4. Chemical and ecological quality of water

4.1. Rivers and lakes

The assessment of the ecological status of water bodies in the category of **rivers** within the Venta RBD in **Lithuanian part** demonstrated that there are **14** water bodies (WB) at *high* ecological status and **27** WB - at *good* ecological status. The largest numbers of water bodies – **46** in the Venta RBD of Lithuanian part are at *moderate* ecological status as well as there is **1** water body at *poor* ecological status (Fig. 4.1.1). Analogous data for **Latvia** are showing **3** WB at *high* ecological status, **33** – at *good* ecological status, **16** – at *moderate* status as well as **1** at *poor* and **2** at *bad* ecological status. Rivers incompatible with at least good ecological quality status are mostly characterized by high nutrient concentrations in the water (Ntot, Ptot). For example, in Latvian part two river WB (V004 *Ālande* and V060 *Zana)* are even at bad environmental quality status due to high Ptot concentration in the first case and due to elevated Ntot concentration in the second case.

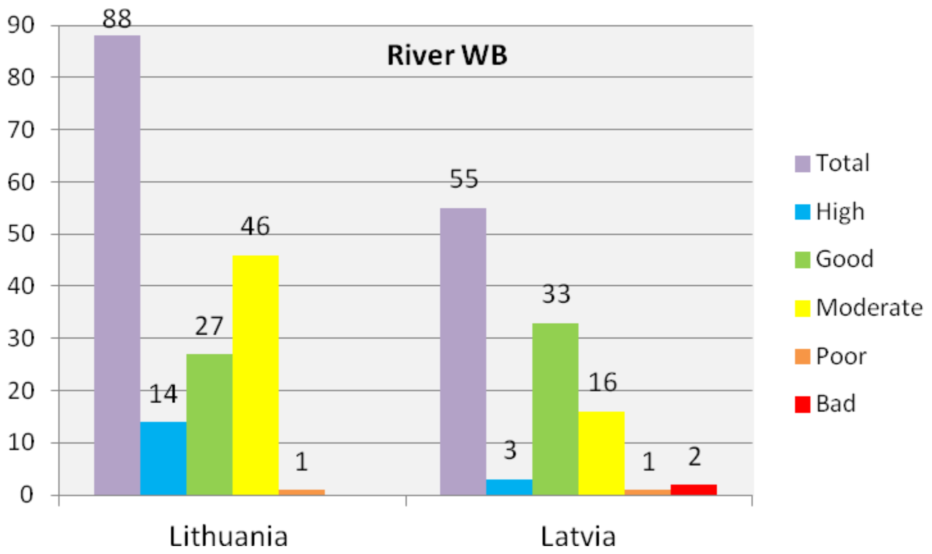

Figure 4.1.1. Ecological quality status of river WB in the Venta RBD, number.

Relative proportion of river WB at different quality grades in both countries is shown in the Figure 4.1.2. Lithuania has more WB at high ecological status than Latvia - 4 water bodies at high ecological status are situated in the Bartuva sub-basin, 10 – in the Venta sub-basin. Nevertheless, Lithuania has much more WB characterized as of moderate status.

With respect to heavily modified water bodies (HMWB) in the category of rivers **6** Lithuanian WB meet the requirements for maximum ecological potential and the same number - for good ecological potential (Fig. 4.1.3). 5 HMWB with maximum potential are located in Venta sub-basin and 1 - in the Bartuva sub-basin.

As regards Latvia, there is a lower amount of HMWB in relation to rivers determined most of them reaching good ecological potential.

Combining together all river WB and HMWB in both countries, Lithuania has the largest proportion of WB at highest ecological status but in the same time a very big amount of WB meeting only the moderate status (Fig. 4.1.4). In its turn, Latvian part of RBD encompasses some WB with bad quality which is not the case in Lithuania.

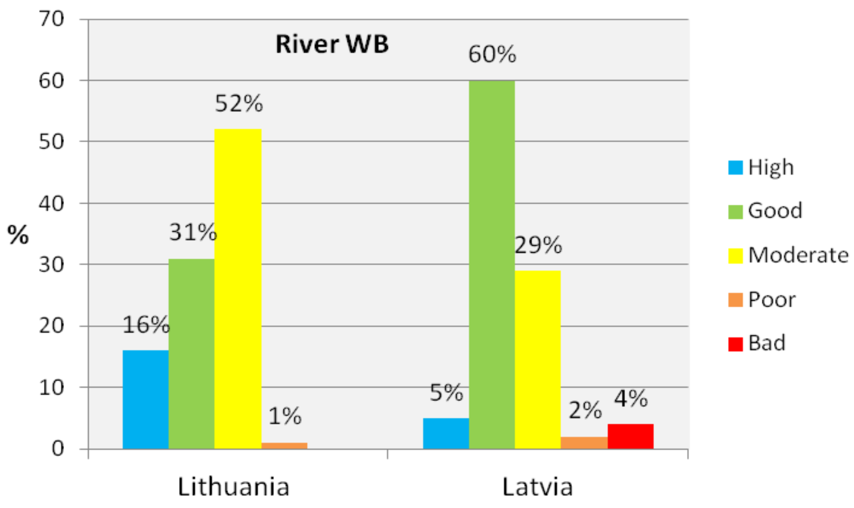

Figure 4.1.2. Relative proportion of river WB at different ecological quality classes within the Venta RBD.

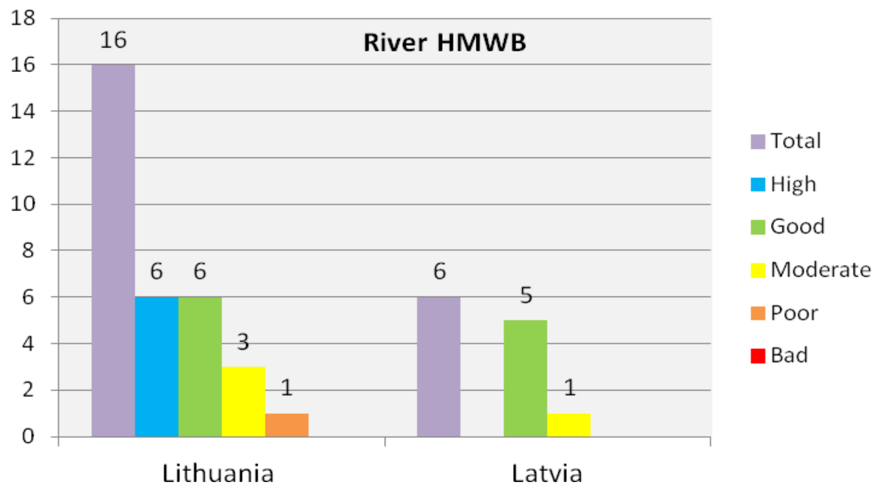

Figure 4.1.3. Ecological potential of rivers concerning HMWB in the Venta RBD, number.

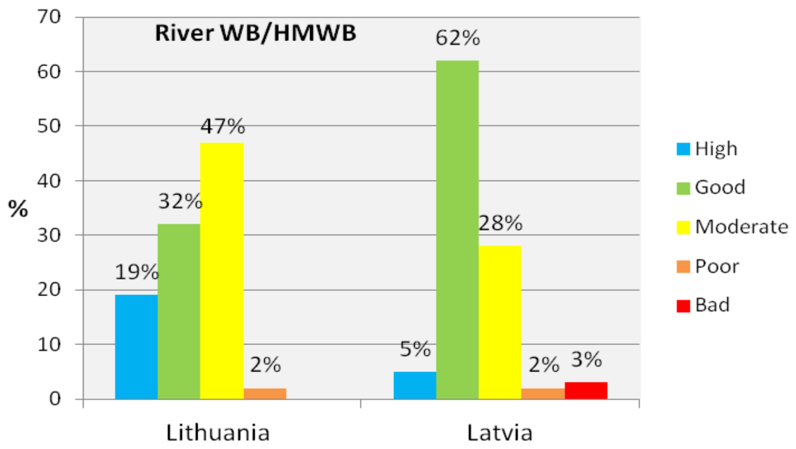

Figure 4.1.4. Relative proportion of river WB and HMWB at different ecological classes within the Venta RBD.

Totally, approx. 50 % of delineated Lithuanian river WB and HMWB does not meet at least good quality criteria (Fig. 4.1.5). In Latvia such river water objects are 1/3 but it shall be mentioned that Latvia has less WB and HMWB demarcated.

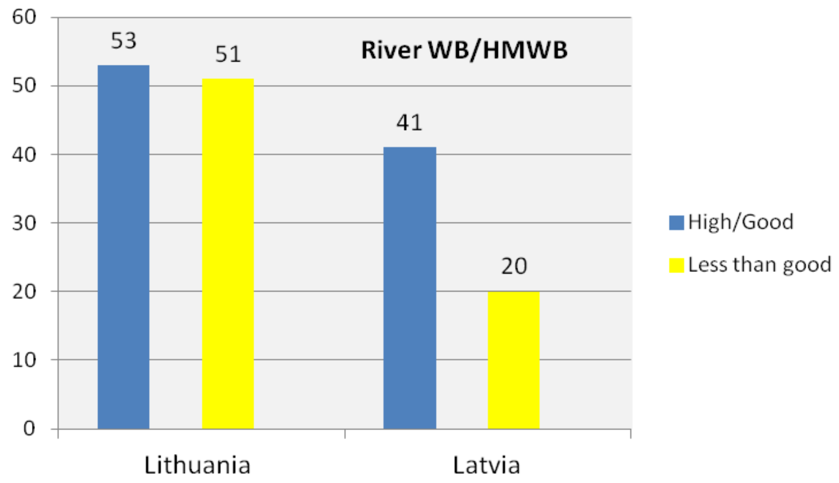

Figure 4.1.5. Compatibility of river WB and HMWB with at least good quality requirements within the Venta RBD, number.

In order to compare the quality status of quite differing number of river water objects in both countries, the logarithmic transformation regarding numbers of various WB and HMWB is used (Fig. 4.1.6).

As regards the **lakes** and **ponds** in the **Lithuanian part** of Venta RBD, **2** WB are at *high* ecological status, **4** WB are at *good* ecological status, **4** WB are at *moderate* ecological status and **1** WB - at *poor* ecological status.

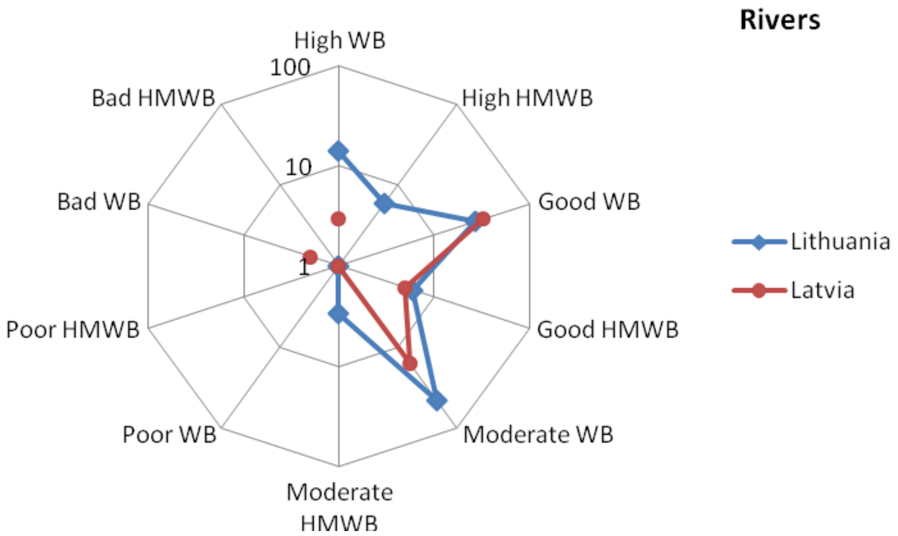

Figure 4.1.6. Comparison of all quality classes in relation to river WB and HMWB within the Venta RBD in Latvia and Lithuania (logarithmic transformation of number with base „10").

With respect to **Latvia**, there are much more lake WB determined showing differing ecological water quality including **7** lakes even with *bad* quality (Fig. 4.1.7). Again, similar to rivers, incompatibility with at least good ecological quality status is mostly characterized by high nutrient concentrations in the water (Ntot, Ptot), in their turn, giving rise to high chlorophyll a concentrations and phytoplankton biomass. Especially in relatively shallow lakes, high water temperature during summer is the favourable factor as the lake rapidly heats up. In relation to Latvia very complicated situation has arisen in Valgums lake (E031), where all parameters used for assessments meet the criteria of either poor or bad quality, despite the fact that it is a lake of type 9 (relatively deep lake).

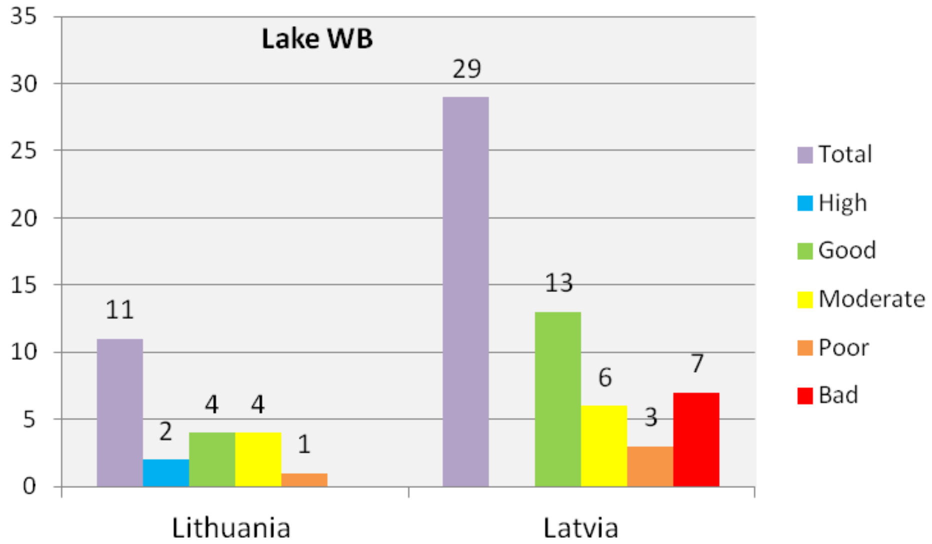

Figure 4.1.7. Ecological quality status of lake and pond WB in the Venta RBD, number.

Relative proportion of lake WB at different quality ranks in both countries is shown in the Figure 4.1.8.

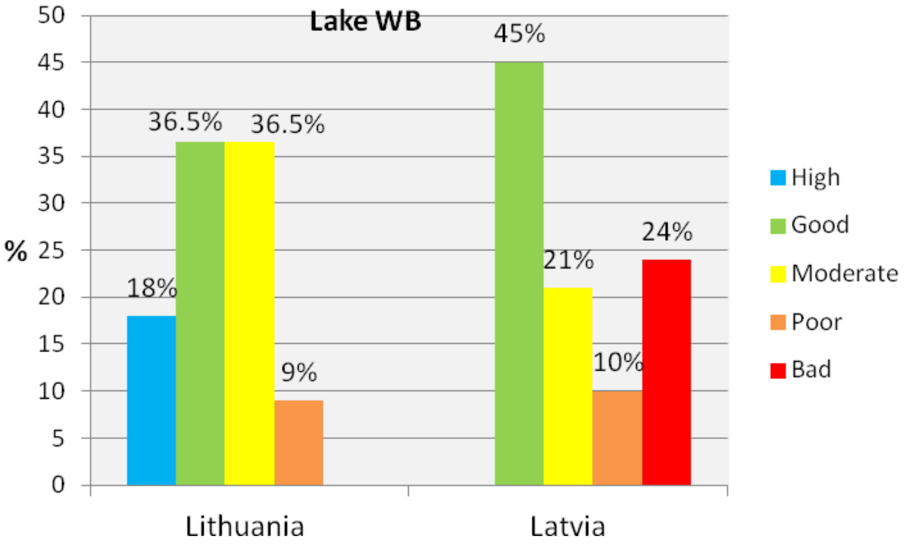

Figure 4.1.8. Relative proportion of lake and pond WB at different ecological quality classes within the Venta RBD.

Regarding HMWB in the category of lakes and ponds in Lithuania **1** HMWB meets the requirements for *maximum* ecological potential, **3** are at *good* ecological potential and **3** - at *moderate* ecological potential as well as **2** water objects – at *poor* ecological potential (Ubiškes pond and Lake Biržulis) (Fig. 4.1.9). In its turn, Latvia has delineated only **one** lake HMWB – Lake Liepāja being at poor ecological potential due to high Ntot concentration in the water.

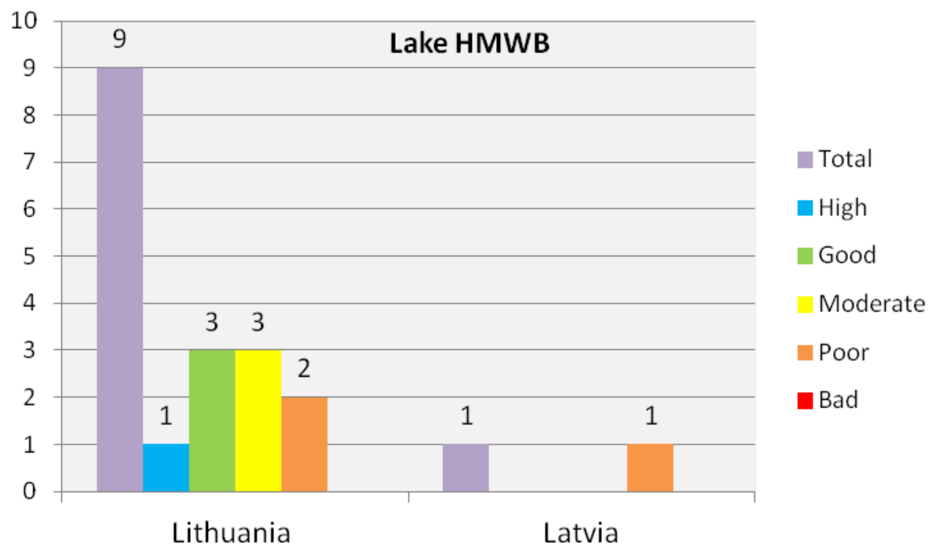

Figure 4.1.9. Ecological potential of lakes and ponds concerning HMWB in the Venta RBD, number.

Totally, 50 % of delineated Lithuanian lake and pond WB and HMWB does not meet at least good quality criteria (Fig. 4.1.10). In Latvia lake water objects with incompatible water quality are even more than 50 %.

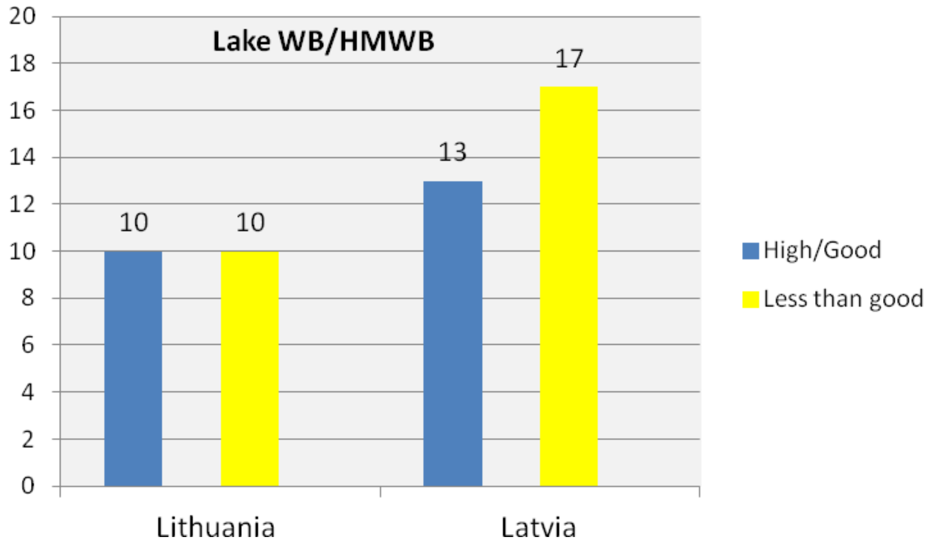

Figure 4.1.10. Compatibility of lake and pond WB and HMWB with at least good quality requirements within the Venta RBD, number.

Comparison of all lake and pond water objects within Venta RBD in relation to their quality ranks in both countries is reflected in the Figure 4.1.11.

Summary of ecological quality / ecological potential of rivers` and lakes` (ponds`) WB as well as HMWB is provided on the map in the Figure 4.1.12. In its turn, in the Figure 4.1.13 the ecological quality (potential) of cross border water bodies is reflected in a more detailed way.

It must be stressed that the ecological quality assessment of WB based on Venta RBD management plans in both countries and given here shall be considered as provisional because a very limited number of biological quality elements have been implemented in the national assessment schemes and used up to now (see detailed information in the chapter 3.5). In Latvian rivers Saprobity index of zoobenthos as well as chlorophyll a concentration and phytoplankton biomass in lakes but in Lithuania – Danish Stream Fauna Index of zoobenthos and Lithuanian Fish Index in rivers as well as chlorophyll a concentration in lakes are covered. Besides, direct monitoring observations not in all WB were available. Lithuania used grouping possibility in relation to similar river WB by means of 51 monitoring stations reflecting quality status in all 104 WB. In its turn, in 27 Latvian river WB as well as in 8 lake WB the assessment was made based on expert judgment. Available anthropogenic pressure information and land use patterns have been taken into account.

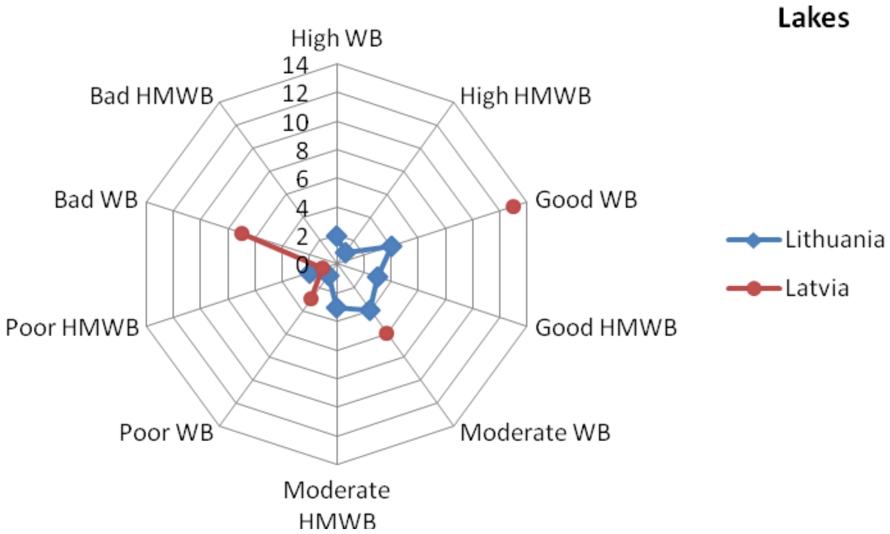

Figure 4.1.11. Comparison of all quality classes in relation to lake and pond WB and HMWB within the Venta RBD in Latvia and Lithuania, numbers.

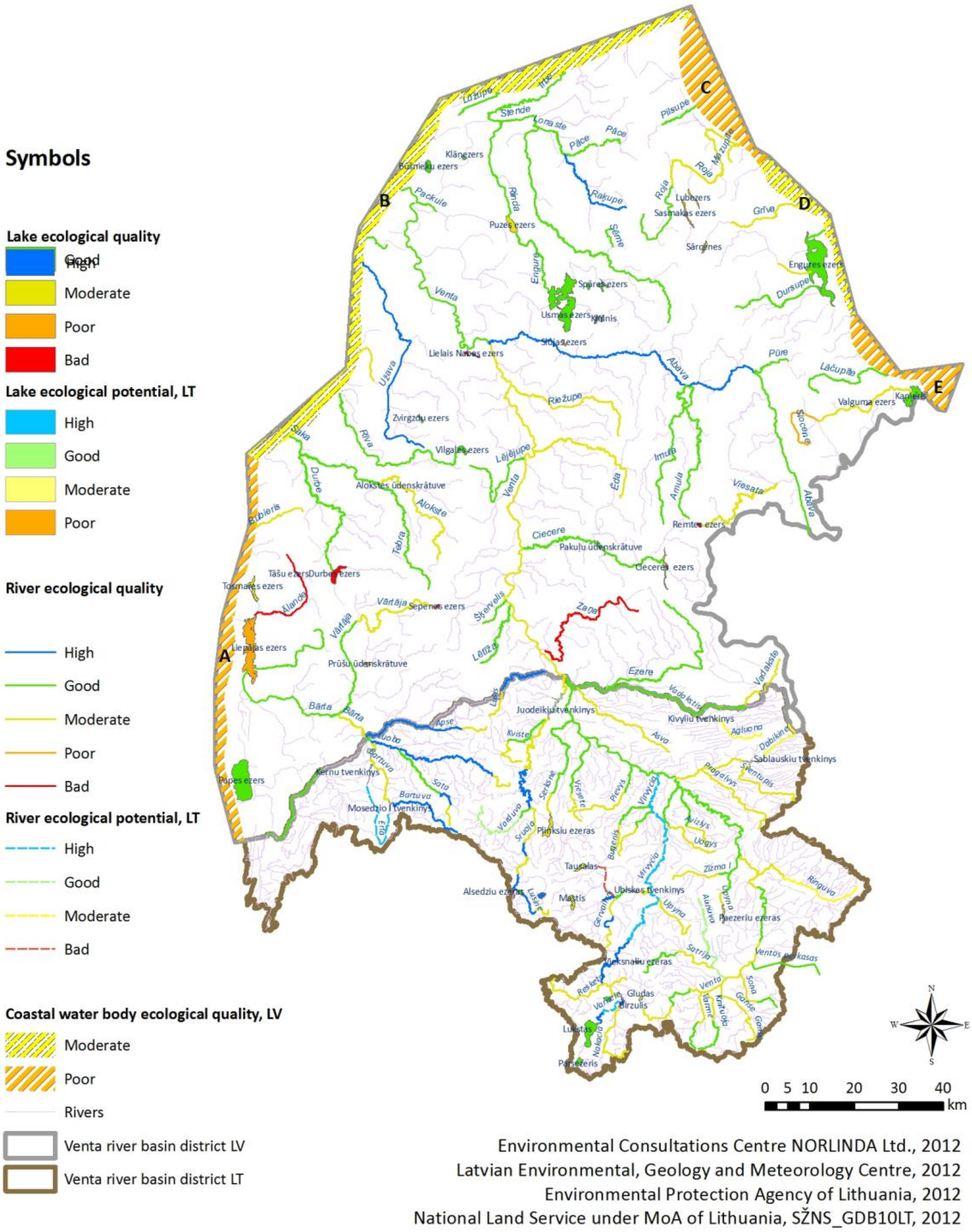

Figure 4.1.12. Summary of ecological quality and ecological potential of WB and HMWB within the Venta RBD.

In addition to ecological quality of surface water the chemical status is assessed as well determining whether the average concentration of hazardous substances in aquatic environment does not exceed the ceilings set out in regulatory enactments. If the threshold is not exceeded, the chemical quality is considered as good, but if it is exceeded - as poor. First of all, monitoring should be carried out in WB where the contaminants could be discharged in significant quantities (from production of wastewater or from intensively cultivated agricultural lands).

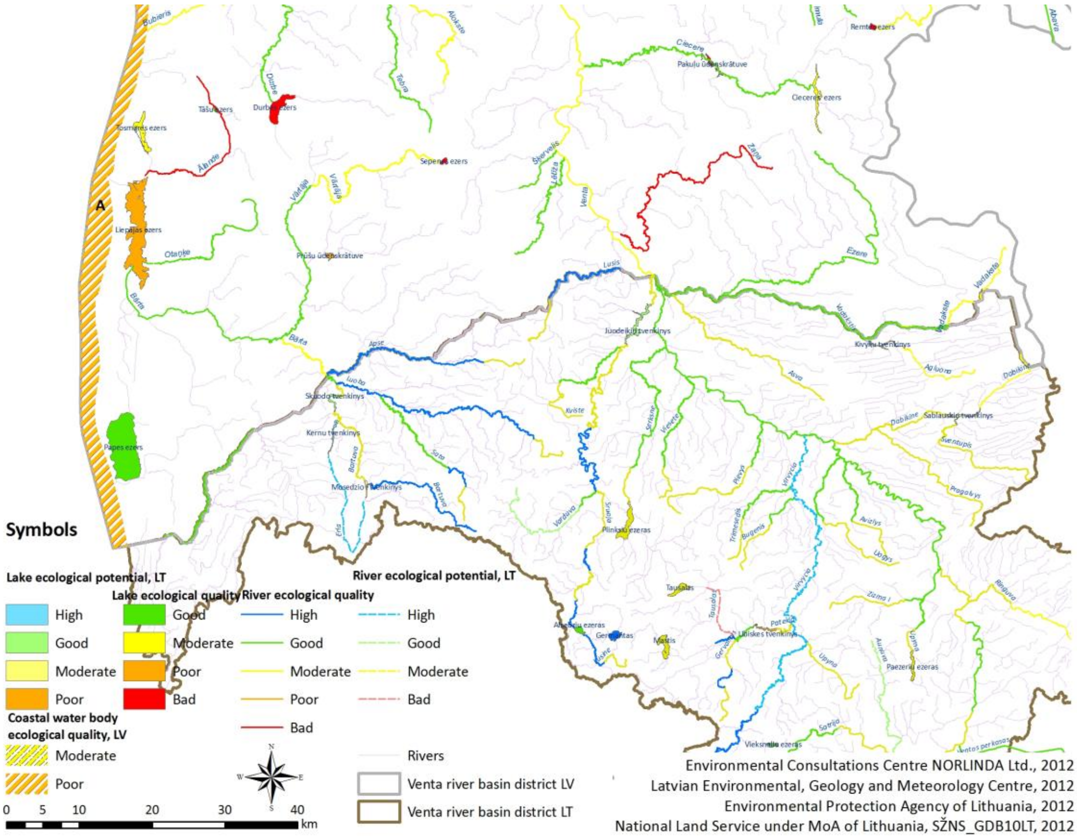

Figure 4.1.13. Summary of ecological quality and ecological potential of cross border WB and HMWB within the Venta RBD.

Following the provisional water quality monitoring data, concentrations of specific pollutants (hazardous substances and priority hazardous substances) exceeded the allowable norms in six places in Lithuania: in the Venta downstream of Mažeikiai, in the Varduva at Grieža, in the Ašva at the Latvian border, in the Virvyte at Janapole, in the mouth of the Šventoji and in the Bartuva upstream of Skuodas. Later, however, no significant pollution with specific pollutants was registered in the mentioned places. Accordingly, the available monitoring data are not sufficient to prove that the rivers are currently failing good chemical status.

More or less permanent monitoring of hazardous substances in Latvia was done from 2006 to 2008 in 8 Venta RBD water bodies - Bārta (V006 HM, V010), Saka (V013 HM), Venta (V027, V043, V056), Amula (V035) and Irbe (V068), where it is required by the Helsinki Convention, the ICP - Water Program[1] or Decision 77/795/EEC on the water monitoring information exchange in the EU. The measurement frequency was 4-6 times per year. In its turn, none of the lake water bodies was monitored with respect to dangerous and especially dangerous substances. For assessment of chemical quality regarding dangerous and especially dangerous substances the mean annual concentrations in 2006 and 2007 as well as older data

[1] The objective of ICP-Water program is to assess water acidification processes in lakes and rivers and its geographical distribution http://www.icp-waters.no/

from 2003-2005 have been used[2]. Since the annual average concentrations with respect to the threshold for dangerous substances in the Latvian part of Venta basin have not been exceeded, the chemical quality of WB is assessed as good.

List of water bodies with water quality characterization is given in the Annex 1.

References

1. Latvijas Vides, ģeoloģijas un meteoroloģijas centrs. Ventas baseina apgabala apsaimniekošanas plāns. 2009. http://www.meteo.lv/public/29935.html (accessed on 16 January 2012).
2. Venta river basin district management plan. Approved by Resolution Nr. 1617 of the Government of the Republic of Lithuania of 17 November 2010. http://vanduo.gamta.lt/files/Venta%20river%20management%20plan.pdf (accessed on 16 January 2012).
3. J. Kalvāns. Bīstamas vielas iekšējos virszemes ūdeņos. LVĢMA, 2007.
4. J. Frīdmanis. Par situāciju ar bīstamo un prioritāro vielu emisiju ūdenī. LVĢMA, 2008.

4.2. Cross-checking of the ecological quality of transboundary water bodies in the Venta RBD

Transboundary water bodies within the Venta RBD are described in the chapter 3.2. There are **10** transboundary river bodies on the Lithuanian side and **7** river bodies on the Latvian side of the RBD. For the common understanding of actual quality of water bodies which is the first step for planning of joint actions in relation to transboundary water bodies it is important to compare classification systems and criteria for ecological quality assessment (see chapter 3.5) and to come to harmonized approaches and methodologies. The starting point of that is to suggest a harmonized ecological typology of surface water (see chapter 14). Cross-checking of the quality of transboundary water bodies using in parallel assessment criteria developed in both countries provides background for further intercalibration of methods and agreement on common quality class boundaries expressed in numerical form. This exercise shall be inevitable constituent part of elaboration of international river basin management plan.

In the beginning stage the cross-checking is based only on the data available in both countries with respect to a certain time period, and here the following assumptions should be made:

- the data shall be of appropriate quality originated from adequate water or bottom sediments` sampling – concerning hydrochemistry normally sampling of **12 times per year** (each month) or at least not rarely than **4 times per year** but distributed evenly during the year and covering all seasons;

[2] Source: Compilation „Bīstamas vielas iekšējos virszemes ūdeņos" (J. Kalvāns, LVĢMA, 2007), „Par situāciju ar bīstamo un prioritāro vielu emisiju ūdenī" (J. Frīdmanis, LVĢMA, 2008)

- the sampling for biological quality elements shall be comparable, id est., using the same or close methods; especially this point is crucial for sampling of zoobenthos;
- time spans of comparisons between countries shall be the same as weather conditions of the particular year play important role;
- parameters used and expressed as numerical values as well as included in the quality classification system of both countries can be compared only.

Taking into account the assumptions mentioned, first of all, the following parameters shall be discarded applied in one country merely – Lithuanian Fish Index (not implemented in Latvia), nitrate nitrogen (NO_3-N) (not included in the Latvian classification system) and phosphate phosphorous (PO_4-P) (not included in the Latvian classification system).

As regards the assessment of river quality by means of macrozoobenthos, Latvia and Lithuania uses different methods, namely, Danish Stream Fauna Index in Lithuania and original Saprobity Index method in Latvia, with quite different sampling of bottom sediments and differing level of determination of organisms. Following, the list of organisms or groups of organisms cannot be objectively cross-checked by application of each others` methods. Based on these considerations, only the following hydrochemical parameters for the cross-checking of the quality of transboundary river water bodies were used: **ammonium nitrogen** (NH_4-N), **total nitrogen** (Ntot), **total phosphorous** (Ptot), **biological oxygen demand** (BOD) and **dissolved oxygen (**O_2). BOD can be determined during 5 (expressed as BOD_5) or 7 days (expressed as BOD_7). The former is the case in Latvia but the latter – in Lithuania.

According to the suggested harmonization of ecological typology outlined in the chapter 14, the following postulations with respect to similar river types were made: LT Type 1 = LV Type 2; LT Type 2 = LV Type 4; LT Type 3 = LT Type 3; LT Type 4 and 5 = LV Type 6. Besides, recalculation from BOD_5 to BOD_7 and vice versa was done applying the formula proposed by Kjellén and Andersson (2002)[3]. According the mentioned authors, the relation between BOD_5 and BOD_7 can be determined as $BOD_5=60/70*BOD_7$ or $BOD_5=0.857*BOD_7$.

With regard to comparable time periods, the analysis of actual water monitoring is carried out. In 2010 and 2011 a very limited amount of monitoring has been executed in Latvia covering **10** river stations within the Venta RBD at all. **2-3** of them are transboundary river water bodies. More stations were covered in 2009 including a bit more transboundary river water bodies, **27** and **4**, respectively. Unfortunately, the monitoring data from 2009 and 2010 must be discarded due to limited and irregular sampling frequency (in 2009 only in the first half of the year and in 2010 – only from July to October) giving biased assessment. In 2011 the sampling was even infrequent - 3 times per year however rather well distributed over the year. Subsequently, the years 2007 and 2008 with normal sampling frequency (4-12 times per year) and good distribution over the year were chosen for cross-checking exercise of transboundary water bodies in the Venta RBD. Latvian and Lithuanian river water bodies were assessed according to classification criteria of each other. The results of assessment are summarized in the Tables 4.2.1 and 4.2.2. It should be stressed that

[3] In: Malin Jonasson. Industrial Electrical Engineering and Automation. Energy Benchmark for Wastewater Treatment Processes - a comparison between Sweden and Austria. 2007.

mean annual concentrations are used and the final ecological quality of river water bodies is determined using the principle "one out, all out".

