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### Working Group on Monitoring and Assessment

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

# Assessment of transboundary waters discharging into the North Sea and Eastern Atlantic[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 sub regional assessment of Western and Central Europe 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

[1] United Nations Economic Commission for Europe.
[2] This document was submitted for publication without formal editing.
* The present document has been submitted on the present date due to late receipt of inputs by concerned countries and resource constraints in the secretariat.

September 2011).

This document contains the draft assessments of the different transboundary rivers, lakes and groundwaters which discharge into the North Sea and Eastern Atlantic.

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.2/2011/8–ECE/MP.WAT/WG1/2011/8

# Contents

# I. Introduction

1. The present document contains the assessments of the different transboundary rivers, lakes and groundwaters which are discharge into the North Sea and Eastern Atlantic. 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 Western and Central Europe sub-regions. River basin commissions have contributed information to the assessments of the Elbe, Meuse, Moselle and Saar, Rhine and Scheldt.

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.2/2011/8−ECE/MP.WAT/WG1/2011/8.

# II. Glama/Glomma River Basin[3]

4. Norway and Sweden share the basin of the about 604-km long Glomma River[4] as approximately one percent of the catchment lies within Sweden. The river's main watercourse Glomma confluencing with the Lågen, the western tributary, runs from Norwegian-Swedish highland areas to the Oslofjord. The lake Aursunden and Lake Mjøsa are lakes in the basin.

Table 1
**Area and population in the Glomma Basin**

| *Country* | *Area in the country ($km^2$)* | *Country's share %* | *Population* | *Population density (persons/$km^2$)* |
|---|---|---|---|---|
| Norway | 42 019 | 99 | 750 000 | 18 |
| Sweden | 422 | 1 | | |
| **Total** | **42,441** | | | |

*Source:* Norwegian Water and Energy Directorate.

## Hydrology

5. 70% of the catchment area is above 500 m.a.s.l and 20% above 1000 m.a.s.l. The surface water resources are estimated at 22 $km^3$/year (as runoff). There are more than 40 dams and 5 transfers of water between sub-basins in the watercourse.

6. The Glomma has experienced several major floods due to melting snow from Jotunheimen, Rondane and other mountain areas in Norway. In 1995, a combination of snow melt and heavy rainfall caused extensive damage to infrastructure, buildings and farm land along the water course.

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

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

[4] The river is known as Glama in Sweden and Glomma in Norway.

## Pressures and status

8. There are 5 RAMSAR sites and 2 national parks partly within the river basin. 32 % of the basin is protected against further hydro power development.

9. Total water withdrawal in the Norwegian part of the basin is $3.9 \times 10^6$ $m^3$/year, out of which 5% is for domestic use and the rest is Temporary reservoir storage for hydropower production.[5]

10. Within the river basin there are more than 50 hydropower plants and more than 20 storage reservoirs. The hydropower stations on the rivers Glomma and Lågen cover about 9% of Norway's electricity demand.

11. The total agricultural area in the basin, mainly located in the southern part, is about 3,500 $km^2$. The lower part of the river was industrialized in the beginning of the 20th century, the main activities being pulp and paper industries and a zinc smelter. Today, one of the main industrial activities is a chromium-titanium plant situated close to the river mouth. There is also a big plant for waste incineration and pulp- and chemical industry is still important in the community of Lower Glomma.

12. The risk analysis done in accordance with the Water Framework directive (2011) shows that approximately 30% of the water bodies are at risk of not achieving good ecological status in 2015. Some 33 % are possibly at risk and the rest are at good status.

13. The program Riverine inputs and direct discharges to Norwegian coastal waters - 2008 shows that the input of Total Organic Carbon (TOC) is 109,124 tonnes from Glomma in 2008 to the Skagerak area. The corresponding figures for total phosphorus is 543 tonnes and for total nitrogen is 15,075. This represents an increase in the concentrations of total nitrogen since 1990.

## Response measures and transboundary cooperation

14. Norway, not being an EU member country, performed a voluntary implementation of the WFD in selected sub-districts across the country from 2007 until 2009, thus gaining the experience of River Basin Management planning. River Basin Management Plans for the selected sub-districts were adopted by the County Councils in 2009, and approved by the national Government in June of 2010.

15. River Basin Management Plans (RBMPs) covering the entire country will be prepared from 2010 until 2015, synchronized with the time schedule of the second cycle of implementation in the EU.

16. Transboundary issues between Sweden and Norway are handled in accordance with the Water Convention (1992) and a Memorandum of understanding (2008) describing the two countries fulfilling of the Water Framework Directive (Directive 2000/60/EC).

## Future trends

17. More precipitation is anticipated due to climate change, particularly in Western and Northern Norway. The projections from the research program RegClim show that in the

[5] Sources: Norwegian Water and Energy Directorate, The Glommens and Laagens Water Management Association

period 2030–2050 around 20 percent more precipitation can be expected in the autumn in these regions compared to the period 1980–2000. In Eastern Norway, the increase in precipitation is expected to primarily occur in winter. The temperature is expected to rise over the whole country, but mostly in winter and in Northern Norway.

