United Nations ECE/MP.WAT/WG.2/2011/16

Economic and Social Council

Distr.: General
2 May 2011

English Only

Economic Commission for Europe

Meeting of the Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes

Working Group on Monitoring and Assessment

Twelfth meeting
Geneva, 2–4 May 2011
Items 5 (a) and 5 (c) of the provisional agenda
Assessment of the status of transboundary waters in the UNECE[1] region: assessment of transboundary rivers, lakes and groundwaters in Eastern, Northern, Western and Central Europe.

Assessment of transboundary rivers, lakes and groundwaters discharging into the Baltic Sea[2]

Note prepared by the secretariat*

Summary

This document was prepared pursuant to decisions taken by the Meeting of the Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes at its fifth session (Geneva, 10–12 November 2009) (ECE/MP.WAT/29, para. 81 (e)), and by the Working Group on Monitoring and Assessment at its eleventh meeting (Geneva, 6–7 July 2010), requesting the secretariat to finalize the Eastern and Northern Europe assessment for the second Assessment of Transboundary Rivers, Lakes and Groundwaters in time for its submission to the Seventh "Environment for Europe" Ministerial Conference (Astana, 21–23 September 2011).

This document contains the draft assessment of the different transboundary rivers, lakes and groundwaters that are located within the Baltic Sea drainage basin.

For background information and for the decisions that the Working Group on Monitoring and Assessment may wish to take, please refer to documents ECE/MP.WAT/WG.2/2011/6–ECE/MP.WAT/WG1/2011/6 and

[1] United Nations Economic Commission for Europe.
[2] This document was submitted for publication without formal editing.
* The present document has been finalized after the official documentation deadline due to late receipt of comments and resource constraints.

ECE/MP.WAT/WG.2/2011/8–ECE/MP.WAT/WG1/2011/8.

Contents

		Paragraphs	*Page*
I.	Introduction	1–3	4
II.	Torne River Basin	4–18	4
III.	Kemijoki River Basin	19–30	6
IV.	Oulujoki River Basin	31–41	7
V.	Jänisjoki River Basin	42–55	9
VI.	Kiteenjoki-Tohmajoki River Basin	56–64	11
VII.	Hiitolanjoki Basin	65–82	12
VIII.	Vuoksi Basin	83–98	14
IX.	Lake Pyhäjärvi	99–100	18
X.	Lake Saimaa	101–104	19
XI.	Juustilanjoki Basin	150–116	19
XII.	Lake Nuijamaanjärvi	117–119	21
XIII.	Rakkolanjoki Basin	120–126	22
XIV.	Urpalanjoki Basin	127–140	24
XV.	Saimaa Canal including Soskuanjoki River Basin	141–146	25
XVI.	Tervajoki River Basin	147–150	26
XVII.	Vilajoki River Basin	151–154	26
XVIII.	Kaltonjoki (Santajoki)River Basin	155–157	26
XIX.	Vaalimaanjoki River Basin	158–162	27
XX.	Narva River Basin	163–177	28
XXI.	Lake Peipsi and surrounding lowlands	178–189	32
XXII.	Salaca River Basin	190–196	34
XXIII.	North Livonian Bogs	197–205	35
XXIV.	Gauja/Koiva River Basin	206–224	37
XXV.	Daugava River Basin	225–250	42
XXVI.	Lake Drisvyay/Druksiai	251–252	48
XXVII.	Lielupe River Basin	253–267	48
XXVIII.	Venta, Barta, Sventoji River Basins	268–283	52
XXIX.	Neman River Basin	284–302	56
XXX.	Lake Galadus/ Galandusys	303–304	61
XXXI.	Pregel River Basin	305–314	62
XXXII.	Prohladnaja River Basin	315–318	64

XXXIII.	Vistula and the Bug sub-basin	319–333	65
XXXIV.	Bug sub-basin	334–351	68
XXXV.	Wetlands along the Bug	352–363	71
XXXVI.	Dunajec and Poprad sub-basins	364–381	73
XXXVII.	Oder River Basin	382–405	76
XXXVIII.	Transboundary aquifers which are not connected to surface waters assessed in the Eastern and Northern Europe Assessment		81

I. Introduction

1. The present document contains the assessments of the different transboundary rivers, lakes and groundwaters which are located in the Baltic Sea drainage basin. The document has been prepared by the secretariat with the assistance of the International Water Assessment Centre (IWAC) on the basis of information provided by the countries in the Eastern and Northern Europe and Western and Central Europe sub-regions, and by the International Commission for the Protection of the Odra River against Pollution.

2. For descriptions of the transboundary aquifer types and related illustrations, Annex V of document ECE/MP.WAT/2009/8 should be referred to.

3. For background information and for the decisions that the Working Group on Monitoring and Assessment may wish to take, please refer to documents ECE/MP.WAT/WG.2/2011/6–ECE/MP.WAT/WG1/2011/6 and ECE/MP.WAT/WG.2/2011/8–ECE/MP.WAT/WG1/2011/8.

II. Torne River Basin[3]

4. Finland, Norway and Sweden share the basin of the about 470-km long Torne River[4]. The river runs from the Norwegian mountains through northern Sweden and the north-western parts of Finnish Lapland to the Gulf of Bothnia. It begins at Lake Torneträsk (Norway), which is the largest lake in the river basin. The Torne River and its tributaries Könkämäeno and Muonionjoki form the border between Finland and Sweden for at least 520 km.

Table 1
Area and population in the Torne Basin

Country	*Area in the country (km²)*	*Country's share %*	*Population*	*Population density (persons/km²)*
Norway	284	0.7		
Finland	14 480	36	39 099	2
Sweden	25 393	63.3	41 000	1
Total	**40 157**			

Sources: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register

Hydrology and hydrogeology

5. In the Finnish part of the basin, surface water resources are estimated at 13.56 km^3/year (average for the years 1991 to 2005) and groundwater resources at 0.155 km^3/year. These add up to a total of 13.72 m^3/year which equals 350,900 m^3/year/capita.

6. There are two dams on the Torne's tributaries: one on the Tengeliönjoki River (Finland) and the second on the Puostijoki River (Sweden).

7. Transboundary groundwaters are irrelevant water resources in the basin.

Pressures

[3] Source: Based on information provided by Finland and Sweden and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

[4] The river is also known as the Tornijoki and the Tornio

8. The total water withdrawal in the Finnish part of the basin is 0.971 × 106 m^3/s (in 2007) and in the Swedish part 0.54 × 106 m3/s (provided by public waterworks).

9. Pressures of local and moderate influence in the river basin are spring floods and ice jams which can cause severe damages, point sources and urban wastewater treatment plants are the main nitrogen and phosphorus load. Hydropower generation is reported as pressure in Finland and also in Sweden. There are 3 hydropower stations on Finnish side and 3 regulated lakes in the Tengeliönjoki sub-basin. On Swedish side there are 2 hydropower stations in Puostijoki river and 1 in Tornionjoki main channel in Pajala (river has not been dammed up, however). The main non-point pollution sources are — with the calculated nitrogen load for period 2001-2006 in parentheses — forestry (54 800 kg/year), scattered settlements and summer houses (36 600 kg/year), background pollution and wet deposition. The calculated nitrogen load from urban wastewater treatment plants is calculated to be 49 000 kg/year). Regarding phosphorus, 77% of the phosphorus transport is from natural background sources and only 13% from anthropogenic sources, 10% originates from wet deposits.

10. The basin area is mainly forest (92% in Finland and some 60% in Sweden). There are 9 Natura 2000 areas (total surface area 5,962 km2) including relevant water areas. The main river channel and nearly all tributaries are included in Natura 2000. There are three RAMSAR sites: Lätäsjoen-Hietajoen suot, Teuravuoma-Kivijärvenvuoma and Kainuunkylän saaret.

Status and transboundary impacts

11. The transboundary impact is currently insignificant, most of the nutrient transported to the rivers originates from the background and from non-point sources.

12. Pollution from municipal wasteweater plants will be eliminated by their renovation by the end of 2015, according to the Programme of Measures.

Response measures and transboundary cooperation

13. In addition to national legislation, the Water Protection Policy Outlines to 2015 of Finland (approved in 2006) provides the framework and defines the basic principles and measures for improving of water quality. The Finnish-Swedish Border River Commission plays a very important role in coordination of activities in the transboundary area of Torne river basin. The main tasks of the Commission are the following: 1) to harmonize programmes, plans and measures that aim at reaching the status objectives and monitoring the status of the water environment, 2) plans for preventing damage caused by floods and other environmental damage, and 3) work concerning nature conservation plans. The Commission is the organization confirming or rejecting plans or programmes for the river basin district. There are three members in the Commission from each state, one representing the state authority responsible for the water issues, one representing the municipalities and one representing business life.

14. River Basin Management plans for the Finnish and Swedish parts of the Torne River Basin for the years 2009-2015 which were approved on December 2009 by the Finnish Government by the Bothnian Bay District Water Authority in Sweden. The water management work has been harmonized to some extent; for example the division and status classification of the common water bodies. Common measures and a common summary of Finnish and Swedish RBMPs were produced and included in the plans. Common forum for discussion and information sharing, "Torne River Water Parliament", was established in order to share and get information from stakeholders and local people from both sides of the river.

15. The two Finnish-Swedish River Torne International Watershed projects (TRIWA I 2003-2006 and TRIWA II 2006-2008) have produced, for example, a common typology for surface waters and a suggestion for a common monitoring program of the ecological status of surface water bodies and evaluation of related biological tools. Transboundary cooperation continues in

the Interreg project “Forestry impact and water management in Torne River International River Basin” (2011-2013)

Future trends

16. In the northern parts of Finland and Sweden, it is predicted that the climate change could result in an increase of 1.5–4.0 ºC in annual mean temperature and 4–12 % increase in annual precipitation in forthcoming 50 years. Changes in seasonal hydrological discharge are predicted to range from -5% to +10/+25%,[5] depending on area. In general the frequency of spring floods may increase, and floods can cause, for example, overflows of treatment plants. Groundwater level may increase in winter time and decline on summer time. The lowest groundwater levels on late summer and autumn may even be lower in the. In small groundwater bodies, oxygen depletion, content of dissolved metals may increase as a result of smaller discharges.

17. The implementation of additional measures related to adaptation to climate change and its impact on water resources and water-dependent sectors has been started. The Flood Risk Management plans for 2015-2020 will include different scenarios and a vulnerability assessment for the basin. For specific sectors, measures to increase resilience and prevention and preparedness measures are being planned.

18. Currently the Torne is in a high/good ecological and chemical status. The ongoing slow eutrophication process may cause changes in the future, especially in the biota of the river.

III. Kemijoki Basin[6]

19. The major part of the Kemijoki River Basin is Finland’s territory; only very small parts of headwater areas are in the Russian Federation and in Norway.

Table 2
Area and population in the Kemijoki Basin

Country	*Country’s share km²*	*Country’s share %*	*Number of inhabitants*	*Population density (persons/km²)*
Finland	49 467[a]	96.8	95 000	2
Russian Federation	1 633	3.2		
Norway	27	0.05		
Total	**51 127**			

Sources Lapland regional environment centre, Finland; Finnish Building and Dwelling Register

Hydrology and hydrogeology

20. In the Finnish part of the basin, surface water resources are estimated at 18.32 km^3/year (average for the years 1991–2005) and groundwater resources at 0.215 km^3/year, adding up to a total of 18.53 km^3/year. This equals 13,000 m^3/capita/year.

21. The river flow is regulated since the 1940s for hydropower generation and for flood protection.

5 A larger precipitation increase is expected in the mountain areas in the western part. At least 25% increase is expected in most model scenarios according to Sweden.

6 Based on information provided by Finland and the Russian Federation, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

22. Finland only has small, insignificant aquifers (of type 3) in uninhabited wilderness areas bordering with the Russian Federation and Norway. Groundwaters are discharging to rills, rivers, lakes and swamps.

Pressures

23. Significant sections of the Kemijoki are hydromorphologically heavily altered: 16 lakes in the basin (representing some 60 per cent of the total lake area; total volume 3.6×10^9 m^3) are regulated, the surfaces of some lakes have been lowered and altogether some 7,300 km of river bed has been dredged. The total hydropower capacity of the 16 plants is 1,030 MW. As pressure factor this is ranked as widespread and severe. Erosional damage caused by spring floods is assessed as widespread but moderate.

24. The importance of wastewater discharges from towns/settlements and tourist centers such as Rovaniemi (with a biological/chemical sewage treatment plant), Sodankylä, Kemijärvi and Levi in Finland is assessed as a widespread but moderate pressure. Forestry is of comparable importance as the river is used for transporting logs.

25. There are three mines currently in operation in the basin (Finland), having local —but potentially severe influence — and several new mines are in planning phases (without permissions so far). The pulp and paper mill in Kemijärvi town ceased to operate in 2008.

26. The annual withdrawal in the Finnish part of the basin is approximately 142×10^6 m^3/year (2007).

Status and transboundary impact

27. On the Russian side, the river water has been classified as “slightly polluted”. From 2008 to 2009, a slight tendency of water quality getting worse was observed (due to metallurgy plant, plus high level of sulfate concentration (not clear if they are linked or if there is another cause) Ecological status of the headwaters in the Finnish side is excellent.

Response and trends

28. Water quality monitoring was not carried out on the Russian side after 1994, until it was restarted in 2003. Compared with the concentrations recorded in the 1980s and early 1990s, at least organic matter (as indicated by BOD5) and ammonium nitrogen levels have markedly decreased.

29. According to the Russian Federation, gaps in the monitoring at present time include the low frequency of observations, the lack of biological (hydrobiological, toxicological) observations and monitoring of pollutant concentrations in bottom sediments.

30. Predicted climate change impacts on the hydrology are described in the assessment of the Teno.

IV. Oulujoki River Basin[7]

31. The major part of the basin of Oulujoki River, which discharges to the Baltic Sea, is on Finnish territory; and only very small parts of the headwater areas have sources in the Russian Federation. The Oulujoki basin is diverse, having both heavily modified water bodies and natural waters.

[7] Based on information provided by Finland and the first Assessment of Transboundary Rievrs, Lakes and Groundwaters

Table 3
Area and population in the Oulujoki basin

Country	Area in the country (km^2)	Country's share %	Population	Population density (persons/km^2)
Finland	22 509	98.5	153 000	7
Russian Federation	332	1.5		
Total	**22 841**			

Source: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register

32. Surface water resources generated in Finnish part of the Oulujoki Basin are estimated at 8,262 m^3/year (based on observations from 1991 to 2005), groundwater resources are 145×10^6 m^3/year, in total $8,407 \times 10^6 m^3$/year. Total water resources per capita in the Finnish part of the basin are approximately 55,000 m^3/year/capita.

Pressures

33. Total withdrawal in the Finnish side of the basin is 145×10^6 m^3/year.

34. Agriculture, which is concentrated on the lower reaches of the basin, has a major impact on water quality, with an estimated loading of some 60 tons per year of phosphorus and 813 tons per year of nitrogen in the Finnish part.

35. Forestry and possibly locally also peat production impact on the ecology, especially in small upstream lakes and rivers.

36. A large pulp and paper mill located on Lake Oulujärvi impacted on water quality and ecology in its vicinity, but its extent was reduced thanks to pollution control in the past decades and the mill finished working in 2009.

37. There are seventeen hydropower plants in the Finnish part of the river which have significantly impacted river system. One hydropower plant has a fish ladder. Some 1,700 km of the river bed has been dredged for timber floating.

Status and transboundary impacts

38. According to the ecological classification of river system Oulujoki in 2009 (following the requirements of WFD?), the ecological status of Oulujärvi was good. Kiantajärvi and Ontojärvi in the upstream in the Finnish part as well as Oulujoki downstream from Oulujärvi have been classified as heavily modified water bodies.

39. At the Finnish-Russian border, the river is in a good status and there is no transboundary impact.

Response measures

40. The Finnish-Norwegian Commission on boundary watercourses operates on the basis of a bilateral agreement of 1980 (see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6).

Future trends

41. According to Finland, a set of climate change scenarios suggests an increase of 2.3–3.7 ºC in annual mean temperature and 8–13 per cent increase in annual precipitation in forthcoming 50 years. The frequency of winter floods may increase but that of spring floods may decrease.

Moreover, annual runoff decreases as a reason of increased evaporation in large lakes. Possibilities to heavy rain floods even in summer time increase especially in small river systems. Flooding can cause overflows in treatment plants or problems with water abstraction, affecting also water quality. Groundwater level may increase in winter time and decline on summer time. Reduced groundwater recharge may cause oxygen depletion in small groundwater bodies and consequently increased metal concentrations in groundwater (e.g. iron, manganese).

V. Jänisjoki River Basin[8]

42. Finland and the Russian Federation share the basin of the Jänisjoki River. The river originates in Finland and its final recipient in the Baltic Sea basin is Lake Ladoga in the Russian Federation. The Juvanjoki tributary joins the Jänisjoki from the Russian side near the Finnish-Russian border

Table 4
Area and population in the Jänisjoki Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Finland	1 988	51.5	5 600	3
Russian Federation	1 873	48.5		
Total	**3 861**			

Source: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register.

Hydrology and hydrogeology

43. In the Finnish part of the basin, surface water resources are estimated to amount to 520.3 × 10^6 m^3/year (average for the years 1991–2005) and groundwater resources to 21.39 × 10^6 m^3/year, adding up to a total of 541.7 × 10^6 m^3/year (or about 97,000 per/capita/year). In the Russian part, the surface water resources are estimated at 1,320 × 10^6 m^3/year (of which transboundary flow is estimated to be 680 × 10^6 m^3/year).

44. The discharge of the river fluctuates considerably. During low precipitation seasons, the water levels can be very low. The discharge figures for the decade from 1991 to 2000 indicate an increase in the water flow compared with the observation period 1961–1990. The more recent values recorded in the period 1991–2005 do not clearly continue the same trend.

45. On the Finnish side, the flow is regulated at hydropower stations of Ruskeakoski (about 60 km from the river mouth (river-km), Vihtakoski (about 55 river-km), Vääräkoski (about 40 river-km) and Saarionkoski (about 35 river-km). The total installed capacity of these 4 Finnish hydropower stations is 8.0 MW. In the lower reaches of the river in the Russian territory, the Jänisjoki is regulated at the Jänisjärvi Reservoir, and there are also three mini-hydropower units at Hämekoski (22 km from the mouth), Harlu (19 km from the mouth) and Läskelä (6 km from the mouth) in Pitkäranta district of Karelia).

[8] Based on information provided by Finland and the Russian Federation, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters.

Table 5
Kanunkankaat aquifer: Type 1. Links with surface water are supposed to be weak.

	Finland	*Russian Federation*
Border length (km)	0.4[a)]	
Area (km^2)	2.46	
Groundwater resources (m^3/year)	365 000	
Thickness in m (mean, max)	N/A	
Groundwater uses and functions	not used	
Other information	The Finnish part is located in Tuupovaara, Joensuu. The national groundwater body code is 0785609	

[a] Border length of the aquifer near the Finnish–Russian border (Hertta database, Finnish Environmental Administration).

Pressures

46. Total water withdrawal in the Russian part of the basin is 786.6×10^6 m^3/year (2009), with 27.7% for domestic purposes, 27.7.for industry and 45% for energy. In the Finnish part the withdrawal is negligible.

47. There is diffuse loading from agriculture, forestry and settlements. Wastewaters discharged from villages in Finland go through biological/chemical treatment. Loads from municipal wastewater (including also some industrial) are 1.1 tons/year of phosphorus and 8.0 tons/year of nitrogen. On the Russian side, insufficiently treated wastewaters discharged from settlements, mainly the village of Wärtsilä (Sortavala municipal district, Karelia) and from Värtsilä metallurgical plant, exert pressure (local, moderate), but the plants use mechanical and biological treatment.

48. Compared to the estimated natural background load of nutrients in the Finnish part of the basin (22 tons/year of phosphorus and 675 tons/year of nitrogen, including fallout), the human pressures are relatively small. The biggest nutrient load originates from agriculture (5.8 tons/year of phosphorus and 98 tons/year nitrogen), and forestry and peat production combined are almost in the same order (5.0 tons/year of phosphorus and 76.3 tons/year of nitrogen).

49. The flow regulation for hydropower causes diminishing biodiversity in the fish fauna. Low water periods pose problems to fisheries (Jänisjärvi Reservoir).

Status, transboundary impact and response

50. The peatlands in the basin make water naturally humus rich.

51. On the Finnish side, the River Jänisjoki was classified as having a “good” ecological status according to the classification for the EU’s Water Framework Directive in 2008 based on data for the period 2000-2007. The transboundary impact on the Finnish-Russian border is insignificant.

52. License permissions in hydropower plants of Ruskeakoski, Vihtakoski, Vääräkoski and Saarionkoski in Finland provide fish stocks, fishery payments and monitoring of fish population in order to diminish negative impacts on fish. Some recommendations about the regulation of the Jänisjoki are given in a recent (2010) Finnish report to promote the recreational use, fish stands and fishing of the river, e.g. lowering of the water level during winter is recommended to be reduced.

53. In addition to regular surface water quality monitoring, benthic invertebrate fauna, phytobenthos and fish fauna are monitored in Finland, and water levels in the two regulated lakes. On the Russian side, the only water quality monitoring is oriented towards surveying intake

quality for water supply in Harlu and potential pollution downstream from Värtsilä metallurgical plant. Discharges are continuously monitored at the Finnish power stations. Among the reported gaps in monitoring transboundary waters in Finland are the following: more intensive monitoring of biota is needed for several rivers and lakes according to the Water Framework Directive and monitoring of water quality and biota should be extended to some additional small rivers and lakes with water surface area exceeding 50 ha (44 in the basin), but this is subject to sufficiency of national monitoring resources.

54 The Jänisjoki is covered by the 1964 agreement on "frontier watercourses" between the riparian countries and by the work of the Joint Commission operating on that basis.

Trends

55. A set of climate change scenarios worked on in Finland suggests an increase of 2.3–3.7 ºC in annual mean temperature and 8–13 % increase in annual precipitation in forthcoming 50 years. Winter floods may occur more frequently but spring floods may decrease. Annual runoff is predicted to decrease due to increased evaporation in large lakes. Possibility of heavy rain floods is expected to increase, especially in small river systems.

VI. Kiteenjoki-Tohmajoki River Basins[9]

56. Finland and the Russian Federation share the basin of the Kiteenjoki-Tohmajoki rivers. River Kiteenjoki (length 80 km) originates from Lake Kiteenjärvi, flows then via Lake Hyypii and Lake Lautakko (Finland) into the transboundary Lake Kangasjärvi, and then in the Russian Federation though several lakes (Lake Hympölänjärvi, Lake Karmalanjärvi) into the Tohmajoki River close to where it runs into Lake Ladoga. The 74-km long river Tohmajoki discharges from Lake Tohmajärvi and runs through small, transboundary Lake Rämeenjärvi and the small Russian Pälkjärvi and Ruokojärvi lakes to Lake Ladoga in the Russian Federation.

Table 6
Area and population in the Kiteenjoki-Tohmajoki Basins

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Finland	759.8	48	10 000	13.10
Russian Federation	834.8	52		
Total	**1 594**			

Source: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register

57. Surface water resources generated in Finnish part of Kiteenjoki-Tohmajoki Basins are estimated at 113.5 m^3/year (1991 to 2005), ground water resources are 25.57 × 10^6 m^3/year, in total 139.1 × 10^{6}m^3/year . This makes total water resources per capita in the basin amount to about 14,000 m^3/year/capita.

Pressures

58. Water withdrawal in the Finnish part of the basin is negligible.

59. There is non-point pollution from agriculture and forestry. A small dairy is situated near Lake Hyypii, but its wastewaters are used as sprinkler irrigation for agricultural fields during growing seasons. According to nutrient load estimates only agriculture is in the same order with

[9] Based on information provide by Finland and the Russian Federation, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

the natural background of phosphorus, and even for agriculture the nitrogen load is substantially lower than the natural background. The nutrient loads from the settlements, industries, forestry and peat production are quantified as minor.

60. Lake Tohmajärvi, the outflow of the Tohmajoki River, receives wastewater from the sewage treatment plant of the Tohmajärvi municipality. In the Basin of the Kiteenjoki River, the wastewater treatment plant of Kitee discharges its waters into Lake Kiteenjärvi. In the Russian part of the basin, discharges of insufficiently treated wastewaters are a pressure factor. Mechanical and biological treatment is applied.

Status, transboundary impacts and response

61. On the Finnish side, the River Kiteenjoki and River Tohmajoki were classified both as having a "good" ecological status in 2008 based on data for the period 2000-2007 (source: database of the Finnish environmental administration, 2009, classification for the Water Framework Directive). The transboundary impact on the Finnish-Russian border is insignificant.

62. At present time, there is monitoring of water levels, flow and water quality in the Russian part of the Kiteenjoki and Tohmajoki. In the Finnish part, the discharge of the Kiteenjoki is monitored continuously, and Kiteenjärvi and Tohmajärvi are monitored for water quality, chlorophyll, microbiology and fish fauna. The peat industry's impact is also surveyed.

63. The status of the river has been stable for many years and is expected to remain so.

64. Transboundary water cooperation happens in the framework of the Joint Finnish-Russian Commission on the Utilization of Frontier Waters which operate on the basis of the 1964 bilateral agreement between Finland and the Russian Federation (see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6).[10]

VII. Hiitolanjoki Basin[11]

65. Finland (upstream country) and the Russian Federation (downstream country) share the basin of the 53-km long Hiitolanjoki River[12]. Its final recipient is Lake Ladoga (Russian Federation). On the Russian side, the Hiitolanjoki serves as a natural environment for spawning and reproduction of Atlantic salmon.

