



Lithuania

Environmental problems and challenges of the Minija River – Towards a sustainable development of the river basin

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Abstract

The Watersketch project focuses on combining spatial planning and implementation of the Water Framework Directive (WFD). The Minija River is one of six case studies in the Baltic Sea Region describing environmental problems and conflicts of river/lagoon basins and supporting sustainable development to create a water resources management plan according to the requirements of the WFD. The aim of this case study is to evaluate the impact of the hydro engineering and recreational activities in the Minija river drainage area on the nature protected areas, migratory fish stocks, water quality and biodiversity. The results should prove important for the sustainable development recommendations as well as for mitigation of any potential negative consequences.

1 Introduction

The southern part of the Minija river basin, the Nemunas river delta and the Curonian lagoon make a unique natural water system. This natural delta complex is an important area for approx. 300 species of birds of which 40 species are included in the Red Book of Lithuania. The delta meadows are among the most important staging-posts for migrating water birds and wading birds in Europe. The importance of the Minija river basin for the reproduction of migratory fish species, especially wild Baltic salmon and sea trout are reported in the EU biodiversity protection framework.

Agriculture has been prevailing in the central and northern parts of the river basin up to the middle of the 1990s. Since 1995 the use of land for agricultural purposes has been decreasing. Currently approximately 53% of land is used for agricultural purposes. Agriculture has been one the major pressures on the biological quality of the waters. Eutrophication and planctonic blooms of surface waters were often observed in the river basin.

Apart from agriculture, most local inhabitants are also engaged in fishing. In particular, fishing is popular in the southern part of the basin, where the river enters the Curonian lagoon.

New activities like organic agriculture and water tourism are emerging in the region. Water tourism and agricultural tourism are being developed along the coastline of the Curonian lagoon and in the Nemunas Delta Regional Park. Agricultural tourism also shows great potential in the area of the Zemaitija National Park.

The hydrographic network of the basin is affected because of modifications to the water bodies. Currently there are three hydropower stations (Plunges, Godingos, Kartemales) built in the river basin, and the trend is towards increasing the number of small and medium size hydropower stations. Problems that directly relate to development of hydropower include the deterioration of hydrological regime, river continuity and biodiversity. This can lead to conflicts with the wildlife protection and water tourism development.

Much of the preservation of the Minija river basin natural complex depends on existing impacts and pressures. At the same time impacts and pressures determine farming and living conditions for local people. Furthermore, experience has shown that the impacts and pressures evaluation methodology acts as an excellent vehicle for discussion and the development of consensus. The method opens up the possibility for better understanding and structuring of complex issues.

2 Background Information

2.1 General characteristics of the Minija river basin

The River Minija - the right tributary of the River Atmata, the northern branch of the Nemunas Delta - is the eighth river in Lithuania by length (201.8 km). Its whole basin is located in Lithuanian territory and occupies 2942 km². The spring of the river is Didovo lake, situated approximately 200 km north-east from the mouth of the Minija River.

The Minija river basin, especially its western part, is characterised by a rather maritime climate. The mean annual air temperature is 5.6 – 6.40 °C. The coldest months are January and February. During winter season lasting frosts, frozen ground, snow and ice cover occur in the Minija river basin a month later than in the rest of Lithuania. Air masses coming from the Atlantic Ocean in winter bring frequent thawing periods that prevent formation of permanent snow cover and cause significant fluctuations in the hydrological regime of the river network. Summers are often cool and gloomy with rather abundant precipitation.

There are approximately 1360 tributaries in the Minija river basin. Most of these are less than 30 km in length. The river network in the Minija basin has a high density – 1.53 km/km². 51% of these are left side tributaries (Fig.1).



Fig.1 River network in the Minija river basin

The largest (>40 km length) tributaries of the River Minija are:

- River Tenenys (left tributary, length – 71.9 km, basin area – 300.0 km²);
- River Veiviržas (left tributary, length – 67.9 km, basin area – 668.0 km²);
- River Alantas (left tributary, length – 42.9 km and 146,4 km²);

- River Babrungas (right tributary, length – 47.3 km and basin area – 270.4 km²) and
- River Salantas (right tributary, length 42.1 km – basin area – 268.5 km²).