18. The average wind velocity is expected to increase a little in most regions during the winter half-year. The frequency of storms causing great damage will probably rise somewhat, and occur mostly along the coast of Møre og Trøndelag county.[6]

# III. Klarälven River Basin[7]

19. The almost 460-km-long Klarälven ("clear river" in Swedish) runs for almost 300 km on Swedish territory. The river begins with a number of streams flowing into Lake Femunden on the Norwegian side of the border. Some of these watercourses also come from Sweden, mainly from Lake Rogen in Härjedalen. The river flowing south from Lake Femunden is first called the Femundselva and later the Trysilelva. The river crosses the border and changes its name to the Klarälven. It flows through northern Värmland, where it follows a valley towards the south. The river empties into Lake Vänern in Sweden with a delta near Karlstad.

20. The surface water resources are estimated at 2,2 $km^3$/year (as runoff, based on the Nybergsund gauging station some 25 km upstream from the Swedish-Norwegian border).

21. The river's average discharge is 165 $m^3/s$. The maximum measured discharge was 1,650 $m^3/s$. Spring floods are common, mainly caused by run-off from the snowy mountains in the northern areas of the basin.

## Status

22. The Klarälven has clean and fresh water, suitable for bathing. The river is internationally recognized as excellent sport fishing watercourse. According to monitoring data from the river delta for the period 2003-2009, the river carried in average 53,000 tons TOC, 66 tons phosphorus and 1,800 tons nitrogen per year.

23. The risk analysis done in accordance with the Water Framework directive (2011) in the Norwegian part of the basin shows that approximately 25% of the water bodies are at risk of not achieving good ecological status in 2015. Some 10% are possibly at risk and the rest are at good status.

## Response

24. In recent years, the lower parts of Klarälven and Karlstad have become a flood risk area. Karlstad is presently part of the EU project SAWA (Strategic Alliance for Integrated Water management Actions) and works with a pilot programme within the EU Flood Directive. There is also a Swedish-Norwegian InterReg cooperation programme to promote salmon migration and ensure good ecological status in the whole transboundary river basin.

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[6] Source: CICERO- Center for International Climate and Environmental Research, Oslo

[7] Based on information provided by Norway, Sweden and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

# IV. Wiedau River Basin[8]

25. The Wiedau River[9] is shared by Denmark and Germany. It starts east of Tønder (Denmark) and flows to the west, ending in the Wadden Sea at the German-Danish North Sea coast (see the assessment of the related Ramsar site).

26. The basin of the rivers Süderau, Alte Au, Scheidebek is shared by Schleswig-Holstein Germany and Denmark. The river has its source in Schleswig-Holstein Germany and discharges to Ruttebüller See (shared by Germany and Denmark).

27. The Wiedau is lowland and tidal river, with an average elevation of only about 7 m a.s.l.

Table 2
**Area and population in the Wiedau river basin**

| *Country* | *Country's share km²* | *Country's share %* | *Number of inhabitants* | *Population density* |
|---|---|---|---|---|
| Denmark | 1 080 | 80.5 | | |
| Germany | 261 | 19.5 | | |
| **Total** | **1 341** | | | |

*Sources:* Ministry of Environment, Nature Protection and Nuclear Safety (Germany) and LIFE Houting-project.

## Hydrology and hydrogeology

28. The Wiedau is highly controlled by weirs and gates to protect it from tides and surges. The sluice at Højer town regulates the water exchange with the Wadden Sea.

29. In the past, the main parts of the watercourses in the basin were heavily modified through drainage, dredging and physical alterations. During the last decade, Denmark has completed a number of nature restoration projects, including the reconstruction of 27 smaller weirs to make them passable for migrating fish. Other projects brought 37 km of straightened, modified water stretches back to original meandering.

Table 3
**Discharge characteristics of the Wiedau at the point of outflow to the Wadden Sea**

| *Discharge characteristics* | *Discharge ($m^3/s$)* | *Period of time or date* |
|---|---|---|
| $Q_{av}$ | 15 | |
| $Q_{max}$ | 95 | |
| $Q_{min}$ | 4 | |

30. There is one transboundary aquifer in the Wiedau river basin. In the German part, the aquifer is divided into two nationally defined groundwater bodies, Gotteskoog-Marchen and Gotteskoog-Altmoränengeest (Ei 22 and Ei 23, respectively). These have been delineated to the state border which follows the Wiedau river system.