Table 7
Area and population in the Hiitolanjoki Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Finland	1 029	73	8 000	8.34
Russian Federation	386	27		
Total	**1 415**			

Source: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register

[10] Source: http://www.rajavesikomissio.fi
[11] Based on information provided by Finland and the Russian Federation, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters.
[12] The river is also known as the Kokkolanjoki or the Asilanjoki.

Hydrology and hydrogeology

66. Surface water resources generated in Finish part of the Hiitolanjoki Basin are estimated at 356.4 m^3/year (1991 to 2005), ground water resources are 10.95×10^6 m^3/year, adding up to a total of $367.3 \times 10^6 m^3$/year. Total water resources calculated per capita in the Finnish part of the basin are then 49,000 m^3/year.

67. Four out of five sets of rapids on the Finnish side have hydropower stations and the total hydropower capacity is about 2 MW. In the Russian part of the basin there are no power stations.

68. Lake Simpelejärvi (area about 90 km2) in the basin is regulated and the amplitude and frequency of water level fluctuation is close to natural conditions with the regulated regime (fall-spring) about 0.5 m).

Pressures

69. The total water withdrawal in the Russian part of the basin was 0.0553×10^6 m^3 in 2009, with 95.6% for domestic purposes and 4.3% for industry.

During dry periods the watercourse suffers from scarcity of water, which may affect the Russian side when prolonged. On Finland's side, there are only adverse effects on recreational uses. Water availability is important for the company generating hydropower but is not significant for energy management more widely.

70. There is non-point pollution from agriculture, forestry. Agriculture in the Finnish part is in terns of nitrogen load is almost comparable to the natural background, and especially releases phosphorus (double the estimated natural background. The other sources are clearly smaller, with loading from settlements about 2 tons/year phosphorus and 33.4 tons/year of nitrogen, and from industrial wastewaters — including peat production and forestry — 2.3 tons/year of phosphorus and 22.8 tons of nitrogen.

71. Felling of trees too close to the river was the reason for the silting of the river bed and disturbs the spawn of the Ladoga salmon on Finnish territory. M-real Simpele Mill (pulp and paper mill), which is equipped with a biological effluent treatment plant, is a pressure factor.

72. Accident in wood processing industry plant or in traffic where a major highway crosses the river may cause releases of harmful substances into water.

73. The relatively high mercury content, originating from previously used fungicides, is still a problem for the ecosystem, but its occurrence in fish has decreased since the 1970s.

Status and transboundary impacts

74. In Finland, the total amounts of wastewater, BOD, suspended solids and phosphorus have been substantially reduced; only the nitrogen discharges remained at the same level. Thus, the water quality is constantly improving and the transboundary impact decreasing. Water quality is not being monitored in the border zone on the Russian side.

75. However, eutrophication is still a matter of concern due to the nutrients in the wastewaters and the non-point pollution from agriculture and forestry. Due to the swampy terrain in the basin, the river water has naturally high humus content.

76. Low flow periods during summer cause problems to water supply in the Russian territory, including the village of Tounan (Lahdenpohja municipal district, Republic of Karelia; some 500 inhabitants). This problem is ranked by the Russian Federation as local but severe. In late 2008 to early 2009, quality of river water where it is withdrawn for use in Tounan did not comply with Russian sanitary requirements for color, turbidity, iron, certain microbiological parameters. According to the Russian Federation, information is lacking about discharges from the dams of the hydroelectric power stations on the Finnish side. Getting such information for analyzing the

hydrological situation and taking operative measures to ensure uninterrupted operation of water intake facilities in Tounan are flagged as important by the Russian Federation.

77. On Finnish territory, water quality in the Hiitolanjoki is assessed as good/moderate.

Response measures

78. The regional rescue organization has prepared an oil spill combating plan in case of a traffic accident.

79. The Hiitolanjoki is covered by the bilateral agreement of 1964 on “frontier watercourses” between Finland and the Russian Federation (see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6) and the joint Commission deals with undertakings which may have an impact.

Future trends

80. With further planned measures related to wastewater treatment, the quality is expected to increase. Simpele pulp and paper mills and all municipalities have wastewater treatment plants that meet the national and EU requirements. The operators use Best Available Techniques (BAT) and best practices to prevent or reduce environmental impacts, which will develop also in the future and decrease loading by nutrients and harmful substances.

81. No significant changes in landuse or water withdrawal are foreseen in the Finnish part of the basin.

82. No significant impacts due to climate change are predicted. Winter time rains may increase erosion and nutrient leaching.

VIII. Vuoksi Basin[13]

83. Finland and the Russian Federation share the basin of the 153-km long Vuoksi River[14]. The Vuoksi originates in Lake Saimaa in Finland. For most of its length (143 km), the river runs through the Russian Federation, discharging to Lake Ladoga as two braches, the northern one having small discharge and only during exceptionally high flooding. The Vuoksi is a complex system of lakes and canals.

Table 8
Area and population in the Vuoksi Basin

Country	*Area in the country (km^2)*	*Country’s share %*	*Population*	*Population density (persons/km^2)*
Finland	52 696	77	564 000	11
Russian Federation	15 805	23		
Total	**68 501**			

Source: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register.

13 Based on information provided by Finland and the Russian Federation, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters.

14 The river is also known as the Vuoksa.

Hydrology and hydrogeology

84. Surface water resources in the Finnish part of the basin are estimated at 18.86 km^3/year (average for the years 1991 to 2005) and groundwater resources at 0.331 km^3/year, totalling 19.19 km^3/year or 34,000 m^3/year/capita .

85. The average discharge at the hydropower station is 547 m^3/s (average for the years from 1945 to 2007).

86. There are only small groundwater areas in the border zone in the Finnish part of the basin which are insignificant considering use.

87. The flow is regulated at hydroelectric power plants in Tainionkoski (62 MW) and Imatra ((56 00 10^6 m^3, 178 MW), Finland as well as Svetogorsk (reservoir volume 28.75 × 10^6 m^3, 94 MW) and Lesogorsk (reservoir volume 35.4 × 10^6 m^3, 94 MW) in the Russian Federation.

Pressures

Table 9
Total withdrawal and withdrawals by sectors

Country	*Total withdrawal ×10^6 m^3/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Finland	331			100		
Russian Federation	90.89[a]	0.2	4.6	84.3	4.9	2.2

[a] Total withdrawal in 2007
[b] The figures are for year 2009.

88. Even though wastewater discharges from industry have decreased, they are still a pressure factor, ranked widespread and severe by the Russian Federation. The industrial facilities discharging to the Vuoksi in Finland are the pulp and paper mills of Stora Enso Oy Imatra, Metsä-Botnia Oy Joutseno and UMP Kaukas. All these have wastewater treatment plants; the latter two biological ones. The wastewaters discharged from Imatra Steel Oy steel plant are also treated. Nutrient load from industries in Finland is estimated at 27 tons/year of phosphorus and 413 tons/year of nitrogen. Peat production and forestry add another 3.9 tons/year of phosphorus and 57.2 tons/year of nitrogen.

89. Urban wastewaters from the cities of Imatra and Joutseno are discharged to the river as treated. Nutrient load from settlements and other urban sources in Finland is estimated to be about 10.8 tons/year of phosphorus and some 212.2 tons/year of nitrogen. In the city of Svetogorsk on the Russian side, household wastewaters are discharged through the biological treatment plant of the pulp and paper mill.

90. Nutrient load from agriculture in the Finnish part of the basin is estimated to be 21 tons/year of phosphorus and 52 tons/year of nitrogen. Agriculture is areally limited; cropland makes up less than 6 per cent of the Finnish territory within the basin.

91. Shore areas are affected by flow regulation for hydropower generation.

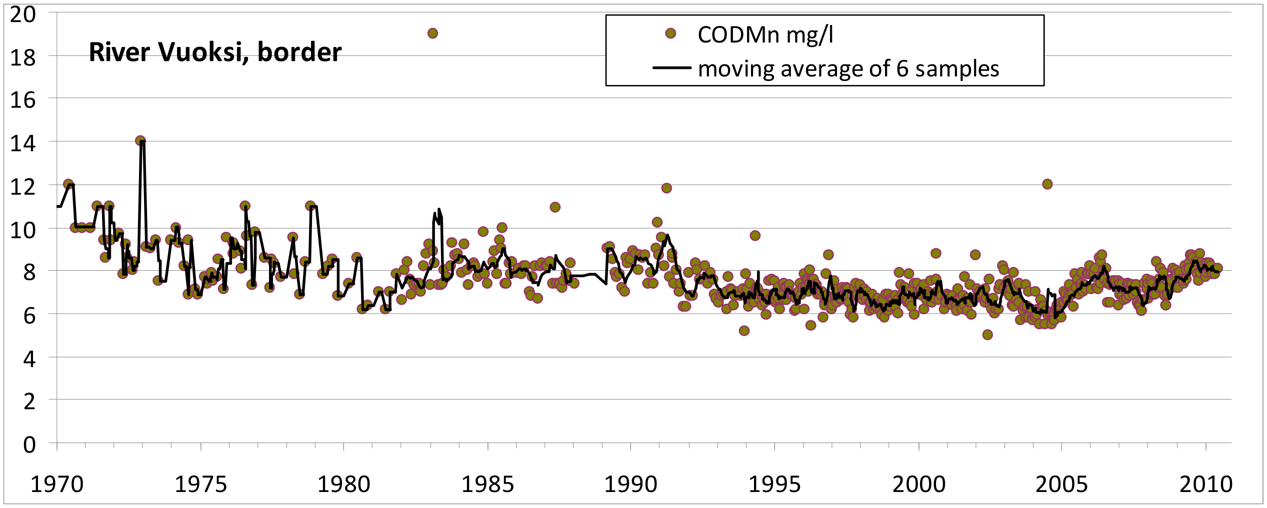
Status and transboundary impact

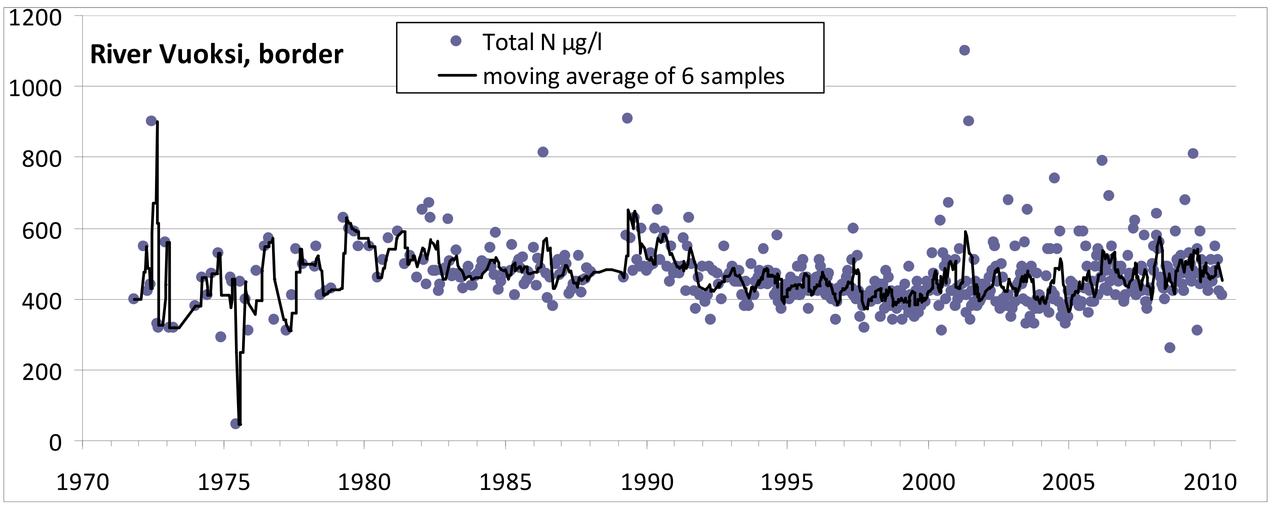
92. Most of the water-quality problems in the Finnish territory arise in the southern part of the river basin, in Lake Saimaa and in the outlet of the river basin. However, in 2009 46 per cent the water area of river Vuoksi was classified as “good” and 43 per cent as "excellent". The situation is reported to be stable and even improving. On the Russian side, water of the Vuoksi was classified

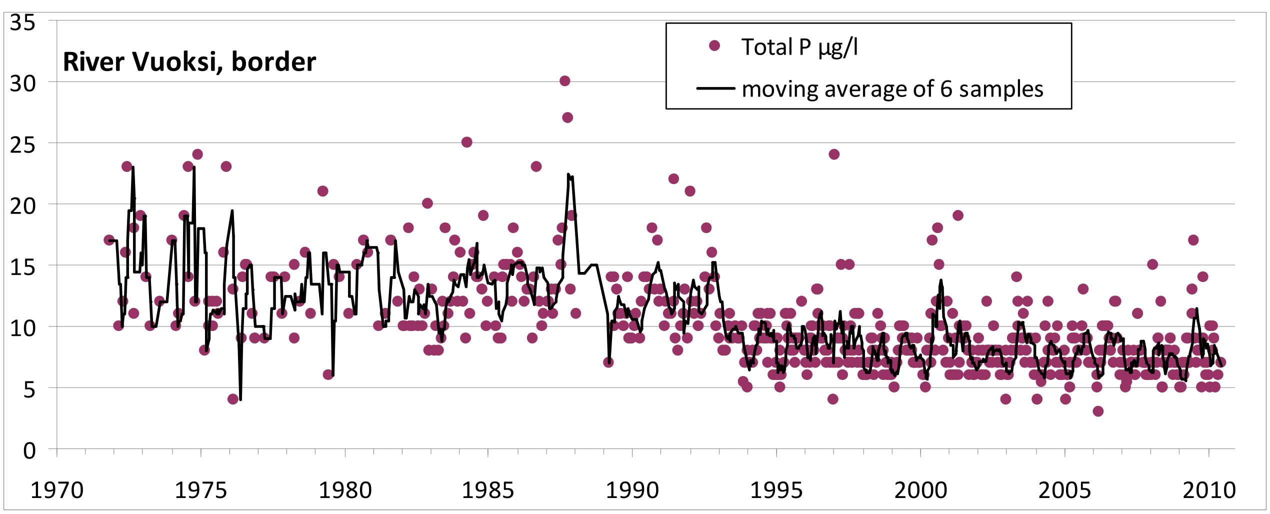
in 2009 according to the Russian classification system as “conditionally clean” in the upstream part, as “slightly polluted” further downstream in the southern and northern branches, and as “polluted” close to the mouth of northern branch (at 0.8 river-km).

93. In terms of organic matter, improvement of water quality from the levels in the 1970s to 1980s is indicated by a decrease of chemical oxygen demand in mid-1990s. The reason is improved effectiveness of wastewater treatment in Finland. After 2005, the production of pulp and paper factories increased and together with it the loading, but not as much proportionally. The nitrogen concentration has not varied significantly, even though it was at a slightly higher level in the 1980s and in early 1990s. The phosphorus concentration decreased markedly in the latter half of the 1990s and has since remained consistently at the same level (figure 1).

Figure 1. **Water quality trends from 1970 to 2010 in the Vuoksi River in Finland.**


River Vuoksi, border
CODMn mg/l
moving average of 6 samples
20
18
16
14
12
10
8
6
4
2
0
1970
1975
1980
1985
1990
1995
2000
2005
2010


River Vuoksi, border
Total N µg/l
moving average of 6 samples
1200
1000
800
600
400
200
0
1970
1975
1980
1985
1990
1995
2000
2005
2010


River Vuoksi, border
Total P µg/l
moving average of 6 samples
35
30
25
20
15
10
5
0
1970
1975
1980
1985
1990
1995
2000
2005
2010

Response

94. Finland strives to ensure that measures set out in the Water Framework Directive are implemented in transboundary river basins shared with the Russian Federation, including the Vuoksi.

95. A preparedness plan for oil spills in Lake Saimaa along the waterway through Saimaa canal connecting Finland-Russian waterways has been prepared as co-operative effort between the rescue departments in Finland and in the Russian Federation.

96. The Discharge Rule of Lake Saimaa and the Vuoksi River (agreement of 1989; see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6), developed by the Joint Finnish -Russian Commission on the Utilization of Frontier Waters, makes it possible to change discharge volumes rapidly and flexibly. Its implementation is supervised by the Commission, to which the Parties report on implementation, discuss implications and, in some cases, agree on compensation[15].

Trends

97. In the Finnish part, increasing water use for recreation and the increasing number of holiday homes exert pressure on water resources.

98. In the Vuoksi area, several scenarios predict that the mean temperature will rise by 3-4 degrees and yearly precipitation by 10-25 % by 2071-2100 relative to 1971-2000. The changes would be the greatest for the winter season. Thus, winter floods are expected to become more severe in the Vuoksi basin,. Also extreme runoff events are projected to be more frequent. The timing of runoff will also change: maximum water-levels in Lake Saimaa will be reached in March and April, instead of June and July as at present time. The discharge to River Vuoksi is likely to increase by 3-27%.

IX. Lake Pyhäjärvi[16]

99. Lake Pyhäjärvi in Karelia is part of the Vuoksi Basin. It is valuable for fishing, recreation, research and nature protection.

Table 10
Area and population in the Lake Pyhäjärvi Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Finland	207	83		
Russian Federation	41	17		
Sub-total, lake surface area only	248			
Finland	804	79	2800	13.5
Russian Federation	215	21		
Total	1019			

[15] UNECE 2009. River basin commissions and other institutions for transboundary water cooperation ECE/MP.WAT/32

[16] Based on information provided by Finland and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

100. There are anthropogenic pressures in the Finnish part (see the assessment of the Vuoksi), but the Russian part is in almost natural state. The estimated nutrient load has been decreasing because of closures of several sources, resulting in improvement in the status of the lake, indicated by a slight decrease in chlorophyll, for example. During the recent very rainy years, the increased leaching from the drainage slightly increased nutrient and chlorophyll concentrations and decreased water transparency (Secchi depth). Moreover, low nutrient status and low humus concentration make the lake vulnerable to nutrient loading. In 2008, the ecological status of Lake Pyhäjärvi is "excellent" according to the requirements set in the EU's Water Framework Directive.

X. Lake Saimaa[17]

101. The basin of Lake Saimaa is shared between Finland and the Russian Federation[18].

102. Lake Saimaa is used a lot for recreational activities and has an endangered population of Saimaa ringed seal.

Table 11
Area and population in the Lake Saimaa Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Finland	51 896	85	564 000	11
Russian Federation	9 158	15		
Total	61 054			

Notes: These figures are for the catchment area of the whole Lake Saimaa water system.

103. The main nutrient load in Finland comes from diffuse sources, agriculture and forestry in particular. In the southernmost part of the lake, pulp and paper industry impact on water quality (see the assessment of the Vuoksi for details), even though improved wastewater treatment has substantially improved water quality in the area during the last two decades.

104. Ecological status of Lake Saimaa according to the requirements set by the EU's Water Framework Directive is "excellent".

XI. Juustilanjoki River Basin[19]

105. Finland and the Russian Federation share the basin of the Juustilanjoki River, which has its source in Lappee, Finland, runs through Lake Nuijamaanjärvi into Lake Juustila (Bol'shoye Zvetochnoye) in the Russian Federation, and discharges to the bay of Vyborg. On the Finnish side, the Juustilanjoki basin includes the Mustajoki River, the catchment of the Kärkjärvi River and part of the Saimaa canal[20], including the Soskuanjoki River.

[17] Based on information provided by Finland and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

[18] As explained in the first Assessment of Transboundary Rivers, Lakes and Groundwaters, it is not clear which ones of the some 120 sub-basins on the same water level are included in Lake Saimaa. In many cases, "Lake Saimaa" only refers to Lake Southern Saimaa (386 km^2), a smaller part of the entire Lake Saimaa system/Lake Greater Saimaa (4,400 km^2).

[19] Based on information provided by Finland and the Russian Federation, as well as the first Assessment.

[20] Saimaa Canal including Soskuanjoki were identified as transboundary in the first Assessment of transboundary waters, but not actually assessed.

Table 12
Area and population in the Juustilanjoki Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Finland	178	60	5000	5
Russian Federation	118	40		
Total	**296**			

Source: The Joint Finnish-Russian Commission on the Utilization of Frontier Waters.

Hydrology and hydrogeology

106. Surface water resources generated in Finnish part of the Juustilanjoki Basin are estimated at 25.2×10^6 m^3/year, groundwater resources are 0.18×10^6 m^3/year, making up a total of $25.4 \times 10^6 m^3$/year (5,200 m^3/year/capita). The average discharge of the Mustajoki is 0.8 m^3/s and of the Kärkisillanoja 0.2 m^3/s (determined by random measurements).

107. The Saimaa canal goes through the river basin, but it is artificially constructed to be a separate hydrological unit apart from the rest of the river basin upstream from Lake Nujamaanjärvi. The water level of Lake Nuijamaanjärvi is regulated for the favor of waterborne traffic. It has definitive upper and lower levels of water and water level variation is narrow, with an annual fluctuation of some 20 cm during the year. The volume of water in canal effects water flows in Lake Nuijamaanjärvi.

Pressures

Table 13
Total withdrawal and withdrawals by sectors (per cent)

Country	*Total withdrawal $\times 10^6$ m^3/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Finland		<1	<1	-	-	
Russian Federation	10.98[a]	-	56.6	8.8	1.1	11.9

[a] This is the figure for 2009 and the withdrawal for 2010 is expected to be at the same level.

108. Pollution by the pulp and paper industry affects Lake Nuijamaanjärvi through the Saimaa Canal. Eutrophication — most significant water-quality problem of the Lake Nuijamaanjärvi — is caused mainly by nutrient loading from agriculture and the pulp and paper industry. According to studies/modelling,, the biggest nutrient load is from agriculture (2.4 tons/year of phosphorus and 45 tons/year of nitrogen).

109. The Saimaa Canal's navigation and harbour activity, which is intensive and continues almost year round, are the most important pressure factors. Lake Nuijamaanjärvi is a secondary recipient for treated waste waters discharged first to Saimaa canal and then flowing into the lake.

Status and transboundary impacts

110. Waterborne traffic in the Saimaa Canal depends most importantly of the water situation, but water availability and quality impact also moderately on livelihoods and on the attractiveness of the living environment, affecting also the preconditions for tourism.

111. Based on the levels of total nitrogen and total phosphorus concentrations, Lake Nuijamaanjärvi is inferred to be mesotrophic. However, the lake's ecological status is good and the situation is stable.

112. In 2009, the quality of water in the Saimaa Canal was classified as moderately polluted (class 2), upstream from the Brusnichoe sluice gate as very clean (class 1) and at the mouth of the canal as "polluted" (class 3a), according to the Russian classification system.

113. The river Mustajoki is in pristine condition.

Response measures

114. Industrial wastewater treatment has been improved.

115. The Juustilanjoki basin is covered by the bilateral agreement of 1964 on "frontier watercourses" between the riparian countries (see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6) and issues having a bearing on transboundary watercourses are dealt with by the Finnish-Russian Joint Commission.

116. On Finnish side; Finnish Transport Agency established in 2010 takes care of management of the Saimaa Canal. The Rescue Department of the State Provincial Office provides rescue services in the canal area on the Russian side as well (The Russian side of the Saimaa Canal area has been rented by Finland). A plan addressing possible boat traffic accidents has been prepared .

XII. Lake Nuijamaanjärvi[21]

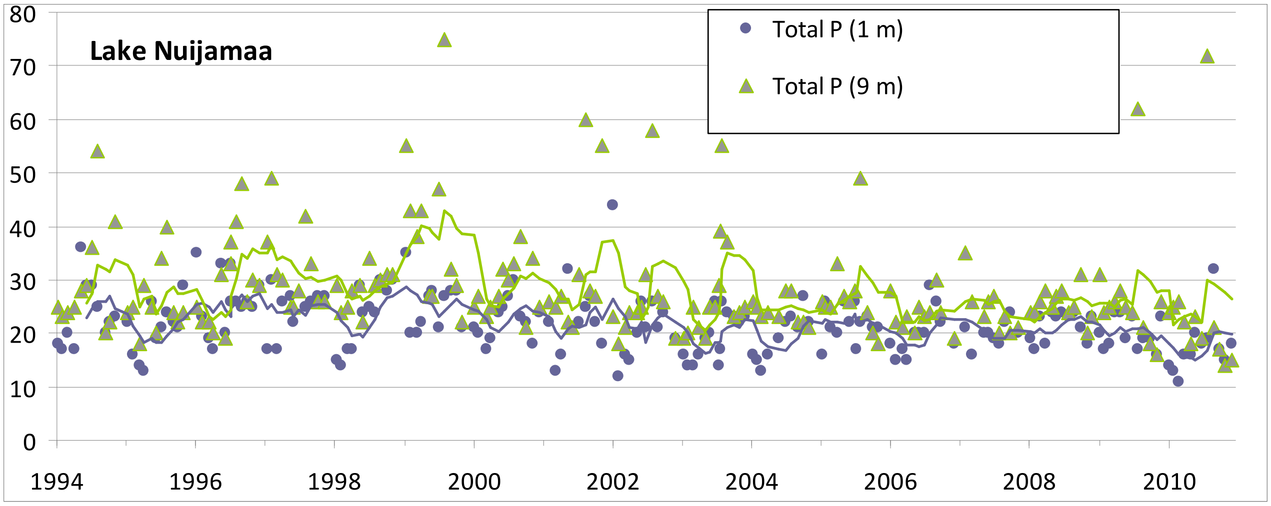
117. Transboundary Lake Nuijamaanjärvi (total lake surface area 7.65 km^2: 4.92 km^2 is in Finland and 2.73 km^2 in the Russian Federation) is part of the Juustilanjoki river basin. The Saimaa canal, an intensively used shipping route from Finland to the Russian Federation, runs from Lake Saimaa and through Lake Nuijamaanjärvi to the Gulf of Finland. .