The exceptional feature of the Minija river basin is the difference in the length between the right and left tributaries. The majority of the right tributaries of the River Minija are short, while the left ones are long; therefore the Minija basin is asymmetric. This asymmetry is caused by the relief, which was formed during the glacier period in western Lithuania and by later post-glacial processes.

Near its mouth (18.4 km) the Klaipėda (Vilhelmo) channel connects the River Minija with Klaipėda harbour.

From its source to the mouth the River Minija descends 157m, creating an average slope of 0.8‰. The annual average water discharge in the mouth of the River Minija is 39m³/s, i.e. an average runoff coefficient of 13 l/s/km².

The River Minija exhibits an unusual characteristic – it discharges at two locations. The major flow discharges to the River Nemunas (Atmata), the remainder flows directly into the Curonian Lagoon (via Upaitis) or into Klaipėda harbour via the Klaipėda channel. It is recommended to assign the Minija river basin as a sub-basin of the River Nemunas due to the following specifications:

- the major discharge is to the River Nemunas;
- discharge directly into the Curonian Lagoon during cold weather occurs infrequently,
- the water quality of the Curonian Lagoon and the Lithuanian part of the Baltic Sea coastal zone is dominated by the River Nemunas discharge (hence the Curonian Lagoon and the coastal waters of the Baltic Sea are likely to be attributed to the Nemunas river basin).

However, the discharge to the River Nemunas may cease due to ice jams, which is why the River Minija discharges directly into the Curonian Lagoon and sometimes acts as a separate river basin.

The Minija is a river dominated by rain floods in the runoff balance. Approximately half of the total runoff comes from rainwater, snow and ground water comprises 22% and 25% respectively. The highest water level in the river is observed from November to March.

From a geomorphologic aspect the Minija river basin could be divided into several smaller units: the very upstream of the Minija runs across Mid-Žemaičiai Highland, formed by the fringe of a glacier, with medium size hills, abundance of lakes and marshy depressions. Below the Zarėnai settlement the River Minija enters a 20–25 m deep valley. Crossing the western Žemaičiai plateau, the River Minija crosses several low ridges formed by the glacial fringe.

The upper part of the Minija river basin is largely occupied by forests, where coniferous tree species prevail. The share of forested area in the Minija river basin is approx. 21 percent. Part of the river that is located in the coastal lowland is attributed to southern floristic belt with temperate vegetation. In the valleys of the River Minija and its larger tributaries grass plants of flood plains dominate.

Lakes in the basin area cover only 0.6% of the total area of the basin, while bogs and marshes cover 5.2% of the basin area. There are 17 ponds in the basin, total area ~ 1539 ha (0.41%). The basin of the River Babrungas, right tributary of the River Minija, differs significantly from the rest of the territory with 5.5% of lakes and 14.1% of bogs (Fig. 2).