8 Based on information provide by Germany and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

9 The river is also known as the Vidå.

Table 4

**Aquifer: type 3, sands and gravels (glacio-fluvial), Mostly pleistocene, some Holocene, Groundwater flow direction from varies from NNW (groundwater flow toward the Wiedau river) to WSW (toward the North Sea). Strong links with surface waters**

| | *Denmark* | *Germany* |
|---|---|---|
| Border length (km) | | |
| Area (km$^2$) | | 261 |
| Thickness in m (mean, max) | | 20, 60 |
| Water uses and functions | | Groundwater supports ecosystems and maintain baseflow and springs |
| Pressure factors | | Natural/background pollution widespread&severe in Ei 22; pollution from agriculture widespread&severe in Ei 23 |
| Groundwater management measures | | |
| Notes | | The aquifer occurs in the entire German part of the Wiedau river basin; extent defined by the groundwater bodies Ei 22 and Ei 23. The shallow aquifer is mostly recharged in the pleistocene covered area (groundwater body Ei 23) in the hinterland of the coastal marsh. In the coastal area the aquifer is covered by marshy sediments and recharge by precipitation is less (groundwater body Ei 22). In the marshy part: upward groundwater flow and aquifer discharge in an artifical drainage system. |

## Pressures, status and transboundary impact

Table 5
**Water use in different sectors (percent) in Wiedau river basin**

| *Country* | *Total withdrawal* $\times 10^6$ $m^3$*/year* | *Agricultural* *%* | *Domestic* *%* | *Industry* *%* | *Energy* *%* | *Other* *%* |
|---|---|---|---|---|---|---|
| Denmark | | | | | | |
| Germany (2007) | 2.7 | | 100 | | | |

Table 6
**Land cover/use in the area of the Wiedau river basin (% of the part of the basin extending in each country)**

| Country | *Water bodies* (%) | *Forest* (%) | *Cropland* (%) | *Grassland* (%) | *Urban/ industrial areas* (%) | *Surfaces with little or no vegetation* (%) | *Wetlands/ Peatlands* (%) | *Other forms of land use* (%) |
|---|---|---|---|---|---|---|---|---|
| Denmark | | | | | | | | |
| Germany | 0.62 | 6.13 | 54.0 | 36.5 | 2.0 | 0.0 | 1.8 | A |

31. In the German part, agriculture and animal husbandry are the main pressures, 91% of the basin is arable land and therefore the influence is widespread. This factor affects also quality of groundwater in groundwater body Ei 23. In the Wiedau River it leads to eutrophication and nutrification and a loss of biodiversity.

32. Utilization of fertilizers in agriculture in Germany has decreasing trend, this fact is supported by the following factors:

- the new agricultural policy of the European Union,
- the enhanced demand for ecological agriculture,
- cost pressure and competition for farmers,
- targeted fertilizers dosing by modern technology using,
- stricter environmental laws and obligations as well as their enforcement..

33. Pollution from municipal wastewater is only local and moderate. Problems with erosion/accumulation of sediments and suspended sediments and mud flow are also local but severe. Sea water intrusion affects locally and only moderately groundwater body Ei 22.

34. The river's important uses are fishing and canoeing.

35. The groundwater status according to the Water Framework Directive is good in groundwater body Ei 22 and poor in groundwater body Ei 23. The reason for failing the good status of Groundwater body Ei 23 is a significant nitrate-pollution caused by diffuse contamination.

## Response and transboundary cooperation

36. Both quality and quantity of surface and groundwaters are regularly monitored in both countries. Each country has proprietary national laws, regulations and defined national strategies. A number of management measures are introduced in the programme of measures in River basin management plan[10]. These include, for example, training for farmers and advisory projects, as well as measures related to improvement of hydromorphology and to prevention of diffuse and point sources pollution.

37. The bilateral Transboundary Commission between Germany and Denmark is a joint body which harmonizes and approves transboundary actions. The Commission supports a joint monitoring programme, data management, funding and other relevant activities.

38. One from the implemented measures in area of legal and policy framework is the adopted Directive in Germany: for the border waterways Scheidebek, Alte Au and Süderau in accordance with article 5 and 6 of the agreement 10 April 1922 on the regulation of the

[10] Project Eider: http://www.wasser.sh/de/fachinformation/daten/aneider.html

water and dyke relation on the German-Danish border as well as based on the decision of the border commission of 7 March 1961.

### Future trends

39. The European Fund for Regional Development (EFRD) supports the region Syddanmark and the region Schleswig during the period 2007-2013 with 44.3 mill. €. Part of that money is used for renaturalization of floodplains, transboundary flood risk management, restoration of wetlands, awareness-raising activities etc.

40. There is a trend to decreasing water use in the German part of the river basin which is expected to continue due to the following factors:

- scientific-technical progress enables installation of water saving technologies.
- the expansion of new renewable energy sources through targeted governmental support is expected to lead to a decrease in conventional such as fossil fuels and nuclear which would lead to a decreasing need for cooling water.
- The trend to a service-based industry combined with relocation of industry to low-income countries

41. Water abstractions are expected to be reduced due to declining industry.

42. While on the one hand, agriculturally used areas are being reduced for renaturalization, on the other hand due to increasing production of raw material for biomass areas foreseen for renaturation of floodplains for example are now used for intensive cultivation of biomass. This could lead to increased nitrification, increased use of pesticides due to monocultures, soil degradation and erosion.