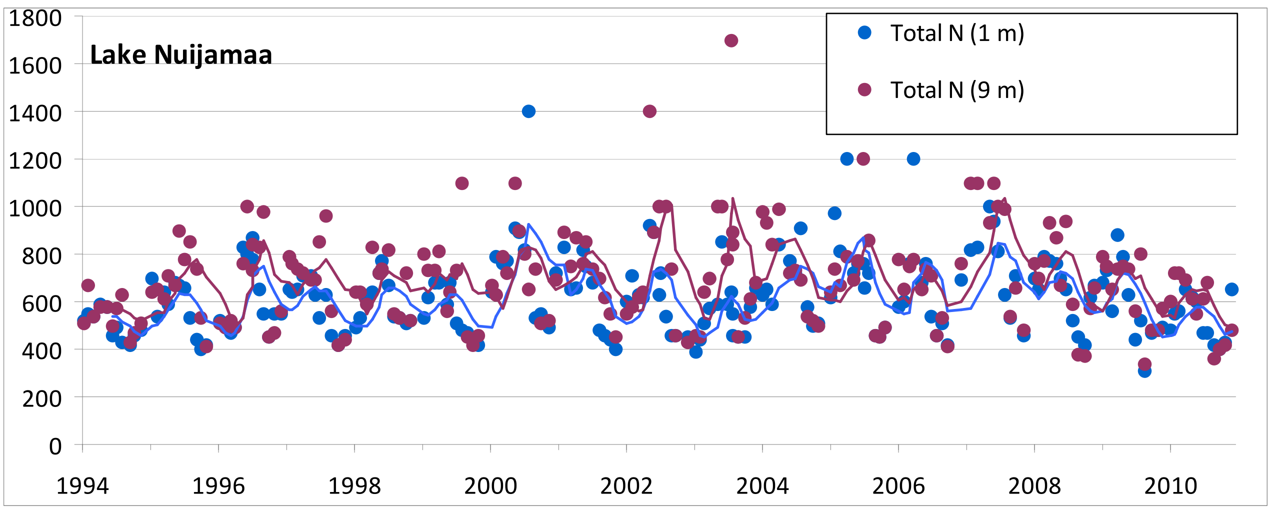
118. Some 28.8% of the catchment consist of agricultural land. In addition to the impact from diffuse pollution from agriculture, pollution by the pulp and paper industry affects the lake through the Saimaa Canal including municipal waste waters discharged by Nuijamaa village (300 inhabitants). The population density in the lake basin area is 24 inhabitants/ km^2. However, the Canal's traffic and harbor activity are the most important pressure factors.

119. Transboundary monitoring has been carried out regularly since the 1960s. The most significant water quality problem is eutrophication, which is mainly caused by nutrients from agriculture and pulp and paper industry. Since the beginning the of 1990s, total nitrogen content has varied from year to year without any clear upward or downward trends, but the total phosphorus content has decreased slightly. The amounts of suspended solids and organic matter have decreased slightly during the past 15 years. The electrical conductivity values have increased slightly. The basic levels of total nitrogen and phosphorus concentrations suggest the Lake Nuijamaanjärvi is mesotrophic (figure 2). Lake's ecological status has been deemed to be good and the situation is stable. However, frequently low oxygen and high phosphorus concentrations in bottom layer waters provide ground for significant internal loading.

[21] Based on information provided by Finland, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters.

Figure 2. **Mean values for total nitrogen and total phosphorus in Lake Nuijamaanjärvi, the Finnish territory.**





XIII. Rakkolanjoki Basin[22]

120. Finland and the Russian Federation share the basin of the Rakkolanjoki River with a total area of only 215 km^2. The Rakkolanjoki River, is a tributary of the Hounijoki. The final recipient of the Hounijoki is the Gulf of Finland (Baltic Sea).

[22] Based on information provided by Finland and the first Assessment of Transboundary Rivers, Lakes and Groundwaters.

Table 14
Area and population in the Rakkolanjoki sub basin

Country	*Area in the country (km²)*	*Country's share %*	*Population*	*Population density (persons/km²)*
Finland	156	73	24 000	153
Russian Federation	59	27		
Total	**215**			

Source: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register

Hydrology and hydrogeology

121. Surface water resources generated in Finish part of Rakkolanjoki Basin are estimated at 40.99 m^3/year. Total (surface) water resources per capita in the Finnish part of the basin are some 1,700 m^3/year/capita.

Pressures

122. The internal load of Lake Haapajärvi contributes to the pressures; this load originates from nutrients, which have been accumulated during a long period of time.

123. Natural leaching (15 to 20 per cent of the nutrient/pollution load), agriculture (20%–40%) and limestone industry (Nordkalk OYj, Lappeenranta) are among the pressure factors in the Finnish part of the basin. The main pollution sources on Finnish territory are treated wastewaters from the town Lappeenranta (40%–60%).

Status and transboundary impacts

124. There is significant eutrophication in the river, which is mainly caused by wastewater discharges and agriculture. The poor water quality is due to the big overall pollution load compared to the small flow of the water course. There is a significant transboundary impact. Wastewater treatment has improved over the years, but control measures are needed. The quality of the environment impacts in the conditions for tourist industry.

Response and future trends

125. Objectives for decreasing diffuse pollution have been set in the River Basin Management Plan. Upon setting the conditions for a new wastewater permit (*of the city of Lappeenranta*), the recipient of discharges may change.

126. The Joint Finnish–Russian Commission has emphasized the need for more effective protection measures. In addition to measures, it will take time and more effective water protection measures to improve the long-lasting situation of poor water quality.

XIV. Urpalanjoki Basin[23]

127. Finland and the Russian Federation share the basin of the 15-km long Urpalanjoki River[24]. The Urpalanjoki River flows from Lake Suuri-Urpalo (Finland) to the Russian Federation and discharges to the Gulf of Finland.

Table 15
Area and population in the Urpalanjoki sub basin

Country	*Area in the country (km²)*	*Country's share %*	*Population*	*Population density (persons/km²)*
Finland	467	84	4 000	8.74
Russian Federation	90	16		
Total	**557**			

Source: Finnish Environment Institute (SYKE), Finnish Building and Dwelling Register

Hydrology and hydrogeology

128. Surface water resources generated in Finnish part of Urpalanjoki Basin are estimated at 114.4 m^3/year and groundwater resources at 0.8×10^6 m^3/year, adding up to a total of 115.2×10^6 m^3/year . Total water resources per capita in the Finnish part of the basin are approximately 29,000 m^3/year.

129. There are no significant aquifers in the border zone.

130. In the river basin, the Joutsenkoski and the Urpalonjärvi dams regulate the water flow. Altogether there are also 11 drowned weirs. The regulation is overall moderate flow regulation, not short-term.

Pressures

131. Total water withdrawal in the Russian side of the basin is 0.040×10^6 m^3/year; 84.8% of which is used for domestic purposes and 3.8% for industry.

132. Agriculture is the most important pressure factor in the Urpalanjoki Basin (loading in Finland estimated at 4 tons/year of phosphorus and 75 tons/year of nitrogen), causing significant eutrophication locally. Wastewater discharges from the municipality of Luumäki in Finland also contribute to eutrophication locally but the impact does not extend over the border. In Luumäki the sewage treatment plant of Taavetti has biological/chemical treatment and the one in Jurvala is not operational

133. Nutrient load from settlements and other urban sources in the Finnish part is estimated at 0.9 tons/year of phosphorus and 18.3 tons/year of nitrogen. The nutrient load from peat production and forestry is minor.

134. Water availability in the Finnish part of the basin mainly has impact on the attractiveness of living conditions, on benefits of small hydropower plant owners and tourism potential through the quality of the environment.

[23] Based on information provided by Finland and the first Assessment of Transboundary Rivers, Lakes and Groundwaters.

[24] The river is also known as the Serga.

Status and transboundary impacts

135. In 2009, water in the border section in the Russian Federation fell into quality class "very polluted" of the Russian classification (class 3b, value 2.52) and water in the 2-km section from the river's mouth was classified as "polluted" (quality class 3a, value 2.65).

136. During 2009, low pH values observed in the river (down to 6.0 with an average of 6.4), but the oxygen regime was satisfactory. Occurrence of organic substances, demonstrated by COD_{Cr}, is characteristic to the river. Nutrient concentrations in river water ranged in the Russian part in 2009 from 0.66 to 1.9 mg/l for total nitrogen and 33–123 µg/l for total phosphorus. Iron, manganese and (slightly) copper exceeded the MACs in 2009, both in the border section and close to the river's mouth.

Response measures and future trends

137. The riverbed is reported to have been dredged in the Finnish part, resulting in some structural changes.

138. The management company of municipal housing in the Vyborg district has made a contract for a sewage treatment facility in the village of Torfyanovka, where wastewaters are discharged to the Urpalanjoki.

139. The Joint Finnish-Russian Commission handles all kinds of measures which may have a transboundary impact, also on the Urpalanjoki.

140. No changes are foreseen in water withdrawal on the Finnish side. Foreseeable changes are not expected from climate change either.

XV. Saimaa Canal including Soskuanjoki River[25]

141. The artificially constructed Saimaa Canal connects Lake Saimaa in Finland though Lake Nuijamaanjärvi at the border to the Baltic Sea. The canal originates from Finland passes through to Russia.

142. Soskuanjoki River is a very small, partly artificially modified river originating from the eastern side of Saimaa Canal and flowing to Russia to Juustilanjoki River.

143. The river basin has an area of 174 km^2; 112 km^2 of which on the Finnish side and 62 km^2 on the Russian side. Annual discharge of Saimaa Canal is 0.03 km^3 and Soskuanjoki River 0.006 km^3. Over half of the basin area is forestry land, about third is agricultural lands and about 3 % is covered by human settlements; peatlands present 8 % of the basin area. There are eight canal locks, three of which are on the Finnish and five on the Russian side of the border.

144. Water quality is monitored on a regular basis in the territory of Finnish. Diffuse pollution from agriculture and peat production are main pressure factors causing pollution in the area. Nutrient concentrations decreased in the 1990s but electric conductivity and pH have been on increase.

145. Water in Soskuanjoki is quite dark and rich in nutrients and humus. Oxygen situation in the river is good. Pollution originates from agriculture and peat production, and eutrophication is the most serious water quality problem. During low discharge season, lack of water is a minor problem in Soskuanjoki River.

146. Water in the Saimaa Canal is slightly rich in humus and nutrients. Oxygen situation is good. The Saimaa Canal is not exposed to diffuse pollution. On the side of Lake Saimaa there is a moderate impact due to diluted wastewaters from forestry, which pass through the locks to the

[25] Based on information provided by Finland.

channel. A salt storage (NaCl) is situated on the shore of the channel causing, together with forestry, a salt water load on the channel. Thanks to water protection acts of forestry, the quality of the water has been improving since mid-1990s.

XVI. Tervajoki River[26]

147. Tervajoki is a small river flowing from Finland to the Russian Federation and it discharges to the Bay of Vyborg in the Baltic Sea (discharge 0.03 km^3/year). The basin area is 204 km^2 and almost equally shared by the two countries. In the Finnish part of the basin, there are several small lakes and few bigger ones (Lake Ruokonen and Lake Suuri-Sarkanen).

148. The catchment area is mostly covered by forestry land (84 %), agricultural lands cover 9% and human settlements less than 1 %; peatlands present 13 % of the area. On the Finnish side of the border there are a few regulated reservoir dams.

149. Sea trout rises to the river on the Russian side and reproduces in the tributaries of Tervajoki River.

150. The river used to be heavily dredged but nowadays it is almost in natural state. Water quality has remained quite stable, between good and satisfactory state. Water in the river is rich in nutrients and in humus material and the oxygen levels are good. Pollution originates from diffuse sources such as agriculture and forestry. There are no serious water quantity problems; during low discharge season water scarcity is a slight problem.

XVII. Vilajoki River[27]

151. The Vilajoki River is a small river flowing from Finland to the Russian Federation, discharging to the Bay of Vyborg in the Baltic Sea (discharge 0.08 km^3/year). Its basin of 344 km^2 covers parts of Finland (73.4 %) and Russia (26.6 %). On the Finnish side, there are several lakes.

152. The catchment area is mostly covered by forestry land (84 %). Agricultural lands cover 8-9% and human settlements about 1 %. Some 14 % of the basin area is peatland. On the Finnish side of the border there are a few regulated reservoir dams.

153. Parts of the river and its tributaries used to be dredged but nowadays the Vilajoki River is close to natural state and well-suited for recreational use / hiking. On the Finnish side there is a reproducing trout population which is likely to be planted, it’s also possible that sea trout can rise from the sea to the river.

154. Water in the river is rich in nutrients and in humus, and the oxygen levels are mostly good. Pollution originates mainly from diffuse sources, especially agriculture and less from forestry, but has decreased. Point source pollution (urban wastewaters) is insignificant in comparison to diffuse pollution. There are no serious water quantity problems; during low discharge season water scarcity is a slight problem. Overall the status of the river is between good and moderate and it has remained quite stable.

XVIII. Kaltonjoki (Santajoki) River[28]

155. The Kaltonjoki is a small river flowing from Finland to Russia, discharging to the Baltic Sea to the Bay of Vyborg (discharge 0.03 km^3/year). The river originates from Lake Ottajärvi in Finland but most of the 187 km^2-basin area is situated in Russia (65.2 %). Nowadays the river is

[26] Based on information provided by Finland.
[27] Based on information provided by Finland.
[28] Based on information provided by Finland.

close to natural state and it has local recreational importance. Sea trout reproduces naturally on the Russian side of the river.

156. Most of the basin area is covered by forestry land (81 %), agricultural lands cover 9% and human settlements about 1 %; peatlands present approximately 14 % of the basin area.

157. Water in the river is rich in nutrients and in humus and the oxygen levels have been moderately good. There is some pollution from diffuse sources, but water protection measures concerning agriculture and forestry have been improved lately. Water quality has remained stable, except for nitrogen content which has been increasing. Eutrophication and keeping it under control is a problem. There are no serious water quantity problems; during low discharge season water scarcity is a slight problem. The overall status of the river is good.

XIX. Vaalimaanjoki River[29]

158. The Vaalimaanjoki River is a small river, with a 245 km^2 basin area mostly situated in Finland (97.4 %). The river flows to the Russian Federation and discharges to the Baltic Sea to the Bay of Vyborg (discharge 0.12 km^3/year). The river has notable recreational importance.

159. The catchment area is mostly covered by forests (80 %), agricultural lands cover 13 % and human settlements about 1 %. Peatlands make up 11 % of the basin area. On the Finnish side of the border there are some old water and saw mill structures which are no longer in use.

160. Baltic whitefish rises regularly to the lower part of the river and also trout appear occasionally.

161. According to the results of monitoring on the Finnish side of the border, water in the river is very rich in nutrients and in humus but the oxygen levels have been good. Pollution originates mainly from diffuse sources, with agriculture as the main factor, forestry and urban wastewaters as minor factors. Impact of the diffuse pollution is evident in the river. Point source pollution is insignificant in comparison to diffuse pollution.

162. Due to monitoring the load from diffuse pollution has decreased in general. Eutrophication and keeping it under control is a problem. There are no serious water quantity problems; during low discharge season water scarcity is a slight problem. Overall the status of the river is moderate.

XX. Narva Basin[30]

163. Estonia, Latvia and the Russian Federation share the basin of the 77-km long Narva River. Lake Peipsi[31] and the Narva Reservoir (built from 1955 to 1956) in the basin are transboundary, shared by Estonia and the Russian Federation. Lake Peipsi is fourth largest lake in Europe in terms of surface area and at the same time it is largest transboundary lake in Europe. The Plyussa River is a tributary of the Narva in the Russian Federation.

164. The basin is in flat terrain with an average elevation of 163 m a.s.l.

[29] Based on information provided by Finland.

[30] Based on information provided by Estonia and the Russian Federation, and the first Assessment of Transboundary Rivers Lakes and Groundwaters

[31] The lake is known as Lake Peipsi in Estonia and Lake Chudskoe in the Russian Federation. It consists of two lakes connected by a straight is reflected in names “Peipsi-Pihkva” (in Estonia) and Pskovsko-Chudskoe (in Russian).

Table 16
Area and population in the Narva Basin

Country	*Country's share km²*	*Country's share %*	*Number of inhabitants*	*Population density (persons/km²)*
Estonia	17 000	30		
Latvia	3 100	6	N/A	5–10
Russian Federation	36 100	64	540 000[a]	16
Total	**56 200**			

[a] TACIS project data from 2002

Hydrology and hydrogeology

Table 17
Ordovician Ida-Viru groundwater body: type 3. Limestones and dolomites of Ordovician formations; the 30 m thick upper part consists of limestones and dolomites, strongly karsted and fissured at places.. Groundwater flow direction from Estonia to Russia at North from Narva Water Reservoir, from Russia to Estonia at South from Narva Water Reservoir. Strong link with Narva river.

	Estonia	*Russian Federation*
Border length (km)	30,7	
Area (km²)	2129	
Renewable groundwater resource (m³/d)	600 000	
Thickness in m (mean, max)	75, 150	
Number of inhabitants	27 1745	
Population density	127	
Groundwater uses and functions	Mainly used for drinking water.	
	Crosses the national border in Ida-Viru County and is thus influenced by water consumption both, in Estonia and in Russia.	
Other information	Ammonium, sodium, chloride and other element concentrations are naturally high,	

Table 18
Ordovician Ida-Viru oil-shale basin groundwater body: type 3. Silurian and Ordovician limestones and dolomites. Groundwater flow direction from Estonia to Russia at North from Narva Water Reservoir, from Russia to Estonia at South from Narva Water Reservoir. Strong link with Narva river.

	Estonia	*Russia Federation*
Border length (km)	33,4	
Area (km²)	1175	

Renewable groundwater resource (m^3/d)	500 000
Thickness in m (mean, max)	75, 150
Number of inhabitants	23 0718
Population density	196
Groundwater uses and functions	Unusable as a source of water supply (polluted), endangers the water of other groundwater bodies.
Other information	Chemical status is poor. 50–90% of the stock is being pumped out in oil shale mining. After the closure of oil shale mines, the groundwater body may have an impact on other water intakes. Rising of water table will cause bog expansion.

Pressures

165. There is Narva hydroenergy plant on the river which belongs to Russian Federation (total capacity 125 MW). In Estonia, there are two thermal power plants (total capacity 2,400 MW), where river water is used for cooling purposes. The river is also used for supplying drinking water to the town of Narva (population 70,000 inhabitants).

Table 19
Total withdrawal and withdrawals by sectors (per cent) in the Narva River Basin

Country	*Total withdrawal* $\times 10^6$ *m³/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Estonia	1018.3[e]	0.00002	0.3	0.4	98.9	0.3
Latvia	3.1[a]	N/A	33	3	N/A	42
Russian Federation	104.0[b]	5.3[c]	27.0	32.1	N/A	29[d]

[a] Water abstraction in 2009; according to the State Statistical Report, only groundwater was abstracted

[b] The figure consists of surface water withdrawal (61×10^6 m^3/year) plus groundwater abstraction (43×10^6 m^3/year) in 2009. For the Russian Federation the sectoral percentages have been calculated as shares of the sum of reported uses, which is 93.32×10^6 m^3/year. For the uses, there was no separation between groundwater and surface water in the figures provided.

[c] Use for fisheries/fish ponds has been included

[d] This figure consists of reported losses during transport/distribution (5.97×10^6 m^3/year or 6.4 percent) and reuse of water in operations and in supply system (21.11×10^6 m^3/year or 22.6 per cent)

[e] The figures are for 2009

166. In Russia’s territory, groundwater use is relatively low in the Narva River Basin, high in the Plyussa River Basin and in-between in the basin of Lake Peipsi. The functions of groundwater include that it supports agriculture.

167. Pressure from nutrient load — causing eutrophication which is a problem — is assessed by the Russian Federation as widespread but moderate. According to the Russian Federation, obsolete or lacking sewage networks and treatment facilities in many locations cause pollution of water resources (local but severe influence). Of the total amount of wastewater discharged to surface watercourses in the Russian part of the Narva and Peipsi Lake basin — 100.9×10^6 m^3 in 2009 — some 20 per cent meets the requirements, another 20 per cent is discharged without treatment and some 60 per cent is discharged as insufficiently treated. As can be seen from Figure 3, most of the wastewater without treatment is discharged to the Plyussa, whereas discharges to the Narva River

meet the Russian federal requirements[32]. Most of the discharges to Peipsi Lake are insufficiently treated.

Figure 3.

Treatment of wastewater discharges in the Russian part of Peipsi Lake, Plyussa River and Narva River in 2009.

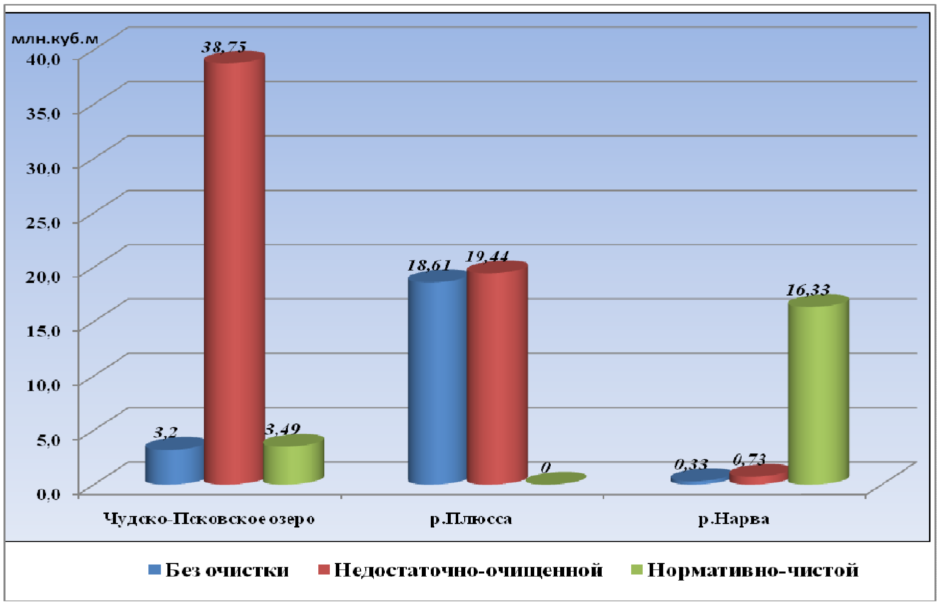


Table 20

Pollutants in wastewaters discharged in the Russian part of the basins of the Narva River and Lake Peipsi in 2008 and 2009 (tons/year)

Substance	*Amount in 2008 (tons/year)*	*Amount in 2009 (tons/year)*
Suspended solids	328.0	320.0
Nitrates	937.1	470.5
Nitrites	22.3	22.78
Total phosphorus	79.0	53.3
Synthetic surfactants	3.2	3.6
Ammonium-nitrogen	302.0	320.6
Oil products	5.0	0.0

168. To a lesser degree, nutrients originate from agricultural lands and livestock farms (moderate and local influence, according to the Russian Federation). Other pressure factors — unauthorized dumping, discharge of untreated mine waters from oil shale mines and deforestation (also in protection zones of water resources) — contribute moderately and locally to the nutrient loading.

[32] Amounts and composition of sewage and concentrations of pollutants are established by a special Decree of the Russian Government (Order No.469 of the Russian Government of June 23, 2008 "On Procedure for Approval of Standards for Permissible Discharges of Substances and Microorganisms into Water Bodies Applicable to Water Consumers"

Of similar impact is unorganized recreation on the banks leads to trash getting into the watercourses (see the section on Ramsar sites below).

169. Uncontrolled groundwater abstraction (without permit) results in depletion of groundwater, the impact of which the Russian Federation assesses as local but severe.

Status and transboundary impact

170. Russian Federation characterizes the ecological status of Narva Reservoir as good. According to Estonian classification it is moderate. The status of Lake Peipsi Estonia assesses as moderate and of Lake Pihkva as bad. The frequency at which water changes in the reservoir is very high because of the large volume of flow.

171. Water in the basin of Lake Peipsi is according to the Northwest management unit of Roshydromet "polluted" to "very polluted" on the Russian national water quality classification system[33] (based on monitoring results from 2007 and 2008). Lake Peipsi is vulnerable to pollution because of its relatively shallow depth (on average some 7 metres).

172. By the same classification during the same period, the Narva is “moderately polluted” to “polluted”. At the time of the first Assessment (2007), the ecological status of the Narva River was reported as good and the transboundary impact was assessed to be insignificant. The Peipsi Lake retains some of the load which improves water quality in the Narva.

Response and transboundary cooperation

173. In the past few years in particular, treatment of wastewater from settlements has been developed in Estonia, with the help of EU funds, to comply with the requirements of the Council Directive 91/271/EEC (1991) by ensuring urban wastewater treatment for agglomerations with more than 10,000 p.e. (due by the end of 2009) and with 2,000 up to 10,000 p.e. (due by the end of 2010). In the Russian Federation’s territory also, construction and repair of wastewater collection and treatment infrastructure is being carried out Tartu in Estonia and Pskov in the Russian Federation are the biggest towns in the basin. Water protection measures to reduce pollution load from point and diffuse sources are also implemented in both parts. Surveying of the flood plain has been worked on in the Russian part of the basin and works to improve the capacity of the channels have been carried out. Future measures will follow the plan “integrated use and protection of water bodies” (to be?) developed for the Russian part of the Narva River Basin.

