in the basin;

14.3. straightened rivers with a low slope (<1.5 m/km) flowing over urbanised territories. There are 33 such water bodies in the Lielupė RBD: 20 in the Mūša Sub-basin, 2 in the Nemunėlis Sub-basin and 11 in the Lielupė Small Tributaries Sub-basin.

The number of surface heavily modified water bodies identified in the Lielupė RBD totals to 40: 6 ponds, 1 lake and 33 river water bodies.

HMWB in the category of rivers account for 27% of the total number of rivers. The aggregate length of heavily modified rivers is 702 km, which makes up 31% of the total length of all river water bodies. The number of heavily modified water bodies in the category of rivers in the Lielupė RBD is provided in Table 12.

Heavily modified water bodies in the Lielupė RBD are demonstrated in Figure 7.

Table 12. Number and length of heavily modified water bodies in the category of rivers in the Lielupė RBD

Sub-basin	River water bodies		of which HMWB		HMWB, %	
	Number	Length, km	Number	Length, km	from the total numbers of river WB	from the total length of river WB
Mūša	74	1 312.6	20	401.3	27.0	30.6
Lielupė Small Tributaries	22	515.3	11	239.7	50.0	46.5
Nemunėlis	28	428.7	2	60.9	7.1	14.2
Total in Lielupė RBD	**124**	**2 256.6**	**33**	**701.9**	**26.6**	**31.1**

Source: experts' analysis results

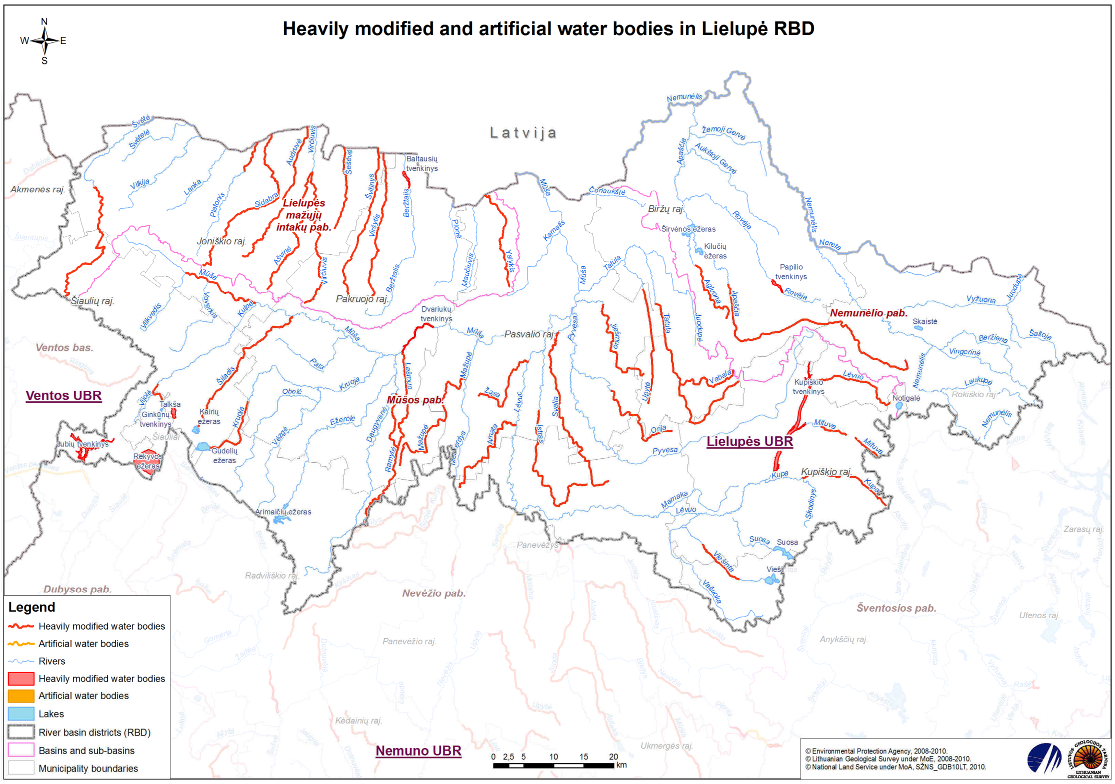


Figure 7. Heavily modified water bodies in the Lielupė RBD

Artificial water bodies

15. Artificial water bodies are water bodies formed in places where they had not existed before, without modifying the existing water bodies. There are no artificial water bodies within the Lielupė RBD.

Reference conditions for surface water bodies

16. Successful planning and introduction of measures required for the ensuring of good ecological status of surface waters directly depend on adequate selection of quality elements (biological, physico-chemical, hydromorphological) for status assessment, and on establishment of the criteria for the parameters of these elements. However, the main precondition of correct ecological status assessment is the establishment of a reference point. The reference point means values typical of the parameters for quality elements under natural, i.e. reference conditions with no anthropogenic impacts. As water bodies of different types are habitats for diverse aquatic communities, each of them requires reference values of the parameters for water quality elements.

Reference characteristics of rivers and lakes must be established on the basis of analysis in water bodies with no or a minimum impact by human economic activities. There are no such water bodies in the Lielupė RBD. The Lielupė RBD borders the Nemunas RBD, so these two are geographically close. There are no material differences in climatic or hydrological characteristics which could determine any notably specific natural characteristics of the water bodies (and, consequently, the structure and composition of the aquatic communities). Neither are there any differences between the characteristics of the aquatic organisms in the water bodies of relevant status and type, which was confirmed by the analysis of the monitoring data and fieldwork results.

Rivers

17. In rivers, values of reference conditions for biological elements were established only for the parameters for fish and zoobenthos (no reference conditions were established for macrophyte parameters due to shortage of data). Parameter values of reference conditions for macrophytes will have to be specified when more data is collected. Values of parameters indicative of physico-chemical quality elements characterising the quality of water, which ensure reference conditions for the biological elements, were established as well. Reference conditions for rivers were also characterised in accordance with the hydromorphological and chemical status criteria. Values and characterisation of reference conditions for river types according to the parameters of the water quality elements are provided in Table 13.

Table 13. Values and characterisation of reference conditions for river types according to parameters of water quality elements

No.	Quality element		Parameter	River type	Spatial assessment scale	Value/characterisation of reference conditions
1.	Biological	Taxonomic composition, abundance and age structure of fish fauna	Average value of the Lithuanian Fish Index (LFI)	1-5	monitoring site	1
2.			Relative abundance of intolerant fish individuals in the community (NTOLE n), %	1		61
				2		22
				3		45
				4		18
				5		27
3.			Absolute number of intolerant fish species in the community (NTOLE sp), unit	1		3
				2		-
				3		5
				4		-
				5		5
4.			Relative abundance of tolerant fish individuals in the community (TOLE n), %	1		1
				2		33
				3		2
				4		37
				5		23
5.			Relative number of tolerant fish species in the community (TOLE sp), %	1		-
				2		18
				3		14
				4		18
				5		14
6.			Relative abundance of omnivorous fish individuals in the community (OMNI n), %	1		3
				2		37
				3		4
				4		53

No.	Quality element			Parameter	River type	Spatial assessment scale	Value/characterisation of reference conditions
					5		38
7.				Absolute number of reophilic fish species in the community (RH sp), unit	1		-
					2		5
					3		8
					4		6
					5		10
8.				Relative abundance of litophilic fish individuals in the community (LITH n), %	1		96
					2		52
					3		93
					4		33
					5		65
9.				Relative number of litophilic fish species in the community (LITH sp), %	1		83
					2		41
					3		72
					4		39
					5		52
10.		Taxonomic composition and abundance of zoobenthos		Average annual value of the ecological quality ratio (EQR) of the Danish Stream Fauna Index (DSFI)	1-5	monitoring site	1
11.				Average annual value of DSFI	1-5		7
12.	Hydromorphological	Hydrological regime	Quantity and dynamics of water flow	Quantity of water flow	1-5	monitoring site	There are no changes in the natural water flow quantity due to human activities (water intake, operation of HPP, water discharge from ponds, or an impact of the head), or fluctuation is insignificant (≤10% of the average flow during a period in question). However, the flow quantity may not be less than the minimum natural flow during the dry period (average of 30 days).
13.		River continuity		River continuity	1-5	stretch*	There are no artificial barriers for fish migration.
14.		Morphological conditions	Structure of the riparian zone	Structure of the river bed	1-5	stretch*	Natural bed (unregulated, no shore embankments)
15.				Length and width of	1-5	stretch*	The zone of natural

No.	Quality element			Parameter	River type	Spatial assessment scale	Value/characterisation of reference conditions
				the natural riparian vegetation zone			riparian vegetation (forests) covers at least 70% of the length of the shoreline of the river bed. The width of the forest zone must be at least 50 m.
16.				Annual average value of nitrate nitrogen (NO_3-N), mg/l	1-5		≤ 0.90
17.				Annual average value of ammonium nitrogen (NH_4-N, mg/l	1-5		≤ 0.06
18.			Nutrient conditions	Annual average value of total nitrogen (N_t), mg/l	1-5	monitoring site	≤ 1.40
19.		General		Annual average value of phosphate phosphorus (PO_4-P), mg/l	1-5		≤ 0.03
20.				Annual average value of total phosphorus (P_t), mg/l	1-5		≤ 0.06
21.			Organic matter	Annual average value of biological oxygen demand in 7 days (BOD_7), mg/l	1-5	monitoring site	≤ 1.80
22.	Physico-chemical		Oxygenation conditions	Annual average value of dissolved oxygen in water (O_2), mg/l	1,3,4,5	monitoring site	≥ 9.5
					2		≥ 8.5
23.		Specific pollutants		Values of substances listed in Annex 1 and part A of Annex 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2010, No. 59-2938)	1-5	monitoring site	Measured values are below the quantitative assessment limit for the respective substance (detection limit).
24.				Values of substances listed in part B of Annex 2 to the Wastewater Management Regulation, with the exception of the values of nutrients given in	1-5	monitoring site	Measured values are below the natural level and the values of synthetic pollutants are below the quantitative assessment limit (detection limit).

No.	Quality element		Parameter	River type	Spatial assessment scale	Value/characterisation of reference conditions
			lines 16-20 of this table			

* the length of the river stretches where the parameters for hydromorphological quality elements are assessed: rivers with the catchment area < 100 km^2 – 0.5 km upstream and 0.5 km downstream of the monitoring site; rivers with the catchment area from 100 to 1000 km^2 – 2.5 km upstream and 2.5 downstream of the monitoring site.
Source: experts' analysis results

Lakes

18. In lakes, values of reference conditions for biological water quality elements were specified only for the parameter of phytoplankton meanwhile reference values established for the parameters for other biological elements are only preliminary ones, with the parameters currently being tested. Parameter values for reference conditions will have to be specified when more data is available. Also, values of parameters indicative of physico-chemical water quality elements, which should ensure reference conditions for the biological elements, were established, as well as parameters for hydromorphological quality elements and criteria for chemical status were characterised. Values and characterisation of reference conditions for lake types according to the parameters of the water quality elements are given in Table 14.

Table 14. Values and characterisation of reference conditions for lake types according to parameters of water quality elements

No.	Quality elements			Parameter	Lake type	Value/characterisation of reference conditions
1.	Biological	Taxonomic composition, abundance and biomass of phytoplankton		Mean value of the EQR of the average annual value and the EQR of the maximum value of chlorophyll *a*	1,2	1
2.				Average annual value of chlorophyll *a*, µg/l	1, 2	2.5
3.				Maximum value of chlorophyll *a*, µg/l	1, 2	5.0
4.	Hydromorphological	Hydrological regime	Quantity and dynamics of water flow	Changes in the water level	1,2	There is no unnatural decrease in the water level (the level has not been lowered, there is no intake of water), or changes are insignificant (the level is not lower than the natural minimum average annual water level), or there is no

No.	Quality elements			Parameter	Lake type	Value/characterisation of reference conditions
						anthropogenic impact which would determine the said alteration of the water level. There is no unnatural fluctuation of the water level (fluctuation conditioned by the operation of a HPP constructed on an effluent or tributary of the lake), or such fluctuation is within the limits of the minimum and maximum natural average annual water level.
5.		Morphological conditions	Structure of the lake shore	Changes in the shoreline	1,2	The shoreline is natural (not straightened, no shore embankments), or changes are insignificant (≤5% of the lake shoreline)
6.				Length of the natural riparian vegetation zone	1,2	The zone of natural riparian vegetation (forests) covers at least 70% of the length of the lake shoreline.
7.	Physico-chemical	General	Nutrient conditions	Annual average value of total nitrogen (N_t), mg/l	1, 2	≤ 1.00
8.					1, 2	≤ 0.020
9.		Specific pollutants		Values of substances listed in Annex 1 and Part A of Annex 2 to the Wastewater Management Regulation	1,2	Measured values are below the quantitative assessment limit for the respective substance (detection limit).
10.				Values of substances listed in part B of Annex 2 to the Wastewater Management Regulation, with the exception of the values of nutrients given in lines 7 and 8 of this table	1,2	Measured values are below the natural level and the values of synthetic pollutants are below the quantitative assessment limit (detection limit).

Source: experts' analysis results

Unnatural changes in the water level should be taken into account only in case of pressures from human activities which would result in alteration of the water level in the said way (dampers, hydropower plants, drainage of the basin, or any other human activity which would cause reduction or unnatural fluctuation of the water level). In the event of any anthropogenic impact, the average minimum natural water level and the limits of the minimum and maximum average natural annual water level (deviation from which serves as a basis for assessing the present hydrological status of the lake according to hydrological parameters) should be established by analysing characteristics of the water level fluctuation which dominated before the impact of human activities, and if no such data is available – using data on characteristics of the water level fluctuation in comparable lakes which have not been affected by human activities.

It should be noted that reference values for the parameters of phytoplankton and corresponding values of total phosphorus and total nitrogen were established only for calcareous lakes. No reference values for physico-chemical and biological quality elements were established for organic lakes (Lake Rėkyva) and siliceous lakes (Lake Notigalė) due to shortage of data.

Maximum ecological potential of artificial and heavily modified water bodies

19. Hydrological and morphological characteristics in artificial and heavily modified water bodies directly depend on the objectives of the formation or modification of such water bodies. Any change in the hydromorphological characteristics results in corresponding changes in the aquatic communities which live in the water bodies. Hence the ecological status of such water bodies should be assessed on the basis of the criteria applied for the evaluation of the ecological status of the water body type with the most similar characteristics. On the other hand, conditions formed in artificial or heavily modified water bodies are usually not identical to the ones in natural water bodies therefore characterisation of their status employs the notion of ecological potential instead of ecological status. The reference point for classifying the ecological potential for AWB and HMWB is maximum ecological potential (equivalent of reference conditions in natural water bodies). Since the hydromorphological conditions of such water bodies often do not allow attaining the same status of aquatic organisms as in natural water bodies, less stringent requirements may be set for the parameters indicative of biological elements. However, if the hydromorphological conditions occurring in AWB and HMWB are identical to the conditions in natural water bodies of a respective type, maximum ecological potential of aquatic communities is considered to be corresponding to high ecological status, i.e. it has to conform to the same criteria. The requirements for the parameters indicative of the physico-chemical water quality elements and chemical status in all cases remain the same as those for natural water bodies, unless they cannot be met due to the nature of an individual AWB or HMWB. In bodies of water where the hydromorphological conditions prevent attainment of the same status of aquatic organisms as in natural water bodies, good ecological potential is deemed to be ensured only in the event of introduction of at least minimum measures that allow for mitigation of impacts of hydromorphological modifications (e.g. restoring woody riparian vegetation where it has been completely destroyed, or providing for at least minimum obstacles for the water flow that determine at least minimum heterogeneity of the composition of the river soil), i.e. measures which will not have any negative impact on anthropogenic objectives pursued when constructing an artificial water body or significantly modifying a natural one. Meanwhile maximum ecological potential can be attained only by applying all possible measures (e.g. partial remeandering of river beds).

Artificial water bodies

20. There are no artificial water bodies within the Lielupė RBD.

Heavily modified water bodies

21. HMWB in the Lielupė RBD include ponds with an area larger than 0.5 km^2, straightened rivers with a low bed slope in urbanised areas and Lake Rėkyva.

Hydromorphological conditions formed in ponds larger than 0.5 km^2 as well as aquatic communities therein should be consistent with those in natural lakes, with the exception of ponds of hydropower plants with unnatural fluctuation of the water level. Accordingly, the parameters indicative of the hydromorphological elements in such ponds are deemed to be failing the characterisation of maximum ecological potential. However, maximum ecological potential of the biological and physico-chemical quality elements in such water bodies should conform to the high ecological status criteria applicable for natural lakes.

Heavily modified Lake Rėkyva

By geology, this lake is an organic lake. No data is available on reference conditions of such lakes. Analyses of macrophyte parameters indicate bad status of the lake. A system of the classification of the ecological status according to the parameters indicative of the said biological element has not been completed yet, so at present the ecological potential of Lake Rėkyva (like the ecological status of other natural lakes within the Lielupė RBD) can be assessed only on the basis of the parameters indicative of physico-chemical quality elements and phytoplanton, meanwhile maximum ecological potential according to the parameters of the said quality elements should conform to the high ecological status criteria applicable to natural lakes.

Table 9. Characterisation of maximum ecological potential in ponds and Lake Rėkyva which are designated as HMWB[(1)]

No.	Quality element	Parameter			Value/characterisation of maximum ecological potential
1.	Biological	Taxonomic composition, abundance and biomass of phytoplankton		Mean value of the EQR of the average annual value and the EQR of the maximum value of chlorophyll *a*	>0.67
2.	Physico-chemical	General	Nutrient conditions	Annual average value of total nitrogen (N_t), mg/l	<1.30
3.					<2.00 *
4.				Annual average value of total phosphorus (P_t), mg/l	<0.040
5.					<0.100 *
6.	Hydromor phological	Hydrological regime	Quantity and dynamics of water flow	Changes in the water level	There is no unnatural decrease in the water level (the level has not been lowered, there is no intake of water), or changes are insignificant (the level is not lower than the natural minimum average annual water level), or there is no anthropogenic impact which would determine the said alteration of the water level.

No.	Quality element	Parameter			Value/characterisation of maximum ecological potential
7.		Morphological conditions	Structure of the lake shore	Changes in the shoreline	The shoreline is natural (not straightened, no shore embankments), or changes are insignificant (≤5% of the lake shoreline)
8.				Length of the natural riparian vegetation zone	The zone of natural riparian vegetation (forests) covers at least 70% of the length of the lake shoreline.

(1) Parameters indicative of hydromorphological quality elements of ponds with a regulated water level (HPP) and of heavily modified Lake Rėkyva are deemed to be failing the characterisation of maximum ecological potential.
* Criteria for marked parameters are applied for assessing the ecological potential of high-drainage lakes (water circulation ratio, i.e. the ratio of the quantity of the annual river flow to the volume of the pond, K>100).
Source: experts' analysis results

The ecological potential of the heavily modified rivers with a straightened bed should be defined following the criteria applicable for the assessment of the types of rivers of the corresponding catchment size and bed slope. High ecological status by the biological quality elements cannot be achieved due to the absence of certain specific habitats and changes in the natural hydrological regime. Monitoring data indicates that maximum ecological potential of the biological quality elements should be conforming to the values of the criteria for good ecological status which are applied to natural rivers, i.e. DSFI EQR ≥0.63, and LFI ≥0.70 (Table 16). Maximum ecological potential for the hydromorphological elements has to meet the criteria for good ecological status. The maximum ecological potential requirements for the physico-chemical water quality elements correspond to the good ecological status criteria for rivers with natural beds.

Table 16. Characterisation of maximum ecological potential in canals and in rivers designated as heavily modified water bodies

No.	Quality element			Parameter	Spatial assessment scale	Value/characterisation of maximum ecological potential
1.	Biological	Taxonomic composition, abundance and age structure of fish fauna		LFI	monitoring site	>0.70
2.		Taxonomic composition and abundance of zoobenthos		DSFI EQR	monitoring site	>0.63
3.	Hydromorphological	Hydrological regime	Quantity and dynamics of water flow	Quantity of water flow	monitoring site	There are no changes in the natural water flow quantity or fluctuation due to anthropogenic impacts (HPP operation) is ≤30% of the average flow during a period in question. However, the flow quantity may not be less than the minimum

No.	Quality element			Parameter	Spatial assessment scale	Value/characterisation of maximum ecological potential
						natural flow during the dry period (average of 30 days).
4.		River continuity		River continuity	stretch*	There are no artificial barriers for fish migration.
5.		Morphological conditions	Structure of the riparian zone	Structure of the river bed	stretch *	The shoreline is meandrous, there are shallow and deep places in the bed determining changes in the flow velocity and soil composition.
6.				Length and width of the natural riparian vegetation zone	stretch *	The zone of natural riparian vegetation (forests) covers at least 50% of the length of the shoreline of the river bed.
7.	Physico-chemical	General	Nutrient conditions	Annual average value of nitrate nitrogen (NO_3-N), mg/l	monitoring site	<1.30
8.				Annual average value of ammonium nitrogen (NH_4-N), mg/l		<0.10
9.				Annual average value of total nitrogen (N_t), mg/l		<2.00
10.				Annual average value of phosphate phosphorus (PO_4-P), mg/l		<0.050
11.				Annual average value of total phosphorus (P_t), mg/l		<0.100
12.			Organic matter	Annual average value of biological oxygen demand in 7 days (BOD_7), mg/l	monitoring site	<2.30
13.			Oxygenation conditions	Annual average value of dissolved oxygen in water (O_2), mg/l	monitoring site	>8.50 in water bodies of Type 1, 3, 4, 5

No.	Quality element			Parameter	Spatial assessment scale	Value/characterisation of maximum ecological potential
14.						>7.50 in water bodies of Type 2

* the length of the river stretches where the parameters for hydromorphological quality elements are assessed: rivers with the catchment area < 100 km^2 – 0.5 km upstream and 0.5 km downstream of the monitoring site; rivers with the catchment area from 100 to 1000 km^2 – 2.5 km upstream and 2.5 downstream of the monitoring site.
Source: experts' analysis results

Methodology for identifying the status of surface water bodies

Criteria for assessment of the ecological status of rivers

22. The ecological status of rivers is assessed on the basis of physico-chemical, hydromorphological and biological quality elements, which reflect all significant impacts of anthropogenic activities.

The ecological status of rivers is assessed on the basis of the physico-chemical quality elements, which are parameters characterising general conditions (nutrients, organic matter, oxygenation): NO_3-N, NH_4-N, N_{total}, PO_4-P, P_{total}, BOD_7, and O_2. Water bodies are assigned to one of five ecological status classes on the basis of the average annual values of each parameter (Table 17). The criteria given in Table 17 have been agreed with the neighbouring country Latvia.

Table 17. Ecological status classes of rivers according to parameters indicative of physico-chemical quality elements

No.	Quality element		Parameter	River type	Parameter value for reference conditions	Criteria for ecological status classes of rivers according to parameter values for physico-chemical quality elements				
						High	Good	Moderate	Poor	Bad
1	General	Nutrient conditions	NO_3-N, mg/l	1-5	0.90	<1.30	1.30-2.30	2.31-4.50	4.51 -10.00	>10.00
2			NH_4-N, mg/l	1-5	0.06	<0.10	0.10-0.20	0.21-0.60	0.61-1.50	>1.50
3			N_{total}, mg/l	1-5	1.40	<2.00	2.00-3.00	3.01-6.00	6.01-12.00	>12.00
4			PO_4-P, mg/l	1-5	0.03	<0.050	0.050-0.090	0.091-0.180	0.181-0.400	>0.400
5			P_{total}, mg/l	1-5	0.06	<0.100	0.100-0.140	0.141-0.230	0.231-0.470	>0.470
6		Organic matter	BOD_7, mg/l	1-5	1.80	<2.30	2.30-3.30	3.31-5.00	5.01-7.00	>7.00
7		Oxygenation	O_2, mg/l	1, 3, 4, 5	9.50	>8.50	8.50-7.50	7.49-6.00	5.99-3.00	<3.00
8			O_2, mg/l	2	8.50	>7.50	7.50-6.50	6.49-5.00	4.99-2.00	<2.00

Source: experts' analysis results

The ecological status of rivers is assessed on the basis of the following parameters characterising hydromorphological quality elements, such as hydrological regime (quantity and dynamics of water flow), river continuity, and morphological conditions (shoreline structure): quantity of flow, river continuity, structure of the river bed, and length and width of the natural riparian vegetation zone. When all parameters indicative of the hydromorphological quality elements are consistent with the characterisation of high ecological status, such water body is deemed to be at high ecological status according to the hydromorphological quality elements (Table 18). When at least one parameter for the hydromorphological quality elements fails the characterisation of high ecological status, such water body is considered to be failing high ecological status according to the hydromorphological quality elements.

Table 18. Characterisation of high ecological status of rivers according to parameters indicative of hydromorphological quality elements

No.	Quality element		Parameter	Spatial assessment scale	Characterisation of high ecological status of rivers according to parameters for hydromorphological quality elements
1	Hydrological regime	Quantity and dynamics of water flow	Quantity of water flow	monitoring site	There are no alterations in the quantity of the natural flow due to human activities (water intake, operation of HPP, water discharge from ponds, or an impact of the head), or fluctuation is insignificant (≤10% of the average flow during a period in question). However, the flow quantity may not be less than the minimum natural flow during the dry period (average of 30 days).
2	River continuity		River continuity	stretch *	There are no artificial barriers for fish migration.
3	Morphological conditions	Shoreline structure	Structure of the river bed	stretch *	The bed is natural (not straightened, no shore embankments).
4			Length and width of the natural riparian vegetation zone	stretch *	The zone of natural riparian vegetation (forests) covers at least 70% of the length of the bed shore. The width of the forest zone must be at least 50 m.

* the length of the river stretches where the parameters for hydromorphological quality elements are assessed: rivers with the catchment area < 100 km^2 – 0.5 km upstream and 0.5 km downstream of the monitoring site; rivers with the catchment area from 100 to 1000 km^2 – 2.5 km upstream and 2.5 km downstream of the monitoring site, and rivers with the catchment area >1000 km^2 – 5 km upstream and 5 km downstream of the monitoring site.
Source: experts' analysis results

The ecological status of rivers is assessed on the basis of the following biological quality elements: taxonomic composition, abundance, age structure of fish fauna and taxonomic composition, abundance of zoobenthos.

The indicator used to assess the ecological status of rivers by the taxonomic composition, abundance, age structure of fish fauna is LFI. Observing the average annual value of LFI, water bodies are assigned to one of five ecological status classes (Table 19).

Table 19. Ecological status classes of rivers according to taxonomic composition, abundance and age structure of fish fauna

Quality element	Indicator	River type	Criteria for ecological status classes of rivers according to parameter values for fish fauna				
			High	Good	Moderate	Poor	Bad
Taxonomic composition, abundance and age structure of fish fauna	LFI	1-5	>0.93	0.93-0.71	0.70-0.40	0.39-0.11	<0.11

Source: experts' analysis results

The indicator used to assess the ecological status of rivers according to the taxonomic composition and abundance of zoobenthos is DSFI. Observing the average annual value of DSFI EQR, water bodies are assigned to one of five ecological status classes (Table 20).

Table 20. Ecological status classes of rivers according to taxonomic composition and abundance of zoobenthos

Quality element	Indicator	River type	Criteria for ecological status classes of rivers according to the EQR of parameter values for zoobenthos				
			High	Good	Moderate	Poor	Bad
Taxonomic composition and abundance of zoobenthos	DSFI	1-5	≥ 0.78	0.77-0.64	0.63-0.50	0.49-0.35	<0.35

Source: experts' analysis results

Criteria for assessment of the ecological status of lakes

23. The ecological status of lakes is assessed on the basis of physico-chemical, hydromorphological and biological quality elements.

The parameters characterising general conditions (nutrients), which is a physico-chemical element, are as follows: total nitrogen (N_{total}) and total phosphorus (P_{total}). Water bodies are assigned to one of five ecological status classes on the basis of the average annual values of each parameter measured in samples of the surface water layer (Table 21).

Table 21. Ecological status classes of lakes according to parameters indicative of the physico-chemical quality element

No.	Quality element		Parameter	Lake type	Parameter value for reference conditions	Criteria for ecological status classes of lakes according to parameter values for the physico-chemical quality element				
						High	Good	Moderate	Poor	Bad
1	General	Nutrient conditions	N_{total}, mg/l	1, 2	1.00	<1.30	1.30-1.80	1.81-2.30	2.31-3.00	>3.00
3			P_{total}, mg/l	1, 2	0.020	<0.040	0.040-0.060	0.061-0.090	0.091-0.140	>0.140

Source: experts' analysis results

The ecological status of lakes is assessed on the basis of the following parameters indicative of hydromorphological quality elements, such as hydrological regime (quantity and dynamics of water flow) and morphological conditions (structure of the lake shoreline): changes in the water level, alterations of the shoreline, the length of the natural riparian vegetation zone. When all parameters for the hydromorphological quality elements are consistent with the characterisation of high ecological status, such water body is deemed to be at high ecological status according to the hydromorphological quality elements (Table 22). When at least one parameter for the hydromorphological quality elements fails the characterisation of high ecological status, such water body is considered to be failing high ecological status according to the hydromorphological quality elements.

Table 22. Characterisation of high ecological status of lakes according to parameters indicative of hydromorphological quality elements

No.	Quality element		Parameter	Characterisation of high ecological status of lakes according to parameters for hydromorphological quality elements
1	Hydrological regime	Quantity and dynamics of water flow	Changes in the water level	There is no unnatural decrease in the water level (the level has not been lowered, there is no intake of water), or changes are insignificant (the level is not lower than the natural minimum average annual water level), or there is no anthropogenic impact which would determine the said alteration of the water level. There is no unnatural fluctuation of the water level (fluctuation conditioned by operation of HPP constructed on an effluent or tributary of the lake), or such fluctuation is within the limits of the minimum and maximum natural average annual water level.
2	Morphological conditions	Shoreline structure of the lake	Changes in the shoreline	The shoreline is natural (not straightened, there are no shore embankments), or changes are insignificant (≤5% of the lake shoreline).
3			Length of the natural riparian vegetation zone	The zone of natural riparian vegetation (forests) covers at least 70% of the length of the lake shoreline.

Source: experts' analysis results

The ecological status of lakes is assessed on the basis of the following parameter indicative of biological quality elements, such as the taxonomic composition, abundance and biomass of phytoplankton: the average annual value and the maximum value of chlorophyll *a*. Observing the mean of the EQR of the annual average value and of the EQR of the maximum value of the parameter, water bodies are assigned to one of five ecological status classes (Table 23).

Table 23. Ecological status classes of lakes according to taxonomic composition, abundance and biomass of phytoplankton

Quality element	Parameter	Lake type	Criteria for ecological status classes of lakes according to the EQR of parameter values for phytoplankton				
			High	Good	Moderate	Poor	Bad
Taxonomic composition, abundance and biomass of phytoplankton	Chlorophyll *a* (the mean of the EQR of the annual average value and of the EQR of the maximum value)	1, 2	>0.67	0.67-0.33	0.32-0.14	0.13-0.07	<0.07

Source: experts' analysis results

Criteria for assessment of the ecological potential of heavily modified water bodies

24. The ecological potential of rivers which have been designated as HMWB and of canals is assessed on the basis of physico-chemical, hydromorphological and biological quality elements.

The parameters indicative of physico-chemical quality elements, such as general conditions (nutrients, organic matter, oxygenation), used to assess the ecological potential of rivers designated as HMWB are as follows: NO_3-N, NH_4-N, N_{total}, PO_4-P, P_{total}, BOD_7, and O_2. The water body is assigned to one of five ecological potential classes on the basis of the average annual values of each parameter (Table 24).

Table 24. Ecological potential classes of canals and of rivers designated as HMWB according to parameters indicative of physico-chemical quality elements

No.	Quality element		Parameter	Type of water body	Criteria for ecological potential classes according to parameter values for physico-chemical quality elements				
					Maximum	Good	Moderate	Poor	Bad
1	General	Nutrient conditions	NO_3-N, mg/l	1-5	<1.30	1.30-2.30	2.31-4.50	4.51 -10.00	>10.00
2			NH_4-N, mg/l	1-5	<0.10	0.10-0.20	0.21-0.60	0.61-1.50	>1.50
3			N_{total}, mg/l	1-5	<2.00	2.00-3.00	3.01-6.00	6.01-12.00	>12.00
4			PO_4-P, mg/l	1-5	<0.050	0.050-0.090	0.091-0.180	0.181-0.400	>0.400
5			P_{total}, mg/l	1-5	<0.100	0.100-0.140	0.141-0.230	0.231-0.470	>0.470
6		Organic matter	BOD_7, mg/l	1	<2.30	2.30-3.30	3.31-5.00	5.01-7.00	>7.00
7		Oxygenation	O_2, mg/l	1, 3, 4, 5	>8.50	8.50-7.50	7.49-6.00	5.99-3.00	<3.00
8			O_2, mg/l	2	>7.50	7.50-6.50	6.49-5.00	4.99-2.00	<2.00

Source: experts' analysis results

The ecological potential of canals and of rivers designated as HMWB is assessed on the basis of the following parameters indicative of hydromorphological quality elements, such as hydrological regime (quantity and dynamics of water flow), river continuity, and morphological conditions (shoreline structure): quantity of flow, river continuity, structure of the river bed, length of the natural riparian vegetation zone. When all parameters for the hydromorphological quality elements are consistent with the characterisation of maximum ecological potential, such water body is deemed to be of maximum ecological potential according to the hydromorphological quality elements (Table 25). When at least one parameter for the hydromorphological quality elements fails the characterisation of maximum ecological potential, such water body is considered to be failing maximum ecological potential according to the hydromorphological quality elements.

Table 25. Characterisation of maximum ecological potential of canals and of rivers designated as HMWB according to parameters indicative of hydromorphological quality elements

No.	Quality element		Parameter	Spatial assessment scale	Characterisation of maximum ecological potential according to parameters for hydromorphological quality elements
1	Hydrological regime	Quantity and dynamics of water flow	Quantity of water flow	monitoring site	There are no alterations in the quantity of the natural flow due to human activities (operation of HPP) or fluctuation is ≤30% of the average flow during a period in question. However, the flow quantity shall not be less than the minimum natural flow during the dry period (average of 30 days).
2	River continuity		River continuity	stretch *	There are no artificial barriers for fish migration.
3	Morphological conditions	Shore structure	Structure of the river bed	stretch *	The shoreline is meandrous, there are shallow and deep places in the bed determining changes in the flow velocity and soil composition.
4			Length of the natural riparian vegetation zone	stretch *	The zone of natural riparian vegetation (forests) covers at least 50% of the length of the bed shoreline.

* the length of the river stretches where the parameters for hydromorphological quality elements are assessed: rivers with the catchment area < 100 km^2 – 0.5 km upstream and 0.5 km downstream of the monitoring site; rivers with the catchment area from 100 to 1000 km^2 – 2.5 km upstream and 2.5 km downstream of the monitoring site, and rivers with the catchment area >1000 km^2 – 5 km upstream and 5 km downstream of the monitoring site.

Source: experts' analysis results

The ecological potential of canals and of rivers designated as HMWB is assessed on the basis of the following parameters indicative of biological quality elements: taxonomic composition, abundance, age structure of fish fauna and taxonomic composition and abundance of zoobenthos.

The indicator used to assess the ecological status of canals and of rivers designated as HMWB according to the taxonomic composition, abundance, age structure of fish fauna is the LFI. The water body is assigned to one of five ecological status classes on the basis of the average annual value of the LFI (Table 26).

Table 26. Ecological potential classes of canals and of rivers designated as HMWB according to taxonomic composition, abundance and age structure of fish fauna

Quality element	Indicator	Type of water body	Criteria for ecological potential classes according to parameter values for fish fauna				
			Maximum	Good	Moderate	Poor	Bad
Taxonomic composition, abundance and age structure of fish fauna	LFI	1-5	≥ 0.71	0.70-0.40	0.39-0.20	0.19-0.10	<0.10

Source: experts’ analysis results

The indicator used to assess the ecological potential of canals and of rivers designated as heavily modified water bodies according to the taxonomic composition and abundance of zoobenthos is the DSFI. Water bodies are assigned to one of five ecological potential classes on the basis of the average annual value of the DSFI EQR (Table 27).

Table 27. Ecological potential classes of canals and of rivers designated as HMWB according to the taxonomic composition and abundance of zoobenthos

Quality element	Indicator	Type of water body	Criteria for ecological potential classes according to the EQR of parameter values for zoobenthos				
			Maximum	Good	Moderate	Poor	Bad
Taxonomic composition and abundance of zoobenthos	DSFI	1-5	≥ 0.64	0.63-0.50	0.49-0.36	0.35-0.21	<0.21

Source: experts’ analysis results

The ecological potential of ponds and lakes designated as HMWB is assessed on the basis of physico-chemical, hydromorphological and biological quality elements.
The parameters indicative of physico-chemical quality elements, such as general data (nutrients), used to assess the ecological potential of ponds and lakes designated as HMWB are as follows: total nitrogen and total phosphorus. The water body is assigned to one of five ecological potential classes on the basis of the average annual values of each parameter in samples of the surface water layer (Table 28).

Table 28. Ecological potential classes of ponds and lakes designated as HMWB according to parameters indicative of physico-chemical quality elements

No.	Quality element		Parameter	Type of water body	Criteria for ecological potential classes by parameter values for physico-chemical quality elements				
					Maximum	Good	Moderate	Poor	Bad
1	General data	Nutrients	N_{total}, mg/l	1, 2	<1.30	1.30-1.80	1.81-2.30	2.31-3.00	>3.00
3			N_{total}, mg/l*	1, 2	<2.00	2.00-3.00	3.01-6.00	6.01-12.00	>12.00
4			P_{total}, mg/l	1, 2	<0.040	0.040-0.060	0.061-0.090	0.091-0.140	>0.140
6			P_{total}, mg/l l*	1, 2	<0.100	0.100-0.140	0.141-0.230	0.231-0.470	>0.470

* Criteria for marked parameters are applied for assessing the ecological potential of high-drainage lakes (water circulation ratio, i.e. the ratio of the quantity of the annual river flow to the volume of the pond, K>100).
Source: experts' analysis results

The ecological potential of ponds (with an unregulated water level) which are designated as HMWB is assessed on the basis of the following parameters indicative of hydromorphological quality elements, such as hydrological regime (quantity and dynamics of water flow) and morphological conditions (shoreline structure): changes in the water level, changes in the shoreline, length of the natural riparian vegetation zone. When all parameters indicative of the hydromorphological quality elements are consistent with the characterisation of maximum ecological potential, such water body is deemed to be of maximum ecological potential according to the hydromorphological quality elements (Table 29). When at least one parameter for the hydromorphological quality elements fails the characterisation of maximum ecological potential, such water body is considered to be failing maximum ecological potential according to the hydromorphological quality elements. The parameters indicative of the hydromorphological elements in ponds with a regulated water level (HPP are constructed on such ponds) and in Lake Rėkyva are deemed to be failing the characterisation of maximum ecological potential.

Table 29. Characterisation of maximum ecological potential of ponds (with an unregulated water level) designated as HMWB according to parameters indicative of hydromorphological quality elements

No.	Quality element		Parameter	Characterisation of maximum ecological potential according to parameters for hydromorphological quality elements
1	Hydrological regime	Quantity and dynamics of water flow	Changes in the water level	There is no unnatural decrease in the water level (the level has not been lowered, there is no intake of water), or changes are insignificant (the level is not lower than the natural minimum average annual water level), or there is no anthropogenic impact which would determine the said alteration of the water level.
2	Morphological conditions	Shore structure	Changes in the shoreline	The shoreline is natural (not straightened, there are no shore embankments), or changes are insignificant (≤5% of the lake shoreline).
3			Length of the natural riparian vegetation zone	The zone of natural riparian vegetation (forests) covers at least 70% of the length of the bed shoreline.

Source: experts' analysis results

The parameters for assessing the ecological potential of ponds and lakes designated as HMWB according to biological quality elements, such as the taxonomic composition, abundance and biomass of phytoplankton, is the average annual value and the maximum value of chlorophyll *a*. Observing the mean of the EQR of the annual average value and of the EQR of the maximum value of chlorophyll *a*, the water body is assigned to one of five ecological potential classes (Table 30).

Table 30. Ecological potential classes of ponds and lakes designated as HMWB according to taxonomic composition, abundance and biomass of phytoplankton

Quality element	Parameter	Type of water body	Criteria for ecological potential classes according to the EQR of parameter values for phytoplankton				
			Maximum	Good	Moderate	Poor	Bad
Taxonomic composition, abundance and biomass of phytoplankton	Chlorophyll *a* (the mean of the EQR of the annual average value and of the EQR of the maximum value)	1-3	>0.67	0.67-0.33	0.32-0.14	0.13-0.07	<0.07

Source: experts' analysis results

Criteria for assessment of the chemical status of surface waters

25. "Good surface water chemical status" means the chemical status required to meet the environmental objectives for surface waters pursuant to the Law of the Republic of Lithuania on Water (Žin., 1997, No. 104-2615; 2003, No. 36-1544), i.e. the chemical status achieved by a body of surface water in which concentrations of pollutants do not exceed the environmental quality standards established in relevant legislation setting environmental quality standards at the Community and national level.

The chemical status of surface waters is divided into two quality classes. Where a body of water achieves compliance with all environmental quality standards established under relevant Community and national legislation setting environmental quality standards, it is classified as achieving good chemical status. If not, the body is recorded as failing good chemical status.

The criteria for assessing the chemical status of surface waters are the environmental quality standards of specific pollutants (priority and other regulated substances) listed in Annexes 1 and 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2010, No. 59-2938) in a receiving water body.

Status classification rules for surface water bodies

26. The status of surface water bodies shall be classified as follows:

26.1. Identification of the status of surface water bodies encompasses assessment of their ecological status (or ecological potential for artificial and heavily modified water bodies) and chemical status. The status of the water body shall be determined by the poorer of its ecological status and chemical status assigning the water body to one of the two classes: conforming to good status or failing good status.

26.2. The ecological status of rivers and lakes shall be classified into five classes: high, good, moderate, poor and bad. The level of confidence in the assessment of the ecological status can be high, medium and low.

26.3. When parameters indicative of biological and physico-chemical quality elements meet the criteria for high ecological status and parameters indicative of hydromorphological quality elements meet the criteria for high ecological status as well, the ecological status of the water body shall be high and the level of confidence in the status assessment shall be high.

26.4. When only parameters indicative of hydromorphological quality elements fail the characterisation of high ecological status meanwhile parameters indicative of biological and physico-chemical quality elements do meet the criteria for high ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be medium.

26.5. When parameters indicative of biological and/or physico-chemical quality elements fail the criteria for high ecological status, the assessment of the ecological status of the water body shall not consider parameters for hydromorphological quality elements, except in the cases specified in paragraphs 26.6.2, 26.6.3, 26.6.5, 26.6.6 and 26.9 of these rules.

26.6. When at least one parameter indicative of biological and/or physico-chemical quality elements fails the criteria for high ecological status but meets the criteria for good ecological status meanwhile the values of other parameters for biological and physico-chemical quality elements do meet the criteria for high ecological status, the ecological status of the water body shall be classified in the following way depending on the water quality element:

26.6.1. when at least both one parameter indicative of biological quality elements and one parameter indicative of physico-chemical quality elements fail the criteria for high ecological status but meet the criteria for good ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be high;

26.6.2. when only one of a few parameters indicative of biological quality elements fails the criteria for high ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for good ecological status is equal to or higher than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status and parameters indicative of hydromorphological quality elements do meet the criteria for high status, the ecological status of the water body shall be high and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.6.3. when only one of a few parameters indicative of biological quality elements fails the criteria for high ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for good ecological status is equal to or higher than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status and parameters indicative of hydromorphological quality elements fail the criteria for high ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.6.4. when only one of a few parameters indicative of biological quality elements fails the criteria for high ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for good ecological status is lower than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be low;

26.6.5. when only one of a few parameters indicative of physico-chemical quality elements fails the criteria for high ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for good ecological status is equal to or lower than 25 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status (in the case of dissolved oxygen and water transparency – equal to or higher than 75 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status) and parameters indicative of hydromorphological quality elements do meet the criteria for high ecological status, the ecological status of the water body shall be high and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.6.6. when only one of a few parameters indicative of physico-chemical quality elements fails the criteria for high ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for good ecological status is equal to or lower than 25 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status (in the case of dissolved oxygen and water transparency – equal to or higher than 75 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status) and parameters indicative of hydromorphological quality elements fail the criteria for high ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.6.7. when only one of a few parameters indicative of physico-chemical quality elements fails the criteria for high ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for good ecological status is higher than 25 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status (in the case of dissolved oxygen and water transparency – lower than 75 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for good ecological status), the ecological status of the water body shall be good and the level of confidence in the status assessment shall be low;

26.6.8. when at least two parameters indicative of biological or physico-chemical quality elements fail the criteria for high ecological status but meet the criteria for good ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be medium.

26.7. When at least one parameter indicative of biological and/or physico-chemical quality elements fails the criteria for good ecological status but meets the criteria for moderate ecological status meanwhile the values of other parameters for biological and physico-chemical quality elements do meet the criteria for good ecological status, the ecological status of the water body shall be assessed as follows:

26.7.1. when at least both one parameter indicative of biological quality elements and one parameter indicative of physico-chemical quality elements fail the criteria for good ecological status but meet the criteria for moderate ecological status, the ecological status of the water body shall be moderate and the level of confidence in the status assessment shall be high;

26.7.2. when only one of a few parameters indicative of biological quality elements fails the criteria for good ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for moderate ecological status is equal to or higher than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for moderate ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.7.3. when only one of a few parameters indicative of biological quality elements fails the criteria for good ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for moderate ecological status is lower than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for moderate ecological status, the ecological status of the water body shall be moderate and the level of confidence in the status assessment shall be low;

26.7.4. when only one of a few parameters indicative of physico-chemical quality elements fails the criteria for good ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for moderate ecological status is equal to or lower than 25 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for moderate ecological status (in the case of dissolved oxygen and water transparency – equal to or higher than 75 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for moderate ecological status), the ecological status of the water body shall be good and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.7.5. when only one of a few parameters for physico-chemical quality elements fails the criteria for good ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for moderate ecological status is higher than 25 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for moderate ecological status (in the case of dissolved oxygen and water transparency – lower than 75 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for moderate ecological status), the ecological status of the water body shall be moderate and the level of confidence in the status assessment shall be low;

26.7.6. when at least two parameters indicative of biological and/or physico-chemical quality elements fail the criteria for good ecological status but meet the criteria for moderate ecological status, the ecological status of the water body shall be moderate and the level of confidence in the status assessment shall be medium.

26.8. When parameters indicative of biological quality elements meet the criteria for high or good ecological status but the ecological status is more than one class poorer by one or more parameters indicative of physico-chemical quality elements, the ecological status of the water body shall be one class higher than indicated by the values of the parameters for physico-chemical quality elements (or any of the parameters for physico-chemical quality elements which shows a poorer status) and the level of confidence in the status assessment shall be low.

26.9. When parameters indicative of physico-chemical quality elements meet the criteria for high or good ecological status but the ecological status is more than one status class poorer by parameters indicative of biological quality elements (or any of the parameters for biological quality elements which shows a poorer status), the ecological status of the water body shall be assessed as follows:

26.9.1. when the ecological status is more than one status class poorer by parameters indicative of biological quality elements (or any of the parameters for biological quality elements which indicates a poorer status) than by parameters indicative of physico-chemical quality elements, meanwhile parameters indicative of hydromorphological quality elements conform to the characterisation of high ecological status, the ecological status of such water body shall not be subject to classification. In such case it is highly likely that the sample of the status analysis data of the water body or the analysis site has not been representative and hence analysis of the status of the water body has to be conducted anew or another representative site for the analysis has to be selected;

26.9.2. when the ecological status is one status class poorer by parameters indicative of biological quality elements (or any of the parameters for biological quality elements which indicates a poorer status) than by parameters indicative of physico-chemical quality elements, meanwhile parameters indicative of hydromorphological quality elements fail the characterisation of high ecological status, the ecological status of the water body shall be determined by the values of the parameters for biological quality elements and the level of confidence in the status assessment shall be low if the ecological status is one class poorer by one parameter, or medium if the ecological status is one class poorer by several parameters;

26.9.3. when the ecological status is more than one status class poorer by parameters indicative of biological quality elements (or any of the parameters for biological quality elements which indicates a poorer status) than by parameters indicative of physico-chemical quality elements, meanwhile parameters indicative of hydromorphological quality elements fail the characterisation of high ecological status, the ecological status of the water body shall be determined by the values of the parameters for biological quality elements and the level of confidence in the status assessment shall be low.

26.10. When parameters indicative of biological quality elements meet the criteria for high ecological status but the ecological status is one status class poorer by parameters indicative of physico-chemical quality elements, meanwhile parameters indicative of hydromorphological quality elements fail the characterisation of high ecological status, the ecological status of the water body shall be good and the level of confidence in the status assessment shall be medium.

26.11. When parameters indicative of both biological and physico-chemical quality elements fail the criteria for good ecological status but meet the criteria for moderate, poor or bad ecological status, the ecological status of the water body shall be assessed as follows:

26.11.1. when the same ecological status class is indicated by the values of parameters for both biological and physico-chemical quality elements, the status of the water body shall be determined by these parameter values and the level of confidence in the status assessment shall be high;

26.11.2. when the ecological status is one status class poorer by at least one of a few parameters indicative of physico-chemical quality elements than by parameters indicative of biological quality elements, the ecological status of the water body shall be determined by the values of the parameters indicative of biological quality elements (or any of the parameters for biological quality elements which indicates a poorer status) and the level of confidence in the status assessment shall be medium;

26.11.3. when the ecological status is two status classes poorer by at least one of a few parameters indicative of physico-chemical quality elements than by parameters indicative of biological quality elements, the ecological status of the water body shall be determined by the values of the parameters indicative of biological quality elements (or any of the parameters for biological quality elements which indicates a poorer status) and the level of confidence in the status assessment shall be low;

26.11.4. when the ecological status is one status class poorer by parameters indicative of biological quality elements (or any of the parameters for biological quality elements which indicates a poorer status), the ecological status of the water body shall be assessed as follows:

26.11.4.1. when only one of a few parameters indicative of biological quality elements fails the criteria for moderate ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for poor ecological status is equal to or higher than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for poor ecological status, the ecological status of the water body shall be moderate and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.11.4.2. when only one of a few parameters indicative of biological quality elements fails the criteria for moderate ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for poor ecological status is lower than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for poor ecological status, the ecological status of the water body shall be poor and the level of confidence in the status assessment shall be low;

26.11.4.3. when at least two parameters indicative of biological quality elements fail the criteria for moderate ecological status but meet the criteria for poor ecological status, the ecological status of the water body shall be poor and the level of confidence in the status assessment shall be medium;

26.11.4.4. when only one of a few parameters indicative of biological quality elements fails the criteria for poor ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of criteria for bad ecological status is equal to or higher than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for bad ecological status, the ecological status of the water body shall be poor and the level of confidence in the status assessment shall be medium; when the data is available only for one parameter indicative of biological quality elements, the level of confidence in the status assessment shall be low;

26.11.4.5. when only one of a few parameters indicative of biological quality elements fails the criteria for poor ecological status but the relative deviation (in per cent) of its value from the lowest value in the range of the criteria for bad ecological status is lower than 50 per cent of the absolute difference between the lowest value and the highest value in the range of the criteria for bad ecological status, the ecological status of the water body shall be bad and the level of confidence in the status assessment shall be low;

26.11.4.6. when at least two parameters indicative of biological quality elements fail the criteria for poor ecological status but meet the criteria for bad ecological status, the ecological status of the water body shall be bad and the level of confidence in the status assessment shall be medium.

26.12. When the ecological status is two status classes poorer by parameters indicative of biological quality elements (or any of the parameters for biological quality elements which indicates a poorer status) than by parameters indicative of physico-chemical quality elements, the ecological status of the water body shall be determined by the values of the parameters for biological quality elements and the level of confidence in the status assessment shall be low.

26.13. When there is no data available on parameters indicative of biological quality elements, the ecological status of the water body shall be determined by the value of parameters indicative of physico-chemical quality elements which is attributed to the poorest status class and the level of confidence in the status assessments shall be:

26.13.1. low when the ecological status is assessed on the basis of modelling results or when a poorer status is indicated by the value of only one parameter for physico-chemical quality elements which was obtained during analysis;

26.13.2. medium when the values of at least two parameters for physico-chemical quality elements which were obtained during analysis indicate a poorer ecological status and belong to the same ecological status class.

26.14. The ecological potential of heavily modified water bodies shall be classified into maximum, good, moderate, poor and bad. The level of confidence in the assessment of the ecological potential shall be determined observing the classification rules for the ecological status of rivers and lakes given in paragraphs 26.3-26.11.

26.15. Surface water bodies shall be assigned to one of the two chemical status classes: conforming to good status or failing good status. A surface water body shall be deemed to be at good chemical status when concentrations of all substances listed in Annexes 1 and 2 to the Wastewater Management Regulation do not exceed the maximum allowable concentrations. A surface water body shall be deemed to be failing good chemical status when the concentration of at least one substance listed in Annexes 1 and 2 to the Wastewater Management Regulation exceeds the maximum allowable concentration.

26.16. The precision of the ecological status and ecological potential established corresponds to the precision of measurements of parameters indicative of the quality elements used for the classification.

Status assessment methods should be agreed between countries, i.e. intercalibrated, so that the ecological status and ecological potential of water bodies is assessed in the same way.

SECTION II. GROUNDWATER BODIES

27. There are five groundwater bodies (GWB) within the Lielupė RBD (Figure 8):

27.1. Lielupė GWB of Permian-Upper Devonian deposits (LT003003400),

27.2. Stipinai-Lielupė GWB of Upper Devonian deposits (LT002003400),

27.3. Joniškis GWB (LT0010023400),

27.4. Biržai-Pasvalys GWB (LT001043400),

27.5. Lielupė GWB of Upper-Middle Devonian deposits (LT001003400).

These groundwater bodies have been identified taking into account distribution of the productive aquifers which produce the largest amount of groundwater, and following consistent patterns of formation of the volume and quality of groundwater resources and quality. The largest amount of groundwater on the territory of the Lielupė RBD is abstracted from deep aquifers (complexes), which have a poor hydraulic connection with surface water bodies, therefore the boundaries of the groundwater bodies in this RBD do not coincide with those of the surface water basins (see Figure 8). The largest groundwater body is the Lielupė GWB of Upper-Middle Devonian deposits (4 448.45 km^2) occupying practically half (49.7%) of the territory of the Lielupė RBD. The smallest groundwater body is Joniškis GWB (see Figure 8), with the area of a little more than 500 km^2. The Lielupė Small Tributaries Sub-basin contains larger or smaller parts of five GWB, the Mūša Sub-basin – parts of four GWB, and the Nemunėlis Sub-basin – parts of two GWB (Figure 8). More detailed information on the distribution of the GWB in the river basins and sub-basins is provided in Tables 31 and 32.

Table 31. Groundwater bodies in the Lielupė River Basin District

Groundwater body	Area of the groundwater body	
	km^2	% of the RBD area
1. Lielupė GWB of Upper-Middle Devonian deposits	4 448.45	49.7
2. Stipinai-Lielupė GWB of Upper Devonian deposits	1 879.03	21.0
3. Lielupė GWB of Permian-Upper Devonian deposits	1 063.38	11.9
4. Biržai-Pasvalys GWB	1 048.35	11.7
5. Joniškis GWB	508.57	5.7
Total:	8 947.78	100

Source: experts' estimations using the data of the Register of the Earth Entrails of the LGS

Table 32. Groundwater bodies in the sub-basins of the Lielupė RBD

River sub-basin	Groundwater body	Area of the GWB in the river sub-basin	
		km^2	% of the sub-basin area
Mūša	Lielupė GWB of Upper-Middle Devonian deposits	2 548.5415	48.1
	Stipinai-Lielupė GWB of Upper Devonian deposits	1 520.4583	28.7
	Biržai-Pasvalys GWB	856.2768	16.2
	Lielupė GWB of Permian-Upper Devonian deposits	371.1552	7.0
	Total:	5 296.4318	100
Lielupė Small Tributaries	Lielupė GWB of Permian-Upper Devonian deposits	692.2224	39.5
	Joniškis GWB	508.3169	29.0
	Stipinai-Lielupė GWB of Upper Devonian deposits	358.827	20.5
	Lielupė GWB of Upper-Middle Devonian deposits	189.5114	10.8
	Biržai-Pasvalys GWB	1.8707	0.1
	Total:	1 750.7484	100
Nemunėlis	Lielupė GWB of Upper-Middle Devonian deposits	1 710.2701	90
	Biržai-Pasvalys GWB	190.3283	10
	Total:	1 900.5984	100

Source: experts' estimations using the data of the Register of the Earth Entrails of the LGS

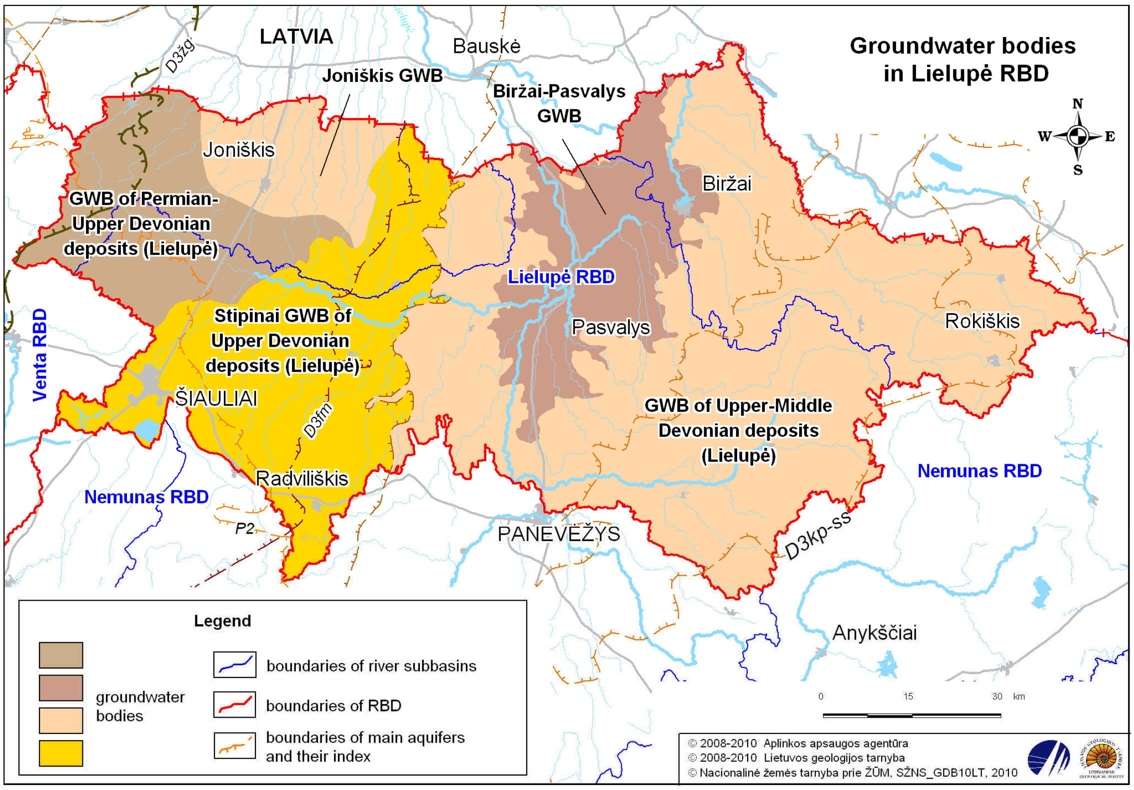


Figure 8. Groundwater bodies in the Lielupė RBD

Status of groundwater wellfields

28. According to the data of the Lithuanian Geological Service, as on 1 April 2010, 229 wellfields were registered on the territory of the Lielupė RBD in the Quaternary (Q), Upper Permian (P_2), Famenian (D_3fm), Stipinai (D_3st), Pliavinas (D_3pl) and Šventoji-Upninkai (D_{3-2}šv-up) aquifers (complexes) (Figure 9). The largest wellfields are those of Šiauliai, Rokiškis, Biržai, Pasvalys and Joniškis towns. More detailed information about the distribution of the wellfields is provided in Table 33.

Table 33. Groundwater wellfields in the Lielupė RBD

Groundwater body	Geological index of the aquifer	Number of groundwater wellfields
Stipinai-Lielupė GWB of Upper Devonian deposits	P_2	10
	D_3fm	10
	D_3st	43
	D_{3-2}šv-up	10
	Total in the GWB:	**73 (31.9)**
Lielupė GWB of Upper-Middle Devonian deposits	Q	2
	D_3pl	28
	D_{3-2}šv-up	52
	Total in the GWB:	**82 (35.8)**
Biržai-Pasvalys GWB	D_3pl	4
	D_{3-2}šv-up	29
	Total in the GWB:	**33 (14.4)**
Joniškis GWB	D_3fm	7
	D_3st	5
	D_3pl	1
	D_{3-2}šv-up	10

Groundwater body	Geological index of the aquifer	Number of groundwater wellfields
	Total in the GWB:	**23 (10)**
Lielupė GWB of Permian-Upper Devonian deposits	P_2	1
	D_3fm	13
	D_{3-2}šv-up	4
	Total in the GWB:	**18 (7.9)**
	Total in the RBD:	**229**

The figure in parentheses is percentage from the total number of groundwater wellfields within the RBD.
Source: experts' estimations using the data of the Register of the Earth Entrails of the LGS

The volume of groundwater abstracted from individual wellfields during the recent years has been varying from a few to several tens of thousands m^3/day, totalling to 28 305 m^3/day on average on the territory of the RBD (Table 34).

Criteria for the assessment of groundwater wellfields were approved by Order No. 3-1395 of the Minister of Environment of the Republic of Lithuania of 31 March 2007 on the approval of the Procedure for the Establishment of Criteria for the assessment of Groundwater Wellfields (Žin., 2007, No. 37-1395).