The assessment reveals that in the case of **7** Latvian transboundary river water bodies evaluated by **dissolved oxygen**, **biological oxygen demand** and **ammonium nitrogen** both Latvian and Lithuanian criteria are giving the same class of ecological quality interpreted as "high" or "good". Applying the principle "one out, all out" the final quality of cross border rivers is usually determined by concentrations of **total nitrogen** or **total phosphorous**. In relation to water bodies *Vadakste* (V062 and V066), *Venta* (V056) in 2007 and *Ezere* (V063) the "good" or "moderate" quality relies on elevated concentration of **total nitrogen**. In other instances (*Bārta* (V010), *Apše* (V011), *Venta* (V056) in 2008 and *Vadakste* (V066) in 2008 the final quality is resulted from data on **total phosphorous**.

Generally, ***application of Lithuanian criteria in relation to total phosphorous is giving better assessment than Latvian ones***. This is the case in 7 occasions out of 9. The difference is even two classes between "moderate" (Latvian assessment) and "high" (Lithuanian assessment) in 2 instances related to Bārta River (V010). It must be said that in 2008 the differing phosphorous estimation constitutes the final assessment. Only sporadically the inconsistency occurs in the case of total nitrogen. It should be remembered that Lithuania applies the same class boundaries for all hydrochemical parameters with exception to dissolved oxygen what is not the case in Latvia.

Additionally, the conclusions outlined above are supported by cross-checking of Lithuanian transboundary river water bodies both by Lithuanian and Latvian criteria (Tab. 4.2.2). Mostly the discrepancy occurs with respect to total phosphorous but in some cases it is observed regarding total nitrogen also. Latvia has more stringent quality criteria with regard to mentioned parameters. On the contrary, ***in relation to dissolved oxygen Lithuanian criteria are stronger than the Latvian ones giving poorer assessment in the range of lower concentrations***.

Table 4.2.1

Latvian Venta RBD cross border river water bodies – comparison of Latvian and Lithuanian ecological quality assessment criteria

Water body	Type	Year	O_2, mg/l		BOD_5, mg O_2/l	BOD_7, mg O_2/l *	NH4-N, mg/l		N_{tot}, mg/l		P_{tot}, mg/l		Final ecological quality (LV / LT)
Sventāja (V001)	4	2007	-		-	-	-		-		-		Good / -
		2008	8.39		1.75	2.04	0.052		1.47		0.049		High / High
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	1	1	1	1	1	1	1	1	
Bārta (V010)	5	2007	9.02		1.33	1.55	0.063		2.14		0.073		Moderate / Good
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	1	1	1	1	2	2	3	1	
		2008	9.59		1.89	2.21	0.046		1.68		0.086		Moderate / High
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	1	1	1	1	1	1	3	1	
Apše (V011)	3	2007	-		-	-	-		-		-		Good / -
		2008	9.28		1,50	1.75	0.053		1.69		0.075		Good / High
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	1	1	1	1	1	1	2-3	1	
Venta (V056)	6	2007	9.81		1.45	1.69	0.059		3.27		0.069		Moderate / Moderate
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	1	1	1	1	3	3	2	1	
		2008	9.41		1.50	1.75	0.070		2.69		0.080		Good / Good
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	1	1	1	1	2	2	2	1	

Table 4.2.1 (continued)

Water body	**Type**	**Year**	**O_2,** mg/l		**BOD_5,** mg O_2/l	**BOD_7,** mg O_2/l *	**NH4-N,** mg/l		**N_{tot},** mg/l		**P_{tot},** mg/l		**Final ecological quality** (LV / LT)
Vadakste (V062)	5	2007	-		-	-	-		-		-		Good / -
		2008	9.85		1.42	1.66	0.054		2.92		0.040		Moderate / Good
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	1	1	1	1	3	2	2	1	
Ezere (V063)	4	2007	-		-	-	-		-		-		Good / -
		2008	8.46		2.13	2.49	0.067		2.04		0.049		Good / Good
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	2	2	1	1	2	2	1	1	
Vadakste (V066)	6	2007	-		-	-	-		-		-		Moderate / -
		2008	8.78		2.54	2.96	0.061		2.62		0.045		Good / Good
			LV	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	
			1	1	2	2	1	1	2	2	2	1	

Notes: a) in the case of lacking data the assessment was done by expert judgment; b) in the case of non-coincidence in assessment between countries the figures are given in red

LV – Latvia, LT – Lithuania; 1 – high quality, 2 – good quality, 3 – moderate quality
*Calculated value

Table 4.2.2

Lithuanian Venta RBD cross border river water bodies – comparison of Lithuanian and Latvian ecological quality assessment criteria

Water body	Type	Year	O_2, mg/l		BOD_7, mg O_2/l	BOD_5, mg O_2/l *	NH4-N, mg/l		N_{tot}, mg/l		P_{tot}, mg/l		Final ecological quality (LT / LV)
Šventoji (LT700108102)	2	2007	10.7		2.63	2.25	0.104		1.78		0.061		Good / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	2	2	2	1	1	1	1	2	
		2008	10.43		2.66	2.28	0.055		1.31		0.048		Good / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	2	2	1	1	1	1	1	1	
Bartuva (LT800120103)	3	2007	10.82		2.58	2.21	0.076		1.58		0.099		Good / Moderate
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	2	2	1	1	1	1	1	3	
		2008	10.86		2.72	2.33	0.071		1.30		0.058		Good / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	2	2	1	1	1	1	1	2	
Apšė (LT800121702)	3	2007	9.10		2.8	2,4	0.068		0.870		0.035		Good / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	2	2	1	1	1	1	1	1	
Lūšis** (LT300114301)	1	2007	9.10		1.9	1.63	0.066		1.60		0.057		High / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	1	1	1	1	1	2	1	2	
Lūšis** (LT300114302)	1	2007	9.10		1.9	1.63	0.066		1.60		0.057		High / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	1	1	1	1	1	2	1	2	

Table 4.2.2 (continued)

Water body	**Type**	**Year**	**O_2**, mg/l		**BOD_7**, mg O_2/l	**BOD_5**, mg O_2/l *	**NH4-N**, mg/l		**N_{tot}**, mg/l		**P_{tot}**, mg/l		**Final ecological quality** (LT / LV)
Varduva (LT300113104)	3	2007	9.25		2.09	1.79	0.059		2.10		0.059		Good / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	1	1	1	1	2	2	1	2	
		2008	10.11		1.46	1.25	0.044		2.22		0.063		Good / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	1	1	1	1	2	2	1	2	
Venta*** (LT300100018)	5	2007	9.40		2.10	1.80	0.048		3.42		0.070		Moderate / Moderate
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	1	1	1	1	3	3	1	2	
		2008	9.95		1.64	1.41	0.067		2.88		0.073		Good / Moderate
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			1	1	1	1	1	1	2	3	1	2	
Vadakstis** (LT300111702)	2	2007	5.70		1.5	1.29	-		4.0		0.075		Moderate / Moderate
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			3	2	1	1	-	-	3	3-4	1	2	
Vadakstis** (LT300111701)	1	2007	5.70		1.5	1.29	-		4.0		0.075		Poor / Poor
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			4	2	1	1	-	-	3	4	1	2	
Dabikinė (LT300106101)	1	2007	6.40		2.30	1.97	0.099		1.60		0.079		Moderate / Good
			LT	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	**LT**	**LV**	
			3	2	2	1	1	1	1	2	1	2	

Note: a) in the case of non-coincidence in assessment between countries the figures are given in red
LT – Lithuania, LV – Latvia; 1 – high quality, 2 – good quality, 3 – moderate quality
*Calculated value; **one monitoring point applies to the both water bodies of the same river; ***is characterized by the point below Mažeikiai

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4.3. Sea coastal water

Similar to lakes and rivers, ecological assessment of coastal waters is based on five classes, but the chemical quality assessment – on two classes. In assessing the ecological quality of coastal waters in **Latvian** part, for water bodies (WB) **A** and **B** monitoring data from 2004 and 2007 are used, but for the WB **C**, **D** and **E**, where the amount of information available is greater– data from 2001 - 2006. 2007 unusually warm winter caused the situation that the soil during the cold months was not frozen, followed by a dry 2006 summer when the plants were not able to make full use of soil nutrient stocks. As a result, nutrients from the soil were washed into the sea and showed unusually high levels in marine water. Consequently, the 2007 observation data are not taken into account. WB **A** according to its overall environmental quality can be judged as *poor* (Fig. 4.3.1). It is mainly determined by cross-border transfer of nutrients as a result of biogenic-rich water entering the sea in the Latvian coastal part from the Curonian Lagoon, the Klaipeda and Palanga wastewater treatment plants forming pronounced pollution gradient from south to north. A secondary reason is the generally medium environmental quality of the Baltic Sea as such. However, the chemical quality of the water body A is assessed as good, because the observed concentrations of heavy metals in tissues of living organisms are in the range usually determined in the Baltic Sea.

Concerning water bodies **B** and **C**, the total environmental quality can be judged as *medium*, but the chemical quality - as good. Quality of these water bodies are determined mainly by the overall state of the Baltic Sea.

Water body **D** is affected by Riga Gulf, and the environmental quality of it has been assessed as *poor*, while its chemical quality is good. In its turn, water body **E** is influenced by adjacent transition waters, but the currently limited amount of data makes it impossible to quantitatively assess it. Its environmental quality is presumed to be *bad*, but the chemical quality- good.

The **Lithuanian** coastal rivers` basin, waters of which enter the Curonian Lagoon in the Baltic Sea and into the coastal waters of the Baltic Sea, was assigned to the Nemunas RBD and not to the Venta RBD because it affects the quality of the Lithuanian coastal waters in the way the Nemunas river basin does. Accordingly, no one sea coastal water body is counted to the Lithuanian part of Venta RBD.

Nevertheless, the Lithuanian coastal WB “Open Baltic Sea stony coast” borders with the Latvian coastal WB **A** - “Baltic south eastern open stony coast”, and the ecological quality of both of them is assessed as “poor”.

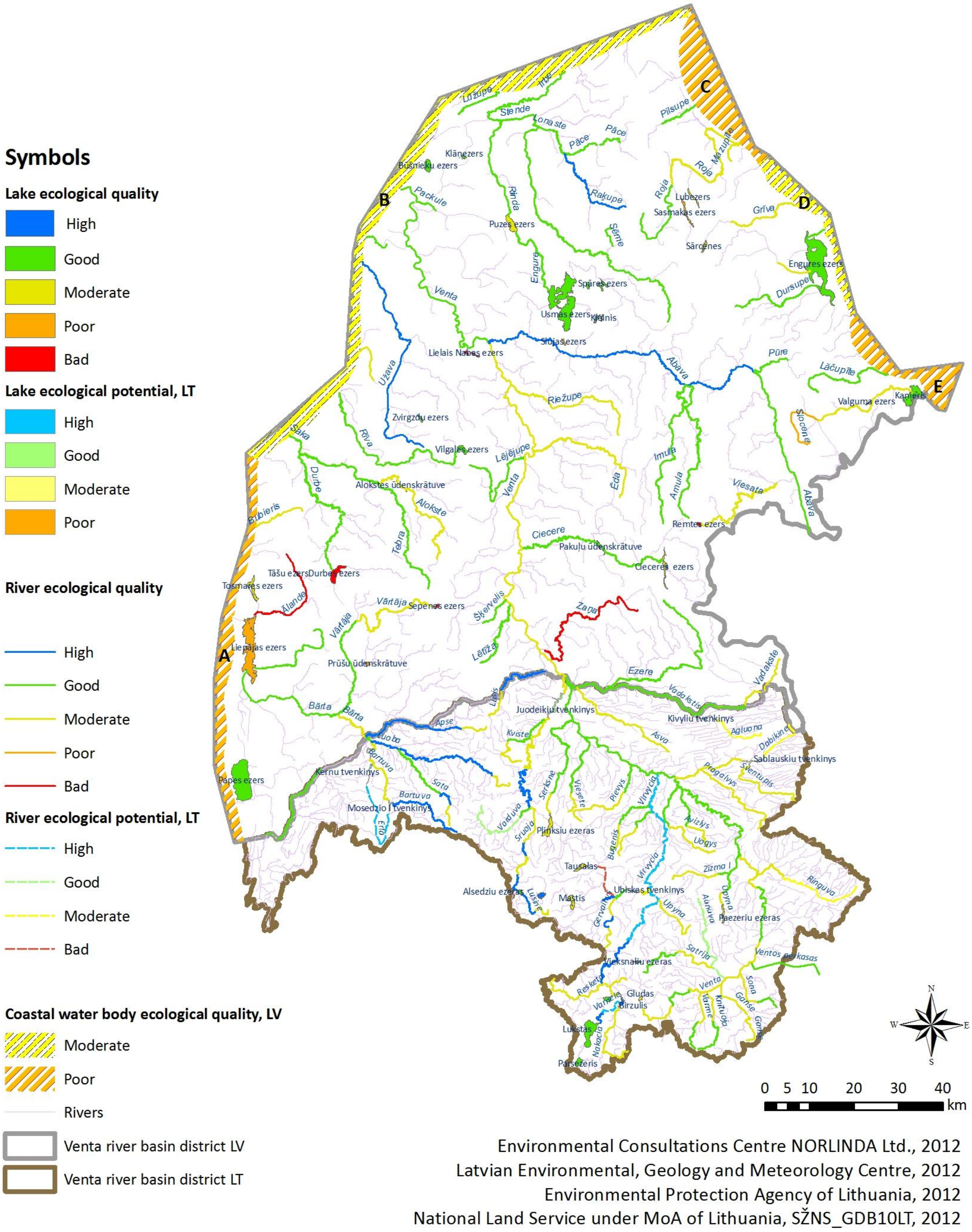

Figure 4.3.1. Preliminary assessment of ecological quality of sea coastal WB in the Latvian part of Venta RBD in the context of surface water quality in the RBD.

References

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4.4. Groundwater

In **Lithuania** there is one groundwater body (GWB) in the Venta RBD – the Venta GWB of Permian-Upper Devonian deposits. Its boundaries coincide with the boundaries of the Venta RBD (Fig. 4.4.1). The *quantitative status* of the groundwater body and well fields is good because the groundwater resources are much more abundant than the current or planned groundwater abstraction.

Also Venta RBD in the **Latvian** part of the territory is well endowed with groundwater for drinking water supply. The *quantitative status* of GWB is good. Problems with groundwater quantity are only in the city of *Liepāja* as well as in the northern part of GWB D2 and D3. In *Liepāja district* the total amount of water supply in the last century exceeded the natural resources of the related horizon, resulting in sea water intrusion into the layer. Also today a possible increase in water consumption is a risk of development of repeated regional depression. In their turn, in relation to northern part of groundwater bodies D2 and D3 the observed scarcity of water resources is due to the nature of the geological structures.

The *qualitative status* of the well fields in the Venta RBD in **Lithuanian** part is also good. Starting from the eastern periphery of the district, Upper Permian (P_2) and Upper Devonian-Famenian (D_3fm) aquifers, otherwise called Žagare aquifers, are situated in the Venta RBD. These aquifers contain groundwater of high quality which is exploited by practically all well fields in the Venta RBD. Water of high quality in Žagare ($D_3žg$) aquifers is contained in fissured dolomite, and further westwards – also in fissured limestone of Upper Permian (P_2) deposits. There is only one problem related to the quality of groundwater, which is of natural origin – the so-called anomaly of fluorides. The anomaly is spread westwards from *Mažeikiai* up to the Baltic Sea and southwards nearly up to *Telšiai* where the concentration of this toxic indicator often exceeds the critical threshold value of 1.5 mg/l (Fig. 4.4.2).

Generally, the *groundwater quality* of the Venta basin in the **Latvian** part can be assessed as good, too (Fig. 4.4.3). In the area of water aquifers no chemical trends in artesian water have been identified with exception of the urban area of central part of *Liepāja* (this area is less than 0.1% of the total basin area) where elevated concentrations of chlorides have been found. Likewise, contaminated groundwater found in small local areas around point sources as well as diffuse pollution is not regionally distributed and is concentrated in the same upper groundwater layers, for example, some nitrates` pollution is detected in the upper groundwater layer up to 5 m depth.

A natural problem related to groundwater quality in Venta RBD like in many other places in Latvia is high iron concentration as well as elevated content of ammonia, manganese and sulfates in some areas giving rise to problems concerning drinking water quality and its acceptability for consumers.

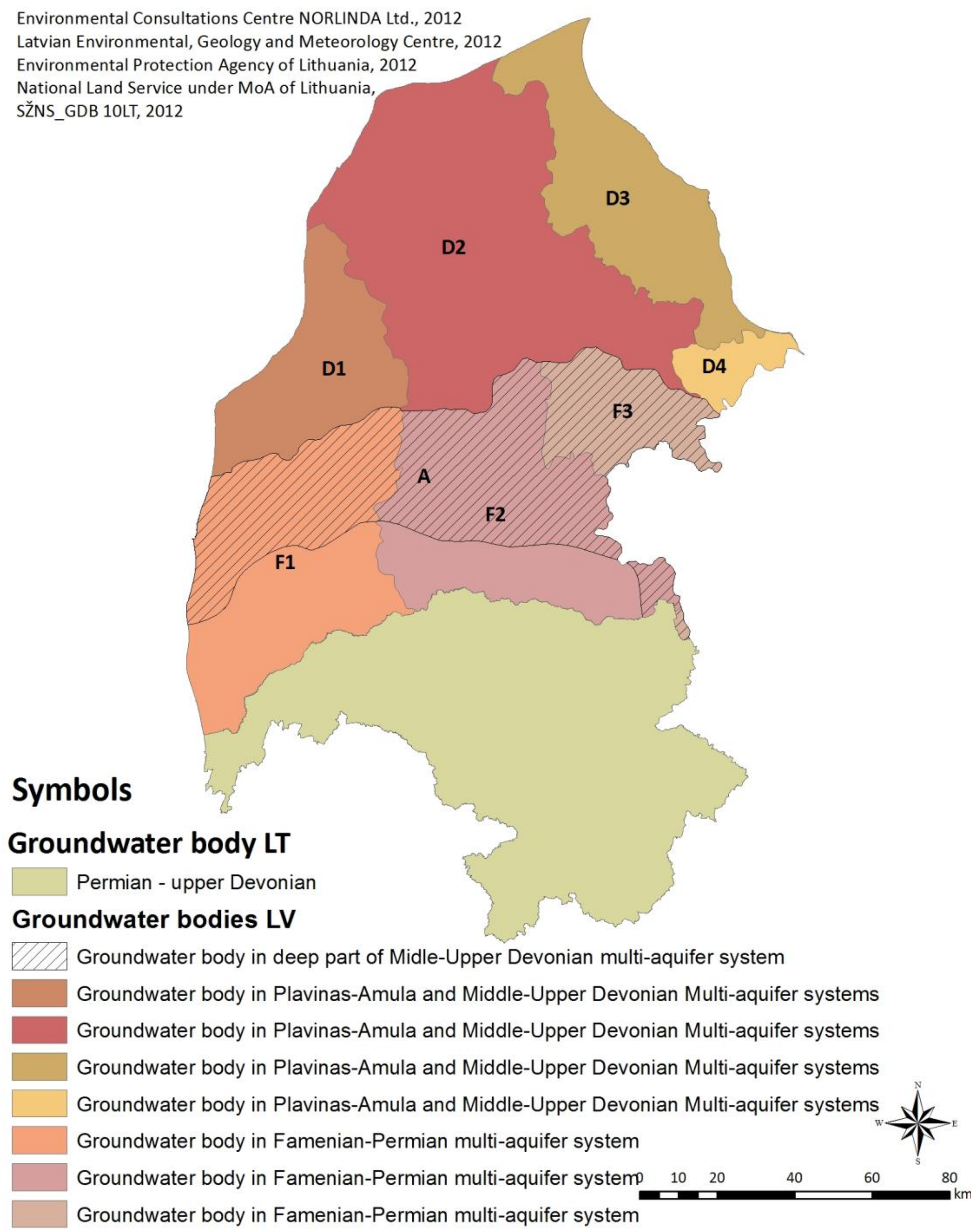

Figure 4.4.1. Groundwater bodies in the Venta RBD.

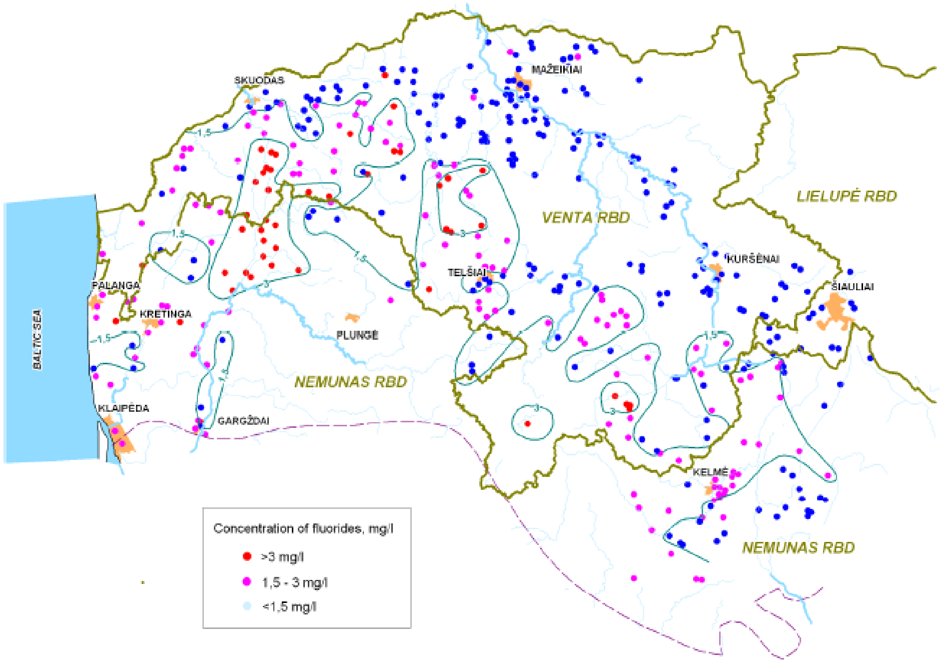

Figure 4.4.2. Anomaly of fluoride in the Upper Permian aquifer in the Lithuanian part of Venta RBD.

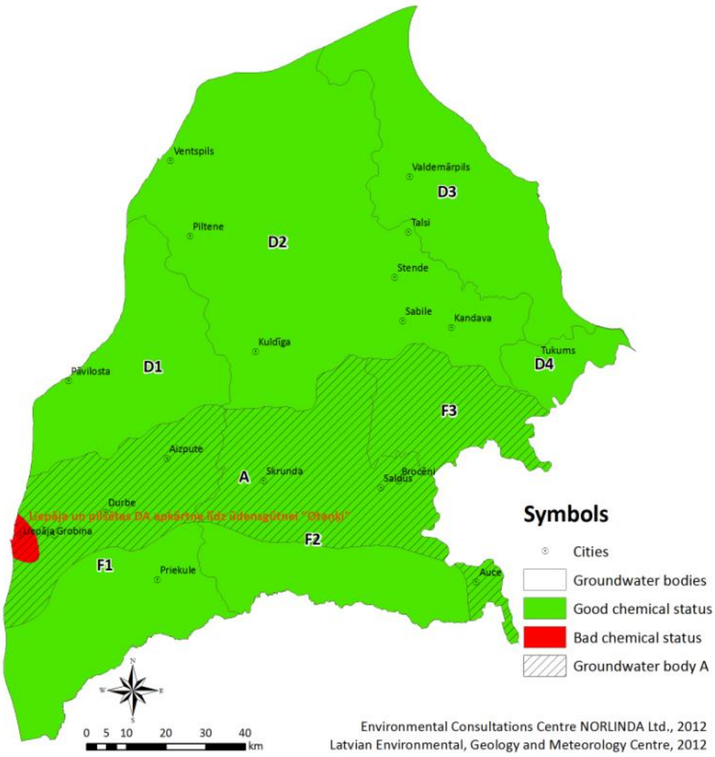

Figure 4.4.3. Qualitative status of groundwater in the Latvian part of Venta RBD.

However data on possible pollution with specific pollutants (pesticides, etc.) are very scarce, groundwater aquifers and artesian groundwater both in Lithuanian and Latvian part of the Venta RBD is well protected in general, since no pollution is envisaged.

References

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5. Water quality characteristics for specific uses and applications

5.1. Bathing water quality

The significance of surface water (rivers, lakes and sea coastal area) for recreational needs as bathing waters cannot be overemphasised. Qualitative bathing sites are very important elements characterizing the general living conditions and quality of life in the community.

According to the EU 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, bathing water is "*any element of surface water where the competent authority expects a large number of people to bathe and has not imposed a permanent bathing prohibition, or issued permanent advice against bathing*". In its turn, "large number" means, in relation to bathers, "*a number that the competent authority considers to be large having regard, in particular, to past trends or to any infrastructure or facilities provided, or other measures taken, to promote bathing*".

According to the Lithuanian Bathing water quality monitoring program for 2009-2011, the bathing place is defined as the beach location for swimming where at the same time the maximum load during the bathing season is at least hundred people. On the contrary, according to the *Latvian Law on water management*, bathing site is a facilitated bathing area where hygienic conditions are met, but the criteria for "a large number of bathers" are not defined. It is seemed that a facilitated bathing area should attract a large number of people and indirectly promote bathing.

According to Directive 2006/7/EC, both in Latvia and Lithuania only the microbiological parameters are detected since 2008 (Fig. 5.1.1). They cover two indicators of fecal pollution merely - *Escherichia coli* and *intestinal enterococci*. Besides, a number of visual observations are carried out during water sampling embracing oil products, floating and other garbage, other visible chemical pollutions as well as potentially mass development of blue-green algae.

Bathing water is classified on the basis of the set of bathing water quality data compiled in relation to the last **four bathing seasons** as follows:

- excellent quality;
- good quality;
- sufficient quality;
- poor quality.

In addition to the requirements laid down by EU legislation which is based on long-term assessment, in both countries an operational assessment of bathing water quality is performed according to national criteria. It means instant assessment of water quality after each sampling case, detecting the total amount of bacteria cells in the water in order to allow bathing, give advice not to bathe or prohibit the bathing if the microbiological pollution is too high

The long-term assessment of bathing water quality is based on statistical analysis of all data obtained during the last four bathing seasons and here 90-percentiles as well as 95-percentiles are playing the role as it is indicated in the Tables 5.1.1 and 5.1.2.

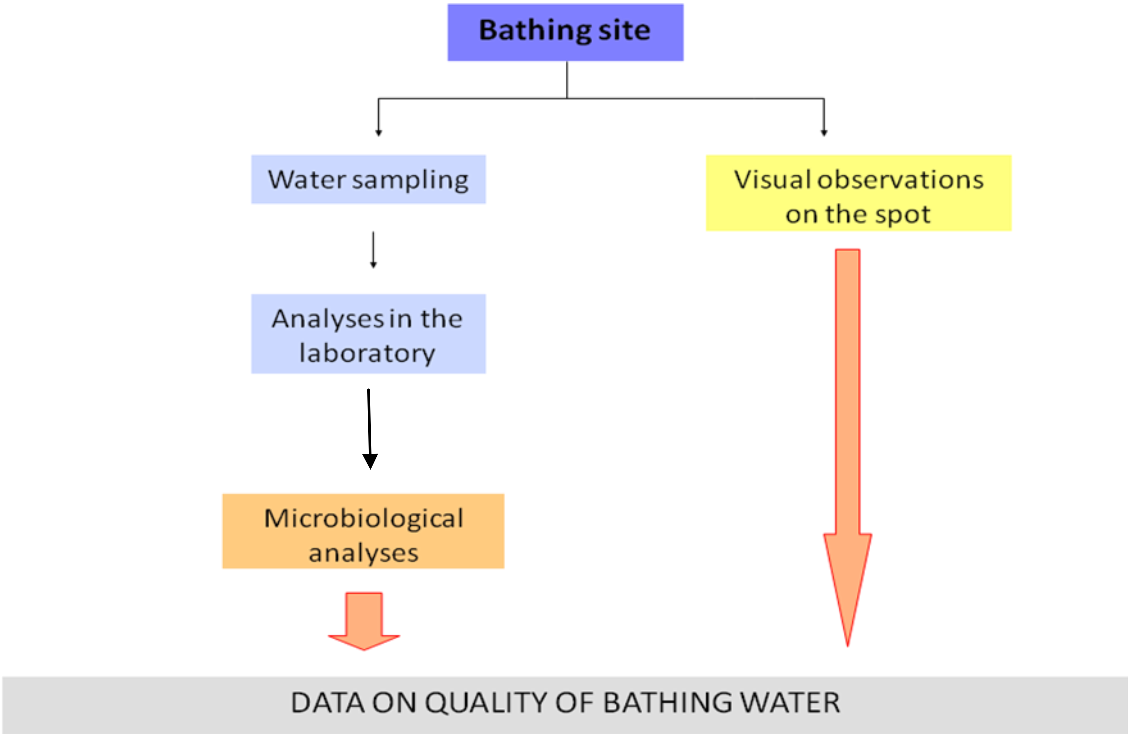

Figure 5.1.1. Scheme for monitoring of bathing water quality.

Table 5.1.1

Criteria for assessment of long-term quality of inland bathing water

	A	B	C	D
	Parameter	Excellent quality	Good quality	Sufficient
1	Intestinal enterococci (cfu/100 ml)	200 (*)	400 (*)	330 (**)
2	Escherichia coli (cfu/100 ml)	500 (*)	1 000 (*)	900 (**)

(*) Based upon a 95-percentile evaluation.
(**) Based upon a 90-percentile evaluation.

Table 5.1.2

Criteria for assessment of long-term quality of sea coastal and transitional bathing water

	A	B	C	D
	Parameter	Excellent quality	Good quality	Sufficient
1	Intestinal enterococci (cfu/100 ml)	100 (*)	200 (*)	185 (**)
2	Escherichia coli (cfu/100 ml)	250 (*)	500 (*)	500 (**)

(*) Based upon a 95-percentile evaluation.
(**) Based upon a 90-percentile evaluation.

Similar to WFD, the goal laid down in the Directive 2006/7/EC is to achieve at least “sufficient” bathing water quality in all bathing places by 2015.

Operational bathing water quality is permanently reported to the public by different means including mass media, internet sites of responsible institutions (Health Inspectorate of Latvia under the Ministry of Health and Centre of health education and prevention of diseases under the Ministry of Health of the Republic of Lithuania[4]), etc. Besides, the bathing water quality in Latvia is visualized by means of Google map technology publishing the map at internet homepage of Health Inspectorate (Fig. 5.1.2). According to the colors of the “balloons” in the map, the bathing water quality is classified as “allowed to bath” (blue), “advice not to bathe” (yellow) or “bathing prohibited” (red).

Comparison of bathing water management and monitoring in Latvia and Lithuania is provided in the Table 5.1.3. Latvia has reduced the number of official bathing places monitored by the Health Inspectorate from 274 (2009) to 46 (2011) but Lithuania has almost not changed the amount of bathing sites in the last years. Some differences with respect to period of bathing season as well as sampling frequencies and organization of monitoring occur. For example, the municipalities in Lithuania are responsible for bathing water monitoring including financing allocated apparently to the budgets of municipalities. On the contrary, the bathing water monitoring in Latvia is performed and financed by the central governmental institution – Health Inspectorate under the Ministry of Health. However, a number of municipalities are choosing to finance additional bathing water monitoring in local bathing sites not included in the official list of national bathing places.

As regards the territory of Venta RBD, there are **17** bathing sites in the Latvian part and **11** sites in the Lithuanian part of the RBD (Fig. 5.1.3). According the long-term assessment with regard to the last four bathing seasons (2008-2011) the water

[4] Since 2011

quality of all bathing sites in the Venta RBD both in Lithuania and Latvia is excellent or good (Tab. 5.1.4). The final assessment is based on the principle “one out, all out”.

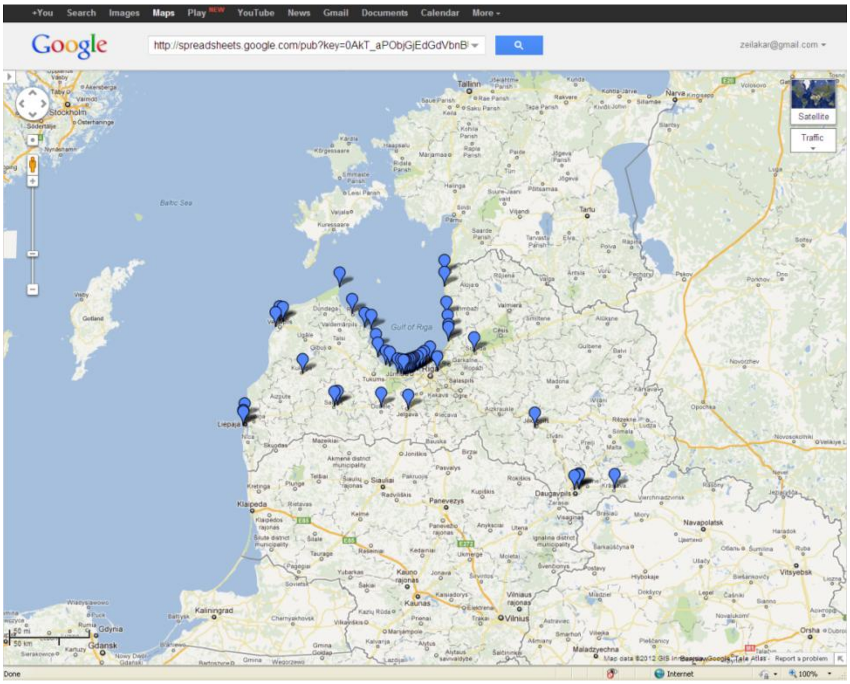

Figure 5.1.2. Visualization of bathing water quality in Latvia.

Table 5.1.3

Bathing water management and monitoring in Latvia and Lithuania

	Latvia (2011)	**Lithuania (2010)**
2006/7/EC introduction year	2008	2008
Number of samples per season	5	7-8
Bathing season	15 May to 15 September	1 June to 15 September
Total number of bathing sites Marine coastal River Lake	**46** 32 3 11	**114** 16 24 74
% from EU sites	~0,2	~0,5
Number of bathing sites in the Venta RBD	17	11
Responsibility about monit.	Health Inspectorate	Municipalities
Number of bathing sites in 2009	**274**	**112**

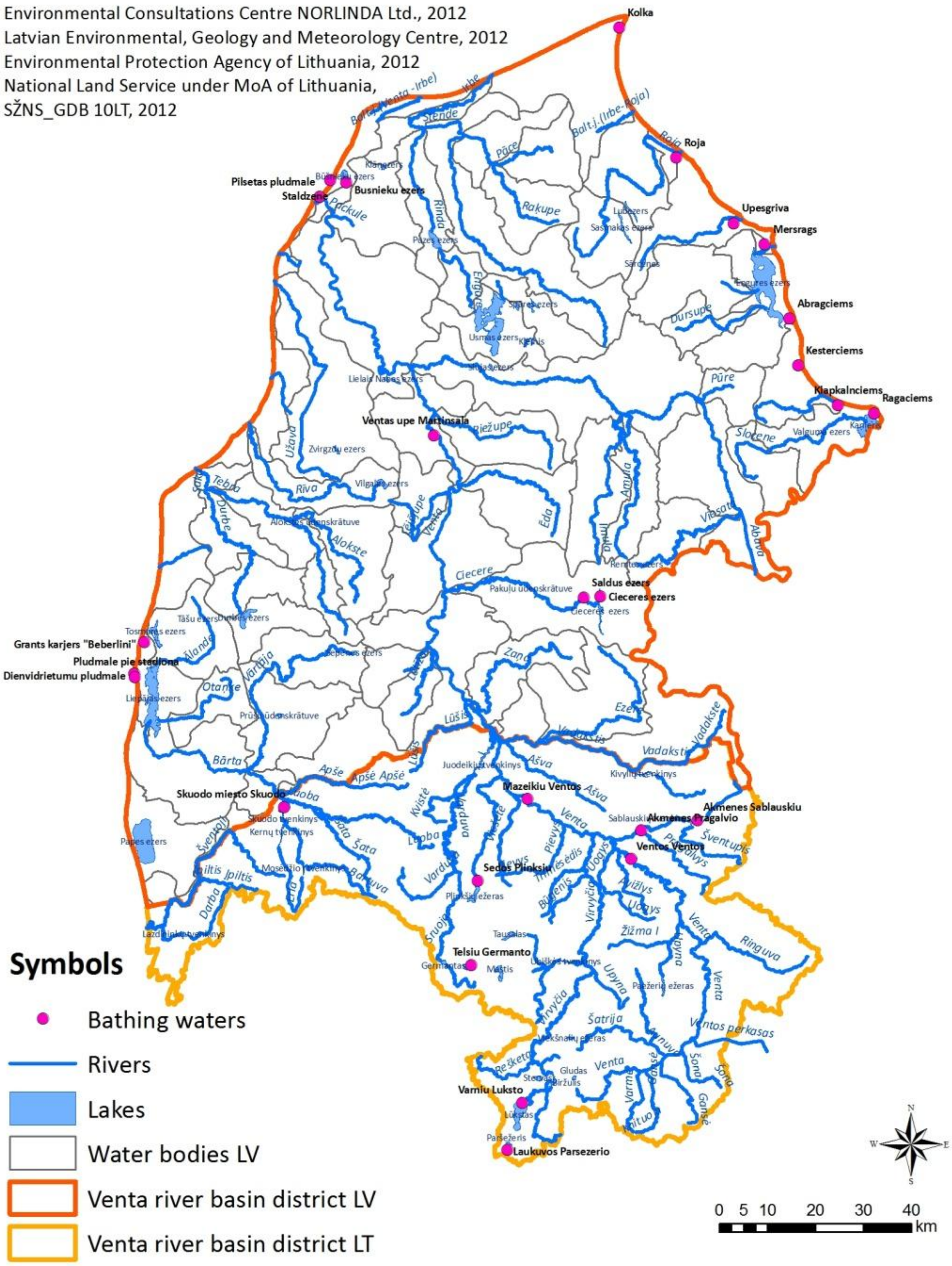

Figure 5.1.3. Location of bathing places within the common Venta RBD.