174. Among management measures applied in the Estonian part is a permitting system for abstraction/withdrawal of more substantial amounts of water, involving payment of an environmental fee and environment usage fee. Fees also apply to discharges of pollutants.

175. The Estonian-Russian joint commission together with its subsidiary working groups has established itself as an important actor in managing Lake Peipsi and Narva River basins, by coordinating actions, for example by organizing exchange of monitoring data and by facilitating cooperation between different stakeholders. Estonia reports as the main achievements of the co-operation with the Russian Federation the following:

- Organisation of comprehensive co-operation, which has led to approaching common understanding of problems and development of common targets;

[33] Surface water pollution is assessed in the Russian Federation with a relative index according to the guidelines "An Integrated Method of Assessing the Degree of Pollution of Surface Water Using Hydrochemical Parameters” (RD 52.24.643-2002), developed by the Hydrochemical Institute of Roshydromet. The class of a water body is calculated based on 6-7 hydrochemical indicators that include dissolved oxygen concentration, pH, and BOD_5 values on a mandatory basis. Source: “10.8. Establishment of Water Quality Standards in Russia. Interim Technical Report, Activity Cluster 10 (Environmental Quality Norms), EU- Russia Cooperation Programme Harmonization of Environmental Standards. Moscow 2009.

- Systematical exchange of information about situation in water management and water quality;
- Approaching of principles and criteria about situation of water bodies;
- Joint monitoring on Lake Peipsi and on Narva reservoir based on agreed monitoring programme: Monitoring of hydrochemical and hydrobiological parameters on Lake Peipsi, Lake Lämmijärv and Lake Pihkva help to get comprehensive information on the status of the transboundary water bodies
- Elaboration of water management plans in both sides.

176. Among the challenges that remain are: achievement of good quality of water bodies, harmonisation of monitoring programmes with international guidelines, implementation of water management plan, agreeing on the criteria to be used for assessing the status of water bodies, ensuring comparability of laboratories and agreeing on the regulation of the Narva Reservoir.

177. There is active public participation work on-going related to transboundary cooperation. The recent efforts include EU INTERREG 3A/TACIS funded PEIPSIMAN project (2007-2009), led by Peipsi Center for Transboundary Cooperation, which involved an assessment of the implementation of the joint Lake Peipsi/Chudskoe Transboundary Management Programme (issued in 2005) as well as investment into reconstruction of the Pskovkirpich settlement (Pskov city area) wastewater treatment plant.

XXI. Lake Peipsi and surrounding lowlands[34]

General description of the wetland area

178. Estonia and the Russian Federation that share Lake Peipsi have designated Ramsar sites covering vast wilderness areas on the western and south-eastern shores of the lake. They include the deltas of two largest rivers discharging into the lake: Emajõgi in Estonia and Velikaya in Russia, different types of mires, rivers and small lakes, as well as the adjacent shores and waters of lake Peipsi. The Estonian site also includes the largest island of Peipsi lake: Piirissaar.

Main wetland ecosystem services

179. Wetlands of both Ramsar sites are extremely important for the hydrology and water quality of Lake Peipsi. They provide water storage and natural purification, sediment filtration, natural flood control (acting as floodplains during spring floods), regulation of surface and ground water

[34] *Sources*:
Latest Information Sheets on Ramsar Wetlands (RIS), available at the Ramsar Sites Information Service: http://ramsar.wetlands.org/Database/Searchforsites/tabid/765/language/en-US/Default.aspx
Haberman, J., Timm, T., Raukas, A. (eds.). 2008. Peipsi. Eesti Loodusfoto, Tartu. (in Estonian).
Kuus, A., Kalamees, A. (eds.) 2003. Important Bird Areas of European Union Importance in Estonia. Estonian Ornithological Society, Tartu.
Pihu, E., Haberman, J. (eds.). 2001. Lake Peipsi. Flora and Fauna. Sulemees Publishers, Tartu.
van Eerden, M., Bos, V., van Hulst (eds.). 2007. In the mirror of a lake. Peipsi and Ijsselmeer for mutual reference. Lelystad. Rijkwaterstaat. Centre of Water Management.
Management Plan for the Lake Chudskoe/Pskovskoe Ramsar Site (2004-2008) / Compl. Musatov V.Yu., Fetisov S.A. – Pskov, 2003.
Konechnaya G.Yu., Musatov V.Yu., Fetisov S.A. Brief history and bibliographic references of scientific papers with information on the Ramsar site "Pskovsko-Chudskaya Lowland": published in 1996-2006 // Nature of the Pskov Land. SPb. 2007. Issue 24. P. 3-55. (in Russian).
Musatov V.Yu., Fetisov S.A., Mel P., Borisov V.V. Comments and practical advice on implementation of the Management Plan for the Lake Chudskoe/Pskovskoe Ramsar Site. Pskov. 2003. (in Russian)
Musatov V. Yu., Fetisov S.A. (eds). Ramsar site "Pskovsko-Chudskaya Lowland" (The Pskov federal protected areas, issue 2). Pskov. 2006. (in Russian.

flow. Other most important ecosystem services include sustaining biodiversity, carbon storage (in large peatlands) and balancing local climate.

180. The principal activities of the local population are fishing, farming, forest cutting (in the Russian Federation), berry and mushroom picking and small-scale hunting. In terms of fish, Lake Peipsi is known to be one of the best-stocked lakes in Europe. Both Ramsar sites contribute to this reputation by holding important spawning sites. The Russian site is noted to be important for maintaining numbers of game bird and mammal species on larger area along the eastern shore of Lake Peipsi.

181. There are good opportunities for outdoor recreation and eco-tourism, though on the Russian side, these activities important for the local economy are still to be developed.

Cultural values of the wetland area

182. Traditional land-use, fishery and architecture are preserved on both sides of the border. A mixture of Estonian and Russian cultures occurs on Piirissaar Island, where the population forms one of the most compact Old Believer's community. On the Russian side there are many old churches, archaeological monuments and historical sites.

Biodiversity values of the wetland area

183. Being an integral complex of different types of peatland (fens, transitional bogs, bogs), rivers and lakes (including the shallow waters of lake Peipsi), reedbeds and swamp forests both sites are good representatives of large mosaic wetland complexes characteristic for the Boreal biogeographical region and hold a number of habitats as well as animal and plant species of European concern.

184. The sites are internationally important as stopovers for migrating waterfowl and as breeding areas for many waterbirds and mammals; they are also important for moulting waterfowl. The huge wetland complex is a perfect habitat for birds of prey (including the globally threatened Greater Spotted Eagle *Aquila clanga*), wolf, brown bear, lynx, otter and beaver Castro fiber.

Pressure factors and transboundary impacts

185. On the Estonian side, the intensification of tourist and cargo traffic in the river Emajõgi - Lake Peipsi region and intensive fishing in Emajõgi delta are potential threats. Decrease in the traditional land-use (onion-growing,mowing of floodplain and fen meadows) is a threat for several rare species of amphibians and birds.

186. On the Russian side, the unfavorable social and economic situation since the beginning of 1990s has led to increased use of biological resources, including illegal fishing, hunting and forest cutting and uncontrolled berry picking. Now the situation is improved, but illegal activities still remain a problem. Another serious threat is disturbance to wildlife caused by people and motorboats. Other threats include the decrease of agricultural areas, fires and burning of grasslands, littering. The possible impacts by alien invasive species (racoon dog, American mink, muskrat) need to be studied and better understood.

187. Lake Peipsi is becoming more eutrophic, a particularly rapid process in its southern basin. The pollution of the rivers Velikaya and Emajõgi is partly to blame. Other water pollution comes from agricultural areas. Nevertheless, the recent restructuring of the economy in Estonia, and the diminished use of agrochemicals in Estonia and Russia have triggered positive trends in the environmental situation. Due to the construction of several new sewage treatment facilities, the water quality in the rivers flowing into Lake Peipsi has remarkably improved.

Transboundary wetland management

188. The Estonian Ramsar site Emajõe Suursoo Mire and Piirissaar Island (32,600 ha) includes Emajõe Suursoo Landscape Reserve (18,130 ha), Piirissaar Zoological-Botanical Reserve (755 ha) and Limited Conservation Area of Emajõe Delta Region (11,310 ha). The establishment of the National Park, covering approximately 35,000 ha and including all mentioned protected, areas is under way. The Russian Ramsar site Pskovsko-Chudskaya Lowland (93,600 ha) includes the Federal Zoological Reserve Remdovsky (74,712 ha) and several regional protected areas. Both

Estonian and Russian wetlands have been identified as Important Bird Areas and the Estonian as a Natura 2000 site. Despite the fact that the Ramsar sites and protected areas do not cover the entire lake Peipsi wetland area, their presence on both sides of the national border undoubtedly has great effect for the protection of habitats of rare and threatened species, especially for migratory species and those having large individual territories.

189. Transboundary cooperation is implemented through an Estonian-Russian Joint Commission formed in 1998. The Peipsi Center for Transboundary Cooperation is working actively to promote balanced development of the entire region. The management plan for the Pskovsko-Chudskaya Lowland has been prepared in 2001-2003 within the Russian-Danish project, with participation of experts from neighboring Estonian Ramsar site (its provisions regarding nature conservation, sustainable use of natural resources and international cooperation mainly remain to be implemented). In joint wetland management on site level first major steps have been made in 2006-2007 when Estonian Fund for Nature carried out a project on transboundary management of nature reserves at lake Peipsi area (including Emajõe Suursoo Mire and Remdovsky) with the objective to establish contacts and good basis for further cooperation and action.

XXII. Salaca River Basin[35]

190. The Salaca River Basin is part of Gauja River Basin District. Therefore, for information on water resources (including transboundary aquifers), response measures and trends, the assessment of the Gauja/Koiva should be referred to.

Table 21

Area and population in the Salaca Basin

Country	*Area in the country (km²)*	*Country's share %*	*Population*	*Population density (persons/km²)*
Estonia	182	5.3	<100	<0.5
Latvia	3 239	94.7	43 813	13.5[a]
Total	**3 421**			

Source: Salaca River Basin Management plan 2006.

[a] The population density in regions of Latvian part of Salaca river basin district is quite even (12–17 persons/km²). Most of inhabitants of river basin (75%) live in cities, towns and settlements. (Source: Salaca River Basin Management plan 2006)

Hydrology and hydrogeology

191. There are seven small hydropower stations and several regulated small rivers in the Salaca river basin.

192. In 1999, State Geology Service calculated that available fresh groundwater resources in Salaca basin are ~ 80 000 m^3/day, i.e. ~ 29,2 $\times 10^6$ m^3/year.

[35] Based on information provided by Latvia

Table 22
Total withdrawal and withdrawals by sectors (per cent)

Country	*Total withdrawal ×10⁶ m³/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Latvia	22.64	36.7	28.23[a]	15.71	2.64	17.72
Estonia	N/A	N/A	N/A	0	0	N/A

Pressures

193. For general information on the pressures, the assessment of the Gauja/Koiva can be referred to. Only specific quantifications are referred to here.

194. Pollution load from agricultural activities in Latvian part of Salaca River Basin is estimated to be around 862 t of nitrogen and 22 t of phosphorus. As a result from forestry there is about 76 t N and 2.8 P discharged into rivers of Latvian part of the Salaca Basin.

195. Around 60 per cent (or some 26,000) of the Salaca Basin's inhabitants are not connected to urban wastewater collecting and treatment system.

196. According to calculations by the University of Latvia (Faculty of Geography and Earth Sciences, 2010), mean riverine load of the Salaca was 2,513 tonnes/year of total nitrogen and 60 tonnes/year of total phosphorus in the period 2004–2008.

XXIII. North Livonian Bogs (Estonia, Latvia)[36]

General description of the wetland area

197. This large mire area spreads across the border between Estonia and Latvia and comprises natural open plateau-like raised bogs with extensive hollow[37] and pool[38] systems, stripes of transitional mires, dystrophic lakes and forested mineral islands. The mires are surrounded by forests and semi-natural agricultural areas. The wetland complex belongs mainly to the Salaca

[36] *Sources of information*:
Latest Information Sheets on Ramsar Wetlands (RIS), available at the Ramsar Sites Information Service: http://ramsar.wetlands.org/Database/Searchforsites/tabid/765/language/en-US/Default.aspx:
Anon 2003-2006 Integrated Wetland and Forest Management in the Transborder Area of North-Livonia (Estonia-Latvia). - PIN/MATRA project No 2002/014. URL: http://www.north-livonia.org
Anon 2006-2007 Tuned management and monitoring of the transboundary protected areas in North-Livonia as a support for local development. - European Union Community Initiative "Baltic Sea Region INTERREG III B Neighbourhood Programme" project. URL: http://wetlivonia.north-livonia.org
Leivits, Agu 2006. Transboundary protected areas: Experiences from Estonia. - In: Hedden-Dunkhorst, B.. Engels, B., Schmid, G., Aliyev, I. (eds) The Role of Biodiversity for Sustainable Development in the Southern Caucasus Region: Azerbaijan - Progress and Perspectives. Report of the Expert Meeting held in Baku, Azerbaijan 22-23 May 2006. NATO Programme on Science of Peace and Security Report No. 278. Bonn pp. 39- 42.
Leivits Agu, Urtāns Andris, Roosalu Anneli, Murel Merivee, Seilis, Valērijs 2010. Cooperative management of the North Livonian Transboundary Ramsar Site. In: Nature Conservation beyond 2010, Tallinn pp17-18.
Zingstra Henk, Roosalu Anneli, Leivits Agu, Urtans Andris and Kitnaes Karina 2006. Master plan for North Livonia; Wetland Protection and Rural Development in the Transboundary Area of Latvia and Estonia, Wageningen International, the Netherlands 44pp. URL: http://www.north-livonia.org/report/MP-North-Livonia.pdf

[37] "Hollow" is peatbog feature, which is often 5 cm below to 5 cm above water table covered mainly by sphagnum mosses and some cyperaceous plants.

[38] "Pool" is peatbog feature, which is permanently water-filled basin, often with some vegetation at their edges.

river basin, though there is partial discharge into river Rannametsa discharging into the Gulf of Riga and into river Reiu which belongs to the Pärnu River Basin. The area is included in the international Ramsar network of wetlands.

Main wetland ecosystem services

198. The following ecosystem services are most important in the area: biodiversity maintenance, water storage, local climate balance, greenhouse gas and carbon capture, and, in marginal parts, flood control.

199. Particularly the marginal parts of the mires are used for berry picking, fishing and hunting. This is a valuable site for outdoor recreation and nature tourism, including bird watching. The site is a "stepping stone" in the regional transboundary tourism development scheme.

Cultural values of the wetland area

200. The mire complex was historically a natural border between two nations belonging to different language groups, the Estonian (Finno-Ugrian) and Latvian (Baltic) groups. The area shows traces of their interaction and mutual influence. Mineral islands in the peatland complex which were difficult access were traditionally used as hide and refuge areas during disasters and military events. Several historical artifacts – offering trees and holy yards are located on the wetland margins. In previous centuries, "frozen roads" that crossed mires were used for cross-border communication.

Biodiversity values of the wetland area

201. The wetlands on the Estonian and Latvian side of the border form one of the largest and least disturbed peatland area in the Baltic region. The area harbours representative examples of habitats listed in Annex I of the EU Habitats Directive characteristic for the Boreal biogeographical region, including active raised bogs, transition mires and quaking bogs, bog woodland, Fennoscandian deciduous swamp woods, and natural dystrophic lakes.

202. Located on the main Eastern Baltic flyway, the wetland provides an important resting place for migratory birds, e.g. up to 40,000 – 50,000 white-fronted geese (*Anser albifrons*) and bean geese (*A. fabalis*) and up to 1000 cranes Grus grus stop over here. It is an important breeding site for rare and vulnerable bird species. Noteworthy mammals include species that need vast and/or untouched forest and bog areas, e.g. large carnivores (wolf *Canis lupus*, lynx *Lynx lynx*, brown bear *Ursus arctos*), ungulates (elk *Alces alces*), pine marten *Martes martes* and flying squirrel *Pteromys volans*. A total of 60 species listed in the EU Habitats and Birds Directives are recorded in this transboundary area.

Pressure factors and transboundary impacts

203. A dense system of drainage ditches located next to the mire complex is the overriding cause for the drainage of the mire lag zone, both on the Latvian and Estonian side, and for increasing forest growth on former open mire areas. Timber harvesting in the vicinity of the Ramsar sites leads to fragmentation of forest habitats; soil erosion from clearcut areas causes increased siltation in the drainage basin and deteriorates water quality. The decrease of the local human population due to a lack of employment possibilities is followed by decrease of open areas essential for maintaining grassland diversity and as migrating bird resting areas.

Transboundary wetland management

204. Raised bogs on both sides of the border are Ramsar sites: Nigula Nature Reserve (6,398 ha) and Sookuninga Nature Reserve (5,869 ha) in Estonia and Ziemelu purvi (5,318 ha; Biosphere Reserve) in Latvia. In 2007, the North Livonian Transboundary Ramsar site was established. The wetlands are identified as Important Bird Areas and Natura 2000 sites, as well as an International Level Core Area in the Pan European Ecological Network.

205. There is strong transboundary cooperation at site level. A masterplan for the Transboundary Ramsar site and its surroundings has been elaborated with a coordinated monitoring program

(including the joint use of remote sensing data) as well as information exchange on species diversity and factors possibly having impact on the other side of the Ramsar site. To restore the natural hydrology and maintain the integrity of the raised bog ecosystem, wetland drainage ditches were closed on the Estonian side. There is also good cooperation to organize joint public events, fieldwork and game management, as well as sharing research and monitoring buildings and equipment.

XXIX. Gauja/Koiva River Basin[39]

206. Estonia and Latvia share the basin of the 452-km long Gauja/Koiva River (26 km in Estonia). The Mustjõgi, Vaidava, Peetri and Pedetsi are transboundary tributaries. Vaidava and Pärlijõgi are important salmon rivers.

207. The Koiva basin has many lakes (lake percentage 1.15%), and the biggest one is Lake Aheru (234 ha).

Table 23
Area and population in the Gauja/Koiva Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Estonia	1 100	13	7 490[a]	
Latvia	7 920	87	~200 000	19[b]
Total	**9 080**			

Source: Gauja River Basin Management plan 2009.
[a] Situation in 2003. The population is expected to remain unchanged until 2015.
[b] The population density in Gauja/Koiva river basin is very irregular (with about 45% of inhabitants living in the cities) and exceeds 50 persons/km^2 in the vicinity of some towns (e.g. Carnikava and Saulkrasti), whereas in other areas it is low, only 5–10 persons/km^2. .

Hydrology and hydrogeology

208. Surface water resources generated in Latvian part of the River Basin District comprising the basins of the Gauja/Koiva and the Salaca are estimated at 2,199×10^6 m^3/year and groundwater resources in the the Gauja/Koiva Basin are ~110–113 ×10^6 m^3/year[40]. There are 43 small hydropower stations and 20 water bodies with regulated small rivers in the Latvian part of the Gauja/Koiva river basin. In the Estonian part, there are 21 dams on rivers (most of them are older than 25 years), and one of them is used for hydropower generation.

209. A small part of groundwater body D 4 is located in the Gauja/Koiva River basin (for the assessment, see the Lielupe Basin), and it does not stretch to the Estonian territory.

Table 24
Groundwater body D5[41] The groundwater body consists of several aquifers.

	Latvia	*Estonia*
Thickness in m (mean, max)	Varies for different aquifers, 235	
Groundwater uses and functions	Some of the aquifers are used for drinking water. Groundwaters support also surface ecosystems	Groundwater supports

[39] Based on information provided by Estonia and Latvia, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters.
[40] Estimate of the Latvian State Geology Service in 1999
[41] Based on information from Latvia. This groundwater body is designated in the Latvian territory only.

	and feed watercourses	agriculture
Other information	Maximum depth from the ground surface is 253 m	

Table 25
Groundwater body D6:[42] This groundwater body consists of several aquifers.

	Latvia	*Estonia*
Thickness in m (mean, max)	Varies for different aquifers, 435	
Groundwater uses and functions	Some of the aquifers are used for abstraction of drinking water. Groundwaters support also surface ecosystems and feed watercourses	Groundwater supports agriculture
Other information	Maximum depth from the ground surface is ~400 m	

Table 26
Groundwater body P[43]: This groundwater body consists of several aquifers.

	Latvia	*Estonia*
Groundwater uses and functions	Drinking water in some towns and parishes	Groundwater supports agriculture
Other information	Location quite deep below the surface (50 – 330 m) offers some protection against impact from the surface.	

Table 27
Middle-Lower-Devonian groundwater body (D2-1): type 2. Devonian sandstones. Groundwater flow direction from Estonia to Latvia and Russia, in places from Latvia to Estonia. Medium link with Koiva river.

	Estonia	*Latvia and Russia*
Border length (km)	46,3 (Estonian Latvian border) and 101,9 (Estonian Russian border)	
Area (km^2)	13 102	
Thickness in m (mean, max)	40, 150	
Number of inhabitants	615 794	
Population density	47	
Groundwater uses and functions	One of South Estonia`s most abundant sources of groundwater.	
Other information	Bigger central water intakes located in Põlva, Elva and Tartu. 10–20% of the stock in use. Only in Tartu the groundwater regime is	

42 Based on information provided by Latvia. This groundwater body is designated in the Latvian territory only.
43 Based on information provided by Latvia. This groundwater body is designated in the Latvian territory only.

	significantly influenced by water abstraction. Good chemical status.	

Table 28

Middle-Devonian groundwater body (D2): type 2. Middle Devonian sandstones and aleurolites. Groundwater flow direction from Estonia to Russia and Latvia in southeast Estonia, from Latvia to Estonia in southeast Estonia. Medium link with Koiva river.

	Estonia	*Latvia and Russia*
Border length (km)	191,3 (Estonian Latvian border) and 233,2 (Estonian Russian border)	
Area (km^2)	447	
Renewable groundwater resource (m^3/d)	50 000	
Thickness in m (mean, max)	50, 100	
Number of inhabitants	17 433	
Population density	39	
Groundwater uses and functions	Groundwater is mainly used for abstraction of drinking water (98 774 m^3/year).	
Other information	Low vulnerability and good chemical status.	

Table 29

Upper-Devonian groundwater body (D3): type 2. Upper Devonian karsted and fissured dolomites and limestones. Groundwater flow direction from Estonia to Latvia and Russia, in places from Latvia to Estonia. Medium link with Koiva river.

	Estonia	*Latvia and Russia*
Border length (km)	75,8 (Estonian Latvian border), 63,1 (Estonian Russian border)	
Area (km^2)	1 330	
Renewable groundwater resource (m^3/d)	50 000	
Thickness in m (mean, max)	20, 30	
Number of inhabitants	45 220	
Population density	34	
Groundwater uses and functions	Groundwater is mainly used for abstraction of drinking water (21 594 m^3/year)	
Other information	Low vulnerability and good chemical status	

Pressures

Table 30
Total withdrawal and withdrawals by sectors (per cent)

Country	*Total withdrawal ×10⁶ m³/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Latvia	22.64	36.7	28.23	15.71	2.64	17.72
Estonia	N/A	N/A	N/A	N/A	N/A	N/A

Note: Some 57 per cent of the total water use in the Latvian part of the basin is met from groundwater. Some 12.8 million cubic metres are abstracted annually. Groundwater is mainly used for supply of drinking water, but is commonly used in industry as well.

210. Iron, sulphate, ammonium, manganese and other element concentrations are naturally high, requiring groundwater to be pre-treated before used as drinking water.

211. There are no big industrial enterprises in the basin. Agriculture and forestry are the main economic activities and also peat production may impact water quality. Agricultural lands cover around 37% of Gauja/Koiva river basin, and the impact of pollution from agriculture is assessed as widespread but moderate.

212. According to the estimation for 2006, 470 t nitrogen and 27 t phosphorus have been discharged to the water bodies from agriculture in the Estonian territory. According to the estimations for 2006, some 1928 t nitrogen and 55 t phosphorus have been discharged from agriculture, which corresponds to 62 per cent and 26 percent of total anthropogenic nitrogen and phosphorus load, respectively, in the Latvian territory of Gauja/Koiva river basin The largest nitrogen load originates from cropland (1,006 t), significant nitrogen and phosphorus loads come from manure storage sites (~ 900 t and ~ 40 t, respectively). Also draining agricultural land intensifies the release of nutrients in the Latvian part and leaves a negative hydromorphological impact on the water environment. The diffuse pollution from the many farms in the sub-basins of the Peetri and Pärlijõgi is unlikely to significantly affect the fish fauna of these rivers. Fishfarms with an annual growth of more than 1 tons affect waterbody status locally, but potentially severely in Estonia.

213. According to estimates in Latvia, some 640 t nitrogen and 26 t phosphorus from originated from forestry in 2006 (clear cutting, drainage etc.), which is 20% and 12%, respectively, from total anthropogenic load in the territory of the Gauja River Basin. The forest drainage systems that have been constructed causes negative hydromorphological impact.