## V. Elbe River Basin[11]

43. The Elbe river basin extends between the territory of four European Union States: The Czech Republic, Germany, Austria, and Poland. The Elbe river originates in the Czech Republic, in the Krkonoše Mountains at a height of 1,386.3 mts a.s.l., and it empties into the North Sea at Cuxhaven, Germany. The total length of the stream is 1,094.3 km, whereas 727 km (66.4 %) lies in Germany and 367.3 km (33. 6 %) lies in the Czech Republic.

Table 7
**Area and population in the Elbe Basin**

| *Country* | *Area in the country ($km^2$)* | *Country's share %* | *Population* | *Population density (persons/$km^2$)* |
|---|---|---|---|---|
| Czech Republic | 49 933 | 33.6 | 5 950000 | 119 |
| Germany | 97 175 | 65.54 | 18 500 000 | 190 |
| Austria | *921* | 0.62 | 50 000 | 54 |
| Poland | *239* | 0.16 | 20 000 | 84 |
| **Total** | **148 268** | | 24 520 000 | |

[11] The assessment has been prepared by the secretariat of the International Commission for the Protection of the Elbe River (ICPER) based on the Elbe River Basin District Management Plan

44. The Elbe river basin belongs to the temperate climate zone. It is situated in the transitional area between the humid ocean climate which prevails in Western Europe and the dry continental climate characterising Eastern Europe. The influence of the maritime climate is apparent to a large extent over the Lower Elbe river basin.

45. From the total Elbe catchment area, 50.5 % lies under 200 mts a.s.l. Half of the river catchment area can then be classified as lowland, whereas the main part is occupied by the Central German Lowland and the North German Lowland, where the height above sea level reaches almost 150 mts. On the contrary, only 28.9 % of the catchment area is situated at heights over 400 mts a.s.l.

46. For the purposes of the Water Framework Directive in the Elbe river basin, no transboundary water bodies of groundwater have been designated. The state boundary between Germany and the Czech Republic in the Elbe river basin region predominantly follows the edge of the Krušné hory mountains, therefore deviations in the surface water divide are insignificant. It is known that in the region of the Cheb basin (Cheb / Vogtland) and in the Saxonian-Czech cretaceous basin (Elbe sandstone), groundwater movement goes beyond the state boundary. These bodies are monitored within the framework of a special monitoring system. Though there is a common hydrogeologic structure between the Czech Republic and Poland (the basin Polická), so far it has not been necessary to define it as a common transboundary body. Nevertheless, a common monitoring system is also carried out here.

## Hydrology and Hydrogeology

47. More than 60 % of the yearly runoff volume flows out during the winter hydrologic half-year. The discharge pattern and the water levels in the Lower Elbe below the Geesthacht weir are influenced by the tide. With its parameters of discharge and its hydrologic regime, the Elbe is ranked among the rainfall-snow water courses. The hydrologic regime is to a great extent influenced by the accumulation and snow-melt.

## Pressures

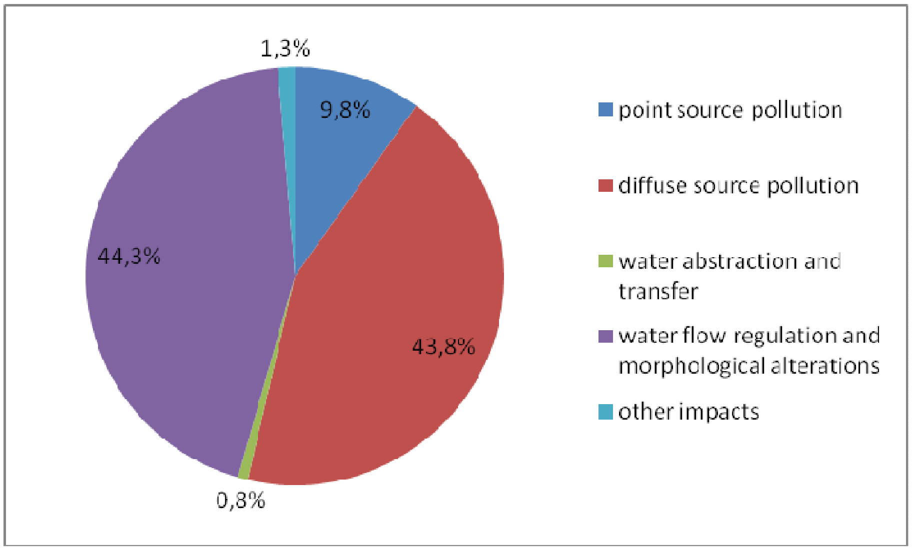
48. The following are significant problems in water management in the Elbe river basin:

- hydromorphological alterations to surface waters,
- significant load of nutrients and pollutants,
- water abstractions and transfer.