Table 5.1.4

Long-term quality of bathing places within the Venta RBD (2008-2011)

Bathing site	Quality acc. to 2006/7/EC	
	E.coli	Enterococci
Liepāja beach near the stadium	Good	Excellent
Liepāja South-West beach	Good	Excellent
Water reservoir “Beberliņi”	Good	Excellent
Ventspils beach	Excellent	Excellent
Staldzene beach	Excellent	Excellent
Būšnieku Lake	Excellent	Excellent
Abragciems beach	Excellent	Excellent
Klapkalnciems beach	Excellent	Excellent
Ķesterciems beach	Excellent	Excellent
Ragaciems beach	Excellent	Good
Mērsrags beach	Excellent	Excellent
Upesgrīva beach	Good	Excellent
Kolka beach	Excellent	Excellent
Roja beach	Good	Excellent
Lake Saldus	Excellent	Excellent
Lake Ciecere	Excellent	Excellent
Bathing place on Venta River “Mārtiņsala” in Kuldīga	Excellent	Excellent
Lake Germantas	Excellent	Excellent
Lake Lukstas	Excellent	Excellent
Lake Paršežerisin	Excellent	Excellent
Lake Plinkšių ežeras	Excellent	Excellent
Pragalvys River	Excellent	Excellent
Sablauskių pond	Excellent	Excellent
Skuodo pond	Excellent	Excellent
Venta River in Akmenė	Excellent	Excellent
Venta River in Mažeikiai	Excellent	Excellent
Uzvencio River	Excellent	Excellent
Lake Saukenas	Excellent	Excellent

It can be concluded that there is no significant cross border influence affecting the bathing water quality in Lithuania and Latvia concerning the Venta RBD.

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6. Pressures in the Venta basin

6.1. Point pollution load impact characterization

Point pollution load is caused by objects that discharge pollutants into the waters in one particular place. Typical examples of point sources of pollution are pipes through which settlements or production companies are discharging their wastewater into natural water bodies. In Latvian river basin management plans contaminated sites also are counted to point pollution sources what is not very true as pollution is usually spreading more in a diffusive way. In most cases pollution from point sources directly affects surface water but it can reach groundwater also. Points of wastewater discharges as well as contaminated and potentially contaminated sites within the Venta RBD are displayed in the Figure 6.1.1.

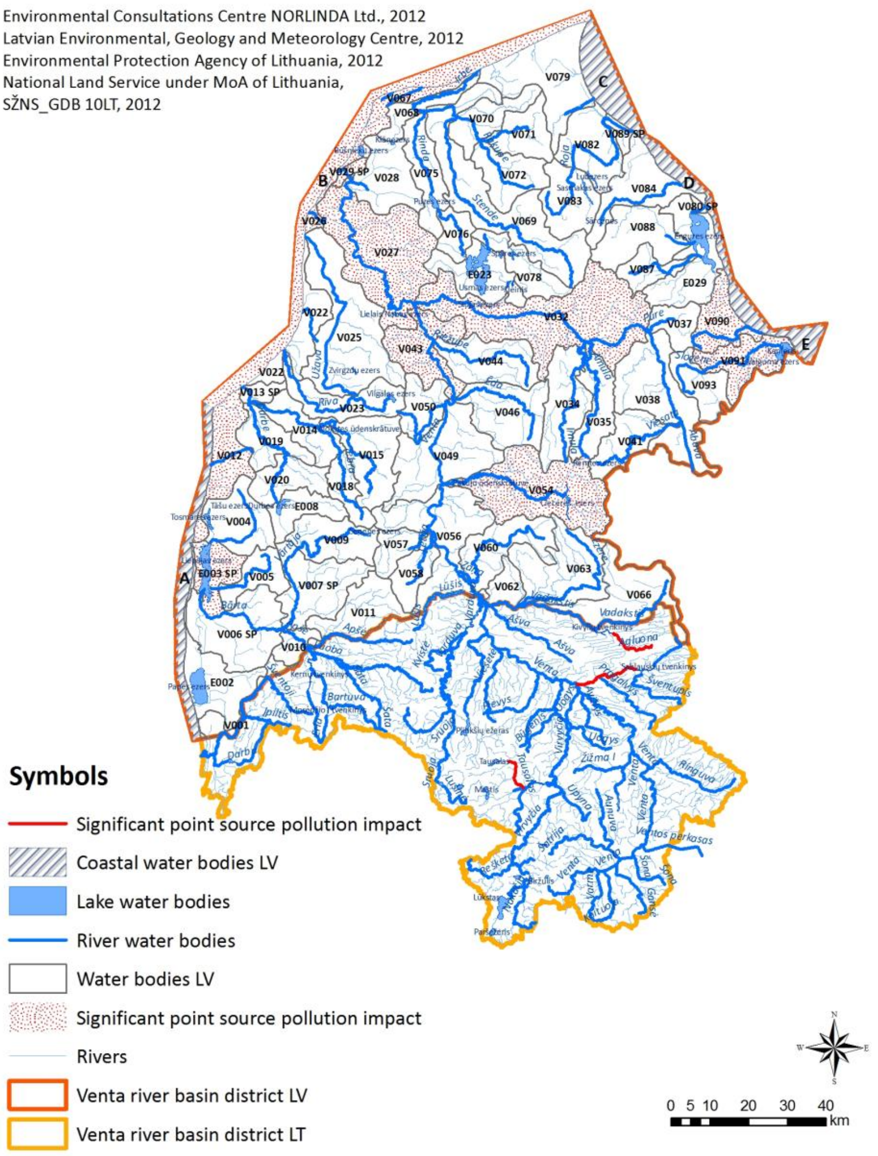

Figure 6.1.1. Impact of point pollution sources and contaminated sites in the Venta RBD.

6.1.1. Lithuania

According to the data provided by the Lithuanian Environmental Protection Agency (LEPA), there were **131** wastewater dischargers in the territory of Lithuania emitting effluents to surface water bodies within the Venta RBD in 2009: **109** outlets were discharging wastewater to surface water bodies of the Venta River basin, **10** – to water bodies of the Bartuva River basin and **12** – to water bodies of the Šventoji River basin.

There are **8** agglomerations within the Venta RBD with a population equivalent (p.e.) of more than 2000: **7** in the Venta River basin and **1** in the Bartuva River basin. Wastewater dischargers of these agglomerations emit the major part of point pollution load.

The major share of urban industrial wastewater enters wastewater treatment plants (WWTP) 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 **8** industrial wastewater outlets in the Venta RBD in 2009: **7** were located in the Venta River basin and **1** in the Šventoji River basin. Industrial wastewater outlets in the Venta River basin cover discharges of **3** fisheries ponds, of **2** companies engaged in waste disposal, of **1** can product production`s company as well as of **1** poultry farm. In its turn, industrial wastewater in the Šventoji River basin is emitted from a brewery. In addition, there are WWTP of two industries in the Venta River basin which treat urban wastewater also. These are WWTP of the oil refinery AB Mažeikių nafta and of Akmenė branch of the milk-processing company AB Pieno žvaigždės.

In 2009 **18.43** tonnes of **BOD_7**, **4.38** tonnes of **ammonium nitrogen**, **9.36** tonnes of **nitrate nitrogen**, **19.36** tonnes of **total nitrogen** and **3.31** tonnes of **total phosphorus** were emitted from the industrial wastewater outlets to the water bodies in the Venta RBD. (Table 6.6.1.) It should be pointed out, however, that the loads from the oil refinery Mažeikių nafta which discharges urban wastewater also accounted for the major part of the mentioned loads, namely, **12.7** tonnes of **BOD_7**, **4.1** tonnes of **ammonium nitrogen**, **9.2** tonnes of **nitrate nitrogen**, **18.2** tonnes of **total nitrogen** and **3.1** tonnes of **total phosphorus**.

According to the LEPA data (2009), there are **54** surface runoff outlets within the Venta RBD: **42** outlets emitting surface runoff to the Venta River basin, **6** – to the Bartuva River basin and **6** – to the Šventoji River basin. The mentioned 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 Venta RBD with surface runoff totals to about **21.88** tonnes of **BOD_7**, **11.99** tonnes of **total nitrogen** and **1.12** tonnes of **total phosphorus** (Tab. 6.1.1).

The major part of all point pollution loads enters the water bodies in the Venta RBD with domestic wastewater. There are **67** outlets within the Venta RBD: **58** outlets emitting surface runoff to the Venta River basin, **4** – to the Bartuva River basin and **5** – to the Šventoji River basin. It is estimated that the annual amount of pollutants which enter water bodies within the Venta RBD with surface runoff totals to **44.4** tonnes of **BOD_7**, **27.4** tonnes of **ammonium nitrogen**, **37.04** tonnes of **nitrate nitrogen**, **87.1** tonnes of **total nitrogen** and **18.4** tonnes of **total phosphorus**. (Tab. 6.1.1). Since 2007 point source pollution from domestic sector was decreased about 45%. It can be explained by the economical crisis.

Table 6.1.1

Point source pollution loads in the Venta RBD of Lithuanian part in 2007 and 2009

Basin	**WWTP**		**Wastewater amount, million.**		**BDS_7, t/**		**NH_4-N, t/**		**NO_3-N, t/**		**N tot, t/ year**		**Ptot, t/ year**	
	2007	**2009**	**2007**	**2009**	**2007**	**2009**	**2007**	**2009**	**2007**	**2009**	**2007**	**2009**	**2007**	**2009**
Point pollution loads from Urban wastewater treatment plants (WWTP) (municipal services) and rural WWTP, t/year														
Venta RB	53	58	7,4	7,2	44,3	41,9	14,7	23,8	112.5	35,2	152.2	80,4	32.3	17,7
Šventoji	2	5	0,01	0,08	0,1	1,2	0,07	2,2	0,01	0,14	0,11	2,2	0,02	0,2
Bartuva RB	4	4	0,37	0,4	0,8	1,3	1,05	1,4	1,3	1,7	3,5	4,5	0,5	0,5
Subtotal	**59**	**67**	**7,78**	**7,68**	**45,2**	**44,4**	**15,82**	**27,4**	**113,81**	**37,04**	**155,81**	**87,1**	**32,82**	**18,4**
Pollutions loads of industrial effluents														
Venta RB	-	-	9,3	8,1	32,1	18,3	2,4	4,3	8,5	9,3	17,1	19,2	3,4/3,3	3,3/3,2
Šventoji	-	-	0	0,02	0	0,13	0	0,08	0	0,06	0	0,16	0	0.014
Bartuva RB	-	-	0,001	-	0	-	0	-	0	-	0	-	0	-
Subtotal	**-**	**-**	**9,3**	**8,12**	**32,1**	**18,43**	**2,4**	**4,38**	**8,5**	**9,36**	**17,1**	**19,36**	**3,4**	**3,31**
Pollution loads of fish farming companies														
Venta RB	-	-	-	4,9	-	4,8	-	0	-	0	-	0	-	0,08
Pollutions loads of surface runoff														
Venta RB	-	-	54	-	25,4	21,5	-	-	-	-	20,4	10,7	2,9	1
Šventoji	-	-	6	-	0,4	0,3	-	-	-	-	0,5	0,4	0,13	0,1
Bartuva RB	-	-	6	-	1,7	0,08	-	-	-	-	1,4	0,09	0,2	0,02
Subtotal	**-**	**-**	**54**	**-**	**27,5**	**21,88**	**-**	**-**	**-**	**-**	**22,3**	**11,19**	**3,23**	**1,12**
Total			**17,08**	**20,7**	**104,8**	**89,51**	**18,22**	**31,78**	**122,31**	**45,54**	**195,21**	**117.65**	**39,45**	**22,91**

However domestic wastewater is the major source of point pollution with total nitrogen in all basins. As much as **73 %** of the overall load of **N_{tot}** enters water bodies within the Venta River basin with domestic wastewater. The input of **N_{tot}** with domestic wastewater in the Šventoji River basin is **80 %**, in the Bartuva River basin – as much as **98 %**. The share of **P_{tot}** load discharged with domestic wastewater totals to about **80 %** in the Venta River basin, **64 %** in the Šventoji River basin and **96 %** in the Bartuva River basin (Fig. 6.1.2).

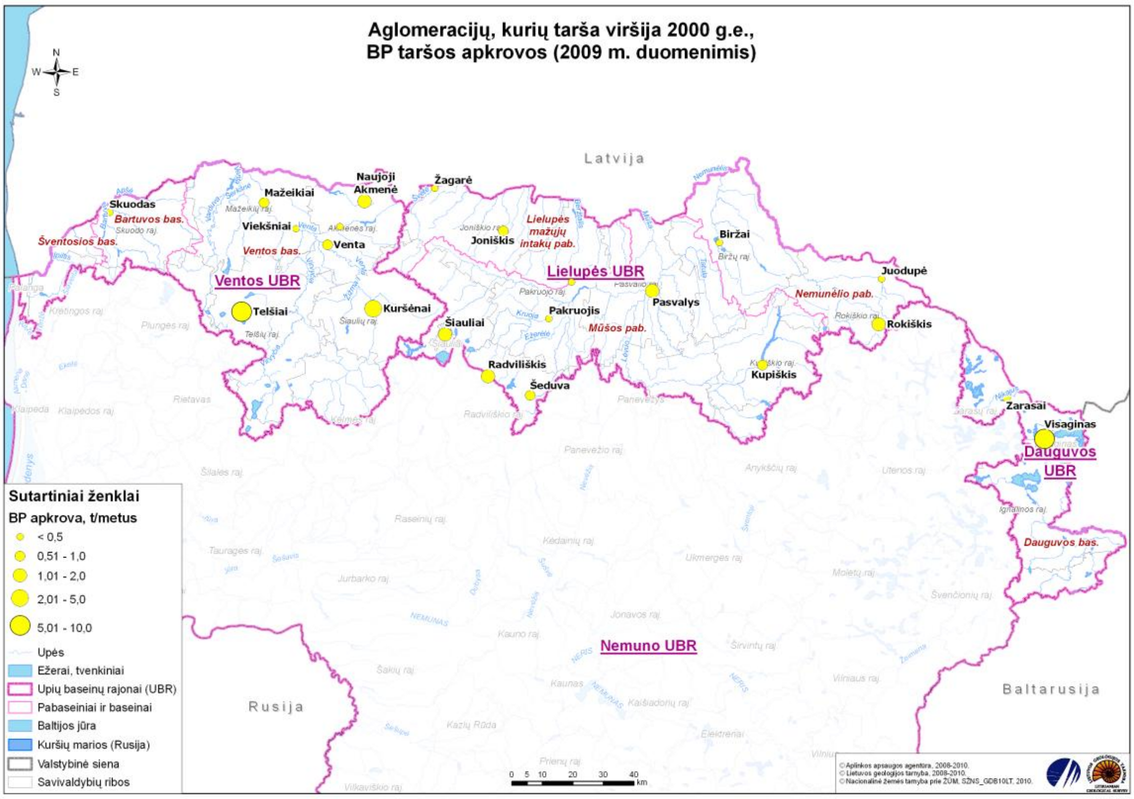

Figure 6.1.2. Lithuanian agglomerations which pollution exceeds 2000 p.e., P load t/year, 2009.

Results of mathematical modelling are showing that point pollution loads in the Šventoji River basin are insignificant in the context of the overall loads. Point pollution loads in the Venta River basin account for **16 %** of the aggregated **ammonium nitrogen** input to the main rivers and for about **20 %** of the aggregated input of **N_{tot}**. In its turn, the input of point pollution sources to the aggregated pollution with **ammonium nitrogen** in the Bartuva River basin totals to about **20 %** but the input of **P_{tot}** is approximately **4 %**. The share of point pollution with BOD_7 and nitrate nitrogen in the aggregated load is insignificant and makes up only a few per cents both in the Venta River basin and in the Bartuva River basin.

However, despite a relatively small share of point pollution in the total load of pollution entering water bodies, it can have a significant impact on the quality of river water during dry periods, therefore the assessment of the impact of point pollution shall take into account the place of each discharger in the river and the hydrological data of the receiving water body.

Following the results of mathematical modelling, none of the point pollution sources in the Šventoji and Bartuva River basins exerts any significant impact on the quality of the receiving water bodies.

As regards Venta River basin, a significant impact on the river quality may be exerted by wastewater discharged from Kuršėnai, Naujoji Akmenė, Akmenė and Telšiai WWTPs. Results of mathematical modelling indicate that concentrations of ammonium nitrogen and total phosphorus in the Tausalas River basin (Fig. 6.1.1) may be failing to meet the good ecological status criteria under the current pollution load from Telšiai WWTP. The present pollution from Kuršėnai WWTP determines concentrations of Ptot in the Venta failing to meet the good ecological status criteria.

A new WWTP was constructed in Naujoji Akmenė in 2009. However, despite the effective operation of the facilities, the wastewater is discharged into the very upper reaches of a small river Agluona. Results of the assessment indicate that the present pollution loads discharged from Naujoji Akmenė may be the reason why concentrations of ammonium nitrogen and total phosphorus fail the good ecological status requirements in the Agluona (Fig. 6.1.1). Besides, findings of the study "Preparation of a feasibility study on the construction of storm water management systems in selected problematic settlements and development of recommendations for the construction of such systems in individual typical cases" demonstrated that the Agluona River basin is significantly affected not only by domestic wastewater but also by surface (storm water) runoff.

At the moment the most significant discharger is the Akmenė WWTP. The available data are showing that the Dabikinė River (Fig. 6.1.1) may be significantly affected not only by discharges from Akmenė WWTP but also by illegal pollution caused by inhabitants of Akmenė town, hence concentrations of ammonium nitrogen and total phosphorus in the river may be failing to meet the good ecological status requirements.

Up to now it is not enough information in order to determine the significance of point pollution sources as polluters releasing dangerous substances. However the concentrations of these substances are generally low in the water environment, during the project "Identification of substances dangerous for the aquatic environment in Lithuania" carried out in 2006 concentrations of di-(2-ethylhexyl) phthalate (DEHP) were found to be exceeding the established norms in the Venta River basin at the border with Latvia. Though additional studies are required to be able to identify the source of the hazardous substance, it is believed that the pollutant may be transported by the Varduva River which receives wastewater from the oil refinery AB Mažeikių nafta.

6.1.2. Latvia

According to expert judgment, only **6** river water bodies (**10 %** of the total number of river water bodies) in the Latvian part of Venta RBD are not affected by influence of discharged wastewater. These are the following water bodies: Sventāja River basin (V001), Bārta (V010), Baltic Sea basin (Venta - Irbe) (V067), Irbe (V068), Lonaste (V070) and SP Mērsraga channel V080). With respect to lakes the situation is much better as **25** lake water bodies (**83** % of the total number of lake water bodies) are not impacted by wastewater pollution.

In total, Venta RBD in Latvia has more than **450** wastewater discharges of which **71 %** resulted from communal sector. **~70 %** of the residents in the Venta RBD are using centralized sewer services. Total volume of wastewater discharged has generally declined since 1998 (Fig. 6.1.3).

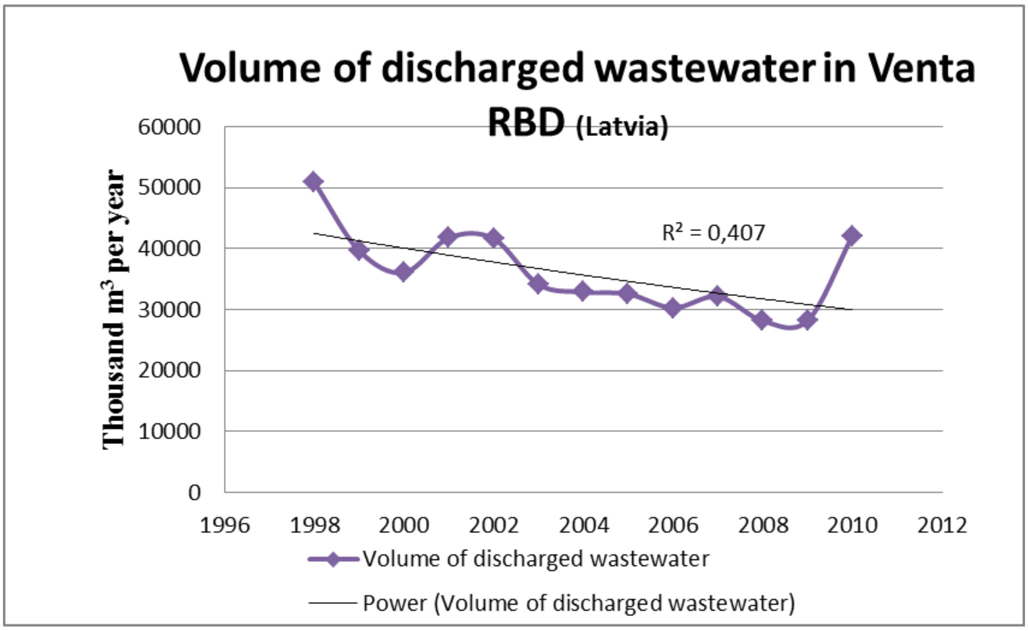

Figure 6.1.3. Volume of discharged wastewater in the Latvian part of Venta RBD.

Levels of some particular pollutants like **COD** are reduced, $\mathbf{N_{tot}}$, $\mathbf{P_{tot}}$ and **suspended solids** have remained at the same level but quantities of $\mathbf{BOD_5}$ are slightly increasing (Fig. 6.1.4). The steep rise in amounts of COD and suspended solids in 2004 and 2010 can be explained by the mistake of operator's and erroneous data in 2004 but in 2010 the first EU co-funded WWTPs began operations causing increased amount of wastewater.

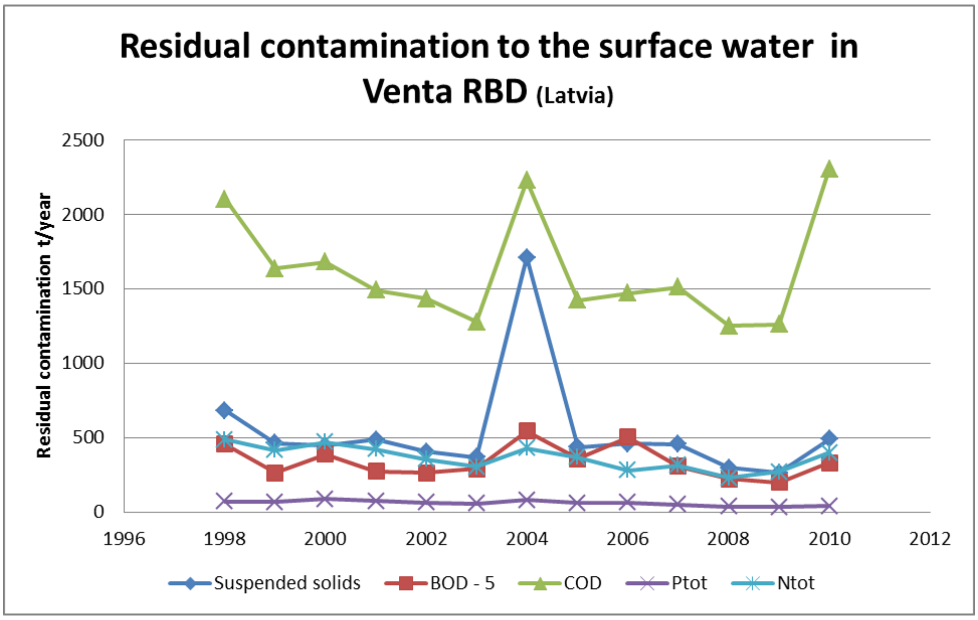

Figure 6.1.4. Residual contamination to the surface water within the Latvian part of Venta RBD.

Generated wastewater load is more essential in water bodies within which large towns are located – in the western part of Venta RBD and in the coastal zone of Baltic Sea. Main producers of pollution both in relation to wastewater volume and to concentration of polluting substances are communal sector, industry (food production and beverage manufacturing), agriculture, forestry and fishery. Besides, a significant pollution pressure originates from petroleum and chemical industry as well as from rubber, plastic, metal, optics and communications` equipment manufacturing. Assessment of WWTPs shows that the most important factor causing release of residual contamination to the natural water is the lack of proper performance of WWTP operations. Improving the efficiency of the WWTPs within Venta RBD in Latvia it is expected that the amount of **suspended solids** would be reduced by **165** tonnes per year, **BOD_5** - by **244.2** tonnes, **COD** - by **376.9** tonnes, **P_{tot}** - by **39.6** tonnes and **N_{tot}** – approximately by **63.9** tonnes[5].

In **5** water bodies within which **6** towns are located (Liepāja, Ventspils, Kuldīga, Tukums, Saldus and Aizpute) heavy metals (mercury, lead, cadmium, chromium, zinc, nickel and copper) in wastewater discharges coming from communal sector are determined as residual contamination to natural water. However, significant effects on the chemical quality of water bodies are not exerted. In addition, in the sewage sludge of a number of WWTPs like in Liepāja, Ventspils, Kuldīga, Aizpute, Brocēni, Saldus, Roja, Tukums, Jaunpagasts and Dzelda as well as in relation to WWTPs of several manufacturing companies heavy metals have been found. Most of the sludge (average of **~76 %**) is stored in sludge fields but the rest is buried in landfills, used in agriculture or composted. With the decreasing amount of wastewater the total volume of sewage sludge is decreasing, too, and it is not expected a significant increase in the volume of sewage sludge in the future.

Contaminated sites are sites for which the available information shows that the soil, water or objects in their territory are containing pollutants. Potentially contaminated sites are these sites suspected that they can contain contamination. There are **36** contaminated sites and **503** potentially contaminated sites registered in the database "Contaminated and potentially contaminated sites” with respect to the Latvian side of Venta RBD (Fig. 6.1.1). They include **170** oil depots and gas stations, **9** petrochemical manufacturing sites, **50** waste disposal sites, **16** fertilizers` and agricultural chemicals` warehouses, **85** farms, **28** former military sites and many other types of objects related to business activities. Additionally, **29** contaminated sites are included in the database "Oil product bases and service stations". The biggest number of contaminated sites is near large urban areas – Liepāja and Ventspils possibly affecting groundwater bodies F1 and D2, respectively.

It can be summarized that centrally collected but not properly treated wastewater discharges as well as contaminated sites are potentially causing or could cause significant impact on the quality of **12** water bodies located in the Latvian part of Venta RBD (Tab. 6.1.1, Fig. 6.1.1). This expert judgment made is in some discrepancy with the assessment of ecological quality of water bodies depending on limited monitoring. The places of monitoring stations should be revised, as well.

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[5] Latvijas Vides, ģeoloģijas un meteoroloģijas centrs. Ventas baseina apgabala apsaimniekošanas plāns. 2009.

Table 6.1.1

Surface water bodies in the Latvian part of Venta RBD potentially mostly impacted by wastewater discharges and/or contaminated sites

Name of water body	Code of water body	Ecological quality
Liepāja Lake	E003 SP	Poor
Baltic Sea basin (Liepāja channel – Saka)	V012	Moderate
Medoles Stream	V026	Good
Venta River	V027	Good
Venta River, harbour territory	V029	Good
Abava River	V032	High
Venta River	V043	Moderate
Ciecere River	V054	Good
Baltic Sea basin (Venta – Irbe)	V067	Good
Riga Gulf basin (Mērsraga channel – Slocene)	V090	Good
Slocene River	V091	Moderate
Baltic south eastern open sandy coast	B	Moderate

Centrally collected and treated wastewater discharges within the Latvian part of Venta RBD bring significant pressure creating **~35 %** of the total anthropogenic **phosphorus** load and **~7 %** of the total anthropogenic **nitrogen** load.

References

1. Venta river basin district management plan. Approved by Resolution Nr. 1617 of the Government of the Republic of Lithuania of 17 November 2010. http://vanduo.gamta.lt/files/Venta%20river%20management%20plan.pdf (accessed on 16 January 2012).
2. Latvijas Vides, ģeoloģijas un meteoroloģijas centrs. Ventas baseina apgabala apsaimniekošanas plāns. 2009. http://www.meteo.lv/public/29935.html (accessed on 16 January 2012).
3. National Statistical Report “Water – 2”. http://vdc2.vdc.lv:8998/udens.html (accessed on 14 February 2012).

6.2. Diffuse pollution load impact characterization and types of land use

Diffuse pollution occurs when potentially polluting substances leach into surface water and groundwater without a certain location of entry. Diffuse water pollution can arise from many sources which may be individually small but their collective impact can be significant causing reduction in water quality, decrease in wildlife, etc. Diffuse sources of pollution include runoff from agricultural and forest land, urban areas, roads and other areas including contaminated and potentially contaminated sites. Agriculture is one of the main sources of diffuse pollution. Generally, two important pollutants associated with diffuse pollution are nitrogen and phosphorus[6].

Results of mathematical modelling demonstrated that the annual natural background diffuse pollution load transported by rivers within the Venta RBD in Lithuania may be of around **1942 t** of **BOD_7**, **32 t** of **ammonium nitrogen**, **850 t** of **nitrate nitrogen** and **38 t** of **total phosphorus**. The share of the background diffuse pollution accounts for about **65 %** of the total load of **BOD_7**, **23 %** of **ammonium nitrogen**, **25 %** of **nitrate nitrogen**, and approximately **34 %** of **total phosphorus** transported by rivers. With respect to Latvia, the share of background diffuse pollution in the Venta RBD accounts for about **70 %** of **total phosphorus** and **36 %** of **total nitrogen**. There are no modelling results on nitrate nitrogen and ammonium nitrogen background loads in Latvia or total nitrogen background loads in Lithuania available, thus these amounts cannot be compared at the moment. As regards the loads of total phosphorus, the differences in Lithuanian and Latvian data could be explained by different models and approaches used.

However one part of diffuse pollution is of natural origin, most important is to decrease the amount of anthropogenic diffuse pollution caused by human activities. Because only anthropogenic diffuse pollution is analyzed further. Land use patterns are giving a general hint both for natural and potential anthropogenic sort of diffuse pollution which may occur (Fig. 6.2.1).

In relation to the entire Venta RBD, most of the territory is occupied by forests and other natural territories (wetlands, etc.) (**48 %**) as well as by agricultural land (**47%**). Water occupies **1 %**, swamps and marshland – **2 %** and urbanised territories– **2 %** (Fig. 6.2.2).

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[6] Scottish Environmental Protection Agency. Diffuse pollution.
http://www.sepa.org.uk/water/water_regulation/regimes/pollution_control/diffuse_pollution.aspx
Foundation for Water Research. Sources of Pollution – diffuse pollution.
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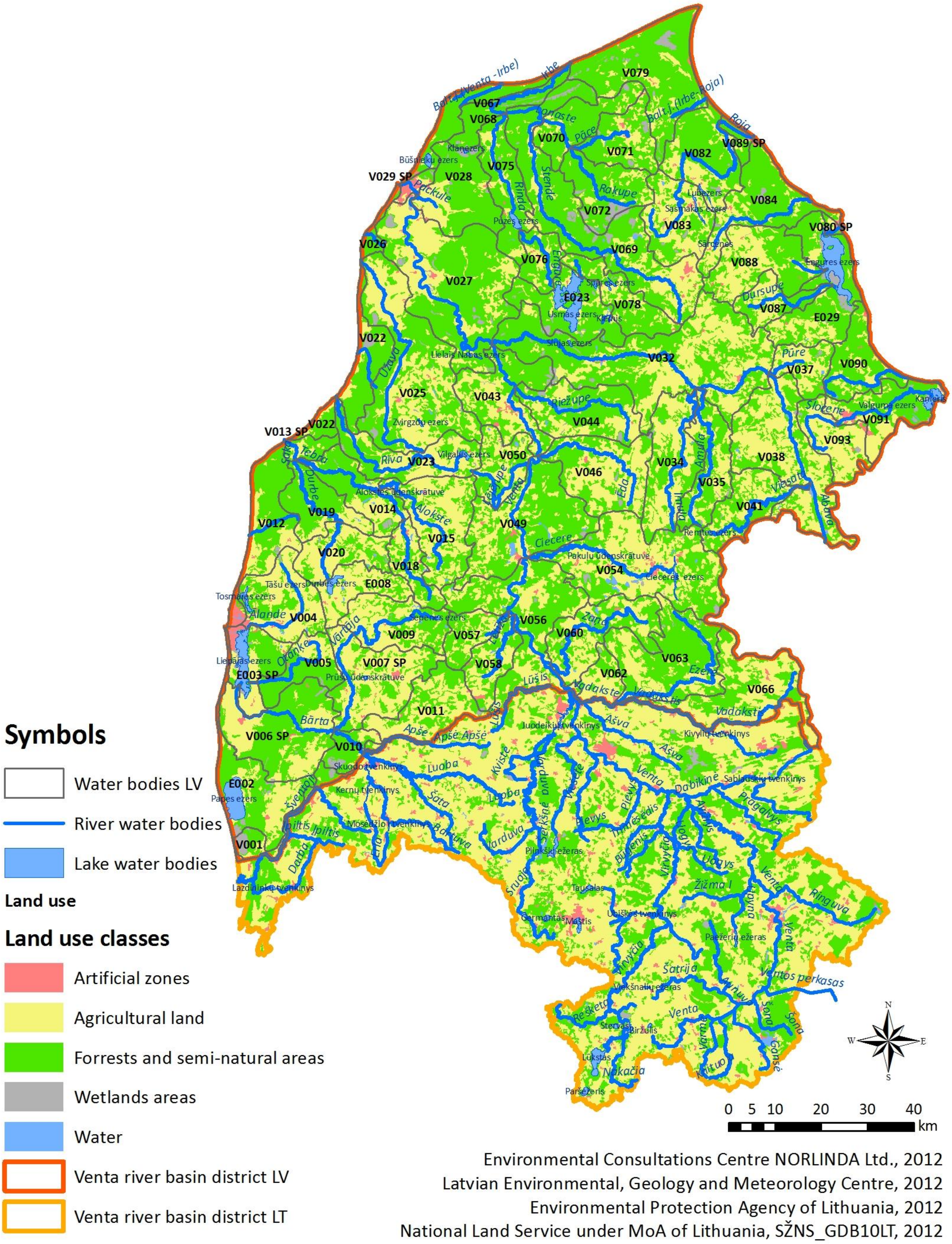

Figure 6.2.1. Land use in the Venta RBD.

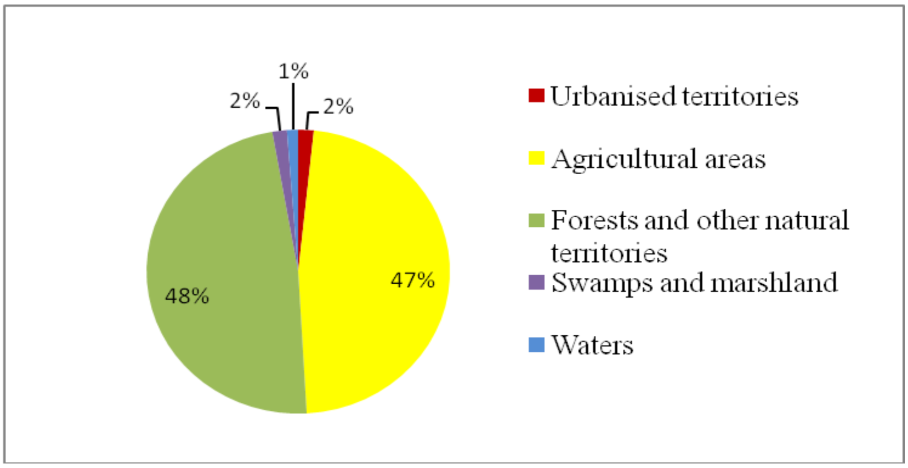

Figure 6.2.2. Relative proportion of different types of land use within the whole Venta RBD.

In relation to Lithuania, the largest part of Venta RBD is covered by agricultural areas (**65 %**) from which approximately **70 %** are used for agricultural activities. Approximately **50 %** consist of arable land and other **50 %** - of grassland and pastures. In total, arable land occupies about **22.7 %** and grassland as well as pastures – about **23%** of the whole area of Lithuanian part of Venta RBD. So, the main source of diffuse pollution is agriculture causing pollution loads from the soil due to overfertilization by animal manure (or leakages from manure stocks) and mineral fertilizers giving **34 – 48 %** of diffuse **total nitrogen** and **total phosphorus** loads. There is no information on pollution loads from forest areas in the Lithuanian part of Venta RBD. By application of the principle of analogy and taking into account the Latvian data recalculated to the area occupied by forests in Lithuania, the amount of diffuse pollution originated from forest territories in Lithuanian part could be **181 t** of **nitrogen** and **6.7 t** of **phosphorus**.