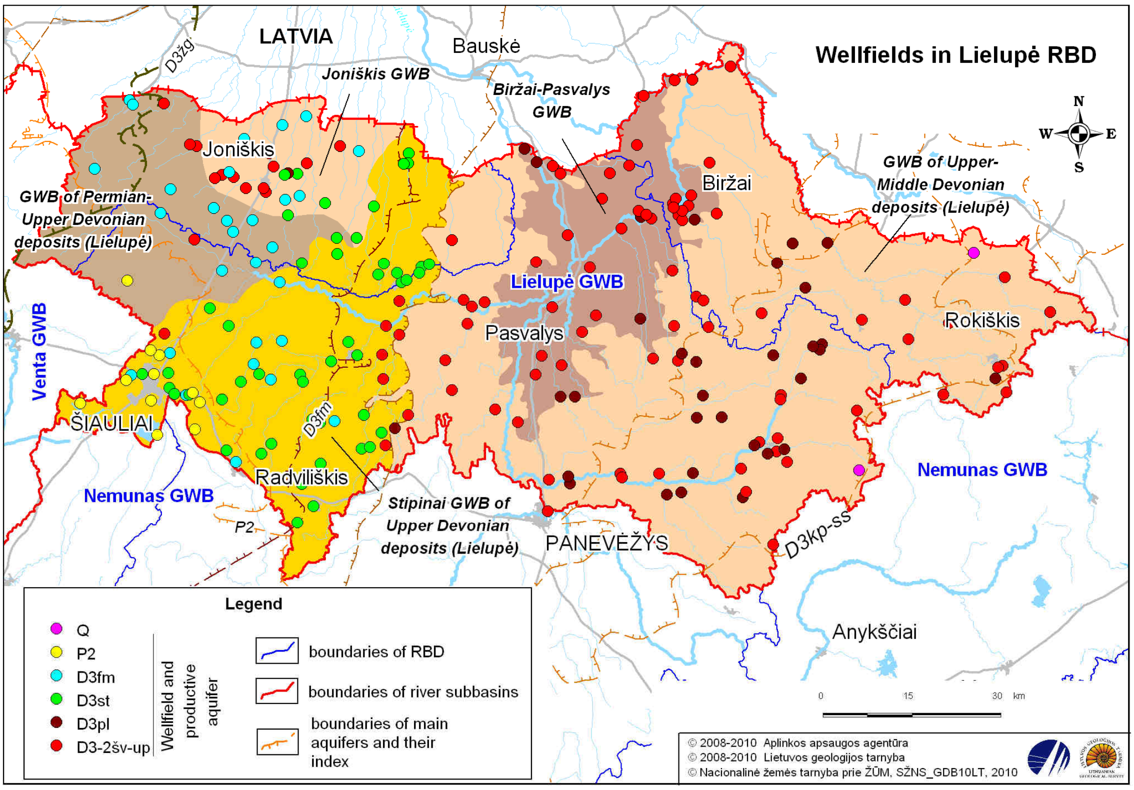


Figure 9. Groundwater wellfields in the Lielupė RBD

Table 34. Water abstraction in groundwater wellfields in the Lielupė RBD

GWB	Geological index of the aquifer	Groundwater abstraction*		
		m^3/day	% from the volume abstracted in the GWB	% from the volume abstracted in the RBD
Upper Devonian Stipinai	P_2	631	4.4	2.2
	D_3fm	165	1.2	0.6
	D_3st	12 684	89.3	44.8
	D_{3-2}šv-up	717	5.1	2.5
	Total in GWB:	**14 197**	**100.0**	**50.2**

GWB	Geological index of the aquifer	Groundwater abstraction*		
		m^3/day	% from the volume abstracted in the GWB	% from the volume abstracted in the RBD
Upper-Middle Devonian (Lielupė)	Q	27	0.3	0.1
	D_3pl	713	8.8	2.5
	D_{3-2}šv-up	7 406	90.9	26.2
	Total in GWB:	**8 146**	**100.0**	**28.8**
Biržai-Pasvalys	D_3pl	55	1.4	0.2
	D_{3-2}šv-up	3 980	98.6	14.1
	Total in GWB:	**4 035**	**100.0**	**14.3**
Joniškis	D_3fm	86	6.3	0.2
	D_3st	91	6.6	0.3
	D_{3-2}šv-up	1 190	87.1	4.2
	Total in GWB:	**1 367**	**100.0**	**4.7**
Permian-Upper Devonian (Lielupė)	P_2	45	8.0	0.2
	D_3fm	279	49.8	1.0
	D_{3-2}šv-up	236	42.2	0.8
	Total in GWB:	**560**	**100.0**	**2.0**
	Total in RBD:	**28 305**		

* average of the period 2008-2009

Source: experts' estimations using the data of the Register of the Earth Entrails of the LGS

Significant groundwater resources within the Lielupė RBD have been surveyed and approved observing the procedure laid down by the LGS and total to 191 555 m^3/day (Table 35).

Table 35. Demand and resources of groundwater in the Lielupė RBD

RBD	GWB	Average abstraction of groundwater in 2008-2009, m^3/day	Demand of groundwater for 2015, thousand m^3/day*	Groundwater resources surveyed and approved, thousand m^3/day
Lielupė	Stipinai GWB of Upper Devonian deposits (Lielupė)	14 197	20 279	79 075
	GWB of Upper-Middle Devonian deposits (Lielupė)	8 146	21 447	91 590
	Biržai-Pasvalys	4 035	10 901	10 390
	Joniškis	1 367	3 772	10 500
	GWB of Permian-Upper Devonian deposits	560	1 375	-
	Total:	28 305 (14.8)	57 774 (30.2)	191 555

* on the basis of data of SWECO-BKG-LSPI; figure in parentheses represents percentage from the volume of the approved resources.

The data in the table above shows that the groundwater volume currently abstracted within the Lielupė RBD accounts for 14.8% of the surveyed and approved groundwater resources. In future (2015) this volume could go up to 30.2% (see Table 39). This indicates good quantitative status of the groundwater bodies and wellfields because the groundwater resources are much more abundant than the current or planned groundwater abstraction. However, the data of the last five years shows that the groundwater abstraction has become stable thus the increase by 15% as planned back in 2007 is hardly likely.

The upper part of the geological section in the area of the Lielupė RBD, as in the rest of Lithuania, consists of Quaternary deposits which cover layers of confined groundwater distributed from east to west, which are connected with various terrigenic, carbonatic, sulfate Middle-Upper Devonian and Upper Permian rocks/deposits. Since there are no significant layers of confined groundwater resources or their abstraction in Quaternary deposits within the Lielupė RBD, the characterisation given below relates only to pre-Quaternary confined aquifers already mentioned, emphasising the qualitative status of the water contained therein.

The main aquifer complex of the northern part of the Upper-Middle Devonian GWB, the Šventoji-Upininkai (D_3šv+D_2up) complex, is spread along the entire Latvian-Lithuanian border and is the most important source of drinking water in this territory (*Gregorauskas, 2008*). Speaking about the qualitative status of groundwater, this complex is divided into two parts – the upper and the lower. Westwards from Panevėžys and Pakruojis, groundwater of good chemical status in the upper part of the complex D_3šv+D_2up turns into particularly hard calcium sulfate-water of poor quality, the source of which is the gypseous succession of younger Devonian aquifers (especially the Tatula aquifers, D_3tt) located at the top of the complex.

In some places it “deteriorates” the quality of water contained in the upper part of this complex and in Biržai-Pasvalys GWB (LT0010043400). Westwards from Joniškis, hard calcium sulfate-/sodium chloride-water of poor quality modifies the chemical status of the lower part of the complex D_3šv+D_2up; however, here the water rises in deeper layers of the complex. These are the two reasons why there is no groundwater suitable for drinking in Joniškis and almost in the entire Joniškis body (LT001023400) as well as further westwards in the complex D_3šv+D_2up.

Speaking about Joniškis groundwater body, practically no groundwater of good quality is contained in the succession of various Upper Devonian dolomite-gypsum layers situated above the aquifer complex D_3šv+D_2up either. Going up, fissured dolomite of Stipinai aquifers (Upper Devonian Stipinai/Lielupė/ GWB LT002003400) occurring above the Įstras-Tatula (D_3įs+tt) aquifers and the Pamūšis (D_3pm) aquitard contains fresh water only in the triangle Linkuva-Šiauliai-Šeduva.

In Upper Devonian Stipinai and Joniškis GWB, calcium sulfate-water of poor quality is also spread and exploited (to a certain extent) in the Devonian aquifers of various age and aquiferous properties, which are assigned to the so-called Famenian complex (D_3fm), where the water content is higher in so-called Kruoja aquifers (D_3krj), though this is not the case everywhere. The northern part of the Permian-Upper Devonian (P_2+D_3) body (LT003), which is the main source of groundwater of good quality in the neighbouring Venta RBD, starts further westwards and south-westwards from Joniškis.

Joniškis GWB (LT001023400) and Stipinai GWB of Upper Devonian deposits (LT002003400) have potentially been designated as water bodies at risk. In certain wellfields within these groundwater bodies, abnormally high concentrations of sulfates failing to meet the drinking water quality requirements (not more than 250 mg/l) and, sometimes, the environmental criteria set by the Lithuanian Geological Survey (not more than 500 mg/l) have been detected.

A national measure “To draft a piece of legislation obligating water supply companies which abstract > 10 m^3 of groundwater per day and which exploit wellfields situated in groundwater bodies at risk to perform monitoring of problematic quality indicators (Cl and SO4) and to provide the data to the Lithuanian Geological Survey” has been provided for in the Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District, which was approved by Resolution No. 1098 of the Government of the Republic of Lithuania of 21 July 2010 (Žin., 2010, No. 90-4756). The data analysis would enable identifying impacts of groundwater abstraction on water quality changes and revealing a trend in deterioration of water quality as a result of human activities. Only then groundwater wellfields can be designated as being at risk or deleted from the category of water bodies at risk. However, it can happen that drinking water of good quality for Joniškis town will have to be supplied from the neighbouring areas. This problem should be addressed by relevant municipalities responsible for the supply of drinking water to the population.

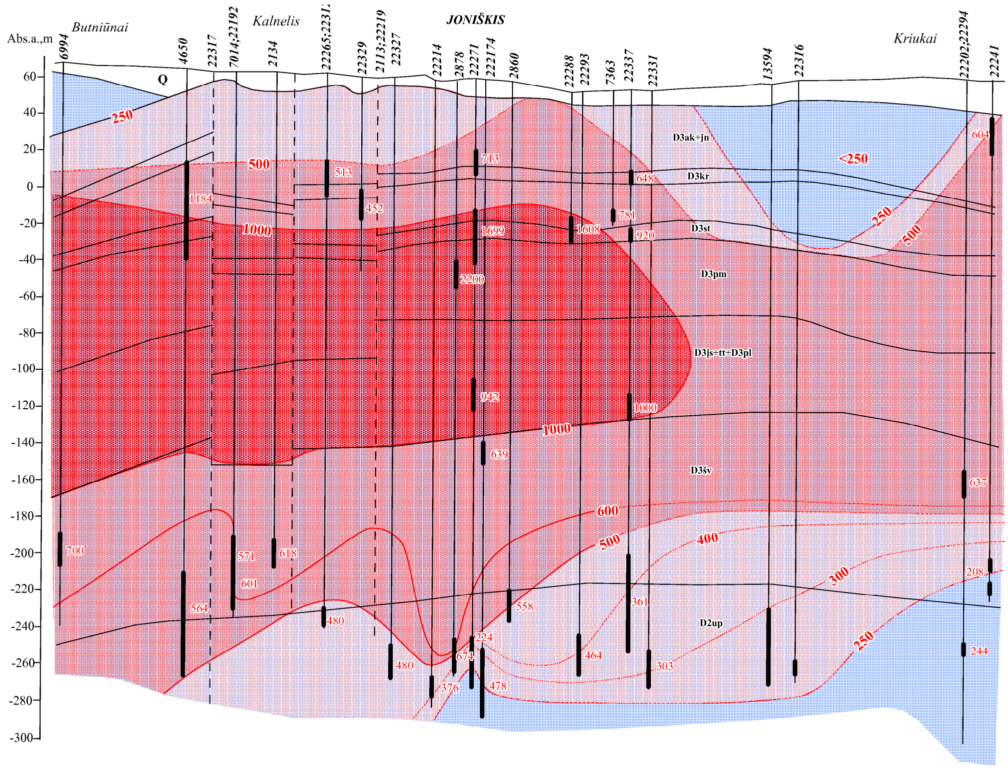


Figure 10. Hydrochemical cross-section (sulfate isolines, mg/)

SECTION III. IMPACT OF CLIMATE CHANGE ON SURFACE WATER BODIES AND GROUNDWATER WELLFIELDS

29. During the study, climate forecasts were developed for three places (which have operating meteorological stations) on the territory of the Lielupė RBD or at its boundary: Panevėžys, Šiauliai, and Biržai. Prognostic values of the weather temperature, precipitation amount, minimum relative air humidity, speed of wind and sunshine duration for all months for the years 2001-2010 and 2011-2020 were estimated and compared to the climate norm values (1971-2000).

It was established that the impact of the climatic factors on the variation of water quality in the Lielupė RBD should be of minor importance. A more serious impact on the quality could be expected only in the event of change of the precipitation and evaporation ratio.

30. The analysis of the predicted changes of the climatic elements during the first two decades of the 21st century during individual seasons demonstrated the following:

30.1. The weather temperature in the Lielupė RBD will be rising during all seasons. The most significant changes in the weather temperature are forecasted for winters (up to 2 ºC) and springs (up to 1.5 ºC), meanwhile changes during other seasons will not be higher than 1 ºC. The average annual temperature in the territory in question is expected to go up a little. In the first decade of the 21st century the temperature will exceed the climate norm by 0.8 ºC in Biržai and Panevėžys, and by 0.9 ºC in Šiauliai. In the second decade, the average annual weather temperature will be similar to the one at the beginning of the century.

30.2. The majority of climate models indicated that the annual precipitation should go up in 2011-2020. The amount of precipitation should increase at the beginning of the year and go down in the second half of summer and at the beginning of autumn.

31. A forecast of the runoff in the Lielupė RBD was developed for three river basins of different size – the Nemunėlis, the Mūša and the Lėvuo – which reflect different hydrological and landscape conditions. The following was established:

31.1. No significant changes in the annual average runoff or in the runoff during individual seasons and months until 2020 due to climate changes are expected. Potential major changes predicted in the Lielupė RBD are related to the runoff distribution during a year and to the ratio of the constituents of the water balance.

31.2. The majority of the rivers in the Lielupė RBD that were analysed have one common tendency: in 2020 their runoff will become more naturally regulated than it is today, i.e. reduced maximum runoff of floods and high waters as well as generally increased runoff during low tides is expected.

31.3. Earlier beginning of spring floods has already been noticed in many rivers, as indicated in the runoff forecasts for 2020 (floods will begin earlier but will last longer ending at the same time as today). However, this process is fairly insignificant (nowhere the predicted earlier start exceeds ten days) and cannot be compared with the results of similar forecasts for the Nemunas RBD.

31.4. Groundwater flow in the Lielupė RBD will remain stable in 2020. Slight changes are expected both in the values and in the distribution of the flow during a year.

31.5. As compared to the current situation, the average annual water level in many lakes within the Lielupė RBD might rise in 2020. Such changes first of all will be determined by alteration in the amount of precipitation and will be mostly noticeable in low-drainage lakes.

31.6. In spring, the maximum water level of drainage lakes in the Lielupė RBD will be attained earlier and the average maximum water level will decrease; the minimum level during dry summers will be higher as compared to the one at the end of the 20th century.

31.7. As a result of the expected rise of weather temperature at the beginning of winters, the ice cover on lakes in the Lielupė RBD is likely to be formed later than today. Higher temperature of the warm season should determine increase of lake water temperature, which would be most noticeable in thermally shallow and non-stratified lakes.

31.8. As from 1961, droughts in the Lielupė RBD have been occurring every 3.5 years (i.e. two droughts in seven years) on average. Lately, there has been a growing tendency to have more frequent, prolonged and more intensive droughts. Droughts in 2002 and 2006 were especially strong and long and made the most powerful (up to now) impact on the river runoff in the Lielupė RBD – many small tributaries of the Lielupė stopped flowing at all.

31.9. Available information allows assuming that the tendency of more frequent prolonged and strong droughts that result in decrease of the river runoff and water level of lakes will also remain in the coming years.

31.10. Prognostic scenarios indicate that definitely more considerable climate changes will be occurring in future. However, the changes in the climatic factors forecasted until 2020 are not expected to have a significant impact on the water balance, runoff regime and water quality and hence will not prevent the attainment of the water protection objectives at this stage.

CHAPTER III. SUMMARY IMPACTS OF ECONOMIC ACTIVITIES

SECTION I. SIGNIFICANT IMPACT ON RIVERS AND LAKES

32. A significant impact is the impact of an economic activity which results in a (potential) failure to meet the requirements for good ecological and/or chemical status. Drivers of significant impacts include loads from one pollution source or aggregate pollution from a number of sources, as well as hydromorphological changes in water bodies due to the straightening of river beds and an impact of HPP. When the impact of anthropogenic activities persists even after the introduction of the basic measures, such water bodies are designated as water bodies at risk and supplementary measures are provided for to achieve good ecological status/potential therein.

Pollution loads and their impact on the status of water bodies

33. Pollution sources exerting significant impacts are those which individually or together determine lower than good ecological status of water bodies.

34. The criteria for good ecological status of water bodies in the category of rivers are as follows:

34.1. average annual concentration of $BOD_7 \leq 3.3$ mgO_2/l;

34.2. average annual concentration of NH_4-N ≤ 0.2 mg/l;

34.3. average annual concentration of NO_3-N ≤ 2.3 mg/l;

34.4. average annual concentration of $N_{total} \leq 3.0$ mg/l;

34.5. average annual concentration of phosphates ≤ 0.09 mg/l ;

34.6. average annual concentration of $P_{total} \leq 0.14$ mg/l;

34.7. The criteria for good ecological status of water bodies in the category of lakes are as follows:

34.7.1. average annual concentration of $N_{total} \leq 1.8$ mg/l;

34.7.2. average annual concentration of $P_{total} \leq 0.060$ mg/l.

Point pollution sources and loads

35. According to the data provided by the EPA, there were 203 wastewater dischargers on the territory of Lithuania emitting effluents to surface water bodies within the Lielupė RBD in 2009: 133 outlets were discharging wastewater to surface water bodies of the Mūša Sub-basin, 26 – to water bodies of the Lielupė Small Tributaries Sub-basin and 44 – to water bodies of the Nemunėlis Sub-basin. The number and designation (codes) of the dischargers within the Lielupė RBD are provided in Table 36 below.

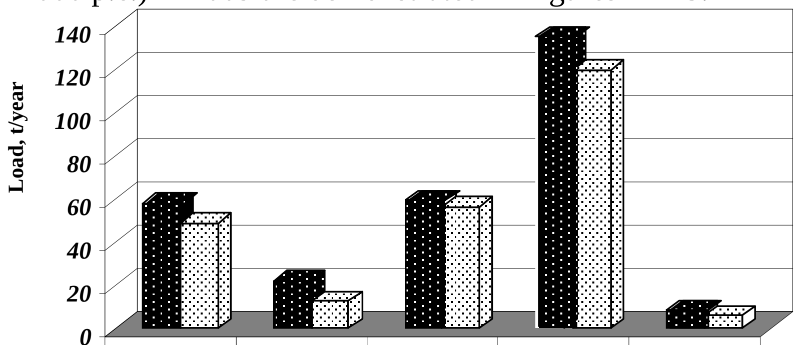
Table 36. Number of point pollution dischargers in the Lielupė RBD

Sub-basin	Total number of dischargers	of which the number of dischargers with the following designation (code)*						
		0	1	2	3	4	5	6
Lielupė RBD:								
Mūša Sub-basin	133	22	12	-	3	52	41	3
Lielupė Small Tributaries Sub-basin	26	4	3	-	-	16	-	3
Nemunėlis Sub-basin	44	15	2	-	5	15	6	1
TOTAL:	**203**	**41**	**17**	**0**	**8**	**83**	**47**	**7**

Source: EPA data (2009)
* Designation (codes) of the dischargers:
0 – Untreated effluents;
1 – Urban wastewater treatment plants (WWTP) (municipal services);
2 – WWTP which are included in the balance of industrial enterprises and which also treat urban wastewater;
3 – WWTP of industrial enterprises;
4 – WWTP in rural areas, except for WWTP of industrial enterprises;
5 – Surface runoff treatment facilities;
6 – Other WWTP.

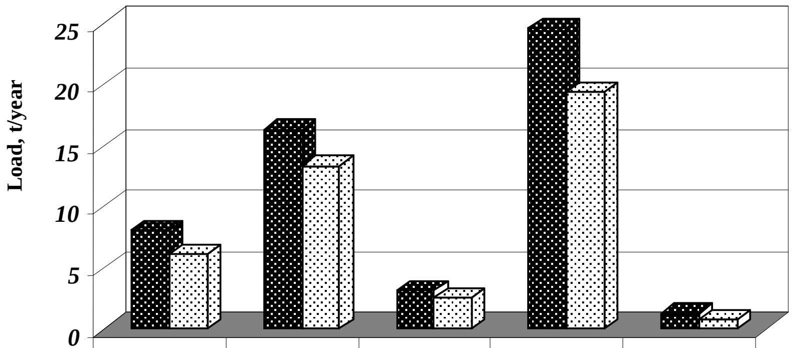
36. There are 12 agglomerations within the Lielupė RBD with a population equivalent (p.e.) of more than 2 000: 8 in the Mūša Sub-basin, 2 in the Nemunėlis Sub-basin and 2 in the Lielupė Small Tributaries Sub-basin. Šiauliai city, which is located in the Mūša Sub-basin, is an agglomeration with a p.e. of more than 100 000. Four agglomerations in the Mūša Sub-basin are classified as agglomerations with a p.e. from 10 000 to 100 000: Biržai, Kupiškis, Pasvalys and Radviliškis. Three towns, Pakruojis, Šeduva and Linkuva, are agglomerations with a p.e. from2 000 to 10 000. In the Lielupė Small Tributaries Sub-basin, there is one town (Joniškis) with a p.e. of more than 10 000 and one (Žagarė) with a p.e. from 2 000 to 10 000 p.e. Rokiškis town, which is located in the Nemunėlis Sub-basin, is an agglomeration with a p.e. of more than 10 000 and Juodupė is an agglomeration with a p.e. from 2 000 to 10 000 p.e.

Agglomerations having the load of more than 2 000 p.e. are the main source of point domestic pollution. Wastewater dischargers of the afore-mentioned towns emit the major part of household effluents into water bodies. The aggregate loads of pollution emitted into surface water bodies from towns and rural areas and pollution loads of large agglomerations (>2 000 p.e.) in 2009 are demonstrated in Figures 11-13.



	BOD7	NH4-N	NO3_N	TN	TP
■ Aggregate pollution loads from WWTP in urban and rural areas, t/year	58.3	22.5	59.75	135.6	8.4
■ Pollution loads from WWTP in agglomerations >2000 p.e., t/year	49.2	12.8	56.5	120	6.1

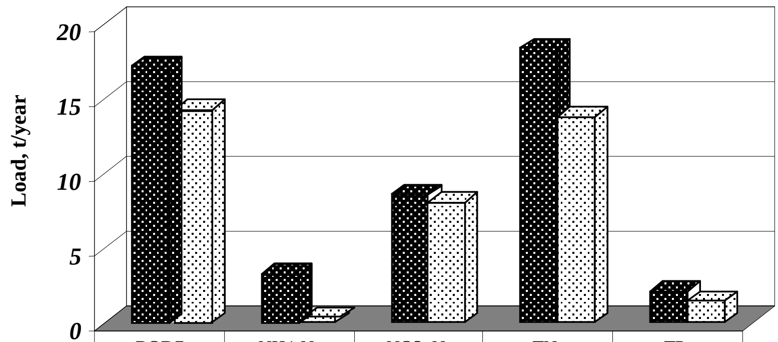
Figure 11. Aggregate pollution loads from WWTP in urban and rural areas and pollution loads in settlements with a p.e. > 2 000 in the Mūša Sub-basin
Source: EPA data (2009) and experts' estimations carried out to fill in data gaps



	BOD7	NH4-N	NO3_N	TN	TP
■ Aggregate pollution loads from WWTP in urban and rural areas, t/year	8.1	16.4	3.2	24.7	1.3
■ Pollution loads from WWTP in agglomerations >2000 p.e., t/year	6.15	13.4	2.6	19.4	0.8

Figure 12. Aggregate pollution loads from WWTP in urban and rural areas and pollution loads in settlements with a p.e. > 2 000 in the Lielupė Small Tributaries Sub-basin

Source: EPA data (2009) and experts' estimations carried out to fill in data gaps



	BOD7	NH4-N	NO3_N	TN	TP
■ Aggregate pollution loads from WWTP in urban and rural areas, t/year	17.2	3.3	8.6	18.4	2.14
■ Pollution loads from WWTP in agglomerations >2000 p.e., t/year	14.3	0.4	8.1	13.8	1.5

Figure 13. Aggregate pollution loads from WWTP in urban and rural areas and pollution loads in settlements with a p.e. > 2 000 in the Nemunėlis Sub-basin

Source: EPA data (2009) and experts' estimations carried out to fill in data gaps

37. The major share of urban industrial wastewater enters wastewater treatment plants together with municipal wastewater. However, a number of enterprises have their own wastewater treatment facilities wastewater from which is discharged directly into water bodies. There were 15 industrial wastewater outlets in the Lielupė RBD in 2009: 6 were located in the Mūša Sub-basin, 6 – in the Nemunėlis Sub-basin and 3 – in the Lielupė Small Tributaries Sub-basin. Industrial wastewater outlets in the Mūša Sub-basin emit discharges of four animal husbandry companies, one building organisation and one company engaged in social work activities. In the Nemunėlis Sub-basin, there are two industrial wastewater outlets of a diary products company as well as outlets of a fabric weaving company, a company which transports petroleum products via pipelines, a vehicle and equipment rental company, and a food products production company. One outlet of an agricultural company and two outlets of companies engaged in social work activities are located in the Lielupė Small Tributaries Sub-basin.

In 2009, about 1.5 tonnes of BOD_7, 0.9 tonne of ammonium nitrogen, 1.1 tonnes of nitrate nitrogen, 2.7 tonnes of total nitrogen and 0.2 tonne of total phosphorus were emitted from the industrial wastewater outlets to the water bodies in the Mūša Sub-basin. The amounts of pollutant emitted to the water bodies in the Nemunėlis Sub-basin in 2009 were as follows: 9.2 tonnes of BOD_7, 2.3 tonnes of ammonium nitrogen, 2.4 tonnes of nitrate nitrogen, 6.8 tonnes of total nitrogen and 2.3 tonnes of total phosphorus. The following amounts of pollutants were discharged to the Lielupė Small Tributaries Sub-basin: about 0.9 tonne of BOD_7, 0.6 tonnes of ammonium nitrogen, 0.9 tonne of nitrate nitrogen, 2.9 tonne of total nitrogen and 0.3 tonne of total phosphorus.

38. According to the EPA data (2009), there are 88 surface runoff outlets within the Lielupė RBD: 63 outlets emitting surface runoff to the Mūša Sub-basin, 21 – to the Nemunėlis Sub-basin and 4 – to the Lielupė Small Tributaries Sub-basin. The said outlets mainly discharge surface runoff collected from the most polluted industrial territories. It is estimated that the annual amount of pollutants which enter water bodies within the Mūša Sub-basin with surface runoff totals to about 4.9 tonnes of BOD_7, 5.6 tonnes of total nitrogen and 1.2 tonnes of total phosphorus. The amounts entering water bodies in the Lielupė Small Tributaries Sub-basin are estimated at about 0.9 tonne of BOD_7, 1.2 tonnes of total nitrogen and 0.06 tonne of total phosphorus, and those discharged to the Lielupė Small Tributaries Sub-basin are as follows: approximately 12.3 tonnes of BOD_7, 8.3 tonnes of total nitrogen and 1.3 tonnes of total phosphorus.

39. The pollution loads discharged from municipal and industrial wastewater and surface runoff outlets are summarised in Table 41, and their percentage distribution is demonstrated in Figures 14 to 16.

40. Following the summary data on point pollution loads, the major part of all point pollution loads of BOD_7 enters the water bodies in the Mūša Sub-basin and Lielupė Small Tributaries Sub-basin with municipal wastewater (i.e. 90% of the loads in the Mūša and 82% in the small tributaries of the Lielupė). Meanwhile in the Nemunėlis Sub-basin, domestic wastewater accounts for only about 42% of the total point pollution load of BOD_7. As much as 32% of the said pollutant may be entering the water bodies with surface (stormwater) runoff. The number of outlets discharging surface wastewater in the Nemunėlis Sub-basin totals to 21 and the number of those emitting household wastewater is 17. Such significant loads discharged from surface runoff outlets are explained by the fact that the pollution level of surface runoff discharges is much higher than that of household and domestic (i.e. municipal) wastewater. The major part of point pollution loads of total nitrogen in the Mūša Sub-basin and Lielupė Small Tributaries Sub-basin is discharged from municipal wastewater outlets: 94% in the Mūša Sub-basin and 86% in the Lielupė Small Tributaries Sub-basin. The share of total phosphorus loads discharged with municipal wastewater is a little lower: 86% in the Mūša Sub-basin and 78% in the Lielupė Small Tributaries Sub-basin. The loads of total nitrogen and total phosphorus discharged with municipal wastewater in the Nemunėlis Sub-basin account for respectively 55% and 37% of the total loads

Table 37. Point pollution loads from different pollution sources in the Lielupė RBD (data of 2009)

Basin/sub-basin	BOD_7, t/year			N_{total}, t/year			P_{total}, t/year		
	Domestic WW	Industrial WW	Surface runoff	Domestic WW	Industrial WW	Surface runoff	Domestic WW	Industrial WW	Surface runoff
Mūša	58.3	1.5	4.9	135.6	2.7	5.6	8.4	0.2	1.2
Lielupė	8.1	0.9	0.9	24.7	2.9	1.2	1.3	0.3	0.06
Nemunėlis	17.2	9.2	12.3	18.4	6.8	8.3	2.14	2.3	1.3

Source: EPA data (2009) and experts' estimations carried out to fill in data gaps

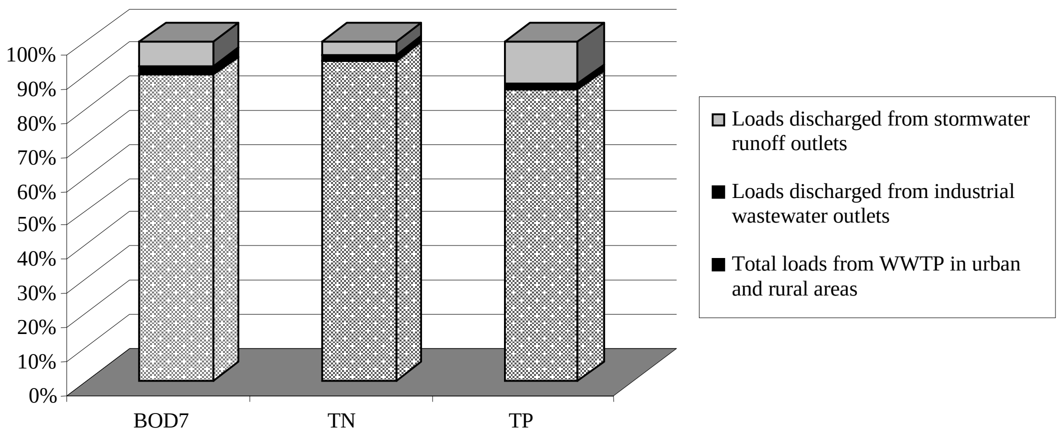


Figure 14. Distribution of pollution loads discharged to water bodies in the Mūša Sub-basin from outlets of municipal and industrial wastewater and surface runoff
Source: EPA data (2009) and experts' estimations carried out to fill in data gaps

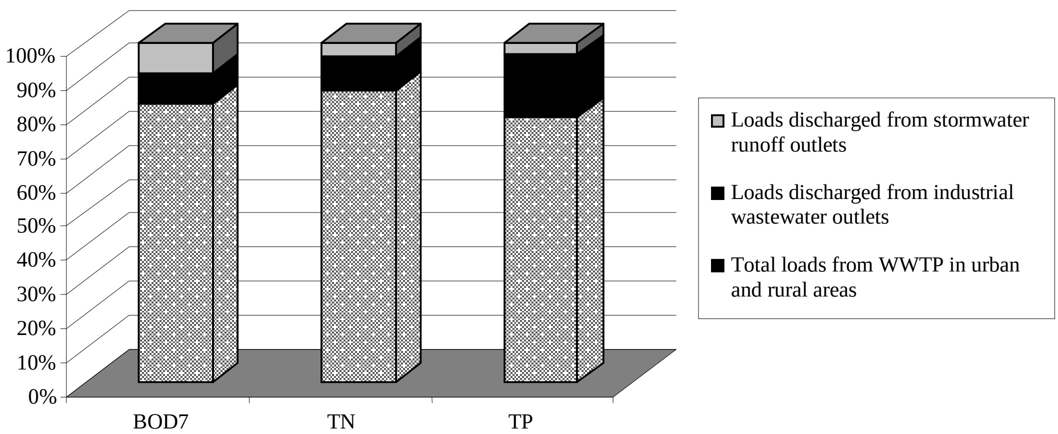


Figure 15. Distribution of pollution loads discharged to water bodies in the Lielupė Small Tributaries Sub-basin from outlets of municipal and industrial wastewater and surface runoff
Source: EPA data (2009) and experts' estimations carried out to fill in data gaps

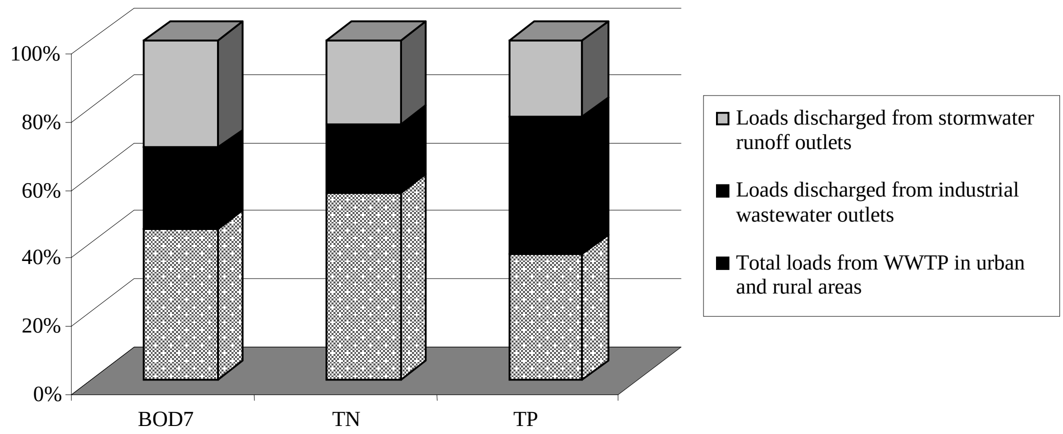


Figure 16. Distribution of pollution loads discharged to water bodies in the Nemunėlis Sub-basin from outlets of municipal and industrial wastewater and surface runoff
Source: EPA data (2009) and experts' estimations carried out to fill in data gaps

Impacts of point pollution sources

41. Rivers within the Lielupė RBD are characterised by low flow (5-6 $l/s/km^2$, in summer time – as low as 0.5 $l/s/km^2$), therefore they are especially sensitive to point pollution. Also, almost all larger towns in this region discharge their wastewater to small rivers with very low accumulation capacities. Despite significantly increased efficiency of wastewater treatment facilities of larger towns, pollution from many major point pollution sources, i.e. agglomerations with a p.e. of more than 2 000, exerts a significant impact on the quality of the receiving water bodies due to poor pollution dilution capacities.

Mūša Sub-basin

The major source of point pollution in this sub-basin is Šiauliai WWTP. Though the efficiency of these treatment facilities has been fairly high and pollutant concentrations in discharges – quite low, the concentrations of total phosphorus and ammonium nitrogen in the Kulpė River may still be exceeding the allowable limits during individual seasons because of low pollution dilution capacities of this river. Also, the Kulpė may be significantly affected by surface (stormwater) runoff.

Mathematical modelling results indicate that there is one more river, the Vijolė, which may be failing the good ecological status requirements by the concentrations of ammonium nitrogen and total phosphorus because of surface (stormwater) pollution loads.

Estimations show that the rivers Šiladis may be facing water quality problems due to Kairiai WWTP which discharges wastewater in the upper reaches of the river and hence failing the good ecological status requirements by the concentrations of ammonium nitrogen and total phosphorus. The water quality problems in the Šiladis are mainly determined by the said discharges in the upper reaches where pollution dilution capacities of the river are too low. The same reason, poor pollution dilution capacities, may also be determining failure of the Vėzgė River to meet the good ecological status requirements by ammonium nitrogen. The three major pollution sources of the Vėzgė are the outlets of the settlements Aukštelkai and Kalnelio Gražioniai and of the agricultural company ŽŪB Gražionių bekonas. All of them discharge effluents in the upper reaches of the river.

Mathematical modelling results indicate that the Daugyvenė River may be significantly affected by pollution from the dischargers of Šeduva WWTP, the company UAB Agrochemos mažmena and Šeduva agrarian centre. As a result, the river may be failing the good ecological status requirements by the concentrations of ammonium nitrogen and total phosphorus.

Despite of a new wastewater treatment plant in conformity to all wastewater treatment requirements recently constructed Radviliškis, measurements performed by the water company UAB Radviliškio vanduo in 2009-2010 indicates significant exceedances of the limit concentrations of BOD_7, ammonium nitrogen and total phosphorus in the Obelis and so the river fails the good ecological status requirements. It is important to note that the high concentrations of he polluting substances have been registered not only downstream but also upstream of the WWTP discharger. This shows that the river is polluted by non-sewered population. Estimations also indicate that the pollution of the Obelė may be determining failure to meet the good ecological status requirements by total phosphorus in the Kruoja River.

For a long time, the main source of pollution determining water quality problems in the Tatula River used to be Biržai WWTP. Today, the level of wastewater treatment in Biržai wastewater treatment facilities is very high so this discharger no longer causes any water quality problems. Nevertheless, estimations indicate that the Tatula continues suffering from a significant impact of point pollution and may be failing the good ecological status requirements by ammonium nitrogen and total phosphorus because of pollution transported by the Vabala River from Vabalninkai WWTP.

Nemunėlis Sub-basin

Rokiškis WWTP has recently undergone reconstruction, which has ensured conformity of discharges with the requirements of Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment (OJ 2004 special edition, Chapter 15, Volume 10 p. 26) (Urban Wastewater Treatment Directive). However, mathematical modelling results indicate that this has not been sufficient to achieve good ecological status of the receiving water body, the Laukupė River, which may be still failing the good ecological status requirements by BOD_7 and total phosphorus. Concentrations of ammonium nitrogen in the river may be close or slightly exceed the ecological status limit. On the other hand, it should be noted that the modelling results showed that the pollution of the river may be determined not only by the loads emitted from Rokiškis WWTP but also by surface runoff. Pollution of surface runoff may be also exerting a significant impact on the stretch of the Nemunėlis in the upper reaches at Rokiškis town, where concentrations of BOD_7 may be failing the good ecological status requirements due to a large volume of surface runoff.

Lielupė Small Tributaries Sub-basin

The reconstruction of Joniškis WWTP was completed in 2009 and resulted in considerable reduction of nitrogen compounds in wastewater discharged to the Sidabra. However, an analysis of the current situation showed that the Sidabra continues facing pollution problems even after having achieved a high level of treatment of wastewater in Joniškis WWTP, because a certain amount of wastewater of non-sewered population enters the natural environment, i.e. the Sidabra, instead of the wastewater treatment facilities. Hence concentrations of ammonium nitrogen and total phosphorus in this river may still be exceeding the good ecological status requirements.

Estimations show that point pollution may be exerting a significant impact on the quality of the Beržtalis River. If the present loads of Žeimelis town persist in future, the river may be failing the good ecological status requirements by total phosphorus.

Diffuse pollution sources and loads

42. Analyses results show that diffuse agricultural pollution at present is one of the major factors determining a significant impact on the quality of water bodies in the Lielupė RBD. Diffuse agricultural pollution is one of main sources of pollution with nitrate nitrogen. The degree of impact of agriculture on water bodies in the RBD varies, largely depending on the intensity of agricultural activities. Diffuse agricultural pollution consists of loads of organic matter, nitrogen and phosphorus compounds which enter the soil with animal manure and mineral fertilisers.

42.1. Information about the land use within the Lielupė RBD is provided in Table 38. The information on the areas of built, nature and agricultural territories was estimated using the CORINE land cover database. The data on the declared agricultural land was obtained from the National Paying Agency. Since now a large number of farmers declare their crop areas, the area of the declared agricultural land is expected to reflect the area of currently cultivated land.

Cultivated agricultural land in the Mūša Sub-basin constitutes about 53%, in the Nemunėlis Sub-basin – about 48%, and in the Lielupė Small Tributaries Sub-basin – as much as 70% of the total area of the respective sub-basins. Arable land occupies the major part of the total agricultural land in all sub-basins. The share of arable land in the Nemunėlis Sub-basin totals to approximately 60%, in the Mūša Sub-basin – to around 73% and in the Lielupė Small Tributaries Sub-basin – to as much as 87% of the total declared agricultural land. Grasslands and pastures make up 23%, 40% and 13% of the total declared agricultural land in the Mūša Sub-basin, Nemunėlis Sub-basin and the Lielupė Small Tributaries Sub-basin, respectively.

Table 38. Land use in the Lielupė RBD

Basin	Area, km^2	Built areas, km^2	Nature areas, km^2	Agricultural areas, km^2	Declared agricultural land, km^2		
					Total area, km^2	Area of arable land, km^2	Area of grassland and pastures, km^2
Mūša	5 296.4	203.2	1242	3771.5	2 815.5	2 059.3	756.2
Lielupė Small Tributaries	1 750.75	56.9	285.2	1401	1228	1073	155
Nemunėlis	1 900.6	42.1	655.4	1177.6	905.4	532.6	372.8
Total:	**8 947.75**	**302.2**	**2182.6**	**6350.1**	**4948.9**	**3664.9**	**1284**

Source: CORINE data of 2006 and data on declared crop areas for 2008 provided by the National Paying Agency (NPA)

42.2. Intensity of agriculture in the Mūša Sub-basin and Lielupė Small Tributaries Sub-basins of the Lielupė RBD is one of the highest in the country. The number of livestock units (LSU) for the total area of the basin is 0.16 LSU/ha in the Lielupė Small Tributaries Sub-basin and 0.14 LSU/ha in the Mūša Sub-basin. The LSU number in the Nemunėlis Sub-basin is a little lower and totals to about 0.1 LSU/ha. Agricultural land in the Lielupė Small Tributaries Sub-basin makes up as much as 70% of the total area of the sub-basin. Agricultural utilised land in the Mūša Sub-basin and Nemunėlis Sub-basin constitute respectively 53% and 48% of the areas of their sub-basins.

Loads which enter the soil with animal manure are calculated taking into account the number of LSU and assuming that one LSU produces 546 kg of BOD_7, 100 kg of N_{total} and 17 P_{total} per year. The total number of LSU and the number of LSU kept on farms of different size within the Lielupė RBD is provided in Table 39 below.

Table 39. Total number of LSU in the Lielupė RBD and the number of LSU on farms of different size

RBD	Basin	LSU	LSU on farms with more than 300 LSU	LSU on farms with 10 to 300 LSU	LSU on farms with up to 10 LSU
Lielupė	Lielupė Small Tributaries	27 305.21	12 160.24	3 755.63	11 389.34
Lielupė	Mūša	76 257.40	22 600.91	19 674.73	33 981.76
Lielupė	Nemunėlis	19 621.75	690.44	8 288.57	10 642.74
Total in Lielupė RBD:		**12 3184.4**	**35 451.59**	**31 718.93**	**56 013.84**

Source: 2008 animal inventory data provided by the Agri-Information and Rural Business Centre

The annual input of BOD_7 into the soil with animal manure in the Lielupė Small Tributaries Sub-basin is estimated to be 85.16 kg/ha and the inputs of total nitrogen and total phosphorus – 15.6 kg/ha and 2.65 kg/ha respectively. The loads entering the soil with animal manure in the Mūša Sub-basin are approximately 79 kg/ha of BOD_7, 14.4 kg/ha of total nitrogen and 2.45 kg/ha of total phosphorus, and those in the Nemunėlis Sub-basin are 56.33 kg/ha of BOD_7, 10.32 kg/ha of total nitrogen and 1.75 kg/ha of total phosphorus.

Table 40. Livestock pollution loads in Lielupė RBD

RBD	Sub-basin	BOD_7		Total nitrogen		Total phosphorus	
		t/year	kg/ha	t/year	kg/ha	t/year	kg/ha
Lielupė	Lielupė Small Tributaries	14 908.64	85.16	2 730.52	15.60	464.19	2.65
Lielupė	Mūša	41 636.54	78.61	7 625.74	14.40	1 296.38	2.45
Lielupė	Nemunėlis	10 713.48	56.33	1 962.18	10.32	333.57	1.75
Total in Lielupė RBD:		**67 258.66**		**12 318.44**		**2 094.14**	

Source: experts' estimations carried out taking into account the estimated number of LSU in the basins

Since no actual data on the use of mineral fertilisers in Lithuania is available at the moment, an analysis of the structure of agricultural utilised land was carried out and the most appropriate crop fertilisation norms recommended by specialists of agriculture were considered. Estimations of the demand of fertilisers for crops also took into account the amount of nutrients generated with animal manure.

The estimated demand of mineral fertilisers in the Lielupė RBD is provided in Table 41.

Table 41. Demand of mineral fertilisers estimated taking into account the crop structure

RBD	Basin	Mineral nitrogen fertilisers		Mineral phosphorus fertilisers	
		t/year	kg/ha	t/year	kg/ha
Lielupė	Lielupė Small Tributaries	9 272.74	53.0	2 087.14	11.9
Lielupė	Mūša	17 955.48	33.9	3 795.21	7.2
Lielupė	Nemunėlis	4 924.40	25.9	939.18	4.9
Total in Lielupė RBD:		**32 152.62**	**35.9**	**6 821.53**	**7.6**

Source: experts' estimations carried out taking into account the crop structure and the recommended most appropriate fertilisation norm

The summarised agricultural pollution loads within the Lielupė RBD are demonstrated in Figures 17 to 19.

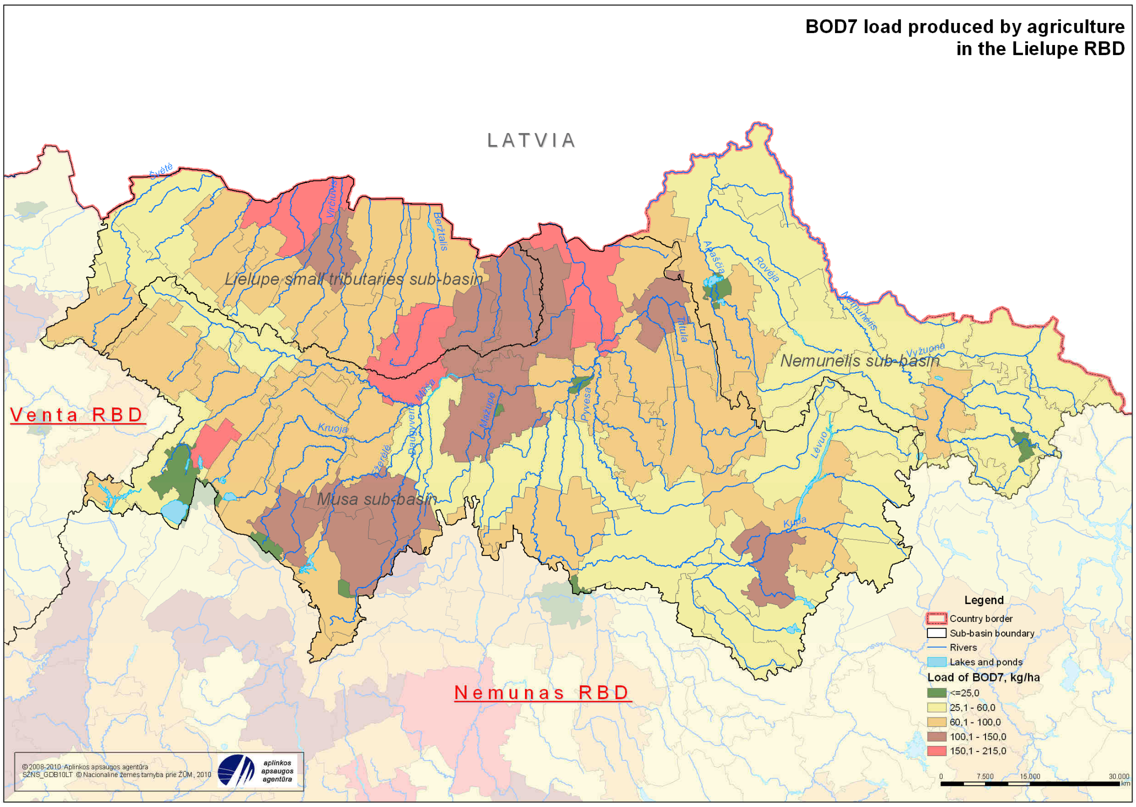


Figure 17. BOD_7 loads generated in agriculture in wards of the Lielupė RBD

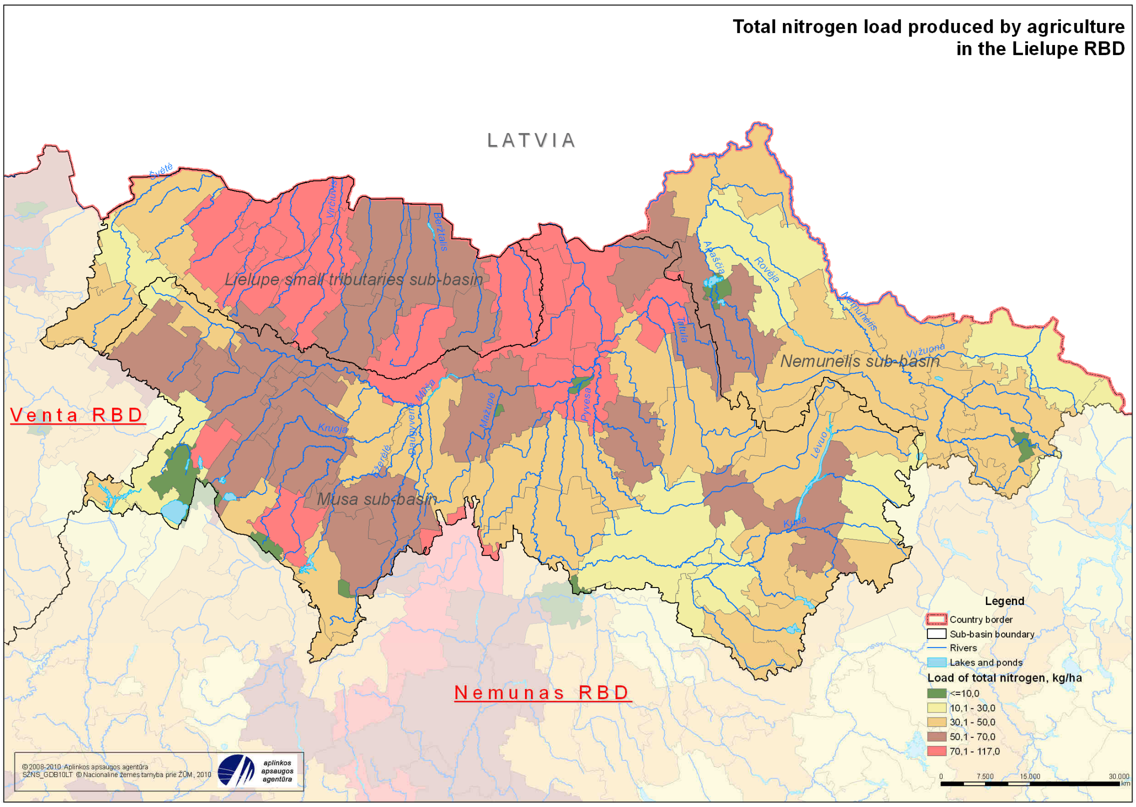


Figure 18. Total nitrogen loads generated in agriculture in wards of the Lielupė RBD

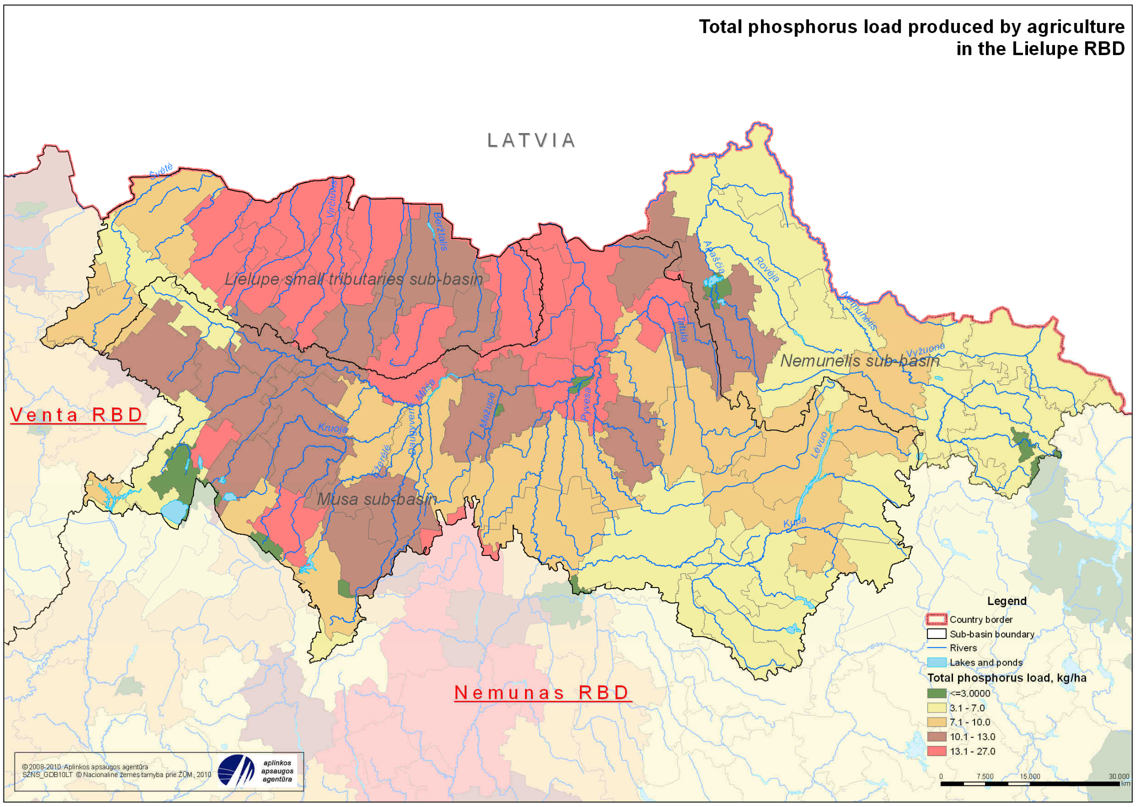


Figure 19. Total phosphorus loads generated in agriculture in wards of the Lielupė RBD

42.3. Inhabitants whose sewerage is not collected and diverted to sewerage networks. As a result, pollution from these toilets as diffuse pollution can be transported with surface runoff to water bodies. According to the information provided by municipalities, there are 141 734 people whose sewerage is not centrally collected in settlements with more than 100 inhabitants within the Lielupė RBD, which accounts for about 40% of the total number of the population. No data on smaller settlements is available at the moment. The number of non-sewered population in the Lielupė RBD is provided in Table 42 below.

Table 42. Total number of inhabitants and the number of non-sewered inhabitants in settlements with population of more than 100 in the Lielupė RBD

Sub-basin	Total number of inhabitants in settlements with population of more than 100	Number of non-sewered inhabitants in settlements with population of more than 100
Mūša	263 632	94 228
Lielupė Small Tributaries	38 109	26 712
Nemunėlis	50 253	20 794
TOTAL:	**351 994**	**141 734**

Source: information provided by municipalities (2007)

Diffuse pollution loads entering the soil from different diffuse pollution sources are summarised in Table 43 below. The table data demonstrates that pollution by non-sewered population accounts for a minor share of diffuse pollution. The main source of diffuse pollution is agriculture. It is estimated that up to 30% of diffuse total nitrogen and total phosphorus loads may be entering water bodies within the Lielupė RBD with animal manure. However, this figure may be not precise because the exact amounts of mineral fertilisers used are not available.

Table 43. Diffuse pollution loads from different pollution sources in the Lielupė RBD

Sub-basin	BOD_7, t/year			Total nitrogen, t/year			Total phosphorus, t/year		
	Manure	Mineral fertilis.	Population	Manure	Mineral fertilis.	Population	Manure	Mineral fertilis.	Population
Lielupė	14 909	-	683.8	2 730.5	9 273	117.5	464.2	2087.1	24.04
Mūša	41 637	-	2 412.2	7625.7	17 955	414.6	1 296.4	3 795.2	84.8
Nemunėlis	10 713	-	532.3	1 962.2	4 924	91.5	333.6	939.2	18.7

Source: experts' estimations carried out taking into account the LSU number and crop structure in the sub-basins

A significant share of diffuse pollution loads which enter the soil is caught or decomposes hence the pollution input in rivers is much lower than the one in the soil. Following mathematical modelling results, the annual diffuse pollution loads transported with the Mūša River are estimated at about 336.2 tonnes of BOD_7, 52 tonnes of ammonium nitrogen, 3 526 tonnes of nitrate nitrogen and 24 tonnes of total phosphorus. The loads transported with the small tributaries of the Lielupė total to 90 tonnes of BOD_7, 38 tonnes of ammonium nitrogen, 2 035 tonnes of nitrate nitrogen and 10 tonnes of total phosphorus. The annual diffuse pollution loads transported with the Nemunėlis within Lithuania is estimated at about 70 tonnes of BOD_7, 11 tonnes of ammonium nitrogen, 678 tonnes of nitrate nitrogen and 7 tonnes of total phosphorus.

Impact of diffuse pollution sources

43. Mathematical modelling methods were engaged to assess the impact of diffuse pollution sources on water bodies.

43.1. There are 12 large animal husbandry companies with more than 400 LSU in the Lielupė RBD. The amount of BOD_7 in the liquid fraction of organic fertilisers (OF) totals to 6 000-9 000 mgO_2/l, the amount of total nitrogen is 1 000-1 400 mg/l, total phosphorus – 200-300 mg/l, potassium – 400-600 mg/l, dry matter – up to 10 g/l.

The available scarce data indicates a significant impact of animal husbandry complexes during different periods. However, the annual average concentrations of transported pollutants usually do not exceed the allowable limits. The surplus of substances in drainage water is determined by fertilisation norms and plant vegetation phases which condition changes in the element balance in the soil, which is verified by analysis data from fields fertilised with liquid organic fertilisers in the Mūša River Basin.

The annual amount of slurry applied on the area of 200 ha by the joint-stock company AB Sidabra (Lielupė RBD, Mūša Sub-basin, Joniškis district, Satkūnai ward, LSU=3 980) totals to 900 m^3. It has established that the amount of organic substances in the drainage runoff from fields where slurry is applied increases nine times, the amount of total phosphorus increased eleven times and that of potassium – five times as compared to the conditions before the fertilisation. No significant changes in the amounts of total nitrogen and chlorine have been registered, but the concentrations of suspended matter increase two to eight times. The approximate resulting increased concentrations are as follows: BOD_7 – 25 mgO_2/l, total phosphorus – 0.95 mg/l, total nitrogen – 56 mg/l, potassium – 26 mg/l, chlorine – 74 mg/l, suspended matter – 82 mg/l. Concentrations of organic matter and total nitrogen go down during an intensive plant vegetation period. However, although concentrations of certain elements are high during various periods, their average concentrations do not exceed the allowable ones, as indicated by the measurements of the whole season. The only substance concentrations of which are higher than the established norm is total nitrogen. The average concentration of suspended matter during the slurry application seasons (April through November) is 42 mg/l, BOD_7 – 6 mg/l, total nitrogen – 39 mg/l, total phosphorus – 0.55 mg/l, potassium – 13 mg/l, chlorine – 60 mg/l. The allowable average annual concentrations of pollutants in the water of drainage systems of fields where liquid organic fertilisers are applied are as follows: BDS_5 – 20 mgO_2/l (BDS_7 – 23 mgO_2/ltotal phosphorus – 2 mg/l, total nitrogen – 15 mg/l, ammonium nitrogen – 5 mg/l, nitrite nitrogen – 0.3 mg/l, and the annual input of total nitrogen in the soil may not exceed 170 kg/ha (as specified in the Environmental Requirements for Manure and Slurry Management approved by Order No. D1-367 / 3D-342 of the Minister of Environment of the Republic of Lithuania and the Minister of Agriculture of the Republic of Lithuania of 14 July 2005 (Žin., 2005, No. 92-3434; 2010, No. 85-4492). The above-given pollutant concentrations were registered at the time when the amount of total nitrogen in the fields of the company AB Sidabra was 594/ha. This is the main reason of the surplus nitrogen amount in the drainage water indicating the necessity to observe the established fertilisation normative standards. When these standards are followed, concentrations do not exceed the allowable limits.

Concentrations of NH_4-N, nitrite and total nitrogen, phosphate phosphorus and total phosphorus in the drainage runoff from the agricultural fields of the company ŽŪB Bariūnai (Lielupė RBD, Mūša Sub-basin, Joniškis district, Saugėlaukis ward, LSU=820), where large amounts of organic fertilisers are spread, in 2008–2010 were respectively 3.3, 1.5, 10 and 3.5 times higher than in other areas (data of the Water Management Institute). Cases have been registered when the amounts of PO_4-P differed as many as 55 to 390 times, the amounts of NH_4-N differed 62 times, those of NO_3-N – 16 times and of total phosphorus – 34 times. Individual concentrations of phosphate phosphorus in the drainage runoff from intensively fertilised fields were as high as 7.56 mg/l, concentrations of total phosphorus were 9.3 mg/l and those of nitrate nitrogen, ammonia nitrogen and total nitrogen – respectively 78.0, 17.0 and 82.0 mg/l. These amounts exceed the allowable limits many times. On the other hand, however, the average annual concentrations do not indicate any significant impact of the animal husbandry complex on the amounts of substances transported with drainage runoff. The average annual concentrations of NH_4-N, NO_3-N, N_{total}, PO_4-P and P_{total} are respectively 3.7, 4.9, 12.6, 0.79 and 1.15 mg/l and as such do not exceed the maximum allowable concentrations according to the above-said requirements.