214. There are around 200 urban wastewater discharge points in the Latvian part of the river basin, influencing significantly quality of two waterbodies, more specifically the Gauja River between the towns Valmiera and Sigulda. According to the estimates, around 34% of anthropogenic phosphorus load and 15% of anthropogenic nitrogen load comes from collected and treated urban wastewater. Sewage in the cities and settlements are collected and treated before discharge usually. In the suburbs or farmsteads where collecting systems are not in place, individual or other appropriate systems should be used but as these are at the owner's responsibility, untreated or insufficiently treated sewage are sometimes discharged. Households that are not connected to a wastewater treatment plant are estimated to create notable pollution by nutrients in the Latvian part of Gauja/Koiva river basin district – about 41 tons P and 202 tons N in year 2006. The biggest settlements on the Estonian side are Varstu, Rõuge, Meremäe, Mõniste, Misso and Taheva. The importance of urban wastewater discharges as pressure factor is assessed as local but severe, with treatment plants of population equivalent of less than 2,000 affecting the status more.

215. Based on permit data, there were around 59 industrial wastewater discharge points in the Latvian part of the basin. Many companies discharge their wastewater into urban wastewater collecting system, but a pre-treatment is required of them.

Status and transboundary impacts

216. As water resources in the basin are assessed as plentiful, no impacts on water availability have been observed. Latvia ranks eutrophication as widespread, varying from moderate to severe in influence.

217. The ecological status of the Koiva River in Estonia in general is “good” (water-quality class 2): 1 out of 28 waterbodies is in very good status, 21 good status, 5 moderate and 1 is heavily modified with moderate status. The river is important for fish breeding for the Baltic Sea. Unfavourable changes in the temperature regime present a problem to fish fauna in some watercourses. Small dams on the Gauja/Koiva’s tributaries, which do not have a water management function anymore, have an adverse effect on the fish fauna. River fragmentation by dams on the Pärlijõgi and Vaidava, resulting in problems for fish migration, cause these rivers to be in moderate status.

Table 31
Ecological quality class/ecological potential of water bodies in the Latvian part of the Gauja Basin (including the Salaca Basin?)

Waterbodies/ number	*Ecological quality class/potential*									
	High		*Good*		*Moderate*		*Poor*		*Bad*	
	number	*%*	*Number*	*%*	*number*	*%*	*number*	*%*	*number*	*%*
River	4	4.9	25	30.9	13	16.1	2	2.5	-	-
Lake	1	1.2	15	18.5	12	14.8	5	6.2	2	2.5
Heavily modified	-		1	1.2	-	-	1	1.2	-	-
Total	**5**	**6.1**	**41**	**50.6**	**25**	**30.9**	**8**	**9.9**	**2**	**2.5**

Source: Gauja river basin management plant, 2009, Latvia

Response measures

218. Since 2004, significant investments have been made and infrastructure projects have been carried out to renovate existing wastewater treatment plants and build new ones, both in big agglomerations and small settlements. This has contributed to the reduction of pollution load to surface waters, which for phosphorus, nitrogen, BOD, COD and suspended solids have decreased by 10-40% nationally (i.e. all surface waters) during period 2004 to 2008 according to Latvian statistics. Thanks to the investments made in building and renovation of wastewater collection and treatment infrastructure in Estonia, the pollution load has decreased from 1992 to 2007: BHT_7 by 94 per cent, total phosphorus by 79 per cent and total nitrogen by 71 per cent.

219. Small part of the Gauja/Koiva Basin is designated as nitrate vulnerable zone in Latvia where more stringent environmental requirements for agriculture are applied, requiring from farmers use of good agricultural practices.

220. The Advisory Council of Gauja River Basin coordinates between different ministries, the regional government and stakeholders the interests related to environmental quality objectives for the basin.

221. Groups of experts from the competent authorities in both countries, established on the basis of a bilateral agreement between Latvia and Estonia (2003) (see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6), met regularly to exchange information and to coordinate issues important for the development of the river basin management plans. This cooperation is regarded as beneficial and satisfactory by all parties.

Future trends

222. According to Koiva/Gauja river basin management plan agriculture has an important impact to waterbodies and it is a rising trend.

223. Environmental Protection Law (adopted in 2006/2007) of Latvia is reported as a means in place for integration of water management issues in the instruments related to other sectors. Latvia's National Development plan 2007-2013 has several objectives of water management such as development of water service infrastructure, reduction of environment pollution and sustainable use of water resources, among others. National Environmental Action Plan for Estonia (2007-2013) defines long-term development trends for maintaining good status of the natural environment (including of waters).

224. The Gauja/Koiva is a part of the scope of the KALME project (2006-2009) aimed at investigating how climate change can potentially influence water resources in Latvia. The current knowledge about the current predictions about the impacts of climate change on water resources in Latvia is summarized in the assessment of the Daugava.

XXV. Daugava basin[44]

225. Belarus, Latvia, the Russian Federation and Lithuania share the basin of the 1,020-km long Daugava[45] River. The Daugava has its source in the Valdai Hills in the Russian Federation and discharges into the Gulf of Riga in the Baltic Sea.

226. The Usvyacha, the Kasplya (Belarus, Russia) and the Disna (Belarus, Lithuania) are transboundary tributaries.

Table 32
Area and population in the Daugava Basin

Country	*Country's share km²*	*Country's share %*	*Number of inhabitants*	*Population density (persons/km²)*
Belarus	33 200[a]	47.9		
Latvia	24 700	35.7	1 370 000	25[a]
Russian Federation	9 500	13.7		
Lithuania	1 871	2.7	57 500[b]	31
Total	**69 271**			

Source (country shares): Belarus — Blue treasure Belarus: Encyclopedia. Minsk, 2007. Other countries — United Nations World Water Development Report, first edition, 2003. Total area — Working Group on the Western Dvina Basin, operating under the joint Russian-Belarussian commission

[a] The average population density (2006) without the biggest cities Riga, Rēzekne and Daugavpils. Riga has approximately 700,000 inhabitants. The number of inhabitants in the Latvian part of the Daugava River

[44] Based on information provided by Belarus, Latvia, Lithuania and the Russian Federation as well as the first Assessment

[45] The river is also known as Dauguva and Western Dvina (Zapadnaya Dvina).

Basin District is predicted to decrease by 6% - 7%, but in Latgale region by 9-11%. Population growth is only expected in and around Rīga. (approved Daugava River Basin Management plan 2009)
[b] The population data is from 2009

Hydrology and hydrogeology

227. Surface water resources in the Latvian part of the basin are estimated to amount to some 20.268 km^3/year. Groundwater resources are estimated at 0.186 km^3/year. The total water resources, 20.454 km^3/year equals 14,929 m^3/year/capita in the Latvian part.

228. In the Belorussian part the surface water resources are estimated at approximately 6.8 km^3/year, and groundwater resources at 2.69 km^3/year, adding up to a total of 9.49 km^3/year.

229. Groundwater body D4 (in Latvia) is partly located within the Daugava Basin, but as it borders with Lithuania in the Lielupe Basin, it is assessed as part of the Lielupe Basin.

Table 33
D10/Polotsk and Lansky terrigenous complex of Middle and Upper Devonian aquifer [46]: Type 4, Sand, sandstone and siltstone of Middle and Upper Devonian age. Weakly linked with surface water.

	Latvia	*Lithuania*	*Belarus*
Border length (km)		~55 with LV, 15 with BY	
Area (km^2)		753	N/A
Thickness in m (mean, max)		150	100–150, 200
Groundwater uses and functions		Public and individual drinking water supply	Groundwater is mainly use for drinking and household water
Other information		Correspond to Upper – Middle Devonian (LT 001004500)	Transboundary aquifers are not being monitored. A gradual development of a network of observation wells for transboundary groundwater is planned from 2011 to 2015. Age/stratigraphic unit: D_{2-3} (Dst+ln; D_2st)

Table 34
D9/Upper Devonian terrigenous-carbonate complex aquifer[47]: Type 4, Limestone, sandstone, marl of Devonian age. Weakly linked with surface water.

	Latvia	*Russian Federation*	*Belarus*
Thickness in m (mean, max)	- , 325		100–150, 190

[46] Based on information from Latvia. Corresponds spatially with aquifer “Sventoji-Arunula” (No. 66) of the Inventory of Transboundary Groundwaters by UNECE Task Force on Monitoring and Assessment (1999), with Latvia and Lithuania as the riparian countries, but later identified as “Sventoji-Arunula / Sventosios-Upninky.

[47] Based on information from Latvia and Belarus. Corresponds spatially with aquifer “Sventoji-Arunula” (No. 66) of the Inventory of Transboundary Groundwaters by UNECE Task Force on Monitoring and Assessment (1999), with Latvia and Lithuania as the riparian countries, but later identified as “Sventoji-Arunula / Sventosios-Upninky.

Groundwater uses and functions	Groundwater is mainly use for drinking and household water
	Transboundary aquifers are not being monitored. A gradual development of a network of observation wells for transboundary groundwater is planned from 2011 to 2015.
Other information	Age/stratigraphic unit: D_3 (D_3fm; D_3f; D_3sr+sm; D_3sm; D_3sr)

Table 35

Groundwater body D8[48]: This groundwater body consists of several aquifers, including the following Quaternary multi-aquifer systems: Pliavinias-Amulas, Arukila-Amata.

	Latvia	*Russian Federation*	*Estonia*
Thickness in m (mean, max)	- , 475		
Groundwater uses and functions	All aquifers are used for abstraction of drinking water to some degree.		
Other information	The aquifers occur up to 400 m below the surface.		

Table 36

Quaternary sediment aquifer[49]: sand and gravel, sandy loam of Quaternary age. Strongly linked with surface water.

	Latvia	*Belarus*
Area (km^2)		N/A
Thickness in m (mean, max)		10–15, 95
Groundwater uses and functions		Groundwater is mainly use for drinking and household water
Other information		Transboundary aquifers are not being monitored. A gradual development of a network of observation wells for transboundary groundwater is planned from 2011 to 2015. Stratigraphic unit(s): Q(aIII-IV; f,lgIId-sz; aIIIpz; f,lgIbr-IId; f,lgIbr)

[48] Based on information from Latvia. This groundwater body is designated in the Latvian territory only. Corresponds spatially with aquifer “Sventoji-Arunula” (No. 66) of the Inventory of Transboundary Groundwaters by UNECE Task Force on Monitoring and Assessment (1999), with Latvia and Lithuania as the riparian countries, but later identified as “Sventoji-Arunula / Sventosios-Upninky.

[49] Based on information from Belarus

Pressures and transboundary impact

Table 37
Total withdrawal and withdrawals by sectors

Country	*Year*	*Total withdrawal × 10 ^{6} m ^{3}/year*	*Agriculture %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Belarus	2000-2009[a]	197.5	15.6	39.7	37.7	6.5	0.5
Latvia[a]	2006	145.643	27.1	55.2	1.3	3.5	6.1
Russian Federation[c]	2008	*0.56*	9.1	67.2	12.8	-	10.9
Lithuania	2009	3.35	76	16	8	-	-

[a] The withdrawal figure is an average for years from 2000 to 2009.
[b] In the Latvian part of the basin, 36 per cent of the total use is met from groundwater. Some 55.6 × 10^{6} m^{3}/year of groundwater is abstracted and 90.2 × 10^{6} m^{3}/year of surface water is withdrawn.
[c] Of the total withdrawal, 0.03 × 10^{6} m^{3}/year is surface water and 0.53 × 10^{6} m^{3}/year is groundwater.

230. In the Belorusian part, the main pressures are urbanization, industrial production, agriculture and to a lesser degree recreation, with the following as typical pollutants: ammonia-nitrogen, petroleum products, suspended substances, organic substances.

231. According to estimates, in 2006 nitrogen loading in the Latvian part of Daugava river basin district was some 3,800 t and phosphorus some 120 t from agricultural activities, which is 47% and 18% from total anthropogenic pressure50. According to calculations made by the University of Latvia (Faculty of Geography and Earth Sciences, 2010), in the period 2004 – 2008, mean riverine load of Daugava from all sources was 34,722 tonnes/year of nitrogen in total (Ntot) and 1,717 tonnes/year (Ptot). Most of the agricultural nitrogen load is from cropland and manure storage sites, and phosphorus from manure storage and grassland. Draining of agricultural land has intensified nutrient emissions. Some pollution of shallow groundwater by nutrients occurs in Latvia, but it is not neither widespread nor intense in the Daugava Basin. The impact of agriculture is assessed by Latvia and Belarus as widespread but moderate. Nutrients have accumulated over the years in the reservoirs.

232. Latvia ranks the impact of discharge of insufficiently treated municipal wastewater as widespread but moderate, Belarus as local but severe. Latvia estimates that 31 per cent of anthropogenic phosphorus load and 10 per cent of anthropogenic nitrogen load comes from collected and treated urban wastewater. A lack of treatment is a problem especially in the suburbs and in farming areas. In 2006, some 25 per cent of the urban wastewater discharges (total discharges 32.7 millions m^{3}) in the Latvian part was not in line with national requirements. Forestry is a minor contributor, origin of some 8 to 15 per cent of the nutrient load based on 2006 figures. In the Belorussian part, 10^{3} × 10^{6} m^{3} of wastewater was discharged to the Daugava in 2009, out of which Belarus reported 79 × 10^{6} m^{3} to have been treated to the level required and 23 × 10^{6} m^{3} met the requirements otherwise. Of the treated amount, some 73 × 10^{6} m^{3} have also gone through biological treatment plants. The amount of wastewater discharged has decreased from about 150 × 10^{6} m^{3} in the early 2000s. According to Belarus, only 1 × 10^{6} m^{3} (about one per cent) of the discharge was insufficiently treated.

233. Many companies discharge their industrial wastewaters into the urban wastewater collection system. The main industries in the Latvian part are food processing, wood-processing,

50 These figures are substantially lower than what was reported in the first Assessment of Transboundary Rivers, Lakes and Groundwaters (2007) as results of the “Daugavas Project” (a bilateral Latvian-Swedish project) which Latvia suspects to be a slight overestimation.

textile manufacturing, power industry, engineering and pharmaceutical industry; in the Belorussian part, food processing and petrochemical industries. In the Latvian and Belorussian parts, discharge of industrial wastewaters is considered severe in impact, but the scale varies from local to widespread. Lukomolskaya Power Plant in Belarus is one energy-generation related source affecting water quality through wastewater discharges. According Latvia, the pollution loads in 2006 for selected substances discharged with wastewater (both municipal and industrial wastewaters) in the Latvian part of the Daugava Basin were as follows: 1,933 tons of suspended solids, 1,182 tons BOD, 6,338 tons COD, 2263 tons nitrogen, 277 tons phosphorus and 12 tons of oil products were.

234. The impact of some 136 old industrial and municipal dumpsites —now closed or remediation is foreseen — is considered local, ranging from moderate to severe. Of local but severe influence are contaminated sites (125 contaminated and 1065 potentially contaminated), many of which are legacy from the Soviet Union army, which are gradually investigated and remediation is planned.

235. The impact of hydromorphological changes ranges from moderate to severe according to Latvia, but remains local. In the Latvian part, there are three big hydropower stations — Ķegums (total capacity 264 MW), Plavinu (869 MW) and Riga (402 MW) — and 44 small ones (capacities ranging from 11 kW up to 1000 kW), Riga harbour, 25 polders and a lot of regulated small rivers in the basin. Two lakes and 13 river water bodies within the basin in Latvia are classified as heavily modified water bodies. On its territory Belarus plans to build several hydroelectric plants.

236. With widespread impact in some parts of the basin in Latvian territory are spring flooding and natural occurrence of e.g. iron and sulphate in groundwater due to which pre-treatment is required. The treatment need for iron removal has widespread implications in the Belarusian part as well.

237. Latvia assesses the transboundary impact in the form of pollution load widespread, with about 70 per cent of both nitrogen and phosphorus load to the Daugava coming from outside its borders[51]. Pollution sources in the Russian part of the basin cause transboundary impact on downstream Belarus in the form of increased concentrations of iron, zinc compounds and manganese.

Status

238. Chemical status of the river in the Belorussian part during the past five years has remained "stable", improved the quality of river water for their content of petroleum products, ammonia nitrogen, inorganic phosphorus and total phosphorus. According to the classification of water resources, adopted in Belarus, some 21 per cent of water in the basin are classified as "clean", 74 per cent as "relatively clean" and almost 5 per cent as "moderately polluted"[52].

Response and transboundary cooperation

239. A small part of the Daugava river basin in Latvia is designated as nitrate vulnerable zone where more stringent environmental requirements for agriculture should be applied. In practice this involves that farmers are required construct manure storages, elaborate fertilisation plans and comply with related requirements. The other measures applied to reduce nutrient pollution include setting up protected belts around waterbodies, where application of fertilizers and herbicides is

[51] For comparison, during the first Assessment (2007), it was reported that about 50 per cent of the measured nutrient load originated from Latvia.The above-mentioned calculations made by the University of Latvia, state that 67% of the N_{tot} and 74% of P_{tot} Daugava riverine load comes from outside Latvia.

[52] *Source:* Key figures for sanitation 2000-2009 in the basin of the Daugava (actual water consumption and sewage discharge in the Republic of Belarus)

prohibited (planned), requiring permits for polluting activities and applying Natural Resources Tax for emission of polluting substances.

240. Latvia reports that thanks to reconstruction of water supply systems in recent years, water loss in the supply system is decreased by 26-41% during period from 2004 to 2009. According to the Latvian national statistic pollution load (phosphorus, nitrogen, biochemical oxygen demand BOD, chemical oxygen demand COD and suspended solids) discharged to the surface waters decreased by 10-40% during period 2004 to 2008. Building and reconstruction of treatment facilities has been carried out in Belarus as well, and for surveillance those of enterprises are covered by local monitoring. The construction of a collector in Braslav on the Druyka has stopped the discharge of wastewater to Lake Boloyso. Among other measures taken by Belarus is establishment of water protection zones around water bodies, with limitations to economic and other activities.

241. The Advisory Council of Daugava River Basin coordinates in the Latvian part government institutions' (including 5 ministries), regional governments', nongovernmental organizations', entrepreneurs' and other stakeholder groups' interests that are connected with achieving the aims of environmental quality in the Daugava river basin.

242. On the basis of a technical protocol on joint management of Daugava, Lielupe and Venta river basin districts signed by Latvian and Lithuanian Ministers of the Environment (2003; see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6), expert groups consisting of competent authorities in both countries meet regularly to exchange information and to coordinate issues related to the river basin management plans.

243. A draft of an Agreement on Cooperation in the Field of Use and Protection of Water Resources in Zapadnaya Dvina/Daugava River Basin exists, involving Belarus, Latvia and the Russian Federation, but its ratification is reported to hardly have advanced since 2004.

Future trends

244. The land use/land cover situation in the Latvian part of the basin is expected to stay very stable, with no change in agricultural land area and only minor change in forest cover. 272. Due to popularity of some areas in the Latvian part for recreational use, some water quality deterioration may occur because of that pressure.

245. Further improvement of existing wastewater treatment plants and building of new ones is expected in Latvia as the implementation of Council Directive 91/271/EEC on urban wastewater continues. Specific objectives related to development of water service infrastructure — but also to e.g. water management and reduction of environmental pollution — are specified in Latvia's National Development plan 2007-2013.

246. Management of flood protection is expected to improve in Latvia thanks to the implementation of the EU Flood Directive, supported by availability of EU funds for flood protection measures.

247. According to observations, in some areas in Latvia, the average amount of precipitation has increased in January, February and March, but in September the amount of precipitation has decreased.

248. Compared with the reference period 1961-1990, the annual sum of precipitation is predicted to increase by 4–11 per cent in the period 2070–2100 in Latvia. Monthly precipitation is predicted to increase in winter (December - February) and in the beginning of summer (May, June), but decrease in summer (July - September). The number of days with intensive precipitation predicted to increase by 20 – 100 (more than 10 mm in twenty-four hours). Due to climate change, periods without precipitation more than 5 days long are expected to occur more frequently in Latvia.

249. Potential influence of climate change on lakes and rivers in Latvia as well as coastal waters has been investigated in research project KALME (2006-2009), which also aimed at preparing proposals related to adaptation. Among the recommended adaptation measures are, for example,

creation of buffer strips in the vicinity of water bodies, construction of sedimentation basins/ artificial wetlands in melioration ditches and avoiding of clear cutting.

250. Average annual discharge is predicted to decrease due to increase in average air temperature and higher evapotranspiration. Discharge in winter is expected to increase considerably, with earlier spring flooding and reduced flooding maximum.

XXVI. Lake Drisvyaty/Druksiai[53]

251. Lake Drisvyaty (Drukshay) is transboundary between Belarus and Lithuania. The area of the lake is 44.5 km^2. The catchment area is 604/621[54] km^2.

252. Lake Drisvyaty / Drukshay is very susceptible to anthropogenic impact, which until recently included also thermal pollution from the Ignalina nuclear power plant in Lithuania, which was closed in the end of 2009 (the lake was used as a cooling reservoir).

XXVII. Lielupe River Basin[55]

253. The basin of the Lielupe is shared by Latvia and Lithuania. The Lielupe River originates in Latvia at the confluence of two transboundary rivers: the 157-km long Musa River and the 199-km long Nemunelis River (or the Memele), and discharges to the Baltic Sea. The Musa has its source in the Tyrelis bog (Lithuania) and the Memele River in the Aukstaitija heights west of the town of Rokiškis (Lithuania). There are numerous other small tributaries of the Lielupe River originating in Lithuania.

Table 38
Area and population in the Lielupe Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Latvia	2 155			
Lithuania	1 892		42 000	24
Nemunelis sub-total	**4 047**			
Latvia	166			
Lithuania	5 297		291 000	55
Musa sub-total	**5 463**			
Latvia	8 662	49.2	315 000	36[a]
Lithuania	8 938	50.8	387 000	43
Total	**17 600**			

Source: Lielupe River Basin Management plan 2009.
[a] In some regions (especially Viesītes, Ilūkstes and Aknīstes rural municipalities) the average population density is lower, about 5 persons/km^2. There is a decreasing trend in the number of inhabitants.

[53] Based on information provided by Belarus and the first Assessment of Transboundary Rivers, Lakes and Groundwaters
[54] The catchment area is 604 km^2 according to Belarus and 621 km^2.
[55] Based on information provided by Latvia, Lithuania and on the first Assessment of Transboundary Rivers, Lakes and Groundwaters,

Hydrology and hydrogeology

254. Surface water resources generated in Latvian part of Lielupe Basin are estimated at 1,844 × 10^6 m^3/year and groundwater resources at 63.34 × 10^6 m^3/year, adding up to a total of 1,907 × 10^6 m^3/year .

Table 39

Groundwater body D4/ Upper Devonian Stipinai (LT002003400) and Upper – Middle Devonian (LT001003400)[56]: A half of the groundwater body D4 is located in the Daugava River Basin District (RBD), another half is in the Lielupe RBD. Only the part in the Lielupe RBD borders with Lithuania. This groundwater body consists from several aquifers, including the following multi – aquifer systems: Quaternary; Pliavinias-Amulas; Arukila – Amata.

	Latvia	*Lithuania*
Border length (km)		~17 (Upper Devonian Stipinai), ~190 (Upper-Middle Devonian)
Area (km^2)		1 879 (Upper Devonian Stipinai), 4 448 (Upper-Middle Devonian)
Thickness in m (mean, max)	110, 322	20 (Upper Devonian Stipinai), 140 (Upper-Middle Devonian)
Groundwater uses and functions	drinking water	Public and individual drinking water supply
Other information	A small part of groundwater body D4 has a poor chemical status due to sea water intrusion. Subsequently groundwater abstraction was reduced and groundwater levels gradually restored. The aquifers lie up to 180–190 m below the ground surface.	Groundwater in some wellfields of Upper Devonian Stipinai aquifer has high amount of sulphates of natural origin. National codes: Upper Devonian Stipinai (LT002003400) and Upper -Middle Devonian (LT001003400)

Table 40

Groundwater body F3[57]: This groundwater body includes several aquifers; some of them are transboundary.

	Latvia	*Lithuania*
Area (km^2)		1063
Thickness in m (mean, max)		40
Population density	36 (average for the Lielupe RBD)	
Groundwater uses and functions	Used for drinking water and for technical needs	Public and individual drinking water supply
Other information	The maximum depth is ~ 135 m	Good quantitative and chemical status; corresponds

56 Based on information from Latvia. This groundwater body is designated for the needs of river basin management plans in the Latvian territory only.

57 Based on information from Latvia. This groundwater body is designated for the needs of river basin management plans in the Latvian territory only. The areas of the groundwater bodies are not coordinated between Latvia and Lithuania,

	from the ground surface.	to Permian-Upper Devonian (LT003003400)

Table 41
Groundwater body A[58]: This groundwater body includes several aquifers; some of them are trans-boundary.

	Latvia	*Lithuania*
Area (km^2)		508
Thickness in m (mean, max)	-, 350	>200
Population density	36 (average for the Lielupe RBD)	
Groundwater uses and functions	Used for drinking water and for technical needs	Public and individual drinking water supply
Other information	Its maximum depths are ~ 470 m from the ground surface.	This aquifer is considered as being at risk due to high content of natural sulphates, which could increase because of groundwater abstraction. Therefore, operational groundwater monitoring is necessary. This aquifer partly corresponds to Upper – Middle Devonian aquifer in Joniškis GWB (LT LT0010023400), but the boundaries currently do not match at the border between the states.

Pressures

Table 42
Total withdrawal and withdrawals by sectors (per cent)

Country	*Total withdrawal $\times 10^6$ m^3/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Latvia	15.28	6.26	45.61	25.27	8.92	13.93
Lithuania	10.66[a]	2	62	19	2	15

Note: The figures for Latvia are from 2008. Groundwater is broadly used for drinking water in the Latvian part but it is also used in industry: about 80 percent of total water use is groundwater (some 16.9 million m^3 abstracted annually).