On the contrary, in the Latvian part of Venta RBD the territory is mostly covered by forests (**55 %**) but agricultural areas are occupying a lesser proportion of the land (**40%**). In Latvia there is no information on current usage of agricultural land for different agricultural activities. Approximately **40 %** of the agricultural areas consist of arable land and other **60 %** - of grassland and pastures. According to estimates from forestry, there have been **842 t** of **nitrogen** and **31 t** of **phosphorus** discharged each year (**20 %** and **14 %** of the all total anthropogenic load in the Venta RBD of Latvia, respectively). As regards agriculture, the loads are much more – **2760 t** of **nitrogen** and **64 t** of **phosphorus** (**64 %** and **30 %** of all total anthropogenic load, respectively)[7,8]. These loads are originated both from agricultural land and animal husbandry. According to calculations made by Latvian Environmental, Geology and meteorology Centre (LEGMC), a significant part of produced diffuse **nitrogen** pollution comes from arable lands (**42 %**) and livestock farming (**30 %**). In its turn, the main part of produced diffuse **phosphorus** pollution is resulted from livestock farming (**41%**) as well as forestry (**21%**).

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[7] Latvijas Vides, ģeoloģijas un meteoroloģijas centrs. Ventas baseina apgabala apsaimniekošanas plāns. 2009.

[8] Organization of United Nations. Second Assessment of Transboundary Rivers, Lakes and Groundwater. 2011.

Intensity of livestock farming is an important factor associated to agricultural pollution. Livestock husbandry in the Lithuanian part of Venta RBD is most intensive in the Bartuva basin where the number of livestock units (LSU) per hectare totals to **0.24** on average. The density of livestock units is almost twice lower in other subbasins of the Venta RBD – **0.11 LSU/ha** in the Šventoji basin and **0.13 LSU/ha** in the Venta Basin. For Latvian part of Venta RBD there are no such numbers given with respect to livestock density.

The annual input of **total nitrogen** and **total phosphorus** into the soil with animal manure in the Lithuanian part of Bartuva basin is **24.3 kg/ha** and **4.13 kg/ha**, respectively. The loads entering the soil with animal manure in the Venta basin (eastern part of Venta RBD) are approximately **13 kg/ha** of **total nitrogen** and **2.2 kg/ha** of **total phosphorus**, and those in the Šventoji basin are **11.3 kg/ha** of **total nitrogen** and **1.92 kg/ha** of **total phosphorus**. Again, for Latvian part of Venta RBD such numbers are not given.

In the Venta RBD within the Lithuanian territory there are ~100142 inhabitants whose sewage is not centrally collected in the settlements with more than 100 inhabitants which make about **48 %** of the total population within the Venta RBD up. The corresponding number in the Venta RBD of Latvia was ~121167 persons in 2006 which are about **34 %** of all inhabitants in the Venta RBD within Latvia`s territory. It must be concluded that the pollution caused by population not connected to centralized sewerage systems accounts for a minor share of diffuse pollution, for example, in Lithuania **~2 %** of the total amount of pollutants which enter the water bodies within the Venta RBD.

Pollution of shallow groundwater due to intensive agricultural activities may occur in several parts of Venta River basin in Latvia but only a small part of Venta RBD is designated as nitrate vulnerable zone where more stringent environmental requirements for agriculture should be applied. Also pesticides in groundwater of urban territories which are located near to agricultural areas (Kandava, Vārve and Jaunpagasts) are detected. For its part, all territory of Lithuania including Venta RBD is designated as nitrate vulnerable zone.

Agricultural activities in the Venta RBD are rather intensive hence agricultural pollution loads can have a significant impact on the quality of water bodies – agricultural sources account for **~70 %** of the produced total **nitrate nitrogen** load and for about **50%** of the **total phosphorus** load generated in the Venta and Bartuva basins, and **~30%** of the **total phosphorus** load generated in the Šventoji basin which enters the water bodies. Results of monitoring are showing that concentrations of nitrate nitrogen may be failing the good ecological status requirements as a result of agricultural pressures in **11** water bodies located in the rivers *Dabikinė*, *Šventupis*, *Ringuva*, *Ašva* and *Agluona*.

As regards Latvia, in **4** water bodies of the Venta RBD the anthropogenic pollution is significant due to high phosphorus load – in water bodies *Lake Liepāja* (E003SP), *Baltic Sea basin* (from Liepāja channel to Saka River) (V012), part of *Venta river* influenced by Ventspils harbor (V029SP) and *Mērsrags channel* (V080SP).

Data on relative impact of different pollution sources in the international Venta RBD are given in Table 6.2.1 below.

Table 6.2.1

Relative impact of different pollution sources in the Venta RBD

Indicator	Latvia		Lithuania	
	Diffuse pollution load, %	Point pollution load, %	Diffuse pollution load, %	Point pollution load, %
Total nitrogen	95 (4071 t/y)	5 (219 t/y)	99.5 (24728.8 t/y)	0.5 (117.65 t/y)
Total phosphorus	75 (163.4 t/y)	25 (53.81 t/y)	99.5 (4472.6 t/y)	0.5 (22.834 t/y)

In the Table 6.2.2 the main anthropogenic diffuse sources in the common Venta RBD are summarized. It should be noted that according to modelling data there are also other sectors in the Latvian Venta RBD which are releasing nutrients into environment. For example, in this table data on stormwater or cross-border nitrogen depositions on water surfaces are not included; other sources are producing about 245 tonnes of total nitrogen and about 36.4 tonnes of total phosphorus.

Table 6.2.2

Relative impact of main diffuse pollution sources in the Venta RBD

Indicator	Latvia				Lithuania			
	Arable land,%	Livestock farming, %	Forestry, %	Population, %	Arable land,%	Livestock farming, %	Forestry, %	Population, %
Total nitrogen	**42** (1617 t/y)	**30** (1143 t/y)	**22** (842 t/y)	**6** (225 t/y)	**61** (15151.4 t/y)	**36** (8955.77 t/y)	**1** (181 t/y)*	**2** (440.7 t/y)
Total phosphorus	**2** (2.94 t/y)	**38** (47.78 t/y)	**24** (31.04 t/y)	**36** (45.24 t/y)	**64** (2853.4 t/y)	**34** (1522.44 t/y)	**0** (6.7 t/y)*	**2** (90.1 t/y)

* Assumption made during preparation of this material (no data given in the Lithuanian Venta RBD management plan)

References

1. Latvijas Vides, ģeoloģijas un meteoroloģijas centrs. Ventas baseina apgabala apsaimniekošanas plāns. 2009. http://www.meteo.lv/public/29935.html (accessed on 16 March 2012).
2. Venta river basin district management plan. Approved by Resolution Nr. 1617 of the Government of the Republic of Lithuania of 17 November 2010. http://vanduo.gamta.lt/files/Venta%20river%20management%20plan.pdf (accessed on 16 January 2012).
3. Organization of United Nations. Second Assessment of transboundary rivers, lakes and groundwaters. 2011. 428 pages.
4. Scottish Environmental Protection Agency. Diffuse pollution. http://www.sepa.org.uk/water/water_regulation/regimes/pollution_control/diffuse_pollution.aspx (accessed on 28 January 2012).
5. Foundation for Water Research. Sources of Pollution – diffuse pollution. http://www.euwfd.com/html/sources_of_pollution_-_diffuse_pollution.html (accessed on 28 January 2012).

6.3. Water abstraction

Analysis of water abstraction made in Latvia and Lithuania slightly differs in each country, for example, annual amount of water abstraction in Lithuania is calculated as average for years 1997-2009, while in Latvia - for the time period 1998-2008, and year 2006 is set as a base year for all examinations of pressure and impact.

6.3.1 Analysis of surface water abstraction

The average annual abstraction of surface water for the whole given period within the Venta RBD in Lithuania totals to **10308.7 thousands m^3** but in Latvia – to **9691.4 thousands m^3**, thus there is no significant difference in water abstraction from surface water observed, however quite pronounced annual fluctuations have been demonstrated in Latvia (Fig. 6.3.1). With respect to Lithuania the related dynamic of surface water abstraction is not available. In Latvia there were **22** places identified (in 2006) where abstraction of surface water occurs. With respect to Lithuanian part of Venta RBD there are no such numbers given.

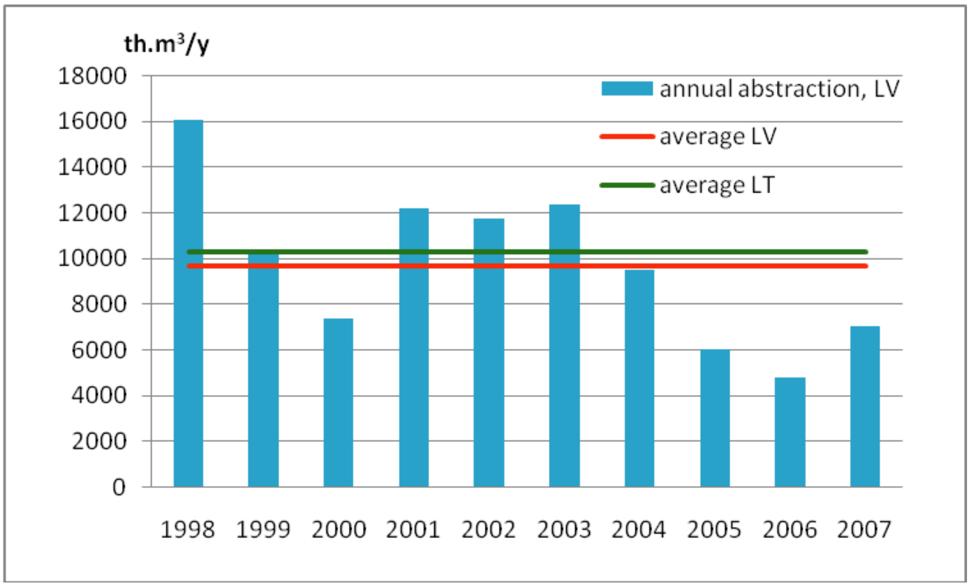

Figure 6.3.1. Abstraction of surface water in the Venta RBD, thousands m^3/y.

Usually the potentially largest user of surface water is agriculture where it is used for irrigation but according to 2001-2008 data there were no areas irrigated with surface water in the Lithuanian part of Venta RBD. The same statement is drawn with regard to Latvia for the base year of 2006. Surface water is no more used for centralized drinking water supply in both countries. In Latvia most of the abstracted surface water is used as technical water for cooling purposes but in Lithuania the main amount of surface water is used for cooling and fishery.

In Lithuania there are **2** rivers identified where water abstraction during low water period can lead to hydrological changes during summers –in *Gansė River* there is a high potential impact but in *Sruoja River* – a moderate impact. During winter the related potential impact on these rivers is accordingly low and insignificant. In relation to lakes such analysis was done also but no detailed information is available.

In Latvia there is no information on this aspect covered in the Venta RBD management plan but it may be assumed that no serious problems exist.

6.3.2. Analysis of groundwater abstraction

In the Latvian part of Venta RBD the groundwater abstraction is approximately **3 times** more intensive than in Lithuanian part of Venta RBD. The average annual abstraction of groundwater within the Venta RBD in Lithuania totals to **7640.5 thousands m^3**, while in Latvia – to **21818.6 thousands m^3** (Fig. 6.3.2). Groundwater is mainly used for drinking water supply and industry both in Latvia and Lithuania. For example, in Latvia **99 %** of the abstracted amount of groundwater was used as drinking water probably including water for food manufacturing (2006).

Current amount of abstracted groundwater in the Venta RBD is less than ¼ of explored and approved groundwater resources – in Lithuania **23.4 %** and in Latvia – only **22.6 %**. In Latvia there are more well fields than in Lithuania, respectively, **629** well fields in Latvia and **170** well fields in Lithuania (Fig. 6.3.3).

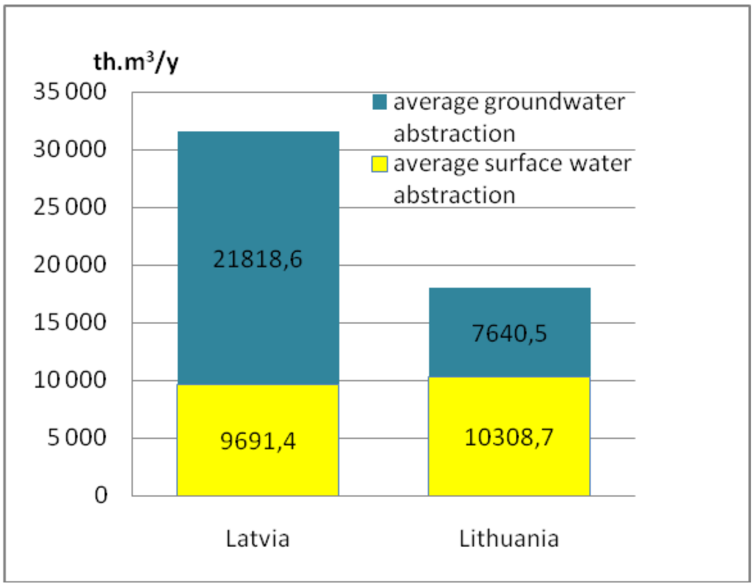

Figure 6.3.2. Average annual abstraction of surface water and groundwater in the Venta RBD for the given period, thousands m^3/y.

According to assessment made both in Lithuanian and Latvian Venta RBD management plans, abstraction of water is not a significant pressure within both parts of Venta RBD.

Places of groundwater abstraction in the Venta RBD are shown in the Figures 1.1.3 and 1.1.4 within the chapter 1.1.2.

References

1. Latvijas Vides, ģeoloģijas un meteoroloģijas centrs. Ventas baseina apgabala apsaimniekošanas plāns. 2009. http://www.meteo.lv/public/29935.html (accessed on 20 January 2011).
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6.4. Morphological changes

Europe‘s surface freshwaters are affected by major modifications, such as water abstractions, water flow regulations (dams, weirs, sluices, and locks) and morphological alterations, straightening and canalisation, and disconnection of flood plains. These are called hydromorphological pressures. Hydromorphological pressures comprise all physical alterations of water bodies modifying their shores, riparian and littoral zones, water level and flow. Also the WFD specifically relates to those waters which have experienced significant anthropogenic impacts – the latter being referred to as `Heavily Modified Water Bodies (HMWB)`. Most important for hydromorphological changes' assessment for Member States which have a common river basin districts is to have a common assessment criteria for that.

Hydromorphology is used in river basin management to describe the hydrological and geomorphological processes and attributes of rivers, lakes, estuaries and coastal water. The ecology of surface water is protected by correctly managing their hydrology and geomorphology. The WFD recognizes the key role that water resources and habitats play in river basin management to support a healthy environment.

Important uses of surface water which may impact hydromorphology include navigation, flood protection, activities for the purpose of which water is stored (drinking water supply, power generation or irrigation) and also recreation. Urbanization is not specifically mentioned in the WFD but it can be associated with modifications to surface water for the purposes of flood protection, land drainage, erosion control and land claim. Water bodies may become at risk of failing to achieve their environmental objectives due to hydromorphological changes, leading to ecological impacts (i.e. impacts on biological elements). Measures to improve the ecological status cannot always be clearly related to one use or to one alteration. In practice, the relation among uses, alterations, state and measures can be complex[9].

Significant hydromorphological changes in the Venta RBD in Latvia and Lithuania are mainly due to river straightening, power generation and harbours (Fig. 6.4.1 and 6.4.2).

6.4.1. River straightening and drainage

For assessment of the significance of rivers` straightening in both countries similar approach is used – proportion of modified and natural river stretches, although other aspects should be compared in both countries also. In Latvian Venta RBD **26** river water bodies have regulated river stretches from which in **8** river water bodies these changes are considered as significant. In Lithuanian part of Venta RBD it is calculated that **556.6 km** or **6.8 %** of all riverbeds are straightened. Straightening is used for agricultural and forestry activities, and there are also maintenance works organized, for example, changing the riverbed, cleaning of riverbed, digging of sediments, restoring the river banks etc.

In the Latvian part of Venta RBD the significance of river straightening is characterized by the total percents of regulated length of water body and the age of alterations made, for example, in water body Vārtāja (V007SP) morphological

[9] WFD and Hydromorphological Pressures. Technical Report. Good practice in managing the ecological impacts of hydropower schemes; flood protection works and works designed to facilitate navigation under the Water Framework Directive. November 2006. 68 p.

changes are significant because **57 %** of main riverbed is altered. In Venta RBD of Latvia most of regulations are done in Soviet times in order to obtain more agricultural areas. Also polder systems which are especially significant in one water body - Bārta (V006SP) have been established. In the case of Bārta an area of **4** polders situated in this water body takes up **13.2 %** of the total area of the water body.

In the Lithuanian part of Venta RBD straightened rivers with a low river slope (<1.5 m/km) flowing over urbanized areas were assigned to HMWB. Straightened rivers with a low river slope (<1.5 m/km) which are not flowing over urbanized areas and straightened rivers which flow over hilly areas (river slope >1.5 m/km) were assigned to water bodies at risk both in Latvia and Lithuania.

The purpose of drainage reclamation is to regulate the moisture regime of the soil thus providing favourable conditions for plants. Lithuania and Latvia are 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, and allowable flow rates are selected and the head is removed. 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** – from **1.1** to **2.4** times as compared to non-drained areas (according to Lithuanian data). Nevertheless, drainage reclamation will not prevent achieving the established water protection objectives in Lithuania. In Latvia according to V.Jansons et.al (2003) surveys in 1994-1999, runoff of nitrogen is significantly higher in drained areas and in areas with higher agricultural activity – the runoff can increase even **2.15** times as compared to non-drained areas.

6.4.2. Hydropower plants

The most typical impacts of hydropower plants (HPP) constructed on river beds are frequent fluctuations of the water level in the river stretches below the HPP, insufficient discharge and erosion of ponds` sides and river bed causing changes in or even disappearance of natural biotopes and species. In the whole, Lithuanian rivers are noted for their high hydropower generation capacity (totally **43 MWh/km^2**). There are **28** HPP on the Lithuanian rivers within the Venta RBD. **5** ponds or water reservoirs of HPPs established on rivers and larger than >0.5 km^2 are classified as HMWB lake water bodies because the characteristics of such ponds are more similar to lakes than to rivers. The largest amount of HPPs is constructed on the Virvytė River within a small distance from each other. Thus, almost the entire Virvytė is designated as a HMWB due to the impact of HPPs. It should be mentioned that a stretch of Virvytė starting with the Baltininkai HPP encompasses **10** HPPs in total.

In the Latvian part of Venta RBD the hydropower generation is not as important as, for example, in the Gauja RBD. However, there are **43** HPP on the Latvian side of Venta RBD. They are producing about **7.5 GWh** of hydropower per year with capacity **~0.5 MWh/km^2**. In **2** river water bodies (Alokste (V015) and Užava (V025)) significant changes caused by small HPPs are noted impacting hydrological regime and biological diversity. It must be stressed that in the Latvian part of Venta RBD the HPPs have more diffuse character and their location isn't concentrated on one river.

In Lithuania **5** of **28** HPPs which are currently operating within the Venta RBD are not likely to have any major impact on the river stretches downstream of the dams (provided that turbines are operated at the most efficient mode, so that the hydrological regime in the tail bay is close to the natural one to the maximum extent). Other **2** HPPs (Leckava HPP and Kernai HPP) are exerting a significant impact on the ecological status of the rivers downstream of the dams (Ašva and Erla). However, it must be said that the HPPs are standing very close to the river mouth and their influence on the overall ecological status of water bodies below is very low within a wider context. On the contrary, the remaining **21** Lithuanian HPPs do exert a significant impact on the river stretches downstream of the dams (10 of them have been constructed on the Virvytė River mentioned above). It is stated that regarding **4** HPPs in Leckava, Alsėdžiai, Rudikiai and Viekšniai the turbines which significantly injure fishes and do not conform to the runoff regime should be replaced by environmentally friendlier ones.

HPPs located in the Venta RBD are displayed in the Figure 6.4.2. Summarizing together there are **49** HPPs in the Venta RBD significantly impacting the water bodies downstream.

6.4.3. Harbors

Harbors are reason for **5** significantly affected water bodies in the Venta RBD on Latvian side - due to related morphological changes all these water bodies are designated as HMWB.

Ventspils harbor is located in the mouth of *Venta River* (V029SP). It is adapted for transferring of oil and its products, potassium salt, metals, wood, liquid chemical products and other materials as well as for services of passengers. The lake water body *Liepāja Lake* (E003SP) is connected to Liepāja harbor where similar activities are carried out (transshipment and transport of passengers). Other 3 harbors are small and with local significance. They are located in estuaries of small rivers. Pāvilosta harbor is situated in the *Saka River* (V013SP) and serves as the basis for fishing boats and tourism of yachts Mērsrags harbor is located in the *Mērsrags channel* (V080SP). It provides services for fishing boats and transshipment of pulpwood for export. In its turn, the Roja harbor is placed in estuaries of rivers *Roja* and *Mazupīte* (V089SP). The harbor provides services for fishing boats and yachts as well as ensures small passenger traffic to Roņu Island. Besides, the harbor is used for shipping of oil and other products.

To maintain long-term economical activity of harbors there are regular deepening of water bodies` beds and removal of sediments organized as well as rivers` banks are altered by building of additional constructions for supporting of harbors` activities (for instance, mole fractions and terminals (quaysides)). These impact natural flow of sediments and near to both moles in a harbour different zones are developing – depending on location of a harbour accumulation of sediments takes a place before one mole and erosion of coast (abrasion) beyond the second mole is observed.

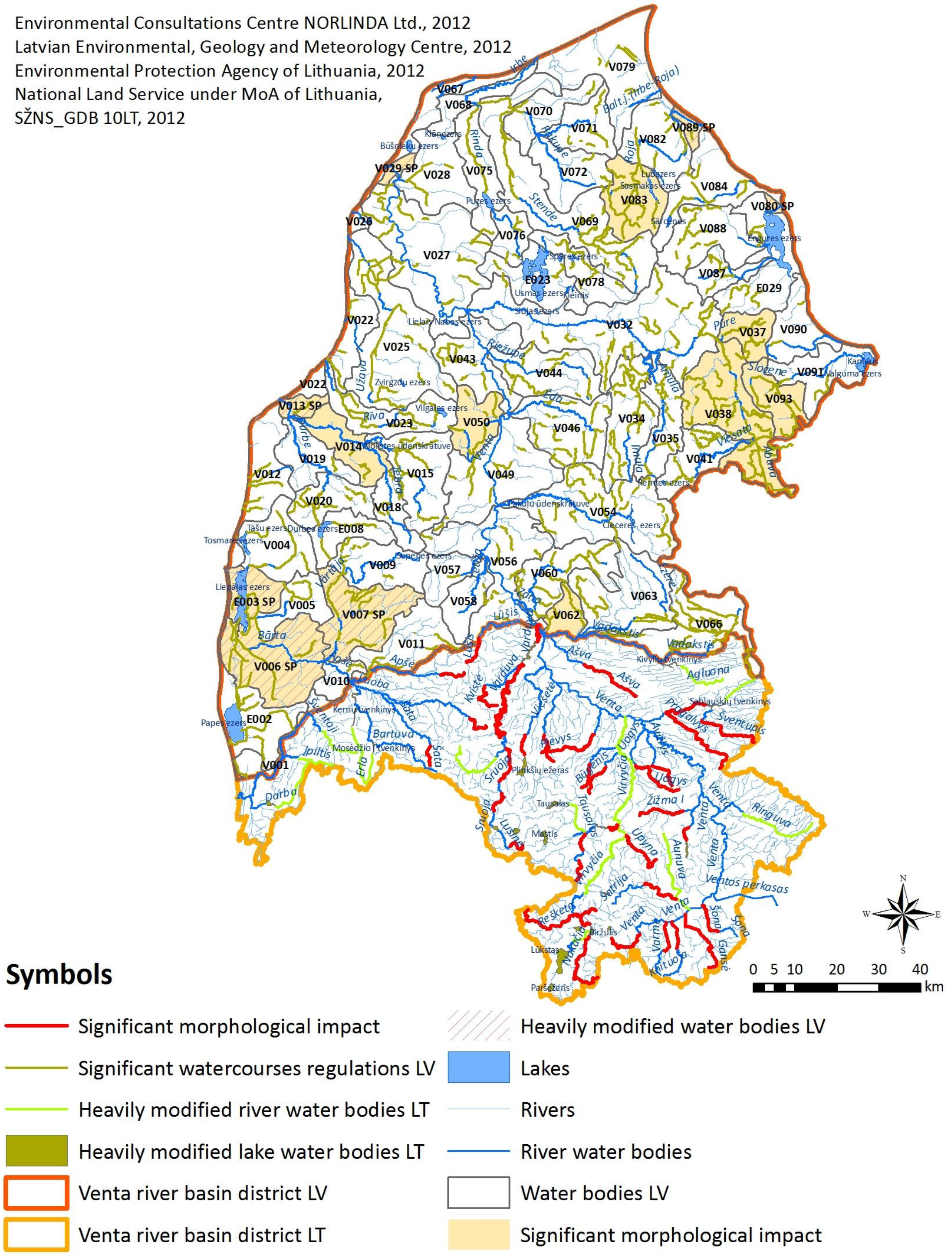

Figure 6.4.1. Characterization of hydromorphological pressures in the Venta RBD.

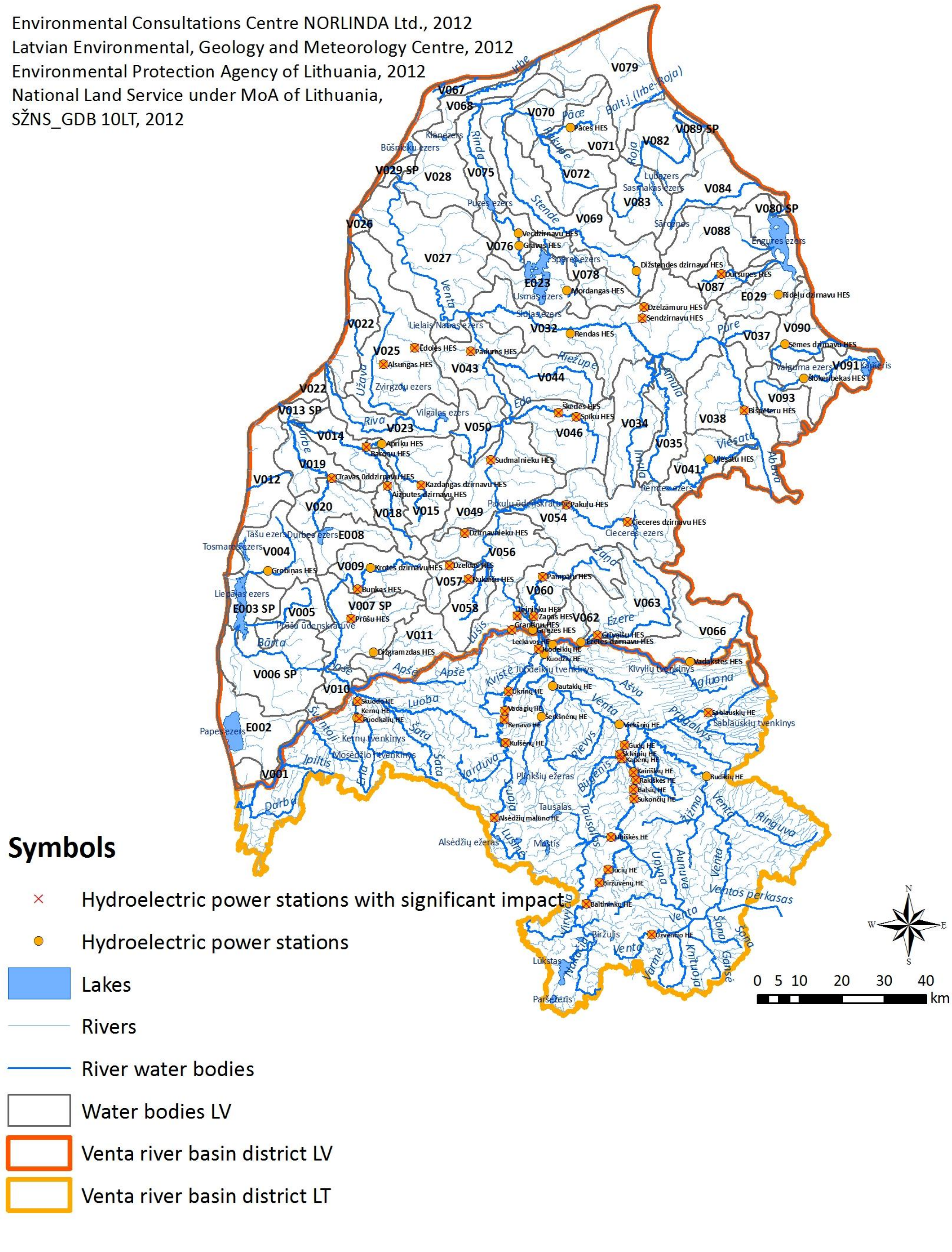

Figure 6.4.2. Hydropower plants located in the Venta RBD.

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7. Economic analysis of water use

Economical and social significance of water use is taken into account during preparation of programmes of measures because chosen measures/actions for improvement of water quality can impact water users (economic sectors), thus broaching several restrictions and negatively impacting their economic activity and development.

Analysis of sectors related to and affecting the use of water resources in the Venta RBD within Lithuania demonstrated that the main drivers causing the major pressures on surface water bodies include households, industry, energy, agriculture and fishery sectors but in the Venta RBD within Latvia – households, industry, agriculture, forestry, energy and transport (harbors) sectors. Thus in both parts of the Venta RBD the main significant sectors which are using water resources are similar but with small differences.

7.1. Households

In Lithuania 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**[10]. According to Eurostat data, the total abstraction of freshwater in Lithuania per capita per year was **720 m^3** (in 2009) but in Latvia – **93 m^3** (in 2007); abstraction of groundwater in both countries in average was similar – about **47** – **48 m^3**. Average numbers for water use per capita per year by domestic sector (households and services) also were similar – in Latvia about **40 m^3**, in Lithuania about **30 m^3**. With respect to Lithuanian part of Venta RBD it is not clear what amount of wastewater is discharged by households and by industries because the majority of industries emit their wastewater to the same wastewater treatment facilities, and there are assumptions used that volumes of wastewater 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 Venta RBD in Lithuania account for **33 %** and industry – for **35 %** of the total volume consumed in the Venta RBD. The share of industry in all districts of the Venta RBD is practically equal to the share consumed by households, except for Mažeikiai district where consumption by industry is 1.5 times higher than by households. In Latvian part these numbers are available in the statistical data base on water abstraction, use and discharge „2-Water". Approximately **45 %** of abstracted water is used for households and **20 %** - for industry, other **35 %** - for agriculture and other sectors[11]. In the Venta RBD of Latvia only groundwater is used for household needs as drinking water, and the water abstraction from groundwater is not a significant pressure in the Venta RBD within Latvia.

In the Venta RBD within Lithuania there are **5** major water supply companies in big towns (Palangos, Skuodo, Mažeikiai, Telšiai, Akmene) but in other municipalities there are smaller companies. In these big towns the average percentage of population connected to water supply networks is **77 %**, and the average share of population connected to sewage networks is **66 %**. Also in Latvian part of Venta RBD the percentage of population connected to sewage networks is similar – **67 %**

[10] EUROSTAT. Pocketbook „Energy, transport and environment indicators". 2011 edition

[11] Latvijas Vides, ģeoloģijas un meteoroloģijas aģentūra. Nacionālais ziņojums par vides stāvokli. 2008

(~239 thousands) but this value differs very much in different territories. In Ventspils, Liepāja, Valdemārpils, Durbe, Sabile the connection rate is more than **90 %** but in some rural areas this proportion is even less than **30 %**. Availability of centralized water supply network and connectivity to it is higher than connection to sewage network. According to Eurostat data, the average connection rate to sewage networks in Lithuania is **67 %** (in 2009) and in Latvia – **63 %** (in 2007) in relation to the whole countries.

In both countries projects are planned and financial funds are available to achieve a strategic goal - **95 %** of population connected to water supply and wastewater collection networks till 2015 in agglomerations with a number of inhabitants more than 2000 p.e. (people **equivalent**). In the Lithuanian part of Venta RBD there will be investments in 3 towns made – in Akmene, Mažeikiai and Telšiai with the total projects` costs of 20.73 millions EUR. In Latvia there will be implemented 17 investment projects with total costs of about 200 millions EUR. It should be stressed that according to calculations in Latvian part of Venta RBD, inhabitants without connection to sewage networks are significant polluters - approximately **45%** of total phosphorus and of total nitrogen are produced by inhabitants (households).

One of the most important factors determining the use of water services by households is the price. At present, different municipalities have set different prices for the water services in both countries. The prices of water supply and wastewater treatment of the main water suppliers in the Venta RBD within Lithuania and Latvia are given in the Table 7.1.1 below. There are also data for small agglomerations from Ventspils district – Užava and Ance given in order to show the differences in prices.

Table 7.1.1

Prices for water services in larger agglomerations in the Venta RBD for customers, EUR/m^3 (incl.VAT)

Water supply area	Year	Price of water supply	Price of wastewater management	Total price
Palangos	2010	0.93	1.32	2.25
Skuodas	2010	0.59	1.14	1.73
Mežeikiai	2010	0.81	0.86	1.67
Telšiai	2010	0.71	0.86	1.58
Akmenė	2010	0.80	1.27	2.07
Ventspils	2011	0.89	1.35	2.23
Kuldīga	2008	1.25	1.44	2.69
Liepāja	2010	0.97	0.63	1.60
Saldus	2012	1.14	1.37	2.51
Užava	2011	0.74	0.71	1.45
Ance	2011	0.33	0.33	0.66

7.2. Industry

Industries in the Venta RBD within Lithuania consume about **30 %** of the total water volume consumed in this river basin district. Almost half of this amount is used up by companies in Mažeikiai district. Most of the companies discharge their effluents to the centralised sewerage networks. Four companies emit their wastewater directly into water bodies. Also, there are many outlets of surface runoff of stormwater (23) including surface runoff from industrial areas. As regards Latvia, most of wastewater from factories in the Venta RBD is entering the centralized wastewater treatment plants (WWTP) belonging to municipalities.

The highest percentage of companies in the Lithuanian part of Venta RBD (excluding public institutions, trade companies, companies providing other services, or similar companies) are operating in manufacturing industry – almost **10 %** (Fig. 7.2.1). According to the Lithuanian statistical data, about **3800** companies were operating in Akmenė, Mažeikiai, Telšiai and Skuodas district as well as in Palanga town within the Venta RBD in 2008.

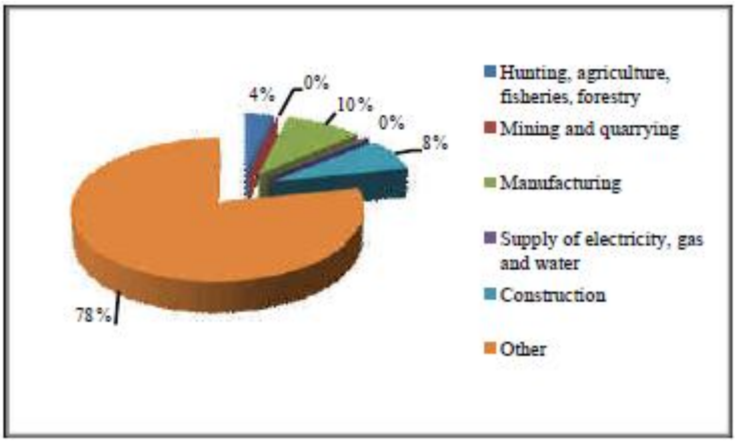

Figure 7.2.1. Distribution of companies by industries in the Venta RBD of Lithuania in 2008.

In the Latvian part of Venta RBD the manufacturing industry plays an important role too – it provides about **18 %** of the districts' added value in 2006. Most developed sub-units of manufacturing industry within the Venta RBD (according to amount of factories and employees) are manufacturing of wood and wood products, production of textiles and clothes, foodstuffs and drinks as well as producing of metals and hardware (Fig. 7.2.2). According to the Latvian statistical data, about **1075** companies were operating in the Venta RBD in 2006. About **27000** of local inhabitants are employed in manufacturing industry within the Venta RBD. About **50 %** of produced production is exported (according to data in 2006).