The average annual leaching of nitrogen and phosphorus compounds transferred with drainage runoff estimated on the basis of the available information on the number of LSU held on the animal husbandry farms in the Lielupė RBD and the area of the application of organic fertilisers is provided in Table 44 below.

Table 44. Annual leaching of nitrogen and phosphorus compounds transferred with drainage runoff in areas of animal husbandry companies

Sub-basin	Company	LSU, units	Area of application of organic fertilisers, ha	Annual leaching with drainage runoff, kg	
				N_{total}	P_{total}
Mūša	ŽŪB Bariūnai	905	2 208.61	8 409	240
Mūša	UAB Kupiškio Akmenlita	1260	160	767	15
Mūša	ŽŪB Mūša	679	1 253	4 775	136
Mūša	ŽŪK Mikoliškio paukštynas	2360	200	983	19
Mūša	Kalpokų ŽŪB	850	2 378	9 039	259
Mūša	UAB Saerimner	3036	0	-	-
Mūša	ŽŪB Vaškai	567	1 600	7 307	145

Sub-basin	Company	LSU, units	Area of application of organic fertilisers, ha	Annual leaching with drainage runoff, kg	
				N_{total}	P_{total}
Mūša	ŽŪB Ginkūnų paukštynas	418	1 05.2	5 726	164
Mūša	Lygumų ŽŪB	823	4 597.17	1 7476	500
Mūša	Žvirblonių ŽŪB	700	2 521	9 590	274
Mūša	Žeimelio ŽŪB	888,86	2 503	9 526	272
Mūša	UAB Sidabra	3980	200	859	22

Source: experts' estimations

Estimations of the average annual volume of leaching with drainage runoff from areas where OF are spread show that the average annual concentrations of total nitrogen and total phosphorus in drainage water should not be exerting any significant impact on the water quality. However, the assessment of leaching with drainage from animal husbandry areas should not be based on the annual average concentrations as it is done now; instead, pollutant concentrations should be measured and assessed in samples taken immediately after the OF application.

43.2. Agriculture is a significant factor determining river water quality (especially in the Lielupė Small Tributaries Sub-basin and Mūša Sub-basin) within the Lielupė Small Tributaries Sub-basin because of high intensity of agriculture and unfavourable hydrological conditions (low river flow). Agricultural pollution result in high concentrations of nitrate nitrogen in rivers failing the good ecological status criteria. However, no significant effect of agricultural pollution has been noticed on concentrations of $BODS_7$ and total phosphorus.

Preliminary analysis results show that concentrations of nitrate nitrogen fail good ecological status criteria due to agricultural pollution in all rivers of the Lielupė Small Tributaries Sub-basin: the concentrations, which are about 4-6 mg/l, exceed the good ecological status requirements (2.3 mg/l) two and more times. Concentrations of nitrate nitrogen in the Mūša Sub-basin are lower (3-4 mg/l) but still fail the good ecological status requirements. The impact of diffuse pollution is less significant in the Nemunėlis Sub-basin, where concentrations of nitrate nitrogen may be failing the good ecological status requirements only in one river – the Apaščia, but even here they are close to the limit value of good ecological status. The exceedance of the allowable concentrations of nitrate nitrogen in the rivers Laukupė and Nemunėlis in the Nemunėlis Sub-basin may be determined by the aggregate impact of point and diffuse pollution.

43.3. Mathematical modelling results show that pollution of non-sewered population does not have any major impact on the quality of water bodies. These loads account for only up to 2% of the total amount of pollutants which enter the water bodies within the Lielupė RBD.

44. A list of rivers suffering from a significant impact of point and diffuse pollution ("1" indicates a significant impact) within the Lielupė RBD is provided in Table 45.

Table 45. A summary list of rivers suffering from a significant impact within the Lielupė RBD ("1" indicates a significant impact)

Sub-basin	River	Number of water bodies	Parameter which determines the designation of the river as a water body at risk					Major pollution sources
			BOD_7	NH_4-N	NO_3-N	P_{total}	Hazardous substances	
Mūša	Kulpė	3	0	1	1	1	0	Šiauliai WWTP Šiauliai surface (stormwater) runoff Agriculture (NO_3-N)
Mūša	Vijolė	1	0	1	1	1	0	Šiauliai surface (stormwater) runoff Agriculture (NO_3-N)
Mūša	Šiladis	1	0	1	1	1	0	Kairiai WWTP Agriculture (NO_3-N)
Mūša	Vėzgė	1	0	1	1	0	0	Aukštelkai WWTP K. Gražionys WWTP ŽŪB Gražionių bekonas Agriculture (NO_3-N)
Mūša	Daugyvenė	2	0	1	1	1	0	Šeduva WWTP UAB Agrochemos mažmena Agriculture (NO_3-N)
Mūša	Obelė	2	1	1	1	1	0	Radviliškis WWTP Pollution by non-sewered households
Mūša	Kruoja	1	0	0	1	1	0	Tributary Obelė Pakruojis surface (stormwater) runoff Agriculture (NO_3-N)
Mūša	Tatula	1	0	1	1	1	0	Vabalninkas WWTP Agriculture (NO_3-N)
Mūša	All other rivers	62	0	0	1	0	0	Agriculture
Nemunėlis	Laukupė	1	1	1	1	1	0	Rokiškis WWTP Rokiškis surface (stormwater)

Sub-basin	River	Number of water bodies	Parameter which determines the designation of the river as a water body at risk					Major pollution sources
			BOD_7	NH_4-N	NO_3-N	P_{total}	Hazardous substances	
								runoff
								Agriculture (NO_3-N)
Nemunėlis	Nemunėlis	2	1	0	1	1	0	Rokiškis surface (stormwater) runoff
								Tributary Laukupė
								Agriculture (NO_3-N)
Nemunėlis	Agluona	2	0	0	1	0	0	Agriculture
Lielupė Small Tributaries	Sidabra	1	0	1	1	1	0	Joniškis WWTP
								Pollution by non-sewered households
								Agriculture (NO_3-N)
Lielupė Small Tributaries	Beržtalis	1	0	0	1	1	0	Žeimelis WWTP
								Agriculture (NO_3-N)
Lielupė Small Tributaries	All other rivers	20	0	0	1	0	0	Agriculture

Source experts' analysis results

Background pollution loads

45. Mathematical modelling results demonstrated that the annual background pollution load transported by rivers within the Lielupė RBD may be around 1 330 tonnes of BOD_7, 16 tonnes of ammonium nitrogen, 595 tonnes of nitrate nitrogen, and 26 tonnes of total phosphorus. The share of the background pollution accounts for about 70% of the total load of BOD_7, 11% of ammonium nitrogen, 9% of nitrate nitrogen, and 34% of total phosphorus transported by rivers.

Transboundary pollution

46. Lielupė RBD is a transboundary river basin district hence a relevant issue here is transboundary pollution. Pollution loads generated on the territory of Lithuania are transported to Latvia by the rivers Mūša, Nemunėlis and small tributaries of the Lielupė. The average annual amounts transported from Lithuania to the neighbouring country are estimated at about 1 905 tonnes of BOD_7, 142 tonnes of ammonium nitrogen, 6 882 tonnes of nitrate nitrogen and 77 tonnes of total phosphorus.

The ecological status and ecological potential of rivers which belong to the Lielupė RBD and which flow out from Lithuania to Latvia is deemed to be moderate or poor. The main reason is high concentrations of nitrate nitrogen due to a significant impact of diffuse agricultural pollution. Pollution in Lithuania prevents achievement of good ecological status and good ecological potential in rivers situated on the territory of Latvia, where many rivers of the Lielupė RBD are considered to be at poor or even bad ecological status and potential. It has been established that only 9% of all river water bodies in the Lithuanian part of the Lielupė RBD meet the good ecological status and good ecological potential requirements and the share of those in Latvia is 13%. Diffuse agricultural pollution is an urgent problem in both Lithuania and Latvia hence the countries are planning to implement supplementary measures to reduce this type of pollution.

Significant impact of river straightening

47. Besides pollution loads, the ecological status of rivers can also be significantly affected by morphological changes. Rivers are first of all affected by the straightening of their beds because specific habitats of aquatic organisms are destroyed and hence species variety and abundance of aquatic organisms is reduced.

Morphological changes were assessed using the criterion K_3:

$$K_3 = \frac{\sum L_{reg}}{L_u}$$

where ΣL_{reg} is the aggregate length of regulated river stretches, km; L_u is the total length of the river.

When $K_3 \leq 20\%$, morphological changes in the river bed are minimum, and anthropogenic transformations do not have any significant impact thereon. When this value is exceeded by up to 10%, morphological changes are assumed to be small; when the exceedance is up to 30% – changes are medium; when 30-100% – changes are significant; and when the value is exceeded by more than 100% – morphological changes are considered to be very significant.

The criterion K_3 was used to identify water bodies (river stretches) at risk or HMWB due to the impact of bed straightening. When a straightened stretch is shorter than 30% of the total length of the water body of a certain type and its length is less than 3 km (river stretches shorter than 3 km the characteristics of which differ from the neighbouring stretches are not considered to be separate water bodies and they are assigned to the neighbouring water bodies), the impact of straightening was deemed to be insignificant and such stretch was not identified as a separate water body at risk or a HMWB due to morphological changes. When these criteria were exceeded, the impact was considered to be significant.

Straightened rivers with a low slope (<1.5 m/km) flowing over urbanised areas were assigned to HMWB. Straightened rivers with a low slope (<1.5 m/km) which are not flowing over urbanised areas and straightened rivers which flow over hilly areas (slope >1.5 m/km) were assigned to water bodies at risk.

It was established that river straightening has a significant impact on the ecological status of six water bodies in the category of rivers with the total length of 59 km. One of these water bodies, a stretch of the Nikajus with a length of 12 km, flows over an urbanised area and hence is assigned to HMWB. Other five water bodies (47 km) were identified as water bodies at risk because of the straightening impact.

The length of river stretches designated as HMWB and water bodies at risk due to a significant impact of straightening and the number of the designated water bodies is given in Table 46.

Table 46. Length of river stretches suffering from a significant impact of straightening and number of water bodies

Sub-basin	Length of straightened river beds, km	Length of rivers designated as HMWB due to straightening, km	Number of rivers designated as HMWB due to straightening	Length of rivers designated as WB at risk due to straightening in flat areas, km	Number of rivers designated as WB at risk due to straightening in flat areas	Length of rivers designated as WB at risk due to straightening in hilly areas, km	Number of rivers designated as WB at risk due to straightening in hilly areas
Lielupė Small Tributaries Sub-basin	373.95	239.7	11	65.15	4	69.1	5
Mūša	733.1	401.25	20	239.9	15	91.95	8
Nemunėlis	214.2	61	2	106.7	7	46.5	4
Total in Lielupė RBD:	**1 321.25**	**701.95**	**33**	**411.75**	**26**	**207.55**	**17**

Source: experts’ analysis results

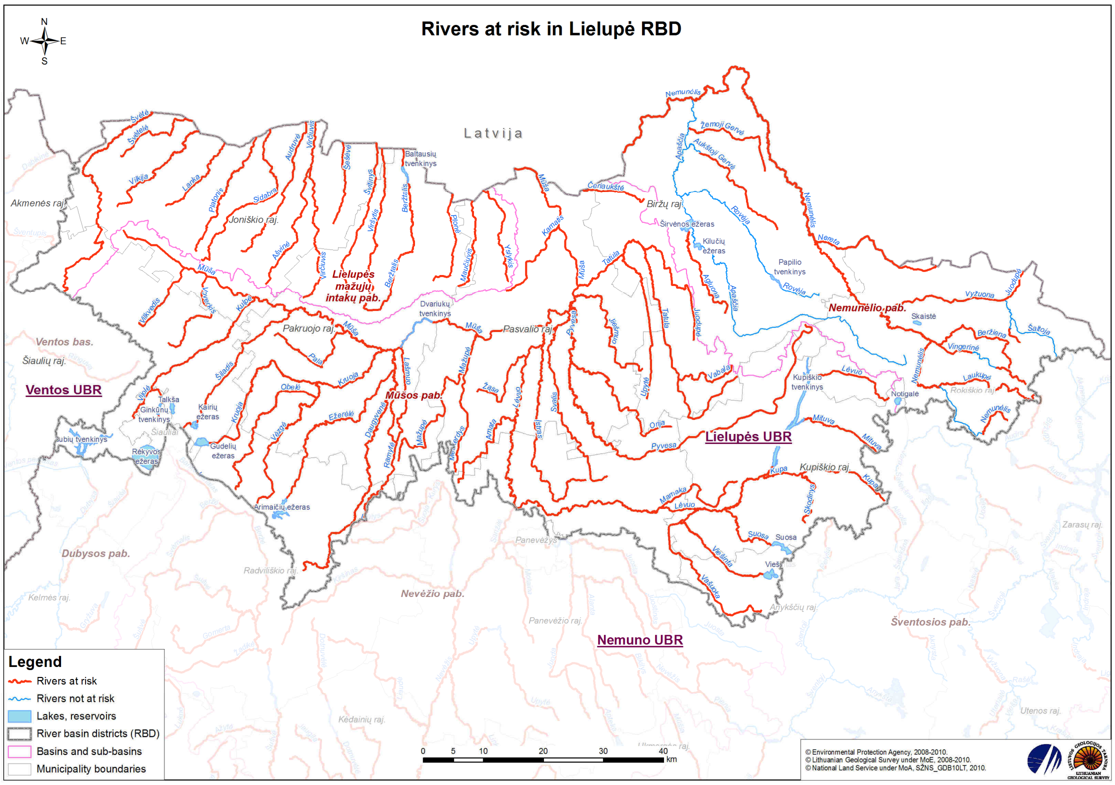


Figure 20. Straightened rivers at risk and heavily modified river water bodies

Impacts of hydropower plants

48. The most typical impacts of hydropower plants constructed on river beds are frequent fluctuations of the water level in the river stretches below the HPP, insufficient discharge, erosion of pond sides and river bed. Light sediments fractions are washed away from the river bottom in the water level pulsation zone, and higher aquatic vegetation (macrophytes) and benthic invertebrates are not able to survive. Frequent fluctuation of the water level is disastrous for spawn and young fish: during the detention of water, spawn and young fish are left on land, and when the turbines are started up, i.e. when the flow and the water level significantly increases, they are taken out into habitats unsuitable for their development and growth. Thus, usually only opportunistic species which easily adapt to various conditions survive in the impact zone of the HPP. In addition, turbines of certain types severely damage fish which get drawn therein.

The most significant fluctuations of the water level occur at the HPP, in the river stretch below the dam. The length of the active water level pulsation zone depends on the rate between the installed discharge of the HPP and the multi-annual discharge of the river, the turbine type and number, and the operational regime of the HPP. Additional factors affecting fluctuation of the water level in the river stretch downstream of the dam are uneven river flow regime, operation of the HPP at the time of low waters (the inflow to the pond is lower than the minimum limit of the installed discharge of the turbine). The impact of the HPP operational regime goes down in proportion to the distance from the HPP (the longer the distance, the less intensive fluctuations); fluctuations also significantly decrease upon the inflow of water of larger tributaries.

The impact of the HPP is considered insignificant (i.e. the river stretch below the HPP is not assigned to a risk category) only if the installed discharge is lower than the minimum multi-annual discharge of the river, and there are modern turbines which are capable of adapting to any flow regime and which do not inflict damage on fish (in such case only a short river stretch is subject to a significant impact), and the operational regime of the HPP does not significantly affect hydrological and hydromorphological river conditions.

It should be noted that construction of a HPP inevitably involves construction of an artificial barrier (disruption of river continuity). A negative impact of an artificial barrier manifests itself not only in the river stretch below the barrier but also in the stretch towards the upper reaches of the river.

At present, there are four operating HPP in the Lielupė RBD (in Akmeniai, Stirniškiai, Dvariūkai and Žiobiškis). One of them (Akmeniai HPP) is not expected to exert any significant impact on the river stretch downstream of the HPP provided that the operation of the turbine is streamlined (the operation is regulated in a way to ensure that the hydrological regime in the tail bay is close to the natural one to the maximum extent). Other HPP significantly affect the river stretches located downstream of the dam. Also, one them, Stirniškiai HPP, stands very close to the river mouth (no measures will be effective, the impact on the overall ecological status of water bodies would be very small in a wider context), therefore it is not proposed to designate Stirniškiai HPP as a water body suffering from a significant impact. However, the Francis turbine therein which injures fish should be replaced with an environmentally friendlier one.

Table 47. HPP which exert a significant impact in the Lielupė RBD

Sub-basin	River	Main river	HPP location	Municipality
Mūša	Mūša	Lielupė	Dvariūkai	Pakruojis distr.
Nemunėlis	Vingerinė	Nemunėlis	Žiobiškis	Rokiškis distr.

Source: experts’ analysis results

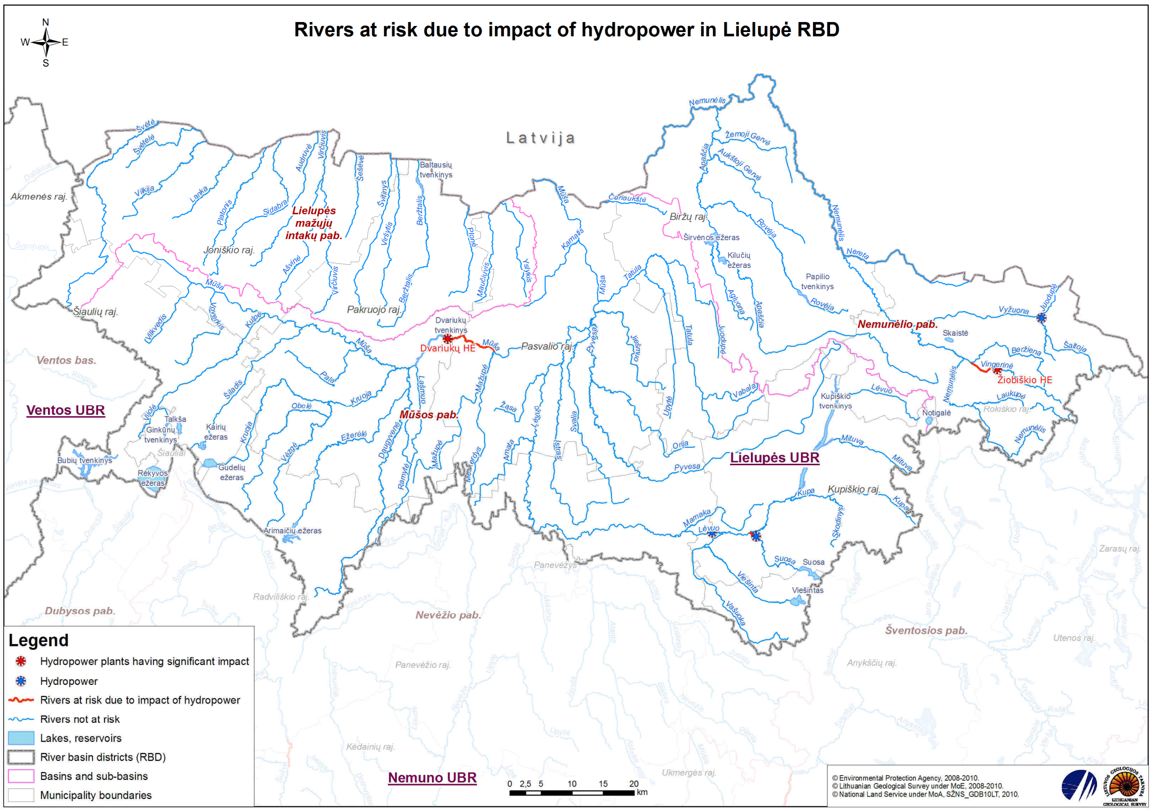


Figure 21. HPP exerting a significant impact

Drainage reclamation

49. The purpose of drainage reclamation is to regulate the moisture regime of the soil thus providing favourable conditions for plants. Lithuania is situated in the zone of surplus humidity therefore ditches were dug and drainage systems were constructed to remove this surplus from cultivated land. The functions of a receiving water body in such systems are performed by rivers, streams and ditches. Since natural rivers are not capable of proper receipt of moisture surplus, they are regulated by adjusting them to receive surplus water flowing by gravity. In fact, a new bed is formed and flow regime is altered in regulated flows: beds are straightened, steady latitudinal and longitudinal cross-sections of the bed are formed, allowable flow rates are selected (slopes and the bottom may not be washed out), and the head is removed. In addition to the said alterations, the structure of the landscape is changing in drained areas: diversity and heterogeneity of elements of the land use diminishes, homogeneity increases, and biological diversity declines.

Table 48. Reclaimed area in the Lielupė RBD

Sub-basin	Total reclaimed area, ha	Drained area, ha	Share of the total reclaimed area in the basin area, %
Mūša	377 729.98	363 553.04	71.3
Nemunėlis	94 986.48	89 462.46	49.9
Lielupė Small Tributaries	145 696.78	139 757.85	83.2

Source: GIS database of land reclamation status Mel_DB10LT

Scientific analyses established that evaporation is reduced in reclaimed areas, which is especially noticeable in spring and at the beginning of summer (April-June). It was also established that drainage determines higher maximum river runoff, although runoff occurs later than in non-drained areas. Together with drainage runoff, soluble chemical substances are washed out of the soil. Depending on land cultivation methods, crop composition and the volume of drainage runoff, the outwash of soluble nitrogen compounds can increase from 1.3 to 5.0 times, and that of phosphorus – 1.1 to 2.4 times as compared to non-drained areas.

The impact of drainage reclamation on the hydrological regime of rivers and streams is more significant in small basin. The larger is the basin, the lower is the impact of drainage reclamation. The hydrological regime of rivers in large river basins is mainly determined by groundwater in deeper aquifers and not by drainage water. The total reclaimed area and drained area in the Lielupė RBD is given in Table 48.

Table 49 and 50 provide the average annual inputs of nitrogen and phosphorus and the total load of nutrients (on the basis of the annual nitrogen and phosphorus loads entering the soil with mineral fertilisers, kg/ha) to the sub-basins of the Lielupė RBD from drainage systems.

Table 49. Nitrogen leaching with drainage runoff in the Lielupė RBD

Sub-basin	Average annual leaching with drainage runoff, kg/ha	Total amount, kg
Mūša	8.15	2 962 957.21
Nemunėlis	7.90	706 753.40
Lielupė Small Tributaries	7.32	1 023 027.45

Source: experts' estimations

Table 50. Phosphorus leaching with drainage runoff in the Lielupė RBD

Sub-basin	Average annual leaching with drainage runoff, kg/ha	Total amount, kg
Mūša	0.122	44353.46
Nemunėlis	0.105	9393.56
Lielupė Small Tributaries	0.085	11879.38

Source: experts' estimations

Experts' estimations show only minor average annual leaching of nitrogen and phosphorus with drainage water due to small loads of nitrogen and phosphorus. Thus it can be maintained that the input of leached nitrogen and phosphorus to the general pollution of surface wastewater is not significant and that drainage reclamation will not prevent achieving the established water protection objectives.

Abstraction of surface water and its impact on rivers and lakes

50. The average annual abstraction of surface water within the Lielupė RBD totals to 552.35 thousand m^3. Abstraction of surface water is conditioned by the concentration of economic entities in the RBD. The main users of surface water are industrial, energy and fisheries companies. The water users and volumes of water abstracted thereby within the Lielupė RBD are given in Table 51.

Table 51. Users of surface water in the Lielupė RBD

User	Place	Average annual abstraction, thou. m^3	Source of abstraction
Company AB Dolomitas	Pakruojis distr.	238.0	pond (Daugyvėnė River)
Company AB Šiaulių stumbras	Šiauliai	136.9	Bubių pond
Company Lietuvos geležinkeliai	Radviliškis distr.	26.0	Lake Arimaičių ežeras

User	Place	Average annual abstraction, thou. m³	Source of abstraction
(Lithuanian Railway)			
Company Lietuvos geležinkeliai (Lithuanian Railway), Šiauliai Railway Infrastructure	Šiauliai	11.5	Lake Arimaičių ežeras
Company AB Juodupės Nemunas	Rokiškis distr.	90.0	Pond (Juodupė River)
Company AB Specializuotas transportas	Šiauliai	5.85	Lake Talkša
Company UAB TDL ODA	Šiauliai	30.6	Lake Rėkyva
Company AB SIŪLAS	Biržai distr.	78.0	Lake Širvėnos ežeras
Company SPAB Šiaulių energija Leno katilinė	Šiauliai	261.0	Lake Rėkyva
Company SPAB Šiaulių energija Rėkyvos katilinė	Šiauliai	3.0	Lake Rėkyva
Company UAB Baltic Mills, manufacture base in Rokiškis	Rokiškis distr.	42.9	Pond (Vyžuona River)
Company UAB Biržų alus	Biržai distr.	112.1	Agluona River
Company UAB Pasvalio gerovė	Pasvalys distr.	0.21	Lėvuo River
Company AB Pamūšio linai	Pakruojis distr.	4.8	Mūša River
Company Žiemgalos linai	Pakruojis distr.	1.0	Mūša River
Company AB Pasvalio žemtiekimas	Pasvalys distr.	0.6	Mūša River

Source: EPA data for 1997-2009

Potentially, the largest user of surface water in agriculture is irrigation. However, according to data of the Ministry of Agriculture of the Republic of Lithuania and the State Land Planning Institute, there were no areas irrigated with surface water in the Lielupė RBD in 2001-2008. The areas suitable for irrigation are provided in Table 52 below. Taking into account the forecasted climate changes, the demand of irrigation may increase in future. However, a poor technical state of the irrigation systems as well as the economic conditions allow maintaining that there will be no surface water abstraction for agricultural purposes during the coming 5-10 years.

Table 52. Irrigated land (ha) in the Lielupė RBD

Municipality	Area of irrigated land in the land reclamation cadastre	Area suitable for use	Irrigated with water in 2001-2008
1	2	3	4
Joniškis distr.	242.00	242.00	0.00
Biržai distr.	372.00	309.75	0.00
Šiauliai distr.	0.00	0.00	0.00
Kupiškis distr.	178.00	178.00	0.00
Pakruojis distr.	0.0	0.00	0.00
Panevėžys distr.	525.50	525.50	0.00
Pasvalys distr.	0.00	0.00	0.00
Radviliškis distr.	277.00	277.00	0.00
Rokiškis distr.	0.00	0.00	0.00

Source: data of the Ministry of Agriculture of the Republic of Lithuania and the State Land Planning Institute of 2001-2008

The impact of water abstraction on the hydrological regime of lakes is assessed with the help of a comprehensive analysis of the following characteristics and changes therein: the average annual lake water level (AAL) (m), average annual water level fluctuation amplitude (ALA) (the difference between the highest and the lowest water level, m) and the ratio between the average annual summer and winter levels (SWL). The indicators for the assessment of hydrological changes due to water abstraction in lakes are provided in Table 53. When at least one characteristic fails the conditions of a low impact specified in this table, the impact automatically becomes medium or high. Such methodology is widely applied in the EU Member States as well as in the USA. The said characteristics should be assessed separately for shallow (<10 m) and deep (>10 m) lakes. The assessment results serve as the basis for identifying the demand of water abstraction.

Table 53. Assessment of hydrological changes due to water abstraction in lakes

Lake type	Changes in the water level			Impact
	AAL	ALA (%)	SWL (%)	
Shallow	<10%	<10	0	low
	10-20%	10-20	>0	medium
	>20%	>20	>0	high
Deep	<0.5 m	<10	0	low
	0.5-1.5 m	10-20	>0	medium
	>1.5 m	>20	>0	high

Source: experts' analysis results

Such assessment requires a lot of comprehensive information about bathymetric measurements and seasonal water level fluctuation and water abstraction characteristics in lakes Arimaičių ežeras, Talkša, Širvėnos ežeras and Rėkyva. However, no detailed information is available at the moment. The assessment of the average annual water abstraction and the average water level characteristics in the lake identified only minor hydrological changes (changes in the water level <10%).

SECTION II. SURFACE WATER BODIES AT RISK

Water bodies at risk in the category of rivers

51. In the category of rivers, water bodies at risk are those which are likely to continue failing the requirements of good ecological or good chemical status or good ecological potential even after the implementation of all basic measures due to one or more of the following factors significantly affecting the status of rivers: water abstraction, straightening of the river bed, HPP, anthropogenic (diffuse and/or point) pollution. Supplementary measures are required for achieving good ecological status/potential in water bodies at risk.

51.1. Water bodies at risk due to the straightening of their beds are river stretches with straightened beds and a slope higher than 1.5 m/km which flow over hilly areas and river stretches with straightened beds and a slope lower than 1.5 m/km which flow over flat non-urbanised areas.

51.2. Water bodies at risk also include river stretches downstream of the HPP to the place where the river catchment area becomes 10% larger as compared to the catchment area at the head.

However, no river affected by the straightening or HPP is regarded a water body at risk when monitoring data indicates that parameters for biological quality elements meet the good ecological status criteria.

51.3. Water bodies at risk due to pollution include all water bodies which, as forecasted, will continue to suffer from a significant impact of anthropogenic pressures after the implementation of the basic measures covering the requirements of the Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (OJ, 2004 special edition, Chapter 15, Volume 2 p. 26) (Urban Wastewater Treatment Directive) and the Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (OJ, 2004 special edition, Chapter 15, Volume 2, p. 68) (Nitrates Directive), hence concentrations in rivers will be exceeding the threshold values of good ecological or chemical status or good ecological potential.

52. The following parameters indicative of physico-chemical quality elements were used for the establishment of conformity of water bodies to the criteria of good ecological status:

52.1. average annual concentration of $BOD_7 \leq 3.3$ mgO_2/l;

52.2. average annual concentration of ammonium nitrogen ≤0.2 mg/l;

52.3. average annual concentration of nitrate nitrogen ≤2.3 mg/l;

52.4. average annual concentration of total nitrogen ≤3.0 mg/l(1);

52.5. average annual concentration of phosphate phosphorus ≤0.09 mg/l(1);

52.6. average annual concentration of total phosphorus ≤0.14 mg/l;

(1) this indicator was not used in the modelling

53. Water bodies at risk due to water quality problems were identified on the basis of summary water quality monitoring data and mathematical modelling results. Mathematical modelling was used to assess present pollution loads and resulting pollutant concentrations in rivers as well as potential changes in pollutant concentrations after the implementation of the basic measures.

54. There are 124 water bodies with the total length of 2 257 km in the category of rivers within the Lielupė RBD. Of these, as many as 113 water bodies (i.e. 90%) were designated as water bodies at risk. The length of the water bodies at risk is 2 079 km.

The total number of water bodies at risk in the Lielupė RBD and the risk factors which determine the assignment of water bodies to the risk group are given in Table 54 below.

Table 54. Water bodies at risk in the category of rivers in the Lielupė RBD and risk factors; “1” indicates a risk

Sub-basin	HMWB	Risk factors					Number of WB	Length, km
		HPP	Straightening	Water quality problems				
				Point pollution	Diffuse pollution	Causes are not known		
Lielupė Small Tributaries	0	0	0	0	1	0	2	32.7
	0	0	1	0	1	0	8	150.7
	0	0	1	1	1	0	1	5.7
	1	0	0	0	1	0	10	225.5
	1	0	0	1	1	0	1	14.2
Mūša	0	0	0	0	1	0	25	395.4
	0	0	0	1	1	0	5	102.5
	0	0	1	0	1	0	18	315.0
	0	0	1	1	1	0	5	63.9
	0	1	0	0	1	0	1	34.5
	1	0	0	0	1	0	18	337.6
	1	0	0	1	1	0	2	63.6
Nemunėlis	0	0	0	0	0	1	2	120.1
	0	0	0	0	1	0	1	7.9

Sub-basin	HMWB	Risk factors					Number of WB	Length, km
		HPP	Straightening	Water quality problems				
				Point pollution	Diffuse pollution	Causes are not known		
	0	0	0	1	1	0	2	40.8
	0	0	1	0	0	0	9	138.7
	0	0	1	1	0	0	1	8.0
	0	1	1	0	0	0	1	8.1
	1	0	0	0	1	0	1	14.0

Source: experts' analysis results

54.1. Lielupė Small Tributaries Sub-basin

Impact of HPP

There are no HPP exerting a significant impact on water bodies in the Lielupė Small Tributaries Sub-basin.

Impact of straightening

Nine river water bodies were identified as water bodies at risk due to the river bed straightening in the Lielupė Small Tributaries Sub-basin. The length of these water bodies is 156.4 km. All these water bodies are also facing water quality problems as a result of anthropogenic pollution.

Water quality problems conditioned by anthropogenic pollution impacts

The Lielupė Small Tributaries Sub-basin is one of the most problematic sub-basin in the entire country from the point of view of diffuse pollution. The total area of declared agricultural land constitutes 70% of the Lithuanian part of the sub-basin. High concentrations of nitrate nitrogen are registered in the rivers of the sub-basin, often exceeding 10 mg/l in the spring months, as a result of intensive agricultural activities. Concentrations of nitrates in the water bodies in the Lielupė Small Tributaries Sub-basin will remain high even after the implementation of the basic measures under the Nitrates Directive, therefore all 22 water bodies in this sub-basin were designated as water bodies at risk due to the impact of diffuse pollution. To be able to achieve good ecological status in these water bodies, supplementary measures will be required, which are expected to reduce the input of diffuse pollution into water bodies by 8 kg/ha.

Two water bodies identified in the rivers Sidabra and Beržtalis are suffering not only from significant diffuse agricultural pollution but also from point pollution. The length of these water bodies is 20 km.

11 water bodies in this sub-basin were designated as HMWB due to the straightening because all of them are facing water quality problems.

54.2. Mūša Sub-basin

There is one hydropower plant, Dvariūkų HPP, which exerts a significant impact on the ecological status of the river. As a result, one river water body of the Mūša River was designated as a water body at risk. Its length is 34.5 km. In addition, this water body is also facing water quality problems.

Impact of straightening

23 river water bodies were identified as water bodies at risk due to the river bed straightening in the Mūša Sub-basin. The aggregate length of these water bodies is 379 km. All these water bodies are also facing water quality problems.

Water quality problems conditioned by anthropogenic pollution impacts

The major driver of pressures on water bodies in the Mūša Sub-basin is diffuse agricultural pollution. The total area of declared agricultural land constitutes about 53% of the sub-basin. Analyses show that the threshold concentrations of nitrate nitrogen for good ecological status will still be exceeded in all water bodies of the Mūša Sub-basin even after the implementation of the basic measures under the Nitrates Directive, therefore all 74 water bodies in this sub-basin were designated as water bodies at risk due to the impact of diffuse pollution. To be able to achieve good ecological status in these water bodies, diffuse pollution loads should be reduced by about 4.4 kg/ha with the help of supplementary measures.

A number of water bodies are facing water quality problems not only because of diffuse pollution but also due to point pollution. As a result, 12 water bodies were designated as water bodies at risk in the rivers Kulpė, Vijolė, Šiladis, Vezgė, Daugyvenė, Obelė, Kruoja and Tatula, with the aggregate length of 230 km.

20 water bodies in the Mūša Sub-basin are facing water quality problems due to the straightening and hence they were designated as HMWB.

54.3. Nemunėlis Sub-basin

Impact of HPP

One water body, the Vingrinė River (8 km), was designated as water body at risk due to a significant impact of Žiobiškis HPP. The river is a water body at risk also because of the impact of the straightening.

Impact of straightening

10 river water bodies were identified as water bodies at risk due to the river bed straightening in the Nemunėlis Sub-basin. The aggregate length of these water bodies is 147 km.

Water quality problems conditioned by anthropogenic pollution impacts

Differently from other sub-basins of the Lielupė RBD, water bodies in the Nemunėlis Sub-basin are not suffering from diffuse agricultural pollution. Here concentrations of nitrate nitrogen may be exceeded due to agricultural pressures only in two water bodies identified in the Agluona River. In addition, two more bodies were identified in the rivers Laukupė and Nemunėlis which may be suffering from an aggregate impact of point and diffuse pollution.

One water body identified in the Nemunėlis River which has been designated as a water body at risk due to diffuse pollution is also a straightened water body. Causes of water quality problems in two water bodies in the Nemunėlis River have not been identified yet. Monitoring data shows that these water bodies are failing the good ecological status requirements by biological parameters but it is difficult to identify the cause of the failure.

In total, there are seven water bodies in this sub-basin which are facing water quality problems and hence have been designated as water bodies at risk. One of this has also been designated as a HMWB because of the bed straightening.

River water bodies at risk due to the impact of HPP and bed straightening and water quality problems within the Lielupė RBD are demonstrated in Figure 22.

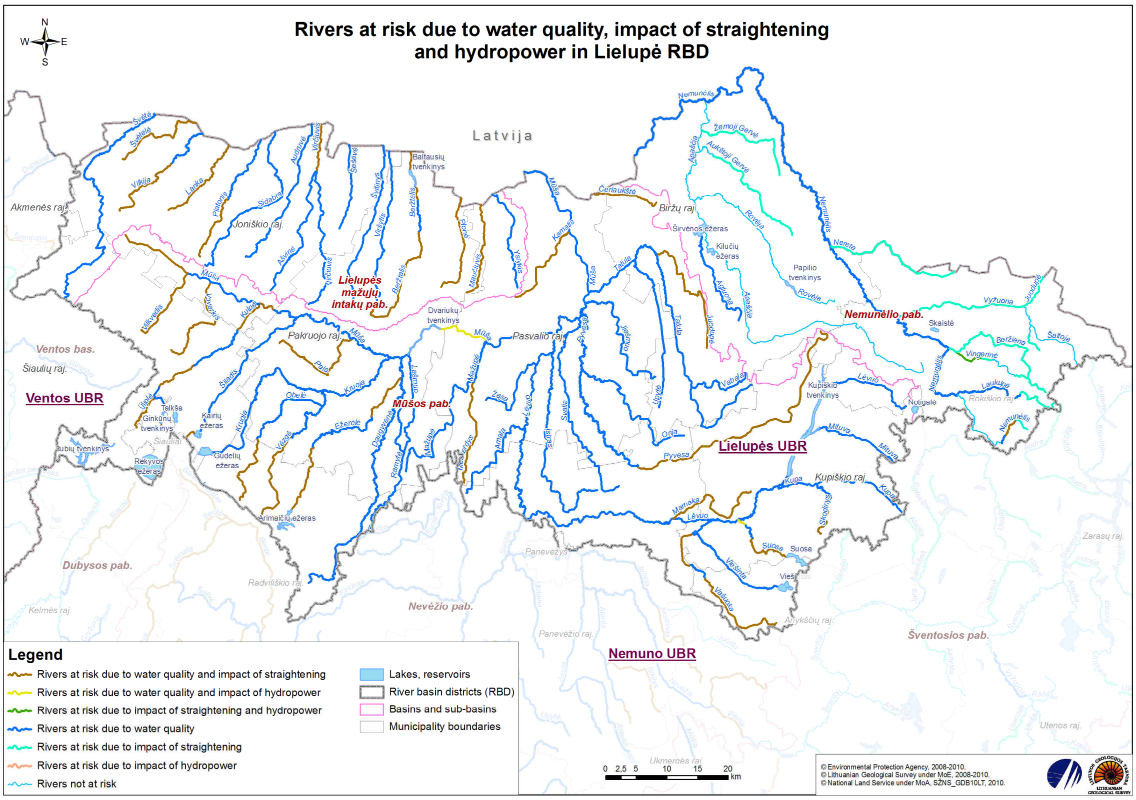


Figure 22. Rivers at risk in the Lielupė RBD

Supplementary measures have been provided for to achieve good ecological status/potential of river water bodies at risk in the Lielupė RBD.

Water bodies at risk in the category of lakes and ponds

55. Water bodies in the category of lakes and ponds have been identified as water bodies at risk when the critical values of total nitrogen, total phosphorus and chlorophyll *a* were exceeded:
$N_{total} > 1.80$ mg/l, $P_{total} > 0.060$ mg/l, EQR of chlorophyll $a > 0.33$.

The ecological status of water bodies in the category of lakes and ponds was assessed on the basis of the national monitoring data, the data provided in the study "Identification of Lithuanian lakes subject to restoration and preliminary selection of restoration measures for these lakes for improving their status", and MIKE BASIN mathematical modelling results. The latter results were used to assess concentrations of total phosphorus conditioned by diffuse and point pollution in the water bodies of the Lielupė RBD in the category of lakes and ponds.

56. When assigning lakes and ponds to water bodies at risk or those not at risk, priority was given to the national monitoring results, meanwhile the results of the lake study were used in the event of absence of such results. However, if no national monitoring

data on the indicators of a lake or pond in question was available and the modelling results showed that the lake/pond should be on a preliminary list of water bodies at risk (when the study data indicates the opposite), the lake or pond was assigned to water bodies at risk. The following order of priorities was observed for the assignment of lakes and ponds to water bodies at risk/not at risk:

56.1. When there was national monitoring data available on the indicators of the ecological status of a lake/pond, the lake/pond was assigned to the ecological status class indicated by the monitoring data. In such case the modelling and study findings were not taken into account.

56.2. When there was no national monitoring data available and a lake in question should not be assigned to the risk group but its status is critical or problematic according to the study findings, such lake was assigned to water bodies at risk.

56.3. When there was no national monitoring data available and a lake in question should be assigned to the risk group on the basis of the modelling results but the study findings indicate a stable status and presence of anthropogenic impact, or the lake is defined as naturally eutrophic, such lake was designated as a water body at risk.

56.4. When there was no monitoring data available and a lake in question should not be assigned to the risk group on the basis of the modelling results but the study findings indicate its critical or problematic status, such lake was designated as a water body at risk.

56.5. When there was no monitoring data available and a lake in question should not be assigned to the risk group on the basis of the modelling results and the study findings indicate a stable status and presence of an anthropogenic impact, or the lake is defined as naturally eutrophic, such lake was not designated as a water body at risk.

56.6. When there was no monitoring data available and a lake in question should be assigned to the risk group on the basis of the modelling results, such lake was designated as a water body at risk.

The water bodies at risk in the category of lakes in the Lielupė RBD and their risk factors are listed in Table 55.

Table 55. Water bodies at risk in the category of lakes; “1” indicates risk factors

Sub-basin	**Lake / pond**	**Area, km^2**	**Risk factors**			
			Diffuse pollution	**Point pollution**	**Potential impact of historic pollution**	**Other reasons**
Mūša	Lake Talkša	0.576	1	1		
	Lake Rėkyva	11.929				1
	Lake Kairių ežeras	0.833	1	1		
	Dvariūkų pond	1.332	1	1		
	Ginkūnų pond	1.049	1			1
	Lake Notigalė	0.916				1
	Lake Skaistė	0.578			1	
Nemunėlis	Lake Kilučių ežeras	0.828	1			
	Lake Širvėnos ežeras	3.201	1			
Lielupė Small Tributaries	Baltausių pond	0.801	1	1		

Source: experts’ analysis results

Following the modelling results for pollution loads from diffuse and point pollution sources, the main factor which determines lower than good ecological status of seven lakes and ponds is present diffuse pollution. Three of these water bodies – Lake Kairių ežeras, Dvariūkų pond and Baltausių pond are also suffering from a significant impact of point pollution, which accounts for 2-29% of the total pollution load. Point pollution may also be exerting a significant impact on the ecological status of the Lake Talkša. Following modelling results, point pollution accounts for as much as 86% of the load on Lake Talkša (although the ecological status should still be good according to modelling results). The status of Lake Talkša may also be significantly affected by pollutants entering the lake with surface runoff from the urban area. Also, it is highly likely that the lake is polluted with domestic wastewater of inhabitants illegally connected to the surface runoff collection system.

Bad ecological potential of Lake Rėkyva may be determined by hydromorphological changes in the lake as well as inflow of biogenic substances.

There is a landfill in the neighbourhood of Ginkūnų pond. Filtration waters from the landfill used to leach to the pond. It is highly likely that not only the ecological potential of the pond is bad but also its chemical status (no studies of hazardous substances have been conducted in this pond).

Ecological status poorer than good in Lake Notigalė may be determined by natural ageing processes.

Causes which have determined poorer than good status in lake Skaistė are not clear. Following mathematical pollution modelling results, the status of the lake should be high but monitoring data indicate moderate status. It is highly likely that poorer than good ecological status ecological status has been conditioned by historic pollution.

Supplementary measures have been provided for to achieve good ecological status/potential of water bodies at risk in the category of lakes and ponds in the Lielupė RBD.

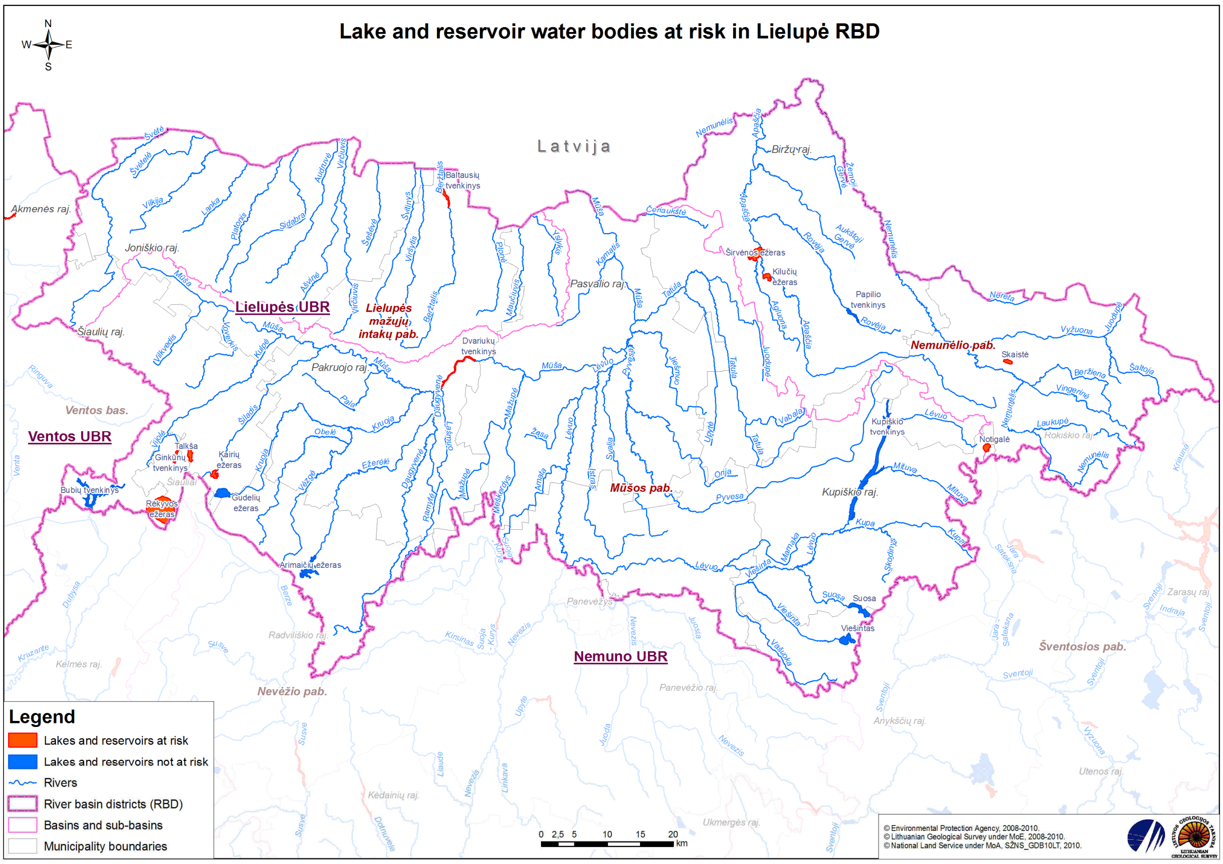


Figure 23. Lakes and ponds at risk in the Lielupė RBD

SECTION III. IMPACT OF ANTHROPOGENIC ACTIVITIES ON GROUNDWATER WELLFIELDS

Impact of diffuse and point pollution on shallow groundwater and, consequently, on surface water bodies

General description

57. A quantitative impact of diffuse pollution on shallow groundwater is demonstrated in maps of increased concentrations of individual analytes of its hydro-chemical composition in shallow groundwater as compared to their background (natural) values, which illustrate the extent of contamination of shallow groundwater with a specific polluting substance in a certain place. The maps can be prepared using maps of technogenic loads and average concentrations of analytes in different types of land use. Such maps, which demonstrate increased concentrations of nitrates and ammonium in shallow groundwater of the Lielupė and neighbouring RBD due to impacts of diffuse pollution, are given in Figures 24 and 25. The maps show that the concentrations of the said nitrogen compounds do not exceed the standards of drinking water at the regional level. The nitrate concentration in shallow groundwater is close to the MAC, which is 50 mg/l, and the ammonium concentration totals to 2.44 mg/l exceeding the MAC a few times (0.5 mg/l) only in certain localities (mainly in wells in urbanised areas). However, this is usually a pollution problem of dug wells constructed in an inadmissible place from the point of view of hygienic requirements, and not of the shallow groundwater layer.

Data analysis shows that the average increase of nitrate concentrations in shallow groundwater in Lielupė RBD as a result of the impact of diffuse pollution is 9.8 mg/l, and of ammonium – 0.32 mg/l. In this RBD, natural territories with background concentrations of nitrates and ammonium (NO_3 – 1.55 mg/l, NH_4 – 0.21 mg/l) take the area of 2 147 km^2, i.e. almost one forth of the RBD area. More than half of the area (56%) has been subject to diffuse pollution from agricultural fields situated in clayey soils, where the average concentration of nitrates is higher by 8.12 mg/l and that of ammonium – by 0.22 mg/l as compared to the background values (see Figures 24, 25). 9% of the area is taken by agricultural fields situated in sandy soils, where the average concentration of nitrates in shallow groundwater is 16.68 mg/l and of ammonium – 0.53 mg/l (the increase due to the impact of diffuse pollution is respectively 15.13 mg/l and 0.32 mg/l) (see Figures 24 and 25). Urbanised areas where the most significant impact of diffuse pollution on shallow groundwater is observed occupy as little as 3% of the total RBD area. Here the average concentration of nitrates exceeds the background values by 43.59 mg/l and totals to 45.14 mg/l, the concentration of ammonium exceeds the background values by 2.21 mg/l and totals to 2.44 mg/l (see Figures 24 and 25).

58. A quantitative impact of shallow groundwater affected by diffuse pollution on surface water within the Lielupė RBD was assessed using mathematical models of groundwater filtration, where values of discharge of groundwater outflow into individual rivers in each calculated block of the model were established. Leaching of nitrates, ammonium, phosphates, total nitrogen, nitrate nitrogen, ammonium nitrogen, and phosphate phosphorus with groundwater to surface water bodies was estimated having entered additional values of the parameters of groundwater pollution in the models. The results of this assessment for the Lielupė RBD are provided in Table 56.

Table 56. Simulated leaching of pollution with shallow groundwater to surface water bodies in the Lielupė RBD

River sub-basin	Area, km^2	Simulated shallow groundwater flow module, l/s/km^2	Parameter	Simulated leaching with groundwater, t/year
Lielupė Small Tributaries	1 750.75	0.74	NO_3	63.32
			NH_4	8.58
			PO_4	3.27
			N_{total}	20.84 (1)
			$N\text{-}NO_3$	14.3
			$N\text{-}NH_4$	6.54
			$P\text{-}PO_4$	1.06 (5.7)
Mūša	5 296.43	1.02	NO_3	250.80
			NH_4	33.98
			PO_4	12.94
			N_{total}	82.52 (2.1)
			$N\text{-}NO_3$	56.63
			$N\text{-}NH_4$	25.89
			$P\text{-}PO_4$	4.21 (6.6)
Nemunėlis	1 900.6	1.24	NO_3	112.38
			NH_4	15.23
			PO_4	5.8
			N_{total}	36.98 (3.8)
			$N\text{-}NO_3$	25.38
			$N\text{-}NH_4$	11.6
			$P\text{-}PO_4$	1.89 (8.7)

River sub-basin	Area, km^2	Simulated shallow groundwater flow module, l/s/km^2	Parameter	Simulated leaching with groundwater, t/year
Total in Lielupė RBD	**8 947.78**	**1.01**	**NO_3**	**426.49**
			NH_4	**57.78**
			PO_4	**22.01**
			N_{total}	**140.34 (2)**
			$N\text{-}NO_3$	**96.31**
			$N\text{-}NH_4$	**44.03**
			$P\text{-}PO_4$	**7.15 (6.9)**

* The figure given in brackets is percentage of the aggregate load from all potential pollution sources within the entire river sub-basin, which was calculated in the MIKE BASIN surface water model.

The amounts of pollutants leaching to surface water bodies with groundwater given in Table 56 above show how much of these compounds enter surface waters as a result of groundwater – river interaction. The entry of the said compounds from groundwater to surface waters, i.e. to different oxidation-reduction conditions, results in rapid destruction, transformation, decay, dilution and other processes of these pollutants, hence their concentrations significantly go down. However, even without taking into account the said destruction and other processes, it can be maintained that the share of diffuse pollution which enters rivers of Lielupė RBD with groundwater flow in the aggregate amount of pollutants in rivers is of a minor significance. For instance, the amount of total nitrogen leaching to surface water bodies with groundwater accounts for 1-3.8%, the amount of phosphate phosphorus – for 5.7-8.7% of the total amounts of these pollutants in the individual sub-basins of the Lielupė RBD (see Table 56). Hence, even without considering the said destruction and other processes, which reduce concentrations of pollutants leaching from shallow groundwater into surface water, it can be maintained that there are no groundwater wellfields which would pose risk to surface water bodies in the shallow aquifer within the Lielupė RBD (the amounts of pollution leaching with shallow groundwater does not exceed 50% of the total amount of pollution of surface water indicated in the EC guidelines). Having in mind that concentrations of nitrogen compounds leaching from groundwater to surface waters go down at least 2.5 times as a result of their destruction, transformation, dilution and other processes (the background concentration of total nitrogen in shallow groundwater is 0.51 mg/l, its concentration in a river during minimum low flow is 0.2 mg/l), the actual impact of diffuse pollution of shallow groundwater on surface water would be even lower.

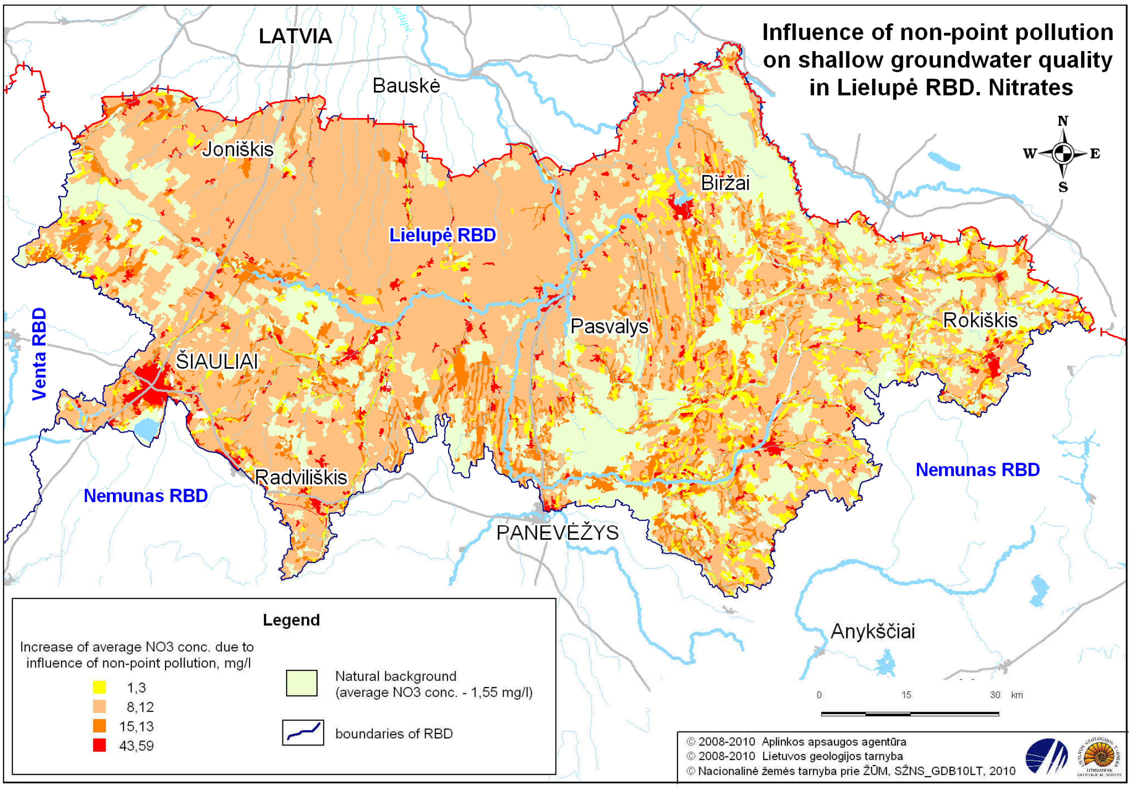


Figure 24. Impact of diffuse pollution on shallow groundwater quality. Nitrates.

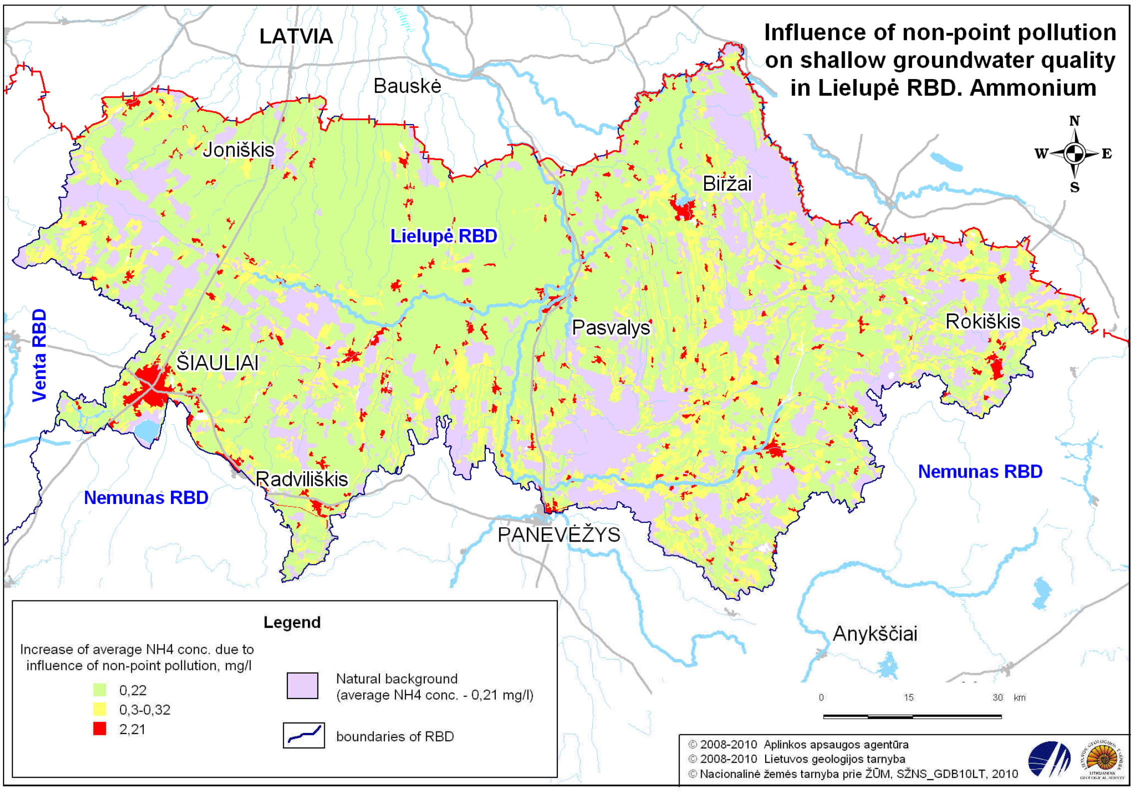


Figure 25. Impact of diffuse pollution on shallow groundwater quality. Ammonium.