[a] The data for Lithuania are from 2009.

255. Agricultural lands cover a significant part of the Lielupe River Basin (around 52 per cent in the Latvian part), and their share is even larger in the Lithuanian part. According to observations in 2006, some 2,461 t of nitrogen and 66 t of phosphorus were discharged from agriculture which corresponds to 73 per cent and 37 per cent of total anthropogenic nitrogen and phosphorus load, respectively, in the Latvian territory of Lielupe Basin. In the some parts of river basin, pollution of shallow groundwater due to intensive agricultural activities has been detected. Nutrients released from forestry are local and moderate in influence, accounting for some 12 per cent of the total nitrogen and total phosphorus loads, respectively, in the Latvian part (2006 estimates).

[58] Based on information from Latvia. This groundwater body is designated for the needs of river basin management plans in the Latvian territory only. The areas of the groundwater bodies are not coordinated between Latvia and Lithuania,

256. There are around 172 urban wastewater discharge points in the Latvian part of the river basin, influencing significantly the quality of four water bodies (out of 45). Some 28 per cent of anthropogenic phosphorus load and 8 per cent of anthropogenic nitrogen load is estimated to come from collected and treated urban wastewater. In the suburbs or farmsteads without wastewater collecting systems, individual or other appropriate systems should be used but this is subject to private owners' responsibility. Many companies use the urban network for their discharges, but there are around 40 industrial wastewater discharge points in the basin. Some leaks of untreated wastewater may occur from deteriorating sewage collecting systems.

257. Naturally high iron, sulphate and other element concentrations make pre-treatment of groundwater widely needed.

258. There are 18 small hydropower stations and 29 water bodies with regulated small rivers in the basin, which cause hydromorphological changes of local extent. Other pressures factors of local impact in the Latvian part of the basin are landfills (two for municipal and one for hazardous waste) and contaminated sites. Construction of these landfills according to national and EU requirements is expected reduce possible pollution. There are some 56 closed industrial and municipal dumps sites, the remediation of which is either completed or foreseen. There are some 32 contaminated and 462 potentially contaminated sites in the Latvian part of the basin which are being assessed for eventual remediation, planned within the available means.

259. Also local, but potentially severe in influence, are road transport of hazardous substances due to the associated accident risk and oil conveyance through a pipeline due to leaks from illegal connections or from other damage.

Status and transboundary impacts

260. Almost a half of the water bodies within the Lielupe Basin in Latvia falls into the ecological quality class "bad" or has "bad" ecological potential (Table 43).

261. According to Latvian calculations, transboundary pollution from outside Latvia formed 60% of nitrogen (out of a total of 20,965 tonnes/year) and 52% of phosphorus (out of a total of 296 tonnes/year) load from the Lielupe Basin to the Gulf of Riga in the period 2004 – 2008.

Table 43

Ecological quality class/potential of water bodies in the Lielupe Basin

Water bodies/ number	***Ecological quality class/potential***									
	High		***Good***		***Moderate***		***Poor***		***Bad***	
	number	*%*	*number*	*%*	*number*	*%*	*number*	*%*	*number*	*%*
River	-	-	3	6.7	9	20.0	1	2.2	13	28.9
Lake	-	-	3	6.7	4	8.9	2	4.4	3	6.7
Heavily modified	-	-	-	-	2	4.4	-	-	5	11.1
Total	**-**	**-**	***6***	***13.4%***	***15***	***33.3%***	***3***	***6.6%***	***21***	***46.7%***

Source: Lielupe river basin management plan, 2009, Latvia

Table 44

Ecological quality class/potential of water bodies in the Lithuanian part of the Lielupe RBD.

Water bodies	***Ecological quality class/potential***				
	High, %	***Good, %***	***Moderate, %***	***Poor, %***	***Bad, %***
River	-	6	48	13,7	1,3
Heavily modified (rivers)	-	2	17,6	10,8	0,6
Lake	-	40	60	-	-
Heavily modified (lakes/ponds)	43	-	29	14	14

Source: Lielupe river basin management plan, 2010, Lithuania

Response measures

262. As almost the whole Lielupe River Basin is designated as nitrate vulnerable zone in Latvia, farmers are required to apply good agricultural practices, which are described in national legislation and in the Code of Good Agricultural Practices.

263. As a result of significant investments into renovation and building of wastewater treatment plants and of water supply related infrastructure in Latvia, pollution loads (especially nutrient and organic pollution) to surface waters have decreased by 10 to 40 per cent during period from 2004 to 2008 (at the national level) and water losses through leaks in networks have also decreased.

264. As described in the assessment of the Gauja/Koiva Basin, a number of water related objectives have been defined in Latvia’s National Development Plan (2007-2013). Analogously to other transboundary basins assessed that are shared by Latvia, an Advisory Council functions as a coordinating institution between the ministries concerned and the various interest groups.

265. Regular transboundary cooperation on the river basin management plans — regarded as beneficial and satisfactory by all parties — is carried out between the competent authorities of Latvia and Lithuania on the basis of a technical protocol on joint management of Daugava, Lielupe and Venta river basin districts (2003; see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6).

Future trends

266. The envisaged further improvement of wastewater treatment, the implementation of the planned non-structural measures in agriculture and water management as well as better policy integration among various economic sectors is expected to reduce transboundary impact and improve water quality. However, it is difficult to ensure the achievement of good status of rivers in the Lielupe Basin as the majority of rivers are small and have small flow volumes (especially during dry period of the year) that do no dilute pollutants significantly and therefore high concentrations of pollutants tend to persist in water.

267. Climate change related predictions are very general at the moment and no specific adaptation measures are planned at the moment in Latvia, but research has been carried out on how climate change will potentially influence water resources (for more information on this KALME project and the current predictions, please refer to the assessment of the Daugava Basin).

XXVIII. Venta, Barta, Sventoji River Basins[59]

268. The Venta, Barta and Sventoji Rivers — typical lowland rivers — all originate in Lithuania and have the Baltic Sea as the final recipient. These basins, which make up the Venta River Basin District, are shared by Latvia and Lithuania. The Barta[60] River discharges into Lake Liepāja (Latvia), which is connected to the Baltic Sea.

[59] Based on information provided by Latvia and Lithuania and on the first Assessment of Transboundary Rivers, Lakes and Groundwaters, for which information was provided by the Environmental Protection Agency of Lithuania.

[60] The river is also known as the Bartuva.

Table 45
Area and population in the Venta, Barta, Sventoji Basins

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Latvia	8 012	56.1	358 000	16[a]
Lithuania	6 280	43.9	220 000[b]	35
Total	**14 292**[c]			

Source: Venta River Basin Management plan 2009. Year: 2006
[a] Population in the Venta river basin district
[b] The population data for Lithuania is from 2009.
[c] From a hydrological point of view, the Venta River basin covers an area of 11,800 km^2, with 7,900 km^2 in Latvia and 5,140 km^2 in Lithuania. The Barta River basin with 2,020 km^2 is also shared by Latvia (1,272 km^2) and Lithuania (748 km^2). The Sventoji River is shared between these two countries as well; its area in Latvia is 82 km^2 and 472 km^2 in Lithuania.

Hydrology and hydrogeology

269. Surface water resources generated in Latvian part of Venta, Barta, Sventoji Basins are estimated at 3,303 × 10^6 m^3/year , groundwater resources are 88 × 10^6 m^3/year, making up a total of 3,391 × 10^6 m^3/year .

270. Transboundary aquifers A, D4 and F3 are described in the assessment of the Lielupe.

Table 46
Aquifer F1/Permian-Upper Devonian.

	Latvia	*Lithuania*
Area (km^2)		6276
Renewable groundwater resource (m^3/d)		716860[a]
Thickness in m (mean, max)	30,315	30 (Permian aquifer), 80 (U. Devonian aquifer)
Groundwater uses and functions		Public and individual drinking water supply ~21000 m^3/d
Other information	A small part is reported to be at poor chemical status due to sea water intrusion, but with reduced groundwater abstraction the groundwater levels have recovered step by step.	Good chemical and quantitative status. National code: LT003002300

[a] As infiltration recharge

Table 47
Aquifer F2/Permian-Upper Devonian.

	Latvia	*Lithuania*
Area (km^2)		6276
Renewable groundwater resource (m^3/d)		716860[a]
Thickness in m (mean, max)	40,360	30 (Permian aquifer), 80 (U. Devonian aquifer)

Groundwater uses and functions	Public and individual drinking water supply ~21000 m^3/d
Other information	Good chemical and quantitative status. National code: LT003002300

Table 48
Total withdrawal and withdrawals by sectors (per cent)

Country	*Total withdrawal ×10⁶ m³/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Latvia[a]	29.79	2.61	33.96	41.67	5.24	16.52
Lithuania	113[b]	23.4	35.1	16.5	24.8	0.2

[a] The figures are for year 2006. Some 67 per cent of the total use is met from groundwater. Groundwater is mainly used for supply of drinking water, but is commonly used in industry as well.
[b] .The data are for 2009.

Pressures

271. Around 35% of anthropogenic phosphorus load and 7% of anthropogenic nitrogen load in the Latvian part of the Venta River Basin District (RBD) are estimated to come from collected and treated urban wastewater. Urban wastewater significantly influences quality of twelve waterbodies in the Venta River Basin District, even though sewage in the cities and settlements is usually collected and treated before discharge. As pressure factor it is assessed as widespread but moderate. According to the national statistics, there were around 329 urban wastewater discharge points in the RBD.

272. Naturally high iron, sulphate and other element concentrations in groundwater, requiring it to be pre-treated before use as drinking water is assessed as widespread but moderate in impact. Groundwater abstraction is ranked as equal in importance.

273. Agricultural lands cover around 40% of Venta River Basin and the pressure from related activities is ranked as widespread by moderate by Latvia. According to the estimates (2006), around 2,760 t nitrogen and 64 t phosphorus (64% and 30% of the total anthropogenic load, respectively) have been discharged from agriculture in the Venta River Basin in Latvia. In the several parts of river basin pollution of shallow groundwater due to intensive agricultural activities may occur. A small part of the Venta Basin is designated as nitrate vulnerable zone where more stringent environmental requirements for agriculture should be applied.

274. According to estimates there have been Some 842 t of nitrogen and 31 t of phosphorus have been estimated discharged from forestry in 2006, which is 20% and 14% from total anthropogenic load in the Latvian territory of the Venta River Basin. This is a moderate pressure factor. The forest drainage systems that have been constructed cause also negative hydromorphological impact.

275. There are around 136 (out of 465 discharge points) industrial wastewater discharge points in the Latvian part of the river basin. However, many companies discharge their wastewater into urban wastewater collecting system and are required a pre-treatment.

276. There are 43 contaminated and 539 potentially contaminated sites in the Latvian part of the basin, and their influence is assessed as local but severe.

277. The impact of other pressure factors such as waste management, transportation, navigation and tourism is considered local and mainly moderate.

Status and transboundary impacts

278. According to calculations made by the University of Latvia (Faculty of Geography and Earth Sciences, 2010) , the mean riverine load of the Venta was 5,808 tonnes/year of nitrogen in total and 165 tonnes/year of phosphorus in total in the period 2004–2008. It is estimated that 74% of total nitrogen and 58% of total phosphorus originated from outside the Latvian territory.

Table 49
Ecological quality class and potential of water bodies in the Latvian part of the Venta River Basin

Waterbodies/ number	*Ecological quality class/potential*									
	High		***Good***		***Moderate***		***Poor***		***Bad***	
	number	*%*	*number*	*%*	*number*	*%*	*number*	*%*	*number*	*%*
River	3	5,5	33	60,0	16	29,1	1	1,8	2	3,6
Lake	0	0,0	13	44,8	6	20,7	3	10,3	7	24,1
Heavily modified	0	0,0	5	71,4	1	14,3	1	14,3	0	0,0
Total	**3**	**3,3**	**51**	**56,04**	**23**	**25,3**	**5**	**5,5**	**9**	**9,9**

Source: Venta river basin management plan, 2009, Latvia

Table 50
Ecological quality class/potential of water bodies in the Lithuanian part of the Venta RBD.

Water bodies	*Ecological quality class/potential*				
	***High**, %*	***Good**, %*	***Moderate**, %*	***Poor**, %*	***Bad**, %*
River	15,4	31,3	34,4	0,6	-
Heavily modified (rivers)	7,7	6,8	3,2	0,6	-
Lake	18,2	36,4	36,4	9,1	-
Heavily modified (lakes/ponds)	11,1	33,3	33,3	22,2	-

Source: Venta river basin management plant, 2010, Lithuania

Response measures and transboundary cooperation

279. Since 2004, significant amount of financial resources have been invested in infrastructure projects in both Latvia and Lithuania, including those aimed at renovating and building new wastewater treatment plants up to standards. Further such improvement is expected with the continued implementation of EU's Directive on Urban Wastewater Treatment[61] in both riparian countries.

280. In October 2003, Latvian and Lithuanian Ministers of the Environment have signed a technical protocol on joint management of the Daugava, Lielupe and Venta river basin districts.

[61] Council Directive 91/271/EEC of 21 May 1991

Technical protocol and agreement provided for establishment of the groups of experts from the competent authorities in both countries, which met regularly to exchange information and to coordinate issues important for the development of the river basin management plans. Meetings took place several times every year since 2004. So far this cooperation is regarded as beneficial and satisfactory by all parties.

281. Objectives set in Latvia's National Development Plan which give direction also to measures in water management are referred to in the assessment of the Gauja Basin.

Future trends

282. The envisaged further improvement of wastewater treatment, the implementation of the planned non-structural measures in agriculture and water management as well as better policy integration among various economic sectors is expected to reduce transboundary impact and improve water quality.

283. The Venta, Barta and Sventoji basins are included in project KALME (2006-2009), aimed at investigating how climate change will potentially influence lakes, rivers and coastal waters in Latvia. More information about the project and the current predictions about the potential impact of climate change on water resources is described in the assessment of the Daugava.

XXIX. Neman River Basin[62]

284. The basin of the Neman River[63], is shared by Belarus, Latvia, Lithuania, Poland and the Russian Federation (Kaliningrad Oblast). The Neman River has its source in Belarus (settlement Verkhnij Nemanec) and discharges to the Baltic Sea. Major transboundary tributaries to the Neman include the Merkys (shared by Belarus and Lithuania; 203 km long), Neris/Vilija (Belarus, Latvia and Lithuania; 510 km) and Sesupe rivers (Lithuania, Poland, Russian Federation; 298 km).

285 Lake Galadus[64], a transboundary lake shared by Lithuania and Poland, is part of the Neman River Basin District. In the River Basin District in Lithuania, there are 48 reservoirs (> 1.5 km length and >0.5 km^2 area) and 224 lakes (> 0.5 km^2 area). The basin has a pronounced lowland character.

Table 51
Area and population in the Neman Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Lithuania	46 626	47.7	2 662 200	57
Belarus	45 600	(46.4)		
Russian Federation	~4 200[a]	(3.2)	96 600	23
Poland	2 544	2.6		
Latvia	98	0.1		
Total	**98 200**			

[62] Based on information provided by Belarus, Lithuania and the Russian Federation, and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

[63] The river is also known as the Nemunas. Following the provisions of the Water Framework Directive, the basins of the Neman and Pregel form one River Basin District, the Neman River Basin District, in Lithuania.

[64] The lake is also known as Lake Galadusys.

Hydrology and hydrogeology

286. The river flow is not being regulated in the river section in the territory of the Russian Federation.

287. Aquifers in the basin — also transboundary ones — occur in Quaternary sediments as well in as Jurassic (Oxfordian) and Cretaceous (Cenomanian) carbonate-terrigenous formations.

288. Surface water resources in the Belarusian part of the basin are estimated at 8.9 km^3/year and groundwater resources at 4.94 km^3/year, adding up to a total of 13.84 km^3/year.

289. In the Russian part (Kaliningrad oblast), surface water resources are estimated at 19.7 km^3/year, of which some 0.6 km^3/year is estimated to form in the territory of the Russian Federation[65].

Table 52

Aquifers in Quaternary deposits shared by Belarus and Lithuania: Type 2, Sands, gravels, sandy loams of Quaternary age. Groundwater flow direction from Belarus to Lithuania. Strong links with surface waters.

	Belarus	*Lithuania*
Border length (km)		~500
Area (km^2)		~2500
Thickness – mean, max (in m)	50-100, 120	10-20, 30 (same for both aquifers)
Groundwater uses and functions		Primary aquifers for public and individual drinking water supply
Other information	Stratigraphic horizons: Q (aIII-IV; f,lgIId-sz; aIIIpz; f,lgIbr-IId; f,lgIbr)	Two main intramorainic aquifers are defined – Medininkai-Zemaitija (aglIIžm-md) and Zemaitija – Dainava (agIIIdn-žm); corresponds to groundwater body LT005001100

Table 53

Oxfordian-Cenomanian carbonate-terrigenous aquifer: Type 2, Sands and sandstones of Jurassic (Oxfordian) and Cretaceous (Cenomanian) age. Groundwater flow direction from Belarus to Lithuania. Weak links with surface waters.

	Belarus	*Lithuania*
Border length (km)		~420
Area (km^2)		~6 000
Thickness – mean, max (in m)	50-100, 120	10-20, 80
Groundwater uses and functions		Secondary aquifer for public and individual drinking water supply
Other information	Stratigraphic units: J_3o+K_2s	K_1, K_2cm

[65] Source: The main hydrological characteristics, Volume 4, Issue 3, Gidrometeoizdat, 1974.

Table 54
Mazursko-Podlashi region aquifer.

	Poland	*Lithuania n*	*Belarus*	*Russian Federatio*
Border length (km)	320	90		
Area (km^2)	2 500 (shallow groundwater), 7 000 (deep groundwater, 1 650 (alluvial groundwater)			
Thickness – mean, max (in m)		10-20 10-20		
Groundwater uses and functions	Drinking water, agriculture	Primary aquifers for public and individual drinking water supply		
Other information	Agriculture is a potential pollution source	Two main intramorainic aquifers are defined – Grūda-Žemaitija (aglIIgr-md) and Medininkai-Zemaitija (aglIIžm-md) and		

Table 55
Upper Cretaceous aquifer: Upper Cretaceous in age.

	Lithuania	*Russian Federation*
Border length (km)	200	
Area (km^2)	~5000	
Thickness – mean, max (in m)	60-100	
Groundwater uses and functions	Primary aquifer for public and individual drinking water supply	
Other information	Pressure factors include industry, households, landfills and urban areas; corresponds to groundwater body LT 004001100	

Pressures

Table 56
Total withdrawal and withdrawals by sectors

Country	*Total withdrawal ×10^6 m^3/year*	*Agricultural %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Lithuania	2629.7	55.3	22.6	16.2	0.1	5.8
Belarus	412.6	15.6	68.0	15.1	0.2	1.1
Russian Federation	12.07[a]	1.3	44.8	53.9	-	-
Poland						

[a] The figures are for 2009. Some 5.92 × 10^6 m^3/year of surface water from the Neman is being used for industrial purposes. Total abstraction of groundwater in the Russian part of the basin is 6.15

× 10^6 m^3/year**,** with 87.6 per cent used for household water, 9.8 per cent for industry and 2.6 per cent for agriculture.

290. Agriculture significantly influences the status of water bodies in the Neman basin, especially in the sub-basins of the Sesupe and Nevezis rivers. Its importance as pressure factor according to Belarus is local but severe. Chemicals get transported to the river from agricultural facilities and pond fisheries are a major source of pollutants.

291. A substantial part of point source pollution comes from industry. Industry in Lithuania is mainly located in Alytus, Kaunas and Vilnius; in Belarus mainly around Grodno (assessed as local and moderate by Belarus). The dominating industrial sectors are food and beverages production, wood and wood products, textiles, chemicals and chemical products, metal products, equipment and furniture production.

292. The greatest human-induced pressures from urban wastewater discharges in the Belarusian part occur on the Neris River downstream from Smorgon, on the Neman River downstream from Grodno, Mostov and Stolbtsy (assessed as local but severe). The main pollutants are suspended solids, phosphates, BOD5, ammonium- nitrogen, petroleum products and total iron. In the Russian part of the basin, urban wastewater discharges from Sovetsk to the Neman and from Krasnoznamensk to its tributary Sesupe. The Russian Federation estimates that the total volume of industrial wastewater discharged to the Neman is about 5.25 × 10^6 m^3/year but licences to discharge have been issued only for a volume of 2.86 × 10^6 m^3/year. The Russian Federation assesses the impact of discharges of both urban and industrial wastewaters as widespread and severe.

293. Iron and manganese concentrations are naturally elevated in groundwater, and fluorine also to lesser degree. The impact of this factor is assessed as widespread but moderate by Belarus.

Status and transboundary impact

294. Results of observations in recent years indicate an improvement in the quality of surface water in the basin of the Neman in the concentration of priority pollutants. In the tributaries of the Neman, shared by Poland and Belarus, the levels of most priority pollutants also decreased. Chemical status of rivers in the basin has remained "stable" over the past five years according to the monitoring by Belarus. According to the Belarusian classification of water resources, 3.2% of water bodies are characterized as "clean", 93.6% as "relatively clean" and 3.2% as "moderately polluted".

295. According to the Centre for Hydrometeology and Monitoring of Kaliningrad, Russian Federation water quality of the Neman upstream from the city of Neman got worse, as indicated by the shift from category “moderately polluted” (2) to “polluted” (3A), but in the past years the quality seems to have fluctuated. A reverse change in water quality was observed above and below the town of Sovetsk moved to category “polluted” (3A; in 2009) from “very polluted” (3B) and “dirty” (4A) in 2008, respectively, in the Russian water quality classification. Also water quality of the Sesupe (at monitoring station Dolgoe) has changed for better from “very polluted” (3B) in 2007 to “polluted” in 2008 and 2009.

Table 57

Concentrations of specific pollutants in the Neman 1.5 km downstream from the town of Sovetsk, Russian Federation measured during the period 1993–2009

Determinand (unit)	*Number of measurements*	*Average value*	*Minimum value*	*Maximum value*
COD (mg/l)	192	47	14.04	81.1
BOD_5 (mg/l)	192	4.77	2.6	9.6
$N\text{-}NH_4$ (mg/l)	192	0.66	0.034	3.34
$N\text{-}NO_2$ (mg/l)	191	0.032	0.004	0.147

Phosphates (mg/l)	79	0.112	0.045	0.292
Mercury (μg/l)	28	0.015	0	0.087

Figure 4
Trend in the concentrations of chemical oxygen demand (COD, blue) and biochemical oxygen demand (BOD_5, red) in the Neman 1.5 km downstream from the town of Sovetsk, Russian Federation measured during the period 1993–2009

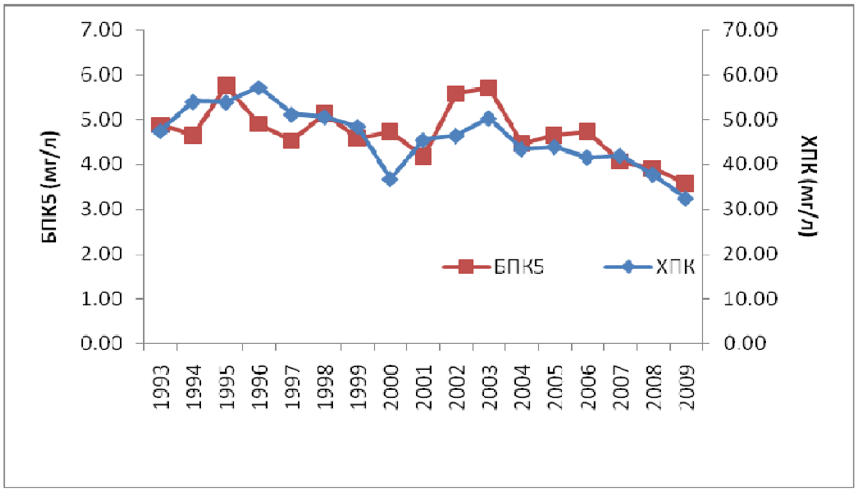
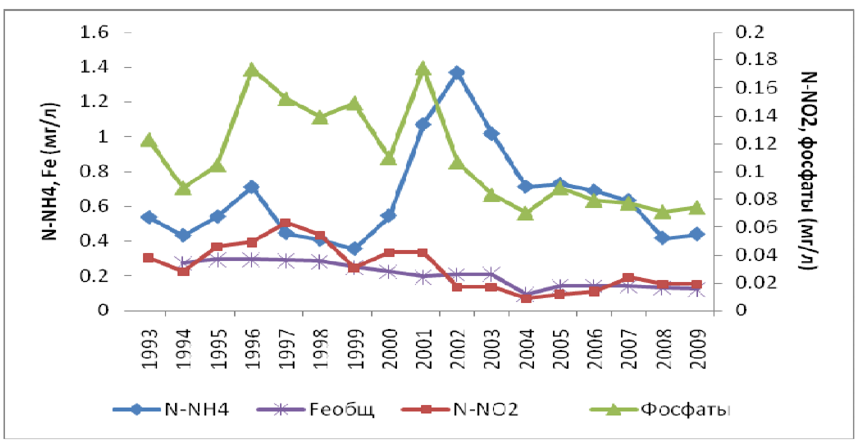


Figure 5
Trend in the concentrations of ammonium-nitrogen ($N\text{-}NH_4$, blue), total iron (Fe, violet), nitrate-nitrogen ($N\text{-}NO_2$, red) and phosphates (green) in the Neman 1.5 km downstream from the town of Sovetsk, Russian Federation measured during the period 1993–2009



Response and transboundary cooperation

296. Protective zones have been established around water bodies in Belarus to limit economic and other activities to reduce impact.