49. The solution for these significant problems in water management is co-ordinated at international level.

50. The main types of load effects on surface waters are those in consequence of hydromorphological alterations, water flow regulation and diffuse source pollution. Other key point sources of load effect are point sources of pollution. Water abstractions and other sources of pressure are of secondary importance.

Figure 1
**Main pressures on the Elbe**




51. The hydromorphological alterations of water courses in the Elbe river basin are due to intensive construction modifications of the water courses, especially for ship transportation, land drainage, flood protection, production of energy, or those related with potable water supply and urbanization. A demonstrable effect of these construction modifications, especially in the upper water courses of rivers, is the interruption of water courses continuity and the disturbance of natural habitats. There are about 530 transversal barriers in supra-regional priority water courses in the Elbe river basin which for the present are unpassable for fish and other aquatic life.

52. The main source of pollution from diffuse sources is agriculture, which plays a decisive part in nutrients input. The proportion of point sources over the total substance loss has markedly decreased during the last years, due to the construction and renovation of waste-water treatment plants.

53. It is possible to demonstrate the load of surface waters by pollutants mainly in sediments that are contaminated primarily by former inputs. Current inputs are in comparison markedly lower.

54. The influence of human activity on surface waters is reflected in the high number of designated heavily modified bodies of surface water in the International Elbe river basin (26 % – see Table 8).

**Table 8: Proportion of artificial and heavily modified bodies of surface water in the International Elbe river basin (2008)**

| Total number of bodies of surface water | 3 896 |
|---|---|
| artificial bodies of surface water | 777 |
| heavily modified bodies of surface water | 1 016 |

55. The yearly abstractions of water in the Elbe river basin during 2005 – 2007 were approximately 8.11 billion m³. From these, domestic water supply represented approx. 0.89 billion m³ (11%).

56. In the area of the treatment of urban waste water, 3,468 waste-water treatment plants discharged 1.72 billion m³ of waste water every year into the water courses during the same period. Approximately 88.2 % inhabitants were connected to a sewer system.

57. Since 1996, every year an overview and evaluation of accidents is produced. Within the period 1996 – 2009, there were 203 cases of accidental water pollution registered in the Elbe river basin. The most serious of them was an accident caused by cyanide in the upper water course of the Elbe, below the city of Kolín in January 2006, which led to a fish kill in a sector of 83 km, up to the confluence with the Vltava River.

58. For groundwater, the following types of pressures, which are the cause of unachieved environmental goals, were identified:

- diffuse sources of pollution: agriculture, atmospheric deposition, built-up areas. Other sources are of less importance (missing connection to drainage, runoff, rubble)
- point sources of pollution: old environmental loads, including old waste dumps, the oil industry, sporadic direct discharge of pollutants (treated waste water from decontaminated old environmental loads)
- groundwater abstractions: public potable-water supply, (Czech Republic and Germany), lignite mining (Germany)
- other anthropogenic influences: impacts of raw materials extraction (effect in the chemical and quantitative status), geothermal bore holes (Czech Republic – effect in the quantitative status)
- intrusion of salt water (Northern Germany).

## Status

59. From the evaluated bodies of water in the International Elbe River Basin, currently (status in 2009) 93 % of the bodies of water evaluated in the category "rivers" and 63 % of bodies evaluated in the category „lakes", do not achieve good ecological status or good ecological potential. From the 6 evaluated bodies of transitional waters and coastal waters, 5 bodies of water (83 %) were evaluated as worse than "good". The reason is mostly the quality component such as macrozoobenthos, fish, macrophyta, phytobenthos, followed by nutrients, pollutants and phytoplancton.

60. In the International Elbe river basin, in 2009, 88 % of bodies of water in the category „rivers", 91 % of bodies of water in the category "lakes" and all the bodies of coastal waters achieve good chemical status, except one. The most frequent cause for exceeding the standards of environmental quality are certain pollutants, such as pesticides and polyaromatic hydrocarbons, heavy metals, furthermore, nitrates and industrial chemicals.

61. A total of 54 % of bodies of groundwater in the International Elbe river basin did not achieve a good chemical status in 2009. More than one third of the bodies of groundwater is loaded with nitrates. Here, high losses of fertilizers used in soil cultivation, related particularly to the application of livestock manure, are shown. A total of 25 % of bodies of groundwater are loaded with other pollutants, such as ammonium or sulphates. Pesticides are considered as another source of pollution for the groundwater. They were detected in 4 % of bodies of water. Significant rising trends of nitrates, pesticides and other pollutants in several bodies of groundwater were also detected.

62. The quantitative balance of groundwater in the International Elbe river basin (status of 2009) is disturbed in 15 % of bodies of water.