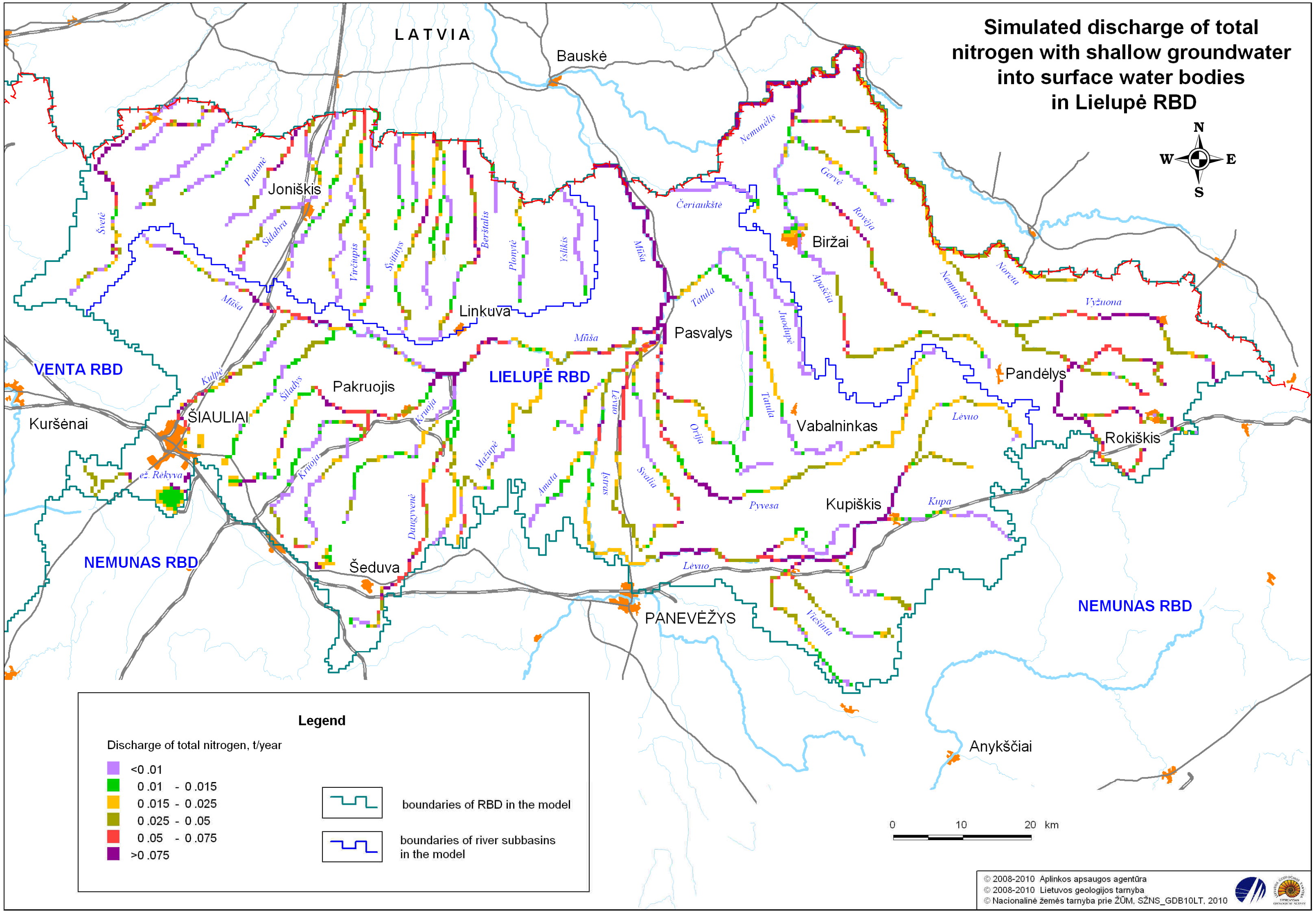


Figure 26. Simulated total leaching of nitrogen with shallow groundwater to surface water bodies in the Lielupė RBD

Figure 26 demonstrates distribution of the outflow of total nitrogen with shallow groundwater in each simulated river along the entire bed depending on filtration properties of the shallow aquifer, concentration of pollutants in shallow groundwater, and the flow gradient. The size of the calculated blocks in the model is 0.5x0.5 km, which means that the figures given in the map show the magnitude of the outflow of this diffuse pollution component with shallow groundwater in a river stretch of 500 m. Following the modelling results, the highest leaching of nitrogen compounds is found in individual stretches of the rivers Mūša, Lėvuo, Nemunėlis, Kruoja, where agricultural or urbanised areas are located in the neighbourhood of the river slope. In many of these areas, the annual leaching of the said pollutants in a river stretch of 500 m totals to 0.05-0.075 and more tonnes (see Figure 26).

Data analysis shows that the average increase of nitrate concentrations in shallow groundwater in Lielupė RBD as a result of the impact of diffuse pollution is 9.8 mg/l, and of ammonium – 0.32 mg/l. In this RBD, natural territories with background concentrations of nitrates and ammonium (NO_3 – 1.55 mg/l, NH_4 – 0.21 mg/l) take the area of 2 147 km^2, i.e. almost one forth of the RBD area. More than half of the area (56%) has been subject to diffuse pollution from agricultural fields situated in clayey soils, where the average concentration of nitrates is higher by 8.12 mg/l and that of ammonium – by 0.22 mg/l as compared to the background values (see Figures 24, 25). 9% of the area is taken by agricultural fields situated in sandy soils, where the average concentration of nitrates in shallow groundwater is 16.68 mg/l and of ammonium – 0.53 mg/l (the increase due to the impact of diffuse pollution is respectively 15.13 mg/l and 0.32 mg/l) (see Figures 24 and 25). Urbanised areas where the most significant impact of diffuse pollution on shallow groundwater is observed occupy as little as 3% of the total RBD area. Here the average concentration of nitrates exceeds the background values by 43.59 mg/l and totals to 45.14 mg/l, the concentration of ammonium exceeds the background values by 2.21 mg/l and totals to 2.44 mg/l (see Figures 24 and 25).

It should be mentioned that estimations carried out for the Nemunas RBD showed that the share of diffuse pollution which enters the rivers with groundwater flow is of a minor significance and constitutes not more than a few per cent in the aggregate pollution amount. The same is indicated by the results of the simulation of groundwater leaching to rivers – the discharge of outflowing groundwater is calculated in litres per seconds meanwhile the discharge of any larger river is calculated in cubic meters per second. Hence, it can be preliminary concluded that the impact of diffuse pollution of groundwater on the quality of surface water within the Lielupė RBD is not significant at the regional level and that there are no groundwater wellfields which would pose risk to surface water bodies in the shallow aquifer (the amounts of pollution flowing out with shallow groundwater does not exceed 50% of the total amount of pollution of surface water indicated in the EC guidelines).

Impacts of point pollution

59. The most important and potentially most dangerous objects of point pollution in the Lielupė RBD, as in other districts, are animal husbandry complexes. No other large potentially polluting objects are situated in this RBD.

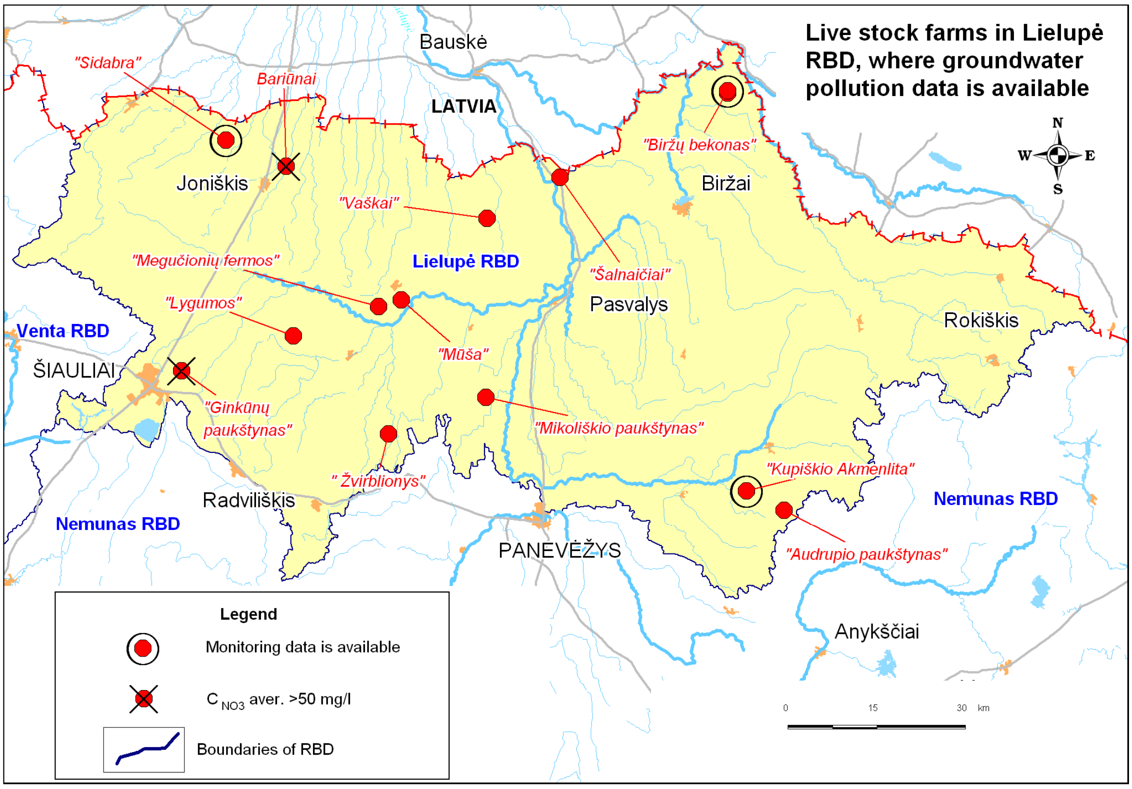


Figure 27. Animal husbandry complexes where data is available on pollution of shallow groundwater

59.1. Assessment of impacts of animal husbandry complexes on shallow groundwater and, consequently, on surface water

According to LGS analysis data, 13 animal husbandry complexes within the Lielupė RBD were looked at during 2004-2007. They are located in Biržai district (one: UAB Biržų bekonas), Joniškis district (two: UAB Sidabra and Bariūnai agricultural company), Kupiškis district (one: UAB Kupiškio Akmenlita), Pakruojis district (four: Kalpokai agricultural company, Megučioniai pig farms, pig breeding complex Mūša of UAB Saerimner, Žvirblionys agricultural company, Lygumos agricultural company), Pasvalys district (three: pig breeding complex Šalnaičiai of UAB Saerimner, agricultural company Vaškai, poultry rearing complex Mikoliškio paukštynas), Rokiškis district (one: poultry rearing complex Audrupio paukštynas), Šiauliai district (1, poultry rearing complex Ginkūnų paukštynas) (Figure 25). However, a certain amount of monitoring data for analysis of shallow groundwater pollution trends is available only for three of the above-listed companies. Though a number of the said 13 complexes have been in operation for a long time already, no comprehensive analysis of groundwater pollution or monitoring have been performed in any of them.

Following the scarce data of "momentary" analyses carried out by the LGS during the period from 2004 through 2007, the level of pollution in the said 13 complexes is very different and generally not high: the average concentrations of nitrates in groundwater of agricultural irrigation fields exceeded 50 mg/l. In addition, the maximum concentrations of NO_3 exceeding the said limit were registered in six more complexes. The highest concentrations were in the complexes of Bariūnai and Ginkūnai (respectively 359 and 748 mg/l NO_3) meanwhile in other complexes did not exceed the said threshold value/MAC (50 mg/l) more than 1.5-3 times. Hence it can be maintained that shallow groundwater is probably polluted with nitrates (to be more precise, it was polluted during the analysis) only in some of the said complexes and only in certain bore wells.

Since pollution of shallow groundwater with nitrate compounds and organic substances significantly and rapidly varies even within the same year, more or less objective assessments of the average/averaged level of pollution of shallow groundwater can be carried out only in the said three complexes (UAB Biržų bekonas in Biržai district, UAB Sidabra in Joniškis district and UAB Kupiškio Akmenlita in Kupiškis district).

Monitoring data of 1999-2006 shows that the highest pollution of shallow groundwater was registered in agricultural irrigation fields of the pig breeding company UAB Sidabra located in Joniškis district. Here shallow groundwater occurs very close to the surface, in the depth of 1.3-2 m, and is accumulated in moraine sandy loam with low water content and therefore it is easily polluted when the area is spread with slurry. However, even here averaged concentrations of nitrates in shallow groundwater were only about 5.5-14 mg/l for a long time. A sudden increase to 400-450 mg/l was registered only in 2003-2003 but it was related to intensive, short-term and local pollution of shallow groundwater (a large amount of slurry was spilled close to a monitoring well) whereas the general level of pollution of shallow groundwater with nitrates in these agricultural irrigation fields remained rather low as it used to be before. As a rule, the maximum values of all parameters are registered at the end of the year, which means that they are definitely determined by application of slurry on agricultural irrigation fields in autumn. Accordingly, inadmissibly high pollution of shallow groundwater in these fields occurs only from time to time and as such, due to self-cleaning processes, very low filtration of shallow groundwater and relatively low discharge of the outflow, cannot pose any threat to surface water.

Background status of shallow groundwater and its status in the production area and in agricultural irrigation fields are monitored in the environment of the pig breeding company UAB Biržų bekonas located in Biržai district. Here shallow groundwater is accumulated in moraine loam fissures, so its volume is low, it can be easily polluted because it occurs very close to the surface, in the depth of not more than 3 m. However, contamination of shallow groundwater in the area is also low because of low intensity of environmental pollution: even the maximum values of almost all pollution indicators in production areas and agricultural irrigation fields are nearly the same as the ones in the background environment and far from the MAC. Variation of concentrations is more noticeable in production areas and agricultural irrigation fields and the maximum concentrations are registered in autumn and winter (like in the environment of the company UAB Sidabra), i.e. they are related to contamination of shallow groundwater in autumn.

Shallow groundwater in the area of the company UAB Kupiškio Akmenlita also occurs in moraine loam, in the depth of 2-3.8 m. Monitoring here also covers background status of shallow groundwater and its status in the production area and in agricultural irrigation fields. Monitoring results show that the highest level of pollution of shallow groundwater was observed in the area of agricultural irrigation fields in 2004-2005 when the nitrate concentration in shallow groundwater in autumn was respectively 78 and 32 mg/l. The concentration of ammonium in shallow groundwater was also higher than usual, which indicated relatively fresh pollution. However, already in 2006 the concentration of nitrates in this area was much lower (5-20 mg/l), and so were the values of other pollution indicators. In the production area, shallow groundwater was polluted only with organic matter, but the level of pollution was rather low.

Pollution of interlayer water in this and other complexes of the basin has not been investigated; however, its is clear that it would be hardly noticeable due to relatively low pollution of shallow groundwater and a minor role of the water (low volumes) in the balance of interlayer water. Also, it has been stated that a negative impact of production areas on groundwater even in irrigation fields with a very high level of pollution is noticed maximum in the depth of 20-30 m. Consequently, no model assessment of such pollution is required.

Conclusion

In the Lielupė RBD, even such source areas of intensive pollution of groundwater as production areas and agricultural irrigation fields in all known cases were only local epicentres of pollution: facts demonstrate that pollution does not spread further than 100-150 m from the pollution source centre. Having in mind that sanitary protection zones (SAZ) of the irrigation fields of animal husbandry complexes vary between 50 m (when wastewater is injected into the soil) and 200 m (when high pressure and low pressure sprinklers are used), it is obvious that even highly polluted shallow groundwater in such fields will not leach from the area of the animal husbandry complex and a respective irrigation fields, i.e. will not exert any negative impact on shallow groundwater in the neighbouring areas.

Impact of shallow groundwater affected by point pollution on surface water

The said report maintains that a flow of polluted shallow groundwater can also reach and feed surface water bodies (rivers, streams, lakes, reclamation ditches, etc.) and, consequently, contaminating them as well. Another argument provided concerns requirements for the quality of surface water which are much more stringent than those for groundwater (e.g. MAC for $N\text{-}NO_3$ in surface water is 2.5 mg/l, i.e. 11.07 mg/l of NO_3, meanwhile in groundwater/drinking water – 50 mg/l of NO_3), therefore a potential impact of polluted groundwater on surface water should also be assessed.

However, to be able to obtain correct impact assessment results, the following detailed and reliable information is required: 1) the dynamics of concentrations of polluting substances in surface water and groundwater within a year and during a multi-annual period; 2) the extent of shallow groundwater outflow to surface water sources; 3) contribution of surface runoff and drainage water to concentrations in surface water from various sources. This means that such assessment requires a much more detailed analysis of the hydro-geological and hydrological conditions of the object being assessed as well as monitoring data banks much larger than the existing ones – two analyses of the quantitative and chemical status of shallow groundwater and surface water during a year provided for in the current monitoring programmes and data of observations which have lasted only a few years are clearly insufficient for the said purposes.

Still, even the available scarce information and multi-annual hydro-geological experience allows maintaining that the impact of polluted shallow groundwater on surface water will be only minor almost in all cases and definitely lower than the said impact of surface outwash or drainage runoff due to the following reasons:

59.1.1. As a result of self-cleaning processes, such objects will not pollute surface water sources located farther than 100 m away from these sources because shallow groundwater will already be clean from pollution.

59.1.2. Shallow groundwater would noticeably pollute surface water only in the event of a high level of pollution of shallow groundwater in the vicinity of the surface water source, i.e. when the concentration of a pollutant in shallow groundwater exceeds the one in surface water tens or even hundreds times. However, such single, momentary cases of pollution have been registered only in a few complexes (Zabulis, 2007).

59.1.3. Less polluted shallow groundwater can pollute surface water when the amount of the outflow of shallow groundwater to the surface water source is equal to its discharge. Since shallow groundwater outflow modules rarely exceed several litres per second per square kilometre, only very small streams or reclamation ditches which cross a sufficiently large pollution source (1 km^2 or larger) can be polluted. However, comprehensive and long-term special investigations are required to be able to estimate this pollution separating this "underground" pollution of surface water from its direct pollution which occurs during irrigation of such fields.

Impacts of groundwater exploitation in deeper confined aquifers on surface water bodies

60. Abstraction of groundwater from confined aquifers reduces their piezometric surface and increases the vertical flow of groundwater, which is one of the sources of groundwater resources, deeper down and thus reduces its outflow to rivers and other surface water bodies.

As already said, the main productive aquifers (complexes) within the Lielupė RBD, Permian-Famenian, Stipinai and Šventoji-Upninkai, occur deep and are sufficiently well isolated from surface water. Quaternary intermoraine aquifers occur locally and produce only small volumes of water. Hence the impact of deeper confined aquifers on surface water bodies is only minor. A quantitative assessment can be made by comparing the modules of groundwater resources in the groundwater bodies situated in the Lielupė RBD which are abstracted today and which are planned for the future (Table 57).

Table 57. Modules of present and prospective groundwater resources in the Lielupė RBD

GWB	Area, km^2	Volume of current groundwater abstraction (m^3/d)* / module (l/s·km^2)	Volume of groundwater resources planned for abstraction in 2015 (m^3/d)** / module (l/s·km^2)
Stipinai-Lielupė GWB of Upper Devonian deposits	1 879.29	14 197/0.09	20 279/0.12
Lielupė GWB of Upper-Middle Devonian deposits	4 448.32	8 146/0.02	21 447/0.06
Biržai-Pasvalys GWB	1 048.48	4 035/0.04	10 901/0.12
Joniškis GWB	508.32	1 367/0.03	3 772/0.09
Lielupė GWB of Permian-Upper Devonian deposits	1 063.38	560/0.06	1 375/0.02

* Average of 2008-2009; ** Data provided by SWECO-BKG-LSPI

The data provided in the table above shows that the modules of groundwater resources which are currently exploited and those which are planned to be exploited in future are tenths and hundredths of $l/s/km^2$. This means that even if all groundwater resources were formed only at the expense of decrease of groundwater outflow to rivers, this decrease would not exceed the said figures. It is clear that exploitation of deep groundwater aquifers in this RBD practically cannot have any impact on shallow groundwater and surface water.

A quantitative impact of groundwater abstraction in the neighbouring countries (Latvia) on shallow and deeper groundwater within the Lielupė RBD was assessed using a mathematical modelling method. A mathematical model included all major productive confined aquifers: Quaternary intermoraine aquifers, aquiferous formations of the Upper Permian, Famenian and Permian-Famenian complex, Stipinai aquifer, Plavinas (Įstras-Tatula and Kupiškis-Suosa) and Šventoji-Upninkai aquifers (complexes).

The modelling established that groundwater abstraction in the neighbouring countries (Latvia) will not exert any negative impact on the status of groundwater bodies within the Lielupė RBD.

Groundwater wellfields which have a negative impact on the status of surface water bodies and/or terrestrial systems dependent on groundwater

61. The conclusion presented in the previous paragraph is supported by results of the simulated prognostic decrease of the groundwater table when wellfields in the Lielupė and neighbouring RBD are used at the discharge which meets the abstraction demand in 2015 (Table 57).

The modelling results (demonstrated in Figure 28) show that the use of wellfields within the Lielupė RBD at the prospective discharge level of 2015 practically does not have any impact on the groundwater table – the simulated decrease of the groundwater table within the entire territory of the RBD is not lower than 1 cm. Somewhat lower decrease (1-5 cm) is expected only in the vicinity of Pasvalys and Biržai where conditions of the interaction between shallow groundwater and confined water are much better, and close to Rokiškis (5-7 cm) where the prospective discharge of the wellfield is more than twice higher than the present one. Figure 28 also demonstrates bogs, marshes and wetlands included in the NATURA 2000 network within this RBD – in none of them the prognostic decrease of the groundwater table exceeds 1 cm. This means that there are no groundwater wellfields within the Lielupė RBD which would have an adverse impact on the status of surface water bodies and/or terrestrial systems dependent on groundwater.

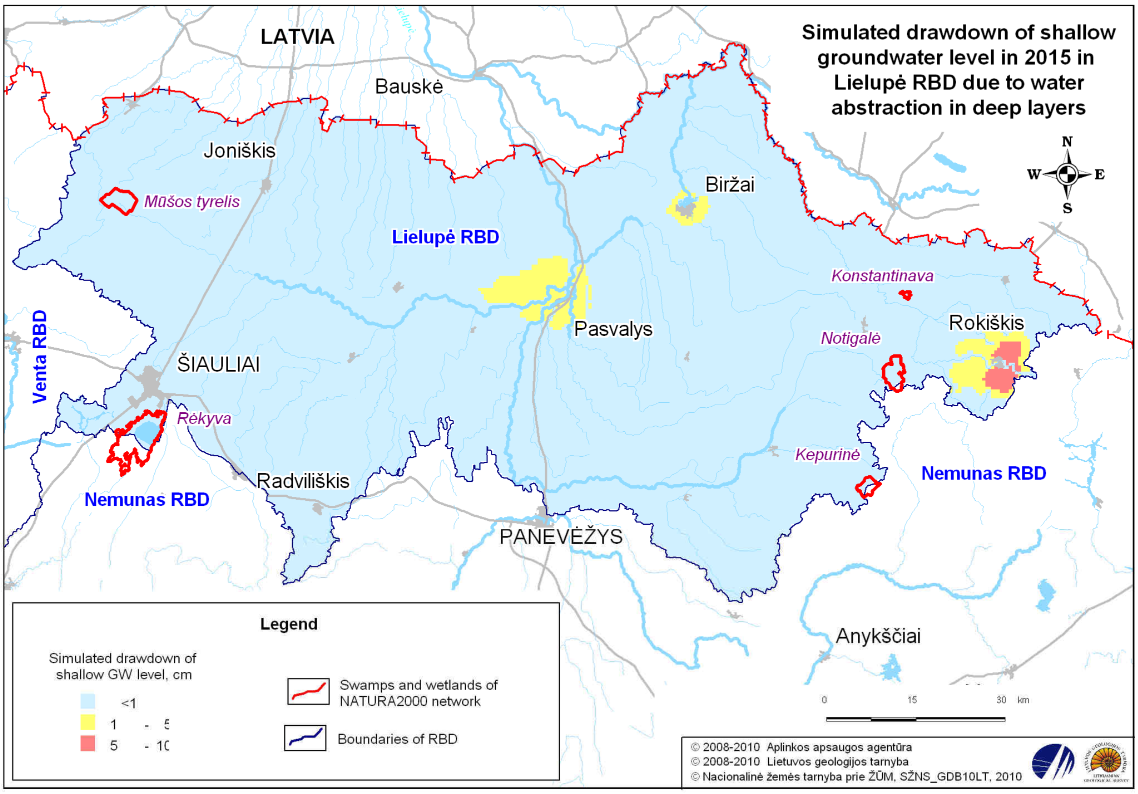


Figure 28. Prognostic simulated decrease of groundwater table in the Lielupė RBD in 2015 as a result of the use of confined aquifers

CHAPTER IV. PROTECTED AREAS

62. Pursuant to the Law of the Republic of Lithuania on Protected Areas (Žin., 1993, No. 63-1188; 2001, No. 108-3902), protected areas are areas of land and/or water with set up clear boundaries, which are of the acknowledged scientific, ecological, cultural and other value, and which have a special protection and use mode.

Protected areas in Lithuania are established in order to preserve values of the natural and cultural heritage, biological diversity, to sustain ecological balance of the landscape, sustainable use and restoration of natural resources, to establish conditions for knowledge-oriented tourism, scientific research and monitoring of the environment status, to promote the natural and cultural heritage.

Particularly protected areas lying within Lielupė RBD take up 97 879 ha, or almost 11% of the total area of the basin (Table 58) and are below the national average and other RBD. The Lielupė RBD contains relatively less protected areas of all types (some of them are not present at all), except for biosphere polygons. Recent establishment of the later type of protected areas demonstrates that a large number of natural values are still available in the region despite intensive agricultural activities in the RBD. The percentage of reserves almost corresponds to the national average.

Table 58. Categories and areas of protected areas in the Lielupė RBD

Categories and types of protected areas	Number	Area* (ha)	Percentage of protected areas in the RBD	Ratio with the country's average
Strict nature reserves and small strict reserves	-	-	-	<
Natural and complex reserves	45	18 648	2.09	≈
Recuperational plots	-	-	-	<
National parks	-	-	-	<
Regional parks	2	21 674	2.42	<
Biosphere reserves	-	-	-	<
Biosphere polygons	5	60 968	6.82	>
Total:	52	97 879*	10.95	<

* The area of reserves situated within biosphere reserves was subtracted from the total area.
Source: Data provided by the State Service for Protected Areas for 2010 and distributed in the RBD by experts.

The Law of the Republic of Lithuania on Protected Areas sets forth public terms related to the protected areas, a legal basis for establishment, protection, management and control of the protected areas. Activities that may cause damage to the protected complexes and objects are prohibited in protected areas. The regulation of activities established by the law is specified in more detail in the regulations of protected areas of individual types as well as in environmental regulations.

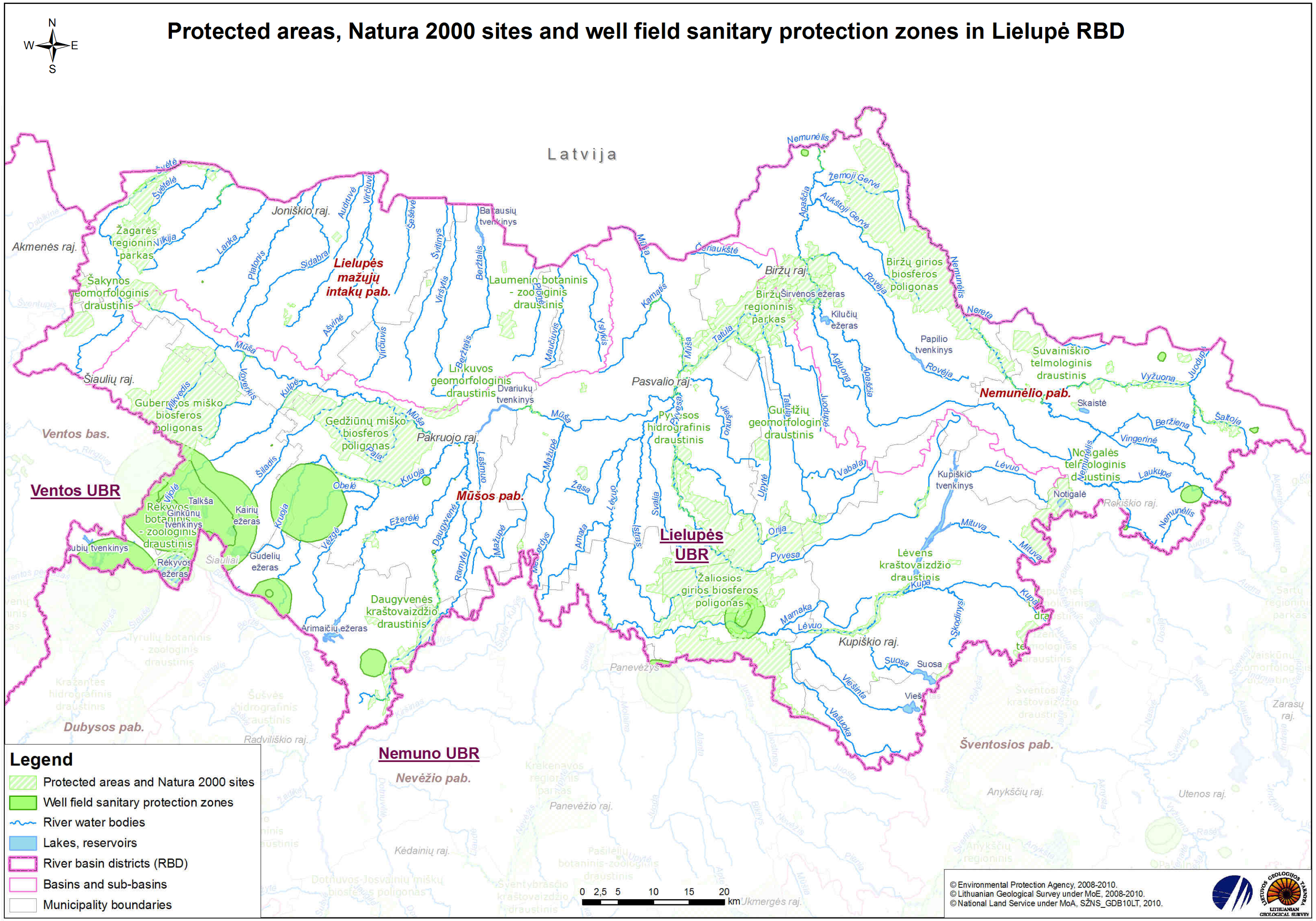


Figure 29. Protected areas in the Lielupė RBD

Reserves

63. Reserves – both state ones (Table 59) and those situated in Biržai and Žagarė regional parks – play an important role in preserving the landscape and biological diversity within the Lielupė RBD.

Table 59. State reserves in the Lielupė RBD

	Reserve	Reserve type	Area, ha	Municipality
1	Daugyvenė	landscape	*3865	Radviliškis distr.
2	Draumėnai	landscape	262	Pakruojis distr.
3	Lėvuo	landscape	1326	Kupiškis distr.
4	Pamūšiai	landscape	427	Pasvalys distr.
5	Buožiai	geological	14	Kupiškis distr.
6	Nemunėlis-Apaščia	geological	297	Biržai distr.
7	Guodžiai	geomorphological	485	Biržai distr.
8	Linkuva	geomorphological	708	Pakruojis distr.
9	Prūsagalė	geomorphological	275	Kupiškis distr.
10	Šakyna	geomorphological	935	Šiauliai distr.
11	Daugyvenė	hydrographical	181	Pakruojis distr.
12	Pyvesa	hydrographical	459	Pasvalys distr.
13	Vilkija	hydrographical	64	Joniškis distr.
14	Glėbavas	pedological	83	Pakruojis distr.
15	Vainiškis	pedological	98	Kupiškis distr.
16	Biržų giria	botanical	143	Biržai distr.
17	Latveliai	botanical	100	Biržai distr.
18	Laumekiai	botanical	44	Pakruojis distr.
19	Lepšynė	botanical	207	Pasvalys distr.
20	Radviloniai	botanical	158	Radviliškis distr.
21	Švendrė	botanical	*83	Šiauliai distr.
22	Čedasas	zoological (ornithological)	132	Rokiškis distr.
23	Vijuoliai	zoological (ornithological)	61	Panevėžys distr.
24	Laumenis	botanical-zoological	645	Pakruojis distr.
25	Rėkyva	botanical	*379	Šiauliai distr.
26	Žalioji giria	botanical	3 103	Panevėžys distr.
27	Aloja	telmological	40	Kupiškis distr.
28	Gaidžiabalė	telmological	172	Rokiškis distr.
29	Girkančiai	telmological	*195	Akmenė distr.
30	Karniškės	telmological	*158	Akmenė distr.
31	Kepurinė	telmological	*435	Kupiškis distr.
32	Konstantinava	telmological	82	Rokiškis distr.
33	Notigalė	telmological	*1270	Kupiškis distr., Rokiškis distr.
34	Sakonių bala	telmological	*60	Kupiškis distr.
35	Suvainiškis	telmological	1193	Rokiškis distr.
	Total		18139	

* Only the share of the protected area situated within the boundaries of the RBD.

Source: Data provided by the State Service for Protected Areas for 2010 and distributed in the RBD by experts.

There are very few reserves established by municipalities within the Lielupė RBD. Ten such reserves occupy the area of 545 ha. The number of municipal reserves varies to a large extent. For example, there are three reserves in the municipality of Joniškis district and as many as six reserves established in Pasvalys district. Such reserves are established observing the Procedure for the Establishment of Municipal Reserves and Announcement of Municipal Objects of Nature Heritage approved by Resolution No. 56 of the Government of the Republic of Lithuania of 19 January 2006 (Žin., 2006, No. 9-335).

State parks

64. State parks make up the largest share of the protected areas system in Lithuania. Only two state parks, Biržai and Žagarė regional parks, are situated in the Lielupė RBD (Table 60). The latter park has been significantly expanded pursuant to the Plan of the Boundaries of Žagarė Regional Park, its Zones and Buffer Protection Zone approved by Resolution No. 1232 of the Government of the Republic of Lithuania of 19 November 2008 (Žin., 2008, No. 139-5497). Consequently, Žagarė Regional Park has incorporated former state reserves (Mūšos tyrelis thelmological reserve, Pabaliai biological reserve) and municipal reserves (Švėtė River valley botanical reserve) and other areas valuable from the point of view of the nature and recreation.

Table 60. State parks in the Lielupė RBD

	State park	Area, ha	Municipality
1	Biržai Regional Park	14 534	Biržai distr., Pasvalys distr.
2	Žagarė Regional Park	7 140	Joniškis distr.
	Total	21 674	

Source: Data provided by the State Service for Protected Areas for 2010 and distributed in the RBD by experts.

Biosphere monitoring territories

65. Biosphere monitoring territories are divided into biosphere reserves and biosphere polygons. There are no biosphere reserves within the Lielupė RBD.

Biosphere polygons are created to facilitate the monitoring of national and regional environments in territories of particular geo-ecological importance. 28 biosphere polygons were established by orders of the Minister of Environment in 2004, 2005 and 2009, including five ones within the Lielupė RBD (Table 61 below), which also approved their individual regulations and boundaries. These large protected areas have significantly increased the territory of the protected areas in the basin.

Table 61. Biosphere monitoring territories in the Lielupė RBD

	State park	Area, ha	Municipality
1	Biosphere polygons of Biržų forest	17 683	Biržai distr.
2	Biosphere polygons of Gedžiūnų forest	14 269	Joniškis distr., Pakruojis distr.
3	Biosphere polygons of Gubernijos forest	*14 592	Joniškis distr., Šiauliai distr.
4	Biosphere polygons of Šimonių forest	*250	Anykščiai distr., Kupiškis distr.
5	Biosphere polygons of Žalioji giria forest	14 174	Kupiškis distr., Panevėžys distr.
	Total	60 968	

*Only the share of the protected area situated within the boundaries of the RBD

Source: Data provided by the State Service for Protected Areas for 2010 and distributed in the RBD by experts.

Network of NATURA 2000 sites

66. NATURA 2000 is a network of protected areas on the territory of the European Union, which covers natural habitats and species that are very important for the biological diversity of Europe. The network is developed by implementing the requirements of Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds of 30 November 2009 (OJ 2010 L 20, p. 7-25) (Birds Directive) and Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora of 21 May 1992 (OJ 2004 special edition, Chapter 15, Volume

2, p. 102) (Habitats Directive). Both directives require establishment of special protected areas for conservation of certain biological species or important habitats.

The network of NATURA 2000 sites in Lithuania has been developed incorporating it into the existing national system of protected areas. To date, the status of NATURA 2000 sites has been granted mainly to the existing protected areas (reserves, strict reserves, national and regional parks) or parts thereof.

There are 9 areas of importance for the conservation of birds (Table 62) and 33 areas of importance for the conservation of habitats within the Lielupė RBD (Table 63).

Table 62. Areas of importance for the conservation of birds in the Lielupė RBD

	Site of importance for the conservation of birds	Area, ha	Municipality
1	Biržų forest**	17 683	Biržai distr.
2	Lake Čedasas and its lake sides	132	Rokiškis distr.
3	Gedžiūnų forest	14 269	Joniškis distr., Pakruojis distr.
4	Gubernijos forest	*14 592	Joniškis distr., Šiauliai distr.
5	Mūšos tyrelis marsh	1 463	Joniškis distr.
6	Nemunėlis River valley	1 550	Biržai distr., Rokiškis distr.
7	Valleys of rivers Šaltoja and Vyžuona	1 569	Rokiškis distr.
8	Šimonių forest**	*263	Kupiškis distr.
9	Žalioji giria forest**	14 174	Kupiškis distr., Panevėžys distr.
	Total	65 695	

* Only the share of the protected area situated within the boundaries of the RBD.
** Overlaps with the area of importance for the conservation of habitats
Source: Data provided by the State Service for Protected Areas for 2010 and distributed in the RBD by experts.

Table 63. Areas of importance for the conservation of habitats in the Lielupė RBD

	Area of importance for the conservation of habitat	Area, ha	Municipality
1	Ąžuolinės forest	92	Biržai distr.
2	Biržų forest**	17 683	Biržai distr.
3	Daudžgirių forest	167	Biržai distr.
4	Surroundings of Draseikiai village	35	Biržai distr.
5	Gaidžiabalės samanynė raised bog	180	Rokiškis distr.
6	Gypsum karst lakes and their lake sides	1 239	Biržai distr.
7	Gružių forest	79	Pasvalys distr.
8	Surroundings of Karajimiškis village	46	Biržai distr.
9	Kepurinės bog	700	Kupiškis distr.
10	Konstantinavos bog	108	Rokiškis distr.
11	Kruoja River valley	195	Pakruojis distr.
12	Kurklių forest	*39	Radviliškis distr.
13	Laumenio forest	645	Pakruojis distr.
14	Lepšynės forest	207	Pasvalys distr.
15	Levuo River valley	862	Kupiškis distr.
16	Forest at Dilbinėliai	69	Joniškis distr.
17	Mūša River valley downstream of Raudonpamūšis	77	Pakruojis distr., Pasvalys distr.
18	Mūšos tyrelio forest**	1463	Joniškis distr.
19	Valleys of rivers Nemunėlis and Apaščia	386	Biržai distr.
20	Notigalės bog	*1270	Kupiškis distr.
21	Pabalių forest and Švėtė River valley	61	Joniškis distr.
22	Padaičių forest	61	Biržai distr.
23	Pamūšiai	478	Pasvalys distr.
24	Rėkyva bog	*2 152	Šiauliai city, Šiauliai distr.
25	Sakonių bala mire	*60	Kupiškis distr.
26	Skapagirio forest	2 124	Kupiškis distr.
27	Suvainiškio forest	1 193	Rokiškis distr.

	Area of importance for the conservation of habitat	Area, ha	Municipality
28	Šimonių forest**	*263	Anykščiai distr., Kupiškis distr.
29	Veržių forest	1 257	Joniškis distr.
30	Vilkiaušio forest	124	Joniškis distr.
31	Vilkija River valley	64	Joniškis distr.
32	Žagarės asar	49	Joniškis distr.
33	Žalioji giria forest	*29 964	Biržai distr., Kupiškis distr., Panevėžys distr., Pasvalys distr.
	Total	63 392	

* Only the share of the protected area situated within the boundaries of the RBD.
** Overlaps with the area of importance for the conservation of birds.
Source: Data provided by the State Service for Protected Areas for 2010 and distributed in the RBD by experts.

The legal basis of the NATURA 2000 networks is two EU directives: Birds Directive and Habitats Directive. The EU environmental policy ensures effective maintenance of unique biological diversity throughout Europe as well as the same legal obligations for all EU Member States in protecting the sites incorporated in the NATURA 2000 network.

Development of the network of transboundary protected areas

67. Protected areas would become much more attractive if they could be better known on both sides of the border.

The key objectives of the establishment of transboundary protected areas are as follows:

67.1. protection of the most valuable territories of nature and culture in border areas;

67.2. ensuring of interconnections when forming a Pan-European nature framework;

67.3. development of ecological tourism in border areas;

67.4. closer cooperation between the neighbouring countries in the environmental field.

A significant part of the state border with Latvia within the Lielupė RBD extends along the beds of the Nemunėlis and other rivers. Protected areas within the Lielupė RBD which are situated at the state border are Nemunėlis–Apaščia geological reserve, Žagarė Regional Park and biosphere polygon of Biržų forest. It is recommended to study potential interconnections of these protected areas with values of the nature on the Latvian side.

Sanitary protection zones of wellfields

68. 442 groundwater wellfields which belong to Lielupė, Venta and Dauguva RBD are registered in the part on the Earth Entrails Resources of the Register of the Earth Entrails of the Lithuanian Geological Survey. Of these, 14 wellfields are not used, including two wellfields of mineral water.

Pursuant to the Procedure for the Approval of Explored Solid Minerals approved by Order No. 1-146 of the Director of the Lithuanian Geological Survey under the Ministry of Environment of 14 July 2010 (Žin., 2010, No. 86-4576), exploitable resources of groundwater must be assessed and approved for all operating and newly designed public water supply and mineral water wellfields. In addition, all wellfields must have the established sanitary protection zones (SPZ) which are designed to protect sources of drinking groundwater and natural mineral water against pollution, as well as to ensure the safety and quality of drinking water supplied to customers. SPZ are established, installed and maintained observing the provisions of the Lithuanian Hygiene Norm HN 44:2006 "Delineation and maintenance of sanitary protection zones of wellfields" approved by Order No. V-613 of the Minister of Health of the Republic of Lithuania of 17 July 2006 (Žin., 2006, No. 81-3217). After the approval of a special plan for the SPZ of a wellfield, the special land use conditions are entered in the Real Property Cadastre and Real Property Register pursuant to the procedure laid down in Article 22 of the Law of the Republic of Lithuania on Land (Žin., 1994, No. 34-620; 2004, No. 28-868) and the Regulations of the Real Property Cadastres of the Republic of Lithuania approved by Resolution No. 534 of the Government of the Republic of Lithuania of 15 April 2002 (Žin., 2002, No. 41-1539; 2005, No. 80-2899). This is an important requirement because it ensures application of restrictions on economic activity within the SPZ.

The number of the SPZ of public water supply wellfields in the State Geological Information System during the period 2003-2009 totalled to 89.

For wellfields abstracting more than 100 m^3/day on average, SPZ have been defined or established using a simulation technique pursuant to the provisions of paragraph 20.2 of the Lithuanian Hygiene Norm HN 44:2006. For wellfields abstracting less than 100 m^3/day on average, pollution restriction belts have been established within 50 m from the well pursuant to paragraph 20.1 of the said Hygiene Norm. SPZ for 16 wellfields in the Lielupė Basin have been established according to the data bank of the Territorial Planning Data of the Master Plan of Lithuania however, they have not been revised observing the Lithuanian Hygiene Norm HN 44:2006. In future, however, when municipalities decide on official designation of bathing waters, the envisaged costs of monitoring of bathing waters may go up.

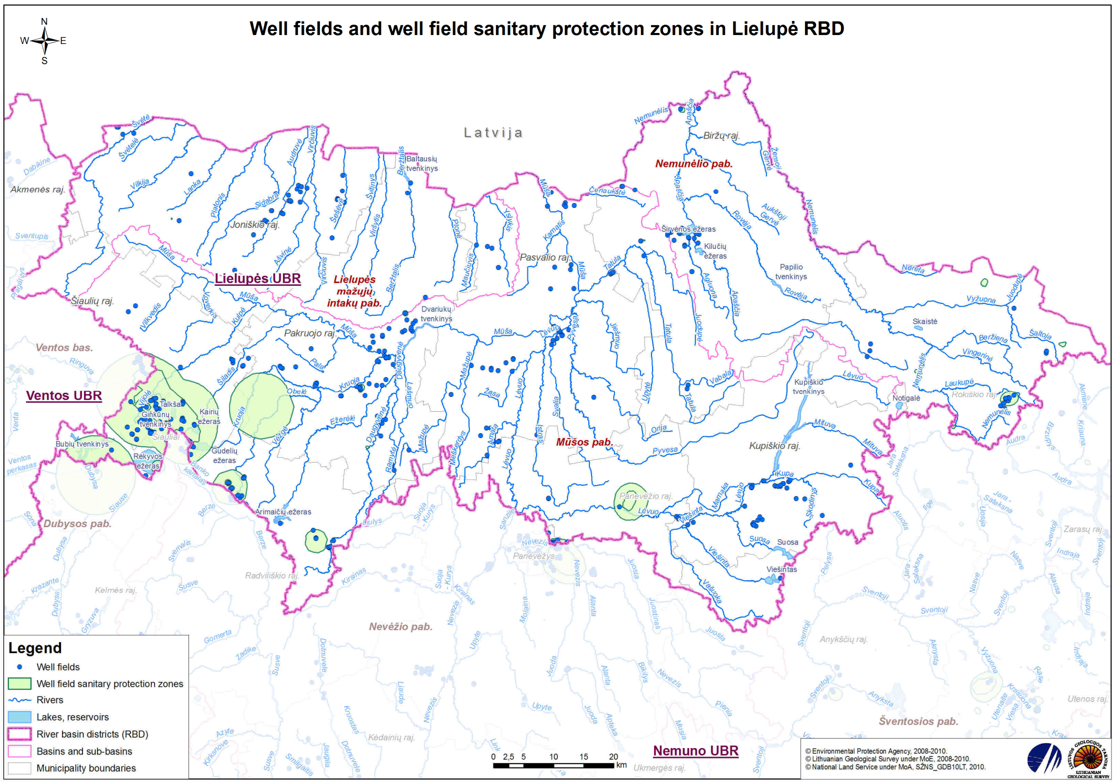


Figure 30. Groundwater wellfields and their SPZ in the Lielupė RBD

CHAPTER V. MONITORING AND STATUS ASSESSMENT OF WATER BODIES IN THE LIELUPĖ RBD

SECTION I. SURFACE WATER BODIES

69. Pursuant to the requirements of the Law of the Republic of Lithuania on Water, the status of surface water bodies is assessed through surveillance and operational monitoring of water bodies and, if needed, investigative monitoring.

The purpose of monitoring is to identify the status of the existing water bodies, to evaluate the effectiveness of pollution reduction measures, and to obtain data which would serve as the basis for taking decisions, during the programme implementation period, on provision of conditions for the attainment of good ecological and chemical status of rivers, lakes, ponds, and related ecosystems.

Monitoring is carried out in accordance with the National Environmental Monitoring Programme.

70. Surveillance monitoring is carried out in order to get information about the overall status of water bodies in the country and its long-term changes. This information is required for designing key measures intended to ensure protection of water bodies in future, supplementing and ensuring the differentiation of water bodies into types, establishing reference conditions for water body types. For the purpose of implementing water quality management based on the basin principle as regulated by law, the surveillance monitoring network was selected so as to enable an assessment of the status of water bodies within each river basin district, basin or sub-basin.

71. Taking into account the monitoring site and the importance of information in respect of the entire river basin district, surveillance monitoring was subdivided into two types: intensive monitoring (conducted every year) and extensive (conducted twice during the implementation of the management plan in a RBD).

Surveillance intensive monitoring sites were selected:

71.1. in the major rivers of the basin;

71.2. in transboundary water bodies situated at the border;

71.3. in reference water bodies (unaffected by anthropogenic pressures);

71.4. in water bodies suffering from significant agricultural pressures and in other water bodies of national significance.

72. Surveillance extensive monitoring is carried out for water bodies which are indicative of the overall status of water bodies, i.e. in water bodies the ecological status of which currently conforms to the criteria for high and good ecological status, or the ecological potential conforms to the criteria for maximum and good ecological potential.

73. Operational monitoring is undertaken in water bodies the current ecological status or ecological potential of which is lower than good. The purpose of operational monitoring is to establish the status of surface water bodies identified as being at risk of failing to meet their water protection objectives, and to assess any changes in the status resulting from the programmes of measures for the achievement of the water protection

objectives. This monitoring allows assessing the impact of sources of pollution on the receiving water body.

74. Investigative monitoring is undertaken in cases when the reason of failure of a parameter indicative of a quality element to conform to the good status requirements has not been identified, or when the extent or impact of accidental pollution needs to be identified.

75. The key objective of a monitoring programme is to establish and monitor the status of all water bodies in the country; therefore the network of monitoring sites is established in respect of water bodies. In total, 124 water bodies in the category of rivers, 17 water bodies in the category of lakes and ponds have been identified within the Lielupė RBD. Consequently, the task of the monitoring programme is to reflect the status of all 141 water bodies in the Lielupė RBD. To this end, monitoring of all required quality elements has been provided for and has been carried out in accordance with the General Requirements for the Monitoring of Water Bodies approved by Order No. 726 of the Minister of Environment of the Republic of Lithuania of 31 December 2003 (Žin., 2004, No. 10-290), which specify only the minimum monitoring frequency. An exception is provided only for the minimum frequency of the monitoring of parameters indicative of biological elements: macrophytes (in all water bodies, except for reference condition sites), fish fauna and zoobenthos (in water bodies in the category of lakes and heavily modified lakes, except for reference condition sites). Macrophyte communities are one of the most inert ones among biological elements, their reaction to qualitative changes in their living environment is exceptionally slow. The water exchanger rate is much lower in lakes and ponds than in rivers, hence communities of fish fauna and zoobenthos also change very slowly. Consequently, parameters indicative of biological elements are sufficient to be monitored once in six years in such specific cases, and not once in three years as provided for in the General Requirements for the Monitoring of Water Bodies (Žin., 2004, No. 10-290). Such monitoring frequency is deemed to be sufficient to be able to assess changes in the status of biological quality elements.

Network of monitoring sites for water bodies in rivers and heavily modified water bodies

76. 124 water bodies were identified as falling into the category of rivers within the Lielupė RBD. If monitoring sites are established in each water body, the monitoring network would become too wide. Consequently, the development of the monitoring network took into account the fact that a number of water bodies in each sub-basin are similar by their typology, status and factors conditioning the status. In order to streamline the monitoring network, water bodies were grouped on the basis of their typology, status and factors determining the status. At least one monitoring site was selected for each group of water bodies assuming that such one monitoring site represents the status of all water bodies within the group. Such grouping of water bodies for monitoring purposes was performed in respect of water bodies at high and good ecological status and maximum and good ecological potential as well as water bodies where poorer than good status is determined by the bed straightening. For example, when a monitoring site is in a water body of Type 1 at high ecological status, it is assumed that the monitoring data of this site will reflect the quality of all water bodies of Type 1 at high ecological status in a respective sub-basin. Individual operational

monitoring sites were provided for in respect of other water bodies where poorer than good ecological status is conditioned by HPP impact, diffuse and/or point pollution.

The type of monitoring was determined based on the results of the assessment of the ecological status of water bodies. Operational monitoring is required for all water bodies which are not included in the surveillance intensive monitoring networks and the ecological status of which is currently lower than good, meanwhile surveillance monitoring should be carried out for the remaining water bodies.

The programme of monitoring of all water bodies in the category of rivers in the Lielupė RBD covers 108 water bodies. Surveillance intensive monitoring should be carried out in 8 water bodies, surveillance extensive monitoring – in 4 water bodies, operational monitoring – in 95 water bodies and investigative monitoring – in 1 water body. The surveillance intensive monitoring programme includes observations in 3 rivers suffering from agricultural pressures and 4 transboundary rivers (including 1 site envisaged for investigating agricultural impact at the same time) and 2 main tributaries.

The number of monitoring sites for rivers in the Lielupė RBD is provided in Table 65 below.

Table 65. Type and number of monitoring sites for rivers within the Lielupė RBD

Sub-basin	Number of surveillance intensive monitoring sites		Number of surveillance extensive monitoring sites	Number of operational monitoring sites	Number of investigative monitoring sites
	Total	in rivers subject to agricultural pressures			
Mūša	5	2	-	67	1
Nemunėlis	1	-	4	11	0
Lielupė Small Tributaries Sub-basin	2	1	-	17	0
Total:	**8**	**3**	**4**	**95**	**1**

Source: experts' data

Network of monitoring sites for lakes and ponds

77. The status of lakes and ponds can be affected and determined by different factors; thus, due to the unique conditions in each lake or pond, monitoring should be carried out in respect of all water bodies falling within the category of lakes and ponds. The programme of monitoring of lakes in the Lielupė RBD covers the total of 17 water bodies (including ponds and heavily modified Lake Rėkyva). Surveillance extensive monitoring should be carried out in 7 water bodies: 4 lakes and 3 ponds. Operational monitoring is required for 6 water bodies, investigative monitoring – in 4 water bodies.

The number of monitoring sites for lakes and ponds within the Lielupė RBD is provided in Table 66 below.

Table 66. Type and number of monitoring sites for lakes and ponds within the Lielupė RBD

Sub-basin	Monitoring of lakes			Monitoring of ponds	
	Surveillance extensive	Operational	Investigative	Surveillance extensive	Operational
Mūša	4	1	2	2	2
Nemunėlis	-	2	2	1	-
Lielupė Small Tributaries	-	-	-	-	1
Total:	**4**	**3**	**4**	**3**	**3**

Source: experts' data

Since monitoring networks of different types pursue different objectives, the monitored elements also differ and so do monitoring regularity and frequency.

Monitoring programme for rivers and heavily modified water bodies

Surveillance intensive monitoring

78. Frequencies of the monitoring of parameters indicative of all quality elements were established so as to ensure a high level of data confidence and precision. Hydrological regime and general parameters for physico-chemical elements shall be measured 12 times a year (every month) in all intensive surveillance monitoring sites, and concentrations of the main ions shall be monitored at the same frequency in transboundary rivers and in the main tributaries. Such measurement frequency and continuous measurements in the same monitoring sites will ensure a high level of confidence in the assessment of natural and anthropogenic changes.

Concentrations of metals shall be measured every year 12 times a year in monitoring sites located in areas of intensive agricultural activities. If the concentrations of metals do not exceed the MAC during the first year of measurement, repeat samples may be taken after three years. Once a year, concentrations of metals shall also be measured in bottom sediments and biota. No analysis of concentrations of specific pollutants and metals is proposed for other surveillance intensive monitoring sites because no exceedance of the MAC have been registered in those sites during the last five years.

Regularity of the analysis of parameters indicative of biological elements in surveillance intensive monitoring sites differs depending on the characteristics of the biological objects. Macrophytes should be monitored only in places representative of rivers other than Type 1. Though the General Requirements for the Monitoring of Water Bodies (Žin., 2004, No. 10-290) provide for the monitoring of macrophyte parameters once in three years, in experts' opinion, one time every six years is sufficient because macrophyte communities are one of the most inert ones (changing the most slowly) among biological elements. Measurements of parameters for fish fauna, which are quicker to react to environmental changes, in the sites of intensive monitoring should be performed once in three years and zoobenthos should be monitored every year. Parameters for phytobenthos should be measured on an annual basis three times a year. Of all biological elements, these parameters are the first to react to changes in the water quality hence three measurements per year are expected to provide information on momentary (short-term) impacts of changes in the water quality. Parameters indicative of morphological conditions in rivers, which change the most slowly, and river continuity are sufficient to be monitored once during a six-year monitoring cycle.

Table 67. Surveillance intensive monitoring programme for rivers

Monitoring elements and parameters			**Surveillance intensive monitoring in rivers**								
			Transboundary rivers			**Main tributaries**			**Basins in agricultural areas**		
		1	2	3	4	2	3	4	2	3	4
Physico-chemical quality elements	General parameters	AP 1	4	12	6	2	12	6	3*	12	6
	Main ions	AP 2	4	12	6	2	12	6	3*	4	2
	Metals	AP 3	0	0	0	0	0	0	3*	12	6
	Metals in bottom sediments	AP 4	0	0	0	0	0	0	3*	1	6
Biological quality elements	Macrophytes	AP 7	2	1	1	2	1	1	2*	1	1
	Zoobenthos	AP 8	4	1	6	2	1	6	3*	1	6
	Fish fauna	AP 9	4	1	2	2	1	2	3*	1	2
	Phytobenthos	AP 10	4	3	6	2	3	6	3*	3	6
Hydromorphological quality elements	Hydrological regime	AP 11	4	12	6	2	12	6	3*	12	6
	Morphological conditions	AP 12	4	1	1	2	1	1	3*	1	1
	River continuity	AP 13	4	1	1	2	1	1	3*	1	1

Explanation of the column numeration:

1 – analytical package, lists of parameters for each analytical package are provided in Table 71
2 – number of monitoring sites
3 – annual number of samples in sites
4 – frequency during a six-year monitoring cycle

*one site is located in a transboundary river, i.e. the same site is included in the table twice – as a transboundary site and as a site subject to agricultural pressures

Note:
If concentrations of specific pollutants in samples do not exceed the established environmental quality standards during the first year of monitoring, repeat samples for assessment of the concentrations may be taken after three years.

Source: experts' data

Surveillance extensive monitoring

79. Surveillance extensive monitoring aims at observing general status in water bodies (natural rivers, heavily modified rivers and artificial canals) which meet the requirements for good ecological status or good ecological potential. There are 11 such water bodies within the Lielupė RBD, 4 surveillance extensive monitoring site have been envisaged for their monitoring. These monitoring sites shall ensure the assessment of the ecological status and ecological potential of all water bodies outside the category of water bodies at risk with a medium level of confidence.

The following elements shall be observed in surveillance extensive monitoring sites: general physico-chemical parameters, main ions, parameters indicative of biological elements, hydrological regime, morphological conditions, and river continuity. The monitoring frequency and regularity for the relevant parameters correspond to those laid down in the General Requirements for the Monitoring of Water Bodies (Žin., 2004, No. 10-290) and are sufficient for monitoring the overall ecological status of water bodies and ensuring medium confidence and precision level of the data. Measurements of all parameters in the same monitoring site should be performed every three years, except for parameters for macrophytes, which are to be monitored once during a six-year cycle (macrophyte communities are the most stable of all biological elements) and only in sites in rivers larger than Type 1. During the monitoring year, general physico-chemical parameters and the hydrological regime should be measured four times a year (every three months) and the remaining parameters – once a year.

Four surveillance extensive monitoring sites are envisaged for the Lielupė RBD (Table 68).

Table 68. Surveillance extensive monitoring programme for rivers (natural and heavily modified rivers)

Monitoring elements and parameters		Surveillance extensive monitoring in rivers			
		1	2	3	4
Physico-chemical quality elements	General parameters	AP 1	4	4	2
	Main ions	AP 2	4	4	2
Biological quality elements	Macrophytes	AP 7	2	1	1
	Zoobenthos	AP 8	4	1	2
	Fish fauna	AP 9	4	1	2
	Phytobenthos	AP 10	4	1	2
Hydromorphological quality elements	Hydrological regime	AP 11	4	4	2
	Morphological conditions	AP 12	4	1	1
	River continuity	AP 13	4	1	1

Explanation of the column numeration:
1 – analytical package, lists of parameters for each analytical package are provided in Table 71
2 – number of monitoring sites
3 – annual number of samples in sites
4 – frequency during a six-year monitoring cycle

Source: experts' data

Operational monitoring

80. Operational monitoring is intended for the monitoring of the ecological status/potential in river stretches where the established water protection objectives are not likely to be achieved. This monitoring allows assessing changes in ecological status/potential which occur while implementing programmes of measures for the achievement of water protection objectives. The operational monitoring network in the Lielupė RBD covers 95 river sites (Table 69).

Frequencies of monitoring elements were established so as to obtain sufficient data for assessing the status of quality elements and its variation. Taking into account the fact that measures for the reduction of impacts of anthropogenic activities take effect with some delay (after a certain time period), measurements of the monitoring elements in operational monitoring sites should be repeated once in three years instead of every year. Such regularity is sufficient to be able to assess measures for the reduction of impacts of anthropogenic activities as well as changes in the status of biological elements. It should be noted that the absolute majority of biological elements react to improvements of their living environment after a certain time and not immediately. Hence the said monitoring frequency ensures an adequate level of data confidence and precision.

In the monitoring sites, parameters indicative of all elements which might prevent the achievement of water protection objectives and parameters indicative of biological elements shall be monitored measuring their values every three years. Less frequent measurements, once every six years, shall be carried out only in respect of elements which change the most slowly, i.e. river morphology, continuity and macrophytes (the latter shall be monitored only in river stretches which are not Type-1 rivers). Though the monitoring frequency (once every six years) for macrophytes is lower than indicated in the General Requirements for the Monitoring of Water Bodies (Žin., 2004, No. 10-290), it is deemed to be sufficient because macrophyte communities are one of the most inert ones (changing the most slowly) of biological elements. General physico-chemical parameters shall be measured in all river sites subject to operational monitoring, taking measurements every three months (four times a year) during the monitoring year. Hydrological parameters (quantity of flow which partially determines concentrations of certain chemical elements in water) shall be monitored at the same frequency.

Monitoring of metals and other specific pollutants is recommended only in river places where exceedances of the MAC of these substances had been registered. No such cases have been identified within the Lielupė RBD. Consequently, operational monitoring of specific pollutants and metals is not proposed in this stage.

Parameters indicative of biological elements, i.e. those for zoobenthos and fish fauna, shall be measured once a year (every three years) and parameters for phytobenthos are recommended to be measured three times a year (every three years) because parameters for phytobenthos are the ones which change the most quickly as a result of changes in the water quality.

Table 69. Operational monitoring programme for rivers

Monitoring elements and parameters		**Operational monitoring in rivers**			
		1	2	3	4
Physico-chemical quality elements	General parameters	AP 1	95	4	2
Biological quality elements	Macrophytes	AP 7	22	1	1
	Zoobenthos	AP 8	95	1	2
	Fish fauna	AP 9	95	1	2
	Phytobenthos	AP 10	95	3	2
Hydromorphological quality elements	Hydrological regime	AP 11	95	4	2
	Morphological conditions	AP 12	95	1	1
	River continuity	AP 13	95	1	1

Explanation of the column numeration:

1 – analytical package, lists of parameters for each analytical package are provided in Table 71

2 – number of monitoring sites

3 – annual number of samples in sites

4 – frequency during a six-year monitoring cycle

Source: experts' data

Investigative monitoring

81. No significant pollution with specific pollutants and metals has been identified in rivers within the Lielupė RBD. However, concentration of these substances have not been analysed in all rivers of this RBD hence it is likely that pollution has not been detected due to lack of investigations. Pollution with specific pollutants and metals is likely in the Kulpė River downstream of Šiauliai there for investigative monitoring is recommended for this place. Concentrations of specific pollutants and metals shall be measured every year 12 times a year. If these concentrations do not exceed the MAC during the first year of measurement, repeat samples may be taken after three years. Once a year, concentrations of specific pollutants and metals shall also be measured in bottom sediments and biota.

Measurements of other parameters in this monitoring site shall be performed at the same frequency as in operation monitoring sites.