297. To tackle the negative impact of wastewater discharges, wastewater treatment facilities have been built and reconstructed in Belarus. Volume of wastewater discharged to the Neman in Belarus has decreased from 157 × 10^6 m^3 in 2001 to 128 × 10^6 m^3 in 2009. In the 2000s, according to Belarusian data, generally more than 10 per cent of the volume discharged has met the

regulatory requirements without treatment, 85–90 per cent has been treated to meet the requirements, and only 1–2 per cent has not been not treated adequately.

298. There is no joint monitoring of transboundary groundwaters. Belarus considers the current groundwater monitoring network not to be sufficiently informative, but a network of monitoring wells for observing the state of transboundary groundwater is planned to be developed gradually 2011-2015 in the framework of the State Program "National Environmental Monitoring System" of Belarus.

299. According to the Russian Federation, there is room for development in monitoring:

- The current list of monitored pollutants is limited
- there is a lack of biological (hydrobiological, toxicology) observations;
- Lack of monitoring pollutants in bottom sediments; and
- Lack of common/uniform monitoring program for the transboundary watercourse with the neighbouring countries that would not be in conflict with the laws of participating countries.

300. Under the Agreement on Cooperation in the field of monitoring and the exchange of data on the state of transboundary water bodies between hydrometeorology and environmental monitoring services at Kaliningrad and Russian federal level on one side and Lithuanian environmental authorities on the other (2003), data on hydrological and hydrochemical regime is being exchanged monthly. The information about monitoring programme (plans of monitoring, parameters, frequency, time table of water samples, maps of monitoring stations etc.) is being exchanged annually (see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6).

301. Division of Water Resources in the Kaliningrad oblast is also participating in the bilateral exchange with information on groundwater abstraction volumes, wastewater discharges and loading of pollutants in the basin of the Neman River and the lagoon according to federal statistics..A representative of the Centre for Hydrometeorology and Monitoring of Kaliningrad as an expert of the Commission on the Environment of the Russian-Lithuanian Council for long-term cooperation between regional and local authorities in the Kaliningrad oblast and in Lithuania participates annually in meetings held in the framework of the Council.

302. Groundwater monitoring of transboundary aquifers was initiated in 2010 based on bilateral agreement between Lithuanian geological Survey and Kaliningrad Agency of Mineral Resources. Groundwater monitoring in the transboundary area between Lithuania and Poland is carried out jointly since 1994 by the Lithuanian Geological Survey and the Polish Geological Institute.

XXX. Lake Galadus/Galandusys

303. Lake Galadus (total surface area 7.37 km^2 out of which 5.6 km^2 is in Poland and 1.7 km^2 in Lithuania) lies in the Podlasie region in Poland and in the western part of the Lithuanian Lake District.

304. Some 60% of the lake basin is agricultural land, and agriculture is causing euthrophication of the lake (current status can be considered "mesotrophic"; in water-quality class 2 of the Polish classification). About 1,800 people live in over a dozen villages in the area making the population density about 20 people/km^2. The lake is used for recreational fishing, and there are also recreation residential plots around the lake.

XXXI. Pregel Basin[66]

305. The basin of the river Pregel[67] is shared by Poland, Lithuania and the Russian Federation. The river has its source in Poland and discharges to the Baltic Sea. The Pregel River has two transboundary tributaries, which have their sources in Poland: the 263.7 km long Lava River[68] and the 139.9 km long Wegorapa (or Angerapp) River. River Pissa is a transboundary tributary (98-km long).

306. The basin has a pronounced lowland character.

Table 58
Area and population in the Pregel Basin

Country	*Area in the country (km²)*	*Country's share %*	*Population*	*Population density (persons/km²)*
Lithuania	65	0.4		
Poland	7 520	53.6		
Russian Federation	7 100	46	781 000	110
Total	**14 685**			

Sources (surface areas): Environmental Protection Agency, Lithuania; National Water Management Authority, Poland; Hydrological study, Baltic Region (Volume 4), Gidrometeoizdat, 1963

Hydrology and hydrogeology[69]

307. The plain area downstream gets flooded annually in spring. During storm surges from the sea, flow in the mouth of Pregel decreases or ceases. On such occasions, flow takes direction towards the Vistula Lagoon.

308. Water resources in the Russian part of the basin are estimated at 2.9 km^3/year (average for years from 1901 to 1980), out of which 1.52 km^3/year is runoff from neighbouring countries.[70]

309. At 54 km from the mouth of the river, the flow of the Lava is regulated at the Pravdinskaya hydropower station.

Pressures

Table 59
Total withdrawal and withdrawals by sectors

Country	*Total withdrawal × 10^6 m^3/year*	*Agriculture %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Lithuania						
Poland						

[66] Based on information provided by the Russian Federation and the first Assessment.
[67] The river is also known as Preglius and Pregolya. Following the provisions of the Water Framework Directive, the basin of the Pregel is a part of the Neman River Basin District in Lithuania.
[68] The tributary is known as the Lyna River in Poland.
[69] Source for the hydrological data from the Russian gauging stations: State Water Cadastre. Long-term data on the mode and surface water resources. Basins of the Kaliningrad region (Volume 1, Issue 4), Gidrometeoizdat, 1988
[70] State Water Cadastre, Basins of the Kaliningrad region (Volume 1, Issue 4), Gidrometeoizdat, 1988.

Russian Federation	85.19[a]	1	68	9	5	17

[a] The withdrawal figure and percentages for 2009. Surface water withdrawal is reported to be 52.9×10^6 m^3/year (35.1×10^6 m^3/year for drinking and household water, 11×10^6 m^3/year for industry and 6.8×10^6 m^3/year for other uses) and groundwater abstraction 31.6×10^6 m^3/year (18.6×10^6 m^3/year for drinking and household water, 0.8 for $\times 10^6$ m^3/year for agriculture and 11.2×10^6 m^3/year for industry,

310. In the sub-basin of the Lava River, sewage discharge mainly originates from the municipal wastewater treatment plant at Olsztyn with an amount of 36,000 m^3/d. Other, smaller municipal discharges originate at Pravdinsk (in the Russian part), Bartoszyce (3,400 m^3/d), Lidzbark Warminski (3,400 m^3/d), Dobre Miasto (1,200 m^3/d), Stawigud (250 m^3/d), Sepopol (200 m^3/d), Tolek (90 m^3/d) and in the Russian part at Znamensk. Discharge of municipal sewage to the Pregel in the Russian part of the basin mainly originates from the cities Gvardeysk, Tshernjahovsk and Kaliningrad. There are discharges to the tributaries from Ozersk (to the Wegorapa) and Gusev (the Pissa). Industrial wastewaters are discharged from the dairy production plant at Lidzbark Warminski (1,100 m^3/d). Discharge of industrial wastewater in the Kaliningrad oblast (Russian Federation) amount to 7.9 million cubic meters in a year.

311. Shipping is a pressure factor mainly in the mouth of the river. Sea-water periodically introduces secondary pollution to the river.

Status and transboundary impact

312. The status of the earlier polluted Lava is improving but that of the Wegorapa (Angerapp) is still poor. According to the Russian water quality classification system[71], water of the Lava upstream from the Znamensk was classified every year from 2007 to 2009 as “very polluted”. Water of the Wegorapa at Berenstovo (classification value ranged from 3.33 to 3.46) and the Pissa at Zilionyi Bor (decreased from 3.86 to 3.31 during this period) was ranked in the same class also. Water quality of the Pregel at Tsernyahovsk (3.72–3.86) was “very polluted” during the period, but at Kaliningrad (1 km from the river’s mouth) it was clearly worse, falling in the Russian quality class “extremely polluted”, with the value ranging from 5.36 to 7.25. There is a great anthropogenic load on the Pregel, especially in the part close to the mouth of the river.

Table 60
Water quality in the Lava

Determinands	*Average concentration in Stopki, Poland in the period 18 January to 13 December 2006 (observed minimum and maximum in parentheses)*[a]	*Results of single sampling (19 November 2007) by the reservoir of the Pravdinskaya hydropower station no. 3 in the Russian Federation (56 km of the river Lava, 9 km from the border of Poland)*[b]
Total suspended solids in mg/l	10.79 (5.7–29.00)	
$N\text{-}NH_4$ in mg/l	0.22 (0.14–0.32)	0.3
$N\text{-}NO_2$ in mg/l		0.034
Total nitrogen in mg/l	2.72 (5.00–1.42)	2.5
Total phosphorus in mg/l	0.20 (0.14–0.32)	0.2
COD_{Cr} in mg O_2/l	28.48 (23.60–33.80)	31
COD_{Mn} in mg O_2/l	9.31 (3.45–13.20)	
BOD_5 in mg O_2/l	1.61 (0.90–2.50)	1.79

[71] Data provided by the Russian Federal State Agency “Kaliningrad Centre for Hydrometeorology and Environmental Monitoring”

Copper in mg/l	0.02
Phenols in mg/l	0.21
Oil products in mg/l	0.01
Suspended solids	

[a] From the first Assessment of Transboundary Rivers, Lakes and Groundwaters
[b] Russian Federal State Agency "Baltvodhoz"

Response

313. There are no monitoring points at the boundary on the Russian side and no information exchange between the countries currently takes place. The Russian Federation is planning to address by organization of observation posts on transboundary water bodies.

314. Insufficient financing for investments/structural measures is reported to be a constraint in the Russian part of the basin.

XXXII. Prohladnaja Basin[72]

315. The basin of the 77-km long river Prohladnaja[73] is shared by Poland and the Russian Federation. The river has its source in Kaliningrad oblast in the Russian Federation and discharges to Baltic Sea. The Prohjadnaja has two major transboundary tributaries originating in Poland: the 42 km-long Kornevka and 33-km long Rezvaja as well as other small streams.

316. The basin is in a plain, bordered by floodplain wetlands in the downstream part.

Table 61
Area and population in the Prohladnaja Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Russian Federation	1 006	86.0		36[a]
Poland	164	14.0		
Total	**1 170**			

[a] An estimate. Average population density in the Kaliningrad oblast in 2002 was 63.

Pressures

317. In the Russian part, municipal wastewaters from the town of Bagrationovsk and from several villages (Dolgorukov, Jushniy, Vladimirov and Ushakovo) as well as some 7,000 m^3 of industrial wastewaters are discharged to the river. In the part of the basin that is Polish territory, 50% of households not served by wastewater treatment. Surges from the sea affect water quality in the mouth of the river.

[72] Based on information provided by the Russian Federation
[73] The river is known as Świeza in Poland.

Table 62
Total withdrawal and withdrawals by sectors

Country	*Year*	*Total withdrawal × 10 ⁶ m³/year*	*Agriculture %*	*Domestic %*	*Industry %*	*Energy %*	*Other %*
Russian Federation[a]	2009	1.229	0.3	73.9	12.6	-	13.5
Poland							

[a] The figure is groundwater abstraction only. According to the Russian Federation there is no surface water withdrawal for use.

Response

318. In the Russian part there are no monitoring stations and no information exchange on the river takes place. Only water users are monitored locally.

XXXIII. Vistula Basin and the Bug sub-basin

319. Belarus, Poland, Slovakia and Ukraine share the basin of the Vistula which discharges to the Gulf of Gdansk in the Baltic Sea.

320. The Bug River is the most important transboundary tributary to the Vistula. The Poprad and Dunajec rivers, with their sub-basins shared by Poland and Slovakia, as well as Syan are smaller transboundary tributaries to the Vistula.

Table 63
Area and population in the Vistula Basin

Country	*Country's share km²*	*Country's share %*	*Number of inhabitants*	*Population density (persons/km²)*
Belarus				
Poland				
Slovakia	1 950		204 034	104
Ukraine				
Total	194 424[a]			

[a] *Source*: Water Research Institute Bratislava
[b] Including the delta, the area of the basin is 199 813

Hydrology and hydrogeology

321. Surface water resources in the Slovakian part of the Vistula Basin are estimated at 0.8151 km^3/year (average for years from 1961 to 2000), which equals 3,995 m^3/year/capita (as surface water resources only).

322. Groundwater resources in the Ukrainian part of the basin are estimated at about 0.855 km^3/year, including the Bug sub-basin. More than per cent or the resources are in Cretaceous formations, about 10 per cent in the Devonian and minor amounts in the Neogene and Quaternary formations.

Pressures

Table 64
Total withdrawal and withdrawals by sectors in the Vistula Basin

Country	*Total withdrawal* *×10⁶ m³/year*	*Agricultural* *%*	*Domestic* *%*	*Industry* *%*	*Energy* *%*	*Other* *%*
Belarus						
Poland						
Slovakia	9.84[a]	1.8	64.5	26.2	0	7.6
Ukraine	81.8[b]	16.3	68.0	11.5		3.8

[a] The figures are for year 2007. No significant changes are expected before 2015.
[b] In 2009. The figure includes groundwater abstraction only. “Other” is groundwater abstracted without actual use. (Geoinform, Ukraine)

323. In the Polish part of the Vistula basin, the following pressures are of concern: uncontrolled discharges of wastewater from households not served by sewerage systems, nitrates from arable land, hydromorphological changes, landfills, discharge of saline waters from mining, uncontrolled uptake of sand and gravel and over-abstraction of water (mainly groundwater).

324. Karst phenomena and flooding are natural “problems” judged as minor. Natural river beds have to be restored related to reclamation of mining and chemical workings. Sulfide-bearing wasterock remaining in closed mines is a pressure factor of local but potentially severe influence in the Ukrainian part. Among the more widespread (but moderate) pressures in the Ukrainian part are illegal dumping along water courses, risks from pipelines and transport as well as tree-felling. Reduction of crustaceans in the aquatic ecosystems has been observed.

325. A large share of wastewater treatment facilities is not functioning effectively and is in need of repair, causing local but potentially severe impacts from discharges. Ukrainian part of the basin of the Syan River is characterized by a high content of organic substances, ammonia, sulfate, total iron and petroleum compounds. In recent years, in the Shklo River (in the Syan Basin, crossing the border) there is a steady tendency of deteriorating quality with increase in nutrients concentrations (observed at the station Krakovets; illustrated by Figure 6), associated with an increase in discharges of untreated sewage. The town of Yavorov in Ukraine has virtually no working sewage treatment plant. The content of sulfur compounds and salinity are also elevated in the Shklo because of polluted waters of the flooded Javorovski mine.

Figure 6
Concentration of ammonium-nitrogen in the late 2000s in Shklo River (in the Syan Basin; station Krakovets).

326. Pressure factors in the Dunajec and Bug sub-basins are described in the respective sub-basin assessments.

Status and response

327. Out of more than 3,100 surface water bodies in the Vistula Basin (including the Bug) in Poland, 652 are at risk of not achieving the good status until 2015, and 18 out of 90 groundwater bodies are at such a risk.

328. On the status and measures in the Slovakian part, please refer to the assessment of the Dunajec and Poprad sub-basins.

329. Work on predicting impacts of climate variability and change is in Ukraine also at early stages as described for the Siret. Scenarios for regional climate change until 2030 have been developed.

Transboundary cooperation

330. The Plenipotentiaries of Ukraine and Poland facilitate the implementation of the bilateral agreement on cooperation in the field of water management in frontier waters signed in 1996. In addition, the Plenipotentiaries of Belarus and Ukraine act as a joint body under the bilateral agreement concerning joint use and protection of transboundary waters signed in 2001 (see Annex II of document ECE/MP.WAT/WG.1/2011/6−ECE/MP.WAT/WG.2/2011/6). These joint institutions coordinate the work of the ad hoc working groups, including those on planning the use of border waters and flood protection.

331. At the transboundary level, sampling on the Ukrainian and Polish side is carried out in accordance with the countries' own monitoring programs using bilaterally agreed indicators. Information is exchanged quarterly, as well as during meetings of the Ukrainian and Polish plenipotentiaries on transboundary waters. In the framework of the State Target Ecological Programme of Monitoring the Environment, it is being planned in Ukraine to carry out an optimization of the monitoring network for surface waters and to introduce a Center for Monitoring of Transboundary Watercourses.

332. There is no coordinating body covering the whole basin and a coherent legal framework for transboundary cooperation is lacking.

333. A single agreement to be signed between the riparian countries for cooperation in the protection and sustainable development of the Vistula basin is called for, covering both surface

water and groundwater, and providing for the protection, preservation and management of water, biological resources and aquatic ecosystems.

XXXIV. Bug sub-basin

334. Belarus, Poland and Ukraine share the Bug River[74] basin. The 772-km long Bug has its source in the L'viv region (Ukraine). The river forms part of the border between Ukraine and Poland, passes along the Polish-Belarusian border, flows within Poland, and empties into the Narew River, a tributary of the Vistula (actually the man-made water reservoir Zegrzynskie).

335. The Bug has three transboundary tributaries: the Solokiia and Rata (Poland-Ukraine) and the Muhavetsa (Poland-Belarus). The Bug is connected through the Dnieper-Bug canal, rivers Muhavets and Pina with the Pripyat River, and is connected through river Narew with the Neman Basin.

336. The mean elevation of the basin is in the Ukrainian part 252 m a.s.l. and in the Belarusian part about 140-150 m a.s.l.

Table 65
Area and population in the Bug sub-basin

Country	*Country's share km²*	*Country's share %*	*Number of inhabitants*	*Population density (persons/km²)*
Belarus	10 400	25.4	550 000	53
Poland	19 400	47.3		
Ukraine	11 205	27.3	1 510 000	135
Total	**41 005**			

Source: Water Research Institute, Bratislava; National Water Management Authority, Poland; Ukraine.

Hydrology and hydrogeology

337. In an average year, (surface) water resources in the Ukrainian part of the Bug Basin are estimated to amount to 1.31 km³/year. Groundwater resources in the Ukrainian part are estimated at 0.805 km³/year. The total equals approximately *990* m³/capita/year In the Belarusian part, the surface water resources are estimated at 1.4 km³/year and groundwater resources at 0.51 km³/year. Total water resources (1.91 km³/year) equals about 3,470 m³/capita/year.

338. The main hydrogeological formation in the basin is the Polish-Lithuanian artesian basin, the northern and central parts of which contain significant groundwater reserves.

339. Long-term average discharge at Strzyzow, at the border between Ukraine and Poland (536.5 rkm), is 40.9 m³/s and at Frankopol, below the border between Belarus and Poland (163.2 rkm), it is 119 m³/s[75]. Average discharge[76] of the Pulva, measured at the gauging station Vysokoe in Belarus, is 1.17 m³/s.

Table 66
Bug aquifer[77]:

[74] The river is also known as the Western Bug.
[75] The average discharges are based on observations from the periods 1961–1990 (Strzyzow) and 1951–1990 (Frankopol)
[76] As average based on observations from 1959 to 2008.
[77] Based on information from the Inventory of Transboundary Groundwaters by UNECE Task Force on Monitoring and Assessment (1999) where it was described as aquifer no. 12.

	Belarus	*Poland*
Border length (km)	162	
Area (km^2)	8 500 (shallow and deep groundwater), 400 (alluvial groundwater)	
Groundwater uses and functions	Drinking water, irrigation, industry	
Other information	Pressure factors include industry, households, agriculture, landfill	

Table 67

Alluvial Quaternary aquifer shared by Belarus and Poland[78]: Type 3. Sands, sand-gravel deposits and sandy loam of Quaternary age. Groundwater flow direction from Belarus to Poland. Strong links with surface waters.

	Belarus	*Poland*
Area (km^2)	10	
Thickness in m (mean, max)	10−20, 60	
Other information	Stratigraphic horizon(s): Q (aIII-IV; f,lgIId-sz; aIIIpz; f,lgIbr-IId; f,lgIbr)	

Table 68

Paleogene-Neogene aquifer shared by Belarus and Poland[79]: Sands and sandstones of Paleogene-Neogene age. Groundwater flow direction from Belarus to Poland. Medium links with surface waters.

	Belarus	*Poland*
Area (km^2)	45	
Thickness in m (mean, max)	20−50, 80	
Other information	Stratigraphic horizons: P-N (P2kn+bc; P2kv+hr; Pkn-hr; P3-N2; N1br)	

Table 69

Oxfordian-Cenomanian aquifer shared by Belarus and Poland[80]: Sands and sandstones of Jurassic and Cretaceous age. Groundwater flow direction from Belarus to Poland. Weak links with surface waters.

	Belarus	*Poland*
Area (km^2)	45	
Thickness in m (mean, max)	10−30, 60	
Other information	Stratigraphic units of the aquifer: J_3o+K_2s	

[78] Based on information provided by Belarus.
[79] Based on information provided by Belarus.
[80] Based on information provided by Belarus.

Pressures

Table 70
Total withdrawal and withdrawals by sectors in the Bug sub-basin

Country	*Total withdrawal* $\times 10^6$ *m*^{3}*/year*	*Agricultural* %	*Domestic* %	*Industry* %	*Energy* %	*Other* %
Belarus	77.6[a]	24.0	61.8	8.8	1.8	3.6
Poland						
Ukraine	92.87[b]	25.0	57.8	4.4	11.6	1.2

[a] The withdrawal in Belarus is an average value for the years 2000−2009 (The actual water consumption and sewage discharge in the Republic of Belarus (in 2008). Central Research Institute for Integrated Water Resources Management, Minsk, 2009)

[b] The figures for Ukraine are for year 2009 (*Source*: Key Indicators of water use in Ukraine in 2009, State Committee for Water Management). Of the total, 76.98×10^6 m^3/year is groundwater and 15.89×10^6 m^3/year is surface water. Groundwater is mainly (87 per cent) used for drinking water, but some (13 per cent) also for industry. More than 70 per cent of the groundwater abstracted is from formations of Cretaceous period and almost 20 per cent from Devonian formations. Abstractions from Neogene and especially Quaternary formations are minor. Abstractions from Carbonaceous formations are related to mining and are not consumptive.

340. Pollution from agriculture (affecting potentially groundwater) and the food-processing industry is an additional pressure factor, ranked as widespread but moderate in impact. With the closing of large animal husbandry farms, the impact of agricultural sector in the past years has been significantly reduced in Ukraine (to local and moderate level).

341. Otherwise, impact of industrial wastewater discharges is insignificant according to Ukraine, making up about 4 per cent of discharges to water bodies in the country. Some enterprises in Brest, Belarus discharge wastewaters with specific pollutants to public sewers, resulting in insufficiently treated wastewater reaching the Mukhavets River. Main wastewater discharges to surface waters are from urban sources, making up 40 per cent of all point discharges with a total amount exceeding 160×10^6 m^3/year (impact ranked as local but severe by Ukraine) It is to be said that in the early and mid-2000s this specific pollutant had a downward tendency in the border stretch of the Bug.

342. Landfills and their drainage waters are significant polluters of surface and groundwaters. In Ukraine, many operating landfills are not in line with the sanitary conditions, have exceeded their planned capacities and do not have equipment for processing trash. In Poland also, landfills are a pressure factor. Accidental pollution occurs rarely, but one such incident was the railroad accident which happened in 2007 and caused six railway tanks of phosphorus to burn. Ukraine reports that this did not pose transboundary threat and had no impact on surface waters.

343. During the last 50 years, the river network structure of the Bug has been altered, involving land use change, degradation of small rivers and construction of artificial waterways, drainage canals in particular. The main watercourse of the Bug River is only regulated in its upper stretch in Ukraine (Dobrotvirsk and Sokalsk dams), but its tributaries are heavily regulated, in particular in Ukraine (more than 218 dams) and Poland (more than 400 dams). The impact of these hydromorphological changes are assessed by Ukraine as widespread and severe, and Poland also reports them as a pressure. Draining has reduced the extent of wetlands and there is a risk of groundwater table decrease upon abstraction in the Cretaceous Hostislavskiy aquifer in Belarus. Intensive erosion is observed in the border segment of the Bug in Ukraine and this pressure is assessed as widespread but moderate. Of comparable impact is flooding, with the highest water levels in spring.

344. As a minor factor, the Bug Basin is reported to be affected by transboundary atmospheric pollution from industrial regions of western Europe.

Status

345. A high level of nitrate compounds and heavy metals is typical to the Bug Basin. In the area of the towns Lvov and Busk in Ukraine, a high level of pollution by ammonium-nitrogen is observed. In the Ukrainian part, in the light of hydrochemical indicators water quality got somewhat worse in 2009 compared with 2008, which is consistent with a stable trend of deteriorating water quality. as a result of increase in discharges of non-treated and insufficiently treated urban and industrial wastewaters into the Bug. Towards the western border of Ukraine (with Poland) no significant changes in pollution measured by hydrochemical indicators have occurred. With the exception of Ambukov, located below the confluence of Hutshva (where water was in quality category 4, class III i.e. clean water according to the Ukrainian classification), water quality has been in category 3, class III i.e. **"**relatively clean water". In the river section in Ukraine approaching the border with Belarus, the most commonly occurring quality defects in 2008−2009 were in phosphorus, nitrates and metals. Belarus reports that water flowing from upstream has an elevated level of dissolved solids.

346. Organic and nitrogen pollution have decreased over the years but phosphorus concentrations have hardly yet decreased. Many actions have been taken, in particular through measures to improve the treatment of wastewaters.

Response and transboundary cooperation

347. In the Ukrainian part of the Bug, related to flood preparedness, works are being carried out to strengthen dams, dredge the river bottom and repair pumping stations. River banks are also being strengthened, especially in the border section. As the result of implementation of international projects, several storages of unidentified and unusable pesticides were eliminated during 2008-2010.