63. In long stretches of its water course, the Elbe has extensive flood plains with dykes, areas with shallows and alluvial forests. Against comparable European water courses, it has many favourable living conditions for a number of native and partially critically endangered species of plants and animals. The Elbe and its river flood plains also fulfil the function of a supra-regional bio-corridor, for instance during the migration or wintering of birds.

64. As a consequence of the improvement in water quality, and hence of improved self-cleaning processes in the water course, there is a growing variety of fish species in the Elbe. Currently, it is estimated that 102 different species of cyclostomatous and fish live in the Elbe. The most important representative among migrating fish in the Elbe is the atlantic salmon *(Salmo salar)* after the eel (Anguilla anguilla*)*. Therefore, in 1995, the German side started programmes aimed at resettling the salmon and the Czech side joined them in 1998. In addition, in the frame of the National German Action Plan for the resettlement of rivers with Common Sturgeon (*Acipenser sturio*), the Elbe was chosen as the first river for releasing fish stocks of sturgeons into the Elbe during the years 2008 and 2009. Another new fish pass was built at the Geesthacht weir on the right bank of the Elbe to enable the sturgeons to return to the fish spawning areas in the Elbe water course.

## Response and transboundary cooperation

65. The states of the Elbe river basin – Czech Republic, Germany, Austria and Poland – agreed to mutually co-operate within the International Commission for the Protection of the Elbe River (ICPER), in order to implement the Water Framework Directive through the international co-ordination group (ICG).

66. They also agreed to draw up a common river basin plan on behalf of the International Elbe river basin, according to the Water Framework Directive – The International Elbe River Basin Management Plan which was published in Czech and German in December 2009. It consists of a jointly prepared Part A with summarized information at international level and of Part B – i.e. the plans worked out at national level by the respective states.

67. “The International Elbe Warning and Alarm Plan“ has been a unified system since 1991 which enables the transfer of information about the place, time and the extent of accidental pollution of the water in the Elbe river basin. The main structure of the Plan is composed of 5 principal international warning centers. The Plan is up-graded on the basis of the latest knowledge and experience gained from previous accidents, and on the basis of the results of regular testing.

68. For the first river basin plan, according to the Water Framework Directive, water courses of particular importance for fish populations and suitable for the development of river courses were identified, due to their inter-connecting function. According to these criteria, the Elbe water course and almost 40 tributaries were classified as of „supra-regional priority water courses“. These tributaries, with a total length of approx. 3,650 km, include about 530 transversal barriers which are so far unpassable for fish and other aquatic life. The objective is to achieve ecological passability on more than 150 transversal barriers by 2015. This will increase the total length of the tributary stretches that fish and other aquatic life can pass through from the current 300 km to almost 1,800 km, of which approximately 62 % will be connected with the North Sea.

69. With regard to the North Sea coastal waters, it is planned to reduce the nutrient load of nitrogen and phosphorus from the whole Elbe river basin by approximately 24% gradually by the year 2027 through the following measures:

- measures to minimize redundant nutrients when fertilizing agricultural land and
- measures to reduce soil surface runoff and washing out nitrates into groundwaters and surface waters, i.e. by suitable cultivation of land and building protective riparian zones.

70. An important potential to reduce nitrogen and phosphorus inputs can be also seen in modernization and intensification of municipal waste-water treatment plants, particularly in the Czech Republic.

71. In order to gradually reduce pollutants input by the year 2027, a sediment management concept will be developed for the whole Elbe river basin, including proposals for measures to handle pollutant loaded sediments. The planned decontaminations of the old environmental loads as well as measures to reduce point source pollution should help to achieve a good status. Other measures at national level have been proposed, aimed at reaching a good status of water. For surface waters, priority is paid to measures leading to reducing hydromorphological effects. Among them, namely the following:

- measures to optimize the maintenance of and renew the passability of water courses in other cases of water constructions,
- measures to stimulate / enable the dynamic development of the water courses including accompanying measures,
- measures to improve the habitats in the riparian zone (i.e. development of wooden vegetation),
- measures to improve the habitats in the development corridor of water courses, including the development of fluvial plains,
- measures to revitalize the water courses (i.e. the stream bottom, variability of depths, the substratum) within the frame of the existing profile,
- measures to improve the habitats in the water course through modified routes of the watercourse, modifications of the bank and the stream bottom, including accompanying measures,
- measures to improve the mode of sediments, eventually the management of sediments,
- connection to side distributaries, to old distributaries (transversal interconnection),
- measures to increase the number of shallow places in the tidal stretch of the Elbe.

72. Among the most frequently considered measures to reduce the input of pollutants from body sources are:

- the connection of so far unconnected areas to the urban waste-water treatment plants,
- other measures to reduce the input of substances through discharged waste waters and rain waters and through discharged urban waste waters,
- optimization of operations of urban waste-water treatment plants,
- reconstruction of urban waste-water treatment plants, with the purpose to reduce inputs of phosphorus.