Table 70. Investigative monitoring programme for the Kulpė River. Analyses to be performed in each analytical package (AP) are provided in Table 71.

Monitoring elements		**Operational monitoring in the Kulpė**			
		1	2	3	4
Physico-chemical quality elements	General parameters	AP 1	1	4	2
Biological quality elements	Zoobenthos	AP 8	1	1	2
	Fish fauna	AP 9	1	1	2
	Phytobenthos	AP 10	1	3	2
Physico-chemical quality elements	Metals in water	AP 3	1	12	6
	Metals in bottom sediments and in biota	AP 4	1	1	6
	Specific pollutants in water	AP 5	1	12	6
	Specific pollutants in bottom sediments and in biota	AP 6	1	1	6
Hydromorphological quality elements	Hydrological regime	AP 11	1	4	2
	Morphological conditions	AP 12	1	1	1
	River continuity	AP 13	1	1	1

Explanation of the column numeration:

1 – analytical package, lists of parameters for each analytical package are provided in Table 71
2 – number of monitoring sites
3 – annual number of samples in sites
4 – frequency during a six-year monitoring cycle

Source: experts' data

Table 71. Parameters for river water quality elements in each analytical package

Analytical package	**List of parameters**
AP 1	General physico-chemical parameters: temperature, colour (Pt mg/l), pH, oxygen concentration, BOD_7, suspended matter, P total, PO_4-P, N mineral, N total, NO_3-N, NH_4-N, NO_2-N, TOC, COD, Cr, Ca, electric conductivity, alkalinity
AP 2	Main ions: Cl, SO_4, Na, K, Mg, Si
AP 3	Metals in water: lead and its compounds, nickel and its compounds, chromium – total, chromium – hexavalent, copper, cadmium, tin, vanadium, arsenic, zinc, aluminium, mercury
AP 4	Metals in bottom sediments: lead and its compounds, nickel and its compounds, chromium – total, chromium – hexavalent, copper, cadmium, tin, vanadium, arsenic, zinc, aluminium, mercury Metals in biota: cadmium and its compounds, lead and its compounds, mercury and its compounds
AP 5	Specific pollutants in water: Substances listed in Annex 1 and Part A of Annex 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2009, No. 83-3473; 2010, No. 59-2938), dibutyl phthalate and polychlorinated biphenyls (PCB)
AP 6	Specific pollutants in bottom sediments: Substances listed in Annex 1 and Part A of Annex 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2009, No. 83-3473; 2010, No. 59-2938), dibutyl phthalate and polychlorinated biphenyls (PCB) Specific pollutants in biota: anthracene, brominated diphenylethers, C10-13-chloroalkanes, di(2-ethylhexyl)phthalate, fluoranthene, hexachlorobenzene, hexachlorbutadiene, hexachlorocyclohexane, pentachloro-benzene, polycyclic aromatic hydrocarbons and tributyltin compounds, and polychlorinated biphenyls (PCB)
AP 7	Macrophytes: species composition, abundance and bottom coverage with each species (SI or other

Analytical package	List of parameters
	adequate indices)
AP 8	Zoobenthos: species composition, abundance of individuals of each species (DSFI or other adequate indices)
AP 9	Fish fauna: species composition, abundance of individuals of each species (DSFI or other adequate indices)
AP 10	Phytobenthos: species composition, abundance
AP 11	Hydrological regime: quantity of water flow
AP 12	Morphological conditions: type of river bed, length and width of the natural riparian vegetation zone
AP 13	River continuity: artificial barriers for fish migration and transportation of outwash material

Source: experts' data

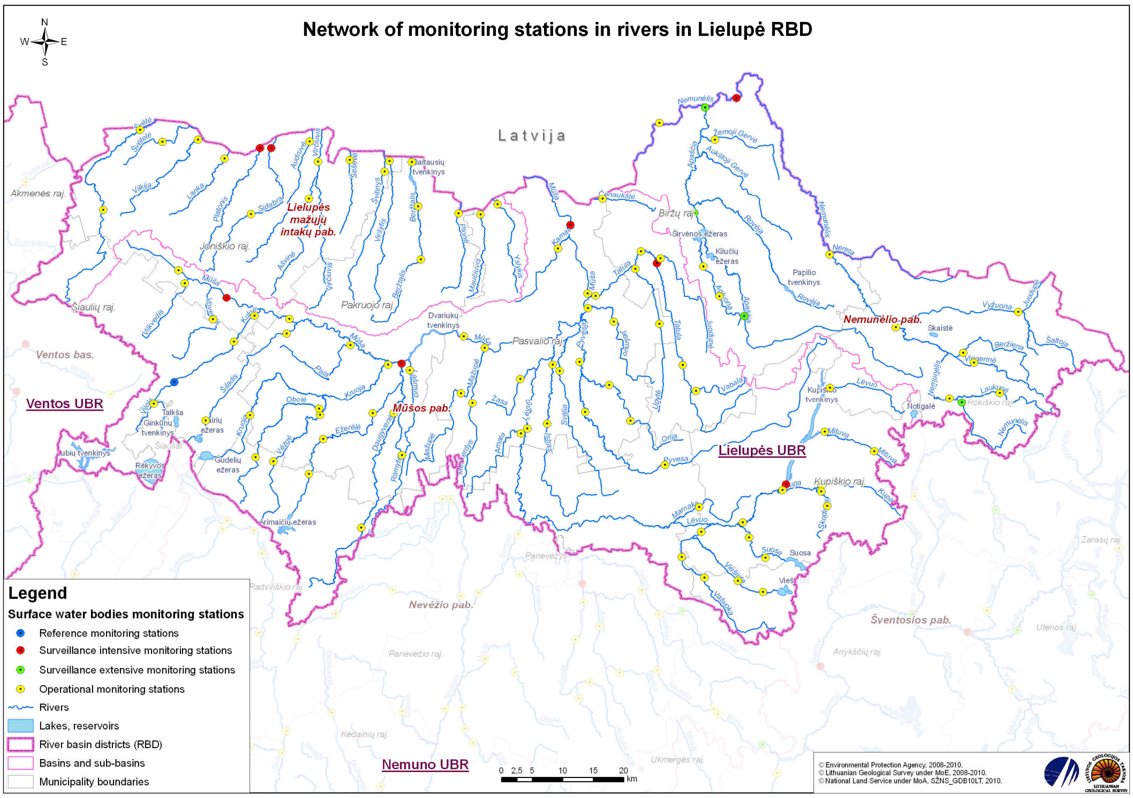


Figure 31. Monitoring network for rivers in the Lielupė RBD

Monitoring programme for lakes and ponds

Surveillance extensive monitoring

82. Surveillance extensive monitoring is intended for the monitoring of the ecological status in lakes and ponds outside the category of water bodies at risk. The surveillance extensive monitoring network in the Lielupė RBD covers 4 lakes and 3 ponds (Table 72). Lake ecosystems change very slowly therefore it is sufficient to monitor the relevant parameters once every six years. Though such monitoring frequency is lower than indicated in the General Requirements for the Monitoring of Water Bodies (Žin., 2004, No. 10-290), it is deemed to be sufficient for the monitoring of general ecological status of water bodies and ensuring medium confidence and precision level of the data.

General physico-chemical parameters and parameters for phytoplankton shall be measured at least four time a year (at the end of April – beginning of May, in the second half of July, second half of August, at the end of September – beginning of October). The remaining monitoring elements shall be measured once during a monitoring cycle. Measurements of parameters for macrophytes and zoobenthos are not recommended for naturally ageing lakes (communities therein may be changed due to natural factors)

Table 72. Surveillance extensive monitoring programme for lakes and ponds

Monitoring elements and parameters		**Surveillance extensive monitoring in lakes and ponds**						
			Lakes			Ponds		
		1	2	3	4	2	3	4
Physico-chemical quality elements	General parameters	AP 14	4	4	1	3	4	1
Biological quality elements	Phytoplankton	AP 19	4	4	1	3	4	1
	Macrophytes	AP 20	4	1	1	3	1	1
	Fish fauna	AP 21	4	1	1	3	1	1
	Zoobenthos	AP 22	4	1	1	3	1	1
Hydromorphological quality elements	Water exchange rate	AP 23	4	1	1	3	1	1
	Morphological conditions	AP 24	4	1	1	3	1	1

Explanation of the column numeration:

1 – analytical package, lists of parameters for each analytical package are provided in Table 75
2 – number of monitoring sites
3 – annual number of samples in sites
4 – frequency during a six-year monitoring

Source: experts' data

Operational monitoring

83. Operational monitoring is carried out in lakes where the established water protection objectives are not likely to be achieved.

Such monitoring within the Lielupė RBD is required for 3 lakes and 3 ponds (Table 73).

With a view to monitor changes in the ecological status of the lake in the operational monitoring network, measurements of parameters indicative of general physico-chemical elements and phytoplankton as well as chlorophyll *a* should be performed at least every three years four times a year. Parameters for other elements which change slower may be measured once during a six-year monitoring cycle. Taking into account the fact that measures for the reduction of impacts of anthropogenic activities take effect with some delay (after a certain time period), such regularity is sufficient to be able to assess changes in the status of parameters for quality elements. The absolute majority of biological elements (except for phytoplankton) react to improvements of their living environment in lakes after a very long time, hence it is believed that such monitoring frequency (once in six years) ensures sufficient data confidence and precision.

Concentration of specific pollutants and metals should be measured in Ginkūnų pond (four time a year in water, once a year in bottom sediments and biota, twice during a six-year monitoring cycle) because filtration waters used to be leaching to the pond from Šiauliai landfill. Although there is no data on concentrations of specific pollutants and metals in Ginkūnų pond, this data is required for the assessment of chemical status. Four measurements per year should ensure sufficient data confidence and precision because of limited pollutant self-removal possibilities of the pond.

Table 73. Operational monitoring programme for lakes and ponds

Monitoring elements and parameters		Operational monitoring in lakes and ponds						
			Lakes			Ponds		
		1	2	3	4	2	3	4
Physico-chemical quality elements	General parameters	AP 14	3	4	2	3	4	2
	Metals in water	AP 15	0	0	0	1	4	2
	Metals in bottom sediments and in biota	AP 16	0	0	0	1	1	2
	Specific pollutants in water	AP 17	0	0	0	1	4	2
	Specific pollutants in bottom sediments and in biota	AP 18	0	0	0	1	1	2
Biological quality elements	Phytoplankton	AP 19	3	4	2	3	4	2
	Macrophytes	AP 20	3	1	1	3	1	1
	Fish fauna	AP 21	3	1	1	3	1	1
	Zoobenthos	AP 22	3	1	1	3	1	1
Hydromorphological quality elements	Water exchange rate	AP 23	3	1	1	3	1	1
	Morphological conditions	AP 24	3	1	1	3	1	1

Explanation of the column numeration:

1 – analytical package, lists of parameters for each analytical package are provided in Table 75
2 – number of monitoring sites
3 – annual number of samples in sites
4 – frequency during a six-year monitoring cycle

Source: experts' data

Investigative monitoring

77. Causes which condition poorer than good ecological status of four water bodies (lakes Skaistė, Notigalė, Talkša and heavily modified Lake Rėkyva) are not clear enough (the lakes may be potentially affected by pollution from unidentified pollution sources and historic pollution). Hence more intensive – investigative monitoring every three years is recommended for these water bodies (Table 74) in order to obtain more precise data on seasonal variation of general physico-chemical parameters and identify the cause which determine poor ecological status/potential of the lakes. Values of general physico-chemical parameters should be measured seven times a year instead of four (six times during the period from the end of April to the beginning of October and once during the period of ice cover) and those of parameters for phytoplankton – six times a year (during the period of intensive vegetation).

Concentrations of specific pollutants and metals should be measured in Lake Talkša (four time a year in water, once a year in bottom sediments and biota, twice during a six-year monitoring cycle).

Lake Talkša is situated in an urban area. According to modelling data, point pollution accounts for as much as 86% of the pollution of the lake. It is highly likely that the chemical status of this water body is also poor (no monitoring of specific pollutants has been performed in the lake). Four measurements per year should ensure sufficient data confidence and precision because of limited pollutant (specific pollutants and metals) self-removal possibilities of the pond.

Morphological conditions (changes in the shore line, length and status of natural riparian vegetation, maximum depth of the lake, thickness of the bottom sediments layer) should be assessed twice and not once during the monitoring cycle (every three years) because the shores of the lake are significantly affected by erosion.

It is not recommended to measure parameters of macrophytes, zoobenthos and fish fauna in Lake Notigalė (since it is an atypical water body).

For lakes Skaistė and Notigalė, monitoring is planned in 2011 and 2014, for Lake Talkša – in 2013 and 2015, in Lake Rėkyva – in 2012 and 2015.

Table 74. Investigative monitoring programme for lakes and heavily modified Lake Rėkyva

Monitoring elements and parameters		**Investigative monitoring in lakes and heavily modified Lake Rėkyva**						
			Lakes			Lake Rėkyva		
		1	2	3	4	2	3	4
Physico-chemical quality elements	General parameters	AP 14	3	12	2	1	12	2
	Metals in water	AP 15	1	4	2	0	0	0
	Metals in bottom sediments and biota	AP 16	1	1	2	0	0	0
	Specific pollutants in water	AP 17	1	4	2	0	0	0
	Specific pollutants in bottom sediments and biota	AP 18	1	1	2	0	0	0
Biological quality elements	Phytoplankton	AP 19	3	6	2	1	6	2
	Macrophytes	AP 20	2	1	1	1	1	1
	Fish fauna	AP 21	2	1	1	1	1	1
	Zoobenthos	AP 22	2	1	1	1	1	1
Hydromorphological quality elements	Water exchange rate	AP 23	3	1	1	1	1	1
	Morphological conditions	AP 24	3	1	1	1	1	2

Explanation of the column numeration:

1 – analytical package, lists of parameters for each analytical package are provided in Table 75
2 – number of monitoring sites
3 – annual number of samples in sites
4 – frequency during a six-year monitoring cycle

Source: experts' data

Table 75. Parameters for water quality elements for lakes and ponds in each analytical package

Analytical package	**List of parameters**
AP 14	General physico-chemical parameters: transparency, oxygen concentration, temperature, pH, suspended matter, P total, N total, colour (Pt mg/l), electric conductivity, alkalinity, Ca, Fe, Si, NO_3-N, NO_2-N, PO_4-P, NH_4-N
AP 15	Metals in water: lead and its compounds, nickel and its compounds, chromium – total, chromium – hexavalent, copper, cadmium, tin, vanadium, arsenic, zinc, aluminium, mercury
AP 16	Metals in bottom sediments: lead and its compounds, nickel and its compounds, chromium – total, chromium – hexavalent, copper, cadmium, tin, vanadium, arsenic, zinc, aluminium, mercury Metals in biota: cadmium and its compounds, lead and its compounds, mercury and its compounds
AP 17	Specific pollutants in water: substances listed in Annex 1 and Part A of Annex 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2009, No. 83-3473; 2010, No. 59-2938), dibutyl phthalate and polychlorinated biphenyls (PCB)
AP 18	Specific pollutants in bottom sediments: substances listed in Annex 1 and Part A of Annex 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2009, No. 83-3473; 2010, No. 59-2938), dibutyl phthalate and polychlorinated biphenyls (PCB) Specific pollutants in biota:

Analytical package	List of parameters
	anthracene, brominated diphenylethers, C10-13-chloroalkanes, di(2-ethylhexyl)phthalate, fluoranthene, hexachlorobenzene, hexachlorbutadiene, hexachlorocyclohexane, pentachloro-benzene, polycyclic aromatic hydrocarbons and tributyltin compounds, and polychlorinated biphenyls (PCB)
AP 19	Phytoplankton: species composition, abundance, biomass, parameters for indicative groups, chlorophyll *a*
AP 20	Macrophytes: species composition, abundance and bottom coverage with each species (SI or other adequate indices)
AP 21	Fish fauna: species composition, abundance of individuals of each species and biomass
AP 22	Zoobenthos: species composition, abundance of individuals of each species
AP 23	Water exchange rate
AP 24	Morphological conditions: changes in the shore line, length of the natural riparian vegetation zone

Source: experts' data

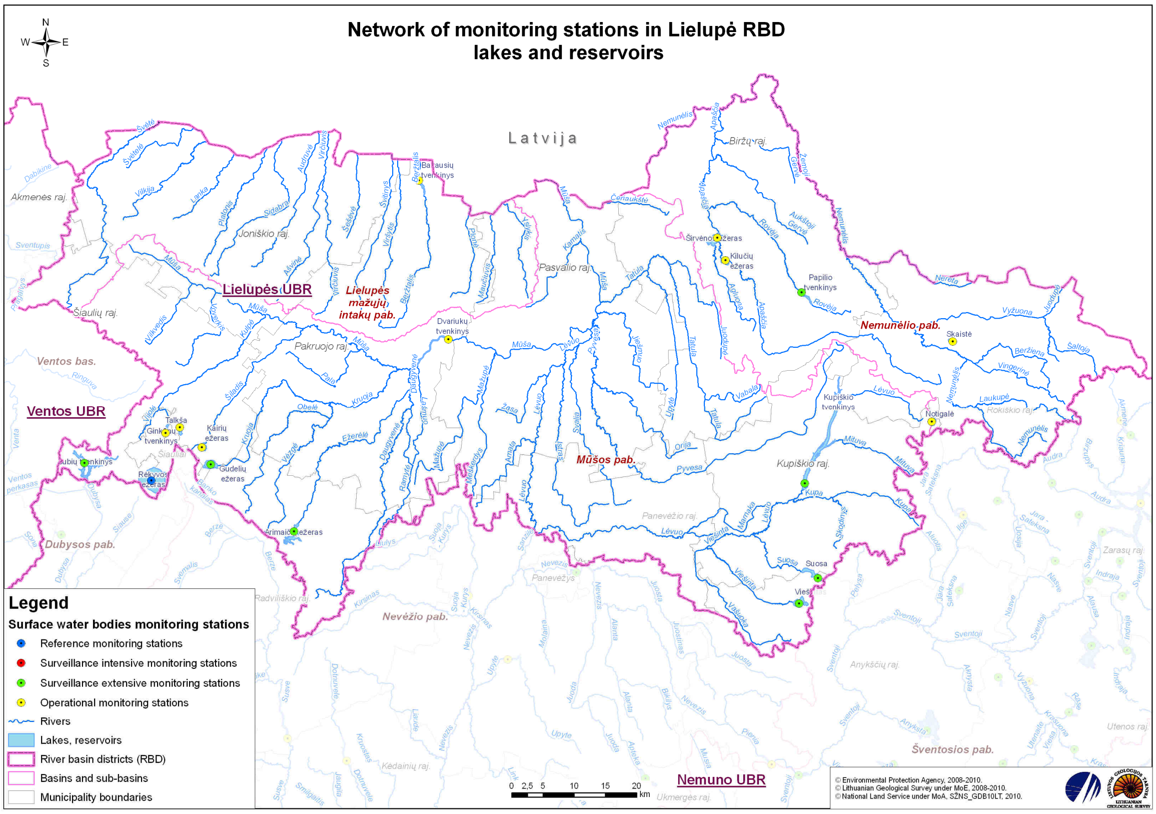


Figure 32. Monitoring network for lakes and ponds in the Lielupė RBD

Status assessment results for surface water bodies

Ecological status and ecological potential of rivers

85. Taking into account river typology and anthropogenic pressures on ecological status, 124 water bodies in the category of rivers were identified within the Lielupė RBD. The most important source of information for the assessment of the ecological status and ecological potential of water bodies was water quality monitoring data of 2005–2009. With a view to ensure accurate assessment, ecological status and ecological potential were identified on the basis of the results obtained only in the monitoring sites

where at least four annual measurements of parameters indicative of physico-chemical quality elements were taken. Data of one-time measurements cannot reflect the actual status of water bodies and therefore was not used in order to avoid major errors. Also, dubious parameter values were excluded. The assessment of the ecological status and ecological potential of water bodies was conducted using the Methodology for the Identification of the Status of Surface Water Bodies approved by Order No. D1-210 of the Minister of Environment of the Republic of Lithuania of 12 April 2007 (Žin., 2007, No. 47-1814).

However, the available water quality monitoring data is not sufficient to identify the ecological status and ecological potential of all water bodies in the category of rivers within the Lielupė RBD. New principles for the delineation of water bodies were proposed while developing the Lielupė RBD Management Plan, therefore the monitoring data collected during 2005–2009 failed to reflect the ecological status of all newly delineated water bodies to the required extent. Thus, the ecological status and ecological potential of water bodies where water quality monitoring had not been conducted were identified on the basis of mathematical modelling results and taking into account hydromorphological parameters for river beds. The assessment of the ecological status and ecological potential on the basis of the modelling results was carried out employing simulated values of parameters indicative of physico-chemical quality elements. Values of parameters indicative of physico-chemical quality elements were estimated with the help of MIKE BASIN model upon evaluation of the present pollution loads and average hydrological conditions.

The mathematical modelling results and data on hydromorphological parameters for river beds were also used as additional information on the assessment of the ecological status and ecological potential of water bodies where monitoring was carried out during 2005-2009.

In cases of discrepancies between the ecological status and/or ecological potential evaluated on the basis of the monitoring data and the one assessed in accordance with the simulated values of parameters indicative of physico-chemical quality elements and hydromorphological parameters, the final assessment of the ecological status of a water body was performed as follows:

85.1. When the ecological status or ecological potential established on the basis of the monitoring data was lower than the one established in accordance with the simulated parameters for physico-chemical quality elements and hydromorphological parameters, the final assessment of the ecological status or ecological potential of the water body was performed using the monitoring data.

85.2. When the ecological status or ecological potential established on the basis of the simulated values of parameters indicative of physico-chemical quality elements and hydromorphological parameters was lower than the one established in accordance with the monitoring data, the final assessment of the ecological status or ecological potential of the water body was performed using the modelling results and the hydromorphological parameters.

Following the Regulations for the Assessment of Ecological Status and Ecological Potential, water bodies were identified as water bodies at risk when any potential significant anthropogenic impact was presumed with a view to minimise the risk of failing to notice deterioration in the current status.

An assessment of the ecological status of water bodies in the category of rivers within the Lielupė RBD demonstrated that there are no water bodies meeting the requirements for high ecological status or maximum ecological potential. 10 water bodies are at good ecological status, all of them are located in the Nemunėlis Sub-basin. Also, there is one water body in this sub-basin which meets the good ecological potential requirements. No bodies of water at good ecological status and good ecological potential were identified in the Lielupė Small Tributaries Sub-basin and Mūša Sub-basin. Most of the water bodies in the Mūša Sub-basin are at moderate ecological status and moderate ecological potential. 44 river water bodies out of the total number of 74 ones identified in the Mūša Sub-basin are at moderate ecological status, 18 HMWB are at moderate ecological potential. In the Nemunėlis Sub-basin, 14 water bodies were identified as being at moderate ecological status, 1 HMWB – at moderate ecological potential. In total, 29 river water bodies were identified in the Nemunėlis Sub-basin, so water bodies at moderate ecological status and potential account for more than half of the total number of rivers in this sub-basin. 3 water bodies in the Lielupė Small Tributaries Sub-basin are at moderate ecological status, 1 HMWB – at moderate ecological potential. This sub-basin contains the largest number of water bodies at poor ecological status or bad ecological potential. 8 river water bodies in the Lielupė Small Tributaries Sub-basin out of the total number of 22 ones were identified as being at poor ecological status and 9 HMWB – at bad ecological potential. In the Mūša Sub-basin, 9 water bodies are at bad ecological status, 2 HMWB – at bad ecological potential. There is only one water body at poor ecological status in the Nemunėlis Sub-basin. 3 water bodies in the Lielupė RBD are at bad ecological status and potential: 2 water bodies at bad ecological status in the Mūša Sub-basin and 1 HMWB at bad ecological potential in the Lielupė Small Tributaries Sub-basin.

The aggregate length of river water bodies in the Lielupė RBD is 2 256.6 km. The length of water bodies at good ecological status totals to 130.7 km (6%), at moderate ecological status – 1 085.5 km (48%), at poor ecological status – 308.8 km (13.7%), at bad ecological status – 29.7 km (1.3%). The length of HMWB meeting the requirements of good ecological potential is 46.9 km (2%), the length of those in conformity with the requirements of moderate ecological potential – 397.5 km (17.6%), of poor ecological potential – 243.3 km (10.8%), and of bad ecological potential – 14.2 km (0.6%).

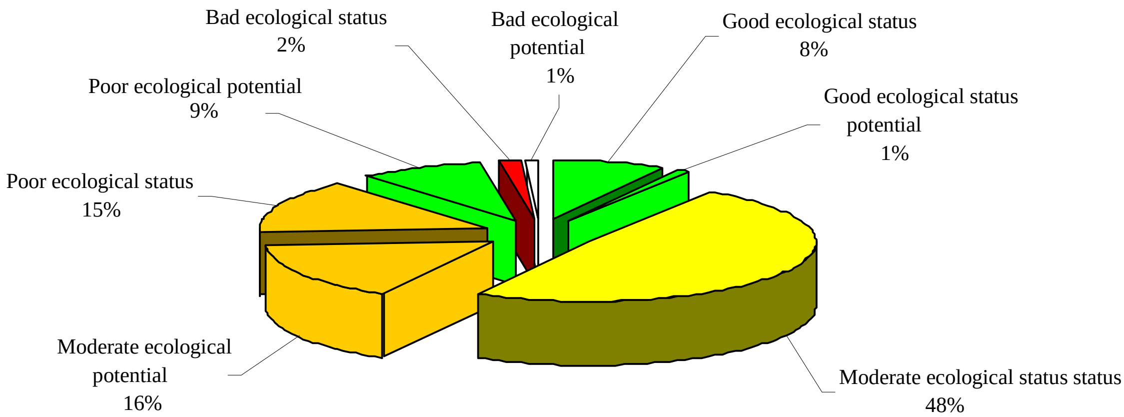


Figure 33. Ecological status and ecological potential of river water bodies in the Lielupė RBD
Source: experts’ analysis results

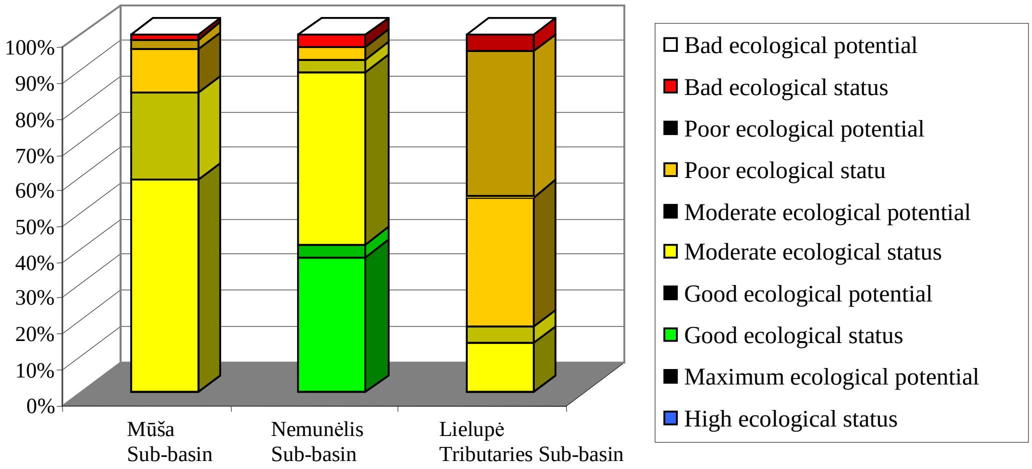


Figure 34. Ecological status and ecological potential of river water bodies in the Lielupė RBD
Source: experts' analysis results

An assessment of ecological status and ecological potential demonstrated that there are 81 water bodies at ecological status poorer than good and 32 HMWB at ecological potential poorer than good within the Lielupė RBD. Analysis of factors determining ecological status showed that 9 water bodies with the aggregate length of 138.7 km fail the good ecological status requirements because of the straightening of their beds; 37 water bodies (699.4 km) fall short of the requirements for good ecological status due to water quality problems; poorer than good ecological status of 33 water bodies with the total length of 543.3 km is conditioned both by the bed straightening and water quality problems. An aggregate impact of HPP and bed straightening determines poorer than good ecological status of one water body (8.1 km) and another water body (34.5) fails the good ecological status requirements due an impact of HPP and water quality problems.

Poorer than good potential of 32 HMWB with the total length of 655 km is determined by water quality problems.

The main risk factors in the Lielupė RBD differ depending on the sub-basin: the key risk factor in the Nemunėlis Sub-basin is bed straightening meanwhile the Lielupė Small Tributaries Sub-basin and Mūša Sub-basin are facing both bed straightening and water quality problems.

Reliability of assessment of ecological status and ecological potential is indicated by the level of confidence in the assessment which can be low, medium and high. Low level of confidence shows a likelihood of a major error meanwhile high level of confidence means that the ecological status or ecological potential was assessed with a minor error and hence is reliable.

An analysis of the level of confidence in the assessment of the ecological status and ecological potential of river water bodies in the Lielupė RBD demonstrated that high level of confidence can be granted to the assessment of the ecological status of 6 water bodies and ecological potential of 2 HMWB. Medium confidence in the status assessment was granted in respect of the majority of the water bodies in the Lielupė RBD. Low confidence was granted in respect of the identification of the ecological status of 72 water bodies and ecological potential of 30 HMWB

Distribution of river water bodies at different ecological status and ecological potential within the Lielupė RBD is demonstrated in Table 76.

Table 76. Distribution of river water bodies at different ecological status and ecological potential and their length within the Lielupė RBD

Sub-basin	Ecological status									
	High		Good		Moderate		Poor		Bad	
	Number of water bodies	Length, km	Number of water bodies	Length, km	Number of water bodies	Length, km	Number of water bodies	Length, km	Number of water bodies	Length, km
Mūša	0	0	0	0	44	729.4	9	171.2	1	10.7
Nemunėlis	0	0	10	130.7	14	281.2	1	21.8	1	15.6
Lielupė Small Tributaries	0	0	0	0	3	73.2	8	115.8	0	0
Total in Lielupė RBD	**0**	**0**	**10**	**130.7**	**61**	**1 083.8**	**18**	**308.8**	**2**	**26.3**

Sub-basin	Ecological potential									
	Maximum		Good		Moderate		Poor		Bad	
	Number of water bodies	Length, km	Number of water bodies	Length, km	Number of water bodies	Length, km	Number of water bodies	Length, km	Number of water bodies	Length, km
Mūša	0	0	0	0	18	354.6	2	46.7	0	0
Nemunėlis	0	0	1	46.9	1	14	0	0	0	0
Lielupė Small Tributaries	0	0	0	0	1	28.9	9	196.6	1	14.2
Total in Lielupė RBD	**0**	**0**	**1**	**46.9**	**20**	**397.5**	**11**	**243.3**	**1**	**14.2**

Source: experts' analysis results

Chemical status of rivers

86. The assessment of the chemical status of rivers was carried out on the basis of the river water quality monitoring data of 2005–2009. The analysis of the data demonstrated that none of specific pollutants (hazardous or priority hazardous substances) in rivers within the Lielupė RBD exceeded the MAC during the said period.

The analysis also took into account the findings of the study "Screening of substances dangerous for the aquatic environment in Lithuania" conducted in 2006. No exceedances of the MAC of specific pollutants (hazardous or priority hazardous substances) in rivers within the Lielupė RBD were detected during this study either. Consequently, all rivers within the Lielupė RBD are assumed to be at good chemical status.

Ecological status and ecological potential of lakes and ponds

87. The ecological status of lakes within the Lielupė RBD was assessed on the basis of the following three information sources:

87.1. national monitoring data;

88.2. data presented in the study "Identification of Lithuanian lakes subject to restoration and preliminary selection of restoration measures for these lakes for the improvement of their status";

88.3. mathematical modelling results.

When classifying the ecological status of lakes, priority was given to the national monitoring data, i.e. in case of availability of the national monitoring data on indicators of the ecological status of a lake, the lake in question was attributed to the status class indicated by the monitoring data, meanwhile the modelling results and the findings of the study were not taken into consideration.

Lakes Suosa, Kilučių ežeras and Širvėnos ežeras, on parameters indicative of physico-chemical quality elements and biological quality elements of which no national monitoring data is available, were attributed to a relevant ecological status class on the basis of the assessment provided in the study and mathematical modelling results. Following the study data, lakes Kilučių ežeras and Širvėnos ežeras are at critical status but according to the modelling results their status is good, hence they were designated as lakes at moderate ecological status. The study results indicate that Lake Suosa is suffering from anthropogenic pressures and according to the modelling results its status is good so it was attributed to lakes at good ecological status.

88. Following the above said ecological status classification principles for lakes, only 4 lakes of 11 ones with a surface area larger than 0.5 km^2 in the Lielupė RBD were identified as being at good ecological status, namely, lakes Viešintas, Gudelių ežeras, Arimaičių ežeras and Suosa. The lake study identified two of these, Lake Arimaičių ežeras and Lake Suosa as problematic. However, since parameters of quality elements in these lakes do conform to the good ecological status criteria according to the national monitoring data, they were not designated as water bodies at risk.

89. The ecological potential of three ponds in the Lielupė RBD was assessed on the basis of the national monitoring data and of other three ones – following mathematical modelling results (no monitoring data on parameters of quality elements is available).

According to the mathematical modelling of pollution loads, the ecological potential of three ponds on which no monitoring data is available are deemed to be at maximum ecological potential. The other three ponds were designated as water bodies at risk due to diffuse pollution, two of these (Baltausių pond and Dvariūkų pond) are also suffering from point pollution.

Table 77. Ecological status/potential of lakes and ponds in the Lielupė RBD

Lake / pond	Ecological status / potential	Level of confidence in status assessment
Lake Arimaičių ežeras	good	low
Baltausių pond	moderate	high
Bubių pond	maximum	low
Dvariūkų pond	moderate	medium
Ginkūnų pond	poor	low
Lake Gudelių ežeras	high	low
Lake Kairių ežeras	moderate	high
Lake Kilučių ežeras	moderate	low
Kupiškio pond	maximum	low
Lake Notigalė	moderate	low
Papilio pond	maximum	low
Lake Rėkyva*	bad	medium
Lake Širvėnos ežeras	moderate	low
Lake Skaistė	moderate	low
Lake Suosa	good	low
Lake Talkša	moderate	medium
Lake Viešintas	good	medium

* Lake Rėkyva is deemed to be a HMWB

Source: experts' analysis result

90. Summing up the assessment of the ecological status and ecological potential of lakes and ponds in the Lielupė RBD, 4 water bodies (lakes Arimaičių ežeras, Gudelių ežeras, Suosa and Viešintas) are at good ecological status, 6 water bodies (lakes Kairių ežeras, Kilučių ežeras, Notigalė, Širvėnos ežeras, Skaistė and Talkša) are at moderate ecological status. 3 water bodies (Bubių, Kupiškio and Papilio ponds) meet the requirements for good ecological potential, 2 water bodies (Baltausių and Dvariūkų ponds) are at moderate ecological potential, 1 water body (Ginkūnų pond) is at poor ecological potential and 1 water body (Lake Rėkyva) is at bad ecological potential.

High level of confidence was granted to the assessment of the ecological status/potential of lakes and ponds in respect in 2 water bodies (12%), medium confidence in the status assessment was granted in respect of 4 water bodies (23%) and low confidence – in respect of 11 water bodies (65%).

Monitoring of specific pollutants in lakes and ponds within the Lielupė RBD was not conducted. Concentrations of heavy metals were analysed only in landfill leachate (the concentration of chromium in leachate exceeded the MAC 2-4 times). Since no data is available, it is assumed that all water bodies in the category of lakes within the Lielupė RBD are at good chemical status, except for Ginkūnų pond which is highly likely to be failing the good status criteria.

Summing up, at present 7 water bodies are at good ecological status or good ecological potential and 10 water bodies are failing the good ecological status/potential requirements.

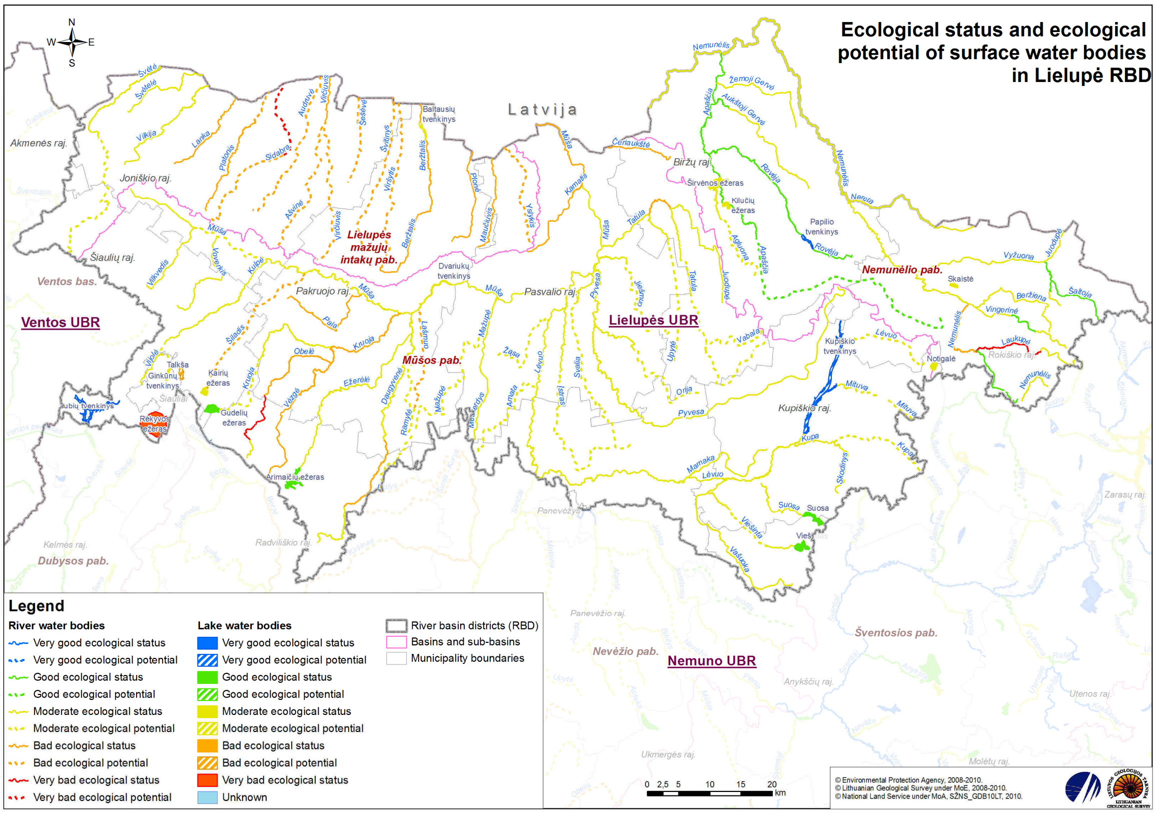


Figure 36. Ecological status and ecological potential of surface water bodies in the Lielupė RBD

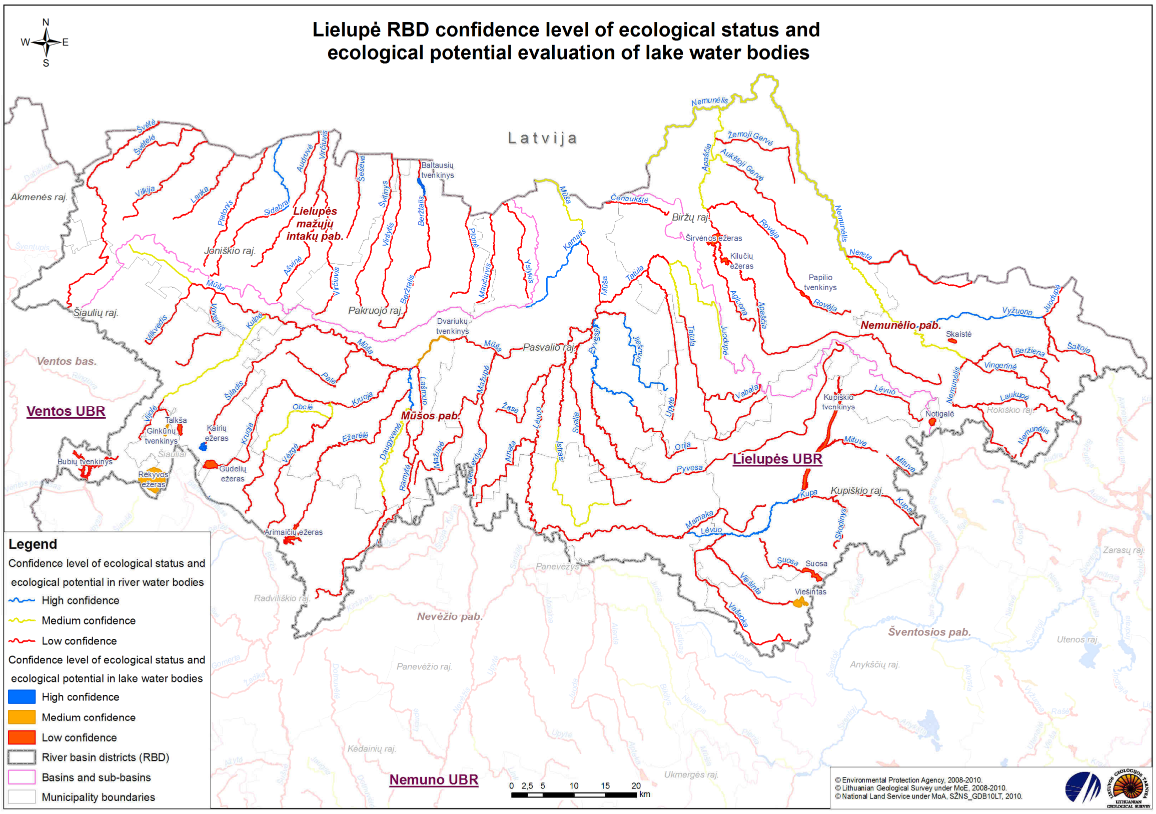


Figure 37. Level of confidence in the assessment of ecological status and ecological potential of surface water bodies in the Lielupė RBD

91. The chemical status of surface water bodies within the Lielupė is demonstrated in Figure 37 and the overall status – in Figure 38.

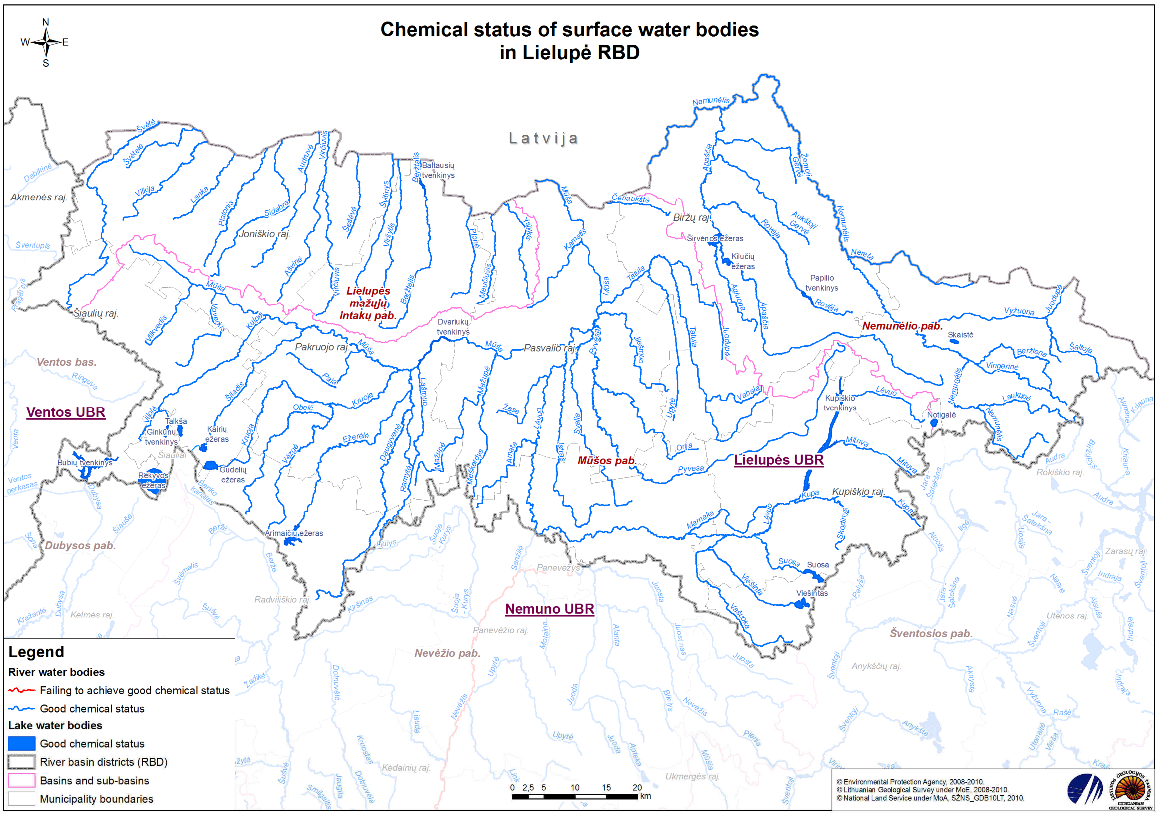


Figure 37. Chemical status of surface water bodies in the Lielupė RBD

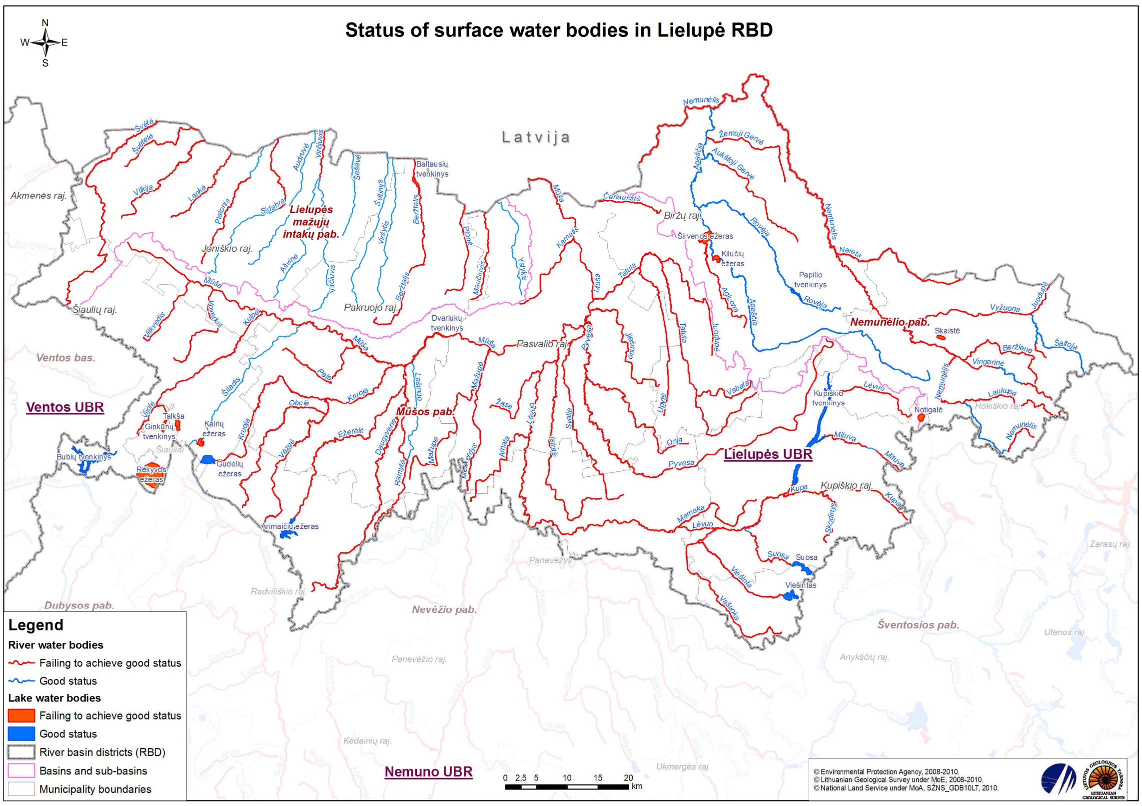


Figure 38. Overall status of surface water bodies in the Lielupė RBD

SECTION II. GROUNDWATER MONITORING

92. The objective set in the National Environmental Monitoring Programme for 2005-2010 approved by Resolution No. 130 of the Government of the Republic of Lithuania of 7 February 2005 (Žin., 2005, No. 19-608; 2008, No. 104-3973) is to assess sources of recovery of groundwater resources, trends of changes in the groundwater quality and respective factors, and to assess chemical composition of water in drinking water abstraction sites. To this end, general chemical composition of water as well as micro components, pesticides and organic compounds, biogenic elements therein are analysed/have to be analysed in selected 280 sites; the monitoring frequency – from once a year to once every two to six years.

National monitoring network

93. The groundwater national monitoring network in the river basins of the Lielupė RBD constitutes an important part of the national monitoring network in the country. Monitoring of groundwater quality and of groups of its individual indicators is conducted observing the principle of rotation: groundwater sampling for assessing general chemical composition and biogenic elements is more frequent (at least once a year) in a shallow aquifer the composition of which is changing more rapidly, and less frequent (every two years) – in confined aquifers. Specific chemical components, such as organic compounds, pesticides, metals the concentrations whereof in groundwater are very low, are monitored once in five years in wells where these components are likely to be detected.

The Criteria for the Assessment of Groundwater Wellfields were approved by Order No. 719 of the Minister of Environment of the Republic of Lithuania of 24 December 2003 on the approval of methodological guidelines for the assessment of groundwater wellfields and their assignment to river basin districts (Žin., 2004, No. 8-193; 2005, No. 51-2041) and Order No. D1-172 of the Minister of Environment of the Republic of Lithuania of 23 March 2007 on the approval of the procedure of the establishment of criteria for the assessment of status groundwater wellfields (Žin., 2003, No. 37-1395).

The depth of occurrence of shallow groundwater is measured once a day with a help of electronic sensors. The groundwater table in confined aquifers is measured only prior to the sampling. The monitoring posts in the Lielupė RBD are demonstrated in Figure 39 and monitoring posts in the sub-basins of the Lielupė RBD are listed in Table 78.

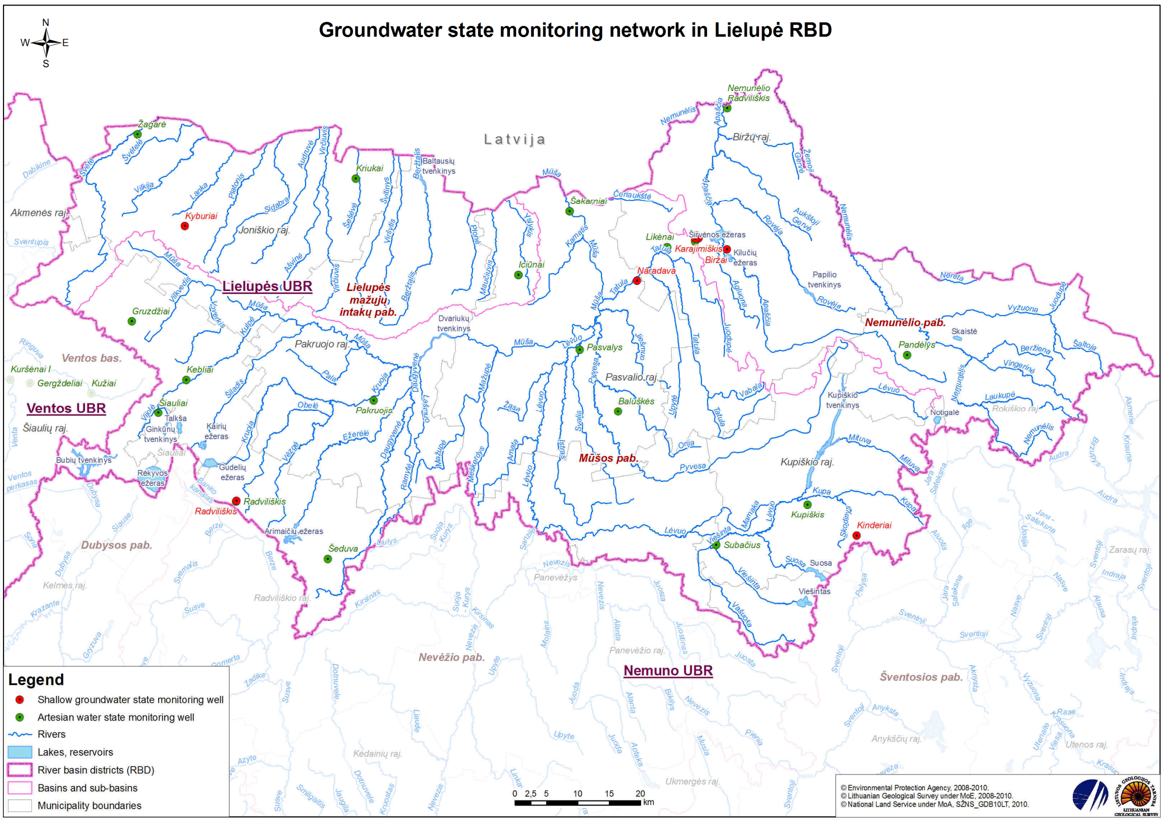


Figure 39. National groundwater monitoring network in the Lielupė RBD

Table 78. National groundwater monitoring network in the Lielupė RBD

River basin/ sub-basin	**Type of aquifer**		
	Shallow	**Confined**	
		Number of wells/posts	Geological index
Lielupė / Lielupė Small Tributaries	2	3	$D_3$is, D_3kp+s, D_3šv
Lielupė / Mūša	2	7	P_2, D_3st, D_3kp+s, D_3šv-D_2up
Lielupė / Nemunėlis	2	3	D_3kp+s, D_3šv, D_3šv-D_2up
Total:	**6**	**13**	

Source: LGS, 2009

Tables 79 and 80 list monitoring wells from which water samples are taken for the analysis of chemical status and quality of shallow and confined aquifers

Table 79. National monitoring posts for the monitoring of shallow groundwater quality

GWB code	**Monitoring post**	**Gr. No.**	**Basin/sub-basin**	**Coordinates**		**Geological index**
				x	y	
LT003	Kyburiai	35979	Lielupė Small Tributaries	6232797	461585	gIII
LT002	Radviliškis	35978	Lielupė Small Tributaries	6189015	469779	ftIII
LT001	Kinderiai	35993	Nemunėlis	6183462	568720	gtIII
LT001	Karajimiškis	220	Nemunėlis	6230990	543012	D3tt
LT001	Karajimiškis	218	Nemunėlis	6231271	543302	gIII
LT001	Karajimiškis	216	Nemunėlis	6230809	543479	D3tt
LT001	Biržai MS	35994	Nemunėlis	6229085	548059	gIII
Total:			**7 wells**			

Source: LGS, 2009

Table 80. National monitoring posts for the monitoring of confined groundwater quality

GWB code	Monitoring post	Gr. No.	Sub-basin	Coordinates		Index	Type of aquifer
				x	y		
LT003	Žagarė	22274	Lielupė Small Tributaries	6247441	454006	D_3mr	pre-Quaternary confined
LT001	Kriukai	22294	Lielupė Small Tributaries	6240435	488804	D_3šv	pre-Quaternary confined
LT001	Iciūnai	837	Lielupė Small Tributaries	6224861	514718	D_3šv	pre-Quaternary confined
LT001	Iciūnai	838	Lielupė Small Tributaries	6224861	514718	D_3kp+s	pre-Quaternary confined
LT001	Iciūnai	839	Lielupė Small Tributaries	6224861	514718	$D_3$is	pre-Quaternary confined
LT002	Šiauliai	20699	Mūša	6203028	457345	P_2	pre-Quaternary confined
LT002	Radviliškis II	3146	Mūša	6188946	469754	D_3st	pre-Quaternary confined
LT002	Šeduva	17301	Mūša	6179747	484339	D_3st	pre-Quaternary confined
LT001	Pasvalys	12209	Mūša	6213124	524536	D_3šv-$_2$up	pre-Quaternary confined
LT001	Subačius	17909	Mūša	6181947	546329	D_3kp+s	pre-Quaternary confined
LT001	Kupiškis	17818	Mūša	6188436	560917	D_3šv-$_2$up	pre-Quaternary confined
LT003	Gruzdžiai	4803	Mūša	6217607	453097	P_2	pre-Quaternary confined
LT001	Karajimiškis	214	Nemunėlis	6230804	543014	D_3kp	pre-Quaternary confined
LT001	Karajimiškis	27733	Nemunėlis	6230804	543014	D_3šv	pre-Quaternary confined
LT001	Nemunėlis, Radviliškis	21885	Nemunėlis	6251607	548079	D_3šv-D_2up	pre-Quaternary confined
LT001	Pandėlys	12641	Nemunėlis	6212256	576787	D_3šv-D_2up	pre-Quaternary confined
Total:			**16 wells**				

Source: LGS, 2009

The groundwater water table is measured in posts listed in Table 81 below.

Table 81. National groundwater monitoring posts for the measuring of groundwater tables

GWB code	Monitoring post	Gr. No.	Sub-basin	Coordinates		Index
				x	y	
LT001	Kinderiai	35993	Nemunėlis	568719.6	6183462	gtIII
LT001	Biržai MS	35994	Nemunėlis	548059.1	6229085	gIII
LT001	Karajimiškis	220/1348	Nemunėlis	6230990	543012	D3tt
LT001	Karajimiškis	214/1349	Nemunėlis	6230990	543012	D3kp+s
LT001	Karajimiškis	27733/1350	Nemunėlis	6230990	543012	D3šv
LT001	Karajimiškis	35995	Nemunėlis	543018	6230818	D3tt
LT001	Iciūnai	35996	Nemunėlis	514787.4	6225058	D3st
LT002	Radviliškis	35978	Lielupė Small Tributaries	469779.4	6189015	ftIII
LT003	Kyburiai, WMS	35979	Lielupė Small Tributaries	461584.6	6232796	gIII
Total:			**9 wells**			

Source: LGS, 2009

The density of the groundwater monitoring network in shallow and confined aquifers is provided in Tables 82 and 83.

Table 82. Shallow groundwater monitoring network in sub-basins of the Lielupė RBD

Sub-basin	Sub-basin area, km	100 km^2	Number of monitoring wells			Number of wells per 100 km^2	
			national	of economic entities	total number	national	total number
Lielupė Small Tributaries	1750	17.5	1	41	42	0.06	**2.4**
Nemunėlis	1902	19.02	3	26	29	0.16	**1.5**
Mūša	5.296	52.96	5	243	248	0.09	4.7
Šiauliai				53			
excl. Šiauliai	5.296	52.96	5	190	195	0.09	**3.7**
Total			**9**		**319**		
average						**0.1**	**2.87**
average excl. cities							**2.5**

Source: LGS, 2009

Table 83 Confined aquifer monitoring network in GWB in the Lielupė RBD

GWB	Area, km^2	100 km^2	Number of monitoring wells			Number of wells per 100 km^2	
			national	of wellfields	total number	national	total number
Lielupė GWB of Permian-Upper Middle Devonian deposits	1 059	10.59	2	1	3	0.19	0.28
Joniškis GWB	506	5.06	1	2	3	0.20	0.59
Stipinai-Lielupė GWB of Upper Devonian deposits	1 871	18.71	5	11	16	0.27	0.86
Lielupė GWB of Upper- Middle Devonian deposits	5 472	54.72	18	20	38	0.33	0.69

Source: LGS, 2009

The present national monitoring network falls short of the latest environmental requirements. When developing the national monitoring network, the most important thing was to ensure that the monitoring posts more or less evenly reflect the natural shallow groundwater formation conditions and anthropogenic pressures on the area, and include all major aquifers utilised for public water supply. The interconnection of groundwater with surface water and other ecosystems was practically not taken into account at that time. This has resulted in uneven distribution of the national groundwater monitoring posts in individual river sub-basins. For example, Joniškis GWB, which is situated in the Mūša-Lielupė Basin, has been designated as potentially being at risk due to high concentrations of sulfate ions in its water. This is a karst region sensitive from the hydro-geological point of view. When implementing the Programme of Measures for Achieving Water Protection Objectives, the monitoring network of economic entities in groundwater wellfields at risk will be expanded so as to cover all wellfields which abstract more than 10 m^3 of groundwater per day.

Status of groundwater

94. A set of groundwater status maps demonstrating the chemical status of the major aquifers (groundwater bodies) and wellfields which are currently utilised has been compiled. As already said, the main aquifer complex of the northern part of the Upper-Middle Devonian GWB, the Šventoji-Upininkai (D_3šv+D_2up) complex, is spread along the entire Latvian-Lithuanian border and is the most important source of drinking water in this territory. Speaking about the qualitative status of groundwater, this complex is divided into two parts – the upper and the lower. Westwards from Panevėžys and Pakruojis, groundwater of good chemical status in the upper part of the complex D_3šv+D_2up turns into particularly hard calcium sulfate-water of poor quality, the source of which is the gypseous succession of younger Devonian aquifers (especially the Tatula aquifers, D_3tt) located at the top of the complex.

Both the quantitative and chemical status of the Lielupė GWB of Upper-Middle Devonian deposits, Lielupė GWB of Permian-Upper Devonian deposits and Biržai-Pasvalys GWB is good. Joniškis GWB (LT001023400) and Stipinai-Lielupė GWB (LT002003400) have potentially been designated as water bodies at risk. Although the qualitative status of these GWB is good, abnormally high concentrations of sulfates failing to meet the drinking water quality requirements (not more than 250 mg/l) and, sometimes, the environmental criteria set by the Lithuanian Geological Survey (not more than 500 mg/l) have been detected in certain wellfields within these groundwater bodies. Since no clear trend in deterioration of water quality as a result of anthropogenic activities has been identified yet, it is proposed to expand the monitoring of problematic areas during the next planning period (2010-2015) so as to cover all wellfields which abstract more than 10 m^3 of groundwater per day. Monitoring data analyses would enable identifying impacts of groundwater abstraction on water quality changes.

Maps of the qualitative and chemical status of groundwater bodies and wellfields within the Lielupė RBD are provided in Figures 40 and 41.