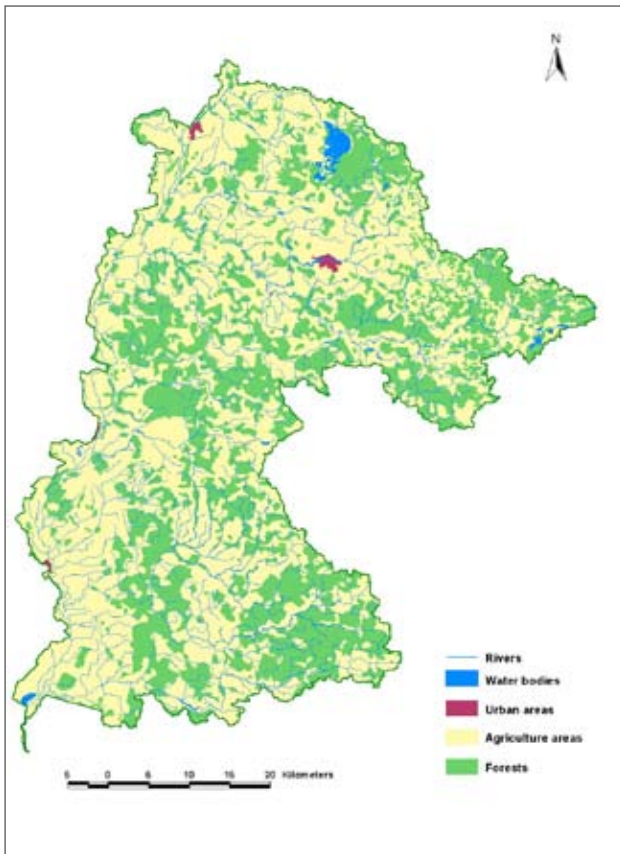


Fig. 2 Land use in the Minija river basin

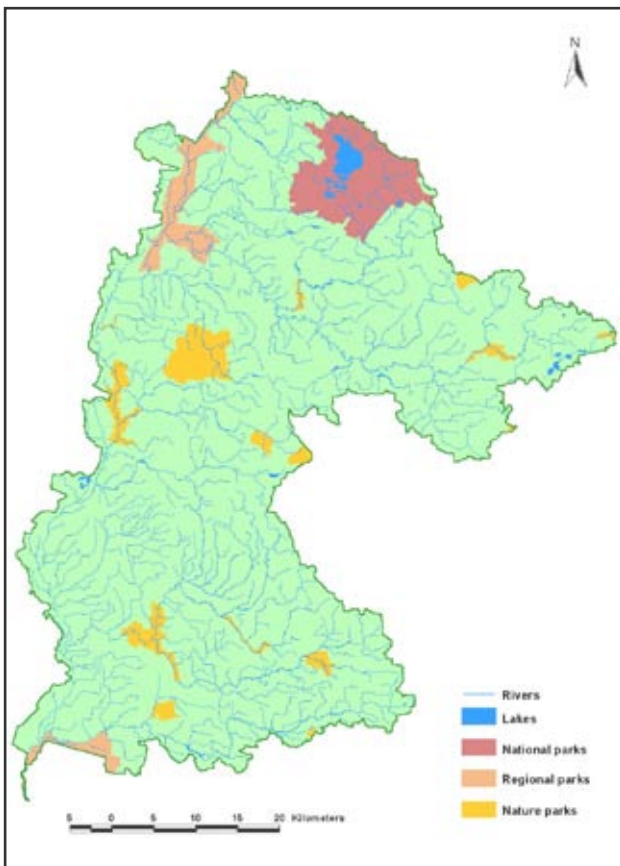


Fig. 3 Protected areas in the Minija river basin

2.2 Wildlife

The biodiversity and natural landscape of the Minija river basin is protected through the national nature protection network. A number of protected areas are established in the river basin (see Table I and Fig. 3).

Nr.	Name of the protected area	Area, km ²
1	Zemaitija National park	~150
2	Regional park of Nemunas Delta	~40
3	Regional park of Salantai	~65
4	Gondinga landscape reserve	2,6
5	Minija breach landscape reserve	5,4
6	Minija old valley landscape reserve	15,8
7	Minija ichtiological reserve	156 km river length and some tributaries
8	Stempliai landscape reserve	5,8
9	Veivirzas landscape reserve	16,3
10	Veivirzas ichtiological reserve	67,9 km river length and some tributaries
11	Ablinga geomorphological reserve	4,5
12	Meskine pedological reserve	1,0
13	Norkaiciai botanical reserve	5,2
14	Kartenale entomological reserve	1,0
15	Tyras Aukstasis telmological reserve	8,8
16	Tyras Reiskiai telmological reserve	40,5

Tab I. Nature protected areas located in the Minija river basin

The most important of the protected areas are:

- **Zemaitija National Park:** This was established in 1991 with the aim of preservation, management and sustainable development of those areas of Zemaitija in north – western Lithuania, that are most highly valued for their natural and cultural qualities. A number of those belongs to the Minija river basin.
- **Regional Park of Salantai:** This is situated at the junction of the Kretinga, Skuodas and Plunge regions and occupies 13630 ha. It was established in 1992 and covers interesting and valuable natural complexes and objects of Northwest Lithuania.
- **Regional Park of the River Nemunas Delta:** The park aims to protect the landscape of the River Nemunas Delta, its natural ecosystem and values of cultural heritage. Since 1993 the park is registered in the Ramsar list of wetlands of international importance http://www.ramsar.org/index_list.htm.

- *Minija and Veivirzas river ichtiological reserves.* Here are protected breeding areas for salmon, sea trout and vimba – all of this species are migratory. The River Minija is mentioned as an index river in the “Baltic salmon action plan 2010” prepared by IBSC and HELCOM

2.3 Human activities in the Minija river basin area

The biggest urban areas in the Minija river basin are Plunge, Gargždai and Salantai. There are no important industrial branches developed in the Minija river basin apart from oil exploration. Oil was discovered in Lithuania in the 1950s. Oil exploration in western Lithuania began in 1958. Presently not many wells are operating, but all of them are located in the western part of the country mostly in the Minija basin area.