73. In 1993 – 2004, the ICPER devised 10 recommendations in the area of the prevention of accidents, the safety of technical equipment and the overcoming of accidents that were implemented into the legal order of the Czech Republic and the Federal German Republic. ICPER is striving to create a stable emergency profile to entrap oil contamination in the boundary profile of the Elbe.

74. A part of the surveillance monitoring of the Elbe river basin, according to the Water Framework Directive is the „International Programme for Elbe Measurement“. This programme includes 9 measurement sites in the Elbe water course (4 in the Czech Republic and 5 in Germany) and 10 measurement sites in its important tributaries. The measurement results are disclosed on the web site of ICPER[12].

### Future trends

75. In the middle and long term future, the strategies of adaptation to climate change will also play a certain role when selecting and implementing measures. The first scientific results related to these impacts in the Elbe river basin were taken into account to draw up these measures at the same time as this river basin plan was being prepared.

76. Climate change impacts are difficult to assess. Depending on regions and the season, precipitation frequency and intensity is expected to change which might lead to an increase in droughts and thus to a rise in water prices in the most affected areas. In the future process of planning measures, predictably effects of climate change will be taken into account.

## VI. Krkonoše/Karkonosze subalpine peatbogs[13] *(*Czech Republic, Poland)

*General description of the wetland*

77. These oligotrophic mountain raised peatbogs of subarctic character are situated on granite bedrock on the summit plateaux of the Giant Mountains (The Sudetes – Krkonoše in Czech, Karkonosze in Polish). They are characterised by a mosaic of arctic and alpine features, and the occurrence of many endangered and endemic plant and animal species as well as plant associations.

78. The site is an exceptional biogeographical island in central Europe, in which relic subarctic phenomena are intermingled with more recent alpine ones. The system of ridge peat bogs developed under extreme climatic conditions within central Europe. The bog surface has a rich relief, in the form of numerous hummocks, oblong ridges, trough-like hollows filled in with water and permanent pools. In the pools a unique flora of algae is to be found.

79. The depth of the peat layer is highly variable (from several decimetres to 2.8 metres) and the surface morphology is similar to the structure of northern mires with bog-lake areas of up to 170 $m^2$.

[12] www.ikse-mkol.org

[13] *Sources*: JENIK J. 1961: Alpine Vegetation des Riesengebirges, des Glatzer Schneegebirges und das Gesenkes. NCAV Praha: 1-409 (in Czech with a German summary).
SOUKUPOVA L., KOCIANOVA M., JENIK J. & SEKYRA J. 1995: Arctic-alpine tundra in the Krkonose, the Sudetes. Opera Corcontica 32: 5-88.

80. Interestingly, the wetland lies in the summit area of the west-east oriented mountain range (administratively divided by the Czech-Polish border), just on the watershed divide of the Baltic Sea (the Elbe river) and Northern Sea basins (the Oder river). This means that waters of this small Ramsar site are drained into two different basins – peat bogs on the northern (Polish) slopes of the mountains drain into the catchment area of the Oder, peat bogs on the southern (mainly Czech) part into the catchment of the Elbe.

81. The total area of the wetland is 250 ha only, the Czech part being 210 ha and the Polish part 40 ha respectively.

*Main wetland ecosystem services*

82. The wetland is situated in the headwaters of two rivers – the Elbe and the Upa. Ecosystem services include the storage and retention of water, flood control and erosion protection. Water from precipitation is accumulated in the raised peat bogs, and retained there by vegetation (esp. *Sphagnum* mosses). Subsequently, water is drained by hundreds of very small, deeply meandering water bodies from the peat bogs. The outflow is relatively slow, partly protecting downstream habitats from erosion and floods, especially in spring, when snow melts, as well as after heavy rainfall in summer.

*Biodiversity values of the wetland area*

83. The most important element of the vegetation cover is the endemic plant association of dwarf pines with the cloudberry (*Chamaemoro-Pinetum mughi*), and several glacial relic plant associations (e.g. *Chamaemoro-Empetrum hermaphroditi*).

84. It further harbours the endemic alga species *Corcontochrysis noctivaga* as well as glacial relics, such as the Sudetan Lousewort *Pedicularis sudetica*, the Cloudberry *Rubus chamaemorus*, the Water Beetle *Hydroporus nivalis* or the Field Vole *Microtus agrestis*.

85. Further, the site is of specific value in terms of biological diversity as it harbours arctic and alpine plant and animal species simultaneously. Three physiognomic units form the vegetation cover of the wetland – mosses, herbaceous plants and dwarf pines.