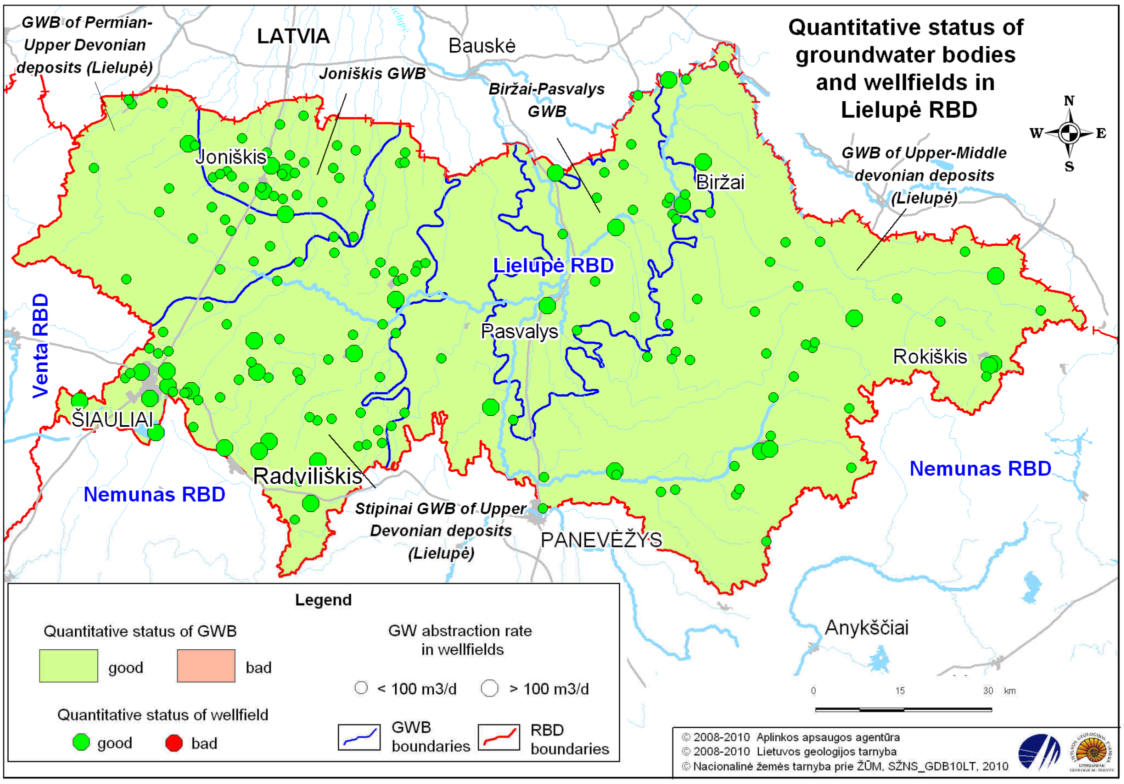


Figure 40. Quantitative status of groundwater bodies and wellfields in the Lielupė RBD

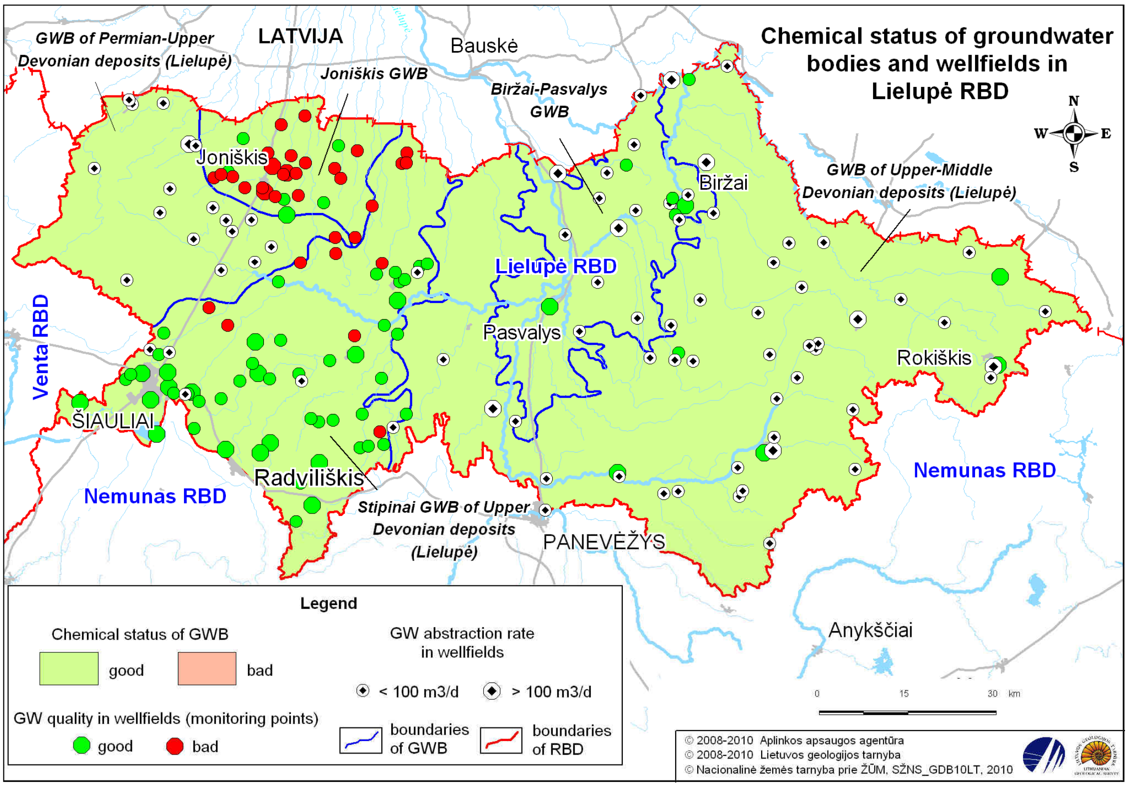


Figure 41. Chemical status of groundwater bodies and wellfields in the Lielupė

SECTION III. MONITORING OF PROTECTED AREAS

95. Pursuant to Order No. 695 of the Minister of Environment of the Republic of Lithuania of 31 December 2002 on the approval of the Monitoring Programme for Areas Important for the Conservation of Habitats or Birds (Žin., 2003, No. 4-161),

monitoring in all areas of Community importance for the conservation of habitats and birds established in Lithuania must be carried out while implementing the Habitats Directive and the Birds Directive.

The objective of monitoring is to ensure collection of information on the status of and changes in the status of areas important for the conservation of habitats and birds as well as species and natural habitats therein that are subject to protection, and provision of this information to national and international authorities responsible for timely and adequate preparation and adoption of decisions necessary for the conservation of protected natural habitats and species of fauna or flora. The monitoring of areas important for the conservation of habitats and birds is supervised by the State Service for Protected Areas under the Ministry of Environment.

The status of and changes in the status of natural habitats under protection in areas important for the conservation of habitats and birds are observed in accordance with an approved action plan. The category of surface water bodies within the Lielupė River Basin District that are subject to monitoring pursuant to the General Requirements for the Monitoring of Water Bodies includes lake habitats and river habitats. The frequency of the habitat monitoring must be at least once every three years. The indicators subject to monitoring include the following: physical and chemical characteristics of water, variety and abundance of typical organisms, structure and distribution of plant communities. The scope and topics of the monitoring programmes differ depending on a protected area in question, varying from narrow programmes (e.g. monitoring of otters) to very wide ones (e.g. monitoring and assessment of the status of the location sites of plants included in the Red Book of Lithuania).

Certain parameters of monitoring of natural habitats or protected species (such as physical, chemical, dynamic characteristics of water, etc.) are not established when necessary and reliable data is obtained while carrying out monitoring in the same areas under other parts of the National Environmental Monitoring Programme. In such case monitoring of areas important for the conservation of habitats and birds and monitoring of the status of surface water bodies partially overlap both in respect of the parameters subject to monitoring and the frequency of monitoring, i.e. their objectives are the same.

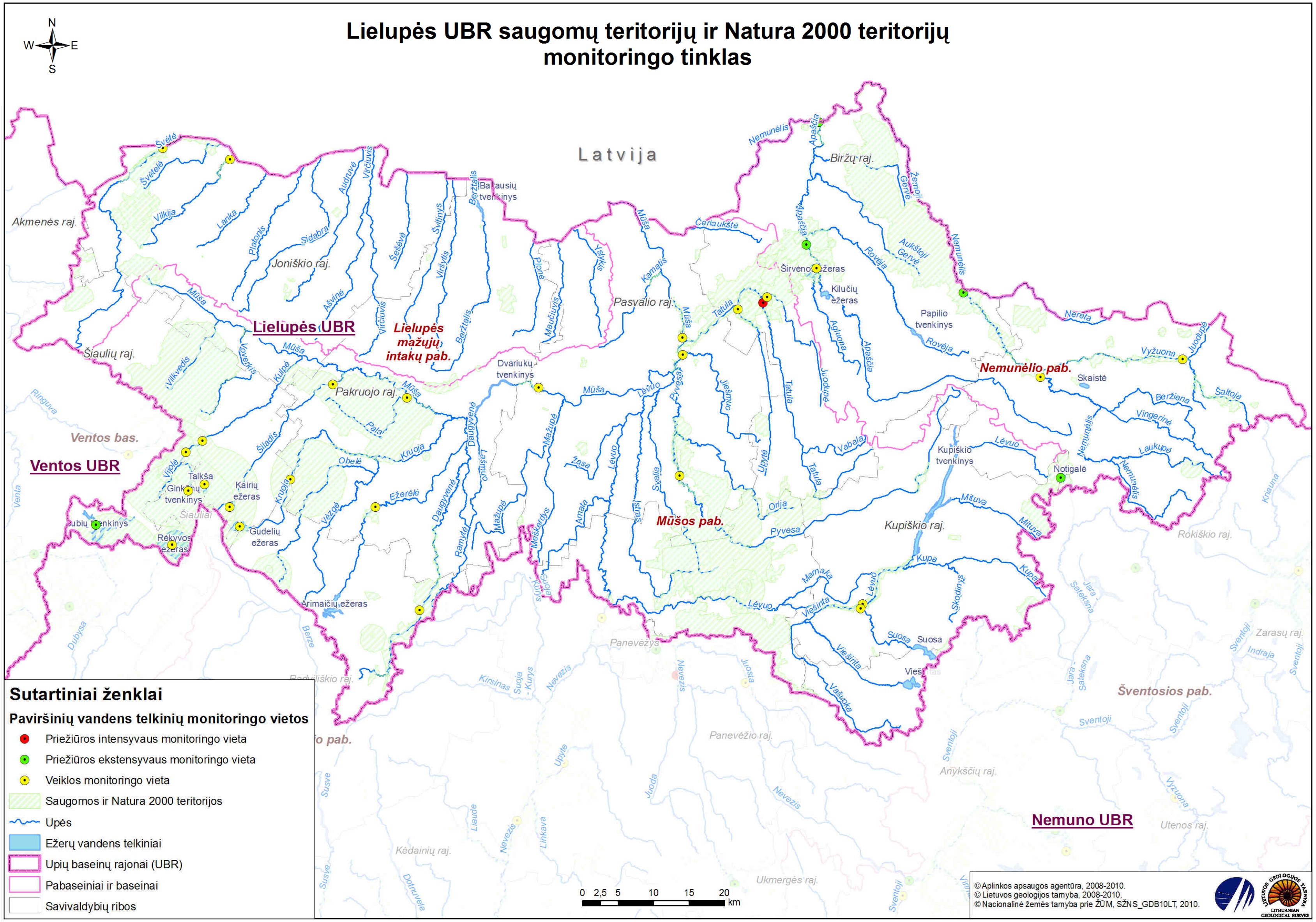


Figure 42. Monitoring network for protected areas in the Lielupė RBD

CHAPTER VI. ENVIRONMENTAL OBJECTIVES FOR SURFACE WATER BODIES AND GROUNDWATER WELLFIELDS

SECTION I. OVERALL WATER PROTECTION OBJECTIVES FOR SURFACE WATER BODIES

96. Pursuant to the requirements of the Law of the Republic of Lithuania on Water, compliance with the established quality standards and water protection objectives shall be achieved not later than by 2015. The key objectives are to prevent deterioration of status in all bodies of surface water and to achieve good status for all water bodies and good ecological potential for heavily modified water bodies.

For the purpose of reaching a balance between the needs of human economic activities and water protection objectives, a number of derogations have been provided for in the Law of the Republic of Lithuania on Water, including postponement of the set objective and establishment of a less stringent objective for reasons of technical feasibility, disproportionate costs, natural conditions, or pollution which is too high, if achievement of good status would involve severe negative socio-economic consequences which cannot be avoided by any other significantly better environmental options.

SECTION II. GOOD STATUS REQUIREMENTS FOR SURFACE WATER BODIES

Rivers

Biological elements

97. Classification systems applicable to the ecological status assessment in Lithuanian rivers have been developed (adapted) only for benthic invertebrates (DSFI) and fish (LFI). Based on relationships between the values of LFI and DSFI as well as on the water quality and hydromorphological elements supporting the biological elements, threshold values of DSFI ≤ 0.63 and LFI ≤ 0.70 were set deviation from which would mean lower than good ecological status.

Physico-chemical elements

98. The general physico-chemical elements which have the most considerable impact on the status of biological elements in rivers include BOD_7, total phosphorus, $P\text{-}PO_4$, total nitrogen, $N\text{-}NH_4$, $N\text{-}NO_3$, and O_2. The values of the parameters for the water quality elements representing good ecological status of rivers which should be achieved by 2015 are provided in the table below.

Table 83. Parameter values of water quality elements for rivers

BOD_7, mgO_2/l	≤3.3
P_{total}, mg/l	≤0.14
$P\text{-}PO_4$, mg/l	≤0.09
N_{total}, mg/l	≤3.0
$N\text{-}NH_4$, mg/l	≤0.2
$N\text{-}NO_3$, mg/l	≤2.3
O_2, mg/l	≥6.5 (in Type-2 rivers) ≥7.5 (in rivers of other types)

Source: experts’ analysis results

Hydromorphological elements

99. Hydromorphological elements are taken into account only for the purpose of identifying water bodies at high ecological status or maximum ecological potential. When the ecological status or ecological potential of a water body is lower than high according to the parameters indicative of biological elements, meanwhile the parameters indicative of physico-chemical and chemical elements do meet the high ecological status or maximum ecological potential requirements, the values for the hydromorphological elements are deemed to be meeting the requirements set for the relevant status/potential of the biological elements, i.e. the ecological status or ecological potential of the water body is not additionally classified on the basis of the parameters for these elements (assignment of the water body to a status/potential class lower than high/maximum is based only on the values of the parameters indicative of the biological quality elements). In other words, an analysis of potential causes of why values of the parameters indicative of the biological elements fail good ecological status or ecological potential would be limited to establishment (knowledge) of whether the parameters indicative of the hydromorphological elements have changed or not. On the other hand, the characterisation of the requirements for good ecological status to be aimed at and provision of adequate measures has involved formulation of criteria for good ecological status according to the hydromorphological elements.

99.1. Current data on aquatic organisms indicates that decrease in the water flow by more than 30% leads to poorer than good status of aquatic organisms. Continuously reduced water flow is one of the criteria for the assignment of water bodies to heavily modified water bodies. However, even individual, relatively short-term decreases in water flow can have a significant impact on the status of aquatic organisms (e.g. when water is accumulated or retained in ponds constructed for HPP or other purposes, and the natural yield is not let pass, or in the event of sharp and significant variations in the water yield when water is discharged from the pond situated on or connected to a river bed). All these factors should be included in the category of changes in the quantity and dynamics of the water flow. Hydrological parameters of rivers are deemed to be meeting the good status requirements when their deviation from the natural values of the mean of 30 days is ≤30%.

99.2. Straightened rivers with a slope less than 1.5 m/km which flow in plains over urbanised territories of the Lielupė RBD were identified as HMWB. Other straightened rivers were classified as water bodies at risk, expecting self-restoration of the river morphology in the long run. It is rather difficult to establish when morphological conditions ensure good ecological status according to biological elements because this also depends on the individual characteristics of a river in question. However, the overall goal would be to ensure at least partially natural conditions when:

99.2.1. natural riparian vegetation covers ≥50 % of the stretch length;

99.2.2. the cross-section of the bed is semi-natural, the bottom relief exhibits clear features of heterogeneity (the stretch contains both shallow and deeper places which determine changes in flow velocity and soil composition);

99.2.3. the form of the shoreline is heterogeneous, with coves or obstacles for the flow where flow velocity and/or direction is bound to change.

99.3. It is rather difficult to describe the aspired criteria for river continuity which would serve as a ground for concluding on conformity or failure to conform to the good status requirements for the biological elements, without taking into account hydromorphological changes conditioned by artificial barriers (impoundments).

Artificial barriers are most damaging for populations of migratory fish (migrating from the sea to rivers or within river catchments). Every artificial barrier and resulting altered hydromorphological characteristics of the river above the barrier lead to either complete disappearance of migratory fish upstream of the barrier (fish which migrate from the sea to rivers), or significant reduction of resources of certain fish type (fish which migrate within river catchments). Even fish bypass channels (passes) do not prevent reduction of migratory fish resources, or complete disappearance thereof, due to disturbed reproduction (loss of spawning grounds and selective passing capacities of fish passes: not all fish manage to pass both towards the upper and lower reaches of the river). Taking into account the above-said, the objective is to improve the conditions for fish migration in places with current artificial barriers in rivers where migratory fish are living today or are known to have lived earlier.

Chemical status

100. The criteria for assessing the chemical status of surface waters are the maximum allowable concentrations of substances listed in Annexes 1 and 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2010, No. 59-2938) in water bodies. Environmental quality standards (EQS) of certain priority hazardous substances in biota are set in paragraph 8.2.2 of the Wastewater Management Regulation. So far, no maximum allowable concentrations have been established for specific pollutants in bottom sediments.

Lakes

Biological elements

101. A classification system for the identification of the status of lakes within the Lielupė RBD has been completely developed only in respect of the parameters for chlorophyll *a* (which characterises the status of phytoplankton). The value for good ecological status in lakes to be aimed at is EQS ≥0.33 for phytoplankton.

Classification systems based on parameters for macrophyte and fish fauna have not been completed yet.

Physico-chemical elements

102. The general physico-chemical elements which have the most significant impact on the status of the biological quality elements in lakes are total nitrogen and total phosphorus. The values for the physico-chemical quality elements characterising good ecological status of lakes which should be attained in lakes by 2015 are as follows:

102.1. P_{total} – 0.06 mg/l

102.2. N_{total} – 1.8 mg/l

Hydromorphological elements

103. When the ecological status or ecological potential of a water body is lower than high according to the parameters indicative of biological elements, meanwhile the parameters indicative of physico-chemical and chemical elements do meet the high ecological status requirements, the values for hydromorphological elements are deemed to be meeting the requirements set for the relevant status/potential of the biological elements.

Classification systems for the identification of the status of lakes in the Lielupė RBD were developed only in respect of phytoplankton, which is more sensitive to changes in water quality. Systems in respect of biological quality elements which should be the most sensitive to changes in lake hydrology and morphology, i.e. macrophytes and fish, have not been completed yet. However, it is the reaction of these biological elements to hydromorphological changes that the criteria for good ecological status according to hydromorphological quality elements should be based on. There are examples in a geographically close river basin district, the Nemunas RBD, when decrease in the water level of a lake resulted in destruction of a variety of fish species. Yet, this data is not sufficient to be able to characterise pursued values of the ecological status according to the parameters indicative of hydromorphological quality elements which ensure good ecological status by the values of the parameters for biological quality elements. Since changes in lakes within the Lielupė RBD (except for a heavily modified Lake Rėkyva) are relatively low, the pursued values should be the same as the values which meet the requirements for high ecological status.

Chemical status

104. The criteria for assessing the chemical status of surface waters are the maximum allowable concentrations of substances listed in Annexes 1 and 2 to the Wastewater Management Regulation approved by Order No. D1-236 of the Minister of Environment of the Republic of Lithuania of 17 May 2006 (Žin., 2006, No. 59-2103; 2010, No. 59-2938) in water bodies. Environmental quality standards (EQS) of certain priority hazardous substances in biota are set in paragraph 8.2.2 of the Wastewater Management Regulation. So far, no maximum allowable concentrations have been established for specific pollutants in bottom sediments.

Requirements for ecological potential and water protection objectives for heavily modified and artificial water bodies

105. Classification of a body of water as a HMWB and AWB usually means that the ecological properties of the water body have been physically altered from the point of view of both morphological and hydrological characteristics. However, such designation does not account for ecological changes brought about by pollutants in water. The general quality criterion is good ecological potential achieved. It reflects ecological quality when a physical impact on a body of water, which allows classifying it as a HMWB, is acceptable. Further physical impact is deemed to be insignificant as long as it does not exceed a difference between reference conditions and good status in a natural body of water.

The classification of good ecological potential of HMWB was developed on the basis of an assessment of a degree of deviations from maximum ecological potential caused by anthropogenic pressures.

Heavily modified water bodies

106. Ponds with an area larger than 0.5 km^2 and their communities of aquatic organisms are comparable to those of natural lakes. Hence, good ecological potential of biological quality elements should meet the same good ecological status criteria applicable for lakes.

Table 84. The parameter value for good ecological potential of HMWB according to biological elements

Parameter	Parameter value
Chlorophyll *a* (mean of the EQR of the average annual value and the EQR of the maximum value)	≤0.33

Source: experts' analysis results

107. Heavily modified Lake Rėkyva

By geology, this is an organic lake. Since there is no data on parameters for biological elements which reflect hydromorphological changes for such lakes, no criteria for good ecological status are available. According to a preliminary index for macrophytes RI, the lake is currently attributable to water bodies at bad ecological status. Consequently, it is proposed to characterise good ecological potential of heavily modified Lake Rėkyva using the same criteria for chlorophyll a, total phosphorus and total nitrogen as the ones used for the characterisation of good ecological status of natural lakes in the Lielupė RBD.

108. The ecological potential of heavily modified straightened rivers should be assessed based on the system developed for natural rivers of a corresponding catchment size and slope. Good ecological potential of biological quality elements should meet the moderate status criteria established for natural rivers: DSFI EQR ≥0.50, LFI ≥0.40.

SECTION III. WATER PROTECTION OBJECTIVES FOR GROUNDWATER WELLFIELDS

109. A set of groundwater status maps demonstrating the chemical status of the major aquifers (groundwater bodies) and wellfields which are currently utilised has been compiled. The following problematic groundwater bodies have been identified within the Lielupė RBD: Joniškis GWB (LT001023400) and Stipinai-Lielupė GWB of Upper Devonian deposits (LT002003400). Since poor groundwater quality in the main aquifers is determined by abnormal concentrations of sulfates of a natural origin, the overall chemical status of groundwater within the entire Lielupė RBD is considered to be "good" following the environmental criteria and is coloured in green.

However, the qualitative status of groundwater in the wellfields was assessed not only observing the environmental criteria (the threshold value for the problematic indicator in this area, sulfates is 500 mg/l) but also on the basis of the drinking water criteria (groundwater quality norm pursuant to the Lithuanian Hygiene Norm HN 24:2003 "Drinking water safety and quality requirements" approved by Order No. V-455 of the Minister of Health of the Republic of Lithuania of 23 July 2003 (Žin., 2003, No. 79-3606) is called a specified parameter value, which is 250 mg/l for sulfates). This status was identified as poor when the average concentrations of sulfates in wellfields were higher than 250 or 500 mg/l. However, only the wellfields where the average concentration of a problematic indicator (in this case – of sulfates) exceeded the threshold value (500 mg/l) was coloured in red in the said maps of LGS (Figure 43).

Pursuant to the Procedure for the Establishment of Water Protection Objectives approved by Order No. 457 of the Minister of Environment of the Republic of Lithuania of 15 September 2003 (Žin., 2003, No.92-4179), the most important water protection objective is good quantitative and qualitative (chemical) status of groundwater wellfields: 1) when the status is good, it must be maintained; 2) when the status is lower than good, measures shall be introduced to improve the status; 3) when the status is critically going down, such threat must be stopped when concentration of the pollutant reaches 75 % of the threshold value and reduced when it exceeds the threshold value.

However, no well-grounded evidence of significant changes in the water quality within the Lielupė RBD as a result of pollution or abstraction is available. Information of changes in the water quality in Joniškis wellfields abstracting groundwater from the complex D_3šv+D_2up is very contradictory. For example, reports of the LGS for the period 1980-1999 demonstrated that the concentration of sulfates in Joniškis wellfield went up from 326 mg/l to 506 mg/l, whereas the final monitoring report for the period 2006-206 prepared by the company UAB Grota indicates the opposite trend – the concentration of this ion during the said period went down from 462 mg/l to 292 mg/l. It should be noted, however, that the latter data characterises a non-operational well, so it can hardly be representative. A number of analyses carried out in individual operational wells suggest that the status became worse during the monitoring period. The analyses data also shows that concentrations of sulfates in this wellfield has always been, and will always be, higher than 250 mg/l. No corresponding data is available on other problematic wellfields within the project area hence mandatory groundwater monitoring to be conducted in the established procedure should be started in the first place.

Summing up, the actual qualitative status of groundwater within the Lielupė RBD is not known due to such factors as geological, hydro-geological and, particularly, groundwater quality formation condition, relatively low level of surveying, and shortage of data. Besides, it is completely unclear whether and how it can change in the wellfields whether it is good at the moment, because such potential changes (or absence of changes) are determined not only by the water abstraction therein but also by the fact that two or three or even more aquifers with varying (and usually unknown) concentrations of sulfates can be combines in the operational wells of the wellfields.

In such situation, all economic entities operating wellfields in this GWB must perform groundwater monitoring in accordance with special programmes agreed with the LGS and comprising a more thorough and detailed analysis of the chemical status of groundwater in this groundwater body.

Pursuant to the Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District, all water supply companies which abstract > 10 m^3 of groundwater per day and which exploit wellfields situated in groundwater bodies at risk to perform monitoring of problematic quality indicators (Cl and SO4) and provide the data to the Lithuanian Geological Survey (LGS). Analyses of this data would enable the LGS to assess water quality deterioration tendencies as a result of groundwater abstraction and to decide whether the wellfields identified should be classified as being at risk. However, monitoring is not a sufficient measure for identifying water bodies of good quality. This should be a task for municipalities which are responsible for the implementation of the Law on Drinking Water.

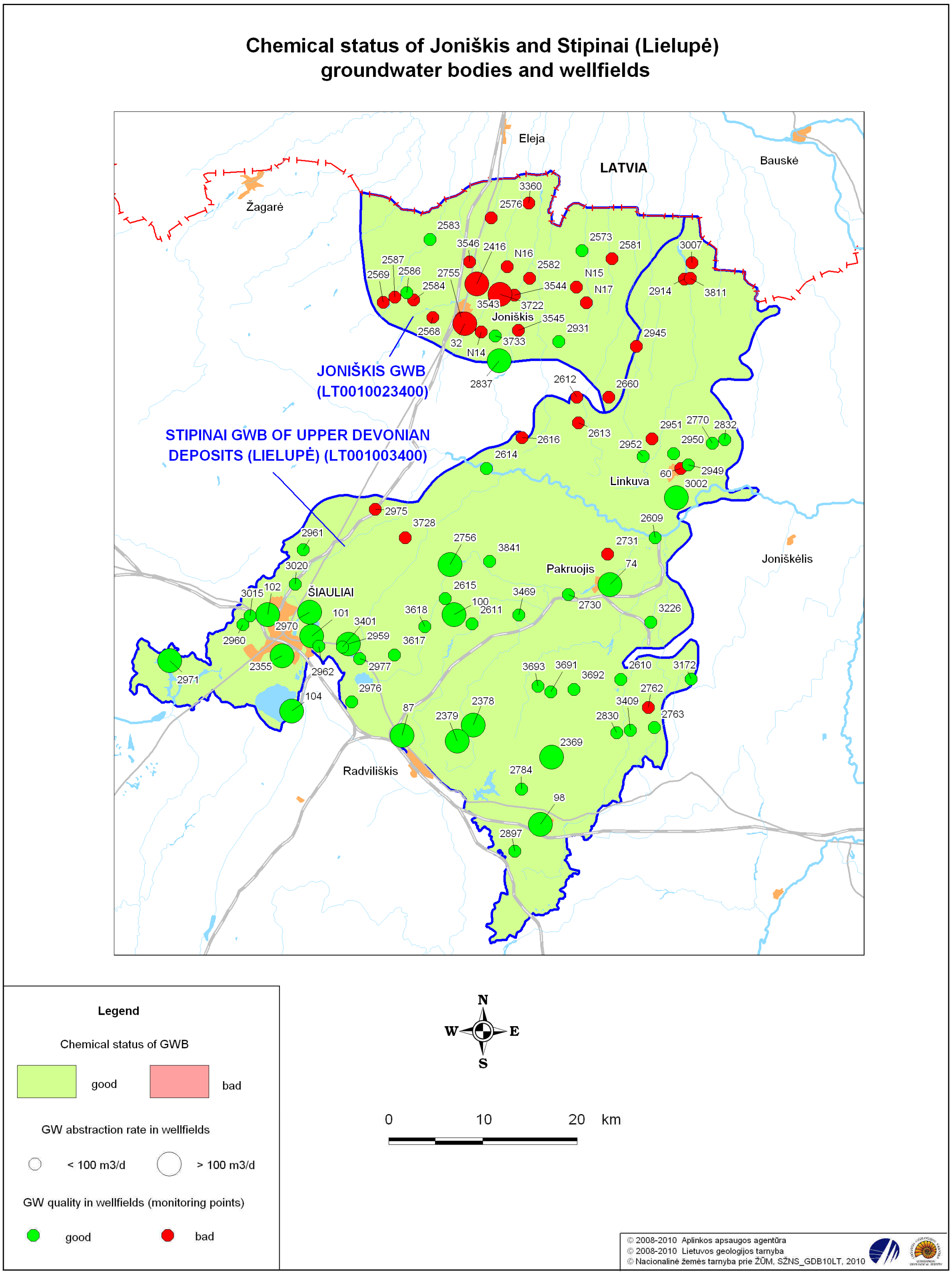


Figure 43. Chemical status of groundwater in Joniškis GWB and Stipinai-Lielupė GWB of Upper Devonian deposits and in the wellfields therein

SECTION IV. ENVIRONMENTAL OBJECTIVES FOR PROTECTED AREAS

110. The Habitats Directive and the Birds Directive require creating special protected areas for the conservation of birds and their habitats of Community importance. The implementation of the directives results in expansion of NATURA 2000 sites.

The objectives set in the Birds Directive and in the Habitats Directive support the objectives laid down in the Law of the Republic of Lithuania on Water. Both directives aim at sustainable development and ensuring quality of a living environment for both humans and birds. In certain cases, however, a question of priorities may arise, for instance, when constructing ponds, cleaning water bodies and adjusting these for recreation. Since protected areas occupy a very small part of the Lithuanian territory (10-15%), many constructions/activities can usually be placed outside the protected areas. Even remote economic activities may have a significant impact on the values of the protected areas. Therefore, significance of an impact of planned economic activities on NATURA 2000 sites must be established and, if necessary, an environmental impact assessment (EIA) performed.

The EU environmental policy ensures effective protection of the unique biological variety throughout Europe and guarantees that all EU Member States have the same legal obligations in respect of the conservation of areas included in NATURA 2000 network. Significance of an impact of planned economic activities on NATURA 2000 sites is established observing the Procedure for the Establishment of an Impact of Plans or Programmes and Planned Economic Activities on Potential NATURA 2000 Sites or Those Already Created, which was approved by Order No. D1-255 of the Minister of Environment of the Republic of Lithuania of 22 May 2006 (Žin., 2006, No. 61-2214).

SECTION V. EXTENSION OF THE DEADLINE FOR ACHIEVING ENVIRONMENTAL OBJECTIVES

111. The provisions on environmental objectives laid down in the Law of the Republic of Lithuania on Water include extension of the deadline for achieving these objectives, which means a possibility of short-term, medium-term or long-term deviation from good ecological status, which is otherwise to be attained by 2015.

Failure to achieve good ecological status by 2015 may be justified on the grounds of at least one of the following reasons:

111.1. the scale of improvements required can only be achieved in phases exceeding the timescale, for reasons of technical feasibility;

111.2. completing the improvements within the timescale would be disproportionately expensive;

111.3. natural conditions do not allow timely improvement in the status of the body of water.

112. An additional analysis was carried out upon the identification of the water bodies at risk within the Lielupė RBD (113 rivers, 10 lakes and ponds) in order to identify possibilities of achieving good ecological status or good ecological potential in these water bodies during the first cycle of the implementation of the Programme of Measures (2010-2015).

It is forecasted that good status or good potential during the first cycle will be achieved in 42 river water bodies. Good status will not be achieved in any lake/pond at risk. For the remaining water bodies at risk (71 rivers and 10 lakes/ponds), extension of the deadline for achieving environmental objectives is proposed for reasons of technical feasibility, disproportionate costs or natural conditions.

Technical feasibility

113. Technical reasons preventing the achievement of the good ecological status objectives can be as follows:

113.1. there is no technical solution to deal with the problem;

113.2. more time is needed to solve the problem than it has been provided;

113.3. there is no information on the cause of the problem hence no solution can be proposed.

114. The required extension for achieving good ecological status in water bodies within the Lielupė RBD is mainly related to the second and third reasons: more time is required or there is insufficient information on the problem and/or its cause and hence no solution can be proposed.

115. Establishment of objectives for ecological status inevitably involves uncertainty therefore a large number of measures are envisaged for reducing uncertainty during the first cycle of the implementation of programmes of measures in many country. Such measures are related to research, monitoring and assessment. An analysis in the Lielupė RBD established the following uncertainties:

115.1. uncertainty about the status of water bodies in the category of rivers and lakes;

115.2. uncertainty about the impact of certain risk factors on water bodies;

115.3. uncertainty about the causes of poor status.

116. It is proposed to postpone the achievement of water protection objectives in water bodies where there is uncertainty about the status assessment results until more data verifying the status of such water bodies and enabling identification of significant pollution sources is obtained. The status has to be specified in respect of two rivers and two lakes of the total number of 123 water bodies at risk because the available data/information is not sufficient for precise establishment of status or reliability of the available data raises certain doubts.

117. River stretches affected by hydropower plants are designated as water bodies at risk. However, in many cases there is no data which would verify a negative impact of hydromorphological alterations on the status of water bodies. Hence, it is not absolutely clear whether pressures from these factors always determine lower than good ecological status/potential of a water body. Uncertainty about impacts of hydropower plants was established in respect of two water bodies in the category of rivers.

118. Mathematical modelling results showed that certain point pollution sources may be exerting a significant impact on the status/potential of water bodies but the monitoring data proving such impact is not sufficient in all water bodies. Also, data is lacking to be able to identify the pollution source which exerts a significant impact. Uncertainty about a potential significant impact of point pollution was established in respect of 16 river

water bodies. Economic entities in the Lielupė RBD (in this case – certain urban wastewater treatment facilities) which are preliminary suspected to be preventing respective water bodies from the achievement of good ecological status by 2015 will be subject to additional examination. Only such factual measurements and consequent identification of a significant impact by relevant economic entities would serve as a basis for revision of the conditions of permits issued (in this instance – integrated pollution prevention and control permits) potentially tightening them taking into account self-cleaning/dilution possibilities of receiving water bodies, even in cases when all formal treatment requirements laid down in relevant legislation are currently met at these entities

119. Straightened rivers need to be mentioned separately. It is commonly agreed that river straightening deteriorates the ecological status of rivers and so such rivers are designated either as water bodies at risk or heavily modified water bodies. However, impacts of the straightening on the ecological status of water bodies have not been analysed in detail yet, therefore it is recommended to postpone the achievement of the objectives due to uncertainty about such impact. In addition, even if the cause was clear, the acceptability by the society and inability to afford renaturalisation of rivers would be a sufficient reason for the extension of the deadline for achieving good ecological status. There are 43 such water bodies within the Lielupė RBD.

120. Sources of pollution are not clear in four lakes (Talkša, Notigalė, Rėkyva and Skaistė).

121. Uncertainty about the effect of potential measures was established in two river water bodies affected by diffuse pollution and one lake. Uncertainty about potential measures to improve hydromorphological status was established in respect of one lake which is designated as heavily modified water body due to hydromorphological changes (Lake Rėkyva where also sufficient information is missing on pollution sources).

Reduction of pollution to the required level in two water bodies using the available measures is technically complicated due to unfavourable natural conditions: there are practically no sandy soils and the area is characterised by low flow.

122. Operational or investigative monitoring has been envisaged for all risk factors the impact of which is not known yet or raises doubts. It is proposed to extend the deadline for achieving water protection objectives in these water bodies until more data proving a significant impact of the risk factors on the status/potential of the water bodies is obtained.

Disproportionate costs of status improvement within the established timescale

123. The question of whether the costs of a measure intended for the achievement of good ecological status in a water body are disproportionate and whether such costs may serve as a basis for derogation is a decision based on economic information. Such decision needs comparing relevant costs and benefits.

The principle of disproportionate costs, i.e. a cost-benefit comparison was not required in any case of extension of the deadline for the attainment of environmental objectives within the Lielupė RBD. All cases of extension are based either on technical uncertainties already discussed or on affordability, which will be addressed in the section below. The latter is in a way a component of the principle of disproportionate costs.

124. Out of the total number of 113 water bodies at risk in the category of rivers within the Lielupė RBD, 43 water bodies were designated as such either due to straightening or because of both straightening and other risk factors. According to expert judgement, stretches situated in the upper reaches of the rivers should be left for natural renaturalisation. Renaturalisation is recommended for the straightened river stretches which are located in areas with a clear public demand as well as in places where renaturalisation can have a significant impact on the minimisation of floods, retention of pollutants and enhancement/restoration of biodiversity (habitats of plants and animals). The renaturalisation of these stretches, i.e. attainment of good ecological status in water bodies at risk, would require LTL 41 million by 2015.

Such measure would have to be implemented by respective municipalities or by the state using their own funds or EU assistance funds. As compared to the expenditure in the water sector during the last few years, the said amount is not very large; however, no additional funding sources can be found because all available ones already have their investment objects planned. At present, the state would not be able to afford such measure. Besides, impacts of the remeandering on the ecological status of specific streams are not known yet. Consequently, first of all a pilot project should be carried out (such project has been planned for the Nemunas RBD), and only then further actions should be taken on the basis of the project results.

Besides, renaturalisation of rivers may be unacceptable to the society because, in the context of lack of funds for such areas as education, health protection and creation of job vacancies, it may be seen as a “luxury” measure.

Lack of funds would also be the reason for postponing the achievement of good water status in 25 water bodies affected by diffuse agricultural pollution.

Natural conditions which prevent attainment of water protection objectives

125. Four lakes and ponds at risk due to impacts of diffuse pollution will not be able to achieve good ecological status and good ecological potential during the first cycle of the implementation of the Management Plan because even if pollutant input to water bodies is stopped, good ecological status/potential may be unattained due to resuspension of pollutants accumulated in bottoms sediments. Self-cleaning processes in standing waters and low-drainage water bodies are much slower than in the ecosystems of flowing water bodies. Self-restoration of more inert biological quality elements, such as macrophytes and fish, is an especially slow process. Accordingly, it is proposed to postpone the achievement of environmental objectives under the Law of the Republic of Lithuania on Water, which provides for a possibility to extend the deadline for achieving the objectives when the achievement is prevented by natural conditions. The water bodies within the Lielupė RBD where such extension would be required are Baltausių pond, Dvariūkų pond, Ginkūnų pond and Lake Kairių ežeras.

The scheme for assessing the degree of achievement of good ecological status in all 123 water bodies at risk is demonstrated in Figure 44. The number of water bodies where the achievement of good ecological status is to be postponed is provided in Tables 85 and 86.

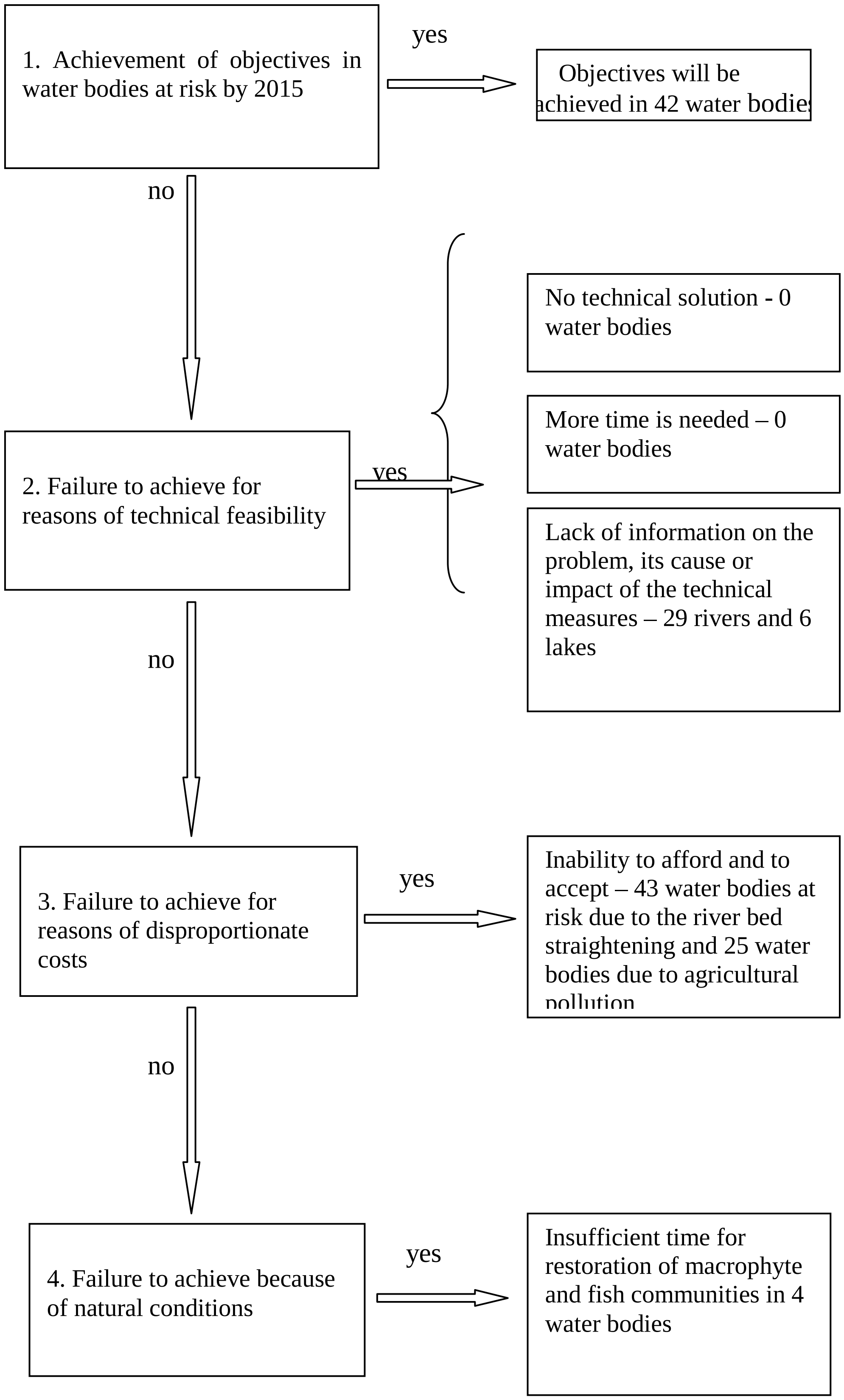


Figure 44. Steps of the deadline extension for achieving good ecological status in water bodies at risk

Note: Achievement of good status in a water body can be postponed due to several reasons, therefore the number of the water bodies given in the scheme does not coincide with the number of the water bodies at risk.

Transboundary pollution

126. Lielupė RBD is a transboundary river basin district hence a relevant issue here is transboundary pollution. Pollution loads generated on the territory of Lithuania are transported to Latvia by the rivers Mūša, Nemunėlis and small tributaries of the Lielupė. The average annual amounts transported from Lithuania to the neighbouring country are estimated at about 1 905 tonnes of BOD_7, 142 tonnes of ammonium nitrogen, 6 882 tonnes of nitrate nitrogen and 77 tonnes of total phosphorus.

There are 19 river water bodies within the Lielupė RBD which flow out to the Latvian territory or flow along the Lithuanian-Latvian border. These are transboundary water bodies (see Table 87). All transboundary water bodies in the Lielupė RBD were designated as water bodies at risk: 8 water bodies were identified as being at risk due to a significant impact diffuse agricultural pollution, 6 – due to an aggregate impact of diffuse agricultural pollution, 1 – due to an aggregate impact of point and diffuse agricultural pollution, 1 – due to an aggregate impact of bed straightening point and diffuse agricultural pollution, 1 water body suffer from a significant impact bed straightening impact, and 2 water bodies fail good ecological status by biological parameters but the reasons of the failure are not known.

7 transboundary water bodies are heavily modified water bodies. The ecological status of 6 water bodies is moderate, 6 water bodies are at poor ecological status. 6 heavily modified water bodies are at ecological potential and 1 – at bad ecological potential.

One of the main reasons of the failure to achieve good ecological status/potential in transboundary water bodies is high concentrations of nitrate nitrogen generated as a result of diffuse agricultural pollution. Pollution in Lithuania prevents achievement of good ecological status and good ecological potential in rivers situated on the territory of Latvia, where many rivers of the Lielupė RBD are considered to be at poor or even bad ecological status and potential. It has been established that only 13 rivers in Latvia of all river water bodies in the Lielupė RBD meet the good ecological status and good ecological potential requirements. Diffuse agricultural pollution is an urgent problem in both Lithuania and Latvia hence the countries are planning to implement supplementary measures to reduce this type of pollution.

Achievement of water protection objectives in water bodies within the Lielupė RBD is provided in Tables 86 and 87 and demonstrated in Figure 45.

Table 85. Measures and extension of the deadline for achievement of water protection objectives in water bodies in the Lielupė RBD (water bodies in bold italics are transboundary water bodies)

WB code	Sub-basin	River	Length of WB, km	Type	HMWB	Achievement of water protection objectives	Envisaged supplementary measures for achievement of water protection objectives	Reasons of deadline extension					
								Uncertainty about status	Uncertainty about the impact of the river bed straightening and lack of affordability	Uncertainty about the impact			Uncertainty about technical feasibility to reduce diffuse pollution
										HPP	Water abstraction	Point pollution	
410100011	Mūša	Mūša	12.8	1	0	Deadline extended			1				
410100012	Mūša	Mūša	15.2	2	1	Until 2015	1,2,3,4						
410100013	Mūša	Mūša	35.4	2	0	Deadline extended			1				
410100014	Mūša	Mūša	34.5	5	0	Deadline extended				1			
410100015	Mūša	Mūša	16.9	4	0	Until 2015	1,2,3,4						
410100016	Mūša	***Mūša***	15.8	5	0	Until 2015	1,2,3,4						
410100701	Mūša	Vilkvedis	15.7	1	0	Deadline extended			1				
410101201	Mūša	Voverkis	19.4	1	0	Deadline extended			1				
410102101	Mūša	Kulpė	5.1	1	1	Until 2015	1						
410102102	Mūša	Kulpė	7.6	1	0	Deadline extended			1			1	
410102103	Mūša	Kulpė	14.1	1	0	Deadline extended						1	
410102104	Mūša	Kulpė	5.7	1	0	Deadline extended			1			1	
410102121	Mūša	Vijolė	6.8	1	0	Deadline extended			1			1	
410102901	Mūša	Šiladis	28.5	1	1	Deadline extended						1	1
410103601	Mūša	Pala	20.4	1	0	Deadline extended			1				
410104301	Mūša	Kruoja	13.0	1	1	Until 2015	1,2,3,4						
410104302	Mūša	Kruoja	25.3	3	0	Until 2015	1,2,3,4						
410104303	Mūša	Kruoja	18.2	3	0	Deadline extended						1	
410104441	Mūša	Obelė	3.8	1	0	Deadline extended			1				

WB code	Sub-basin	River	Length of WB, km	Type	HMWB	Achievement of water protection objectives	Envisaged supplementary measures for achievement of water protection objectives	Reasons of deadline extension					
								Uncertainty about status	Uncertainty about the impact of the river bed straightening and lack of affordability	Uncertainty about the impact: HPP	Uncertainty about the impact: Water abstraction	Uncertainty about the impact: Point pollution	Uncertainty about technical feasibility to reduce diffuse pollution
410104442	Mūša	Obelė	10.7	1	0	Deadline extended			1			1	
410104443	Mūša	Obelė	26.5	1	0	Deadline extended						1	
410104531	Mūša	Vėzgė	33.1	1	0	Deadline extended			1			1	
410105101	Mūša	Daugyvenė	15.5	1	0	Until 2015	1						
410105102	Mūša	Daugyvenė	20.0	1	0	Deadline extended						1	
410105103	Mūša	Daugyvenė	23.6	1	0	Until 2015	1,2,3,4						
410105104	Mūša	Daugyvenė	10.4	3	0	Until 2015	1,2,3,4						
410105381	Mūša	Ramytė	28.1	1	1	Until 2015	1,2,3,4						
410105391	Mūša	Ežerėlė	12.9	1	0	Deadline extended			1				
410105392	Mūša	Ežerėlė	20.1	3	0	Until 2015	1						
410105393	Mūša	Ežerėlė	9.2	3	0	Deadline extended			1				
410106101	Mūša	Lašmuo	18.2	1	1	Until 2015	1,2,3,4						
410107301	Mūša	Mažupė	29.2	1	1	Until 2015	1						
410107302	Mūša	Mažupė	8.7	3	0	Until 2015	1						
410107441	Mūša	Meškerdys	18.7	1	0	Deadline extended			1				
410108501	Mūša	Lėvuo	16.9	1	1	Until 2015	1						
410108502	Mūša	Lėvuo	31.4	2	0	Until 2015	1,2						
410108503	Mūša	Lėvuo	82.3	5	0	Until 2015	1,2,3,4						
410108591	Mūša	Mituva	10.3	1	1	Until 2015	1						
410108592	Mūša	Mituva	3.8	1	0	Until 2015	1						
410108871	Mūša	Kupa	17.2	1	1	Until 2015	1,2						
410108872	Mūša	Kupa	8.7	3	0	Until 2015	1,2						
410108991	Mūša	Skodinys	7.4	1	0	Deadline extended			1				
410108992	Mūša	Skodinys	6.2	1	0	Until 2015	1,2						

WB code	Sub-basin	River	Length of WB, km	Type	HMWB	Achievement of water protection objectives	Envisaged supplementary measures for achievement of water protection objectives	Reasons of deadline extension					
								Uncertainty about status	Uncertainty about the impact of the river bed straightening and lack of affordability	Uncertainty about the impact			Uncertainty about technical feasibility to reduce diffuse pollution
										HPP	Water abstraction	Point pollution	
410109231	Mūša	Suosa	9.7	1	0	Deadline extended			1				
410109232	Mūša	Suosa	5.5	1	0	Until 2015	1						
410109351	Mūša	Viešinta	5.9	1	0	Until 2015	1						
410109352	Mūša	Viešinta	9.0	1	1	Until 2015	1						
410109353	Mūša	Viešinta	12.7	1	0	Until 2015	1						
410109441	Mūša	Vašuoka	18.8	1	0	Deadline extended			1				
410109442	Mūša	Vašuoka	5.2	1	0	Until 2015	1						
410109443	Mūša	Vašuoka	7.3	1	0	Deadline extended			1				
410109621	Mūša	Marnaka	22.7	1	0	Deadline extended			1				
410109961	Mūša	Amata	20.6	1	1	Until 2015	1,2,3,4						
410110291	Mūša	Žąsa	16.6	1	1	Until 2015	1,2,3,4						
410110451	Mūša	Įstras	28.4	1	1	Until 2015	1,2						
410110452	Mūša	Įstras	13.4	1	0	Until 2015	1,2						
410110531	Mūša	Svalia	36.6	1	1	Deadline extended							1
410111201	Mūša	Pyvesa	47.7	1	0	Deadline extended			1				
410111202	Mūša	Pyvesa	33.8	2	0	Until 2015	1						
410111203	Mūša	Pyvesa	16.5	3	0	Until 2015	1,2,3,4						
410111551	Mūša	Orija	19.2	1	1	Until 2015	1,2,3,4						
410111552	Mūša	Orija	13.5	1	0	Until 2015	1,2,3,4						
410112101	Mūša	Ješmuo	20.6	1	1	Deadline extended							1
410112102	Mūša	Ješmuo	7.7	1	0	Deadline extended							1
410112401	Mūša	Tatula	35.2	1	1	Deadline extended						1	1
410112402	Mūša	Tatula	10.3	3	0	Deadline extended							1

WB code	Sub-basin	River	Length of WB, km	Type	HMWB	Achievement of water protection objectives	Envisaged supplementary measures for achievement of water protection objectives	Reasons of deadline extension					
								Uncertainty about status	Uncertainty about the impact of the river bed straightening and lack of affordability	Uncertainty about the impact			Uncertainty about technical feasibility to reduce diffuse pollution
										HPP	Water abstraction	Point pollution	
410112403	Mūša	Tatula	7.6	3	0	Deadline extended							1
410112404	Mūša	Tatula	11.4	3	0	Deadline extended							1
410112471	Mūša	Vabala	13.7	1	1	Until 2015	1,2,3,4						
410112631	Mūša	Juodupė	23.7	1	0	Deadline extended			1				1
410112751	Mūša	Upytė	19.8	1	1	Until 2015	1						
410112752	Mūša	Upytė	8.4	1	0	Until 2015	1						
410113301	Mūša	Kamatis	17.9	1	0	Deadline extended			1				1
410114501	Mūša	Čeriaukštė	11.7	1	0	Deadline extended			1				
420100011	Nemunėlis	Nemunėlis	8.0	1	0	Deadline extended			1			1	
420100013	Nemunėlis	Nemunėlis	21.8	2	0	Deadline extended						1	
420100014	Nemunėlis	***Nemunėlis***	99.6	2	0	Deadline extended		1					
420100015	Nemunėlis	***Nemunėlis***	20.6	5	0	Deadline extended		1					
420100501	Nemunėlis	Laukupė	9.3	1	0	Deadline extended			1				
420100502	Nemunėlis	Laukupė	19.0	1	0	Deadline extended						1	
420101101	Nemunėlis	Vingerinė	7.4	1	0	Deadline extended			1				
420101103	Nemunėlis	Vingerinė	8.1	1	0	Deadline extended			1	1			
420101161	Nemunėlis	Beržiena	21.6	1	0	Deadline extended			1				
420101801	Nemunėlis	Vyžuona	3.7	1	0	Deadline extended			1				
420101803	Nemunėlis	Vyžuona	22.5	2	0	Deadline extended			1				

WB code	***Sub-basin***	***River***	***Length of WB, km***	***Type***	***HMWB***	***Achievement of water protection objectives***	***Envisaged supplementary measures for achievement of water protection objectives***	***Reasons of deadline extension***					
								Uncertainty about status	***Uncertainty about the impact of the river bed straightening and lack of affordability***	***Uncertainty about the impact***			***Uncertainty about technical feasibility to reduce diffuse pollution***
										HPP	***Water abstraction***	***Point pollution***	
420101921	Nemunėlis	Juodupė	6.3	1	0	Deadline extended			1				
420103101	Nemunėlis	***Nereta***	25.3	1	0	Deadline extended			1				
420105721	Nemunėlis	Agluona	14.0	1	1	Until 2015	1						
420105722	Nemunėlis	Agluona	7.9	1	0	Until 2015	1						
420106391	Nemunėlis	A. Gervė	22.0	1	0	Deadline extended			1				
420106531	Nemunėlis	Ž. Gervė	20.5	1	0	Deadline extended			1				
400100101	Lielupė Small Tributaries	***Yslykis***	19.2	1	1	Deadline extended							1
400100221	Lielupė Small Tributaries	***Maučiuvis***	17.2	1	0	Deadline extended			1				1
400100331	Lielupė Small Tributaries	***Plonė***	18.3	1	0	Deadline extended			1				1
400100461	Lielupė Small Tributaries	Beržtalis	21.5	1	0	Deadline extended			1				1
400100462	Lielupė Small Tributaries	Beržtalis	6.5	1	0	Deadline extended							1
400100463	Lielupė Small Tributaries	***Beržtalis***	5.7	3	0	Deadline extended			1			1	1
400101101	Lielupė Small Tributaries	***Švitinys***	29.0	1	1	Deadline extended							1
400101281	Lielupė Small Tributaries	***Viršytis***	27.1	1	1	Deadline extended							1
400101601	Lielupė Small Tributaries	***Šešėvė***	14.9	1	1	Deadline extended							1
400101701	Lielupė Small Tributaries	Virčiuvis	27.0	1	1	Deadline extended							1
400101702	Lielupė Small Tributaries	***Virčiuvis***	8.2	2	0	Deadline extended			1				1
400101811	Lielupė Small Tributaries	Ašvinė	25.4	1	1	Deadline extended							1
400101941	Lielupė Small Tributaries	***Audruvė***	28.7	1	1	Deadline extended							1

WB code	Sub-basin	River	Length of WB, km	Type	HMWB	Achievement of water protection objectives	Envisaged supplementary measures for achievement of water protection objectives	Reasons of deadline extension					
								Uncertainty about status	Uncertainty about the impact of the river bed straightening and lack of affordability	Uncertainty about the impact			Uncertainty about technical feasibility to reduce diffuse pollution
										HPP	Water abstraction	Point pollution	
400102501	Lielupė Small Tributaries	Platonis	21.3	1	0	Deadline extended			1				1
400102502	Lielupė Small Tributaries	***Platonis***	6.1	1	1	Deadline extended							1
400102691	Lielupė Small Tributaries	***Sidabra***	14.2	1	1	Deadline extended						1	1
400102692	Lielupė Small Tributaries	Sidabra	19.4	1	1	Deadline extended							1
400103201	Lielupė Small Tributaries	Švėtė	28.9	1	1	Until 2015	1						
400103202	Lielupė Small Tributaries	***Švėtė***	26.1	3	0	Until 2015	1						
400103521	Lielupė Small Tributaries	***Vilkija***	29.2	1	0	Deadline extended			1				
400103711	Lielupė Small Tributaries	***Lanka***	17.1	1	0	Deadline extended			1				
400103721	Lielupė Small Tributaries	***Švėtelė***	17.9	1	0	Deadline extended			1				

* Supplementary measures:

1 – National agricultural pollution reduction measures:

- manure management in small farms,
- fertilisation plans in farms with more than 10 ha of utilised land,
- revision of the manure absorption capacity coefficient;

2 – More favourable conditions to use support schemes under the RDP;

3 – Compensatory scheme for the application of fertilisation norms 20% lower than the optimal one;

4 – Compensatory scheme for the sowing of sandy and mixed soils with catch crops.

Table 86. Achievement of water protection objectives in water bodies at risk in the category of lakes in the Lielupė RBD

WB code	***Sub-basin***	***Lake***	***Length of WB, km***	***Type***	***HMWB***	***Achievement of water protection objectives***	***Reasons of deadline extension***		
							Uncertainty about pollution sources	***Uncertainty about achievement of good status after removal of the impact***	***Uncertainty about technical feasibility to reduce the impact***
441040010	Mūša	Lake Talkša	0.576	2	0	Deadline extended	1		
441040012	Mūša	Lake Rėkyva	1.19	1	1	Deadline extended	1		1
441040020	Mūša	Lake Kairių ežeras	0.833	1	0	Deadline extended		1	
340050001	Mūša	Dvariūkų pond	1.332	1	1	Deadline extended		1	
340050046	Mūša	Ginkūnų pond	1.049	1	1	Deadline extended		1	
442030022	Nemunėlis	Lake Notigalė	0.916	1	0	Deadline extended	1		
442030032	Nemunėlis	Lake Skaistė	0.578	1	0	Deadline extended	1		
442040060	Nemunėlis	Lake Kilučių ežeras	0.828	1	0	Deadline extended		1	
442040061	Nemunėlis	Lake Širvėnos ežeras	3.201	1	0	Deadline extended		1	
340050020	Lielupė Small Tributaries	Baltausių pond	0.801	1	1	Deadline extended		1	

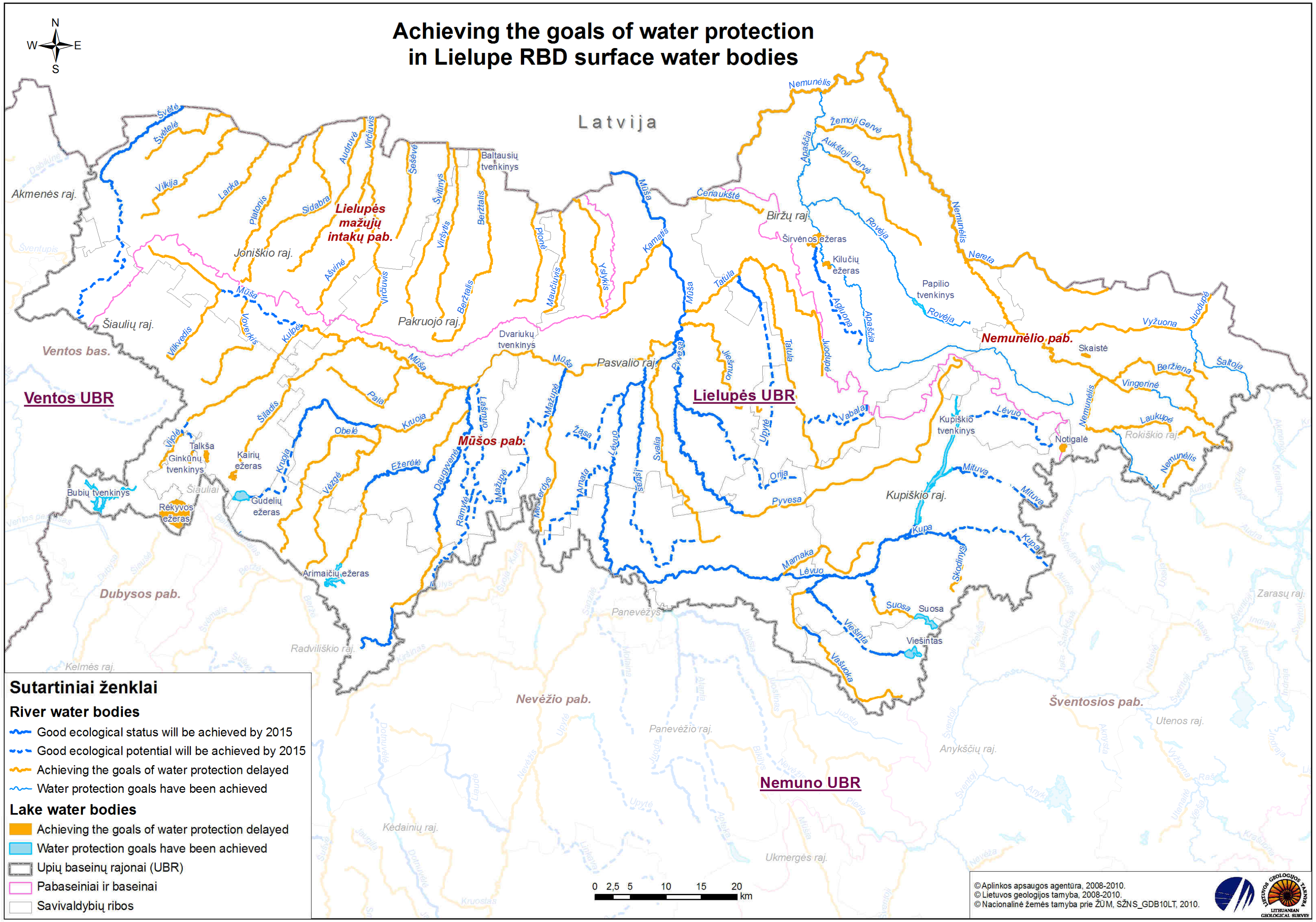


Figure 45. Achievement of water protection objectives in surface water bodies in the Lielupė RBD

CHAPTER VII. SUMMARY ECONOMIC ANALYSIS OF WATER USE

SECTION I. GENERAL OVERVIEW OF THE SITUATION

127. With the area of 8 940 km^2, the Lielupė RBD constitutes 13.7% of the total area of the country and is the second largest river basin district in Lithuania. The Mūša Sub-basin takes up 59% (5 296 km^2) of the total area of the RBD. The remaining area is shared by the Lielupė Small Tributaries Sub-basin (1 902 km^2) and Nemunėlis Sub-basin (1 751 km^2). Most of the population (188 thousand) live in the Mūša Sub-basin and the total number of the population in the Lielupė RBD is 387 270, which is 11.5% of the total population in the country. The density of the population varies from 24 inhabitants per km^2 in the Nemunėlis Sub-basin to 55 inhabitants per km^2 in Mūša Sub-basin.