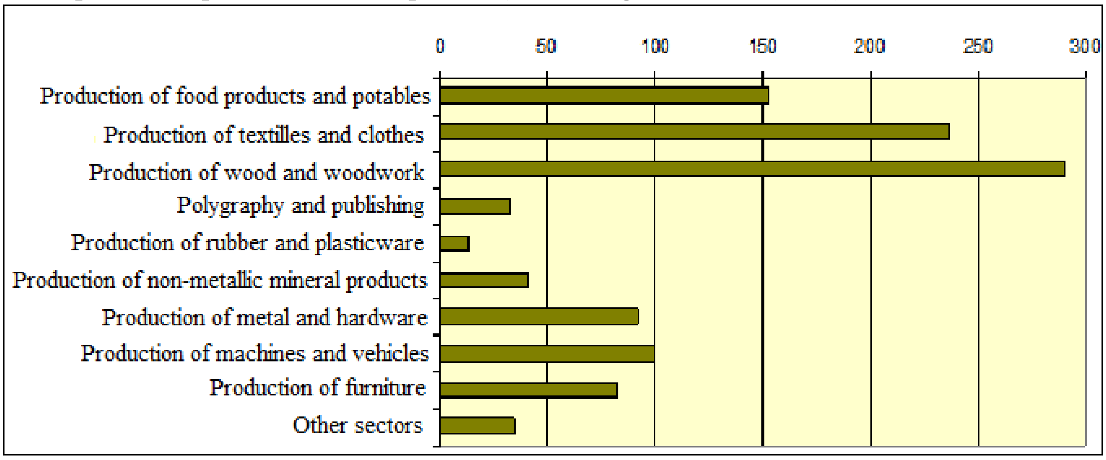

Figure 7.2.2. Amount of factories in different sub-sectors of manufacturing industry in the Latvian part of Venta RBD in 2006, number.

By-products of industry, of course, are industrial wastewater and different polluting substances. Information on occurrence of hazardous substances in natural water is provided in the chapter 4.1. The sources of pollution can be attributed to WWTP also as in effluents of some of them a number of hazardous substances are found. It shall be mentioned that there are **16** companies in the Venta Basin and **1** company in the Bartuva Basin in Lithuania for which integrated pollution prevention and control (IPPC) permits have been issued by 2008. Similar data for Latvian part of Venta RBD are not given in the management plan of RBD, nevertheless in the homepage of Environment State Bureau there are **22** A category permits for **19** large enterprises available and more than **200** enterprises which have B category permits are listed.

The amount of charges for pollution of the environment and its dynamic illustrates the magnitude of pollution and its change. The number of payers of charges for water pollution in 2008 in the Lithuanian part of Venta RBD was **56** (**67** in 2007) and the charges paid in 2008 were **73850 EUR** (**125000 EUR** in 2007).

7.3. Agriculture

Agriculture 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 and melioration systems.

The annual amount of water consumed for agricultural purposes in the Venta RBD within Lithuania totals to **52000 m^3** which accounts for **0.5 %** of the total consumption in the RBD (including the energy sector). So, agriculture does not have any significant impact on the amount of water resources in the Lithuanian part of Venta RBD. Areas potentially subject to irrigation in the Venta RBD within Lithuania totalled to more than 500 ha but not all of them are suitable for use. No significant abstraction of surface water for agricultural purposes is forecasted for the coming 5-10 years in Lithuania also due to poor technical state of irrigation systems and due to natural and economic conditions.

Approximately **25 %** of abstracted water is used for agricultural activities in the Venta RBD within Latvia including production of agricultural products. The territory of Venta RBD in Latvia is producing quite significant amount of agricultural production – approximately **29 %** of grains produced in the whole Latvia, **17 %** of potatoes and **17 %** of vegetables, **31 %** of grass hay as well as **24 %** of produced milk and **21 %** of meat. According to statistical data from 2005, there were about **24 thousands** farms (households) in the Venta RBD of Latvia which was about **18 %** of all farms in Latvia. Approximately **27 %** of the territory of Venta RBD of Latvia is occupied by land usable in agriculture and in about **60 %** of these territories melioration systems are built. No significant future changes are forecasted for Latvian agricultural sector within the Venta RBD.

7.4. Forestry

Forestry and economical importance of water use in this sector is analysed only in the Latvian part of Venta RBD. Most of the territory of the Latvian part of Venta RBD is covered by forests (**51 %**) from which approximately **20 %** are "anthropogenic forest" type - it means forest territories with built melioration systems and thus with increased productivity of forests. Venta RBD provides about **27 %** of the total harvested wood in the territory of Latvia, and this was about **2.6 millions m^3** of wood in 2006. It is forecasted that till 2015 the total area of forests will be stable and will not increase but the total area of clear-cuts will decrease by **3 %**. According to drained areas it is not forecasted significant increase in drained forest areas but due to planned constructions of new forest roads the drained areas could slightly increase.

7.5. Hydropower generation

Rivers in the Venta RBD are noted for their high hydropower generation capacity (43 MWh/km^2) in Lithuania. There are **28** hydropower plants (HPP) on the rivers in this part of RBD. The largest number of HPPs has been constructed on the Virvytė River and their operation thereof exerts a significant impact on the aquatic environment of the river. **17 %** of all water abstracted in the Venta basin in Lithuania is used for power generation. Also, Mažeikiai oil refinery plant has its own fuel combustion facilities with a nominal thermal capacity higher than 50 MW.

In the Venta RBD within Latvia there are **45** HPPs with power generation capacity less than 1 MW constructed, most of them (**21** HPPs) are with power generation capacity less than 100 kW. In 2005 these 45 HPPs produced **~7.6 GWh** or **13 %** of the total amount of energy produced by small HPPs. Small HPPs in the Latvian part of Venta RBD are still insignificant at the whole state level with respect to the total energy produced and make up only **0.2 %**. Thus, small HPPs are significant only at the local scale.

7.6. Fishery

Fishery is analysed only in the Lithuanian Venta RBD management plan. The most common type of fishery in Lithuania is pond fishery breeding mainly carps. The fishery (aquaculture) sector covers special ponds which are considered to be merely industrial objects and not water bodies that must achieve good water status.

In Lithuania there are **26** companies breeding fishes in ponds with the total area of around **10000 ha**. The number of live marketable fishes` grown up in these ponds in 2008 totalled to about **3.76 thousand tons**. It is forecasted that the number of ponds will not be increasing because they need land and large investments, and in the 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 are no reliable data on any negative impact of fishery on surface water bodies, thus this sector is not included among significant pressures.

Fish farming 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 of fish breeding were used, such as feeding, pond fertilisation, preventive maintenance, etc. Fishes consumed **10255 tons** of fish feed including **3352 tons** of ecological feed in 2008. The average yield in feeding ponds totalled to **853 kg/ha**. The production of aquaculture is expected to grow in the 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 designed 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 in 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.

The aquaculture sector is dominated by micro and small companies. Also, there are more than 50 farms in Lithuania which are engaged in commercial aquaculture growing fishes in their ponds. 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 induced by the ponds of aquaculture companies. However, according to information of Lithuanian Environmental Protection Agency, the quality parameters (BOD_7, N_{tot} and P_{tot}) of water released from fishery ponds are seldom exceeding the permitted norms.

In 2010 certificates of ecological fishery were issued to 15 farms with 5040 ha in total.

7.7. Harbors

Harbors are analysed only in the Latvian Venta RBD management plan. Big harbors– Liepāja harbor and Ventspils harbor – have a significant role in the state economy. Small harbors have mainly local significance.

Ventspils Freeport is the biggest harbor in Latvia by the cargo turnover. In 2005 the turnover of cargo was about **30 million tons** or **50 %** of total cargo turnover in the state. It is adapted for transferring of oil and its products, potassium salt, metals, wood, liquid chemical products and other materials as well as for services of passengers. After reconstruction works and deepening of the water bed the harbor can maintain ships of every size.

Liepāja harbor was recently not very significant harbor regarding cargo turnover – in 2005 there were only **4.5 million tons** or **7.5 %** of the total cargo turnover in the state processed. However, in the last years the significance of Liepāja harbor and the cargo turnover is risen. In Liepāja harbor similar activities like Ventspils Freeport were carried out concerning transhipment and transport of passengers.

Main activities of small harbors are cargo transport within the Baltic Sea area (Mērsrags harbor), serving as the basis for fishing boats (Roja harbor, Engure harbor and Pāvilosta harbor) and tourism of yachts (Roja harbor, Engure harbor, Mērsrags harbor and Pāvilosta harbor). Main cargos are round timbers, woodchip, timber and peat. Harbors impact local fishery and fish production sector also which is significant employer. For example, in the territory of Mērrags harbor two fish production enterprises are working which employ ~700 persons.

7.8. Recreation

This field is separately described only in the Lithuanian Venta RBD management plan. Up to **12 thousand** people can use **8** largest ponds with an area larger than **0.5 km^2** (Juodeikių, Karnų, Kivylių, Lazdininkų, Mosėdžio I, Sablauskų, Skuodo and Ubiškės) for recreation purposes. The estimation is based on the assumption that about **55 %** of the local population use water bodies for recreation. Most of them are used for fishing and/or bathing. There are **11** bathing waters officially designated: Lake Germantas in Telšiai district, Lake Lukstas in Varniai (Telšiai district) Lake Paršežerisin in Laukuva (Šilalė district), Lake Plinkšių ežeras in Seda (Mažeikiai distr.), Pragalvys River in Akmenė district, Sablauskių pond

(Dabikinė area, Akmenė district), Skuodo pond in Skuodas, Venta River in Akmenė, Venta River in Mažeikiai, Lake Saukenas in Saukenas and Uzvencio River in Uzvencio.

As regards Latvia, there are **17** official bathing sites within the Venta RBD designated– **12** places in the coastal part of Baltic Sea and the Gulf of Riga (beaches in Liepāja (2), Ventspils (2), Abragciems, Klapkalnciems, Ķesterciems, Ragaciems, Mērsrags, Upesgrīva, Kolka and Roja) as well as **5** places in inland waters – pond Beberliņi, lakes Būšnieku, Saldus and Ciecere, and bathing site of Venta River named "Mārtiņsala" in town Kuldīga. They are important recreational places attracting large number of both local residents and non-residents, especially the beaches of Liepāja and Ventspils.

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5. Ventspils. Pilsēta. Komunālie maksājumi. Ūdensapgāde un kanalizācija. Norēķinu tabulas. http://www.ventspils.lv/files/dokumenti/pamatinformacijai/Udeka_norekinu_tabula.pdf (accessed on 15 April 2012).
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8. Vides pārraudzības valsts birojs. Piesārņojums. A, B atļaujas. http://www.vpvb.gov.lv/lv/piesarnojums/a-b-atlaujas (accessed on 4 April 2012).

8. Summary of the main risk factors within the Venta river basin district in a transboundary context

Main risk factors are significant pressures within the Venta RBD exerting serious influence on the water quality or having potential to cause essential impact like risks from accidental spillages of polluting substances downstream from urban wastewater treatment plants or industrial objects.

In the whole Latvian part of Venta RBD point pollution sources are significant pressures still causing potential impact on water quality but diffuse pollution can play even more essential role. For shallow groundwater potential impact from diffuse pollution caused by agriculture could not be neglected. Besides, historical impact of intensive water abstraction is still causing some concerns in the area of Liepāja town. Furthermore, hydromorphological modifications (straightening of rivers, polders) must be noted.

In the Lithuanian part of Venta RBD point pollution sources (urban wastewater treatment plants and other sources) could be marked as rather significant pressures also bur probably the diffuse sources from agriculture are playing crucial role taking into account large proportion of agricultural lands in the Lithuanian part of RBD. In addition, water abstraction for fish farms and hydromorphological modifications (hydropower stations, physical alterations of channels) should be mentioned.

Special case of cross border impact exerted on water bodies located on the Lithuanian – Latvian border or near the border is induced by small hydropower plants (HPP) situated almost on the border. Vadakste HPP is located on the Vadakste (Vadakstis) River in the Vadakste parish of Saldus territory in Latvia. The water reservoir was established on the Lithuanian side during Soviet times, and now the border between countries crosses the water reservoir in the middle part. However, it must be noted that bypass for fishes is set up minimizing the related impact. So, it is considered that the mentioned small HPP does not have significant impact.

In addition, dam on the Šventoji River on the Lithuanian side is established, though the bypass for fishes is set up. Furthermore, Šventoji water body can be influenced by further development of small harbor in the mouth of Šventoji.

Summarizing the main risk factors which are influencing the cross border water bodies within the Venta RBD, diffuse pollution from agricultural sources mainly generated in the Lithuanian part of the basin shall be stressed. In addition, point pollution sources should still not be neglected, especially due to potential accidental spillages from urban and industrial wastewater treatment plants or industrial objects in Mažeikiai and Skuodas (Tab. 8.1). Besides, cooling waters from industrial objects in Mažeikiai (especially - Mažeikiai oil refinery and oil-processing plant) entering the Venta River can cause so called thermal pollution with possible influences on the aquatic ecosystems downstream.

Table 8.1

Main risk factors influencing cross border water bodies in the Venta RBD

Code of water body	Name of water body	Main risk factors
V001	Sventāja basin	No serious risk factors but possible influence of anticipated further development of small harbor
V010	Bārta	Transboundary pollution from Lithuania; flood risk
V011	Apše	Diffuse pollution originated in the Lithuanian part of the basin
V056	Venta	Transboundary pollution from Lithuania – mainly diffuse pollution originated in the Lithuanian part of the basin; risk of accidental spillage from Mažeikiai, potential impact of "thermal pollution" caused by cooling waters from Mažeikiai
V062	Vadakste	Diffuse pollution originated in the Lithuanian part of the basin
V063	Ezere	Diffuse pollution originated in the Lithuanian part of the basin
V066	Vadakste	Diffuse pollution originated in the Lithuanian part of the Basin
A	Baltic south eastern open stony coast	Poor ecological status of the Baltic Sea itself; risk of accidental spillage from Klaipeda and Butinge
LT700108102	Šventoji	No serious risk factors but possible influence of anticipated further development of small harbor

Table 8.1 (continued)

Code of water body	Name of water body	Main risk factors
LT800120103	Bartuva	Diffuse pollution; risk of accidental spillage from Skuodas
LT800121702	Apšė	Diffuse pollution
LT300114301	Lūšis	Diffuse pollution
LT300114302	Lūšis	Diffuse pollution
LT300113104	Varduva	Diffuse pollution
LT300100018	Venta	Diffuse pollution; risk of accidental spillage from Mažeikiai, potential impact of "thermal pollution" caused by cooling waters from Mažeikiai
LT300111702	Vadakstis	Diffuse pollution, possible influence of Vadakste HPP
LT300111701	Vadakstis	Diffuse pollution, possible influence of Vadakste HPP
LT300106101	Dabikinė	Diffuse pollution

9. Analysis of the planned and measures taken so far for the achievement of water quality objectives in the Venta basin

In both countries implementation of measures according to programs of measures is on-going. There are many projects in starting phase on which the information can be found at official internet homepages of responsible institutions, for example, at the homepage of Latvian Ministry of Environmental Protection and Regional Development information on investment projects under the Urban Wastewater Treatment and Drinking Water Directives is published. In its turn, at the homepage of Lithuanian Ministry of Environment the related information on approved investment projects in Lithuania are published also. Nevertheless, still this is a problem how to find and collect all information according to implementation status of planned measures/activities. Summary of all measures implemented or on-going in the Venta RBD is shown in the Figure 9.1.

The second aspect of implementation process of measures is legal status of planned measures. In Lithuania the Venta RBD management plan is approved by resolution of Government of the Republic of Lithuania, however in Latvia the corresponding Venta RBD management plan is approved by the order of the Minister of Environment only. Thus, in Lithuania the approved document is of more practical use and more powerful than in Latvia. This legal status of Latvian RBD management plan should be changed in order to implement all necessary measures for WFD needs and for improvement of water quality in Latvia. Nevertheless, during preparation of RBD management plans in Latvia several legislation acts (for example, Law on Spatial Planning and related Regulation of the Cabinet of Ministers) were valid, and there were included requirements according to water management issues. During this period local municipalities were sending their spatial plans for approval, and Latvian Environmental, Geology and Meteorology Centre (LEGMC) as one of the competent institutions was involved in preparation of provisions and reviews on these documents. According to "Requirements of local municipalities` spatial planning" (Regulations of the Cabinet of Ministers Nr. 1148, issued on 6 October 2009) requirements from river basin management plans and programs of measures should be included in these spatial plans. However, spatial planning process was finished approximately by the end of 2008 but river basin management plans were approved only at the end of 2009. Basic and supplementary measures planned are included in this approved, final version of RBD management plans. Thus, there are many doubts on measures which were included in these spatial plans. It should be also noted that in 2009 the territorial reform in Latvia was ongoing, following **109** territories (*novadi*) have been established and **9** state cities have been marked, but spatial plans were mainly elaborated for previous more than 500 municipalities (districts, parishes and towns). Still in many homepages of municipalities the previously approved spatial plans for towns and parishes can be found but no common spatial plans for territories (novadi). For example, the spatial plan for Kuldīga town[12] stresses the wastewater problems and proposes solutions for this which is in connection with the Venta river basin plan, too. Besides, the general sentence is included that the Venta RBD

[12] Kuldīgas pilsētas teritorijas plāns. Paskaidrojuma raksts. 2010. http://www.kuldiga.lv/uploaded/5planosana/TP/Kuldiga_PR_GR_2010_0527_galv.pdf

management plan should be considered as well as Venta River should achieve good quality till 2015.

In the spatial plan of Gudenieku parish[13] (now – part of Kuldīga territory) few aspects of water management issues are included and necessary measures have been analyzed but without any connection with Venta river basin management plan.
One other example, the spatial plan[14] of Ezere parish situated in the Saldus territory has been approved also. Unfortunately, there are only requirements for allowed and forbidden actions without detailed information on environmental conditions.

As regards Lithuania, in the spatial plan[15] for Mažeikiai region severe types of measures are included, as issues related to wastewater treatment management and buffer zones along river banks but there is no direct reference to the Venta river basin management plan.

Consequently, we must conclude that clear requirements from respective Venta RBD management plans are not included in the spatial plans of municipalities up to now. In the better case there are very general statements with respect to good water quality which should be ensured in water bodies.

[13] Gudenieku pagasta teritorijas plānojuma paskaidrojuma raksts. 2006. http://www.kuldiga.lv/uploaded/5planosana/TP_novads/Gudenieki/Paskaidrojuma_raksts/PR_Gudenieki/gud_pag_pr_05.2007..pdf
[14] Ezeres pagasta padome. Ezeres pagasta teritorijas plānojums. Teritorijas izmantošanas un apbūves noteikumi. 2006. http://www.saldus.lv/4798/dokumenti0/planosanas-dokumenti5/saldus-novada-planojums/
[15] Klaipėdos universitetas Regioninio planavimo centras. Mažeikių rajono teritorijos bendrasis planas. Trečioji dalis - Sprendinių konkretizavimas. 2008. http://www.mazeikiai.lt/go.php/lit/Planavimo_dokumentai_/979

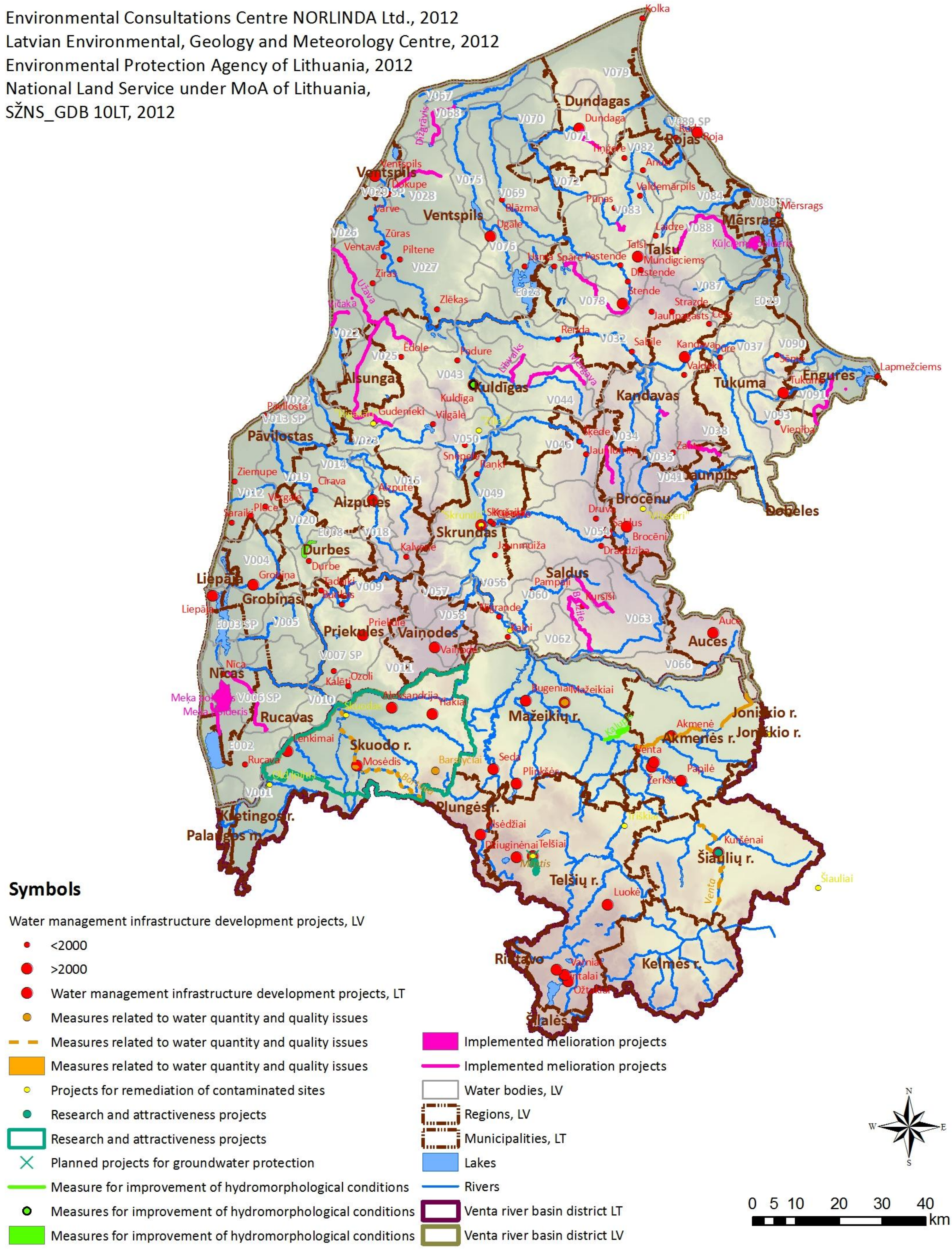

Figure 9.1. Summary of measures implemented or on-going in the Venta RBD.

9.1. Measures for decreasing of point source pollution

Supplementary measures to reduce the impact of point pollution sources are planned in both countries in the Venta RBD. In Lithuania there are 4 water bodies within the Venta RBD identified in the rivers Dabikinė, Tausalas and Agluona where the supplementary measures are needed due to the significant impact of point pollution even after the implementation of the basic measures under the Urban Wastewater Treatment Directive. As the first action recommended in order to improve the quality of Agluona river is to conduct operational monitoring downstream of Naujoji Akmenė. In its turn, for improvement of water quality of Tausalas river, there should be reduction in pollution from point source – wastewater treatment plant (WWTP) in Telšiai ensured. About half of pollution loads in Telšiai comes from the milk processing company Žemaitijos pienas. There was planned to perform operational monitoring in Tausalas River at first in order to specify pollution reduction objectives in more detail. For the river Dabikinė it is suggested to postpone achievement of the water protection objectives in the water bodies identified in the Dabikinė River until a sufficient amount of data is collected to be able to establish the demand and implementation scope of supplementary measures.

There were three types of supplementary measures planned to reduce impact of point pollution sources in Latvia, and those are:

1) *construction and reconstruction of centralized wastewater treatment systems for agglomerations smaller than 2000 residents to improve treatment efficiency*, and such measures are planned for **8** small WWTP, thus decreasing nitrogen and phosphorus load: a) influenced water bodies: V004 un E004, place - Kapsēde, responsible municipality - Medze parish council; b) influenced water body: V060, place – Baltaiskrogs, responsible municipality - Zaņa parish council, as well as Ēvaržu village and responsible municipality - Novadnieki parish council; c) influenced water bodies: V054 un E018, place - Lielciecere, responsible organization - Ltd. „Brocēnu siltums"; d) influenced water bodies: V084 un E028, place – Laidze, responsible municipality - „Laidze parish council; e) influenced water body: V054, place – Ošukalns, responsible organization - Ltd. „Brocēnu siltums", and place Namiķi with responsible municipality Lutriņi parish council, as well as place Butnāru village and responsible municipality Zirņi parish council;
2) *preparation of strategy or concept paper* in a few municipalities – how to decrease amount of phosphorus and nitrogen pollution from households (also camping places and summer houses, etc.) which are not connected to centralized wastewater collection systems, and related measures would be needed for **3** water bodies (*Roja* (V083), *Sasmakas lake* (E027) and *Laidzes lake* (E028);
3) *research* – in the territories where the exact pollution amounts are currently not known it is foreseen to assess possible impact on water quality and to implement most appropriate measures, especially concerning correct management of stormwater; such activities are planned in the area of **4** lake water bodies – a)*Tosmare lake* (E004), responsible organizations - Ltd. „Aizputes ceļinieks", Ltd. „Griģis un Co", Ltd. „GP komunālserviss", place - Gūžas); b) *Remte lake* (E016), responsible organization - Ltd. „Brocēnu siltums", place - Remte); c) *Ciecere lake* (E018), responsible organizations - Ltd. „Cemex" and State Ltd. „Vides projekti"; d) *Sasmaka lake* (E027), responsible municipality - Valdemārpils town council, place – Lubezere.

In Latvia the state Operational Program „Infrastructure and Services" is dedicated to implementation of requirements laid down by the Urban Wastewater Treatment Directive having direct impact on the improvement of surface water quality.

Under the state Operational Program „Infrastructure and Services", activity 3.5.1.1 "Development of water management infrastructure in agglomerations with more than 2000 residents" projects in **15** Latvian agglomerations were accepted, in **3** of them (Grobiņa, Brocēni and Priekule) projects are already finished. Totally, for ~10000 inhabitants a qualitative drinking water supply and wastewater treatment is provided. Estimated total costs of the measures anticipated in these 15 agglomerations is **11.09 millions EUR** with co-financing from EU Cohesion Fund of **7.17 millions EUR**.

Additionally, under the state Operational Program „Infrastructure and Services", activity 3.4.1.1 "Development of water management infrastructure in populated areas where number of residents is up to 2000" **67** projects are accepted since 2007, **6** of them are already finished - in *Ploce* village within Vērgale territory, *Durbe* town, *Pāvilosta* town, *Rucava* village within Rucava territory, *Laidze* village within Talsi territory and *Tadaiķi* village within Bunka territory. For more than 2800 inhabitants a qualitative drinking water supply and for more than 3000 persons connection to wastewater treatment systems is provided. The estimated total costs of the measures to be implemented in the smaller settlements are **29.86 millions EUR** with co-financing of European Regional Development Fund of **20.11 millions EUR**.

All water management improvement projects will be finished till the autumn of 2015, but within 5 agglomerations with more than 10000 residents (Ventspils, Tukums, Talsi, Kuldīga, Saldus) the deadline for these projects was the end of 2011.

It shall be underlined that under the mentioned activity 3.4.1.1 "Development of water management infrastructure in populated areas where number of residents is up to 2000" **8** projects which will have direct impact on the quality of transboundary water bodies will be realized (Tab. 9.1.1).

Table 9.1.1

Ongoing projects of development of water management infrastructure influencing the Latvian transboundary water bodies

Transboundary WB to be influenced	Project	Drinking water supply, number of inhabitants	Wastewater treatment, number of inhabitants	Total costs, EUR	ERDF* co-financing, EUR
Bārta (V010)	Water management development in Priekule territory Kalēti	320	325	420 903.56	357 768.03

Table 9.1.1 (continued)

Transboundary WB to be influenced	Project	Drinking water supply, number of inhabitants	Wastewater treatment, number of inhabitants	Total costs, EUR	ERDF* co-financing, EUR
	municipality Kalēti village				
Apše (V011)	Water management development in Priekule territory Kalēti municipality Ozoli village	0	57	121 829.75	103 555.29
Venta (V056)	Water management development in Nīgrande municipality Kalni village	520	520	271 169.40	230 493.99
Venta (V056)	Water management development in Nīgrande municipality Nīgrande village	485	485	444 636.60	377 941.11
Venta (V056)	Water management infrastructure development in Skrunda territory Jaunmuiža village	263	263	457 635.18	388 989.90
Venta (V056)	Water management infrastructure development in Skrunda territory Kušaiņi village	202	200	324 510.46	275 833.89

Table 9.1.1 (continued)

Transboundary WB to be influenced	Project	Drinking water supply, number of inhabitants	Wastewater treatment, number of inhabitants	Total costs, EUR	ERDF* co-financing, EUR
Venta (V056)	Water management infrastructure development in Skrunda territory Ciecere village	108	108	203 378.11	172 871.39
Ezere (V063)	Water management development in Saldus territory Kursīši	440	449	487 402.21	414 291.87
Total		**2338**	**2407**	**2 731 465.27**	**2 321 745.47**

* European Regional Development Fund

Also in Lithuania projects for reconstruction or improvement of wastewater treatment plants have been started or are already implemented as well as improvement of sludge management in agglomerations is carried out (Tab. 9.1.2). Total sum for **15** projects is **53.46 millions EUR**.

Table 9.1.2

Ongoing projects of development of water management infrastructure influencing the Lithuanian water bodies

Project	Responsible institution	Implementation status	Total costs, EUR
Special plan for rain network development in Varniai and Telšiai cities, in suburban settlements	Telšiai county administration	Ongoing (from 2011)	19 588
Reconstruction and development of drinking water and sewage networks in Skuodas county (Alexandrijos, Lenkimiai, Mosėdžio and Ylakiai pop.)	Joint stock company "Skuodo vandenys"	Ongoing (from 2011)	5 537 722

Table 9.1.2 (continued)

Project	Responsible institution	Implementation status	Total costs, EUR
Renovation and development of water supply and wastewater infrastructure in Plunge county (Šateikiai*, Alsėdžiai)	Joint stock company "Plungės vandenys"	Ongoing (from 2011)	4 421 742
Water supply and wastewater management infrastructure development in Akmene county (Vento, Papile, Žerkščiuose)	Joint stock company "Akmenės vandenys"	Ongoing (from 2011)	3 783 934
Water supply and wastewater management infrastructure renovation and development of the Telšiai county (Varniuose, Gintalas, OžtakiuoseL, Luokėje, Džiuginėnuose)	Joint stock company "Telšių vandenys"	Ongoing (from 2010)	4 275 394
Water supply and wastewater management infrastructure development in the Mazeikiai county (Seda, Plinksiai, Bugeniai)	Joint stock company "Mažeikių vandenys"	Ongoing (from 2010)	2 170 239
Construction of Mazeikiu sludge treatment plant	Joint stock company "Mažeikių vandenys"	Ongoing (from 2010)	4 088 359
Construction of Akmenės sludge treatment plant	Joint stock company "Akmenės vandenys"	Ongoing (from 2010)	1 221 970
Development of water supply and wastewater management infrastructure in Telsiai	Joint stock company "Telšių vandenys"	Ongoing (from 2009)	1 936 527
Development of water supply and wastewater management infrastructure in Akmene county	Joint stock company "Akmenės vandenys"	Ongoing (from 2009)	8 363 090
Development of water supply and wastewater management infrastructure in Mazeikiai county	Joint stock company "Mažeikių vandenys"	Ongoing (from 2009)	2 355 327
Renovation of water supply and wastewater management infrastructure in Šiauliai county (Kairiai*, Vijoliai*, Kuršėnai)	Joint stock company "Kuršėnų vandenys"	Ongoing (from 2009)	4 484 758

Table 9.1.2 (continued)

Project	Responsible institution	Implementation status	Total costs, EUR
Construction of Telšiai sludge treatment plant	Joint stock company "Telšių vandenys"	Ongoing (from 2009)	6 363 010
Elaboration of development plan for water supply and wastewater management infrastructure	Telšiai county administration	Implemented (2009-2011)	23 195
Development of water supply and wastewater management infrastructure in Mazeikiai	Joint stock company "Mažeikių vandenys"	Ongoing (from 2009)	4 423 224

* outside of the territory of the Venta RBD

9.2. Measures for remediation of contaminated sites

For contaminated sites in Latvian part of Venta RBD two types of measures are planned – research of contaminated sites in order to prepare necessary documentation for rehabilitation works and remediation of contaminated sites. Research as one of measures anticipated in the Latvian Venta RBD management plan is highlighted with respect to **1** potentially contaminated site in Ventspils town (territory of enterprise "Agroķīmija") but at least **9** remediation projects of contaminated sites are accepted – in Ventspils town (oil products` handling and transport objects), in Roja town (old waste dump area) and in Liepāja town (oil depots).

Additionally, in the Venta RBD of Latvia there are **5** projects in differing stages related to remediation of old waste dump sites which are at the same time contaminated sites. Total costs for these **5** projects are **1 381 183 EUR** from which **85%** are co-financing from Cohesion Fund and other **15 %** - self-financing from municipalities. In the Table 9.2.1 most important information on these projects is given. In the cross border territory on the Latvian side one project is started in the water body Venta (V056).

Similar to Latvia, a number of projects in different stages dedicated to remediation of contaminated sites have been implemented or are ongoing in Lithuanian part of Venta RBD (Tab. 9.2.2). Total costs for these **6** projects for remediation of contaminated sites are **1 144 129 EUR** from which **1 074 981 EUR** (**94 %**) is EU funding and other **69148 EUR** (**6 %**) - self-financing of implementing institutions. Again, it should be noted that such kind of measures was not planned in the approved Lithuanian Venta RBD management plan.

Table 9.2.1

Projects for remediation of contaminated sites in the Venta RBD of Latvia

WB to be influenced	Project	Implementation status (planned starting/ ending dates)	Responsible institution	Costs, EUR		
				Total costs	Int.al. from Cohesion Fund	Int.al. self-financing
Užava (V025)	Recultivation of household waste dump site „Bigasāti” in Gudenieki parish	Implemented (19.08.09. / 18.08.11.)	Kuldīga district council	27131.87	23062.09	4069.78
Venta (V049)	Recultivation of household waste dump site „Skrunda” in Skrunda town with rural territories	Ongoing (07.07.09. / 06.07.11.)	Skrunda district council	277 348.05	235 745.84	41 602.21
Ciecere (V054)	Recultivation of improper acc. to requirements of legislation waste dump site „Vibsteri” in Brocēni district	Ongoing (24.05.11. / 23.05.13.)	Brocēni district council	435536.96	370206.42	65330.55
Venta (V056) (cross-border water body)	Recultivation of improper acc. to requirements of legislation waste dump site „Bandzeri” in Saldus district Nīgrande parish	Ongoing (25.05.11. / 24.05.13.)	Saldus district council	194442.66	165276.26	29166.40
Lējējupe (V050)	Recultivation of waste dump site „Zīles” in Kuldīga district	Ongoing (18.05.11. / 17.05.13.)	Kuldiga district council	446723.23	379714.74	67008.48

Table 9.2.2

Remediation projects for contaminated sites in the Lithuanian part of Venta RBD

Project	Implementation status (planned starting/ ending dates)	Responsible institution	Costs, EUR		
			Total costs	Int.al. from EU Funds	Int.al. self-financing
Remediation of contaminated site – Triškių pesticide warehouse (0,15 ha)	Implemented (09.09. / 03.11.)	Telšiai county administration	73103	62138	10965
Liquidation of contaminated site – boiling house in Telšiai district	Not started (07.12. / 01.14.)	Mažeikiu county administration	75335	71569	3766
Liquidation of contaminated site – pesticide warehouse in Mergeluičių (0,7ha)	Ongoing (04.09. / 12.11.)	Akmenės county administration	45868	38942	6926
Liquidation of abandoned buildings and other objects in environment in Šaiaulių county	Not started (09.12. / 02.14.)	Šiaulių county administration	91462	86889	4573
Hazardous waste management in Lithuania: regional development tasks for old pesticides Įpiltis outbreak (Reduce pesticide contamination in polluted areas of Old Įpiltis rural area, digging out contaminated soil (1.1232 ha, 180 m^3 soil with pesticide waste).)	Not started (01.12.- 12.13.)	Kretingos county administration	376506	357681	18825
Hazardous waste management of the Skuodas-road companies` former parking area and oil holding arrangement (Digging out contaminated soil (with petroleum products) in former car parking place, urban area in Skuodas (350 m^3 soil, 0.7462 ha))	Not started (01.12. - 12.13.)	Skuodo county administration	481855	457762	24093

9.3. Measures according to hydromorphology

Measures according to hydromorphology can be aimed at changing a number of hydrological and morphological characteristics of water bodies in order to improve the water quality, for example, they can improve longitudinal continuity, achieve improvements in flow regime or improve other hydromorphological elements.

In the Venta RBD management plans there are many measures pointed to this field. In the Lithuanian Venta RBD management plan **3** measures in order to eliminate or mitigate impact of hydropower plants, straightened rivers and artificial barriers are included: restoring/ensuring river continuity and flow, reduction of the impact of hydropower plants and renaturalisation of river beds. Already in the previous years (2002-2009) **5** fish migration facilities in the Lithuanian territory of Venta RBD have been constructed. Additionally, on Šerkšnė River a fish pass in the place of Bugeniai dam should be built (costs of measure – **43877 EUR**). First priority is removing of the rock weir in Šerkšnė River (**7009 EUR**) and then in Šata Rriver (with similar costs of about **7000 EUR**). Besides, in the Venta RBD of Lithuania turbines of **4** hydropower plants (HPPs) should be replaced by environmentally more friendly ones – in Rudikiai HPP, in Viekšniai HPP, in, Alsėdžiai HPP and in Leckava HPP. The total investment costs for these activities are about **382300 EUR**. Approximately **204 km** of rivers in the Lithuanian part of Venta RBD should be renaturalised, and the total costs would be about **5.9 millions EUR**. In addition, one of „soft" measures planned is to develop methodology for the assessment of damage in the water bodies done by HPPs.