Fig. 4 Administrative map of the Minija river basin

Agriculture has been prevailing in the rest of the river basin until the mid 1990s. Since 1995 the use of land for agricultural purposes has been decreasing. Currently approximately 53% of land is used for agricultural purposes. Flax has been among the most popular crops in the northern part of the river basin, therefore flax production companies have been serious polluters. Currently flax production is approximately 30% lower than in 1995.

The following issues are important and may influence water qualities and habitats for wildlife in the Minija river basin:

- agriculture;
- recreational activity;
- hydro engineering activities (damming of river for hydropower stations);
- waste water from the Minija river drainage area;
- oilfield exploitation.

The Minija river basin is situated near the Baltic Sea; and fishing is one of the traditional occupations in the basin. In particular fishing is popular in the southern part of the basin, where the river enters the Curonian lagoon. The majority of the population in the Šilutė region is employed in the fishing business. The fishermen of the region have established the fishermen association “Lampetra”. There are also anglers. Active fishing in the Minija river basin has caused a decrease of fish populations; moreover, illegal fishing creates another serious problem for the region.

New activities such as organic agriculture and water tourism are emerging in the region. Water tourism and agricultural tourism are being developed at the larger rivers of the basin and in the Nemunas Delta Regional Park. Agricultural tourism has also strong potential in the area of the Žemaitija National Park.

The hydrographic network of the basin is affected because of modification of water bodies. Currently there are three hydropower energy stations built the Minija river basin (see Table II).

Name of the station	River	Distance to the river mouth, km	Water flow, m ³ /s	Dam	
				area (ha)	capacity, (1000 m ³)
Plunge HE	Babrungas	21,5	2,74	1,5	30
Gondinga HE	Babrungas	15,5	2,95	88,0	3420
Vasiliausko	Kartenale	1,5	-	-	-

Tab. II: Hydropower stations constructed in the Minija river basin

A master plan was prepared for the Nemunas Lowland river basin in 2002 as a background document for the programme of implementation of the Urban Waste Water Directive.

The economic analysis of water use in the Nemunas Lowland basin was carried out as part of the preparation of the master plan. An overview of the situation on water use in the settlements of the Minija river basin is provided in the Table III.

Municipality	Settlements with more than 500 inhabitants	Number of inhabitants	Water tariff, Lt/m ³	Consumption of water, m ³ /day /person*	Water consumption in the settlement, m ³ /day	Cost of water, Lt/year	Expenditures for water, Lt/year /person
Klaipėda region (Households use 45% of water)	Gargzdai	15000	3,06-4,06**	0,12	1800	6498	134,12
	Dovilai	1279		0,05	63,95	230,86	55,88
	Vezaiciai	1825		0,06	100,38	362,35	61,47
	Kvietiniai	562		0,05	25,29	91,3	50,29
	Endriejavas	748		0,05	37,4	135,01	55,88
	Agluonenai	740		0,05	37	133,57	55,88
	Judrenai	586		0,05	26,37	95,2	50,29
	Veivirzenai	1080		0,05	54	194,94	55,88
	Ketvergiai	500		0,05	22,5	81,23	50,29
	Priekule	1800		0,06	99	357,39	61,47
	Total	24120				2265,89	8179,84
Kretinga region (Households use 71% of water)	Salantai	2200	4,46-4,38	0,06	121	536,85	89,6
	Kulupenai	1332	2,87-5,26	0,05	66,6	237,3	52,41
	Kartena	1041		0,05	52,05	185,46	52,41
	Baubliai	536		0,05	24,12	85,94	47,17
	Total	5109			263,77	1045,56	
Skuodas region	Notenai	513	4,68	0,05	23,09	108,04	76,92
	Total	513			23,09	108,04	
Silutė region	Saugos	962	4,08	0,05	48,1	196,25	74,51
	Vilkyciai	878		0,05	43,9	179,11	74,51
	Gardamas	501		0,05	22,55	91,98	67,06
	Inkakliai	519		0,05	23,36	95,29	67,06
	Sveksna	2208		0,06	121,44	495,48	81,96
	Total	5068				259,34	1058,11
Plunge region	Plunge	24696	3,21	0,12	2963,52	9512,9	140,69
	Plateliai	990		0,05	49,5	158,9	58,62
	Kuliai	927		0,05	46,35	148,78	58,62
	Sateikiai	787		0,05	39,35	126,31	58,62
	Stalgenai	502		0,05	22,59	72,51	52,76
	Norvaisai	502		0,05	22,59	72,51	52,76
	Total	28404				3143,9	10091,92
TOTAL:		63214			5955,98	20483,47	

Tab. III: Consumption of water in the settlements of the Minija river basin.