The Nemunėlis Sub-basin situates 68% of Biržai district municipality and 47% of Rokiškis district municipality. Mūša Sub-basin situates 79% of Kupiškis municipality, 62% of Pakruojis municipality, 32% of Biržai municipality, 90% of Pasvalys municipality, 81% of Šiauliai city municipality, 26% of Panevėžys district municipality and 9% of Panevėžys city municipality; Lielupė Small Tributaries Sub-basin contains 86% of Joniškis municipality, 38% of Pakruojis municipality, 10% of Pasvalys municipality and 6% of Šiauliai district municipality.

Table 87. Comparison of the general indicators in four RBD, 2008

	Venta RBD	**Lielupė RBD**	**Lielupė RBD**	**Nemunas RBD**	**Lithuania**
Area, km^2	6 277.3	8 949.1	1 870.8	48 202.8	65 300
Share of the area from the total area of Lithuania, %	9.6%	13.7%	2.9%	73.8%	100%
Number of population	220 000	387 271	57 534	2 710 813	3 375 618
Density of population	35	43	31	56	52
Share of the total number of population in Lithuania, %	6.5%	11.5%	1.7%	80.3%	100%
Total GDP, LTL million	5 935.07	9 114.13	1 629.02	81 460.48338	98 138.7
Share of GDP in the RBD from the national GDP	6.0%	9.3%	1.7%	83.0%	100%
GDP per capita, LTL	26 978	23534	28 314	30 050	29 073
Average disposable monthly income per household member	884	882	869	1013	987
Working-age population	130 725	230 375	37 149	1 811 276	2 209 525
Registered unemployed population (April 2010)	22 251	32 193	5 500	247180	307 124
Share of registered unemployed population from working-age population	17.0%	14.0%	14.8%	13.6%	13.9%
Total water consumption, thousand m^3, 2009	11 304	10 658	1 916 758	3 390 993	5 329 713

Source: Statistics Lithuania, the data recalculated by experts for the RBD following population distribution in individual RBD

The data in Table 87 demonstrates that GDP in the Lielupė RBD in 2008 totalled to LTL 9 114.1 million, which accounted for 9% of the national GDP. The GDP share per capita was LTL 23 534, which is a little lower than the Lithuanian average. The indicator only slightly varies in individual sub-basin.

The average monthly disposable income per household member in the Lielupė RBD in 2008 was lower than the national average and totalled to LTL 882, meanwhile the national average in 2008 was LTL 987 per household member. Registered unemployed population in the Lielupė RBD in 2008 accounted for 14% of the total working-age population, which is approximately the same as the average national figure.

The annual water consumption in the Lielupė RBD in 2008 totalled to 10 658 thousand m^3, which is 0.2% of the total water consumption in Lithuania. Apart from the water volume consumed for energy purposes, the water consumption in the Lielupė RBD accounts for 5.1% of the total consumption in Lithuania. The highest consumption is registered in the household sector. The distribution of water consumption by sectors is provided in Figure 46 below.

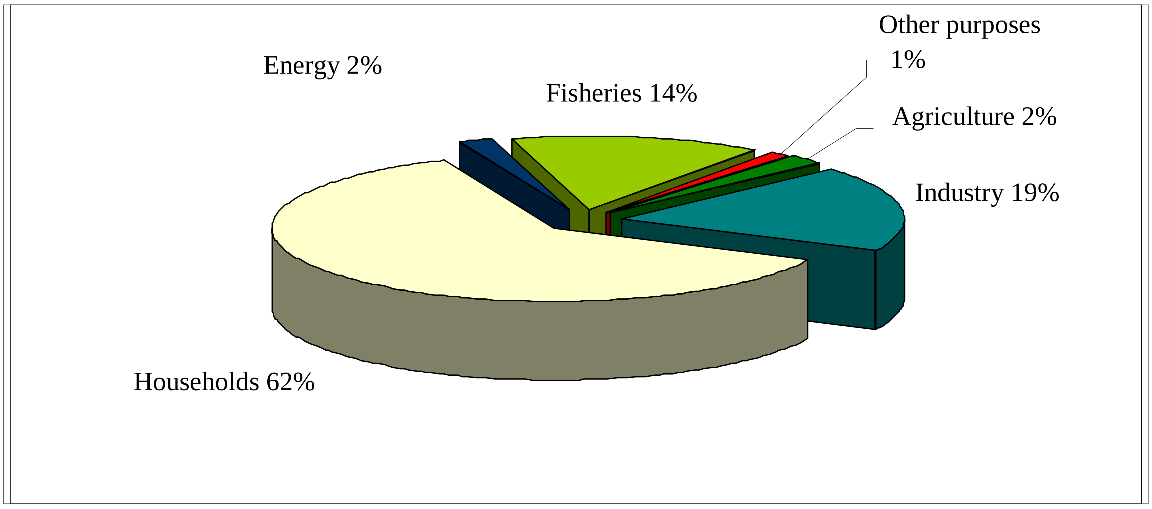


Figure 35. Water consumption in the Lielupė RBD in 2009
Source: Statistics Lithuania. The chart was drawn by the Expert

Differently from the data on water consumption, information on the wastewater treatment level is given on the basis of the information on municipalities provided by the Statistics Lithuania instead of observing the proportions of the population number in the RBD and sub-basins.

There is no untreated wastewater discharged in seven major municipalities within the Lielupė RBD (Biržai, Rokiškis, Kupiškis, Pasvalys, Šiauliai city, Pakruojis and Joniškis) (the respective national figure is 0.3%); however, the treatment quality is insufficient: 82% of wastewater in 2008 was treated below the established standards meanwhile in Lithuania this figure is 27% (excluding wastewater which is generally not subject to treatment). Since wastewater from Šiauliai city accounts for the largest share in the total wastewater volume and this wastewater in 2008 was treated insufficiently, the percentage of improperly treated wastewater in this RBD is very high. It should be noted that in 2007 insufficiently treated wastewater constituted only 22% because wastewater from Šiauliai city was treated to the standard.

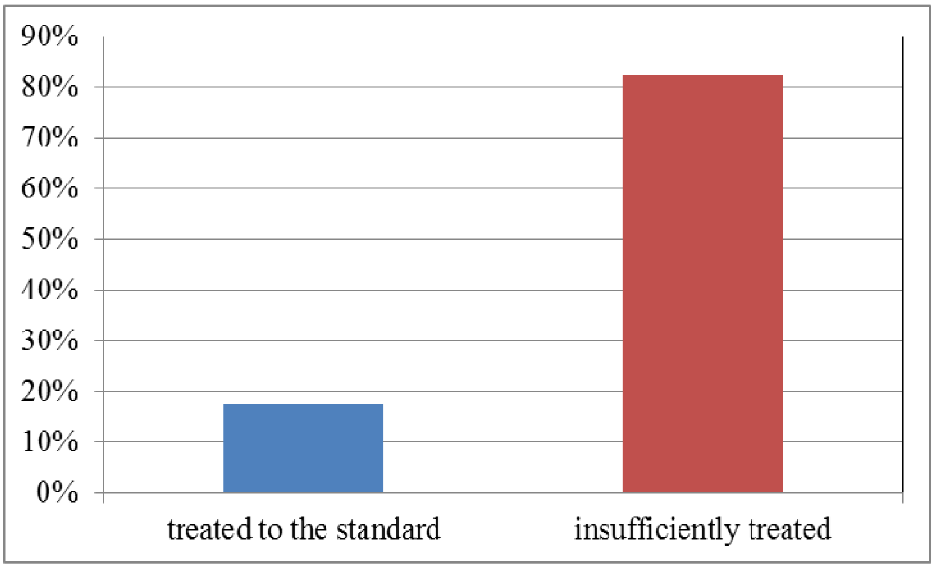


Figure 47. Level of treatment in seven municipalities in the Lielupė RBD in 2008
Source: Statistics Lithuania. The chart was drawn by the Expert.

SECTION II. ANALYSIS OF ECONOMIC SECTORS

128. An analysis of sectors related to and affecting the use of water resources demonstrated that the main drivers of the major pressures on surface water bodies include households, industry, energy, agriculture and fisheries. The main sources of pollution identified in the Lielupė RBD are municipal and industrial wastewater and agricultural pollution. Also, as already said, about 20 km of rivers are water bodies at risk due to an impact of HPP (four HPP).

Monitoring and modelling data shows that supplementary measures due to excessive amounts of nitrogen and phosphorus in wastewater are required in respect of two point pollution sources. Pollution or its source is not sufficiently clear in eleven sites hence studies will be required to examine the situation.

No water bodies at risk due to hazardous substances have been identified. The length of hydromorphologically altered rivers as a result of straightening, which was carried out back in Soviet times, totals to 1 321 km. The sectors which generate major loads on water bodies are discussed in more detail below.

Differently from countries with insufficient water resources, Lithuania little depends on water resources, which do not have any significant influence on the selection of an economic activity (except for activities directly connected with water resources, such as hydropower and navigation) or place of residence. The analysis of pressures given above, economic activities and supplementary measures required in the Lielupė RBD as described further in the text demonstrated that the input of agriculture, which generates relatively higher loads on water bodies, to the GDP is lower than the input of industry, which has a lower impact on water resources. Pollution generated in the process of other activities is more or less proportionate to the economical product produced thereby.

Households

129. The household sector is one of the most important users of water resources. In 2008, the average consumption of water by one member of a household connected to a

centralised network in Lithuania was 63 litres per day[1]. The consumption in Biržai district was 63 litres per day, in Rokiškis district – 45, in Kupiškis district – 50, in Pasvalys district – 45, in Šiauliai district – 42, in Pakruojis district – 50 and in Joniškis district – 49 litres per day per household member. The average daily consumption by one inhabitant serviced by seven water supply companies totalled to 58 litres in 2008.

The precise figure on wastewater discharges by households and by industries cannot be provided because the majority of industries emit their wastewater to the same wastewater treatment facilities. The analysis was conducted on the assumption that wastewater volumes discharged by households and industries are proportionate to the amounts consumed by these sectors. Comparison of households and industry shows that consumption by households within the Lielupė RBD is 2.4 times higher than the industry sector. The annual water consumption by households in seven main municipalities in the Lielupė RBD accounts for 57.4% of the total water consumption in the RBD.

There are seven major water supply companies in the Lielupė RBD. In addition, there are a number of small ones, although these should cease to exist having in mind the legal provision to have one public water supplier per municipality.

The number of people in households connected to water supply networks by the main water supply companies within the Lielupė RBD is provided in Table 88.

Table 88. Percentage of population connected to water supply and sewerage networks in the Lielupė RBD, 2009

Water supply company	Percentage share of population connected to water supply networks in the areas serviced by water supply companies	Percentage share of population connected to sewerage networks in the areas serviced by water supply companies
1	85	85
2	81	69
3	80	46
4	69	58
5	46	34
6	29	29
7	58	41
In Lielupė RBD on average	**71**	**88**

Source: Water Suppliers' Association

For the purpose of implementing the strategic goal to achieve that 95% of the population becomes able to use water supply and wastewater management services, it has been planned to allocate funds for all main municipalities of the Lielupė RBD from the Financial Perspective 2007-2013. Table 89 provides data on the planned investment projects including the required costs.

[1] Report of the National Control Commission for Prices and Energy, 2008

Table 82. National projects in the Lielupė RBD in 2007-2013

Municipality	Settlement	Planned works							Project value, LTL million
		New WWTP, unit	Renovated WWTP, unit	New WW netw., km	Renovated WW netw., km	New water supply netw., km	Renovated water supply netw., km	New/renovated water improvement facilities	
Kupiškis distr.	Kupiškis		1	4.2		4.8			16.744
	Aukštupėnai			3.4		1.0			
Pakruojis distr.	Pakruojis		1	6.4		3.5		1	31.0
	Linkuva		1	10.5		6.1			
Pasvalys distr.	Pasvalys			3.3		0.7			2.8
Radviliškis distr.	Radviliškis			3.1		3.0			3.146
Šiauliai city	Šiauliai			25.0		23.0			72.0
Šiauliai distr.	Šiauliai		1						20.41
	Ginkūnai			12.2	3.9	4.3	4.0		
Šiauliai distr.	Kairiai			11.0	2.9	8.7	2.1		19.04
	Vijoliai			1.9		1.9			
Biržai distr.	Biržai			18.0		5.9			16.73
Rokiškis distr.	Rokiškis			11.1		3.1			9.94
Joniškis distr.	Joniškis			8.0		7.1			15.1
Joniškis distr.	Žagarė	1		15.0		12.4			22.7
TOTAL		**1**	**4**	**133.1**	**6.8**	**92.3**	**6.1**	**1**	**229.61**

Source: List No. 01 under Measure No. VP3-3.1-AM-01-V "Renovation and development of water supply and wastewater treatment systems"

One of the most important factors determining the use of water services by households is the price. At present, different municipalities have set different tariffs of the water services.

The tariffs of water supply and wastewater management of the main water suppliers in the Lielupė RBD are given in Table 90 below.

Table 90. Tariffs of water supply and wastewater management in the Lielupė RBD, 2010, LTL/m^3, incl. VAT

Water supply company	Tariff of water supply		Tariff of wastewater management		Total tariff	
	for customers	for subscribers	for customers	for subscribers	for customers	for subscribers
Biržų vandenys	2.81	2.77	5.26	5.22	8.07	7.99
Joniškio vandenys	2.96	2.89	5.74	5.6	8.7	8.49
Kupiškio butų ūkis ir vandentiekis	2.96	2.9	4.39	4.28	7.35	7.18
Pakruojo vandentiekis	2.81	2.8	4.54	4.53	7.35	7.33
Pasvalio vandenys	1.78	1.78	2.63	3.7	4.41	5.48
Rokiškio vandenys	2.01	1.98	3.38	3.34	5.39	5.32
Šiaulių vandenys	3.45	3.39	3.18	3.12	6.63	6.51

Source: Water supply companies

Industry

130. Industries in the Lielupė RBD consume abut 20% of the total volume consumed in this river basin district. Almost half of this amount is used up by companies in Rokiškis district.

The highest percentage of companies (excluding public institutions, trade companies, companies providing other services, or similar companies) is operating in manufacturing – almost 11% (Figure 48). According to the data provided by Statistics Lithuania by counties and adjusted for municipalities, about 6 200 companies were operating in seven municipalities of the Lielupė RBD in 2008.

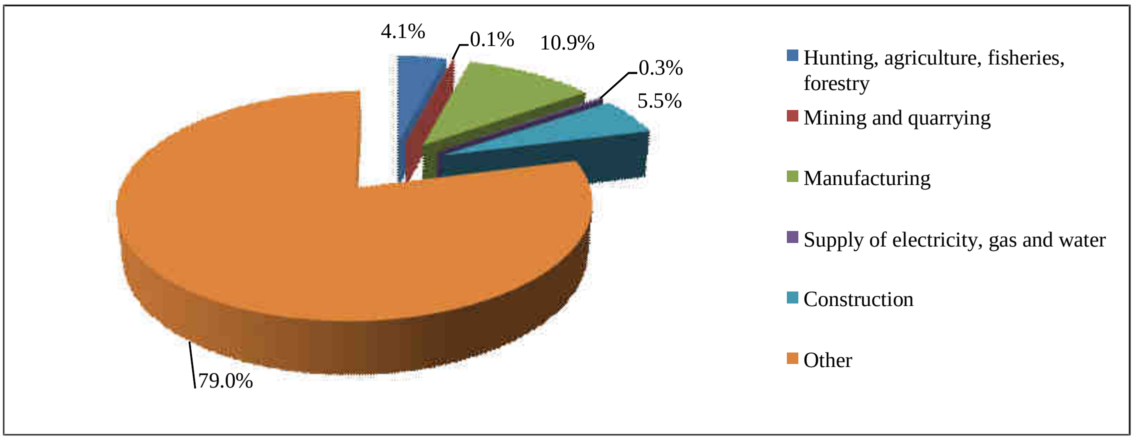


Figure 48. Distribution of companies by industries in the Lielupė RBD, 2008

Source: Data of Statistics Lithuania by counties, revised by the Expert

During the project "Identification of substances dangerous for the aquatic environment in Lithuania" carried out in 2006, examination of hazardous substances discharged with wastewater was performed in various wastewater treatment facilities. The findings revealed that a few hazardous substances of concern, namely, phenols and their ethoxylates, polycyclic aromatic hydrocarbon, organotin compounds and phtalates (in addition to those which are monitored under the National Monitoring Programme) were detected in wastewater treatment plants of a few towns. In the Lielupė RBD, hazardous substances were examined in effluents discharged from Rokiškis and Šiauliai WWTP as well as in the Nemunėlis and Mūša at the border. No exceedance were detected in discharges from Rokiškis and Šiauliai WWTP. Amount of di-(2-ethylhexyl)phthalate were disturbing in the Nemunėlis. No exceedances were registered in the Mūša at the border.

There are 16 companies in the Lielupė RBD which have been issued integrated pollution prevention and control (IPPC) permits. Table 91 below specifies the number of installations subject to the IPPC requirements by individual types specified in the IPPC legislation.

Table 91. Number of companies with IPPC permits by types of installations in the Lielupė RBD, 2008

Installation type	Number of installations
Mūša Sub-basin	
Large combustion installations with a rated thermal input exceeding 50 MW	1
Landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste	3
Installations for the intensive rearing of poultry with more than 40 000 places for poultry	2
Installations for the intensive rearing of pigs with more than 2 000 places for production pigs (over 30 kg), or 750 places for sows	6
Nemunėlis Sub-basin	
Installations for the intensive rearing of pigs with more than 2 000 places for production pigs (over 30 kg), or 750 places for sows	2

Installation type	Number of installations
Landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste	2
Treatment and processing of milk, the quantity of milk received being greater than 200 tonnes per day (average value on an annual basis)	1
Lielupė Small Tributaries Sub-basin	
Installations for the intensive rearing of pigs with more than 2 000 places for production pigs (over 30 kg), or 750 places for sows	1

Source: Data of regional environmental protection departments. Distribution by sub-basins was carried out by the Expert.

The amount of charges for pollution of the environment and changes therein illustrate the magnitude of pollution and its change.

The number of payers of charges for water pollution and the payable amounts are given in Table 92 below. Both the number of payers and the amounts paid in 2008 went down as compared to the figures of 2007.

Table 92. Payments of the water pollution charge in the Lielupė RBD

District	Number of payers		Payable amounts, LTL (rounded up)	
	2007	2008	2007	2008
Biržai distr.	21	16	39 000	16 000
Rokiškis distr.	10	7	39 000	25 000
Kupiškis distr.	10	8	24 000	13 000
Pasvalys distr.	14	10	33 000	24 000
Šiauliai city	7	6	220 000	87 000
Pakruojis distr.	10	8	16 000	9 000
Joniškis distr.	8	7	53 000	26 000
Total	**80**	**62**	**424 000**	**200 000**

Source: Database of pollution charges of the Ministry of Environment

No consistency in pollution charges for any specific substance has been notice in Šiauliai. In Joniškis district, payments for total nitrogen account for the largest share of all charges, the largest amount paid in Pakruojis district is for petroleum products. The highest amounts in Biržai and Kupiškis districts were paid for pollution with total nitrogen and BOD_7; also, as much as 25% of the charge for BOD_7 in Biržai district in 2007 was paid under a higher tariff, i.e. for the exceedance of the allowable limit. Biržai In addition to BOD_7, and Rokiškis districts are also facing pollution with phosphorus.

Energy and dams

131. This sector is the main driver of alterations of the hydrological regime due to dams and similar embankments, in many cases preventing attainment of good ecological status in water bodies.

There are three HPP in the Mūša Sub-basin. The key data on these HPP and their pond are provided in Table 93.

Table 93. HPP in the Mūša Sub-basin

Municipality	Pond	River	Distance to the mouth	Installed capacity, kW	Area of the pond, km^2	Height of the head, m
Kupiškis distr	Stirniškiai HPP	Suosa	1.6	55	0.133	10.5
Kupiškis distr.	Akmenių	Lėvuo	85.6	35	0.094	not available
Pakruojis distr.	Dvariūkų	Mūša	81.1	494	0.75	4.5

Source: Website of the company AB Lietuvos energija and the Expert

HPP dams are always barriers for local fish, and the one in Dvariūkų pond also poses an obstacle to potamodromous species. In addition, there are at least three large dams in the Mūša Sub-basin situated in Ginkūnai (Malavėnai) (1.12 km^2), Bubiai (4.10 km^2) and Kupiškis (8.28 km^2).

One HPP is located in the Nemunėlis Sub-basin. The key data on the HPP and its pond are provided in Table 94.

Table 94. HPP in the Nemunėlis Sub-basin

Municipality	Pond	River	Distance to the mouth	Installed capacity, kW	Area of the pond, km^2	Height of the head, m
Rokiškis distr.	Žiobiškio	Vingerinė	6.5	15	0.165	6.1

Source: Website of the company AB Lietuvos energija and the Expert

This HPP dam is a barrier for local fish. In addition, there is at least one large dam in the Nemunėlis Sub-basin – a dam in Papilys (pond area 0.86 km^2).

There are no HPP in the Lielupė Small Tributaries Sub-basin. However, there is one large dam situated in Baltausiai (pond areas 0.80 km^2) which is is a barrier for local fish.

It should be noted that over time the characteristics of the ponds have become similar to those of lakes.

Agriculture[2]

132. Agriculture uses (affects) water resources directly by consuming water and indirectly by polluting water bodies. Major pressures (indirect use of water resources) also include river straightening used to be performed for land reclamation purposes.

Annual water consumption for agricultural purposes in Lithuania is comparatively insignificant – in 2009 the consumed amount totalled to 1 381 thousand m^3, which accounted for 0.03% of the total water consumption. Even excluding water consumption for energy purposes from the total water consumption, the share for agriculture would still be as low as 0.7%.

[2] The majority of the data in the analysis of the agricultural sector, such as distribution of agricultural holdings, water consumed for agricultural purposes, agricultural production, was recalculated observing the proportions of the distribution of agricultural land in districts and respective basins and sub-basins.

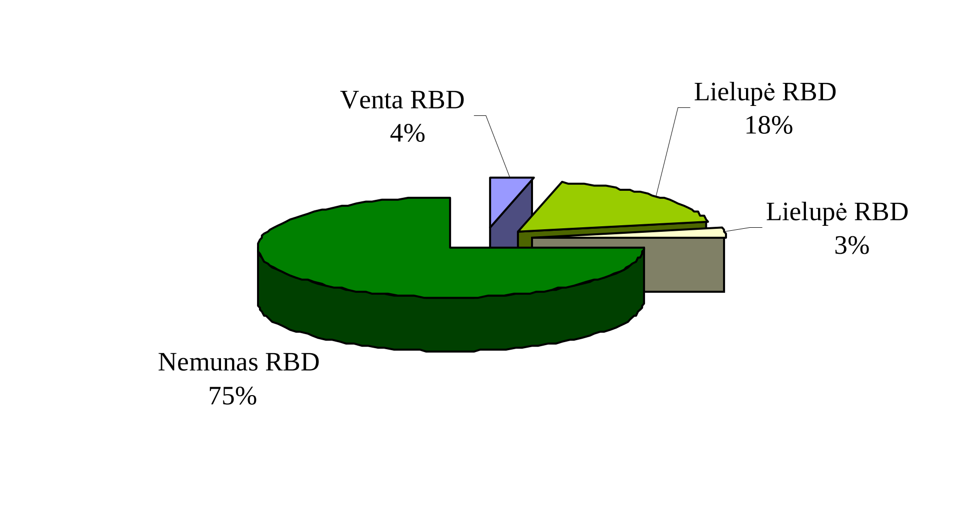


Figure 49. Water consumption for agricultural purposes in different RBD, 2009
Source: Environmental Protection Agency, the chart was drawn by the Expert

The amount of water consumed for agricultural purposes in the Lielupė RBD, like in other river basin districts, totals to less than 0.1% of the total consumption in Lithuania. Consequently, the sector of agriculture does not have any significant impact on the amount of water resources in the Lielupė RBD. According to the data of Eurostat, the area irrigated in Lithuania in 2007 totalled to 1 340 ha and in 2005 – to 4 420 ha[3]. The irrigated areas in the Lielupė RBD provided in the Land Reclamation Cadastre total to about 1 500. Not all of these are suitable for use. Practically there were no irrigated areas in 2001-2008. No significant abstraction of surface water for agricultural purposes is forecasted for the coming 5-10 years in Lithuania due to poor technical state of irrigation systems and natural and economic conditions.

The amount of water consumed for agricultural purposes in the Lielupė RBD totals to 246 thousand m^3, which accounts for 2.3% of the total consumption in the RBD.

Table 95. Water consumption for agricultural purposes, 2009

	Lielupė RBD			Lithuania
	Nemunėlis Sub-basin	Mūša Sub-basin	Lielupė Small Tributaries Sub-basin	
Consumption for agricultural purposes, thou. m^3	8.5	101.8	135.7	1 381.3

Source: Statistics Lithuania

One hectare of agricultural land in the Lielupė RBD consumes about 0.5m^3/ha, which is similar to the national average (0.54 m^3/ha). The most intensive consumption of water is observed in the Lielupė Small Tributaries Sub-basin (1.1 m^3/ha of agricultural land). In the Mūša Sub-basin, this indicator is 0.4 m^3, in the Nemunėlis Sub-basin – as low as 0.1 m^3/ha of utilised agricultural land.

Diffuse pollution and hydromorphological changes (for purposes of land reclamation) constitute indirect use of water resources for agricultural needs. The major share of diffuse pollution loads generated in agriculture is pollution entering the soil with animal manure and mineral fertilisers.

[3] http://nui.epp.eurostat.ec.europa.eu/nui/show.do?dataset=tag00095&lang=en

Fisheries

133. The fisheries (aquaculture) sector covers special ponds which are considered to be merely industrial objects and not bodies of water that must achieve good water status. The most common type of fisheries in Lithuania is pond fisheries breeding mainly carps.

According to the data of the Fisheries Department of the Ministry of Agriculture, there are 26 companies in Lithuania breeding fish in ponds the total area of which makes around 10 000 ha. The number of live marketable fish grown in these ponds in 2008 totalled to about 3.76 thousand tonnes. It is forecasted that the number of ponds will not be increasing because they need land and other large investments, and in future this number is likely to go down a little. Such assumption was made taking into account the current tendency of decrease of fish farms in Lithuania. At present, there is no reliable data on any negative impact of fisheries on bodies of surface water, thus this sector is not included among significant pressures.

Fish farming results highly depend on natural conditions. In 2008, natural conditions were moderately favourable for fish breeding and growing. For the purpose of achieving high production indicators, all measures intended for intensifying fish breeding were used, such as feeding, pond fertilisation, preventive maintenance, etc. In 2008, fish consumed 10 255 tonnes of fish feed, including 3 352 tonnes of ecological feed. The average yield in feeding ponds totalled to 853 kg/ha. The production of aquaculture is expected to grow in future.

The ponds of aquaculture companies are old, constructed 30-40 and more years ago. The actual cubic volume of water in the ponds makes up only about 40-50% of the design capacity. Such situation has been determined by the technical design projects of certain ponds providing for that the ponds may be filled with 105 million m^3 of water only with the help of pumps. However, due to economical considerations, water is supplied by pumps only in urgent cases. After the increase of electricity prices, a number of companies completely stopped using pumps. For the purpose of reduction of electricity consumption, a number of the pumping stations have been undergoing reconstruction financed from the EU Structural Funds.

No major reconstruction of the ponds was carried during the period 2000-2005. A renovation programme is planned for 2007-2013 using the assistance from the EU Fisheries Fund.

The aquaculture sector is dominated by micro and small companies. Also, there are more than 50 farms in Lithuania which engage in commercial aquaculture growing fish in their ponds. Profitability of such companies is low (only 2-3 %) due to out-of-date and inefficient technologies used and a short vegetation period. Many ponds are filled up using electricity which significantly increases expenses of the fish farming companies. Decrease of resources, seasonal fishery, prohibition to fish during certain periods do not ensure a sufficient level of income for the fishermen. The owners of aquaculture companies lack their own funds for acquisition of modern equipment, upgrading of hydro-technical equipment, application of fish disease control and elimination, planting and growing of new fish species. Another problem to be addressed is organic pollution by the ponds of aquaculture companies. In 2010, certificates of ecological fishery were issued to 15 farms with 5 040 ha (the area of the stocked ponds – 4 940 ha).

Currently, the Lithuanian fisheries sector is undergoing the Action Programme 2007-2013. One of the most important axes of the Programme is “Aquaculture, fishing in internal waters, processing and marketing of fishery and aquaculture products”; however, water resources can be affected by measures under other axes as well. The Programme includes such objectives as development of the aquaculture sector, upgrading of aquaculture companies and of inland water vessels.

There is one commercial pond fish farming company in the Lielupė RBD – UAB Auksinis karpis situated in Rokiškis district, i.e. in the Nemunėlis Sub-basin. The area of the ponds totals to 786 ha. The annual water consumption by the company totals to about 1 400 thousand m^3.

According to the data of the EPA, the quality parameters (BOD_7, N_{total} and P_{total}) of water released from fishery ponds seldom exceed the permitted norms.

Recreation

134. There are 12 lakes and ponds larger than 0.5 km^2 in the Mūša Sub-basin. Most of them are used for fishing and/or bathing. There are 12 bathing waters officially designated pursuant to Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (OJ 2006 L 64, p. 37-51) (Bathing Waters Directive): Lėvuo River in Panevėžys; Lėvuo River in Pasvalys; Lėvuo River in Kupiškis; Apaščia River in Dauguviečio park in Biržai; Lake Indubas in Pyragiai, Kupiškis; Lake Šilo ežeras in Pasvalys; Lake Rėkyva in Šiauliai, Lake Arimaičių in Radviliškis, Šeduva surroundings, Bubių pond (Šiauliai Sea) in Šiauliai;, Prūdelis pond in Šiauliai, Eibariškių pond in Radviliškis, Laičių II pond in Paežeriai, Pakruojis, Rozalimas)[4].

Up to 95.5 thousand people can use five largest ponds with an area larger than 0.5 km^2 in the sub-basin (Dvariūkų, Ginkūnų, Kupiškio, Petraičių and Širvėnos) for recreation purposes. The estimation is based on the assumption that about 55 % of the local population use water bodies for recreation[5].

No National Water Tourism Routes[6] have been planned for the Mūša Sub-basin.
There is one pond larger than 0.5 km^2 in the Lielupė Small Tributaries Sub-basin. No bathing sites have been officially designated under the Bathing Waters Directive in this sub-basin.

Baltausių pond (the only pond larger than 0.5 km^2 in the sub-basin) can be used by up to 950 people. The estimation is based on the assumption that about 55 % of the local population use water bodies for recreation.

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[4] Source: Report on the implementation of the Bathing Waters Directive to the European Commission (MS Excel file).

[5] Willingness to Pay Study in the Neris and Nevėžis sub-basins carried out by the Centre for Environmental Policy. The study revealed that about 55 % of the local population use water bodies for recreation in one or another way..

[6] Special Plan of the National Water Tourism Routes approved by Order No. 4-67 of the Minister of Economy of the Republic of Lithuania of 23 February 2009 (Žin., 2009, No. 27-1075). The Plan was commissioned by the State Tourism department and prepared by Vilnius Gediminas Technical University.

No National Water Tourism Routes have been planned for the Lielupė Small Tributaries Sub-basin.

There are four lakes and ponds larger than 0.5 km^2 in the Nemunėlis Sub-basin. Most of them are used for fishing and/or bathing. There are five bathing sites officially designated in accordance with the Bathing Water Directive: Lake Kilučių ežeras in Biržai; Lake Širvėnos in Jaunimo park, Biržai; central bathing site in Lake Širvėnos ežeras in Biržai; Lake Vyžuona in Rokiškis; Rokiškio pond in Rokiškis.

Up to 600 people can use Papilio pond (the only pond larger than 0.5 km^2 in the sub-basin) can be used by up to 950 people. The estimation is based on the assumption that about 55 % of the local population use water bodies for recreation.

No National Water Tourism Routes have been planned for the Nemunėlis Sub-basin.

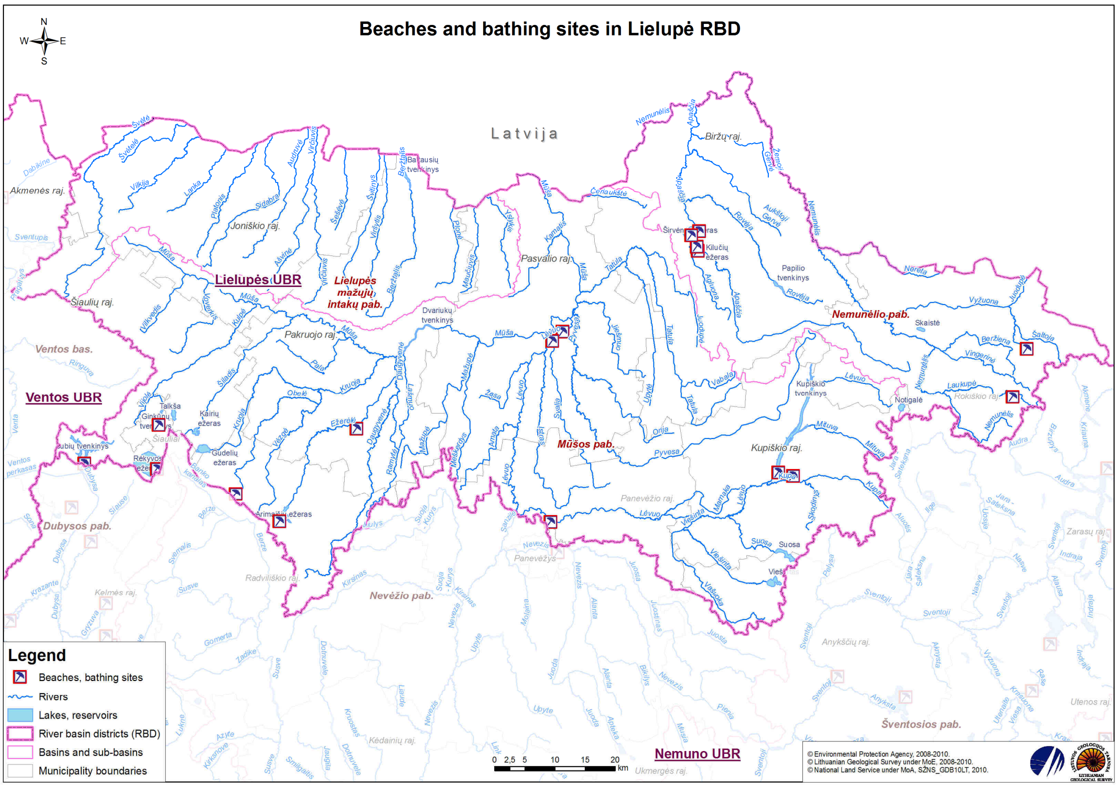

Figure 50. Beaches and bathing sites in the Lielupė RBD

Economic and social importance of sectors

135. A brief description of the main sector which can exert a negative impact on water resources in the Lielupė RBD demonstrates that there is no one specific sector which would be exerting a more significant impact on water bodies than others. The main user of water in this river basin district is households. 16 river water bodies identified in 12 rivers within the Lielupė RBD are water bodies at risk due to point pollution pressures, which in their turn are mainly determined by domestic wastewater discharged from WWTP of towns and settlements. Another significant source of pollution of rivers is surface (stormwater) runoff. No significant impact of industrial wastewater on water bodies in the Lielupė RBD has been identified.

Economic importance of the said sectors is in a way characterised by such indicators as the number of employees in the sector and value added. Indicators characterising the importance of each sector are provided in Tables 96 and 97.

Table 96. Employed population in the Lielupė RBD, 2008

Municipality	Employed population, thousand								
	Total	Hunting, agriculture, fisheries, forestry	%	Indus try	%	Constr uction	%	Servi ces	%
Biržai distr.	14.56	1.58	10.8	3.34	23.0	1.31	9.0	8.34	57.3
Rokiškis distr.	17.18	1.86	10.8	3.95	23.0	1.55	9.0	9.84	57.3
Kupiškis distr.	10.20	1.11	10.8	2.34	23.0	0.92	9.0	5.84	57.3
Pasvalys distr.	14.35	1.56	10.8	3.30	23.0	1.29	9.0	8.22	57.3
Šiauliai city	57.67	8.93	15.5	10.42	18.1	6.46	11.2	31.81	55.2
Pakruojis distr.	12.45	1.93	15.5	2.25	18.1	1.40	11.2	6.87	55.2
Joniškis distr.	13.67	2.12	15.5	2.47	18.1	1.53	11.2	7.54	55.2
Total	140.09	19.09	13.6	28.07	20.0	14.46	10.3	78.45	56.0

Source: Statistics Lithuania and experts' calculations

Table 97. Value added in the Lielupė RBD by industries, 2008

Municipality	GDP and value added, LTL million									
	Total	Per capita, LTL thousand	Hunting, agriculture , fisheries, forestry	%	Industry	%	Constr uction	%	Services, etc	%
Biržai distr.	691.4	23.5	65.7	9.5	157.1	22.7	85.1	12.3	383.5	55.5
Rokiškis distr.	815.5	23.5	77.5	9.5	185.3	22.7	100.3	12.3	452.4	55.5
Kupiškis distr.	484.2	23.5	46.0	9.5	110.0	22.7	59.6	12.3	268.6	55.5
Pasvalys distr.	681.3	23.5	64.7	9.5	154.8	22.7	83.8	12.3	377.9	55.5
Šiauliai city	2 704.8	23.8	295.5	10.9	536.9	19.8	261.0	9.6	1 611.5	59.6
Pakruojis distr.	584.0	23.8	63.8	10.9	115.9	19.8	56.4	9.6	347.9	59.6
Joniškis distr.	641.3	23.8	70.1	10.9	127.3	19.8	61.9	9.6	382.0	59.6
On average/in total	6 602.5	23.7	683.3	10.3	1 387.4	21.0	708.0	10.7	3 823.9	57.9

Source: Statistics Lithuania and experts' calculations adjusting Panevėžys and Šiauliai county data for municipalities

The values of the indicators given above were recalculated using the data on former counties. The figures in the tables demonstrate that the most important sector by employment, excluding the sector of services, is industry. The value added created in 2007 in the sector of industry, which employs 20% of all labour force, totalled to 21%.

The economic importance of agriculture in Lithuania is significantly lower than that of manufacture, trade, construction and some other sectors. The number of population working in the sector of agriculture makes up around 11.2% of all working-age population, creating more than 9% of the value added created in this river basin district. Agricultural companies supply a significant share of everyday products to tradesmen or processers and production of an in-kind economy is highly important for the Lithuanian countryside. Animals kept within the Lielupė RBD account for 10% of the total number of animals in the country.

Agricultural land in the Lielupė RBD makes up 55% of the total area of the river basin district and is larger than in other river basin districts (Lithuanian average is 39%). Agricultural land in the Lielupė RBD constitutes 19% of the fund of such land in

Lithuania. The share of gross agricultural production in the Lielupė RBD in the total amount of Lithuanian production is 20%, of which 69% is plant-growing production and over 30% – animal husbandry production.

The value of gross agricultural production produced in one hectare of agricultural land within the Lielupė RBD is around LTL 2 963 per hectare, which is similar to the Lithuanian average (LTL 2 865 per hectare of utilised agricultural land). The value of agricultural production in this RBD totals to LTL 1 466 million, which constitutes about 20% of the value of the total agricultural production produced in Lithuania.

The Lielupė Small Tributaries Sub-basin is dominated by large plant growing farms. Water consumption for agricultural purposes is several times higher than the national average, i.e. almost 1.2 m^3/ha of agricultural land. Naturally, the value of gross agricultural production, which is mainly plant-growing production, in this sub-basin is one of the highest in Lithuania and totals to LTL 3489 per one hectare of agricultural land (the national average is LTL 2 865 per hectare). The largest number of animals in the Lielupė Small Tributaries Sub-basin is held on small farms up to 10 ha (the percentage of animals held on large farms over 300 LSU is as low as 4%).

The share of large agricultural holdings in the Mūša Sub-basin is a little lower than in the Nemunėlis Sub-basin but larger than the national average. There are more large animal husbandry farms with over 300 LSU – animals kept on such farms account for around 30% of the total number of animals in the sub-basin. Nevertheless, plant-growing production per one hectare of agricultural land is twice higher than animal husbandry production. Gross agricultural production is LTL 3 049 per one hectare of agricultural land. The sub-basin accounts for 11.7% of the total agricultural production in Lithuania.

The Nemunėlis Sub-basin is noted for large animal husbandry farms where the number of animals kept in farms with over 300 LSU makes up 45%. But here again the share of animal husbandry production is not high – LTL 792 per one hectare of agricultural on average, which is partially because of low density of animals in this sub-basin (0.22 animal per one hectare of agricultural land).

In some areas, agriculture is important from the social point of view. For example, in the share of population working in the agricultural sector in the Lielupė Small Tributaries Sub-basin constitutes more than 21.6%[7] of all working-age population and this percentage is higher than the national average (8.1%). The number of people working in the agricultural sector in the Mūša Sub-basin constitute 9% and in the Nemunėlis Sub-basin – 16% of the total number of working-age population. However, the value added created in the sector of agriculture within the Lielupė RBD is less than 10% of the total value added produced in the sub-basin.

CHAPTER VIII. SUMMARY PROGRAMME OF MEASURES

SECTION I. INTRODUCTION

136. The programme of measures for improving the status of water bodies in a river basin district is one of the pillars of the river basin management planning. Having summed up the available information on the scope of planned pollution reduction

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[7] Note: relative workers are calculated and not all people working in agriculture.

measures, water quality monitoring data and mathematical modelling results, water bodies have been identified which will fail to conform to the good water status criteria after the implementation of the main (basic) measures (i.e. the requirements laid down in the key water directives). With a view to improve, where possible, the status of such surface water bodies, packages of supplementary measures which are most effective from both environmental and economic point of view have been proposed.

137. An integrated programme of measures consists of specific measures or studies suggested for the selection of supplementary measures during later stages.

SECTION II. BASIC MEASURES

138. Following Part A of Annex VI to the WFD, the basic measures are the ones which must be implemented in order to meet the requirements of the following directives:

138.1. Bathing Waters Directive;

138.2. Birds Directive;

138.3. Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption (OJ 2004 special edition, Chapter 15, Volume 4, p. 90) (Drinking Water Directive);

138.4. Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances (OJ 2004 special edition, Chapter 5, Volume 2, p. 410) (Major Accidents Directive);

138.5. Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (OJ 2004 special edition, Chapter 15, Volume 1, p. 248) as amended by Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No. 1013/2006 (OJ 2009 L 140, p. 114-135) (Environmental Impact Assessment Directive);

138.6. Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (OJ 2004 special edition, Chapter 15, Volume 1, p. 265) (Sewage Sludge Directive);

138.7. Urban Wastewater Treatment Directive;

138.8. Council Directive 91/414/EEC concerning the placing of plant protection products on the market (OJ 2004 special edition, Chapter 3, Volume 11, p. 332) as amended by the Commission Directive 2010/42/EU of 28 June 2010 amending Council Directive 91/414/EEC to include FEN 560 (fenugreek seed powder) as active substance (OJ 2006 L 161, p. 6-8) (Plant Protection Products Directive);

138.9. Nitrates Directive;

138.10. Habitats Directive;

138.11. Directive 2008/1/EC of the European Parliament and of the Council concerning integrated pollution prevention and control (OJ 2008 L 24, p. 8-29), as last amended by Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No. 1013/2006 (OJ 2009 140, p. 114-135) (IPPC Directive).

Seven directives out of the eleven ones the implementation of which also means introduction of the basic measures are related to high costs. The implementation of the remaining directives – the Birds Directive, Environmental Impact Assessment Directive, Plant Protection Products Directive, and Habitats Directive – means establishment of relevant legal, institutional, procedure, and other measures which do not require any investments.

Measures required for implementing the transposed Community legislation for protection of water

140. Measures required for implementing the Community legislation for protection of water transposed into the Lithuanian acquis are provided in Table 98 below.

Table 98**.** Measures required for implementing the Community legislation for protection of water

	Key legislation of the Republic of Lithuania transposing the EU directive	**Measure**	**Implementation costs at the national level**
Environmental Impact Assessment Directive	Law on Environmental Impact Assessment of the Proposed Economic Activity (Žin., 1996, No. 82-1965; 2005, No. 84-3105).	Environmental impact assessment in all relevant cases	No need of supplementary investments; annual costs estimated according to the number of potential EIA total to LTL 300 thousand
IPPC Directive	Rules for the Issuing, Renewal and Revocation of Integrated Pollution Prevention and Control Permits approved by Order No. 80 of the Minister of Environment of the Republic of Lithuania of 27 February 2002 (Žin., 2002, No. 85-3684; 2005, No. 103-3829)	Application of IPPC permits in all relevant cases; implementation of BAT	Acc. to preliminary estimates in 2000, implementation costs of the IPPC Directive in Lithuania must have ranged from LTL 1 200 to 2 000 million. The demand of one-time costs in the Lielupė RBD until 2015 is estimated to be LTL 100 thousand according to the number of potential IPPC permits.
Major Accidents Directive	Regulations of the Prevention, Response to and Investigation of Industrial Accidents approved by Resolution No. 966 of the Government of the Republic of Lithuania of 17 August 2004 (Žin., 2004, No. 130-4649; 2008, No. 109-4159); Programme on the Inspection of Dangerous Installations of the Republic of Lithuania approved by Order No. 1-528 of the Director of the State Fire and Rescue Department of 29 December 2006 (Žin., 2007, No. 3-143)	Development of safety reports and emergency plans; measures for accident prevention	No need of supplementary investments. One-time expenditure until 2015 estimated on the basis on the potential number of relevant documents to be prepared total to LTL 150 thousand

	Key legislation of the Republic of Lithuania transposing the EU directive	Measure	Implementation costs at the national level
	List of Potentially Dangerous Installations approved by Order No. 539 of the Minister of Environment of the Republic of Lithuania of 11 October 2002 (Žin., 2002, No. 111-4929; 2005, No. 58-2025)		
Plant Protection Products Directive	Law of the Republic of Lithuania on Plant Protection (Žin., 1995, No. 90-2013; 2010, No. 13-620). List of Active Substances which May Be Contained in Plant Protection Products approved by Order No. 3D-187 of the Minister of Agriculture of the Republic of Lithuania of 19 April 2004 (Žin., 2004, No. 60-2145).	Control of the use of plant protection products; application of the Code of Good Practice for Plant Protection; studies and analyses of impacts of plant protection products; withdrawal/banning of harmful substances	Investment costs until 2015 estimated on the basis on the number of the existing plant protection products and their potential demand total to LTL 1.91 million. Annual operating costs total to LTL 15 thousand.
Bathing Water Directive	Lithuanian Hygiene Norm HN 92:2007 “Beaches and Bathing Water Quality” approved by Order No. V-1055 of the Minister of Health of the Republic of Lithuania of 21 December 2007 (Žin., 2007, No. 139-5716); Bathing Water Quality Monitoring Programme for 2009-2011 approved by Resolution No. 668 of the Government of the Republic of Lithuania of 25 June 2009 (Žin., 2009, No. 80-3344)	Monitoring of bathing water quality; provision of information to the public on bathing water quality. Official designation of bathing sites, improvement of water quality, restoration of poor water quality to good status, development of an information system.	Costs of implementation of the Bathing Water Monitoring Programme for 2006–2008 were estimated at about LTL 3 200 thousand, including water sampling, analysis and training (LTL 2 700 thousand), public information measures and reporting to the Commission (LTL 500 thousand). Maintenance of bathing sites in the Lielupė RBD in 2010-2015 will annually require around LTL 104 thousand.
Birds Directive	Law of the Republic of Lithuania on Protected Areas (Žin., 1993, No. 63-1188; 2001, No. 108-3902) General Regulations of Areas of Importance for the Conservation of Habitats or Birds approved by Resolution No. 276 of the Government of the Republic of Lithuania of 15 March 2004 (Žin., 2004, No. 41-1335). Criteria for the Screening of Areas of Importance for the Conservation of Birds approved by Order No. D1-358 of the Minister of Environment of the Republic of Lithuania of 2 July 2008 (Žin., 2008, No. 77-3048)	Establishment of sites important for the conservation of birds, development and implementation of management plans for protected areas	Required investment costs for the management of bird habitats until 2015 total to ca. LTL 1.9 million and operating costs – ca. LTL 350 thousand.
Habitats	Law of the Republic of Lithuania	Establishment of sites	Required investment

	Key legislation of the Republic of Lithuania transposing the EU directive	Measure	Implementation costs at the national level
Directive	on Protected Areas Regulations of Areas of Importance for the Conservation of Habitats or Birds Criteria for the Screening of Areas of Importance for the Conservation of Habitats approved by Order No. 219 of the Minister of Environment of the Republic of Lithuania of 20 April 2001 (Žin., 2001, No. 37-1271; 2008, No. 87-3495)	important for the conservation of habitats; development of protected area management plans	costs for the establishment and management of habitats until 2015 total to ca. LTL 370 thousand, operating costs – ca. LTL 760 thousand.
Sewage Sludge Directive	Regulatory document LAND 20-2005 "Requirements for the use of sewage sludge for fertilisation and recultivation" approved by Order No. 349 of the Minister of Environment of the Republic of Lithuania of 28 June 2001 (Žin., 2001, No. 61-2196; 2005, No. 142-5135) (LAND 20-2005)	Development of fertilisation plans; analysis and accounting of sewage sludge; withdrawal/banning of dangerous substances	According to the Study on Development of an Investment Programme for Sludge Management in Lithuania prepared by SWECO BKG, the required total costs are estimated at about LTL 300 million. The amount planned to be invested in the Lielupė RBD until 2013 totals to about LTL 80 million. Annual operating costs – LTL 2.4 million.
Urban Wastewater Treatment Directive	The Directive has to be implemented in 2010, Law of the Republic of Lithuania on Water (Žin., 2001, No. 64-2327); Law of the Republic of Lithuania on Drinking Water Supply and Wastewater Management (Žin., 2006, No. 82-3260) Wastewater Management Regulation	Assurance of centralised wastewater treatment in agglomerations larger than 2 000 p.e.	Investment costs for 2003-2009 are estimated at about LTL 1 billion. In 2007-2013, about LTL 2.1 billion are planned to be allocated for the development and rehabilitation of water supply, wastewater collection and sludge management infrastructures in settlements larger than 2000 p.e. in Lithuania. . Such measures in the Lielupė RBD will require about LTL 230 million for investments until 2015; operating costs – LTL 4.6 million.
Nitrates Directive	National Programme on the Reduction of Water Pollution from Agricultural Sources approved by Resolution No. 1076 of the Government of the Republic of	Construction of manure and slurry storages on farms having more than 10 LSU; regulation of crop rotation and	Investment costs at 2002 prices were estimated at ~ LTL 320 million for Lithuania. The amount needed for

	Key legislation of the Republic of Lithuania transposing the EU directive	Measure	Implementation costs at the national level
	Lithuania of 26 August 2003 (Žin., 2003, No. 83-3792)	fertilisation, promotion of ecological farming, establishment and control of water protection belts, restoration and establishment of wetlands. Continuously.	the implementation of these requirements in the Lielupė RBD until 2015 totals to ca. LTL 70 million of investment costs and ca. LTL 700 thousand of annual operating costs
Drinking Water Directive	Law of the Republic of Lithuania on Water Law of the Republic of Lithuania on Drinking Water Supply and Wastewater Management Wastewater Management Regulation State Procedure for Drinking Water Control approved by Order No. 643 of the Director of the State Food and Veterinary Service of the Republic of Lithuania of 10 December 2002 (Žin., 2002, No. 3-99); Lithuanian Hygiene Norm HN 24:2003 "Drinking water safety and quality requirements" approved by Order No. V-455 of the Minister of Health of the Republic of Lithuania of 23 July 2003 (Žin., 2003, No. 79-3606); Lithuanian Hygiene Norm HN 44:2006 "Delineation and maintenance of sanitary protection zones of wellfields" approved by Order No. V-613 of the Minister of Health of the Republic of Lithuania of 17 July 2006 (Žin., 2006, No. 81-3217)	Drinking water quality surveillance and control; expansion of fields with multi-annual crops; monitoring of agricultural activities; application of the Code of Good Agricultural Practice	According to estimates in 2001, costs of addressing problems of fluoride and iron totalled to ca. LTL 100 million. However, removal of iron, as of an indicative parameter, is not obligatory under the Drinking Water Directive. Costs for the expansion and rehabilitation of drinking water supply systems in the Lielupė RBD from 2007 have been planned together with wastewater management costs and total to LTL 230 million; annual operating costs – LTL 4.6 million.

Practical steps and measures for application of the principle of water costs recovery as laid down in Article 9 of the WFD

141. Practical steps and measures for application of the principle of water costs recovery as laid down in Article 9 of the WFD and in the Law of the Republic of Lithuania on Water are given in Table 99.

Table 99. Practical steps and measures for application of the principle of water costs recovery as laid down in Article 9 of the WFD

Relevant legislation	Measures
Methodology for the Pricing of Drinking Water Supply and Wastewater Management Services approved by Order No. 03-92 of the National Control Commission for Prices and Energy of 21 December 2006 (Žin., 2006, No. 143-5455). Law of the Republic of Lithuania on Water Law of the Republic of Lithuania on Drinking Water Supply and Wastewater Management Law of the Republic of Lithuania on Charges for State Natural Resources (Žin., 1991, No. 11-274; 2006, No. 65-2382); Law of the Republic of Lithuania on Environmental Pollution Charge (Žin., 1999, No. 47-1469; 2002, No. 13-474).	The key measure for implementing Article 9 of the WFD is introduction of the cost recovery principle for all consumers. Such principle has already been enacted in the Law of the Republic of Lithuania on Water and the Methodology for the Pricing of Drinking Water Supply and Wastewater Management Services approved by the National Control Commission for Prices and Energy. In addition, an informal working group for coordinating development of the water management system, consisting of representative of the Ministry of Environment, Association of Local Authorities in Lithuania, Lithuanian Water Suppliers Association and the National Control Commission for Prices and Energy, was established in March 2010 on the initiative of the Ministry of Environment. It is proposed to discuss issues regarding accounting of depreciation of donated assets related to cost recovery in this group. The cost recovery level in the sector of public water supply and wastewater management in the Lielupė RBD estimated by way of direct comparison of income and expenses totals to ca. 87%.

Table 100. Recovery of water supply and wastewater management costs in individual water supply companies in the Lielupė RBD in 2008 and 2009, %

Water supply and wastewater management costs and income	Water supply company							Lielupė RBD
	1	2	3	4	5	6	7	
2008	75	92	99	95	72	69	66	80
2009	85	83	103	99	97	83	71	87

Source: experts' estimations on the basis of prices and cost prices of water supply companies

142. The main reason of the failure to fully implement the cost recovery principle in many water supply companies is delay by municipalities to approve tariffs covering the costs.

Municipalities are currently preparing Water Supply and Wastewater Management Infrastructure Development Plans. 25 such plans were prepared until 2010, 26 were being prepared and the remaining 9 municipalities were only planning to develop of such plans. One of the components of the plans is assessment of the forthcoming tariffs and affordability, hence these plans are believed to have enhanced and to enhance capacities of decision makers in the municipalities. In this way the approval of tariffs based on the cost recovery principle will become more effective.

143. Environmental costs are included in the cost recovery mechanisms through charges for state natural resources and for pollution of the environment.

144. The two main reasons of the failure to fully implement the cost recovery principle in the sector of industry are subsidies and failure to reflect the actual industrial pollution

of water resources in the tariffs of charges for state natural resources and for pollution of the environment.

Companies usually finance investments to the water sector with their own funds and bank credits. The amount of subsidies to the water sector in Lithuania is rather small.

Until 2007, EU structural support was granted to business (industry included) under the Single Programming Document 2004–2006 (SPD). More than LTL 1.13 billion of the support administered by the Ministry of Economy was allocated for the implementation of 333 projects during that period. None of these, however, was related to the water sector. Accordingly, the only source of importance for the assessment of cost recovery is subsidies granted by the Lithuanian Environmental Investments Fund (LEIF).

Only about LTL 1 million of the annual amount of LTL 13 million received from the LEIF was granted to industrial and construction companies for the water sector in 2008 and about LTL 1.7 million – in 2007. As a result of the poor financial situation, only one application of an industrial enterprise was approved for the funding of the water sector in 2009.

Having in mind that industry creates more than LTL 20 billion of the value added, internalisation of LTL 1-2 million (which is the amount of subsidies granted during a more favourable period 2007-2008), i.e. inclusion of such amount into the polluter's costs, does not have any effect on the cost recovery level in the sector of industry.

Today, no reliable data is available on which companies are responsible for discharge of certain hazardous substances to rivers, and to what extent. For this reason, the costs of supplementary measures (if any) for the sector of industry cannot be compared to the "external" pollution costs at the moment[8].
Following the afore-said assumption that charges for state natural resources and for pollution of the environment reflect the external environmental costs, it can be maintained that the cost recovery level in the sector of industry is 100%.

145. The cost recovery estimation method used for the public sector cannot be applied for agriculture. The sector of agriculture is not an important direct user of water in Lithuania, the Lielupė RBD included. An important component for estimations is diffuse agricultural pollution which is not included in water or any other costs.

It is very difficult to assess costs of the environment, resources and other expenditure due to agricultural pressures (there are no studies and data available on how much the "value" of water bodies is reduced due to agricultural pollution) hence another estimating method could be applied. In such case it should be assumed that "external" costs are approximately equal to the agricultural pollution removal costs. This amount in the Lielupė RBD during the first stage of the Management Plan will total to about LTL 9.4 million every year until 2015. LTL 98 thousand of this amount will have to be

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[8] Deterioration of the environmental status is treated as "external costs" in our economic system. External costs appear when action or failure to act one individual or a group of individuals has a damaging effect on other individuals or groups. Pollution means negative "external costs". For example, when a factory pollutes a river with untreated wastewater, the downstream water users incur expenses related to health or water treatment. The English equivalent "externality" is sometimes used in other economic areas. It means an external impact, i.e. a benefit or cost caused by an action or process and incurred by a party not related to that action or process.

borne by the state for measures of control. Farmers will have to fund the major part of the costs – LTL 3.45 million. Such agricultural pollution reduction measures would cut down agricultural pollution in areas where it exerts a significant impact.

However, in some areas water bodies are more sensitive to agricultural pollution due to natural conditions of the environment, such as low runoff, etc. In such cases pollution by agriculture can be significant even when loads do not exceed the allowed limits (i.e. when they are not larger than in other places where agricultural pollution is not significant). It is proposed that such additional costs, which would be required in the Lielupė Small Tributaries Sub-basin and Mūša Sub-basin, are borne by the state (through rural support programmes). These costs total to LTL 5.9 million and account for 63% of the total costs required for the reduction of pollution (LTL 9.35 million, excluding the costs of controls). This means that the polluter pays principle would be implemented in all sub-basins with the cost recovery totalling to 37% because 63% of the required costs will be covered with state subsidies.

However, this is only an a priori assessment meanwhile the actual cost recovery level in agriculture will be identified only in 2015 upon evaluation of farmers' contribution to the implementation of the measures.