On the Latvian side of Venta RBD the planned supplementary measures according to hydromorphology are mainly strategic and type of research measures, for example, research on impact of each new HPP before construction as well as reconsideration of permits issued for small HPPs. Up to now there is no information on such measures started or implemented. Plans to create cooperation model for harbors were anticipated as so called "soft" measures with purpose to discuss planned maintenance activities in harbors in order to select the most environmentally friendly measures. The same applies to straightened rivers and polder systems – elaboration of national scale technical standards for maintenance works (melioration) was planned as implementation of "soft" measures. Unfortunately, the listed above measures have not started yet.

According to renaturalisation of rivers, there are plans to elaborate guidelines at national scale and to organize research on the water bodies *Ēda* (V046), *Zaņa* (V060) and *Roja* (V082) with regard to the possibilities of renaturalisation of these rivers. Again, it shall be noted that these projects are still not started.

Following, up to now we cannot find many measures already implemented within the Venta RBD with respect to improvement of hydromorphological conditions (Tab. 9.3.1). Good examples are provided by subprojects within the "Live Venta" project dedicated to implementation of quite simple measures in order to improve the flow regime of rivers or remove the vegetation in excess in lakes.

Table 9.3.1

Measures for improvement of hydromorphological conditions

Project	Description of activities	Imple-mentation status (planned starting/ ending dates)	Responsible institution	Costs, EUR		
				Total costs	Int.al. from EU Funds	Int.al. self-financing
Cross border cooperation in management of Venta river basin area nature values (LIVE VENTA)	Cleaning of Venta river in Latvia from macrophytes in Kuldīga town (800 m)	Implemen-ted (04.11. / 11.11.)	Kuldīga local municipality	42 610	85%	6 391
	Cleaning of Durbe lake in Latvia from macrophytes (mechanized plant cutting 30 ha)	Implemen-ted (04.11. / 11.11.)	Durbe local municipality	21 904	85%	3 285
	Cleaning of Kalupis river from garbage in Lithuania (1.5 km)	Implemen-ted (04.11. / 04.12.)	Adminis-tration of Venta Regional Park	16 190	85%	2 428

Special sort of hydromorphological measures constitute already implemented, started or planned activities devoted to reconstruction of melioration systems in Kurzeme region of Latvia. Nevertheless, this type of measures is still under discussion with regard to their impact on water bodies. On the other hand, most actions realized in the framework of these reconstruction projects are reconstruction or renovation of river bed of straightened rivers. Sites of implementation of these projects are shown in the Figure 9.3.1. In total, from 2009 till the end of 2011 there are **27** projects of reconstruction of melioration systems in the Venta RBD implemented. Total costs of the implemented projects are **2 368 223 EUR**, and **~184 km** of melioration channels have been reconstructed as well as reconstruction of polder "*Ķūļciema polderis*" is carried out. In average, each reconstructed kilometer costs **12 882 EUR**.

Information on implemented projects of reconstruction of melioration systems in the Latvian part of Venta RBD is summarized in the table 9.3.2.

Figure 9.3.1. Measures for reconstruction of melioration systems in Kurzeme region of Latvia. Notes: objects reconstructed , objects still in reconstruction process , objects planned to be reconstructed 

Table 9.3.2

Implemented melioration projects in the Venta RBD within Latvia

Project	**Project number**	**Implementation date**	**Public financing, EUR (without VAT)**	**Length of reconstruction works,** km
Bed reconstruction of national importance waterchannel Isvintes strauts (USIK code 362822) in Tukums district	09-04-L12500-000001	24.09.2009	50 086	10.38
Bed reconstruction of national waterchannel Vidusupe (USIK code 372472724, pik.00/00/109/70) in Talsi district	09-04-L12500-000002	06.11.2009	35 358	3.75
Renovation of national importance waterchannel Macupe (USIK code 375832, pik. 00/00-57/60) in Talsi district, Vandzenes parish	09-04-L12500-000045	06.11.2009	23 414	5.76

Table 9.3.2 (continued)

Project	**Project number**	**Implementation date**	**Public financing, EUR (without VAT)**	**Length of reconstruction works,** km
Renovation of national importance waterchannel Kazukalnu grāvis (USIK code 36269201, pik. 00/00-34/50) in Tukums district, Zantes parish	09-04-L12500-000046	06.11.2009	15 450	3.45
Reconstruction of national importance waterchannel Lībvalks (USIK code 36364, pik. 07/75-86/20) in Kuldīgas district, Rendas parish	09-04-L12500-000047	27.11.2009	32 895	7.85
Reconstruction of national importance waterchannel Kārklupe (USIK code 36786, pik. 00/00-61/55) in Saldus district, Kursīšu parish	09-04-L12500-000037	24.09.2010	24 809	6.16
Reconstruction of national importance waterchannel Mērgava (USIK code 36366, pik. 73/90-138/55) in Kuldīga district, Rendas parish	09-04-L12500-000038	30.09.2010	54 061	6.47
Renovation of national importance waterchannel Platene (USIK code 36122, pik. 27/00-137/30) in Ventspils district, Tārgales and Popes parishes	09-04-L12500-000024	15.10.2010	35 054	11.03

Table 9.3.2 (continued)

Project	**Project number**	**Implementation date**	**Public financing, EUR (without VAT)**	**Length of reconstruction works,** km
Bed renovation of national importance waterchannel Dēliņstrauts (USIK 36264, pik.34/55-94/78) in Kandava county, Zemītes parish	09-08-L12500-000072	16.11.2010	39 426	6.02
Bed renovation of national importance waterchannel Vīkšņu purva grāvis (USIK 362632, pik.00/00-53/62) in Kandava county, Kandavas and Vānes parishes	09-08-L12500-000073	16.11.2010	46 548	5.36
Bed renovation of national importance waterchannel Štēbrupe (USIK 3722468, pik.05/92-94/96) in Dundaga county, Dundagas parish	09-08-L12500-000076	01.11.2011	66 904	9.02
Reconstruction of national melioration system "Ķūļciema polderis" in Talsi county, Ķūļciema parish	10-08-L12500-000085	04.11.2011	63 172	0
Reconstruction of national importance waterchannel Bruzile (USIK code 36842, pik.40/24-204/14) in Saldus county, Kursīšu parish	09-02-L12500-000114	28.11.2011	346 630	16.59
Reconstruction of national importance waterchannel Tērande (USIK code 3582, pik.00/00-	09-02-L12500-000108	08.12.2011	57 743	4.61

Table 9.3.2 (continued)

Project	Project number	Implementation date	Public financing, EUR (without VAT)	Length of reconstruction works, km
48/74) in Kuldīga county, Ēdoles parish				
Reconstruction of national importance waterchannel Ezervalks (USIK 363622, pik.00/00-50/37) in Kuldīga county, Rumbas parish	09-02-L12500-000133	08.12.2011	85 035	5.04
Renovation of national importance waterchannel Šķēde (USIK 376386, pik.224/45-273/23, 277/72-285/48, 306/90-325/12) in Talsi county, Vandzenes and Laucienes parishes	09-08-L12500-000069	26.11.2010	56 025	7.47
Renovation of national importance waterchannel Augšdonava (USIK 37498, pik.00/00-68/50) in Talsi county, Ģibuļu and Valdgales parishes	09-08-L12500-000131	26.11.2010	52 156	6.85
Bed reconstruction of national importance waterchannel Vičaka (USIK 3578, pik.05/00-58/60) in Ventspils county. Užavas parish	09-08-L12500-000074	27.05.2011	49 457	5.36
Reconstruction of national importance waterchannel Puļķupīte (USIK code 3428562, pik.00/00-67/00) in	09-02-L12500-000113	21.06.2011	115 957	6.70

Table 9.3.2 (continued)

Project	**Project number**	**Implementation date**	**Public financing, EUR (without VAT)**	**Length of reconstruction works,** km
Grobiņa county, Bārtas parish				
Renovation of national importance waterchannel N-24 (USIK 374982, pik.00/00-50/70) in Talsi county, Valdgales parish	09-08-L12500-000130	21.06.2011	71 346	5.07
Renovation of national importance waterchannel Brancupīte (USIK code 362422, pik.00/00-87/73) in Brocēni county, Gaiķu parish	09-02-L12500-000135	21.06.2011	155 510	8.77
Bed renovation of national importance waterchannel Skujupīte (USIK 37824, pik.40/59-134/55) in Engure county, Smārdes parish	09-08-L12500-000071	28.07.2011	93 231	9.40
Renovation of national importance waterchannel Dzīvene (USIK 364234, pik.12/04-62/09) in Brocēni county, Gaiķu parish	09-02-L12500-000134	28.07.2011	89 023	5.01
Bed reconstruction of national importance waterchannel Dižgrāvis (USIK 358158, pik.00/00-110/50) in Ventspils county, Užavas and Zīru parishes	09-08-L12500-000075	30.09.2011	89 866	11.11

Table 9.3.2 (continued)

Project	Project number	Implementation date	Public financing, Ls / EUR (without VAT)	Length of reconstruction works, km
Reconstruction of national importance waterchannel Jēčupe (USIK code 34284, pik.00/00-34/00) in Nīca county, Nīcas parish	09-02-L12500-000110	20.10.2011	265 964	3.40
Renovation of Meķa polder dams (USIK 3488242, pik. 00/00-35/10) and Tuklera channel (USIK 33832, pik. 50/18-77/25) in Nīca county, Nīcas parish	10-02-L12500-000082	20.10.2011	104 552	3.61
Reconstruction of national importance waterchannel Užava (USIK code 358, pik.535/51-631/43) in Kuldīga county, Gudenieku parish	09-02-L12500-000111	28.10.2011	248 564	9.59

It must be mentioned that in the Venta RBD of Latvia **7** reconstruction projects of melioration systems are still in implementation stage. Besides, **3** other reconstruction projects are planned but not started yet.

9.4. Measures related to water quantity and quality issues

Measures in relation to to water quantity issues can be divided in two parts – water efficiency measures related to irrigation in agriculture and/or forestry as well as drinking water protection measures. In their turn, measures related to improvement of water quality cover wide range of different measures – cleaning of bed and banks, reduction of pollution inflow, etc. Sometimes these measures are overlapping with measures concerning hydromorphology. In the Table 9.4.1 projects aimed at improvement of water quality are listed.

Table 9.4.1

Measures for improvement of water quality in the Venta RBD within Lithuania

Project	Description of activities	Implementation status (planned starting/ ending dates)	Responsible institution	Costs, EUR		
				Total costs	Int.al. from EU Funds	Int.al. self-financing
Liquidation of historical pollution from Mastis lake: unknown pollution from Žemaitijos village museum	Cleaning of the most polluted part of the lake Mastis by removing the contaminated mud, sapropel and excess vegetation (8ha)	Ongoing (03.09. / 03.11.)	Telšiai county adminis-tration	653168	587851	65317
Cleaning of parts of river Dabikinė	Cleaning and restoration of river stretches (5.6 ha) of recreational area, for development of recreational, cognitive, gross tourism infrastructure	Ongoing (12.09. / 08.12.)	Akmenė county adminis-tration	376838	339154	37684
Improvement of status of Virvyte river and pond in territory of Biržuvenu	Cleaning and restoration of pond shore (4 ha).	Ongoing (12.10. / 12.12.)	Telšiai county adminis-tration	384280	345852	38428
Alignment of Juodpelkio pond and banks in Mažeikiu town	Removing of polluted sludge from Juodpelkio pond and coastal clean-up in a pond shores removing debris, surplus land	Ongoing (12.11. / 05.14.)	Mažeikiai county adminis-tration	366910	330220	36690

Table 9.4.1 (continued)

Project	Description of activities	Implementation status (planned starting/ ending dates)	Responsible institution	Costs, EUR		
				Total costs	Int.al. from EU Funds	Int.al. self-financing
	vegetation, and planted with grass in cleaned slopes. Cleaned two water bodies, arranged 2.5ha					
Cleaning of Mastis lake	Elimination of historical pollution of Mastis lake	Not started (02.2012. / 02.2014.)	Telšiai county administration	450520	405468	45052
Cleaning of Venta River banks in Kuršių towns	Cleaning of part of Venta River and the coastal area (28.5 ha), removing of sludge with macrophytes and biogens (87.228 m^3)	Implemented (30.06.09. / 31.01.12.)	Šiauliu county administration	1193714	1014657	179057
Improving the water quality in Skuodas	Removing deposits of mud (sapropel) from Bartuva river bed and Gėsalų II pond; eliminating the roots of coastal macrophytes (2 water bodies with improved quality; 1.5ha both)	Implemented (09.09. - 02.11.)	Skuodo county administration	218284	196456	21828

Table 9.4.1 (continued)

Project	Description of activities	Implementation status (planned starting/ ending dates)	Responsible institution	Costs, EUR		
				Total costs	Int.al. from EU Funds	Int.al. self-financing
Improvement of water quality in Barstyčių town ponds	Cleaning of water bodies by removing the sludge from the ponds (sapropel) and removing the root macrophytes from coastal area of two ponds (No.5 and 6), total area 0,87 ha.	Not started (07.2012. / 09.2013.)	Skuodo county administration	177230	159507	17723

9.5. Measures related to diffuse pollution

There are supplementary measures in both countries planned in order to decrease diffuse pollution from agricultural activities and forestry. Basic measures are also planned in both countries, and those all are obligatory or in legislation written measures, as, for example good agricultural practice in nitrate vulnerable areas. According to information in the Lithuanian Venta RBD management plan, for agriculture mainly legal and administrative measures are planned, for example, in order to control the maximum fertilizer loads there are intentions to develop fertilization plans (maximum amount of fertilizers allowable per hectare for farms utilizing **10 ha** of land or more) as well as to develop methodology for the elaboration of such fertilization plans. Other important measures are manure management plans according to Good Farming Rules for farms with less than **10 livestock units** (LSU) and management of necessary documentation for manure and/or slurry use, handover or sale, especially in overfertilized areas. The key mechanism helping to ensure implementation of measures is control, and Lithuania is planning to increase the amount of controls in farms on the measures mentioned above. Annual planned costs for the measure „Manure management in small farms" are about **111 120 EUR** but for the measure „Fertilisation plans in farms ≥10 ha" - about **165 520 EUR**. Besides, the costs for the measure „Additional control" are about **16 970 EUR** per year. There is no information on implementation progress of these measures yet.

In the Latvian part of Venta RBD a number of practical measures as control of maximum fertilizers` loads in farms where fertilizers are used for more than **20 ha** are planned. Additionally, **2** measures in relation to research projects are planned: 1) to assess impact of agricultural activities and effect of implemented measures concerning buffer zones and 2) to assess impact of forestry activities and effect of implemented measures concerning buffer zones and “good cutting practice”. Besides, **2** other measures regarding decreasing of runoff of nutrients from agriculture and forestry (buffer zones, clear-cutting, wintergreen areas, etc.) are planned. Similar to Lithuania, there is no information on implementation progress of these measures up to now.

In addition to what was already said above, other aspects which have to be covered by activities directed towards reduction of diffuse pollution is potential pesticide pollution originated by agriculture. Besides, advisory services for agriculture in order to promote the good agriculture practice are essential. Unfortunately, such measures are not found to be envisaged within the context of implementation of RBD management plans.

9.6. Water pricing policy measures

At the moment there is no information on implementation progress of water pricing policy measures (for households, industry or agriculture) in Latvia or in Lithuania. These measures are to be implemented at national level, and the final summary will be prepared in both countries by the end of 2012 when reports on progress shall be submitted to the European Commission.

9.7. Other measures (research, monitoring, improvement of knowledge, etc.)

As many issues emerged during the preparation of river basin management plans and programs of measures are not enough clear, many research or investigative measures are planned both in Latvia and Lithuania.

Special measures dedicated to research activities or dissemination of knowledge within the Venta RBD are not implemented or started at the moment. A few projects for elimination of existing and potential causes of pollution of groundwater by hazardous substances are planned to be implemented in Lithuania (Tab. 9.7.1). Similar activities are on-going in Latvia also but these activities are mainly part of infrastructure projects for improvement of wastewater treatment systems. Unfortunately, it is not possible to divide separate costs for liquidation of unused wells.

In Lithuania a few *monitoring measures* are planned – investigative monitoring in the lakes *Alsedžiu Ezeras* and *Tausalas* after removing of Bugeniai dam. Also more intensive investigative monitoring every three years is planned for these water bodies in order to obtain more precise data on general physicochemical parameters and to find out where phosphorus compounds are released from bottom sediments. In the *Lake Mastis* and *Sablauskiu pond* investigative monitoring is planned also to assess pollution sources which may cause the moderate quality of these water bodies. Besides, in the *Lake Birzulis* study on pollution sources and their impacts is planned also. Till now there are a few projects in the Lithuanian part of Venta RBD started according to improvement of attractiveness of water bodies as well as some research projects (Tab. 9.7.2). A number of projects or parts of projects started are devoted to improvement of the water quality of Lake Mastis.

Table 9.7.1

Planned projects for groundwater protection in the Lithuanian part of Venta RBD

Project	Implementation status (planned starting/ ending dates)	Responsible institution	Costs, EUR		
			Total costs	Int.al. from EU Funds	Int.al. self-financing
Liquidation of unused wells (10 places, in order to prevent groundwater pollution by hazardous substances)	Not started (04.12. / 04.13.)	Telšiai county administration	21957	8547	13409

Table 9.7.2

Planned research and attractiveness projects in Lithuania

Project	Responsible institution	Implementation status	EU funding, EUR
Special plan for local water tourism route in Mastis Lake, Telšiai city	Telšiai county administration	Ongoing (from 2011)	19 588
Informing the public about water conservation and improvement of water bodies	Environmental Protection Agency	Ongoing (from 2011)	104 193
Natural water bodies and fish populations of rare passers-by, conditions for the determination of research	Environmental Protection Agency	Ongoing (from 2011)	316 855
Improving the status of water bodies in Skuodas county	Skuodas county administration	Ongoing (from 2010)	125 387
Cleaning of the river banks of Venta river in Kuršėnai city	Šiauliai county administration	Ongoing (from 2010)	540 679
Rehabilitation of contaminated urban areas in Telšiai city near lake Mastis - reclamation and treatment works, stage I (number I)	Telšiai county administration	Ongoing (from 2010)	2 970 159
Rehabilitation of contaminated urban areas in Telšiai city near lake Mastis - reclamation and treatment works, stage I (number II)	Telšiai county administration	Ongoing (from 2011)	1 356 470

Table 9.7.2 (continued)

Project	Responsible institution	Implemen-tation status	EU funding, EUR
Rehabilitation of contaminated urban areas in Telšiai city near lake Mastis - reclamation and treatment works, stage II	Telšiai county administration	Ongoing (from 2011)	2 035 144
Rehabilitation of contaminated urban areas in Telšiai city near lake Mastis - reclamation and treatment works, stage III (number I)	Telšiai county administration	Implemented (2010-2011)	624 418

Similar to Lithuania, intensive investigative monitoring in Latvia during 3 years in at least **3** water bodies *Viesata* (V041), *Prūšu* water reservoir (E006) and *Sepene lake* (E007) is anticipated. In addition, there is a need for additional assessment of pressures in the water body *Slocene River* (V093) where bad water quality was detected but not explained yet.

In order to improve the water quality in a number of lakes, there should be research projects implemented in order to clarify the causes of problems regarding water quality which is lower than good and to prepare suggestions for improvement of lakes' water quality in question, especially in water bodies at risk. One small research project according to lake water bodies at risk is already implemented but it was aimed at theoretical data review and not at practical activities.

Analysis of Natural Resources Tax as a special research measure in Latvia was planned but it is not started yet. Furthermore, elaboration of suggestions concerning renaturalisation of straightened and impacted rivers and renewal of fish spawning places is planned but no information on progress available at the moment.

In relation to priority and hazardous substances in Latvian surface water and groundwater a special research project is carried out during 2009-2010 spending about **230 thousands EUR** in total.

There was research project on aquaculture activities planned in Latvia but it is still not launched.

With respect to development of information systems and increasing of availability of environmental information including information related to water management a special project is started in Latvia. The project will be implemented till the end of 2012 by the State Environmental Service.

Moreover, in both countries measures on public information and education with regard to different environmental aspects are planned. For example, in the Lithuanian part of Venta RBD information campaigns for farmers and other interested groups are to be organized. Like to Lithuania, Latvia plans information campaigns on river basin management for the general public (lectures for students are already ongoing). Besides, involvement of public into issues associated to river basin management is envisaged.

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10. "Success story" analysis of international river basin management measures

The integrated approach to water resources management (IWRM) that many countries have introduced into their national policies must also be the backbone of transboundary basin management. The catchment area of a river, lake and aquifer is indeed the space where hydrological, social, economic and environmental interdependences appear and where integrated development and management of water resources and territories have the potential to yield the greatest success[16].

Under the WFD, water management is based on River Basins. EU Member States set up river basin districts and designate the administrative unit for each district. Where a river basin includes more than one Member State or crosses from the EU to neighboring countries (Fig. 10.1), the WFD calls for the creation of an international river basin district.

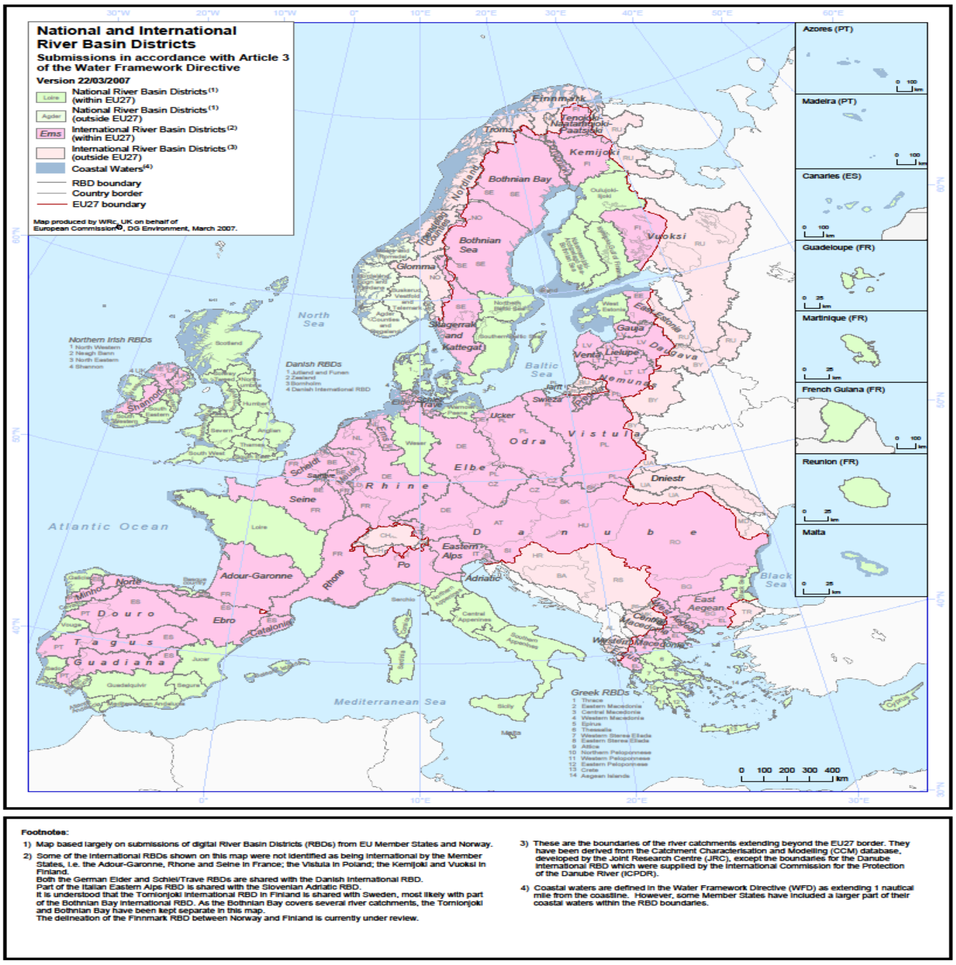

Figure 10.1. Map of national and international RBDs[17].

[16] The Handbook for Integrated Water Resources Management in Transboundary Basins of Rivers, Lakes and Aquifers. March 2012.

[17] National and International River Basin Districts. Submissions in accordance of Article 3 of the Water Framework Directive.

This chapter includes information on most successful cooperation forms for improovement of water quality in International River Basin districts in EU.

10.1. Biggest RBD Danube – „give a political impetus to cooperate"

The International Convention on Protection of Danube River (ICPDR) was signed on 29 June 1994 in Sofia, and entered into force in October 1998. All countries sharing over 2000 km² of the Danube River basin (8 EU countries, 1 accession country and 5 non-EU countries) as well as the European Commission are contracting parties to the Danube Convention (Fig. 10.2 and Tab. 10.1).

The Danube is 2857 km long, and up to 1.5 km wide, with depths of 8 meters in some places. The Danube is the second largest river in Europe - after the Volga.

Figure 10.2. Countries in the Danube RBD.

In the Danube RBD, all countries (including most of those not being members of the EU) have been working on their national management plans.

As these plans need to be established for each river basin, the countries are also cooperating at the international level. They use the ICPDR as a platform to discuss and agree on the transboundary aspect of the management of the water resources. The countries of the Danube River Basin have jointly developed the Danube River Basin Management Plan (DRBMP) including measures that ensure that at least good status is reached by 2015 and including thematic maps. The DRBMP has been adopted by the Commission of the ICPDR on 10 December 2009 and is available now.

The preparation of the DRBMP was possible because of a number of factors. First and foremost the countries of the Danube had been cooperating together in the framework of the ICPDR since 1994. The political commitment to cooperation expressed at the time of the signing of the Convention has been realized in the work of the ICPDR since that date. All the countries of the Danube are signatories to the

Convention and have active participation in the work of the Commission to the Convention.

Table 10.1

Information on countries in the Danube RBD

Country	Code	Coverage in Danube RBD (km²)	Percentage of Danube RBD (%)	Percentage of Danube RBD in the country (%)	Population in Danube RBD (Mill.)
Albania	AL	126	< 0.1	0.01	< 0.01
Austria	AT	80.423	10.0	96.1	7.7
Bosnia and Herzegovina	BA	36.636	4.6	74.9	2.9
Bulgaria	BG	47.413	5.9	43.0	3.5
Croatia	HR	34.965	4.4	62.5	3.1
Czech Republic	CZ	21.688	2.9	27.5	2.8
Germany	DE	56.184	7.0	16.8	9.4
Hungary	HU	93.030	11.6	100.0	10.1
Italy	IT	565	< 0.1	0.2	0.02
Macedonia	MK	109	< 0.1	0.2	< 0.01
Moldova	MD	12.834	1.6	35.6	1.1
Montenegro	ME	7.075	0.9		
Poland	PL	430	< 0.1	0.1	0.04
Romania	RO	232.193	29.0	97.4	21.7
Serbia	RS	81.560	10.2		
Slovak Republic	SK	47.084	5.9	96.0	5.2
Slovenia	SI	16.422	2.0	81.0	1.7
Switzerland	CH	1.809	0.2	4.3	0.02

Table 10.1 (continued)

Country	Code	Coverage in Danube RBD (km²)	Percentage of Danube RBD (%)	Percentage of Danube RBD in the country (%)	Population in Danube RBD (Mill.)
Ukraine	UA	30.520	3.8	5.4	2.7
Total		**801.463**	**100**		**81.00**

A central element of that cooperation has been focused on reliable and organised **information on water quality**. The countries of the region have been actively engaged in activities that are needed to ensure mutual understanding and cooperation. In particular, a yearly status of water quality has been published since 1996 based upon the Transnational Monitoring Network developed by the countries in response to the Convention. This monitoring activity provided the necessary basis for harmonised water quality assessment throughout the whole basin which not only gave an overview on water quality trends in the basin and on loads of substances discharged into the Black Sea but it fostered achieving of compatibility among water assessment approaches in the Danube countries.

A critical element of the success of the development of the management plan was also the work performed under the River Basin Management Group (RBMG) of the ICPDR and under the other expert groups of the ICPDR who organised their work according to the requirements of the WFD. The RBMG was the place where the existing information came together and the members of this group saw themselves as responsible for coordinating the inputs of their countries into the plan.

Finally, the development of the Plan was only possible because of **the political commitment** of the countries to cooperate together. Without this it is unlikely that the River Basin Management Plan would have been possible. The joint work on preparing the plan helped each country to strengthen its national responsibility as well as helped to ensure the development of common (or at least comparable) methods for analysis and information collection.

The development of the **Danube Strategy** by the EU gave a positive boost to the chances of success of the Danube River Basin Management Plan**.** This overarching regional development policy is intended to promote a strengthening of regional development in the Danube region. The implementation of all the actions in the Danube River Basin Management Plan are not assured by the Danube Strategy itself but the process of developing of the Strategy has added new political support and acknowledgement to the actions outlined.

Although non-EU Member States were not able to ensure collection and processing of all data, they benefited significantly from this process in many ways. Firstly, ICPDR and other donors **financially supported necessary projects** towards achievement of Danube River protection goals. Besides, **non-EU Member States got familiar with the new EU regulations**. And finally, **communication among water management specialists** from different countries was improved by this process.

Another significant benefit was the ability to examine in detail the various implications (particularly financial) of the implementation of EU water directives in Serbia.

10.2. Rhine - future of Salmonids – "cooperation limited to a portion of a river strongly affected by a problem to solve"

The Rhine River Basin is a good example to demonstrate that **cooperation initially restricted to the main river can be extended to the whole basin**: the old and the new Convention on the Protection of the Rhine are limited to the river itself without its tributaries but with the exception of flood protection and of pollutants` discharges which adversely affect the river.

The Rhine is a river that flows from Grisons in the eastern Swiss Alps to the North Sea coast in the Netherlands and is one of the longest and most important rivers in Europe. It is about 1233 km long with an average discharge of more than 2000 m^3/s (Fig. 10.3).

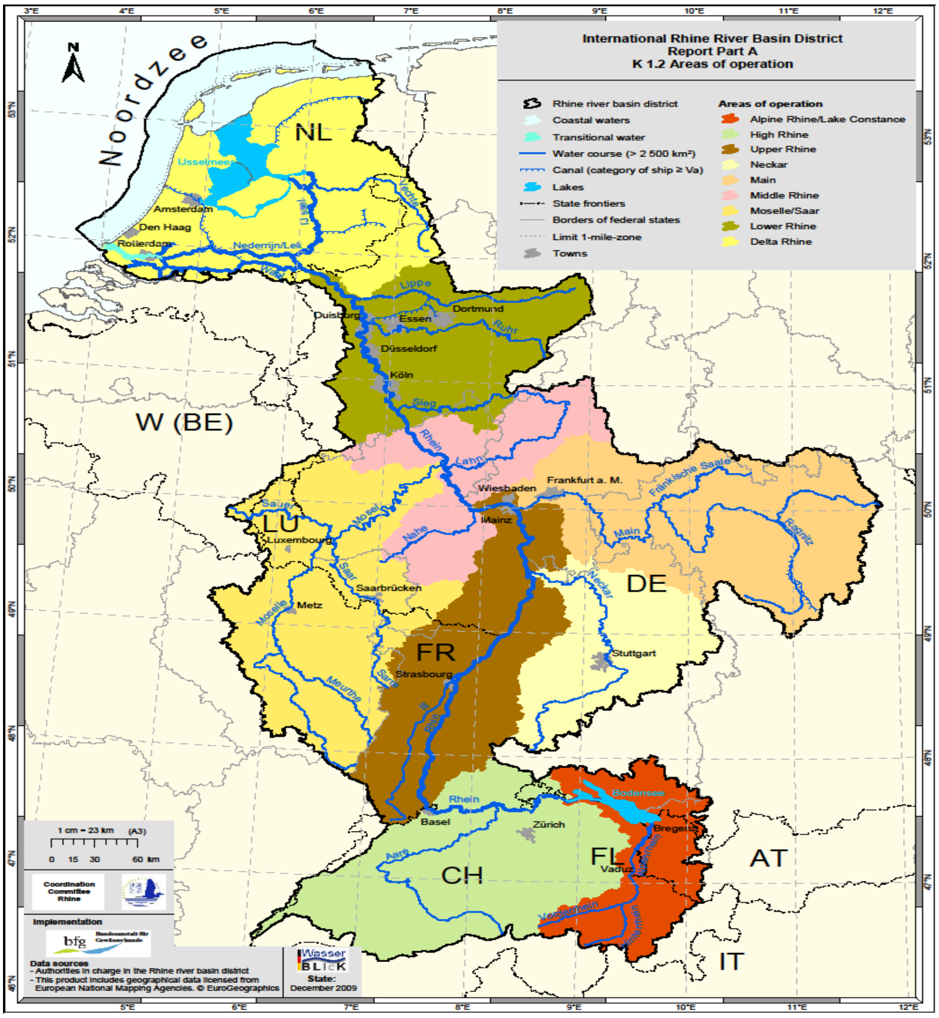

Figure 10.3. Map of the Rhine RBD[18].

[18] International Commission for the Protection of the Rhine. Management plan (part A).

For the benefit of the Rhine and of all waters running into the Rhine, the members of the International Commission for the Protection of the Rhine (ICPR) – Switzerland, France, Germany, Luxemburg, the Netherlands and the European Commission successfully co-operate with Austria, Liechtenstein and the Belgian region of Wallonia as well as with Italy. Nine states and regions in the Rhine watershed closely co-operate in order to harmonize the many interests of water use and protection in the Rhine area. Focal points of work are directed towards sustainable development of the Rhine, its alluvial areas and reaching the good state of all waters in the watershed.

Working and expert groups with clearly defined mandates work on all relevant technical issues arising from the implementation of the Convention on the Protection of the Rhine and of the European laws. Decisions are taken in the annual plenary assembly. The Conference of Rhine Ministers takes decisions on matters of political importance and establishes the basis for coherent, co-ordinated programmes of measures.

The Convention on the Protection of the Rhine is the basis for international cooperation for the protection of the Rhine within the ICPR. It was signed on 12 April 1999 by representatives of the governments of the five Rhine bordering countries – France, Germany, Luxembourg, Netherlands and Switzerland and by the European Community. Thus, they formally confirm to continue to protect the valuable character of the Rhine, its banks and floodplains by means of increased cooperation.

Among other objectives, the preservation, improvement and sustainable development of the Rhine ecosystem are central elements of the convention. This target was fixed against the background that the Rhine is an important European navigation lane and is supposed to continue to serve different uses.

In January 2001 the ministers in charge of the Rhine adopted "Rhine 2020", the "Programme on the Sustainable Development of the Rhine" following the most successful "Rhine Action Programme" (1987-2000). It determines the general objectives of Rhine protection policy and the measures required for their implementation for the next 20 years including certain deadlines. Besides, intermediate objectives have been defined with a view to success control. The balance on the implementation of the measures of the programme "Rhine 2020" until 2005 shows first success but also that further efforts are required, e.g. when enhancing the variety of river banks.

The core parts of the programme „Rhine 2020" are the following ones:

- the implementation of the Rhine habitat patch connectivity;
- Salmon 2020;
- the improvement of flood mitigation by implementing the Action Plan on Floods;
- the indispensable further improvement of water quality;
- groundwater protection.

The continuous surveillance of the state of the Rhine and further improvement of the water quality continue to be an essential part of ICPR work.

„Rhine 2020" supports the implementation of the WFD and will contribute to the achieving a "good chemical and ecological state" in the Rhine watershed. The programme also enhances the implementation of the EU Flood Management Directive.

The draft of the management plan (part A) is a result of international coordination in the Rhine RBD. All states have agreed on the international part of the management plan (part A).

In the meantime, after some years of existence in parallel the two processes related to the Convention on the Protection of the Rhine and to the WFD have been structurally merged. Most issues are now discussed together without focusing on which issue should be treated under which structure. Of course, there are issues that pertain only to the Convention or only to the WFD; nevertheless. many issues overlap and synergies are possible. For the implementation of the WFD it has proved to be an **absolute advantage to build on an existing international structure and not to have to start from zero.**

10.3. Elbe – “Adaptive basin management”

The Elbe originates in the Czech *Riessengebirge* and has a length of 1094 km of which 367 km are located in the Czech Republic and 727 km - in Germany. The river basin covers an area of nearly 150 000 km^3 and is in size the fourth basin of Middle-Europe. About two third of the basin is located in the Germany but about one third - in the Czech Republic. A negligible part of the basin can be found in Austria and Poland (Fig. 10.4).

Figure 10.4. Map of the Elbe RBD[19].

[19] NeWater. Transboundary River Basin Management Regimes: The Elbe Basin Case Study. August 2005.

The International Commission for the Protection of the Elbe (ICPE) established recommendations for river basin management which are adopted by the (yearly assembled) official delegations of Germany, Czech Republic and the European Union. Under the ICPE seven working groups are established among which the working group on flood protection, the working group on hydrology and the working group on the implementation of the WFD are active.