*the norms for consumption are determined according to the size of settlement: **private use

3 Environmental and water related problems

Hydrochemical conditions of the water in the Minija river basin are predetermined by the chemical composition of rocks and the water regime. Influx of precipitation and soil erosion in the Minija river basin take a longer time and are more intensive than elsewhere in Lithuania. This means that the amount of leaching of chemical elements is larger. Especially large amounts of chemicals leach from cultivated soils. Agricultural land occupies a large area of the river basin – approximately 52% of the whole basin area, therefore the contamination of the surface water directly depends on the intensity of agriculture. It was experimentally established that under Lithuanian conditions, depending on type of soil and agricultural practices, the leaching of nitrate ranges from 10 to 140 kg/ha/year.



Fig. 5 Pollution point sources in the Minija river basin

The hydrological and meteorological parameters are monitored in the stations of the hydrometeorological service. The runoff of the Minija basin is monitored in the River Minija at the River Kartena and at the River Lankupiai, in the River Veiviržas – near Mikuziai and in the River Upita at Eidukai. Meteorological observations are carried out in the Rivers Vezaiciai and Kartena. From 1992 until 2003 the Joint Research Centre was responsible for river monitoring. Since 2003 the newly established Environmental Protection Agency is responsible for river monitoring

The quality of river water in the Minija river basin is presented in annual reports on water quality regional by the environment protection department of Klaipeda (see Table IV). Figure 5 presents point pollution sources in the Minija river basin. As mentioned before, soil erosion is intensive in the Minija river basin, and the pollution of the river is highly dependent on the agricultural practices. The results of assessment of river quality presented in the master plan also suggest that agricultural production activities have a significant impact on rivers in the Nemunas Lowland river basin.

3.1 Existing legal basis: laws and regulations

The legal system water resource management in Lithuania consists of laws and regulations. Laws establish general management principles and regulations lay down detailed requirements for the implementation of the requirements established by the laws. Only the most important regulations will be discussed in more detail in the following.

- The **Law on Environmental Protection, 1996** defines the main principles of environmental protection in Lithuania. This framework law defines rights and responsibilities of private persons and public bodies in respect to the environment, use of natural resources, regulation of economic activities, and introduces the general principles for use of economic instruments for the protection of the environment;
- The **Law on Water, 1997** is the main law, which regulates the management of water resources. It replaced the Code of Water, 1972. This law defines the main principles of management, use, protection and ownership of water resources (except for marine waters). Requirements of the law are in line with the EU Water Quality Directives. Some minor adjustments will be needed when the EU Water Framework Directive is adopted. According to this law only groundwater can be used for abstraction of drinking water for human consumption;
- The **Law on Protection of Marine Environment (1997)** defines the main principles of protection of the marine environment: protection from pollution from vessels, leaking liquids of incidents, regulation of economic activities at sea, etc.