348. In Belarus, wastewater treatment plants are upgraded and reconstructed. Livestock dung runoff is being limited/treated. Water protection zones for water bodies have been organized.

349. Establishment of a new national park, Western Polissia, has been planned in Ukraine.

350. Absence of joint monitoring of transboundary groundwaters is noted as a gap. As described in the assessment of the Neman, Belarus is developing its groundwater monitoring network during next few years.

351. Ukraine established in 2006 a Basin council for water resources management, but existence of such a body in one country only is reported to be insufficient, and it is important to conclude a trilateral agreement on the Bug and establish a transboundary council or commission for the basin.

XXXV. Wetlands along Bug (Belarus, Poland, Ukraine)[81]

352. Large transboundary wetland complex in the middle course of Bug River stretches across the boundaries of Belarus, Poland and Ukraine. It covers western part of Polesie biogeographic region (which is shared also by the Russian Federation in the east), and partly belongs also the catchments of Wieprz and Pripyat rivers. This well preserved natural wetland area constitutes part of the Bug River ecological corridor which is considered as a "back bone" of the Pan-European Ecological Network. Various wetland ecosystems include first of all rivers (Bug, its tributaries and

[81] *Sources*:
Latest Information Sheets on Ramsar Wetlands (RIS), available at the Ramsar Sites Information Service: http://ramsar.wetlands.org/Database/Searchforsites/tabid/765/language/en-US/Default.aspx:
UNESCO MAB Biosphere Reserves Directory: http://www.unesco.org/mabdb/br/brdir/directory/database.asp
Final Report, BBI/Matra project "Protection and Management of the Bug as an Ecological Corridor in the Pan-European Ecological Network"; Zingsrta H., Simeonova V., Kitnaes K. 2009.

other small rivers) with floodplain forests and meadows, as well as numerous lakes, river backwaters, fens, transitional mires and raised bogs.

Main wetland ecosystem services

353. Bug River and groundwater from adjacent areas have great importance for water supply of urban areas and villages of the region. At the same time, lakes and mires play very important role in groundwater recharge.

354. Natural habitats are used mainly for haymaking, cattle grazing, fishing and outdoor recreation and sport; extensive forestry (in Poland) and hunting (in Ukraine) are practiced as well. In Poland, Poleski National Park offers good opportunities for nature tourism; Educational Center and Natural Museum are built at Załucze Stare. In Belarus and Ukraine there is a number of health resorts.

Cultural values of the wetland area

355. This transboundary area historically was a meeting point for different ethnic communities - Belarusians, Ukrainians, Russians and Poles. A long history of sustainable natural resources use has led to the formation of specific landscape that includes both natural and semi-natural habitats (both of high conservation value). Especially on the Polish side, village wooden houses and windmills, old mansion parks and orthodox churches contribute to the uniqueness of the traditional landscape.

Biodiversity values of the wetland area

356. Ecosystems preserved in natural or near-natural state harbor rich biodiversity, including habitats and species of plants and animals protected in Europe. The tundra-like vegetation on the Polish side is known to be at its westernmost location within the Eurasian continent.

357. Thousands of duck, herons, gulls and other waterbirds find here suitable breeding places, and in addition dozens of thousands waterbirds use this area as a moulting site and stop-over site during migration. This area holds more than 1% of the European and world population of globally threatened species Aquatic Warbler *Acrocephalus paludicola*. In Poland, a Rearing Center is working to save the endangered Pond Turtle *Emys orbicularis*.

Pressure factors and transboundary impacts

358. During the 20th century the Polesie region lost most of its natural wetland areas as a result of drainage; this process was accompanied by irreversible losses of biodiversity. 388. The remaining natural and semi-natural areas are now extremely vulnerable to outside impacts.

359. Besides changes of natural hydrological regime due to drainage of adjacent areas and water abstraction, threatening factors include water pollution by runoff from surrounding agricultural areas and sewage waters from settlements; recreational pressure (that includes direct disturbance and damage to certain habitats); loss of habitats due to fires and overgrowing of abandoned agricultural lands; poaching; pollution by household and industrial solid waste; unsustainable agricultural and forestry practices and road construction on adjacent areas.

Transboundary wetland management

360. In Poland, Ramsar site (9,762 ha) coincides with Poleski National Park and has the same name. In Ukraine, Ramsar site Shatsk Lakes (32,850 ha) also has status of National Park (Shatskyi NP). At present governments of the three countries consider an opportunity to designate a trilateral Ramsar site that may include, in addition to existing Ramsar sites, untouched floodplain of Bug River in Belarus, as well as additional wetland areas in Poland and Ukraine.

361. The National Committees of Poland, Belarus and Ukraine under the UNESCO Man and Biosphere program have signed a memorandum of understanding in 2002 concerning cooperation on the designation of a Trilateral Man and Biosphere Reserve in Polesie area. Within UNESCO - Japanese Funds-In-Trust project “Establishment of a Transboundary Biosphere Reserve and a Regional Ecological Network in Polesie” (2006-2008), two international tools (UNESCO transboundary biosphere reserves and the Pan-European Ecological Network – PEEN) were used to elaborate joint scientific approaches and further enhance the trilateral cooperation. The proposed

Trilateral Biosphere Reserve will encompass the three existing biosphere reserves: West Polesie (Poland), Shatskyi (Ukraine) and Pribuzhskoye Polesie (Belarus).

362. In a wider sense, the cooperation on the management of Bug river basin and Polesie area (including development of ecological networks) between the three countries is on-going within different project initiatives often with international support. The three countries are currently willing to elaborate national policies and new legislation in line with the provisions of the EU Birds and Habitats Directives and the Water Framework Directive.

363. The project "Protection and Management of the Bug as an Ecological Corridor in the Pan-European Ecological Network" (financed by BBI/ Matra) aimed to improve transboundary cooperation between the governments and institutes of Belarus, Ukraine and Poland to secure coordinated approach to management of water resources and biodiversity in line with European requirements. The Final Project Seminar held in 2008 in Lublin, Poland concluded inter alia on the importance of harmonizing establishment of an ecological network along the Bug river with the elaboration of the River Basin Management Plan.

XXXVI. Dunajec and Poprad sub-basins[82]

364. The sub-basins of the Dunajec and its transboundary tributary Poprad are both shared by Slovakia and Poland. The 170-km long Poprad River has its source in the Tatra Mountains in Slovakia and ends up in Poland in the Dunajec River which discharges to the Vistula River.

365. The sub-basin of Poprad has a pronounced mountain character with an average elevation of 826 m a.s.l. There are small glacier lakes in the sub-basin.

Table 71
Area and population in the Dunajec and Poprad sub-basins

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Slovakia	1 594	76.7	204 034	104
Poland	483	23.3		92
Sub-total (Poprad)	**2 077**			
Slovakia	358	7.6		
Poland	4 369	92.4		
Sub-total (Dunajec without the Poprad sub-basin)	**4 727**			

Source: Institute of Meteorology and Water Management (Poland) and Slovak Hydrometeorological Institute

[82] Based on information provided by Slovakia and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

Hydrology and hydrogeology[83]

366. Groundwater resources in the Slovakian part of the Poprad sub-basin are estimated at 33.18 $\times 10^6$ m^3/year (based on observations from 2004 to 2006; groundwater body SK 200440 KF makes up 13.60 $\times 10^6$ m^3/year of the amount).

Pressures

367. In the Poprad sub-basin, water use for domestic purposes is 53 per cent and water use by industry is around 47 per cent. In 2008, groundwater abstraction for drinking water was some 230,200 m^3 (from groundwater body SK 200440KF), and is expected not to change significantly until 2015.

368. Growing crops (potato and cereals) and animal husbandry is limited to small farms. Increase of nutrients in surface waters and groundwater due to incorrect application of organic and inorganic fertilizer and possible pollution from the application of pesticides are reported.

369. Manufacturing is limited to mechanical engineering (refrigerators and washing machines), small chemical and textile companies and several other small manufactures. Some chemical pollution originates from permitted industrial discharges. The extent of possible illegal discharges is not presently known. Nutrient, organic and chemical pollution from wastewaters of agglomerations without collecting and treatment system is a significant pressure factor on groundwater and surface water quality. In recent years, 83.5% of the agglomeration with up to 10,000 p.e. was connected to sewerage system and 67.6 % of the agglomerations with more than 10,000 p.e. was connected to sewerage system with treatment system. Only 21% of agglomeration in 28.2 % is without collecting and treatment system.

370. Pollution of groundwater and also surface waters may result from uncontrolled dump sites.

371. Recreation and tourism is significant as pressure factor, mainly due to wastewater discharges and artificial snowing in ski resorts.

372. Hydromorphological changes on rivers interrupt natural river and habitat connectivity and hydrological regime. Due to the influence of snow melting in mountains, natural water flow is seasonally highly variable.

Status and transboundary impacts

373. The most serious water-quality problems are organic pollution and pollution by bacteria, nitrogen species and by heavy metals.

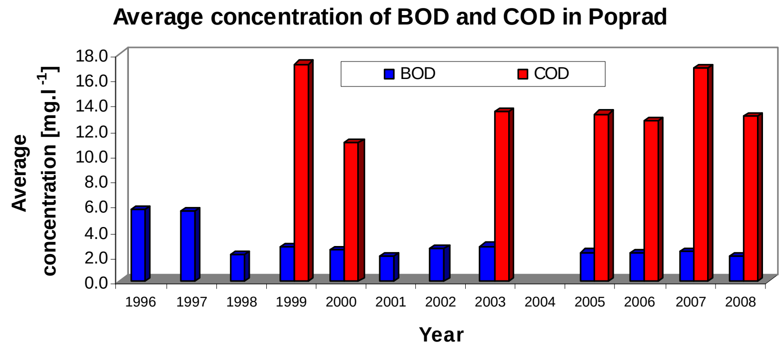
374. As can be seen from figure 7, in terms of biochemical oxygen demand (BOD) and chemical oxygen demand (COD), after a decrease in BOD in the late 1990s, water quality in the Poprad has not changed significantly.

375. The ecological status of water bodies in the Poprad River in Slovakia was evaluated as moderate in general, but at water body Veľká Lomnica (107.6 km from the mouth of the river) the status was poor. Good chemical status is failing to be achieved in the Poprad at Veľká Lomnica and Leluchov (38.4 km from the mouth of the river)[84]. The chemical status of the Dunajec and the Poprad is lowered by an increased concentration of (bis(2-etylhexyl)-phtalate.

[83] At the request of Slovakia, the aquifer "Alluvium of Poprad" is not included in the inventory/assessment on the basis that no transboundary groundwater body (as defined in the EU's Water Framework Directive) has been defined. SK 200440KF is the related groundwater body defined nationally by Slovakia. Poland's view is waited for.

[84] Water bodies SKP0002 and SKP0006

Figure 7
Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) in the Poprad.



376. Hydromorphological changes in Poprad River at the border section are insignicant according to Slovakia, but significant in Dunajec (border section) because of regulated flow below drinking water reservoir built in the Polish territory.

Response measures

377. Cooperation on transboundary waters is realized through Slovak-Poland bilateral Commission and three subsidiary working groups on the basis of the agreement of 1997 (see the list of agreements). The composition of working groups and their scope of work is currently being revised.

378. Recently agreed transboundary actions between Slovakia and Poland in general include common measurements, data harmonisation, data exchange and experience exchange, common projects Joint monitoring of water quantity and quality is being carried out several times per year. Reporting on the data involves submitted to Slovak-Poland Commission. A proposal has been submitted for a European regional development project to set up an information system for the transboundary region which would be used to support the implementation of the EU Flood Directive and WFD.

Future trends

379. Ecological status and chemical status of transboundary section of Dunajec and Poprad rivers is expected to improve due to realization of basic and supplementary measures defined in the River Basin Management Plan, based on the requirements of the WFD in both riparian countries (to be implemented by 2015).

380. However, a good ecological and chemical status in Poprad river is not expected to be reached by 2015, because the main reason being the high cost of realization of measures, especially of hydromorphological and supplementary measures in small agglomerations. Measures will be taken gradually up to 2025.

381. It is expected that climate change in the sub-basins will not significantly impact surface water status, but this has not been predicted in detail. The National climate program of Slovakia is aimed at studying impacts of climatic change on ecological and chemical status of surface water.

XXVII. Oder/Odra River Basin[85]

382. The Oder/Odra River originates in the Oder Mountains (elevation 632 m.a.s.l.) in the south-western part of the Central Sudetes. With the length of 855 km, the Odra is the sixth largest tributary of the Baltic Sea.

Table 72
Area and population in the Oder/Odra Basin

Country	*Area in the country (km^2)*	*Country's share %*	*Population*	*Population density (persons/km^2)*
Czech Republic	7 278	5.9	1 610 000	221
Germany	9 602	7.7	750 000	78
Poland	107 169	86.4	14 080 000	131
Total	**124 049**		**16 440 000**	**133**

383. Of the largest tributaries of the Odra, Lusatian Neisse, Opava and Olza, are transboundary.

384. The Warta River, the largest tributary, (mean discharge of 224 m^3/s; sub-basin area of 54,000 km^2), supplies about 40% of the Odra's longstanding mean flow.

Hydrology and hydrogeology

385. Some 2,574 surface water bodies of all categories (2,147 rivers, 423 lakes, transitional waters, coastal waters) have been established within the entire International Odra River Basin District[86].

386. Within the entire International Odra River Basin District (IORBD), 227 surface water bodies are considered to be artificial and 694 water bodies as heavily modified.[87]

387. The area of IORBD is predominated by groundwater bodies that are found in unconsolidated deposits; those in solid rock can be found only in the south.

388. There have been 103 groundwater bodies established within the area of IORBD.

389. What is more, there are differences in the size of the established areas of groundwater bodies within the IORBD. The average area size of the established groundwater bodies varies: in the Republic of Poland it is approximately 1,793 km^2 , in Czech Republic 812 km^2, whereas in the Federal Republic of Germany it amounts to 413 km^2. It is due to the aggregation procedure of the groundwater bodies. Transboundary groundwater bodies have not been determined.

Pressures

390. The following significant problems in water management within the area of the IORBD have been identified with the analysis of the anthropogenic impact and the ICPO is coordinating the response on the international level.

[85] Based on information/draft provided by the International Commission for the Protection of the Odra River against Pollution

[86] The entire area of the International Odra River Basin District (IORBD) amounts to 124,049 km^2 including 5,009 km^2 of transitional waters and coastal waters of the Szczecin Lagoon along with the sub-basin of that lagoon, eastern part of Usedom and western part of Wolin islands; of which 3,804 km^2 is located in the territory of Germany and 1,205 km^2 is in Poland.

[87] These have been defined according to the annex to the II Directive 2000/60/WE.

- **hydromorphological alteration** of flowing waters due to e.g. river developments or bed straightening as well as water-course maintenance hinder reaching ecological quality objectives for biological quality elements, disturb habitats of fish and cyclostomatas as well as other water organisms in their migration areas:
- transverse structures across flowing waters constructed for energy production, flood protection and flow regulation for example disturb the linear continuity of water-courses. Moreover, they disturb the flow, the natural sedimentary regime and the transport of debris.
- **significant pollution of surface waters** with nutrients and hazardous substances from point and diffuse pollution sources that prevents obtaining a good water quality within the IORBD.
- pressure due to the reduction of the natural flow resulting from **water intake and transfer**

391. In addition, some other significant issues of regional character include:

- ecological improvement of morphological structure of water-courses within small areas,
- integrated treatment of water and land ecosystems that are dependant on them,
- adapting the level of wastewater treatment for environmental purposes,
- effects of operational and out of operation lignite strip mines,
- usage of groundwater,
- pollution of groundwater with nutrients and pesticides,
- point pollution of groundwater from landfills and from mining,
- flood protection.

Status and transboundary impacts

Table 73
Ecological status of surface water bodies within the IORBD (water class), number of surface water bodies

	Ecological status					
Water Status	*High*	*Good*	*Moderate*	*Poor*	*Bad*	*Unknown**
Rivers	-	338	141	202	578	2
Lakes	8	132	30	12	209	-
Transitional waters	-	-	-	-	-	-
Coastal waters	-	-	-	2	-	-

* No monitoring data for these surface water bodies.

392. The environmental objective for heavily modified or artificial waters is a good ecological potential. Within the IORBD, there are 887 such rivers, 32 lakes and 2 transitional waters.

Table 74
Ecological status of surface water bodies within the IORBD (water class), number of surface water bodies

	Ecological potential				
Water status	*High and above good*	*Moderate*	*Poor*	*Bad*	*Unknown*[a]
Rivers	83	120	166	514	4
Lakes	10	1	2	19	-
Transitional waters	-	1	-	1	-
Coastal waters	-	-	-	-	-

[a] No monitoring data for these surface water bodies

Table 75
Chemical status of surface waters within the IORBD (water status), number of surface water bodies

	Chemical status		
Water status	*Good*	*Failing to achieve good*	*Unknown*
Rivers	885	1,261	1
Lakes	187	236	-
Transitional waters	0	1	-
Coastal waters	1	-	-

393. About 42% of water bodies classified as rivers, lakes, transitional waters and coastal water within the IORBD have 'good' chemical status.

394. In the Oder basin, 80 of the 103 groundwater bodies are described as having good quantitative status and the remaining 23 poor status. For chemical status, 68 are described as good and 35 as poor (of these 35, 29 are in main aquifers and the remaining 6 in upper groundwater bodies). Due to multi-layer structure of ground waters, different layers of aquifers are monitored.

Table 76
Total withdrawal and withdrawals by sectors in 2005 and predictions for 2015

				Domestic %				
Country		*Total withdrawal* $\times 10^6$ m^3/*year*[a]	*Agricultural %*[b]	*Drinking water %*	*Households supply %*	*Industry %*	*Energy %*	*Other %*
Czech Republic	2005	261.2	0.2	33.6	20.9	35.2	10.1*	
	2015	271.9	0.2	34.0	21.0	33.2	11.7*	
	2005	234.9	2.0	23.7	10.7	47.9	15.6*	
Germany	2015	240.4	2.0	23.0	9.8	42.1	16.0*	
	2005	5083.2	8.5	13.2	10.2	7.0	61.0*	
Poland	2015	5831.5	9.1	10.2	10.3	N/A	N/A	
Total	**2005**	**5579.2**						
	2015	**6343.8**						

[a] Figures for power industry abstraction.
[b] Agriculture and forestry

The connectedness to water supply in the Oder Basin ranged in 2005 from 91.2% in Poland and 92.7% to 99.9% in Germany.

Table 77

Urban waste water discharge and treatment within the IORBD countries

Country		*Number of urban waste water treatment plants for 1. p.e. >2000*	*Amount of urban waste water [×10^6 m^3/year]*	*Number of connected inhabitants*	*Specific demand [dm^3/person/day]*
Czech Republic	2005	171	55.67	1,210,000	74.9
	2015	176	59.8	1,356,000	84
Germany	2005	44	36.2	631,500	84.2
	2015	42	34.4	582,400	84.4
Poland	2005	949	822.6	8,223,100	58.8
	2015	1,038	871.9	8,716,500	63.9
Total	**2005**	**1164**	**914.5**	**10,015,500**	**60.9**
	2015	**1256**	**966.1**	**10,654,900**	**66.8**

Table 78

Industry, power industry and agriculture - supply, waste water discharge and treatment within the IORBD countries

Country		*Discharge and treatment of industrial waste water [×10^6 m^3/year]*	*Discharge and treatment of power industrial waste water[×10^6 m^3/year]*	*Agriculture [×10^6 m^3/year]*
Czech Republic	2005	83.7	18.3	1.0
	2015	82.03	18.3	1.6
Germany	2005	94.9	17.6	4.8
	2015	85.4	17.6	4.8
Poland	2005	328.04	2,431.44	431.8
	2015	N/A	N/A	532.55[a]
Total	**2005**	**506.64**	**2,467.34**	**437.6**
	2015	N/A	N/A	**539.0**

[a] PL - intakes for agriculture and forestry.

395. Among other forms of water use within the IORBD we can find surface waters usage for the navigation purposes and usage of water for power industry purposes. Significant importance is also given to mining and flood protection.

Response measures

396. Since December 2006, programmes set up for the monitoring of surface waters, groundwater and protected areas to establish comprehensive overview of water status according to article 8 of the Water Framework Directive are in place in the individual member states within IORBD.[88]

397. According to the Urban Waste Water Treatment Directive (Council Directive 91/271/EEC), the entire IORBD has been considered as sensitive, involving that action programs will be implemented in the entire area of the country. Some 1,235 km^2 has been designated as vulnerable by the EU Nitrates Directive (Council Directive 91/676/EEC) in Czech part of the Oder/Odra

[88] Detailed description of the monitoring programmes can be found in the 2007 Report for the EC.

Basin, 9,713 km^2 in the German part and 3,437 km^2 in the Polish part. Areas designated for habitats and species where maintenance or status improvement is a crucial factor for their protection cover approximately 914 km^2, 4,605 km^2 and 24,173 km^2.

398. Thematic classification of the basic (for all surface water bodies) and supplementary measures (for surface water bodies failing to achieve good status) was undertaken and all were collected in a form of a catalogue, where they were grouped according to significant pressures and types of the pressure. The way of classifying into an adequate status varied significantly.

399. Basic and supplementary measures proposed for the entire IORBD include the following:

- construction of new and expansion of the existing treatment plants (industrial and municipal) along with its infrastructure as well as sewage system construction in areas without one;
- reduction of point and area source pollution;
- reduction of farming-related biogenic pollution;
- reduction of farming-related loads of pesticides;
- reduction of water intake for industrial, mining, agricultural and waste economy purposes;
- improvement of waste economy (morphological changes in surface waters);
- reduction of anthropogenic impact;
- conceptual activities (expertise, research projects);
- informing and consulting the public opinion.

Future trends

400. Due to the post-1990 political and economic changes in all states within the IORBD, a significant decrease in the consumption of drinking water of 25% - 30% has been observed, thus present drinking water sources should meet the demands until 2015. The tendency in demographics - looking at period from 2005 to 2015 - is stable in Czech part of the basin, an 8% decrease in German part and an 3.1% decrease in the Polish part.

401. The need for an implementation of a wide range of costly improvements in the scope of sewerage and wastewater treatment such as expansion and modernization of the existing infrastructure may necessitate price increase for water services.

402. For the past decades, a rising trend in temperature has become increasingly apparent, also within the Odra river basin. [89] In terms of changes in the amount of precipitation, there are significant uncertainties. Possibility of precipitation increase during the winter and its decrease during the summer months has also been predicted. Forecasts predict long-lasting periods without precipitation or periods of very low precipitation from spring to fall. The frequency of dry periods with temperatures >35oC will most likely increase. The probability of short but intense rainfalls, even during droughts, will increase. Increased average temperatures in winter will result in more frequent and heavier precipitation but less frequently in the form of snow. Significant rise in temperature will lead to an increase in evapotranspiration.

403. Lower snow fall will cause, especially in the highlands, changes in water flow in winter and spring. Increased evaporation and decreased snowfall in the winter months may lead to the decrease of water stored in the soil, lowering the level of retention of groundwater as well as lower level of water in lakes and rivers. This would lead to a decrease in the amount and quality of water

[89] Detailed description on the climate change can be found in 2009 Report – Odra River Basin Management Plan, pursuant to Article 13 of the Water Framework Directive

resources. Within the entire Odra river basin, the risk of local floods will increase as the result of more frequent and intensive rainfalls.

404. Due to the global rise in sea levels as well as the intensity of storms, especially during colder seasons, natural and anthropogenic system of the Baltic coast will be risk.

405. Knowing that the increase of the climatic change impact will most likely lead to a decrease of the available water recourses and simultaneously to the increase of water demand in the region – especially from municipal users and agriculture – steps aiming at water retention ought to be considered as crucial.

XXXVIII. Transboundary aquifers which are not connected to surface waters assessed in the Eastern and Northern Europe Assessment

Table 79

Cambrian-Vendian Voronka groundwater body: type 4, Cambrian and Vendian sandstones and aleurolites. Groundwater flow direction from Russia to Estonia. No link with surface water.

	Estonia	*Russian Federation*
Border length (km)	78.45	
Area (km^2)	5 756	
Renewable groundwater resource (m^3/d)	15 000–30 000	
Thickness in m (mean, max)	100, 130.	
Number of inhabitants	87 142	
Population density	151	
Groundwater uses and functions	Groundwater body is very important for water management. In addition to hundreds of wells in sparsely populated areas, there are water intakes in almost all towns and settlements of Ida-Viru County.	
Other information	In coastal areas often the only groundwater body usable for public water supply. Use is limited by lower quality due to intrusion of salt water. 60–80% of the stock in use. The Cm-V Voronka groundwater aquifer crosses the national border and is thus influenced by water consumption both, in Estonia and in Russia .	

Table 80

Ordovician-Cambrian groundwater body: type 4. Sandstones and aleurolites of Ordovician and Cambrian formations. Groundwater flow direction from Latvia and Russia to Southeast–Estonia, from Southwest Estonia to Latvia and from Northeast–Estonia to Russia. No link with surface water.

	Estonia	*Russian Federation and Latvia*
Border length (km)	119,1	

Area (km^2)	33 571
Renewable groundwater resource (m^3/d)	50 000
Thickness in m (mean, max)	35, 60
Number of inhabitants	379 132
Population density	112
Groundwater uses and functions	mainly used for drinking water; very important for water management
Other information	Crosses the national border in Ida-Viru County and is thus influenced by water consumption both, in Estonia and in Russia.