The main goals of the ICPE are:

- to secure the (future) possibility to produce drinking water from water pumped from the river accompanying groundwater and to use the water and sediments for agriculture;
- to return to the state close to natural ecosystem status with a healthy species diversity;
- to reduce the negative effects of Elbe river basin on the North Sea.

To reach these goals, an improvement of the physical, chemical and biological status of the water, sediments and organisms is required as well as the improvement of the ecological value of the Elbe basin in the whole.

Scientists assessed that Elba basin can be one of the cases where **adaptive river basin managemen**t could be the most effective management aproach. Traditionally, river basin management has been treated as a technical issue which can be addressed through prediction and control. In practice, however, river basin management is faced with complex issues that are characterised by uncertainty and change because current knowledge is unlikely to be sufficient in the future. River basin management needs to be adaptable to new information and changing circumstances. Adaptive management aims at active learning of all stakeholders and continually improving management strategies as well as by learning from the outcomes of the implemented policies. This approach might require changes in the management regime, consisting of law, policy, formal and informal actors` networks and interactions among these elements.

10.4. Key points for succesful transboundary water management

- The willingness of states to cooperate regarding water management can start with specific challenges or common goals, with regional or community dynamics and even with a risk of conflict.
- Cooperation can be firstly established within a part of the basin or even among limited number of countries before being expanded. The evolutionary process must build on existing agreements.
- Legal agreements as foundations for transboundary water resources management can be:
    - ✓ Cooperation through a long-standing transboundary basin organization;
    - ✓ Cooperation through a new basin organization;
    - ✓ Cooperation in a bilateral setting;
    - ✓ Cooperation through the adjacent settlements;
    - ✓ Cooperation based on a non-governmental approach;
    - ✓ Cooperation through integrated transboundary projects.

1. Three levels of general mandates for transboundary basin organizations in ascending order of importance are:

- ✓ a merely informational mandate; focusing on the exchange of data and tasks mainly technical and on the execution;
- ✓ a consultative mandate where the body is an institution complementary to the states but has no decisional power;
- ✓ a decisional mandate; implying indeed a partial loss of the states' sovereignty to the benefit of the organization in the field of shared waters.

2. Using of new approaches – adaptive basin management.

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PUBLIC PARTICIPATION

11. The main target groups

The WFD includes a number of principles of river basin management to ensure communication among water users throughout the entire planning cycle, and directive has direct requirements for public information and participation in decision-making. Both Latvia and Lithuania have developed a formal tool to fulfil the WFD requirements - River basin Advisory (Consultative) Boards are established for each river basin district whose primary role is to coordinate state agencies, municipalities, non-governmental organizations (NGOs), entrepreneurs (merchants) and other stakeholders` interests in matters related to the environmental quality objectives in the basin district. At the same time, the process of development of river basin management plans requires agreement of all water users (stakeholders) to be achieved on the matters in relation to the cost-effective remedy measures to be taken in the river basin districts.

The most important target groups which opinion on water management must be taken into account are the following ones:

- ***Economic area:***
  - Water supply and wastewater services providers;
  - Farmers;
  - Foresters;
  - Manufacturers.
- ***State and municipal area:***
  - Statutory developers and responsible institutions for implementation of WFD;
  - Natural protected area managers;
  - Spatial planners;
  - Regional Administration and Local Government.
- ***Social area:***
  - NGOs and other community organizations;
  - Mass media;
  - Households;
  - Children and young people.
- ***Areas of expertise:***
  - Educational institutions;
  - Scientists;
  - Experts.

The mentioned target groups have been selected by several criteria: 1) the majority of pollution load producers (population, agricultural producers, manufacturers in other industries, forest managers); 2) decision-makers (developers of regulations, planners at various levels, municipal authorities, etc.); 3) executive bodies (providers of water supply and sewage management services); 4) other target groups which have or may have a significant role in water management (NGOs, mass media, experts, researchers, educators, etc.) (Fig. 11.1).

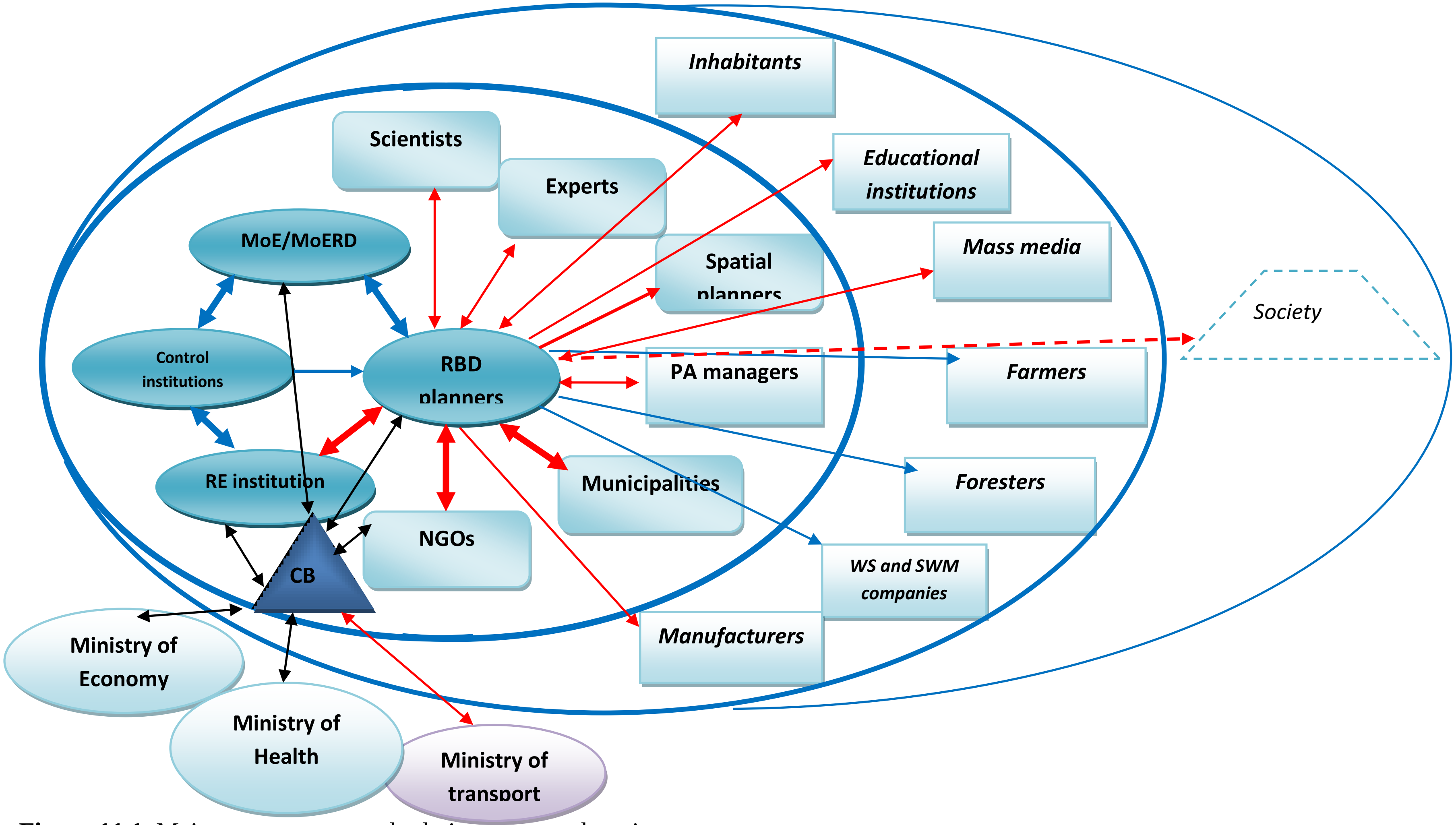

Figure 11.1. Main target groups and relations among them in water management.

CB – Consultative Boards; RE institution – Regional Environmental institutions; PA managers – Protection areas managers; WS – Water supply; SWM – Savage water management; MoE – Ministry of Environment; MoERD – Ministry of Environment and Regional Development

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12. Public informing and involvement in the Venta basin management

Generally, public involvement in the river basin management is based on theoretical considerations and assumptions resulted from scheme of main target groups and their relations reflected in the chapter 11. One more time it must be stressed that WFD lays down a number of principles to be implemented with respect to public involvement in the river basin management. It means informing and getting participation of broader public in decision-making related to basin management beyond those state and municipal institutions which are directly responsible for river basin management. The general mechanism envisaged by the WFD is establishment of river basin Advisory or Consultative Boards (CB). As it was already mentioned previously, both Latvia and Lithuania have established such CBs for each river basin district including Venta RBD.

The CB for Venta RBD consists of the following representatives from different main stakeholders` groups:

- NGOs;
- Ministries;
- Municipalities.

For example, in Latvia the CB of Venta RBD for time period 2010 – 2016 is composed of the representatives from the *Ministries of Agriculture, Health, Economy and Environmental Protection and Regional Development* (two participants delegated from the Ministry of Environment represent Liepāja and Ventspils Regional Environmental Boards and one – Spatial Planning Department of the ministry), *Auce, Kuldīga, Saldus, Ventspils and Rucava municipalities* as well as from the *Rīga Planning Region*. In addition, there are participants from professional associations like "*Farmers Saeima*" and "*Association of Small Hydropower Energy*", environmental protection NGOs like "*Club for Environmental Protection*" and local development associations, namely, "*Centre for Development of Abava Valley*". Besides, environmental consultancy companies are represented by *Baltic Environmental Forum*.

The meetings of CBs are organized usually 2 times per year but the chair elected from the members of the CB has the rights to announce additional extra meetings in the case of necessity. The functions of secretariat of CBs are fulfilled by Latvian Environmental, Geology and Meteorology Centre and Lithuanian Environmental Protection Agency. All information related to the meetings (Minutes of the meeting, presentation materials, etc.) is published at internet sites of respective organizations.

It could be said that participants from NGOs and municipalities are representing interests of general public in its broader sense covering different circles of society. Especially it should be true regarding local NGOs operating within the particular RBD. Both participants from municipalities and NGOs shall educate and inform the local inhabitants with respect to main principles of WFD, elaborated river basin management plans, programs of measures foreseen and so on. The level of knowledge of local people living in the particular river basin in relation to water management issues can be tested by public opinion polls. Such surveys of public opinion have been already performed in the Venta RBD within the framework of "Live Venta" project in 2011 as well as are planned additionally in the near future.

During the survey **505** inhabitants in **Latvian part** of Venta RBD and **501** inhabitants in **Lithuanian part** of Venta RBD were questioned covering the range of ages from 18 to 74 years. Generally, the investigation reveals rather poor knowledge about the river basin management plans – only **26 %** of all respondents had heard about them. Even smaller amount of questioned people had idea what means good water quality in the light of WFD. Especially among young people the awareness of water management issues is poor. In addition, most of the respondents do not have idea what is causing the main pressures in relation to deterioration of water quality beyond untreated wastewater effluents which is in many aspects already more or less solved problem. With respect to potential information channels through which the people are preferring to receive the information on water protection, they have listed the traditional ones to which they have used in everyday life. It shall be mentioned that large amount of inhabitants expressed their readiness to take part in actions dedicated to clean-up of water bodies. Visual impression of water as well as abundance of fishes is the main aspect considered by people when they are evaluating the water quality.

What is the real role of NGOs taking part in the CB of Venta RBD, it is not clear looking at the results of the survey. They have actively to deliver information obtained during meetings of CB to the local public as well as raise issues expressed by local people to the CB. So, the role of NGOs is very important in establishing feedback between state level and local level, however municipalities have the same responsibility. Although the role of state institutions shall not be neglected with respect to informing of the public and preparation of centralized educational campaigns, NGOs and municipalities should be the main driving force concerning public involvement in matters related to water management locally. From this point of view, the role of CBs is still not fulfilled completely and there is room for improvement both in the case of Venta RBD and other RBDs.

Informing of general public regarding management of Venta RBD must be seriously improved, as basin management plans and water quality reports published by Latvian and Lithuanian responsible institutions are mainly for professionals. There are no short and popular versions of "easy to read and understand for everyone" available.

As regards the actual project on development of cross border Venta basin management plan, first of all, it is dedicated to Lithuanian and Latvian specialists dealing with water management issues. In such format and in English it is not deemed for broad public. Translation of the cross border basin management plan in Latvian and Lithuanian as it was proposed by some participants of working group on the project is beyond the scope of the actual project. Besides, it seems not necessary. Instead, a short and popular version of the plan should be developed but, again, this is not the task of the project in question taking into account the short terms allowed for it. Nevertheless, the cross border Venta basin management plan shall be published at the internet sites of Kurzeme Planning Region and Venta Regional Park cooperating under the "umbrella" "Live Venta" project. The plan should have "open" status with possibility to be commented by everybody and all suggestions are welcomed to be considered during preparation of the official Latvian – Lithuanian international Venta RBD management plan.

During the course of the actual project a special working group of the project was established consisting of participants from the Ministries of Environment in both countries, Lithuanian Environmental Protection Agency and Latvian Environmental, Geology and Meteorology Centre (competent authorities for river basin management in both countries), Kurzeme Planning Region, Venta Regional Park, Liepāja Regional Environmental Board, Siauliai Regional Environmental Protection Department, Kuldīga and Saldus municipalities and Skuodo County municipality. Totally, four meetings of the working group were organized. Two of them were enlarged working group meetings dedicated to broader audience separately in Lithuania and Latvia with involvement of additional participants from municipalities, regional state environmental authorities and NGOs. However the activity and involvement of some of the participants nominated to the working group could had to be greater, discussions which occurred during these four meetings were fruitful and inspiring. Ideas resulted from discussions of participants taking part in these meetings are included in the section of recommendations, as well. In addition, press releases on the project are prepared by the Kurzeme Planning Region and disseminated both in Latvia and Lithuania.

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RECOMMENDATIONS

13. Proposals for optimization of institutional framework of Venta basin management in a transboundary context

First of all clear division of responsibilities among different management levels (state, regional and municipal) inevitable for the management of RBD and related implementation of WFD shall be made. Such task should be initiated and performed by Ministries of Environment in both countries being the central institutions responsible for implementation of EU legislation on environmental protection and management as well as sustainable usage of natural resources. Starting the process, the working group consisting of all stakeholders involved in river basin management could be established and all relevant issues must be discussed. Actually, the mechanisms to launch the process or some prototypes of the mentioned working group are already in place both in Latvia and Lithuania, namely, RBD consultancy boards. After discussions in all RBDs consultancy boards established in both countries related ideas should be consolidated and implemented by the Ministries of Environment. The coherence of all territorial management levels in order to achieve the synergy in the water management might be pictured as follows in the Figure 13.1.

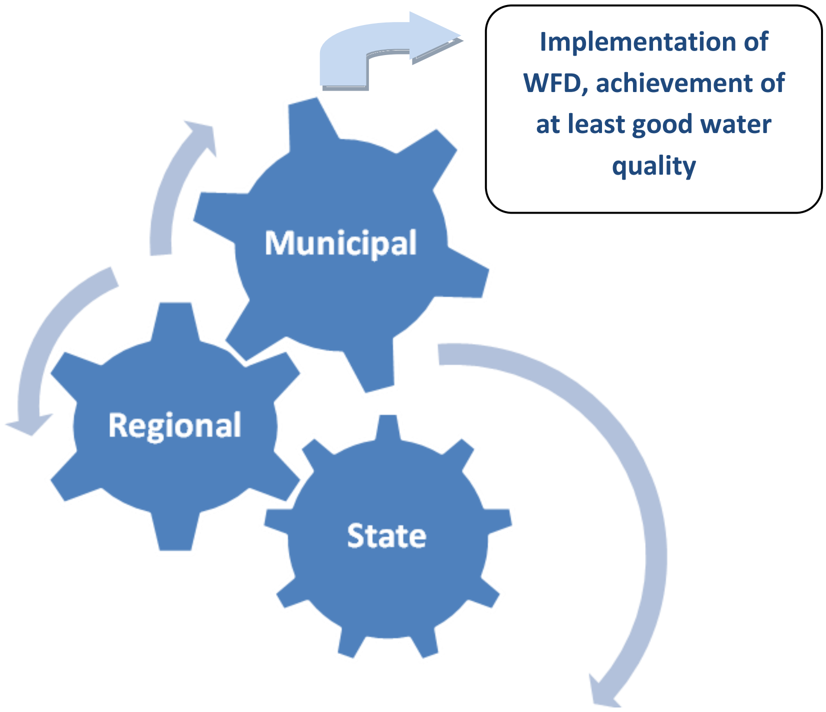

Figure 13.1. Synergy of state, regional and municipal levels for the implementation of WFD.

Governmental institutions and in the first place Ministries of Environment shall ensure the general provisions for implementation of WFD in all RBDs including aspects of cross-border cooperation:

- To close formal agreement between both ministries on information exchange and cooperation. As such agreement between Latvia and Lithuania already exists, but is not actively operated, it must be activated deciding on certain implementing bodies in both countries. Probably high level working group at ministerial level of both countries should be established. Furthermore, during the workshops of the enlarged project working group an opinion was expressed that such agreement between the governments of both countries should be signed because the level of Ministries of Environment is not enough.

- The ministries should delegate the coordination of cross-border cooperation within RBDs by means of contracts to subordinated institutions or to the third parties which can be regional authorities not subordinated to the Ministries of Environment or even NGOs being active in the area of environmental protection and sustainable development.
- The ministries shall ensure the necessary scientific support inevitable for river basin management – initialization of education and preparation of field biologists dealing with biological quality elements laid down by the WFD, elaboration of assessment methods and development of ecological typology of surface water as well as systems for classification of ecological quality of water bodies. For the implementation of all tasks mentioned a proper allocation of financial resources is crucial according to a strategic plan elaborated and agreed upon. As for small countries like Latvia and Lithuania it is difficult to cover all scientific aspects related to implementation of WFD and preparation of needed experts, cooperation on this subject between both countries is necessary. The following exchange of experts in the future might be possible.
- The state level is responsible for allocation of financial resources for regional and municipal level taking into account strategic needs, for scientifically methodological support as well as for supporting of capacity building - human, technical, administrative.
- The state level is responsible for regular information provided to regional and municipal level on strategic issues concerning implementation of WFD both at national level and EU level. Information on planned activities should be given at regular basis. This can be done by means of working groups.
- The state level is responsible for maintenance and operation of the scheme for notification on accidents in the environment in the transboundary context which is not properly working for the moment.

In their turn, **regional authorities** shall be responsible for supervision and implementation of tasks directly within the RBDs. They must be the leading bodies regarding coordination of action programs based on related management plans. Regional authority shall establish a consultative cross-border body where representatives from each country and from all management levels (state institutions, other regional institutions dealing with some tasks related to implementation of WFD as well as local (municipal) authorities) are participating. Formal arrangement as supplement to the general agreement on information exchange and cooperation in the field of environmental management between the ministries shall be concluded. It is possible that such consultative cross-border entity on the basis of existing consultative boards of RBDs is formed.

The regional level, similar to general tasks of state level outlined above, as much as possible is responsible for allocation of financial resources for municipal level taking into account the strategic needs within the whole RBD, for scientifically methodological support as well as for supporting of capacity building - human, technical and administrative capacity at local level. Besides, the regional authority responsible for coordination of implementation of WFD at RBD`s level shall initiate common projects covering all municipalities involved including those located on both sides of Latvian-Lithuanian border.

State and regions` level working groups on cooperation within RBDs can involve particular experts, for instance, scientists in the case of necessity.

In addition, the notification on accidents in the environment in the transboundary context shall be duplicated at the regional level, too. The regional authorities shall inform the related municipalities probably impacted or supposed to be impacted by the incident in question.

At **municipal level** the cross-border working groups could be established by neighbouring municipalities (bilateral, trilateral, etc.) occupying the RBD in question in order to discuss local issues (not only those associated to water management) and cooperate in a number of matters. Formation of such local working groups should be initiated by adjoining municipalities themselves. They can ask support from regional cross-border working groups when it is needed. Besides, representatives from local municipal working groups have to take part in the work of regional working groups. Some good examples are already in place, for instance, during discussions on the development plan of Rucava territory representatives from the adjacent cross border Lithuanian municipalities have been taken part.

The local municipalities shall guarantee that water management issues associated to RBD`s management plans are incorporated into spatial development plans. They must regularly provide information to regional and state level on local measures taken in order to implement requirements of WFD. Details on local trends with respect to quality of water bodies could be clarified by local municipalities, as well.

Very important task of local municipal level with respect to management of water is to ensure communication with inhabitants and entrepreneurs living and operating in the municipality. A proper communication means interaction with local NGOs, as well. In addition, municipalities are responsible for realization of local environmental protective activities in connection to common management plans and action programs in relation to RBD. The local municipalities must be asked to take part in elaboration of these management plans and action programs cooperating with regional and state institutions. As it is already up to now, they will be responsible for local drinking water supply and provision of sewage treatment services of acceptable quality. Furthermore, they could initiate local nature conservation projects.

The main task of regional and municipal level working groups is to reach agreement on management of cross-border water bodies.

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14. Proposals for harmonization of water ecological typology and quality classification system in the common water bodies of Venta basin

14.1 Harmonization of ecological typology for surface water in Latvia and Lithuania

14.1.1 Rivers

5 river types in Lithuania **6** in Latvia have designated based on two main natural factors which determine the major differences among the water communities in rivers: catchment size and river bed slope. According to these descriptors, rivers can be small (<100 km^2), medium (100 – 1000 km^2) and large (> 1000 km^2) as well as slow flowing or potamal and fast flowing or ritral. In the case of potamal rivers the bed slope per 1 km is less than 1 m (Latvian criteria) or less than 0.3-0.7 m (Lithuanian criteria). Having bigger bed slope as mentioned previously the river is specified as ritral river. The only one difference with respect to descriptors in both countries is the river slope but these differences are quite small, so it is possible to draw conclusion that the Lithuanian and Latvian river types` classes can be combined but bearing in the mind that the similar types` numbers are not coinciding (Tab. 14.1.1).

Table 14.1.1

Interrelation between Lithuanian and Latvian typology of rivers in the Venta RBD

Catchment size, km^2	< 100	100 - 1000		> 1000	
Bed slope, m/km	-	< 0.7	> 0.7	< 0.3	> 0.3
Lithuania	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**

Latvia	**Type 1***	**Type 2***	**Type 3**	**Type 4**	**Type 5**	**Type 6**
Bed slope, m/km	> 1	< 1	> 1	< 1	> 1	< 1
Catchment size, km^2	< 100		100 - 1000		> 1000	
Type name	Small ritral	Small potamal	Medium ritral	Medium potamal	Large ritral	Large potamal

*Not determined in the Venta RBD

According to **Option one**, *small potamal rivers* within the common Venta RBD are combining Lithuanian **type 1** and Latvian **type 2** rivers, *medium potamal rivers* - Lithuanian **type 2** and Latvian **type 4** rivers, *medium ritral rivers* – Lithuanian **type 3** and Latvian **type 3** rivers but *large potamal rivers* - Lithuanian **types 4** as well as **5** and Latvian **type 6** rivers. Large ritral rivers provide a special kind of rivers designated in Latvia but it is possible that some Lithuanian river stretches can correspond to the mentioned type of rivers with quite high bed slope. It should be noted that small ritral water bodies have not been determined in the Latvian part of Venta RBD[20] but in Lithuania all small rivers are grouped in one ecological class.

According to **Option two**, all rivers can be even divided only in three types based on their size of catchment area as *small*, *medium* and *large* rivers. Such division corresponds to approximations which were made towards a common typology of European rivers in similar geographical zones during the EU intercalibration exercise. In total, five geographical intercalibration groups were agreed upon:

- Northern;
- Central European & Baltic;
- Alpine;
- Mediterranean;
- Eastern Continental[21].

Both Latvia and Lithuania belongs to the Central European & Baltic region abbreviated as Central/Baltic group, however is was noted already in the early beginning of the process that rivers and lakes in the Baltic region are often quite different from the rest of the Central European regions, with very high values for alkalinity and organic matter. Alkalinity was used as a proxy for siliceous/calcareous geology. All Latvian and Lithuanian rivers are mainly characterized by calcareous substratum. The proposed typology of rivers for intercalibration exercise is given in the Table 14.1.2.

Table 14.1.2

Central/Baltic rivers: intercalibration types

RC1	RC2	RC3	RC4	RC5	RC6
Small, lowland, siliceous-sand	Small, lowland, siliceous - rock	Small, mid-altitude, siliceous	Medium, lowland, mixed	Large, lowland, mixed	Small, lowland, calcareous

Following, all Latvian and Lithuanian rivers can be divided into intercalibration types RC4 (medium rivers), RC5 (large rivers) and RC6 (small rivers).

Taking into account the fact that speed of water flow, in its turn, determined by bed slope, can be a very important factor associated to water community structure, the Option one is preferred for the joint ecological typology of rivers.

14.1.2 Lakes and ponds

Only **2** main types of **lakes** and **ponds** have been identified in the Lithuanian part of Venta RBD based on the average depth of lakes. By geology, almost all lakes (with individual exceptions) are classified as calcareous usually having high water

[20] Latvijas Vides, ģeoloģijas un meteoroloģijas aģentūra. Upju baseinu apgabalu raksturojums. Antropogēno slodžu uz pazemes un virszemes ūdeņiem vērtējums. Ekonomiskā analīze. 2005.

[21] European Commission. Joint Research Center. Overview of common Intercalibration types. Version 5.1. 23 April 2004.

hardness. Only lakes larger than 0.5 km² (50 ha) were considered. This is the case in Latvia, too, however Latvian classification system is more complicated and discriminates lakes with hard and soft water as well as clear water lakes and brown water lakes associated to high content of humic substances (usually in wetlands and swamp areas).

Irrespective of rather differing classification systems, very simple way for possible harmonization of both Lithuanian and Latvian lakes` typologies is to simplify the Latvian system and to adjust it to the Lithuanian one (Tab. 14.1.3).

Table 14.1.3

Interrelation between Lithuanian and Latvian typology of lakes and ponds in the Venta RBD

Average depth, m	< 3	3-9
Lithuania	**Type 1**	**Type 2**

Latvia	**T. 1**	**T. 2**	**T. 3***	**T. 4**	**T. 5**	**T. 6**	**T.7***	**T.8***	**T. 9**	**T.10***
Average depth, m	< 2				2 – 9				> 9	
Water hardness determined by geology, mkS/cm	>165		< 165		>165		< 165		>165	< 165
Water colour, Pt-Co	<80	>80	<80	>80	<80	>80	<80	>80	<80	<80

*Not determined in the Venta RBD

Following, according to **Option one**, *very shallow lakes* (average depth < 2-3 m) are combining Lithuanian **type 1** lakes and Latvian **type 1, 2, 3** and **4** lakes, but *shallow lakes* (average depth 3 – 9 m and a bit more) - Lithuanian **type 2** lakes and Latvian **type 5, 6** and **9** lakes. It must be reminded that lakes type 7, 8 and 10 are not determined in the Venta RBD. Nevertheless, lakes with characteristic brown water colour should not be taken into account and excluded from the possible comparison.

Sound reason for the simplified typology outlined above is again provided by the approximations which were made towards a common typology of European lakes in similar geographical zones during the EU intercalibration exercise. In total, five geographical intercalibration groups were agreed upon:

- Northern/Nordic;
- Atlantic;
- Central/Baltic;
- Alpine;
- Mediterranean/Eastern Continental[22].

[22] European Commission. Joint Research Center. Overview of common Intercalibration types. Version 5.1. 23 April 2004.

Both Latvia and Lithuania belongs to the Central/Baltic region. The proposed typology of lakes for intercalibration exercise is given in the Table 14.1.4.

Table 14.1.4

Central/Baltic lakes: intercalibration types

L-CB1	L-CB2	L-CB3
Lowland (<200m), shallow (3-15m), calcareous (> 1 meq/l), residence time 1-10	Lowland, very shallow, calcareous, (> 1 meq/l), residence time 0.1-1	Lowland, shallow, small, siliceous, moderate alk (0.2-1 meq/l), residence time 1-10

Again, all Latvian and Lithuanian lakes and ponds can be divided into intercalibration types L-CB1 (shallow - medium depth lakes) and L-CB2 (very shallow lakes). Actually, this corresponds to the national Lithuanian typology of lakes and ponds.

A slightly more sophisticated classification as the **Option two** could be division of lakes into **three** groups according to intercalibration types L-CB1 (shallow - medium depth lakes with high water hardness), L-CB2 (very shallow lakes) and L-CB3 (shallow - medium depth lakes with low water hardness). Option two means that Lithuania shall introduce an additional descriptor for the typology of lakes and ponds, namely, water hardness measured by electroconductivity in the field.

Similar to Option one, the Option two neglects the water colour also, so lakes with characteristic brown water colour should be excluded from the possible comparison.

The **Option three** means complication of ecological typology of lakes and ponds in Lithuania by introduction both of water hardness and colour criteria, at least in lakes and ponds of mutual interest both for Latvia and Lithuania. Nevertheless, potential occurrence of soft water lakes as well as brown water lakes in Lithuania should be taken into account.

It must be added that harmonization of lakes` typology may be of general scientific interest or relevant for the other common RBD, as all cross border water bodies in the Venta RBD are represented by a number of river water bodies as well as by adjacent sea coastal water bodies only.

14.1.3 Sea coastal water

However there is no one sea coastal water body belonging to the Lithuanian part of Venta RBD, the adjacent coastal water body to the Latvian one “Baltic south eastern open stony coast” is the Lithuanian sea coastal water body in the Nemunas RBD named “Open Baltic Sea stony coast (northern coast)”. The related typologies of both coastal water bodies coincide in general.

14.2 Harmonization of ecological classification systems for surface water in Latvia and Lithuania

However a several biological quality elements and are envisaged to be monitored in rivers and lakes as well as are used in order to describe reference conditions (although more based on qualitative rather than on quantitative characteristics applied by experts` judgement) in Latvia and Lithuania, only for a limited number of them certain numerical criteria have been elaborated to cover the whole assessment range from high to bad ecological quality. Comparison of chemical and biological parameters used for ecological classification of river and lake water bodies in Latvia and Lithuania are displayed in the Tables 14.2.1 and 14.2.2.

Table 14.2.1

Parameters used for ecological classification of river water bodies in Lithuania and Latvia

Lithuania	Latvia
NO_3-N	-
NH_4-N	NH_4-N
Ntot	Ntot
PO_4-P	-
Ptot	Ptot
BOD_7	BOD_5
O_2	O_2
Danish Stream Fauna Index (zoobenthos)	Saprobity index (zoobenthos)
Lithuanian Fish Index	-

Table 14.2.2

Parameters used for ecological classification of lake and pond water bodies in Lithuania and Latvia

Lithuania	Latvia
Ntot	Ntot
Ptot	Ptot
-	Transparency with Secchi disk
chlorophyll a	chlorophyll a
-	Biomass of phytoplankton

Analysis of both countries and their applied parameters allows drawing of the following conclusions with respect to ecological classification of river water bodies:

- almost no differences with respect to values of chemical criteria in different Lithuanian rivers` types (the same criteria for all types), but the opposite situation is in Latvia;
- the same biological criteria for all Lithuanian rivers` types, but the opposite situation concerning Saprobity Index exist in Latvia (different values for different rivers` types);
- different approaches in Latvia and Lithuania for final assessment ("one out, all out" principle in Latvia, rather complicated scheme in Lithuania);
- Danish Stream Fauna Index (DSFI) applied in Lithuania succeeded in the EU intercalibration process, but the Latvian Saprobity Index failed due to different kinds of pressures being intercalibrated and reflected by the Saprobity Index;
- for comparison transformation from BOD_5 to BOD_7 and vice versa is needed;
- biological quality element "fishes" used for classification in Lithuania is missing in Latvia;
- biological quality elements "macrophytes" and "phytobenthos" are missing in both countries.

Similar conclusions shall be made in relation to ecological classification of lakes and ponds:

- no differences with respect to values of chemical and chlorophyll a criteria in different Lithuanian lakes` types (the same criteria for all types), but the opposite situation is in Latvia;
- different approaches in Latvia and Lithuania for final assessment ("one out, all out" principle in Latvia, quite complicated scheme in Lithuania);
- chlorophyll a succeeded in EU intercalibration process for both countries;
- regarding biological quality element "phytoplankton" only chlorophyll a is introduced in Lithuania;
- it is not clear how the values of chlorophyll a concentration are translated into Ecological Quality Ratio (EQR) values given for classification in Lithuania;
- biological quality elements "macrophytes", "phytobenthos", "zoobenthos" and "fishes" are missing in both countries.

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15. Proposals for joint water monitoring system, the exchange of information and public involvement in the Venta basin management in a transboundary context

15.1. Joint water monitoring system

In the first stage joint **monitoring system** should be established only in the cross-border water bodies given in the Table 15.1.1 and taking into account already existing type of monitoring and ecological quality determined in the first management plans of Venta RBD. It shall be underlined that all Latvian-Lithuanian cross-border water bodies in the Venta RBD are natural river water bodies with exception to Lithuanian water body Dabikinė which is heavily modified water body (HMWB).

Table 15.1.1

Cross border water bodies in the Venta RBD and their characterization

Lithuania					Latvia				
Code of water body	**Name of water body**	**Type**	**Ecolo-gical quality/ potential**	**Type of monit. ***	**Code of water body**	**Name of water body**	**Type**	**Ecolo-gical quality/ potential**	**Type of monit. ***
LT700108102	Šventoji	2	2		V001	Sventāja basin	4	2	**S**
LT800120103	Bartuva	3	2		V010	Bārta	5	3	**S/O**
LT800121702	Apšė	3	1		V011	Apše	3	2	**O**
LT300114301	Lūšis	1	3		V056	Venta	6	3	Stat.1-**S** Stat.2-**O**
LT300114302	Lūšis	1	1						
LT300113104	Varduva	3	3						
LT300100018	Venta	5	2						
LT300111702	Vadakstis	2	2		V062	Vadakste	5	2	**O**
					V063	Ezere	4	2	**O**
LT300111701	Vadakstis	1	2		V066	Vadakste	6	3	**O**
LT300106101	Dabikinė	1	3 (HMWB)						

***S** – surveillance monitoring; **O** – operational monitoring

As it was already indicated in the chapter 3.6, **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. In its turn, **operational monitoring** is undertaken in water bodies where the current ecological status or ecological potential 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 programs 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.

According to these considerations, the Latvian cross border river water bodies are not obliged to a pertinent monitoring type or the meaning what is surveillance and operational monitoring is confused in the Latvian water monitoring programme for 2009-2014. It is stated that operational monitoring is with less frequency usually which is in contradiction to reflections outlined in the WFD. So, the joint monitoring in the cross-border water bodies should be rearranged changing its types according to existing water quality – more frequent operational monitoring in water bodies with water quality problems or uncertainties with respect to detection of water quality and more rare surveillance monitoring in water bodies with stable good or high water quality.

15.2. Exchange of information and public involvement

Exchange of raw monitoring **data and information** on assessment of ecological quality of water bodies between Lithuania and Latvia as well as informing of all stakeholders associated to RBD, including the broad public, is the initial element and starting point for public involvement in the management of RBD.

The procedure and related agreements and protocols for information exchange between neighbouring countries shall be decided by cross-border working groups (see chapter 13) at regional level which encompasses the particular RBD. Both raw monitoring data and final assessment made based on these data should be reported mutually once a year. On the occasion of accidental cases (accidental spillage of polluting substances into the natural water, technical or natural disasters, etc.) the related data and information should be reported immediately.

It is advisable that data and information with regard to the whole RBD should be exchanged and entered into the common data base of RBD to be established and jointly operated. This will allow keeping an oversight what is happening in the RBD as a whole, however, the data and information on particularly cross-border water bodies will be of greater interest for both countries. Also the related monitoring programs shall be exchanged by both sides.

The exchange of data and information (including monitoring programs) could be simplified by providing of internet sites where the related information is placed in both countries, but it shall be prepared in English.

Public involvement can be realized at all three levels – state, regional and local (municipal). Sometimes it is even not possible to discriminate which level is used mostly as they can coincide and act mutually. Notwithstanding, practical involvement by different means shortly described below is more characteristic to regional and even more – to local level.

One of possibilities for public involvement is to use indirect mechanisms through already existing consultative boards of RBDs in both countries as they are consisting of representatives of NGOs, too. The other conventional form of involvement are internet web pages - first of all at regional institutions implementing the main project "Cross border cooperation in management of Venta river basin area nature values (Live Venta)" – Kurzeme Planning Region in Latvia and Venta Regional Park in Lithuania. Speaking more generally and looking at the future implementation of cross-border river basin management plans and cooperation between Latvia and Lithuania, they shall be the responsible regional institutions which will organize and coordinate the work of regional cross-border working group in both countries. Additionally, all materials related to cross-border river basin management should be published at internet sites of the Ministries of Environment and municipalities involved. The NGOs and public in general shall be asked to comment all relevant materials published. Besides, the responsible regional institutions shall disseminate regular press releases to mass media informing on all topicalities in relation to management of water within the RBD and implementation of WFD. A special emphasis on issues of cross-border cooperation should be laid.

All joint cross-border projects performed should cover the topic of public informing and involvement, and water projects are not an exception. The general principle “act locally, think globally” can be applied showing how the local decisions taken and measures implemented can improve the water quality in the whole river basin and in the Baltic Sea after all. But the starting point always shall be the examination of and look at local aspects, problems and their solutions.