River	Location	Parameter	1997	1998	1999	2000	2001	2002	2003	2004
River Minija	Upstream Plunge	BDS ₇ , mgO ₂ /l	2,2	2,9	1,8	1,7	2,7	2	1,9	2,3
		N _{min} , mgN/l	1,053	1,042	1,117	1,003	1,158	0,669	0,852	0,904
		PO ₄ -P, mgP/l	0,037	0,037	0,043	0,036	0,041	0,03	0,052	0,037
	Downstream Plunge	BDS ₇ , mgO ₂ /l	2	2,8	1,7	2,1	2,9	2	2,2	2,1
		N _{min} , mgN/l	1,351	1,057	1,331	1,244	1,389	0,761	0,965	0,886
		PO ₄ -P, mgP/l	0,06	0,047	0,067	0,085	0,076	0,095	0,078	0,103
	Downstream Gargzdai	BDS ₇ , mgO ₂ /l	1,9	2	2,3	3,2	4	2,3	2,3	2,4
		N _{min} , mgN/l	1,673	1,531	0,95	1,032	1,21	0,72	0,98	0,96
		PO ₄ -P, mgP/l	0,032	0,032	0,031	0,031	0,04	0,12	0,075	0,056
	Downstream Priekule	BDS ₇ , mgO ₂ /l	2,3	2	2,3	2,6	2,6	2,6	2,3	2,4
		N _{min} , mgN/l	1,565	1,49	0,934	1,011	1,4	0,65	0,948	0,881
		PO ₄ -P, mgP/l	0,032	0,024	0,029	0,029	0,03	0,04	0,059	0,047
River Veiviržas	Near Veivirzenai	BDS ₇ , mgO ₂ /l	2	2	1,7	2,3	2,2	2,1	2	2
		N _{min} , mgN/l		1,23	0,76	0,92	1,08	0,56	0,899	0,82
		PO ₄ -P, mgP/l		0,02	0,03	0,03	0,02	0,05	0,039	0,038

Tab. IV: Concentrations of selected, main pollutants in the Minija river basin

- **The Underground Law (1995)** establishes requirements for the protection, control and exploitation of underground resources (including water);
- The **Law on Drinking Water (2001)** fully transposes the requirements of the EU Directive on Water intended for Human Consumption (98/83/EC).

In addition to these main laws there are a number of other laws regulating water management in Lithuania, including:

- The **Law on Taxes on State Owned Natural Resources (1991)**, and the **Law on Pollution Charges (1991)**. These two laws establish a system of economic instruments for the protection of the environment;
- The **Law on Monitoring of the Environment (1997)** establishes and sets requirements for implementation structure of the environmental monitoring in Lithuania;
- The **Law on Protected Areas (1993)**;
- The **Law on Environmental Impact Assessment (1996)**;
- The **Law on Land (1994)**.

The abstraction of water and the discharge of effluents in Lithuania are regulated via a permit system - Regulation on Issue of Permits for Use of Natural Resources and Discharge of Pollutants into Environment (1995). All abstractions of water > 10 m³ /day and discharge of effluents > 5 m³ /day are subject to regulation via permit system. In addition, these water users are required to supply statistical data about use of water and discharge of effluent to the Ministry of the Environment. The regulation of permits for use of natural resources and discharge of pollutants needs significant amendments to comply with the requirements of the Integrated Pollution Prevention and Control Directive 96/61/EEC (IPPC).

The quality of receiving waters in Lithuania is regulated by controlling the concentration of pollutants in the effluents. The Regulation on Effluent Pollution Standards (1995) sets requirements for treatment of effluents (concentrations of nutrients and dangerous substances). Effluent pollution standards depend on the amount of effluents discharged. The regulation needs to be amended to comply with the requirements of the EU Directive on Urban Waste Water Treatment (91/271/EEC) and Dangerous Substances Directive (76/464/EEC) and its daughter directives.

Diffused pollution of surface waters is controlled via the Regulation on Special Condition for Use of Land and Forest (1992). This regulation requires the establishment of special protection strips and zones around water bodies. However, this regulation is not sufficient to fulfil the requirements of the EU Nitrates Directive (91/676/EEC). Currently, the Ministry of the Environment with assistance from the Danish EPA is starting a project to transpose this directive.

The State Environmental Monitoring Programme (1998) is a regulation issued under the Monitoring Law. It defines sampling points, frequencies, and parameters for monitoring of surface, ground and coastal waters. Within the European DISAE Programme, the financed project "Development of the Programme for Approximation and Implementation of EU Water Quality Legislation in Lithuania" (executed at the Ministry of Environmental Protection) has concluded that the Lithuanian network for monitoring of surface waters is not sufficient to fulfil the needs of the EU Water sector Directives and EUROWATERNET. Additional parameters should be analysed and the number sampling points and frequency of sampling need to be increased.

There are a number of other regulations that have been adopted for the protection of the aquatic environment:

- Regulations on the scaling and temporary closing of wells, 1996;
- Regulations for the maintenance, first time dredging and river bed maintenance of inland waterways of state importance, 1996;
- Regulations on the establishment of rain water collection systems and discharge standards, application of taxes for rainwater discharges and laboratory monitors, 1995;
- Directions for the construction and sealing of individual wells, 1995;
- Regulations on use and maintenance of water reservoirs, 1995;
- Water use estimates for different activities, 1991;
- Hygiene Norm HN 24: 1998 "Drinking Water. Quality Requirements and Monitoring";
- draft Hygiene Norm on quality of bathing waters.