Measures to meet the requirements of Article 7 of the WFD

146. Measures required to meet the requirements of Article 7 of the WFD are given in Table 101.

Table 101. Measures to meet the requirements of Article 7

Relevant legislation	**Measure**
Regulations of the Register of the Earth Entrails approved by Resolution No. 584 of the Government of the Republic of Lithuania of 26 April 2002 (Žin., 2002, No. 44-1676; 2006, No. 54-1961); Procedure for Groundwater Monitoring by Economic Entities approved by Order No. 1-190 of the Director of the State Geological Survey of 24 December 2009 (Žin., 2009, No. 157-7130)	Monitoring of water bodies where abstraction exceeds 100 m3 per day Relevant protection of water bodies

Controls over abstraction and impoundment of water and measures aimed at economical and sustainable use of water

147. Controls over abstraction and impoundment of water and measures aimed at economical and sustainable use of water are provided in Table 102.

Table 102. Controls over abstraction and impoundment of water and measures aimed at economical and sustainable use of water

Relevant legislation	Measure
Water abstraction Building Technical Regulation STR 2.02.04:2004 "Water Abstraction, water preparation. Basic provisions" approved by Order No. D1-156 of the Minister of Environment of the Republic of Lithuania of 31 March 2004 (Žin., 2004, No. 104-3848)	Water abstracting entities report information on the abstraction volume. The EPA stores information received in its data bases. Companies which abstract, use or supply groundwater or surface water are subject to relevant permits. Permits shall specify the water source, yielding capacity of the water abstraction facilities

Relevant legislation	Measure
Rules of the Issuing, Renewal and Revocation of Integrated Pollution Prevention and Control Permits	m^3/s, the volume of water abstracted, presence of water accounting facilities, etc. and provide for measures for rational water use and protection.
Regulations of the Register of the Earth Entrails Resources Order No. 1-10 of the Director of the State Geological Survey of 19 February 2003 on the approval of Form 1-PV for quarterly reports on groundwater abstraction (Žin., 2003, No. 19-849)	All economic entities which abstract more than 10 m^3 of groundwater per day for the purposes of drinking water supply or industrial needs shall provide quarterly water abstraction reports to the State Geological Survey.
Water impoundment: Law of the Republic of Lithuania on Water	The Law on Water defines both preventive and hard control measures for impoundment. The Minister of Environment lays down a procedure for use and maintenance of ponds by issuing relevant legislation.
Standard Rules for the Use and Maintenance of Ponds (LAND 2-95) approved by Order No. 33 of the Minister of Environment of the Republic of Lithuania of 7 March 1995 (Žin., 1997, No. 70-1790; 2004, No. 96-3563; 2006, No. 101-3915);	A separate part of the Rules is devoted HPP ponds. The latest amendment of the Rules sets a deadline for the introduction of automatic devices measuring and registering the water level in HPP and requires performing measurements of discharges and water levels.
Resolution No. 1144 of the Government of the Republic of Lithuania of 8 September 2004 on the approval of the List of Ecologically or Culturally Valuable Rivers or River Stretches (Žin., 2004, No. 137-4995)	The Resolution prohibits impoundments for any purposes in 169 rivers and their stretches.

Measures intended to prevent or control potential discharge of pollutants from diffuse pollution sources

148. Lithuanian legislation provides for general requirements for the protection of surface water bodies and groundwater bodies against pollution from diffuse sources. These requirements are regularly revised and updated, if necessary.

Measures which prohibit unauthorised discharges of pollutants directly into groundwater

149. The Lithuanian Geological Survey issues permits for discharging pollutants directly into groundwater bodies. The permitting procedure is regulated observing the Procedure for the Inventory of Discharges of Hazardous Substances into Groundwater and Collection of Information Thereon approved by Order No. 1-06 of the Director of the Lithuanian Geological Survey under the Ministry of Environment of 3 February 2003 (Žin., 2003 No.17-770). There are no such discharges directly into groundwater in the Lielupė RBD.

Summary of controls over point source discharges and other activities with an impact on the status of water

150. Pollution from point sources is regulated by the Wastewater Management Regulation, Rules of the Issuing, Renewal and Revocation of Integrated Pollution Prevention and Control Permits, and the Surface Runoff Management Regulation

approved by Order No. D1-193 of the Minister of Environment of the Republic of Lithuania of 2 April 2007 (Žin., 2007, No. 42-1594).

Flood control measures

151. Activities of preparation for floods and elimination of consequences thereof are carried out observing the Civil Protection Law of the Republic of Lithuania (Žin., 1998, No. 115-3230) and the Procedure for Flood Risk Assessment and Management approved by Resolution No. 1558 of the Government of the Republic of Lithuania of 25 November 2009 (Žin., 2009 No.144-6376).

Pursuant to the said Resolution, the Ministry of Environment has to:

151.1. draw up and approve preliminary flood risk assessment reports not later than by 22 December 2011;

151.2. discuss and approve, if required, preliminary flood risk assessment reports and amendments thereof not later than by 22 December 2018, and afterwards – every six years;

151.3. draw flood threat maps and flood risk maps and submit these to the Government of the Republic of Lithuania for approval not later than by 22 June 2013;

151.4. prepare flood risk management plans and submit these to the Government of the Republic of Lithuania for approval not later than by 22 June 2015.

Summary of measures implemented under Article 16 on priority substances

152. Summary of measures implemented under Article 16 on priority substances is provided in Table 103.

Table 103. Summary of measures implemented under Article 16 on priority substances

Relevant legislation	**Measure**
Wastewater Management Regulation Programme on the Reduction of Pollution of Waters with Hazardous Substances approved by Order No. D1-71 of the Minister of Environment of 13 February 2004 (Žin., 2004, No. 46-1539)	Regulation of maximum allowable concentrations of dangerous and priority dangerous substances Self-regulation of dangerous and priority dangerous substances in wastewater

Measures which prevent or reduce impacts of accidental pollution incidents

153. Measures which prevent or reduce impacts of accidental pollution incidents are provided in Table 104.

Table 104. Measures which prevent or reduce impacts of accidental pollution incidents

Relevant legislation	**Measure**
Regulations on the Prevention, Response to and Investigation of Industrial Accidents Programme on the Inspection of Dangerous Installations of the Republic of Lithuania approved by Order No. 1-528 of the Director of the State Fire and Rescue Department of 29 December 2006 (Žin., 2007, No. 3-143)	Development of industrial accidents prevention and liquidation plans and emergency reports

154. Legislation provides for measures required to prevent leakage from technical installations as well as to prevent and reduce impacts of pollution due to accidental incidents. Accidental incidents include storms, floods, chemical spills and transport accidents in the air, on land and in the sea. Accident prevention and liquidation plans have to provide for systems of warning about accidents and measures for reduction of risk for water bodies.

Measures which ensure that hydromorphological conditions of water bodies are consistent with good ecological status, or good ecological potential in artificial or heavily modified water bodies

155. So far, a potential impact of hydro technical constructions (dams) and other morphological alterations on river ecosystems and river bed processes has not been adequately studied in Lithuania. Measures for today which would ensure better ecological conditions in hydromorphologically altered water bodies include construction of fish by-passes, which are regulated by Order No. 3D-427 of the Minister of Agriculture of the Republic of Lithuania of 25 September 2007 on the approval of the List of Dams where Facilities for Fish Migration are Required and of the List of Former Dam Remains where Barriers for Fish Migration Have to Be Removed (Žin., 2007, No. 102-4180).

Controls over artificial recharge or augmentation of groundwater bodies

156. These measures are not relevant for Lithuania because there is no artificial recharge/augmentation of groundwater in our country.

Measures for water bodies which are unlikely to achieve the environmental objectives set out under Article 4

157. Lithuanian legislation provides for certain derogations for water bodies where water protection objectives cannot be achieved or are disproportionally expensive:

157.1. postponing of an objective (maximum until 2027) if accomplishment thereof is prevented by technical possibilities, disproportionate costs or natural conditions;

157.2. in the procedure laid down by the Minister of Environment, water bodies heavily modified by anthropogenic activities may be subject to less stringent water protection objectives ensuring that less stringent objectives will not deteriorate the status of a water body in question.

158. Derogations may be applied only in rare cases, upon performance of an economic analysis and well-founded proof of the necessity of the derogation.

Details of supplementary measures identified as necessary to meet the environmental objectives

159. Supplementary measures will be proposed for water bodies which will fail good water status requirements after the implementation of the basic measures, and environmental and economic efficiency of these measures will be evaluated. Supplementary measures have been defined for the reduction of point and diffuse pollution, improvement of hydromorphological status and reduction of the impact of recreation.

Details of measures to avoid increase in pollution of marine waters

160. This provision is relevant only for water bodies within the Nemunas RBD and, partially, within the Venta RBD.

Measures to mitigate temporary deterioration in the status of water bodies if this is the result of circumstances of natural cause or force majeure which could not have been foreseen

161. Measures for the prevention and mitigation of pollution arising from unforeseen accidents (which are always unpredictable) have been provided for in the following legislation:

161.1. Regulations on the Prevention, Response to and Investigation of Industrial Accidents, and

161.2. Programme on the Inspection of Dangerous Installations.

Emergency plans envisage ensuring protection of people and the environment in the event of emergencies as well as mitigation of negative impacts of accidents on people and the environment.

Effect of implementation of the basic measures

162. The implementation of the basic measures will have a minor but nevertheless a positive effect on the status of water bodies. The major beneficial measure will the implementation of the Urban Wastewater Treatment Directive and the Nitrates Directive. The implementation of the requirements of other directives will be less noticeable because many of them are only indirectly related to the improvement of the status of water bodies.

Table 105. Summary implementation costs of the basic measures

Directive	Costs		
	Investment costs until 2015, LTL	Operating costs, LTL/year	Annual costs, LTL/year
Mūša Sub-basin			
Bathing Water Directive *	0	68 100	68 100
Birds Directive *	1 584 654	599 594	814 594
Drinking Water Directive	together with the costs of the Nitrates Directive		
Major Accidents Directive *	100 000		14 000
Environmental Impact Assessment Directive *		70 000	70 000
Sewage Sludge Directive **	72 178 000	2 165 340	8 458 340
Urban Wastewater Treatment Directive **	165 140 000	3 302 800	17 700 800
Plant Protection Products Directive *	1 288 000	10 000	254 000
Nitrates Directive **	43 379 568	433 796	4 215 796
Habitats Directive *	177 950	641 513	665 513
IPPC Directive *	30 000	0	4 000
Total ~	**283 880 000**	**7 290 000**	**32 270 000**
Nemunėlis Sub-basin			
Bathing Water Directive *	0	18 160	18 160
Birds Directive *	345 660	114 723	161 723
Drinking Water Directive	together with the costs of the Nitrates Directive		
Major Accidents Directive *	50 000		7 000
Environmental Impact Assessment Directive		70 000	70 000

Directive	Costs		
	Investment costs until 2015, LTL	Operating costs, LTL/year	Annual costs, LTL/year
*			
Sewage Sludge Directive **	7 800 000	234 000	914 000
Urban Wastewater Treatment Directive **	26 670 000	533 400	2 858 400
Plant Protection Products Directive *	332 000	2 500	67 500
Nitrates Directive **	13 912 395	139 124	1 352 124
Habitats Directive *	196 026	160 363	187 363
IPPC Directive *	12 000	0	2 000
Total ~	**49 320 000**	**1 270 000**	**5 640 000**
Lielupė Small Tributaries Sub-basin			
Bathing Water Directive *	0	18 160	18 160
Birds Directive *	10 542	8 886	9 886
Drinking Water Directive	together with the costs of the Nitrates Directive		
Major Accidents Directive *	0	0	0
Environmental Impact Assessment Directive *		70 000	70 000
Sewage Sludge Directive **	0	0	0
Urban Wastewater Treatment Directive **	37 800 000	756 000	4 052 000
Plant Protection Products Directive *	292 000	2 500	52 500
Nitrates Directive **	12 387 907	123 879	1 203 879
Habitats Directive *	25 168	68 874	71 874
IPPC Directive *	8 000	0	1 000
Total ~	**50 520 000**	**1 050 000**	**5 480 000**
Lielupė RBD in total			
Bathing Water Directive *	0	104 420	104 420
Birds Directive *	1 940 856	723 203	986 203
Drinking Water Directive	together with the costs of the Nitrates Directive		
Major Accidents Directive *	150 000	0	21 000
Environmental Impact Assessment Directive *	0	210 000	210 000
Sewage Sludge Directive **	79 978 000	2 399 340	9 372 340
Urban Wastewater Treatment Directive **	229 610 000	4 592 200	24 611 200
Plant Protection Products Directive *	1 912 000	15 000	374 000
Nitrates Directive **	69 679 870	696 799	6 771 799
Habitats Directive *	399 144	870 750	924 750
IPPC Directive *	50 000	0	7 000
Total ~	**383 720 000**	**9 610 000**	**43 380 000**

Notes:
* Estimations of annual (annualised) costs were based on a 10 years service life.
** Estimations of annual (annualised) costs were based on a 20 years service life.
Operating costs were estimated applying the following investment percentage: Sewage Sludge Directive – 3%, Urban Wastewater Directive – 2%, Nitrates Directive – 1%.

SECTION III. OTHER PROGRAMMES ATTRIBUTED TO BASIC MEASURES

163. The following available programmes related to the management of water resources can be attributed to basic measures:

163.1. Programme on the Reduction of Agricultural Pollution of Waters approved by Order No. 3D-686/D1-676 of the Minister of Agriculture and the Minister of Environment of the Republic of Lithuania of 9 December 2008 (Žin., 2008, No. 143-5741);

163.2. Strategy for the Use and Protection of Groundwater for 2002–2010 approved by Resolution No. 107 of the Government of the Republic of Lithuania of 25 January 2002 (Žin., 2002, No. 10-362);

163.3. Programme on the Assessment and Use of Groundwater Resources for Drinking Water Supply for 2007–2025 approved by Resolution No. 562 of the Government of the Republic of Lithuania of 8 June 2006 (Žin., 2006, No. 66-2436);

163.4. Development Strategy for Drinking Water Supply and Wastewater Management for 2008–2015 approved by Resolution No. 832 of the Government of the Republic of Lithuania of 27 August 2008 (Žin. 2008, 104-3975);

163.5. National Strategy for the Implementation of the United Nations Framework Convention on Climate Change by 2012 approved by Resolution No. 94 of the Government of the Republic of Lithuania of 23 January 2008 (Žin., 2008, No. 19-685);

163.6. Lithuanian Rural Development Programme for 2007-2013 (RDP) approved at the EU Rural Development Committee on 19 September 2007;

163.7. Cohesion Promotion Action Programme approved by the Commission Resolution of 30 July 2007.

SECTION IV. SUPPLEMENTARY MEASURES

164. Supplementary measures have been proposed for the bodies of water which will be failing the good status requirements after the implementation of the basic measures, and their environmental and economic efficiency has been assessed.

Supplementary measures have been discussed and proposed for the following key areas:

164.1. for reducing the impact of point pollution;

164.2. for reducing the impact of agricultural pollution;

164.3. for mitigating and regulating hydromorphological changes;

164.4. for additional research.

The most important measures for the attainment of good ecological status in water bodies within the Lielupė RBD are measures to reduce agricultural pressures and mitigate hydromorphological changes

Measures to reduce point pollution

150. There are 16 river water bodies in the Lielupė RBD identified as water bodies at risk due to an impact of point pollution which need supplementary measures in order to achieve good ecological status/potential. Such water bodies at risk were identified in the rivers Kulpė, Vijolė, Šiladis, Kruoja, Obelė, Vėzgė, Daugyvenė, Tatula, Nemunėlis, Laukupė, Beržtalis and Sidabra. The achievement of water protection objectives in all these water bodies is postponed either due to lack of funds for implementing the proposed water reduction measures by 2015 or shortage of data to be able to identify the pollution reduction demand.

Estimations indicate that the Kulpė River may still be failing the requirements for good ecological status after the implementation of the basic measures under the Urban Wastewater Treatment Directive and despite the purification level in Šiauliai WWTP consequently achieved even much higher than required. Findings of the study

“Preparation of a feasibility study on the construction of stormwater management systems in selected problematic settlements and development of recommendations for the construction of such systems in individual typical cases” demonstrated that the Kulpė River may be significantly affected by surface runoff. Since all possibilities to reduce pollution from Šiauliai WWTP have already been fully used, supplementary surface runoff management measures are recommended for improving the ecological status of the river, i.e. construction of surface runoff collection and treatment system in Šiauliai city.

A considerable share of surface runoff in Šiauliai city is discharged into the Vijolė River. Consequently, according to estimations, water quality problems can occur not only in the Kulpė but also in the Vijolė. Stormwater runoff management measures in Šiauliai city are expected to reduce pollution inputs both in the Kulpė and in the Vijolė. Following the feasibility study of stormwater runoff management, the investment demand totals to around LTL 33 million. It will not be possible to allocate such amount by 2015; besides, the project has not been developed technically, therefore the achievement of the water protection objectives in the rivers Kulpė and Vijolė should be postponed.

The reconstruction of Joniškis WWTP was completed in 2009 and was expected to ensure a high wastewater treatment level. However, the available data shows that this may not be sufficient in order to achieve good ecological potential of the Sidabra. The river also suffers from pollution from non-sewered population therefore visible pollution reduction can be expected only after the connection of a larger number of households to the wastewater treatment facilities. This is planned in 1.5 years. It is difficult to forecast pollution reduction as a result of the connection of more households to the wastewater treatment facilities because the present pollution loads of non-sewered population are not known. The Sidabra pollution problem may persist even after the connection of more households to the wastewater treatment facilities because of a significant input of surface (stormwater) runoff in addition to domestic wastewater. Consequently, a demand of supplementary measures will have to be assessed during the next planning period when data is available on the effect of the said connection. Hence it is proposed to postpone the achievement of the water protection objectives in the Sidabra River.

The quality of wastewater discharged from Radviliškis WWTP fully conforms to the requirements of the Urban Wastewater Treatment Directive. Nevertheless, this is not enough to achieve good ecological status in the Obelė River. The data of operational monitoring performed by the water company UAB Radviliškio vandenys indicates that high pollutant concentrations failing the good ecological status requirements are registered even upstream of the WWTP discharger. This shows that the river is polluted not only by effluents from the WWTP but also by non-sewered population. Due to this reason, supplementary measures to improve the performance of the WWTP would not be expedient and effective. The river status should be monitored until a larger number of households are connected to the wastewater treatment facilities and only then more significant pollution reduction can be expected. However, mathematical modelling results indicate that it might be complicated to achieve concentrations of total phosphorus in compliance with the good ecological status requirements in the Obelė River. Accordingly, mitigation of the water protection objectives may be required at the next planning stage. It is proposed to postpone the achievement of the water protection objectives for the water bodies in the Obelė River. Operational monitoring in the Obelė downstream of Radviliškis is recommended at this stage to be able to assess the pollution reduction after the connection of a larger number of households to the wastewater treatment facilities.

Findings of the study “Preparation of a feasibility study on the construction of stormwater management systems in selected problematic settlements and development of recommendations for the construction of such systems in individual typical cases” demonstrate that the ecological status of the Kruoja is affected not only by pollution transported from the river Obelė but also by surface runoff. Hence stormwater runoff management measures are proposed – construction of a runoff collection and treatment system in Pakruojis. Following the feasibility study on stormwater treatment, the demand of investments totals to around LTL 220 thousand. Such amount will not be available until 2015 and the project has not been prepared technically. Hence it is suggested postponing the achievement of water protection objectives in the Kruoja River.

Mathematical modelling results indicate that the Daugyvenė River may be failing the good ecological status requirements after the implementation of the basic measures under the Urban Wastewater Treatment Directive. However, such evaluation has not been based on measurements because no water quality measurements in the Daugyvenė downstream of Niauduva have been conducted during the recent years (the water company UAB Radviliškio vandenys has been performing measurements only in Niauduva downstream of the discharger of Šeduva WWTP). It is proposed to postpone the implementation of supplementary pollution reduction measures until more data on the ecological status of Daugyvenė is collected. Operational monitoring in the Daugyvenė is recommended in order to specify the ecological status of the river and identify the demand of supplementary measures.

Supplementary point pollution reduction measures may be required to achieve good ecological status of the rivers Laukupė and Nemunėlis. Since the estimations performed and information collected indicate that the drivers of pollution in the Laukupė and Nemunėlis include not only the loads from Rokiškis WWTP but also surface runoff and effluents of non-sewered population, supplementary measures should be designed for a more accurate identification of all potential pollution sources and a quantitative assessment of their loads. Priority should be given to the assessment of stormwater runoff loads. Also, operational monitoring is proposed downstream of Rokiškis because actual measurements are missing to be able to accurately assess the ecological status of the Laukupė and Nemunėlis. It is proposed to postpone the achievement of the water protection objectives for the water bodies in the rivers Laukupė and Nemunėlis until further specification of their ecological status and collection of more data on pollution sources which exert a significant impact and on their pollution loads.

The Vėzgė River has been identified as a water body at risk due to point pollution impacts. The basic measures under the Urban Wastewater Treatment Directive will have no effect on the ecological status of this river because the main polluters are settlements with a p.e. of less than 2 000 (namely, villages Aukštelkai and Kalnelio Gražioniai) and the agricultural company ŽŪB Gražionių bekonas. High concentrations of NH_4-N were registered in effluents discharged from all these entities in 2009: the concentration of NH_4-N in effluents of ŽŪB Gražionių bekonas was 22 mgN/l, the one in effluents discharged from Aukštelkai WWTP – 31 mgN/l and from Kalnelio Gražioniai – 44 mgN/l. Mathematical modelling results indicate that the concentrations of NH_4-N in the

Vėzgė under the present pollution loads may be as high as 0.7 mgN/l in years of a medium water volume, i.e. exceed the threshold of good ecological status more than three times.

Mathematical modelling results show that good ecological status in the Vėzgė will not be achieved if the present pollution loads of the wastewater treatment facilities of Aukštelkai and Kalnelio Gražioniai villages and ŽŪB Gražionių bekonas persist. A single water quality measurement conducted in 2006 also showed that concentrations of ammonium nitrogen or total phosphorus failing the good ecological status requirements may be present in the river. The concentration of NH_4-N in the Vėzgė at Mažaičiai measured on 7 June 2006 totalled to 0.42 mg/l (i.e. more than twice exceeded the threshold of good ecological status) and the concentration of P_{total} was 0.24 mg/l (i.e. 1.7 times exceeded the good ecological status requirements). The Vėzgė has been identified as a water body at risk due to point pollution impacts and hence supplementary point pollution reduction measures may be required to achieve good ecological status therein.

Estimations conducted following mathematical modelling results demonstrated that the aggregate pollution load of ammonium nitrogen discharged into the Vėzgė from the three dischargers should not exceed 130 kg/year to be able to reduce the concentrations of ammonium nitrogen to the required level. The demand of the reduction of total phosphorus is not clear enough yet because modelling results show that the concentrations of P_{total} in the river under the present pollution loads should be failing the good ecological status requirements only in dry years meanwhile in years of a medium water volume in the river the concentration of total phosphorus should not be exceeding the threshold of good ecological status. To be able to specify the demand of supplementary measures for reducing pollution with total phosphorus, the river water quality should be monitored downstream of the dischargers. With a view to achieve a maximum effect, the implementation of supplementary measures for reducing pollution with ammonium nitrogen is proposed to be postponed for some time until the establishment of a demand to reduce phosphorus pollution loads. Operational monitoring in the Vėzgė is recommended in order to specify the demand of supplementary measures for reducing pollution with phosphorus.

The Beržtalis River has been identified as a water body at risk due to a significant load of total phosphorus. Mathematical modelling results show that the recently (in 2009) increased pollution with ammonium nitrogen by the main polluter, Žeimelis WWTP, has posed a risk of failing the good ecological status requirements by this pollutant as well. The situation is not expected to change in the nearest future because the settlement is not subject to the requirements under the Urban Wastewater Treatment Directive so no pollution reduction measures will be implemented. To be able to achieve good ecological status in the Beržtalis River, supplementary point pollution reduction measures may be required. Before that, however, water quality analysis in the river downstream of Žeimelis town has to be conducted because the present evaluation of risk has been based only on the modelling results which can contain certain errors. Hence, it is proposed to postpone the achievement of the water protection objectives in the Beržtalis and to perform operational monitoring in order to specify the demand of supplementary pollution reduction measures. After the analysis and specification of the ecological river status, supplementary point pollution reduction measures, if such are required, will have to be established during the next planning stage.

Estimations show that the rivers Šiladis and Tatula may be failing the good ecological status requirements due to significant point pollution impacts. The Šiladis may be suffering from pollution loads from Kairiai WWTP and the Tatula – from the ones discharged from Vabalninkas WWTP. A significant impact of these pollution sources was identified by way of calculations hence actual data validating the impact is required in order to have a basis for introducing supplementary measures because calculation results can contain errors. Consequently, it is proposed to postpone the implementation of supplementary measures in Kairiai and Vabalninkas wastewater treatment facilities. Operational monitoring sites have been envisaged for the monitoring of the river status downstream of these dischargers. After the analysis and specification of the ecological river status, supplementary point pollution reduction measures, if such are required, will have to be established during the next planning stage.

The following measures have been provided for in the Programme of Measures for Achieving Water Protection Objectives: to conduct additional analysis in order to identify loads of BOD_7, biogenic and petroleum substances as well as heavy metals which enter the rivers Laukupė and Nemunėlis with surface runoff; to conduct analysis of effluents (for nitrogen, phosphorus and BOD_7) discharged from Rozalimas and Mikoliškis settlements and of their impact on the receiving water bodies.

Measures to reduce diffuse pollution

166. Water bodies in part of the Lielupė RBD will be failing good water status after the implementation of the basic measures due to diffuse pollution from agriculture. This problem is most acute in the Lielupė Small Tributaries and Mūša sub-basins.

Most of the measures proposed for the Lielupė RBD have already been approved in the Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District, which was adopted by Resolution No. 1098 of the Government of the Republic of Lithuania of 21 July 2010 (Žin., 2010, No. 90-4756). Some of the measures are proposed for the entire country, meanwhile others – only for certain identified areas.

167. Measures recommended for the whole of Lithuania:

167.1. validated maximum allowable amounts of nitrogen and phosphorus fertilisers per hectare, irrespective of whether organic or mineral fertilisers are used (approved in the Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District);

167.2. a revised and validated mandatory methodology for the development of fertilisation plans (approved in the Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District);

167.3. an obligation to develop fertilisation plans for farms utilising 10 ha of land and more[9];

167.4. an obligation to manage manure in line with the recommendations set forth in the Good Farming Rules and Guidelines and in compliance with the Environmental Requirements for Manure Management for farms with less than 10 LSU (i.e. farms which are not subject to the requirements of the Nitrates Directive) (approved in the

[9] The Environmental Requirements for Manure and Slurry Management laid down that farms with 100 ha and more will have to develop fertilisation plans as from 2011 and those with 50 ha and more – from 2012.

Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District).

168. Measures to reduce diffuse pollution in identified areas:

These measures are not mandatory for the entire country. It is proposed that such measures are optional and their costs are compensated thus ensuring equal farming conditions for all farmers.

168.1. Amendment of the existing support schemes under the RDP and implementation thereof without allocating additional funds.

In the case of budget restrictions, a general recommendation for all the below-listed support areas is to give priority to the economic entities located in the identified areas thus ensuring that funds are directed first of all to areas where they can be used for the achievement of the water protection objectives to the maximum extent. The recommendation is applicable to the following support areas (activities) under the Lithuanian Rural Development Programme for 2007–2013:

1) Rules for the implementation of Activity 1 “Compliance with the requirements of the Nitrates Directive and the new compulsory Community standards” of the Measure “Modernisation of agricultural holdings” under the Lithuanian Rural Development Programme for 2007-2013; the Rules were approved by Order No. 3D-479 of the Minister of Agriculture of the Republic of Lithuania of 31 October 2007 (Žin., 2007, No. 117-4806);

2) Rules for the implementation of Activities 2 and 3 of the Measure “Modernisation of agricultural holdings” under the Lithuanian Rural Development Programme for 2007-2013; the Rules were approved by Order No. 3D-480 of the Minister of Agriculture of the Republic of Lithuania of 31 October 2007 (Žin., 2007, No. 117-4807; 2010, No. 67-3364);

3) Rules for the implementation of the schemes “Landscape Stewardship Scheme”, “Organic Farming Scheme” and “Scheme for Improving the Status of Water Bodies at Risk” of the Measure “Agri-environment payments” under the Lithuanian Rural Development Programme for 2007-2013; the Rules were approved by Order No. 3D-152 of the Minister of Agriculture of the Republic of Lithuania of 6 April 2007 (Žin., 2007, No. 41-1561; 2010, No. 41-1995).

169. Development of new compensatory schemes under the RDP and application thereof in areas where agricultural pollution will remain significant even after the introduction of measures common for the whole of Lithuania (approved in the Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District):

169.1. Application of a fertilisation norm lower than the optimal one by 20%

169.2. Growing of catch crops in sandy and mixed soils

170. Supportive measures to reduce diffuse pollution:

170.1. Education and information of farmers and implementing institutions

170.2. Additional control of farms

While implementing supplementary measures, it is recommended to conduct additional checks on 5% of all small farms in Lithuania having up to 10 LSU; 10% of farms utilising 10 ha agricultural land and more (which will have to develop fertilisation plans under this Plan) in areas where supplementary measures are required to reduce diffuse pollution from agriculture; and 2% of farms of the same size in the remaining territory of Lithuania.

170.3. Additional accountability of farms

The major problem at the moment is local rather than general over-fertilisation in districts of intensive agriculture, therefore it is important to establish the amounts of fertilisers used and specific fertiliser application places. Currently, only a small number of farms are obligated to have documents on the use of fertilisers. It is recommended to amend the Environmental Requirements for Manure and Slurry Management approved by Order No. 367/3D-342 of the Minister of Environment and the Minister of Agriculture of the Republic of Lithuania of 14 July 2005 introducing a requirement for farms with 50 and more LSU to keep documents proving legal use, transfer or sale of manure and/or slurry for at least two years.

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171. A summary of the measures for the Lielupė Small Tributaries Sub-basin is given in Tables 106 to 109.

171.1. All water bodies in the category of rivers within the Lielupė Small Tributaries Sub-basin have been designated as water bodies at risk due to the impact of diffuse agricultural pollution. This means that supplementary measures for reducing agricultural pollution are required in the entire sub-basin where seven problematic catchments are situated[10] (with the total area of 94 545 ha). Diffuse pollution with nitrate nitrogen leaching into water bodies may have to be reduced by 8 kg/ha, or by 795 thousand kg in total.

Table 106. Measures to reduce diffuse pollution from agricultural sources in the Lielupė Small Tributaries Sub-basin

Measures for Lielupė Small Tributaries Sub-basin	Measure application scope, ha/LSU/unit	Effect of the measure on N reduction, kg/year	Annual costs, LTL
Manure management on small farms	11 389 LSU	45 946	113 893
Fertilisation plans on farms ≥ 10 ha	75 003 ha	400 153	533 301
Implementation of measures under RDP under more favourable conditions in identified areas	currently applied	18 887	0
Implementation of a new support scheme: application of a fertilisation norm 20% lower than the optimal one	9 850 ha	68 508	492 480
Implementation of a new support scheme: growing of catch crops in sandy soils	1 183 ha	40 640	455 584
Implementation of a new support scheme: growing of catch crops in mixed soils	2 786 ha	60 092	1 072 693
Additional control	-	-	17 598
Total:		634 225	2 685 549

Source: experts' estimations

[10] Units used in the mathematical model applied for the assessment of agricultural pollution.

The annual costs of the measures required to reduce diffuse pollution in the Lielupė Sub-basin would total to around LTL 2 686 thousand. Farmers with more than 10 ha of land who will have to develop fertilisation plans would have to spend LTL 533 thousand and farmers who keep up to 10 LSU – about LTL 114 thousand. The annual burden to the state would total to LTL 17.6 thousand for the control of the implementation of the measures. LTL 2 021 thousand are expected from the EU for new compensatory schemes. The listed measures are not sufficient for reducing pollution to the required level in six catchments of the Lielupė Small Tributaries Sub-basin.

171.2. In the Mūša Sub-basin, supplementary measures for reducing agricultural pollution are also required in the entire area (27 catchments, 417 838 ha). However, the pollution input in water bodies to be reduced is only 4.4 kg/ha. The aggregate amount of total nitrogen which has to be removed is 2 108 tonnes.

A summary of the measures for the Mūša Sub-basin is given in Table 107.

Table 107. Measures to reduce diffuse pollution from agricultural sources in the Mūša Sub-basin

Measures for Mūša Sub-basin	Measure application scope, ha/LSU/unit	Effect of the measure on N reduction, kg/year	Annual costs, LTL
Manure management on small farms	33 982 LSU	264 146	339 818
Fertilisation plans on farms ≥ 10 ha	140 578 ha	1 618 935	1 641 375
Implementation of measures under RDP under more favourable conditions in identified areas	currently applied	69 762	0
Implementation of a new support scheme: application of a fertilisation norm 20% lower than the optimal one	18 432 ha	182 339	921 588
Implementation of a new support scheme: growing of catch crops in sandy soils	3 470 ha	113 319	1 335 937
Implementation of a new support scheme: growing of catch crops in mixed soils	4 213 ha	95 439	1 622 145
Additional control	-	-	67 372
Total:		2 343 941	5 928 234

Source: experts' estimations

The annual costs of the measures required to reduce diffuse pollution in the Mūša Sub-basin would total to around LTL 5 928 thousand. The major amount would have to be borne by farmers with more than 10 ha of land who will have to develop fertilisation plans (LTL 1 641 thousand) and farmers who keep up to 10 LSU (LTL 340 thousand). The annual burden to the state would total to LTL 67 thousand for the control of the implementation of the measures. The listed measures are not sufficient to reduce pollution to the required level in three catchments of the Mūša Sub-basin.

171.3. Pollution with nitrate nitrogen is not that urgent in the Nemunėlis Sub-basin. There are two water bodies in the sub-basin where concentrations of nitrate nitrogen fail the good ecological status requirements due to diffuse agricultural pressures and two water bodies where exceedances are determined by the aggregate impact of point and diffuse pollution. Supplementary measures for reducing diffuse agricultural pollution in the Nemunėlis sub-basin are required in the total area of 12 188 ha, the pollution reduction demand here is 0.8 kg/ha (in total 12 775 kg).

A summary of the measures for the Nemunėlis Sub-basin is given in Table 108.

Table 108. Measures to reduce diffuse pollution from agricultural sources in the Nemunėlis Sub-basin

Measures for Nemunėlis Sub-basin	Measure application scope, ha/LSU/unit	Effect of the measure on N reduction, kg/year	Annual costs, LTL
Manure management on small farms	10 642 LSU	14 474	106 420
Fertilisation plans on farms ≥ 10 ha	31 469 ha	49 584	719 511
Additional control	-	-	13 221
Total:		64 059	839 151

Source: experts' estimations

The annual costs of the measures required to reduce diffuse pollution in the Nemunėlis Sub-basin would total to around LTL 839 thousand. The major amount would have to be borne by farmers with more than 10 ha of land who will have to develop fertilisation plans (LTL 719.5 thousand) and farmers who keep up to 10 LSU (LTL 106 thousand. The annual burden to the state would total to LTL 17.6 thousand for the control of the implementation of the measures.

171.4. A summary of measures to reduce diffuse pollution from agricultural sources in the entire Lielupė RBD is provided in Table 109.

Table 109. Measures to reduce diffuse pollution from agricultural sources in the Lielupė RBD

Measures for Lielupė RBD	Measure application scope, ha/LSU/unit	Effect of the measure on N reduction, kg/year	Annual costs, LTL
Manure management on small farms	56 013 LSU	324 567	560 131
Fertilisation plans on farms ≥ 10 ha	247 050 ha	2 068 673	2 894 187
Implementation of measures under RDP under more favourable conditions in identified areas	currently applied	88 649	0
Implementation of a new support scheme: application of a fertilisation norm 20% lower than the optimal one	28 281 ha	250 848	1 414 068
Implementation of a new support scheme: growing of catch crops in sandy soils	4 653 ha	153 958	1 791 520
Implementation of a new support scheme: growing of catch crops in mixed soils	7 000 ha	155 531	2 694 838
Additional control	-	-	98 190
Total:	-	3 042 225	9 452 934

Source: experts' estimations

172. After the application of all above-listed measures, nine catchments, or 27 water bodies, will still be facing pollution problems. Following the assumptions on the cost-effectiveness of the measures, the cheapest way to remove pollution therein would be to create artificial wetlands/sedimentation catchments, where the reduction of 1 kilogram of total nitrogen would cost LTL 11. However, this measure has not been tested in Lithuania and it would be risky to apply it on a large scale. Therefore only a pilot project is recommended, postponing the implementation of the measure (and thus attainment of good water status in 9 catchments) until the next stage. Reduction of pollution down to the required level in the said catchments is also complicated for the reason of technical feasibility – due to the prevailing soil type (practically there are no

sandy soils) and low flow. Accordingly, the application of the available measures would not be effective.

Measures to improve hydromorphological status

173. The main reasons which determine hydromorphological changes in water bodies and thus prevent the achievement of good ecological status in some bodies of water are related to artificial barriers (disruption of river continuity). To eliminate these causes or mitigate their impact, measures are proposed for restoring/ensuring river continuity and flow.

Construction of fish bypass facilities

174. The most important measure which ensures river continuity is construction of fish bypass facilities. 25 fish migration facilities were constructed in Lithuania until 2010: sluices, rock channels with weirs, and vertical-slot pool fish passes.

175. Fish bypass facilities should be first of all installed in rivers which are most important for fish migration. There are two such places in the Mūša Sub-basin[11] – in the Lėvuo River (Table 110). However, a HPP is planned to be constructed on the Mūša in Latvia. In such case any fish migration to the Lithuanian part of the Mūša Basin will be blocked and so construction of fish by-passes in Lithuania will be useless because there will be no migrating fish.

The costs of the construction of fish migration facilities on the Mūša River were estimated in 2001. Since no later data is available, the amounts presented in Table 111 were calculated by applying the rate of the consumer price index.

Fish bypass facilities should be constructed following the results of special feasibility studies conducted to select the most suitable technological solution for a bypass channel in question. The construction of a facility should also take into account the data of monitoring performed both before and after the construction of such facilities to be able to assess an impact thereof on the ecological status of the river and thus select the best option. However, no such information is currently available in Lithuania hence an impact analysis should be postponed for the second stage of the development of the Nemunas River Basin Plan, i.e. the planning cycle from 2015.

176. Taking into account the information provided on the List of Dams where Facilities for Fish Migration are Required and on the List of Former Dam Remains where Barriers for Fish Migration Have to Be Removed as well as expert judgement, the fish bypass facilities required and the barriers to be removed in the Lielupė RBD, observing the priorities given under the table, are as follows:

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[11] According to the List of Dams where Facilities for Fish Migration are Required and of the List of Former Dam Remains where Barriers for Fish Migration Have to Be Removed and expert judgement of the consultant-ecologist.

Table 110. Fish migration facilities and dam remains to be removed in the Mūša Sub-basin and their costs, LTL

River	Dam location	Measure*	District	Notes	Investment costs, 2009**, LTL
Fish migration facilities***					
Lėvuo	Pasvalys [(1)]	Fish pass (ladder)	Pasvalys distr.		147 882
Lėvuo	Akmeniai HPP[(2)]	Fish pass (ladder)	Kupiškis distr.	Operating small HPP	9 274
Barriers to be removed					
Lėvuo	Karsakiškis mill[(2)]	to remove remains of the rock weir	Panevėžys distr.		10 527
TOTAL					**168 000**

Source: List of Dams where Facilities for Fish Migration are Required and List of Former Dam Remains where Barriers for Fish Migration Have to Be Removed
* - [(1)] a higher priority measure; [(2)] a lower priority measure;
** Costs taken from the study "Improvement of fish migration conditions in ichtiologically important rivers" (Gedilieta and Institute of Ecology, 2001) and adjusted for 2009 taking into account the inflation;
*** On the Lėvuo, a fish pass at the dam in Pasvalys situated in the very lower reaches of the river should be constructed in the first place.

The improvement of fish migration conditions in the Mūša Sub-basin would require around LTL 168 thousand of investment costs. If this amount is distributed evenly on a yearly basis from 2011 until 2015, the annual demand would be about LTL 34 thousand. The annual total costs at the average lifecycle of 50 years would be approximately LTL 15 400.

177. Following the List of Dams where Facilities for Fish Migration are Required and the List of Former Dam Remains where Barriers for Fish Migration Have to Be Removed as well as expert judgement, the Nemunėlis Sub-basin and Lielupė Small Tributaries Sub-basin contain no rivers where fish migration facilities are required or former dams remains posing a barrier for fish migration have to be removed.

An artificial barrier mechanically blocks the water way for the migration of water organisms. This impact is most significant for migratory fish: they are blocked from the river stretch upstream of the barrier, therefore the fish species variety in such river stretch is always much lower than in the stretch downstream of the barrier (at the expense of migratory and, in a way, semi-migratory fish species). As a result (due to the decreased variety of sensitive fish species), the ecological status of the river stretches upstream of the artificial barrier is always lower by the fish index than the ecological status of those downstream of the barrier. Construction of fish bypass facilities mitigates the said impacts. However, measures which are necessary to ensure (or improve) conditions for fish migration produce different effects on the status of fish populations. Some rivers are particularly important for the reproduction of migratory or semi-migratory fish and hence migration barriers have a highly significant impact on the status of their populations (and also on the ecological status of the river), meanwhile construction of fish passes (or removal of barriers for migration) in other rivers would produce a lower effect. Accordingly, different priorities were given to the measures designed to provide for conditions for fish migration. A higher priority was granted to migration conditions in rivers (at the barriers) which are important for migratory fish, including the fish species and lamprey species protected under the Habitats Directive. Provision of adequate migration conditions in these rivers would enhance the overall status and resources of the said fish populations in Lithuania and would improve the ecological status (by fish indices) of the river stretches upstream of the artificial barriers.

The fish species protected under the Habitats Directive in the Mūša Sub-basin are the River Lamprey (migratory fish) and the Asp (semi-migratory fish). The migration of these species to the largest tributary of the Mūša, the Lėvuo, is prevented by Pasvalys dam situated in the very lower reaches of the river. Hence the construction of a fish pass at this dam is given a higher priority. Other barriers for fish migrations are located in the stretches of the Lėvuo upstream of Pasvalys. Here, fish migration conditions should be improved only if the path for migration is opened up at the dam in Pasvalys and thus the species specified in the Habitats Directive settle in the lower stretch of the Lėvuo. Following the criteria set for the Nemunas RBD, the barriers for fish migration in the Lielupė RBD would be given lower – second and third – priorities.

Summary costs of mitigation of hydromorphological changes

178. Measures for mitigating the impact of hydromorphological changes and their total costs are provided in Table 111.

Table 111. Measures for mitigating the impact of hydromorphological changes in the Lielupė RBD

Measure	Amount	Investment costs	Operating costs	Total annual costs
Fish passes and removal of dam remains	4	167 700	4 700	15 400
Total ~:		167 700	4 700	15 400

Source: experts' estimations

Research

179. As already said in the sections on point and diffuse pollution and provision of postponement of water protection objectives, there are a few water bodies in the Lielupė RBD where data is lacking on causes which determine their poor status. Hence additional research is required before proposing status improvement measures for these water bodies.

180. Supplementary point pollution reduction measures may be required to achieve good ecological status of the rivers Laukupė and Nemunėlis. Since the estimations performed and information collected indicate that the drivers of pollution in the Laukupė and Nemunėlis include not only the loads from Rokiškis WWTP but also surface runoff and effluents of non-sewered population, supplementary measures should be designed for a more accurate identification of all potential pollution sources and a quantitative assessment of their loads. Priority should be given to the assessment of stormwater runoff loads. Also, operational monitoring is proposed downstream of Rokiškis because actual measurements are missing to be able to accurately assess the ecological status of the Laukupė and Nemunėlis.

181. Pollution load models suggest that the ecological status of Lake Talkša should be high; however, according to both monitoring data and lake study findings, the ecological status of the water body is lower than good. It should be noted that, following the modelling data, point pollution in Lake Talkša accounts for 86% (although as such it should not be exerting a significant impact). The status of Lake Talkša may be

materially affected by pollutants transported with surface runoff from the urban areas. Also, it is highly likely that the lake is being polluted with wastewater discharged from households illegally connected to the surface runoff collection system. Hence inventory of pollution sources and investigative monitoring are required in order to identify the causes determining poor status of this lake.

182. Poor ecological potential of Lake Rėkyva may be determined by the inflow of biogenic substances caused by its shore erosions (as a result of hydromorphological changes in the lake) as well as by pollution from unidentified pollution sources.

Rėkyva is situated in a wetland complex, the eastern shore of the lake adjoins a moraine ridge. Under natural conditions, such lakes do not have steady surface runoff and short-term surplus of water runs off through a descent in a low-lying bog. The stability of the shores of lakes situated in wetland complexes is conditioned by the natural balance of the lake, changes in which can lead to re-formation of the shores and shallow water. Water circulation in such lakes is extremely slow, therefore even the slightest pollution can impair their water quality.

The water regime of Lake Rėkyva has been artificially regulated from the end of the 19th century already. The present hydrographic connection was established in 1959 when Kulpė Canal was reconstructed by constructing a hatchless sluice therein. Approximately at that time a collector of surface runoff from Rėkyva settlement was also constructed on the eastern shore of Lake Rėkyva. The garden area on the north-eastern shore of the lake has become a residential area with no household wastewater collection and treatment systems hence a certain amount of wastewater may be entering Lake Rėkyva. When a water level raising system was constructed in the said sluice in 1978, the water level of the lake increased and is currently 30 cm higher than the natural one. 75-80% of the lake shores consist of peat ground which determines significant abrasion of the shores, especially in winter when ice expands.

A peat quarry of Rėkyva is situated in the south of the lake. The residual strip of a raised bog in the width of 400-600 meters between the lake and the peatbog has been broken in many places by choked reclamation ditches and narrow self-restoring peat extraction strips. Negative changes in the hydrological regime have been occurring, with the divide moving closer to the lake. An environmental impact assessment will be carried out before deepening the drainage ditches of Rėkyva peat quarry.

A number of key measures have been taken recently to reduce the adverse impact of the exploitation of the peat quarry on Lake Rėkyva to the maximum extent:

1) A working group of independent experts conducted an analysis of past scientific studies, which maintain that the exploitation of the peat quarry is not a crucial factor determining the eutrophication and sinking of the lake.

2) A Monitoring Programme for Rėkyva Peat Field has been prepared by Dr. J. Taminskas and approved by the Environmental Protection Department of Šiauliai Region on 23 July 2010. The Programme will cover such measures as monitoring of the water level in the strip between the lake and the bog, measurement of water runoff and quality, assessment of the impact of the water volume which does not enter the lake from the peat field on the lake water level as well as the impact of the drainage of the peat field. Also, the sinking of the surface of the bog e will be registered in the raised bog strip situated between the exploited peat field and Lake Rėkyva. All this

information will be provided to the general public. Private capital investments will total to more than LTL 300 thousand.

It is recommended to study changes in the physico-chemical and morphometric parameters of the lake in more detail (to conduct more intensive – investigative monitoring, including checks of pollution sources situated around the lake and assessment of the extent and rate of the shore erosion as well as changes in the lake depth). Such studies (in parallel with the studies of hydromorphological changes in the lake already conducted) would enable evaluating possibilities to stabilise the ecological potential of the lake.

183. Causes determining poorer than good ecological status of Lake Skaistė are not clear. Pollution load models suggest that the ecological status of Lake Skaistė should be high. It is highly likely that poor ecological status of the lake has been conditioned by historic pollution. To be able to identify the origin of pollution of this lake at risk (to find out whether it suffers from anthropogenic pressures due to historic or present pollution), detailed studies (investigative monitoring, including monitoring of the near-bottom layer of the lake, checks of the pollution sources around the lake) are required.

184. Poorer than good ecological status of Lake Notigalė may be determined by natural ageing processes. Besides, this is not a typical lake in Lithuania (with soft brown water). There is not much monitoring data on quality parameters of this lake. Investigative monitoring would allow evaluating the processes in the lake more accurately and assess its actual status.

Research measures for the Lielupė RBD also include public education measures and amendment of legislation.

The costs of the necessary research, educational and legislative measures are provided in Table 112.

Table 112. Research, educational and legislative measures

Measure	**Necessary costs**		
	Investment / single costs, LTL	**Operating, LTL/year**	**Annual, LTL/year**
Extensive research of morphometric, physico-chemical and biological parameters, erosion processes, inventory of pollution sources, analysis of identified pollution sources in Lake Rėkyva	22 000		3 000
Investigative monitoring, including monitoring of the near-bottom layer, and inventory of pollution sources to establish the origin of pollution of Lake Skaistė	23 000		3 000
Investigative monitoring and inventory of pollution sources to identify causes of poor status of Lake Talkša	90 000		12 000
Investigative monitoring and inventory of pollution sources to validate or deny the designation of Lake Notigalė as a water body at risk	18 000		2 000
Amendment of the Environmental Requirements for Manure and Slurry	no funds required for the		

Measure	Necessary costs		
	Investment / single costs, LTL	Operating, LTL/year	Annual, LTL/year
Management approved by Order No. D1-608/3D-651 of the Minister of Environment and the Minister of Agriculture of the Republic of Lithuania of 14 July 2010 to include the obligation to keep documents which prove legal use, handover or sales of manure and/or slurry at least two years for farms with 150 LSU; as from 2012 - for farms with 75 LSU and from 2013 - for farms with 15 and more LSU	implementation of the measure		
Implementation of the provisions of the Environmental Requirements for Manure and Slurry Management and the requirement to develop annual control plans within the Lielupė RBD as provided for in paragraph 2.1 of Annex 1 to the Programme of Measures for Achieving Water Protection Objectives within the Nemunas River Basin District approved by Resolution No. 1098 of the Government of the Republic of Lithuania of 21 July 2010 (Žin., 2010, No. 90-4756)	no funds required for the implementation of the measure		
Analysis of surface runoff in Rokiškis to identify loads of BOD_7, biogenic and oil substances and heavy metals entering the rivers Laukupė and Nemunėlis with surface runoff	10 000		1 000
Assessment of the impact of wastewater discharged from Rozalimas and Mikoliškis settlements on the rivers Daugyvenė and Atmata	10 000		1 000
Education and information campaigns for the general public, farmers and other groups of interest		10 000	10 000
Total	**173 000**	**10 000**	**32 000**

Source: experts' estimations

Summary costs of supplementary measures

185. Summary information on the costs required for the implementation of the supplementary measures is given in Tables 113 and 114. The latter table provides the demand of costs only for the reduction of diffuse pollution and construction of fish migration facilities.

Table 113. Preliminary costs of supplementary measures for the Lielupė RBD until 2015

Supplementary measures, excl. reduction of point pollution, renaturalisation of river beds and replacement of turbines	Investment costs, LTL	Operating costs, LTL/year	Annual costs, LTL/year
Reduction of diffuse (agricultural) pollution	0	9 452 934	9 452 934
Hydromorphological changes	168 000	5 000	15 000
Research, pilot projects and education	173 000	10 000	32 000
Total ~	**341 000**	**9 470 000**	**9 500 000**

Source: experts' estimations

The total costs of the whole Programme of Measures, including both the basic and the supplementary measures, are provided in Table 114

Table 114. Implementation costs of the whole Programme of Measures for the Lielupė RBD until 2015

Group of measures	**Investment costs, LTL**	**Operating costs, LTL/year**	**Annual costs, LTL/year**
Basic measures			
Bathing Water Directive	0	104 420	104 420
Birds Directive	1 940 856	723 203	986 203
Drinking Water Directive	together with the costs of the Nitrates Directive		
Major Accidents Directive	150 000	0	21 000
Environmental Impact Assessment Directive	0	210 000	210 000
Sewage Sludge Directive	79 978 000	2 399 340	9 372 340
Urban Wastewater Treatment Directive	229 610 000	4 592 200	24 611 200
Plant Protection Products Directive	1 912 000	15 000	374 000
Nitrates Directive	69 679 870	696 799	6 771 799
Habitats Directive	399 144	870 750	924 750
IPPC Directive	50 000	0	7 000
Basic measures in total	**383 720 000**	**9 610 000**	**43 380 000**
Supplementary measures			
Point pollution	0	0	0
Diffuse pollution	0	9 452 934	9 452 934
Hydromorphological changes	168 000	5 000	15 000
Studies and education	173 000	10 000	32 000
Supplementary measures in total ~	**341 000**	**9 470 000**	**9 500 000**
Basic and supplementary measures			
GRAND TOTAL ~	**384 100 000**	**19 100 000**	**52 880 000**

Source experts' estimations

SECTION V. BENEFITS OF ACHIEVING GOOD STATUS IN WATER BODIES

186. The benefit which will be obtained upon the implementation of the supplementary measures has been estimated on the basis of the "Study on willingness to pay for improvement of the Nevėžis River water quality to achieve good status" and the "Study on willingness to pay for improvement of the Neris River water quality to achieve good status and remeandering of the Neris". Such relative assessment studies are rather widely used in many countries for the estimating benefits of natural resources (i.e. the benefits which cannot be estimated using conventional economic-commercial methods).

The said two sub-basins are situated in the Nemunas RBD. It is believed that the benefits derived therein may be directly transferred into other Sub-basins in Lithuania due to highly similar geographical and social conditions throughout the country.

It was estimated that a statistically reliable monthly amount which respondents agreed to pay in the Nevėžis Sub-basin is LTL 1.85 per household (including the households which agree to pay 0 litas). Such study was conducted in 2007.

187. The "Study on willingness to pay for improvement of the Neris River water quality to achieve good status" identified four scenarios.

187.1. Willingness to pay for improvement of all water bodies in the Neris Sub-basin to achieve good ecological status;

187.2. Willingness to pay for improvement of all water bodies in the Neris Sub-basin to achieve good ecological status and also for remeandering of straightened rivers;

187.3. Willingness to pay for improvement of the water quality of Lake Riešės ežeras to achieve good ecological status;

187.4. Willingness to pay for improvement of the water quality of Lake Riešės ežeras and Lake Didžiulis to achieve good ecological status.

188. In this way statistically reliable figures illustrating willingness to pay both for individual water bodies and for improvement of all bodies of water in the Neris Sub-basin were derived.

189. In the Neris Sub-basin, the amount agreed to be paid by one household was LTL 40.51 per year, or LTL 3.38 per month only for improvement of the water quality, and LTL 48.18 per year, or LTL 4.01 per month both for improvement of the water quality and remeandering of rivers. In the first case, the amount totals to about 0.29% and in the second case – to 0.36% of the income of the studied households.

In the case of willingness to pay (i.e. to pay more than 0 litas), the payment for improvement of the water quality and remeandering of rivers totals averagely to more than 30% of people's water bills.

Having in mind that the number of population in the Lielupė RBD totals to about 312 thousand and that the size of one household is 2.63 persons (average household size in Lithuania), the benefit in the Lielupė RBD estimated on the basis of the said Neris study would be around LTL 480 thousand per month, or LTL 5.78 million per year.

It should be pointed out that these figures are provided for the purposes of information on how people in the Lielupė RBD view good status in water bodies.

At the present stage of the development of the Programme of Measures, the measures selected pursuant to a cost-efficiency analysis are those which will be the most effective during the first cycle of the implementation of the Management Plan. The question of whether the costs of a measure intended for the achievement of good ecological status in a water body are disproportionate and whether such costs may serve as a basis for derogation is a political decision based on economic information. Such decision needs comparing relevant costs and benefits. The principle of disproportionate costs, i.e. cost-benefit comparison was not required in any case of extension of the deadline in the Lielupė RBD. All cases of extension are based either on technical uncertainties already discussed or on affordability and/or negative attitude (acceptability) of the public to implement such measures until 2015. The latter is in a way a component of the principle of disproportionate costs. Besides, only extension of the deadline for the attainment of environmental objectives is required and no lower objects are proposed. Consequently, a cost-benefit analysis and the figures illustrating the benefit which are given in this section were not required at this stage.

CHAPTER IX. PUBLIC INFORMATION AND CONSULTATION

190. Public participation activities in the management of the Lielupė RBD commenced in 2005 observing Order No. D1-273 of the Minister of Environment of the Republic of Lithuania of 31 May 2005 on the approval of the Personal Composition of the Coordination Councils of the Nemunas, Lielupė, Venta and Lielupė RBD (Žin., 2005, No. 72-2613). The main task of the Lielupė Coordination Council is to coordinate interests of public authorities, water users, interested non-governmental organisations and the public in setting and pursuing water protection objectives.

191. Other public information activities carried out:

191.1. A general Schedule for the Development of the Management Plans for all RBD in Lithuania was approved pursuant to Order No. V-110 of the Director of the Environmental Protection Agency of 25 October 2006 on the approval of the Schedule for the Development of River Basin District Management Plans (not published).

191.2. A few information events were arranged in 2007 for representatives of municipalities, regional environmental protection departments (REPD), non-governmental organisations (NGO), Coordination Councils of all four Lithuanian RBD, including the Coordination Council of the Lielupė RBD. The participants were informed about the progress of the development of Lithuanian RBD management plans.

191.3. Reviews of water protection problems identified in water bodies within the Lielupė RBD were prepared and placed on the EPA website on 22 December 2007. The general public could provide their comments until 22 June 2008.

191.4. Water protection problems in Lithuanian RBD, including the Lielupė RBD, were discussed on 26 June 2008 at the EPA with representatives of the RBD Coordination Councils. Mainly general comments and proposals were put forward in relation to the identification and solution of water protection problems.

191.5. A meeting of the Coordination Councils of the Lielupė, Venta and Lielupė RBD was held on 25 November 2009 in Šilagalis village to discuss draft management plans and programmes of measures.

191.6. The following public information and consultation event took place in 2010:

191.6.1. A meeting was held with representatives of the Water Problems Council under the Academy of Science of the Republic of Lithuania on 14 April 2010 at the EPA to discuss Lielupė RBD, Venta RBD and Dauguva RBD management plans and programmes of measures and relevant comments.

191.6.2. The progress of the development of the Lielupė RBD Management Plan was presented on a specially designed website (www.upiubaseinai.lt).

191.6.3. The general public was informed about the progress of the development of the Management Plan in email newsletters.

191.6.4. Information about the progress of the river basin management was announced in the media.

191.6.5. A video film (175 copies) and an information publication (700 copies) about the Lielupė RBD Management Plan and Programme of Measures were prepared and distributed to the general public.

191.6.6. An information conference was held on 28 October 2010 at the municipality of Pasvalys district where the final drafts of the Lielupė RBD Management Plan and Programme of Measures were presented.

Comments of the general public on the Lielupė RBD Management Plan

192. The general public was invited to provide comments on draft managements plans and programmes of measures. The following institutions provided their written comments and questions regarding the draft management plan:

192.1. The National Control Commission for Prices and Energy (Letter No. R2-621 of 19 April 2010) recommended providing reviews on the preparedness of municipalities to implement the provisions of the Law on Drinking Water Supply and Wastewater Management and on the relevant measures available.

Observing the comment of the National Control Commission for Prices and Energy, the status of the preparation of municipal water management projects within the Lielupė RBD was analysed. These projects in a way reflect the implementation status of the Law on Drinking Water Supply and Wastewater Management in municipal territories.

192.2. The Administration of Biržai Regional Park (Letter No. 1.8-291 of 30 January 2009) proposed to construct a fish pass on the dam of Širvėnos pond (Apaščia River) because this is the river of the migration of the pike and bream; the vimba also goes up from the Nemunėlis to the Apaščia.

Construction of fish passes during the first stage of the implementation of the Management Plan is proposed only for protected species. Fish passes on the dam of Širvėnos pond should be planned for the next stage of the Management.

192.3. The State Service for Protected Areas under the Ministry of Environment (Letter No. V3-7.7-1568 of 11 October 2010) pointed out some editorial comments on the Management Plan and Programme of Measures, some inaccuracies related to the number of protected areas and shortage of legislation.

All comments of the State Service for Protected Areas were taken into account in this Management Plan.

CHAPTER X. COMPETENT AUTHORITIES

193. The role of the Environmental Protection Agency, as specified in its regulations, is to collect, analyse and provide reliable information on the status of the environment, chemical flows and pollution prevention measures as well as to ensure arrangement of water protection and management for the attainment of water protection objectives. The Agency is also responsible for the development and coordination of basin management plans in the entire territory of Lithuania as well as for the reporting to the European Commission.

194. The Lithuanian Geological Survey organises exploration and maintenance of groundwater resources**.** Generally, the Survey organises and performs national exploration of the entrails of the Earth, regulates and controls the use and protection of the entrails of the Earth, collects, stores, and administers state geological information.

195. Regional Environmental Protection Departments are responsible for controls over the implementation of environmental legislation in the respective regions. The Departments will also be in charge of the controls over the implementation of the WFD requirements in their regions.

Table 115. Competent authorities

Competent authority and its website	**Area of responsibility in relation to the Lielupė RBD**	**Contact persons, duties, telephone**	**Details for correspondence**		
			by fax	**by email**	**by mail**
Environmental Protection Agency www.gamta.lt	Development of the Management Plan and Programme of Measures	Mindaugas Gudas, Head of the Environment Status Assessment Department +370-5-662814	(8~5) 266 2800	M.Gudas@aaa.am.lt	Juozapavičiaus str. 9 LT-09311 Vilnius
Lithuanian Geological Survey www.lgt.lt	Research and maintenance of groundwater resources	Kęstutis Kadūnas, Head of the Hydrogeology Department +370-5-136272	(8 5) 233 6156	Kestutis.Kadunas@lgt.lt	Konarskio str. 35 LT-03123 Vilnius
Environmental Protection Department of Panevėžys Region	Check-up of information on the Lielupė RBD for purposes of analyses and problem identification and control over the implementation of the management plan	Valdemaras Jakštas, Director +370-45 514481	(8-45) 581401	v.jakstas@prd.am.lt	Žvaigždžių str. 1, Panevėžys
Environmental Protection Department of Šiauliai Region	Check-up of information on the Lielupė RBD for purposes of analyses and problem identification and control over the implementation of the management plan	Vidmantas Svečiulis Director +370-41 524143	(8-41) 503705	Srd@srd.am.lt	Čiurlionio str. 3, LT-76303, Šiauliai
Environmental Protection Department of Utena Region	Check-up of information on the Lielupė RBD for purposes of analyses and problem identification and control over the implementation of the management plan	Ričardas Vygantas Director +370-389-6106	8-389 69662	utena@urd.am.lt	Metalo str.11, LT-28217, Utena