Supplementary measures for involvement could be provided by school visits, involvement of school teachers and organization of project weeks, contests of research projects of school pupils dedicated to water issues and local informative events (“water days”, “environmental protection days”, etc.). Institutions of higher education and students shall be involved by delivering lectures on water management matters and providing suggestions to work out bachelors`, masters` and doctoral thesis in the area.

Organization of voluntary water monitoring performed by school pupils, students and all interested persons living within the river basin could be a quite attractive opportunity how to involve practically all parties interested in environmental protection and sustainable usage of water resources.

In addition, opinion surveys on water management matters could reveal the overall level of knowledge of public associated to water issues as well as might give hints how to best disseminate the related information to the public and what are the most attractive ways of information spreading.

In relation to novelties of dissemination of information, the possibilities of social networks, especially the twitter and blogs devoted to water management subjects should be investigated.

16. Cross border action program for water bodies in the Venta basin, analysis of implementation costs and priorities

For preparation of common international Venta river basin management plan there are a few working fields remaining in spite of the fact that first river basin management plans in Latvia and Lithuania have been prepared and reported to European Commission (EC) in 2009/2010. More detailed plan for further common activities could be highlighted after receiving resolution from EC experts. There are still some uncertainties and gaps that should be eliminated through actions in different cross-border projects.

16.1. Identification and prioritization of actions to be implemented in the cross border context

As it has been described in previous sections and crystallized after organized seminars with environmental specialists and wider public, the *first activity* for development of common international Venta river basin management plan should be the elaboration of common monitoring program and harmonization of methods used for assessment of biological quality elements as well as harmonization of ecological typology and ecological quality criteria in both countries in order to assess water quality and impacts of pressures on water quality without bias.

Second direction of activities should be improvement of bilateral cooperation between Latvia and Lithuania – analysis of existing collaboration practice including agreements already signed and functions of responsible institutions with respect to fulfillment of cooperation. Unfruitful procedures must be replaced by feasible ones.

Third direction of activities should be research on sources of polluting substances in the Venta RBD because still in both countries there are identified water bodies where reasons for water quality lower than good is unclear. These potential pollution sources can be linked both to point sources and diffuse pollution sources. Point sources are represented by urban wastewater treatment plants (UWTP) treating wastewater both from households and industrial objects. Especially with respect to potential pollution of priority and hazardous substances they shall be considered taking into account provisions of Dangerous Substances Directive. Also diffuse sources as agricultural areas can be identified as important sources of pollution. Nevertheless, potential impact of storm waters shall not be neglected.

Involvement of municipalities for support of practical research and surveys by providing additional local information (possibly, by involving of volunteers) with regard to their territories in order to describe all aspects of possible sources of pollution is vital. Besides, volunteer observers can be involved in execution of so called public water monitoring. Before there must be specific training courses organized. They can cover both issues related to simple monitoring methods and how to identify impacts and pollution sources.

Public informing, general environmental education in the context of water management and public involvement in water management issues is essential *fourth direction* of actions. In general, public voluntary monitoring would be a good opportunity how to involve public (especially, school pupils) in practical environmental – educational actions. It must be mentioned that some methodological materials dedicated to volunteer monitoring operators are already elaborated and published in Latvia.

The other aspect of public involvement is associated with involvement of local municipalities. As Planning regions are bodies uniting municipalities within the particular region, their role is crucial for organization of practical seminars and discussions for key representatives from municipalities. They can further foster local discussions in order to involve broader public in preparation process of river basin management plans. The local people should give feedback on what kind of information and in which formats they would like to see it as well as what are the priority actions to be implemented locally. In the transboundary context these are measures equally important both for Lithuanian and Latvian municipalities located near the border. Besides, such kind of public involvement will raise environmental awareness and promote environmentally friendly behavior.

In order to improve public informing, general local environmental information as well as information related to water management should be part of information provided via internet homepages of municipalities. Technical experts on homepage programming could be involved in order to increase attractiveness and availability of information provided.

The *fifth direction* of activities relates to hydromorphological modifications and renaturalization of straightened and regulated rivers in order to improve their self-purification capacity and foster biological diversity.

The *sixth group of activities* is connected to probably most important issues in the management of water basins - tackling and prevention of pollution sources. Most important pollution source in the Venta RBD as a whole and also in the cross-border water bodies is diffuse pollution from agriculture, thus main activities should be directed to decrease or minimize impact of agricultural pressure. With reference to surveys on runoff of historical agricultural pollution from soils made in Lithuania and other Baltic countries some time ago nutrients are still flushing away from soils into water even after a strong decreasing of agriculture in the 90-ties of the last century[23]. Thus most important action would be to launch *informative campaigns on agricultural impact, activities and good agricultural practice* even in small farms in order to prevent potential further accumulation of pollutants into soils with following flushing out and getting into natural water.

During this activity *survey data on agricultural pollution* in cross-border area (till now there are no such data concerning this territory) should be collected and *modeling* on agricultural and other sources` impacts should be done using one common mathematical or/and geographical model. There are quite a lot of models which can be applied; for modeling of surface water quality the MIKE model or SWAT model could be used. MIKE model has been used in the Lithuanian part of Venta RBD for preparation of management plan, in Latvia MIKE model is adapted for Lielupe RBD but hasn’t been used for modeling of all impacting sources during preparation of RBD management plans. Depending on model used the necessary data and their gatherings as well as preparation in required mode vary also. There could be the necessity to attract scientific institutions in order to get their contribution during surveys and modeling.

[23] Information obtained during discussions of the project working group meeting in Vieksniai, Lithuania on 17 April, 2012

After implementation of both these activities it would be significant to start more practical measures to reduce agricultural pollution`s impact. For example, to maintain *buffer zones* of 5 or 10 meters along the river or lake coast. Costs of such measure would be unearned income from selling of agricultural products. Ministries of Environment and Agriculture should elaborate mechanisms how to promote good agricultural practice including some monetary measures and compensation schemes in places where implementation of good agricultural practice is not obligatory. Other very effective measure to decrease nutrients (also due to drainage) would be establishment of *sedimentation ponds* in specific parts of water courses.

Special kind of measures associated to agriculture would be increased controls from controlling institutions on application of set standards for farmers also. This action is in a very close relevance with the budget available for controlling institutions.

Reduction of point source pollution is simpler than decreasing of diffuse pollution because there are already known sources of polluting substances (in most cases).

List of concrete priority actions proposed for implementation in the common Venta RBD, especially in its transboundary context, is given in the Table 16.1.1. The related priorities were harmonized by the members of the enlarged project working group during workshops.

Table 16.1.1

Priority actions for reduction of cross border pressures and impacts in the Venta RBD

Nr. of priority	Action	Short description of the action	Provisional costs, EUR
1	Harmonization of essential prerequisites for adequate assessment of ecological quality of transboundary surface water bodies, introduction of missing biological quality elements and bilateral intercalibration of biological assessment methods	Harmonization of Latvian and Lithuanian surface water monitoring program in the cross border water bodies, reaching agreement on joint sampling. Harmonization of ecological typology and hydrochemical quality criteria. Mutual assessment of Latvian and Lithuanian cross border water bodies by means of Latvian Saprobity Index and Danish Stream Fauna Index (DSFI). Introduction of DSFI in Latvia. Bilateral intercalibration of DSFI and other biological	75000

Table 16.1.1 (continued)

Nr. of priority	Action	Short description of the action	Provisional costs, EUR
		methods based on the experience from EU intercalibration exercise. Evaluation of possibilities to use Lithuanian Fish Index in Latvia.	
2	Elaboration and implementation of information campaign and education program for two main stakeholders (farmers and forest managers) in order to reduce diffuse pollution and improve hidromorphological conditions of surface water in the Venta RBD	Elaboration of education program by means of preliminary scientific report worked out by neutral experts. Information campaign for farmers and forest owners receiving EU or national support. Implementation of suggested pollution reduction measures in pilot areas. Follow-up of success by means of water monitoring.	100000
3	Elaboration and implementation of education program for spatial planners in municipalities with respect to water management and issues related to implementation of WFD and river basin management plans, study visits to other countries	Theoretical and practical seminars on water management and ecology for spatial planners, delivering of experience from other countries, study visits possible	100000
4	Development of common methodologies for assessment of diffuse pollution within the river basin	Analysis of available methods and models as well as practical experience in other countries, implementation of most feasible approaches in Latvia and Lithuania	15000

Table 16.1.1 (continued)

Nr. of priority	Action	Short description of the action	Provisional costs, EUR
5	Inventory of cross border rivers, lakes and ponds in which improvement of hydromorphological conditions by easy to be realized measures as well as establishment of facilitated recreational areas is necessary	Easy to be realized measures – cleaning and removal of overgrown macrophytes and sediments, establishing of recreational areas, enhancement of attractiveness of place	20000
6	Elaboration of concept on gathering of necessary data for water quality modeling	Analysis of data needs for a number of models (MIKE, etc.), analysis of existing data in both countries, preparation of concept on improvement of hydrological and other monitoring	10000
7	Analysis of existing offer of water tourism routes in Latvia and Lithuania and elaboration of integrated new ones covering both countries	Elaboration of routes for boat tourism with possibility to start the trip in Lithuania and follow in Latvia. Guided tours by rangers – water ecologists informing participants about water quality issues	30000
8	Elaboration of public (voluntary) water monitoring program dedicated to school pupils and other interested people, launching of the process	Elaboration of easy-to-use in the field materials for determination of water quality, organization of seminars, collection of results, dissemination and discussion via internet site	50000 (for five years)
9	Elaboration of guidelines for hydromorphologically altered rivers` and lakes` renaturalization, implementation in a few pilot parts of water bodies	Analysis of available methods as well as practical experience in other countries and in Latvia and Lithuania, study of scientific literature, preparation of guidelines	100000

Table 16.1.1 (continued)

Nr. of priority	Action	Short description of the action	Provisional costs, EUR
		and testing of some methods in pilot river stretches and lakes	
Total			**500 000**

In addition, the following proposals with respect to future common transboundary and other projects in the Venta RBD have been mentioned by the members of the project working group:

- Development of automated "early warning" monitoring station on the Venta River on the Latvian – Lithuanian border;
- Cleaning of rivers and lakes;
- Liquidation of abandoned wells;
- Collection and treatment of stormwaters in large agglomerations;
- Elaboration of method for estimation and modeling of pollution from point sources (necessary for assessment of pollution scattering in order to assess effects from wastewater as well as to choose outlet places from new wastewater treatment plants and enterprises directly discharging wastewater into natural water);
- Making of the movie about Venta covering geology, history, biology, etc. in an understandable way for everyone;
- Establishment of a common working group at local political level from members of municipality councils.

16.2. Concepts on the three priority actions in the cross border context

16.2.1. First priority: *Harmonization of essential prerequisites for adequate assessment of ecological quality of transboundary surface water bodies, introduction of missing biological quality elements and bilateral intercalibration of biological assessment methods*

Goals of the project: 1) To reach agreement on common ecological typology of surface water in the Venta RBD; 2) To reach agreement on hydrochemical quality criteria; 3) To establish joint or at least adjusted sampling of cross border water bodies; 4) To cross-check mutual methods for assessment of biological quality of water bodies in both countries; 5) To introduce missing biological quality elements in Latvia taking into account experience of Lithuania; 6) To try additional methods for assessment of river water bodies based on macrozoobenthos; 7) To organize Lithuanian – Latvian bilateral intercalibration of biological quality elements.

General considerations: However the focus of the Latvian – Lithuanian cooperation within the Venta RBD is on cross border water bodies, the proposed tasks of the project relate to the whole RBD, especially in the Lithuanian part of the river basin.

This assumption is based on the fact that Lithuania has relatively small part of the common Venta RBD and there are no so important, single point sources of impact left which are located near the border with Latvia. As it could be considered that the main pollution pressure is generated by diffuse pollution, it shall be tracked within the entire area of the basin. Besides, natural conditions of the Venta RBD are quite similar in both countries. Furthermore, all harmonization exercises which are detailed below are pertinent to other common RBDs shared by both countries. The expected results of the project should be transposed to other RBDs taking into account the overall similarity of natural conditions in Lithuania and Latvia. The leading principle must be the acknowledgement that countries should learn from each other. With respect to introduction of different biological quality elements for rivers Lithuania is a bit ahead of Latvia. On the other hand, Latvia has tried a broader range of assessment methods for determination of river quality by means of zoobenthos. Nevertheless, experience gained by other EU countries shall be used – this statement particularly relates to organization and practical procedures associated to EU intercalibration of biological assessment methods.

General organization of the project: All tasks foreseen under the project should be subdivided into work packages (WP) according to goals of the project outlined above.

WP 1: ***Elaboration of common ecological typology of surface water in the Venta RBD.***

Form of work – establishment of expert working group consisting of water ecologists from both countries and supplemented by practitioners involved in water basin management. Independent review of suggestions given in the chapter 14 as a starting point. Exchange of opinions by means of internet "newsgroup" with following final discussion at the meeting. Delphi method and SWOT analysis could be applied.

WP 2: ***Elaboration of common hydrochemical quality criteria***.

Form of work - expert working group established under WP 1. Independent review of analysis given in the chapter 4.2 and of summary provided in the chapter 3.5 as a starting point. Exchange of opinions by means of internet "newsgroup" with following final discussion at the meeting. Delphi method could be applied.

WP 3: ***Harmonization of monitoring in the cross border water bodies of the Venta RBD***.

Form of work – establishment of monitoring expert working group. Discussion on existing monitoring approaches and programs at the meeting. Agreement on essence and content of surveillance, operational and investigative monitoring in the light of WFD. Independent generation of proposals for joint monitoring program in the cross border water bodies. Exchange of opinions by means of internet "newsgroup". Delphi method could be used in order to come to the final agreement on common monitoring program with joint sampling in a number of cross border water bodies and adjusted sampling in others or at least adjusted in time sampling in the cross border water bodies. Launching of pilot monitoring exercise according to the agreed common program.

WP 4: ***Reciprocal assessment of cross border river water bodies by usage of existing biological quality assessment methods in both countries***.

Assessment of Lithuanian and Latvian cross border river water bodies by means of DSFI and Saprobity Index in parallel with following comparison of results. Shall be carried out during the joint pilot monitoring exercise within WP 3 directed mainly to sampling concerning hydrochemical parameters.

WP 5: ***Introduction of DSFI in Latvia and evaluation of possibilities to use Lithuanian Fish Index in Latvia***.

Joint sampling of zoobenthos in a number of cross border water bodies in Lithuania and Latvia with regard to determination of DSFI. Lithuanian experts of zoobenthos share their experience to Latvian colleagues. Comparison of results obtained. Establishment of Lithuanian – Latvian fish expert working group. Discussion at the meeting on existing experience regarding fish monitoring in both countries as well as on the experience to use fishes as biological quality element. Joint sampling and assessment of Lithuanian Fish Index in a number of cross border water bodies in Lithuania and Latvia with following discussion on results at the final meeting. Latvian fish experts can start to work on elaboration of national assessment method.

WP 6: ***Testing of additional methods for assessment of river water bodies based on zoobenthos***.

Establishment of working group consisting of water ecologists dealing with zoobenthos. Selection of additional methods to be proved and exchange of opinions via internet “newsgroup”. The Latvian Macroinvertebrate Common Index or Latvian Macroinvertebrate Common Metrix (LMCM) recently proposed and based on combination of two methods - DSFI and Average Score per Taxon (ASPT) should be tested first of all (see the chapter 3.5.6). Practical tasks envisaged in this WP should be performed in parallel with activities related to determination of DSFI and foreseen within W 5.

WP 7. ***Lithuanian – Latvian bilateral intercalibration of biological quality elements.***

Establishment of intercalibration expert working group. The tasks of the working group can be expanded to all biological quality elements laid down by the WFD but in the initial stage they should be restricted to zoobenthos and fishes in rivers only. The most promising methods and indexes resulted from activities carried out within WP 4, 5, 6 can be intercalibrated using the methodology developed during the EU intercalibration exercise (choosing of real or description of past reference conditions with respect to common ecological types of surface water, selection of water bodies reflecting a pressure gradient, sampling, application of methods in question, analysis of results obtained). Besides, developed EU intercalibration data bases could be used. Discussion on results at the meetings of expert working group.

Proposed duration of the project: 18 months.

16.2.2. Second priority: *Elaboration and implementation of information campaign and education program for two main stakeholders (farmers and forest managers) in order to reduce diffuse pollution and improve hidromorphological conditions of surface water in the Venta RBD*

Goals of the project: 1) Preparation of the scientific report, presenting the description of the problem, the phosphorous and nitrogen reduction targets, and possible measures for reduction of diffuse pollution from agricultural and forest areas of Venta RBD; 2) Providing of wide information campaign on diffuse pollution pressure on surface and groundwater and possible measures for reduction of pressure; 3) Organizing of 60 initial workshops (in each territory (Latvia – 24) or district (Lithuania – 6) for farmers and forest owners separately) and 60 field trips (to pilot territory) for realizing of educational program with practice orientation; 4) Gathering of monitoring data on water quality (phosphorous and nitrogen compounds) before and 5 years after (4 times per year) in some pilot areas or in all areas where implementation of measures took place; dissemination of results to involved stakeholders.

General considerations: Diffuse pollution was recognized as most significant pressure on surface and groundwater in River basin management plans as well as in the assessment which was made during this project and according to opinions expressed at the project seminars, too. Two main sectors – agriculture and forestry are biggest polluters, besides unknown impact gives historical pollution of accumulated phosphorous and nitrogen. Basic measures for reduction of diffuse pollution from agricultural lands theoretically are applied in Lithuania and in small part of Latvia which are designed as Nitrate vulnerable territories. Other polluters since 2009 when River basin management plans get into force are not realizing any supplementary measures which are approved by management plans.

General organization of the project: All tasks foreseen under the project should be subdivided into work packages (WP) according to goals of the project outlined above.

WP 1. Identification of the relevant stakeholders and preparation of the scientific report by neutral experts, presenting the description of the problem, the phosphorous and nitrogen reduction targets and possible measures.

Identification of the relevant stakeholders can be done either by the *top-down* approach by the competent authority (or project team – representatives from the regional authority, local authority, rural support authorities). Stakeholders – farmers (all categories which get payments from EU) and forest owners (private forests which get support from state or EU). Neutral experts prepare scientific report presenting the description of the problem, the phosphorous and nitrogen reduction targets and possible measures.

WP 2. Agreement of program of measures and selection of pilot territories.

In local workshops stakeholders will be working together on local plans and measures at territory or district level based on the scientific report. Working together with all

stakeholders will result in two main crucial, processes: 1. improved relationships among the sides and fruitful cooperation; 2. the process shall be perceived as fair and thus legitimate. Agreeing to work together, the sides will replace their competitive strategy by a cooperative strategy. By working together the process will not allow some sides to be a 'non-paying passengers' - enjoying the benefits of actions without taking actions themselves. Thus, it will be perceived as fair and as different sides start to take actions, others will become committed, as well.
In election process all participants of workshop choose one pilot territory where agreed measures will be implemented. Owner of pilot territory will get grant for implementation of measures. Samples of water quality will be taken before start of pilot projects. If necessary, during the pilot the owners of pilot territories will be visited individually by advisors to discuss and promote implementation of the recommended measures.

WP 3. Implementation of measures.

Samples of water quality (phosphorous and nitrogen) will be taken before start of pilot projects and results will be published in project site at internet. If necessary, during the pilot the owners of pilot territories will be visited individually by advisors to discuss and promote implementation of the recommended measures. Time for implementation of measures will be 1 (one) vegetation season. Most significant actions must be documented in visual materials (photo or video) and published in project site. After ending of all actions samples of water quality will be taken and results will be published on project site.

WP 4. Assessment of results.

Field trips to pilot territories after one year from project start will be organized. Samples of water quality will be taken five years after project ending four times per year and results disseminated to all involved stakeholders and published in project site at internet. Project site will be used for interpretation of results from scientists, water managers and involved stakeholders. Cost effectiveness of measures will be prepared at local level for each territory or district taking into account local features. Results will be disseminated for all involved stakeholders and published in project site at internet.

Proposed duration of the project: 12 months for the basic implementation stage and afterwards up to 60 months for the follow-up stage

16.2.3. Third priority: *Inventory of cross border rivers, lakes and ponds in which improvement of hydromorphological conditions by easy to be realized measures as well as establishment of facilitated recreational areas is necessary*

Goals of the project: 1) Development of common working group for selection of territories with hydromorphological changes; 2) Identification of cross border water bodies (rivers, lakes, ponds) which have a local impact from hydromorphological modifications; 3) Field trips organized for micro-approach assessment of selection of local territories; 4) Elaboration of development plan for territories which are impacted by hydromorphological modifications; 5) Preparation of necessary documentation for gathering of necessary permits for implementation of planned measures; 6) At least two common cross border measures implemented to decrease hydromorphological impact and to establish facilitated recreational areas.

General considerations: Hydromorphological modifications have been pointed out as significant pressure in both countries in the Venta RBD. However, inventory of cross border water bodies in relation to their hydromorphological improvement needed is not carried out, especially stressing the cross border aspect. No measures have been started or planned in the framework of international projects in the Venta RBD according to diminishing hydromorphological impact or establishing recreational areas in impacted territories, as well. A few measures to minimize impact of hydromorphological modifications in both countries are included in the river basin management plans, but there are no basic or supplementary measures planned for common cooperation and finding solutions in cross border water bodies which are impacted by hydromorphological modifications.

General organization of the project: All tasks foreseen under the project should be subdivided into work packages (WP) according to goals of the project outlined above.

WP 1. Identification of cross border water bodies where rivers, lakes and ponds are impacted by hydromorphological modifications.

In general, water bodies which are impacted by hydromorphological modifications are already known, but those areas are identified using macro systemic approach. Measures in this work package would be pointed at involvement of local municipalities and NGOs. Working group of environmental specialists from state institutions and municipalities as well as from environmental NGOs will be established. Working group will organize working meetings to identify those local rivers, lakes and ponds where hydromorphological changes are made. During this process also the nature protection plans will be assessed in order to identify protected areas where such modifications are significant for living organisms. Local inventory trips to these impacted areas will be organized – at least 10 one-day trips in each country in the Venta RBD and 5 two-days trips in each country for the assessment of hydromorphological impact using the micro systemic approach. Territories with local hydromorphological impacts will be identified.

WP 2. Elaboration of the list of easy implementable and necessary measures.

Environmental specialists, NGOs and spatial planners will organize working meetings for common cross border areas where hydromorphological impact during fulfillment of WP 1 is identified. Such meetings will be organized for at least 6 common river basin areas (Šventoji/Sventāja basin, Bartuva/Bārta basin; in the Venta basin at least 4 common working groups). Good practice examples from other international projects will be selected and discussed. Spatial planners will provide a list of potential recreational areas in the impacted territories. Environmental specialists will provide a list of necessary and easy to be realized measures for improvement of impacted water bodies. A common meeting will be organized during which all these aspects will be taken into account and discussed. A common development plan with measures will be elaborated.

WP 3. Implementation of measures.

According to WP 2, the list of easy implementable measures will be developed. During activity of WP 3 the necessary documentation for permits will be developed. Selected areas where renaturalization of rivers can occur and prepared necessary documentation for implementation of such measure will be the outcome including environmental assessment procedures performed. Besides, selected areas where recreational areas can be developed will be chosen and necessary documentation for this will be prepared in order to improve the degraded territories. At least two measures in cross border area will be implemented to decrease hydromorphological impact as well as to establish facilitated recreational area.

Proposed duration of the project: 36 months

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ANNEXES

Annex 1

List of water bodies in the international Venta river basin district

Surface waters – river water bodies
(water bodies in bold – cross border water bodies)

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
NATURAL RIVER WATER BODIES				
V001	**Sventājas baseins**	Latvia	31,71	2
V004	Ālande	Latvia	27,30	5
V005	Otaņķe	Latvia	28,52	2
V009	Vārtāja	Latvia	36,23	3
V010	**Bārta**	Latvia	12,29	3
V011	**Apše**	Latvia	22,07	2
V012	Baltijas jūra (Liepājas kanāls-Saka)	Latvia	13,53	3
V014	Tebra	Latvia	46,57	2
V015	Alokste	Latvia	41,48	3
V018	Tebra	Latvia	26,21	2
V019	Durbe	Latvia	35,09	2
V020	Durbe	Latvia	20,05	2
V022	Baltijas jūra (Saka-Venta)	Latvia	12,14	3
V023	Rīva	Latvia	56,20	2
V025	Užava	Latvia	62,80	1
V026	Medupes strauts	Latvia	6,82	2
V027	Ventspils ostas teritorija	Latvia	61,64	2
V028	Packule	Latvia	5,74	2

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
V032	Abava	Latvia	90,59	1
V034	Imula	Latvia	47,33	2
V035	Amula	Latvia	48,31	2
V037	Pūre	Latvia	10,62	2
V038	Abava	Latvia	42,51	2
V041	Viesata	Latvia	43,76	3
V043	Venta	Latvia	31,73	3
V044	Riežupe	Latvia	39,54	3
V046	Ēda	Latvia	43,64	3
V049	Venta	Latvia	28,76	3
V050	Lējējupe	Latvia	30,61	2
V054	Ciecere	Latvia	55,35	2
V056	**Venta**	Latvia	45,70	3
V057	Šķervelis	Latvia	9,09	2
V058	Lētīža	Latvia	25,39	2
V060	Zaņa	Latvia	52,76	5
V062	**Vadakste**	Latvia	13,17	2
V063	**Ezere**	Latvia	54,99	2
V066	**Vadakste**	Latvia	56,44	3
V067	Baltijas jūra (Venta-Irbe)	Latvia	12,87	2
V068	Irbe	Latvia	33,16	2
V069	Stende	Latvia	95,34	2
V070	Lonaste	Latvia	13,97	2
V071	Pāce	Latvia	19,62	2

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
V072	Raķupe	Latvia	30,52	1
V075	Rinda	Latvia	28,60	2
V076	Engure	Latvia	22,38	2
V078	Tirukšupe	Latvia	5,02	2
V079	Baltijas jūra (Irbe-Roja)	Latvia	13,02	2
V082	Roja	Latvia	43,96	3
V083	Roja	Latvia	24,99	2
V084	Rīgas jūras līcis (Roja-Mērsraga kanāls)	Latvia	32,12	3
V087	Dursupe	Latvia	27,05	2
V088	Dzedrupe	Latvia	8,44	3
V090	Rīgas jūras līcis (Mērsraga kanāls- Slocene)	Latvia	29,57	2
V091	Slocene	Latvia	31,83	3
V093	Slocene	Latvia	17,22	4
LT300104802	Žižma l	Lithuania	3	2
LT300104871	Upyna	Lithuania	4	3
LT300108443	Gervainys	Lithuania	5	3
LT300107521	Varnelė	Lithuania	5	1
LT300113102	Varduva	Lithuania	5	2
LT300107621	Druja	Lithuania	5	3
LT300100016	Venta	Lithuania	5	3
LT300108252	Patekla	Lithuania	5	2
LT300108253	Patekla	Lithuania	5	3
LT300108251	Patekla	Lithuania	5	1

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
LT300110901	Šerkšnė	Lithuania	6	3
LT300100013	Venta	Lithuania	6	3
LT300113271	Lušinė	Lithuania	6	3
LT300104803	Žižma l	Lithuania	6	2
LT300113263	Sruoja	Lithuania	6	1
LT300107401	Virvyčia	Lithuania	6	3
LT300106282	Šventupis	Lithuania	6	3
LT300110401	Viešetė	Lithuania	6	3
LT300113261	Sruoja	Lithuania	6	1
LT300108442	Gervainys	Lithuania	7	1
LT300113103	Varduva	Lithuania	7	1
LT300108441	Gervainys	Lithuania	7	3
LT300104872	Upyna	Lithuania	7	2
LT300100902	Knituoja	Lithuania	7	3
LT300108811	Trimėsėdis	Lithuania	7	3
LT300100017	Venta	Lithuania	8	3
LT300108732	Būgenis	Lithuania	8	2
LT300100012	Venta	Lithuania	8	2
LT300112363	Ašva	Lithuania	8	3
LT300106103	Dabikinė	Lithuania	8	3
LT300100702	Varmė	Lithuania	8	3
LT300114301	**Lūšis**	Lithuania	8	3
LT300102101	Šona	Lithuania	8	2
LT300112362	Ašva	Lithuania	8	4

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
LT300105801	Avižlys	Lithuania	8	3
LT300102102	Šona	Lithuania	9	3
LT300103802	Ringuva	Lithuania	9	3
LT300101301	Gansė	Lithuania	9	3
LT300108731	Būgenis	Lithuania	9	3
LT300113262	Sruoja	Lithuania	9	3
LT300100701	Varmė	Lithuania	10	2
LT300113272	Lušinė	Lithuania	10	1
LT300109702	Pievys	Lithuania	10	2
LT300101302	Gansė	Lithuania	10	3
LT300113264	Sruoja	Lithuania	11	3
LT300113511	Kvistė	Lithuania	11	3
LT300101742	Šatrija	Lithuania	11	3
LT300100011	Venta	Lithuania	12	3
LT300104801	Žižma l	Lithuania	12	3
LT300106102	Dabikinė	Lithuania	12	3
LT300108812	Trimėsėdis	Lithuania	14	2
LT300107402	Virvyčia	Lithuania	14	1
LT300110902	Šerkšnė	Lithuania	14	2
LT300101741	Šatrija	Lithuania	14	2
LT300107911	Upyna	Lithuania	14	3
LT300105802	Avižlys	Lithuania	14	2
LT300105901	Uogys	Lithuania	15	3
LT300111701	**Vadakstis**	Lithuania	15	2

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
LT300100901	Knituoja	Lithuania	15	2
LT300105902	Uogys	Lithuania	16	2
LT300112361	Ašva	Lithuania	17	3
LT300106281	Šventupis	Lithuania	17	3
LT300113512	Kvistė	Lithuania	17	1
LT300100015	Venta	Lithuania	17	2
LT300109701	Pievys	Lithuania	19	3
LT300107711	Rešketa	Lithuania	19	3
LT300100014	Venta	Lithuania	20	3
LT300107431	Nakačia	Lithuania	21	3
LT300114302	**Lūšis**	Lithuania	22	1
LT300110903	Šerkšnė	Lithuania	22	2
LT300110402	Viešetė	Lithuania	22	2
LT300106651	Pragalvys	Lithuania	26	3
LT300111702	**Vadakstis**	Lithuania	38	2
LT300113104	**Varduva**	Lithuania	55	3
LT300100018	**Venta**	Lithuania	88	2
LT700101102	Šventoji	Lithuania	8	2
LT700101402	Darba	Lithuania	8	2
LT700108102	**Šventoji**	Lithuania	70	2
LT800120103	**Bartuva**	Lithuania	3	2
LT800121271	Šata	Lithuania	6	3
LT800121701	Apšė	Lithuania	7	3
LT800121101	Luoba	Lithuania	8	3

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
LT800121272	Šata	Lithuania	8	1
LT800120102	Bartuva	Lithuania	24	3
LT800121273	Šata	Lithuania	25	2
LT800120101	Bartuva	Lithuania	32	1
LT800121702	**Apšė**	Lithuania	41	1
LT800121102	Luoba	Lithuania	54	1
HEAVILY MODIFIED RIVER WATER BODIES				
V006 SP	Bārta	Latvia	33,93	2
V007 SP	Vārtāja	Latvia	31,04	2
V013 SP	Saka	Latvia	6,88	2
V029 SP	Venta	Latvia	6,02	2
V080 SP	Mērsraga kanāls	Latvia	9,66	2
V089 SP	Roja ar Mazupīti	Latvia	5,10	3
LT300107522	Varnelė	Lithuania	6	1
LT300108321	Tausalas	Lithuania	10	4
LT300107406	Virvyčia	Lithuania	11	1
LT300106101	**Dabikinė**	Lithuania	13	3
LT300111811	Agluona	Lithuania	14	3
LT300107404	Virvyčia	Lithuania	16	1
LT300113101	Varduva	Lithuania	18	2
LT300107405	Virvyčia	Lithuania	20	1
LT300103801	Ringuva	Lithuania	22	3
LT300101601	Aunuva	Lithuania	27	2
LT300107403	Virvyčia	Lithuania	40	1

Code of water body	Name of water body	Country	Length of water body, km	Quality / potential
LT700101101	Ipiltis	Lithuania	10	2
LT700108101	Šventoji	Lithuania	13	2
LT700101401	Darba	Lithuania	17	2
LT800120801	Erla	Lithuania	23	1
ARTIFICIAL RIVER WATER BODIES				
LT140200011	Ventos perkasas	Lithuania	18	2

Surface waters – lake water bodies

Code of water body	Name of water body	Country	Area of water body, km^2	Quality/ potential
NATURAL LAKE WATER BODIES				
E002	Papes ezers	Latvia	30,39	2
E004	Tosmares ezers	Latvia	3,82	3
E005	Tāšu ezers	Latvia	0,58	2
E006	Prūšu ūdenskrātuve	Latvia	0,66	4
E007	Sepenes ezers	Latvia	0,59	5
E008	Durbes ezers	Latvia	5,66	5
E009	Alokstes ūdenskrātuve	Latvia	0,77	3
E010	Vilgales ezers	Latvia	2,29	2
E011	Zvirgzdu ezers	Latvia	0,71	2
E012	Klāņezers	Latvia	0,60	2

Code of water body	Name of water body	Country	Area of water body, km^2	Quality/ potential
E013	Lielais Nabas ezers	Latvia	0,63	5
E014	Mazais Nabas ezers	Latvia	0,62	5
E015	Slujas ezers	Latvia	0,55	4
E016	Remtes ezers	Latvia	0,61	5
E017	Pakuļu ūdenskrātuve	Latvia	1,61	5
E018	Cieceres ezers	Latvia	2,59	3
E019	Puzes ezers	Latvia	4,81	3
E020	Gulbju ezers	Latvia	0,96	2
E021	Kleinis	Latvia	0,37	2
E022	Mordangas kaņu ezers	Latvia	0,82	2
E023	Usmas ez.	Latvia	36,42	2
E024	Spāres ezers	Latvia	1,78	2
E025	Būšnieku ezers	Latvia	3,27	2
E026	Lubezers	Latvia	1,30	3
E027	Sasmakas ezers	Latvia	2,28	4
E028	Sārcenes	Latvia	1,38	3
E029	Engures ezers	Latvia	40,54	2
E030	Kaņieris	Latvia	8,98	2
E031	Valguma ezers	Latvia	0,48	5
LT330030071	Vieksnaliu ezeras	Lithuania	50	2
LT330030014	Gludas	Lithuania	53	3
LT330030140	Alsedziu ezeras	Lithuania	91	3
LT330040064	Stervas	Lithuania	127	2
LT330040050	Paezeriu ezeras	Lithuania	151	4

Code of water body	Name of water body	Country	Area of water body, km^2	Quality/ potential
LT330030146	Germantas	Lithuania	164	1
LT330040095	Tausalas	Lithuania	191	3
LT330030062	Parsezeris	Lithuania	197	2
LT330040090	Mastis	Lithuania	272	3
LT330040110	Plinksiu ezeras	Lithuania	404	1
LT330030063	Lukstas	Lithuania	956	2
HEAVILY MODIFIED LAKE WATER BODIES (AND PONDS)				
E003 SP	Liepājas ezers	Latvia	28,69	4
LT230050064	Lazdininku tvenkinys	Lithuania	111	2
LT230050100	Mosedzio I tvenkinys	Lithuania	54	3
LT230050103	Skuodo tvenkinys	Lithuania	87	2
LT230050120	Kernu tvenkinys	Lithuania	82	1
LT230050140	Sablauskiu tvenkinys	Lithuania	112	3
LT230050180	Ubiškes tvenkinys	Lithuania	75	4
LT230050271	Kivyliu tvenkinys	Lithuania	77	3
LT230050282	Juodeikiu tvenkinys	Lithuania	249	2
LT330040060	Birzulis	Lithuania	119	4

Surface waters – coastal and transitional water bodies

Code of water body	Name of water body	Country	Area of water body, km^2	Quality / potential
A	**Dienvidaustrumu atklātais akmeņainais krasts**	Latvia	205,76	4
B	Dienvidaustrumu atklātais smilšainais krasts	Latvia	450,19	3
C	Rīgas līča mēreni atklātais smilšainais krasts	Latvia	103,45	3
D	Rīgas līča mēreni atklātais akmeņainais krasts	Latvia	132,57	4
E	Rīgas līča mēreni atklātais smilšainais krasts	Latvia	215,38	3
T	Rīgas līča pārejas ūdeņi	Latvia	934,26	3

Groundwater water bodies

Code of water body	Name of water body	Country	Area of water body, km^2	Quantitative status	Chemical status
D1	D1	Latvia	1530	2	2
D2	D2	Latvia	4788	2	2
D3	D3	Latvia	2044	2	2
D4	D4	Latvia	10166	2	2
F1	F1	Latvia	2955	2	2
F2	F2	Latvia	2970	2	2
F3	F3	Latvia	3492	2	2

Code of water body	Name of water body	Country	Area of water body, km^2	Quantitative status	Chemical status
A	A	Latvia	6905	2	2
LT003002300	Permo-viršutinio devono (Ventos)	Lithuania	6276	2	2