In addition to Laws and Regulations the Ministry of the Environment (former Ministry of Environmental Protection) has developed several strategic documents. The Lithuanian Environmental Protection Strategy (1996) defines environmental protection goals and priorities, actions to be taken and sets the time scale for implementation. Avoiding the details, just a few major activities related to protection of aquatic environment will be mentioned:

- Reduction of contamination with municipal, industrial and surface (storm) waste water;
- Reduction of the Baltic Sea pollution and contaminated water influx from other countries;
- Reduction of groundwater contamination, improvement of drinking water quality;
- Reduction of water contamination from agricultural and other non-point pollution sources;
- Protection of water resources from over-use whilst operating water intake sites;
- Prevention of structural changes in the natural hydrographic network.

3.2 Public involvement

Public participation will play a key role in the implementation of the WFD. The collaboration of all water use sectors is needed to reach the ambitious objectives of the WFD. Water managers will need to listen to the water users, give them some influence and share responsibility. Involving the general public is a means of developing high quality River Basin Management Plans, creating awareness of environmental issues and helping to increase acceptance and commitment towards intended plans (WFD, 2000/60/EC).

The following legal acts form the basis for public participation in water (environmental) management in Lithuania:

- Constitution of the Republic of Lithuania (1992): Basic rights for public participation are guaranteed by the Lithuanian Constitution, adopted by a referendum on October 25, 1992. The Lithuanian Constitution provides the citizens of Lithuania with almost all basic rights for public participation: right of expression, right to information, right of free assembly, right of association, right to petition, right to petition the Constitutional Court (except the right to a healthy environment). All these rights are established and stated in the traditional, democratic manner. Citizens are able to implement, to use and to protect their rights according to the order established by law. Institutions of state governance established by the Constitution also have a duty to protect and to develop citizen's rights to act under public participation.

- Law on Environmental Protection (1991)
- Law on Water (1997) Amended 2003.03.25: The actual update of the Water Law was drafted in line with WFD requirements. The following topics relate to the public participation issues:
 1. coordination council in River Basin Districts (art. 20, 2)
 2. public consultation on River Basin Management Plans (RBMP)(art. 25, 3)
 3. access to background information, used for RBMP preparation (art. 29)
- Law on Environmental Impact Assessment (2000)
- Law on Spatial Planning (1995)
- Law on Local Self-government of the Republic of Lithuania (2000)

According to the Lithuanian laws the general public must be consulted in relation to all spatial management plans and investment projects within 10 days after a decision about plan preparation was made. This is described in:

1. Government Decision 1999-10-22 Nr. 1175 "On information supply".
2. Government Decision No 967 "On the Approval of the description of the procedure for the strategic assessment of the impact of the plans and programmes on the environment" adopted on 18 August 2004 (Official Gazette, 2004, No 130-4650).
3. Government Decision No 904 "On the amendment of Resolution No 1079 "On the approval of the provisions for the consideration of the territorial planning documents in conjunction with the public" adopted by the Government of the Republic of Lithuania on 18 August 1996", adopted by the Government of the Republic of Lithuania on 16 July 2004 (Official Gazette, 2004, No 112-4189).
4. Order No D1-455 "On the involvement of the public in the procedures of the strategic assessment of the impact of the plans and programmes on the environment and on the approval of the description of the procedure for the notification of the member states of the European Union "(Official Gazette, 2004, No 136-4970).
5. Guide on the Strategic Environmental Impacts Assessment. 2004. Ministry of Environment of the Republic of Lithuania, Dutch International Business and Cooperation Agency (EVD), p. 22.

In line with requirements of the EU Water Framework Directive the following stakeholders should be involved:

- Professionals – public or private sector organisations connected with the plan;
- Authorities, elected people – government departments, statutory agencies, municipalities, local authorities;
- Local groups - organised non professional entities operating at a local level:
 1. Communities centred on place – which includes groups such as residents associations and local councils;
 2. Communities centred on interest – farmers groups, fishermen, birdwatchers, etc;
- Individual citizens, farmers and companies representing themselves (for example individual landowners, or local individual residents).

Opinions formulated by the general public should be taken into account by the competent authorities as far as legal and economic possibilities permit, but these opinions in some cases are not obligatory for decision makers.

4. Conclusion

Decision problems concerning environmental and natural resources management are usually complex or even hyper-complex problems. A thorough analysis and decision making process requires a comprehensive background in environmental, economic and social disciplines.

The paradox here is that the scientific community is mostly working on very detailed and specific aspects, whereas the managers require a holistic and ecosystem approach, not necessarily at a high level of detail. But the gap between those who analyse and those who decide not only can be found at the knowledge level, but also in the aims and the way of thinking.

For that reason, our objective was to give a comprehensive overview of the Minija river basin and propose a matrix of impacts and pressures (Fig. 6), which could serve as a background to integrate water, social, socio-economic, economic and environmental issues.

The main conflicts include:

Protection of biodiversity and recreational development

At present, recreational activities in the Minija river basin are increasing, especially the number of anglers and water tourists. The problems caused by main recreation activities are also growing. For example, the restrictions regarding the rules of amateur fishing in inland waters at times must be made less abstract, more flexible and connected to real climatic fluxes for each separate year. There are no regulatory means for the water tourism flows in the Minija river basin either, neither regarding time nor number of people. Of course, such a situation is not favourable for the biodiversity of the whole Minija river basin area and especially not in the protected areas of basin.

		Physical-chemical quality elements								Biological quality elements					Hydromorphological quality elements					
		Transparency	Temperature	Oxygen conditions	Conductivity	Salinity	Nutrient status	Acidification status	Priority substances	Other pollutants	Macrophytes	Phytoplankton	Planctonic blooms	Benthic invertebrates	Eutrophication	Hydrological regime	Morphology	River continuity	Tidal regime	Biodiversity
Diffuse sources	Urban drainage																			
	Agriculture diffuse	Low impact		Medium Impact			Medium Impact					High impact		High impact						Low impact
	Forestry																			
	Other diffuse																			
Point sources	Waste waters	Low impact		Low impact			Low impact							Low impact						
	Industry								Low impact											
	Mining																			
	Contaminated lands																			
	Agriculture point						Low impact								Low impact					
	Waste management																			
	Aquaculture																			
Abstraction	Manufacture																			
	Potable supply																	Low impact		
	Agriculture																	Low impact		
	Industry																	Low impact		
	Fish farming																			
	Hydro-energy														High impact			High impact		High impact
Morphological pressures	Open cast coal sites																			
	Flow regulation			Low impact								Low impact			Low impact					Low impact
	River management						Medium Impact						Low impact							
	Coastal management																			
Other anthropogenic pressure	Other																			
	Recreation																			Medium Impact
	Fishing/angling																			Low impact
	Climate changes																			
	Land drainage														Low impact					
	Exploitation of animals																			
	Introduced species											Low impact								
Introduced diseases																				

Fig. 6 Minija river impact and pressure matrix

Protection of migratory fish species and development of use of hydro energy

Growing demands of energetic resources also have an influence on the quality of biodiversity in the river basin. The prices of electricity are increasing, and cheap hydroelectricity in comparison with other energy resources is in the spotlight of energy producers. Efforts to expand the net of small hydroelectric power stations are being stepped up. In some cases, the overall potential impact on the surrounding nature and biodiversity is completely underestimated. For example, wrong installation of fish ladders at hydropower stations may render these unusable for fish. Unsatisfactory exploitation of hydropower stations can cause water regime disturbances and lead to problems both for fish migration and for settled fish fauna. It is vital to implement drastic measures regarding building limitations of new hydropower stations on the one side, and control of existing hydropower stations on the other.

Drinking water quality in rural areas and agricultural development

Currently the number of people who want to relocate to rural areas, especially to more attractive places, of which there are numerous in the Minija river basin, is increasing. The raising of living standards in future will intensify this process. According to the European Environment and Health Committee data approx. 70% of inhabitants of villages and individual households in Lithuania are not connected to the public water supply and sanitation networks and use water from shallow dug wells, which are often highly polluted with nitrates and microbiological pollution, which is not permitted. Development activities connected to agriculture will also be more intensive. Accordingly, in future the consumption of potable water in the Minija river basin will increase. As the demand for potable water quality must fulfil the requirements of law on drinking water it will be necessary to implement appropriate monitoring and control measures for water quality in the whole basin.

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