86. The shrub vegetation is formed by mosaic stands of the Swiss Alpine Pine *Pinus mugo*, willows *Salix lapponum* and *S. silesiaca*, and solitary individuals of the spruce *Picea abies* and the Mountain Ash *Sorbus aucuparia*. Dominant and characteristic plant species of the wetland include moss species such as *Sphagnum lindbergii*, the Leafy Liverwort *Gymnocolea inflata*, sedges like *Carex limosa*, and other species such as *Vaccinium* spp., the Bog Rosemary *Andromeda polifolia*, the Common Sundew *Drosera rotundifolia*, the Tufted Bulrush *Trichophorum caespitosum*, the Tussock Cottongrass *Eriophorum vaginatum* or the Sudetic Lousewort *Pedicularis sudetica*.

87. Noteable in terms of fauna are the following: dragonflies *Somatochlora alpestris* and *Aeshna caerulea*, moth *Xestia alpicola*, carabid beetles *Nebria gyllenhali* and *Patrobus assimilis*, or the Alpine Shrew *Sorex alpines*. The area also serves as an important breeding site for several birds, especially the Red-spotted Bluethroat *Luscinia svecica svecica*, the Ring Ouzel *Turdus torquatus*, the Scarlet Rosefinch *Carpodacus erythrinus* or the Water Pipit *Anthus spinoletta*.

*Pressure factors and transboundary impacts*

88. There is a considerable impact of tourism in the wetland area, because this part of the mountains is visited by thousands of tourists per day during peak seasons from June to September. Two historical and reconstructed mountain chalets at the border of the wetland and a network of hiking trails inside the wetland affect surrounding vegetation.

89. The impact of air pollution, noticed throughout the entire area of the Giant Mountains in the 1970–90s and resulting in a large-scale forest decline especially, has been reduced during the last two decades.

90. No impact of climate change on the hydrology of the area has been noted yet. However, a probable impact of climate change on bird communities has been observed recently as there is an increasing abundance of species preferring lower altitudes, such as warblers *Sylvia* spp. and the chiffchaff *Phylloscopus collybita.*

*Transboundary wetland management*

91. The entire transboundary wetland area is protected under the following regulations and programmes:

- Czech Krkonose National Park (part of the strictly protected core zone, where only “soft” tourism activities are allowed, e.g. hiking or cross-country skiing just along fixed trails for visitors),

- Polish Karkonosze National Park (part of the strictly protected core zone with the same regime as the mentioned above),

- Bilateral Krkonose/Karkonosze Biosphere Reserve (part of the core zone) under UNESCO’s Man and the Biosphere Programme,

- Natura 2000 sites on both sides of the border (both Special Protected Areas and Sites of Community Interest) based on the EU Habitats and Birds Directives,

- Important Bird Area in Europe under the BirdLife International Programme,

- Transboundary wetland of International Importance under the Ramsar Convention on Wetlands (designated officially in September 2009).

92. The area is managed by both the Krkonose National Park and Karkonosze National Park Administrations, and no special staff is devoted directly to the Ramsar site.

93. Management plans are ready and in use for both the NPs, prepared in close cooperation with the other NP. They cover inter alia also the management of wetland sites (incl. the Ramsar site) – esp. control of tourism and elimination of allochthonous plant species spreading along the hiking trails.

94. In regard to transboundary cooperation, a joint Czech-Polish nature trail through the wetland area was prepared for visitors, and multilingual information booklets on the Krkonose peatbogs are available.

# VII. Ems River Basin[14]

95. Germany and the Netherlands share the Ems River basin[15]. The 371-km long Ems has its source in North Rhine-Westphalia in Germany, running through another German State, Lower Saxony, further downstream. The tributaries of the Ems in the Netherlands discharge directly into the Ems-Dollart estuary. The Hase is the largest tributary. Near the

[14] Based on information provided by Germany (office of the Ems cooperation) and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

[15] In the Netherlands also known as the Eems. The Ems River Basin District includes the Ems-Dollart estuary.

city of Emden, the Ems flows into Dollart estuary and finally flows into the North Sea. Important channels within the basin are Dortmund-Ems-Kanal, Mittellandkanal, Küstenkanal and the Eemskanal in the Netherlands. Parts of the Ems are used for inland navigation and near the mouth as sea waterways.

Table 9

**Area and population in the Ems Basin**

| *Country* | *Area in the country (km²)* | *Country's share %* | *Population* | *Population density (persons/km²)* |
|---|---|---|---|---|
| Germany | | ~84 | 2805 000 | 187 |
| Netherlands | | ~13 | | |
| Ems –Dollart estuary | 482 | ~3 | | |
| **Total** | **17 879** | | | |

*Source:* International River basin management plan the Ems river basin district, Germany and the Netherlands.

96. Characteristic for the Ems river basin is that there are no natural rivers or aquifers which cross the border between Germany and the Netherlands. The tributaries in the Netherlands and in Germany meet each other in the Ems-Dollart estuary. Since the end of the Middle Ages the border between Germany and the Netherlands in this area is controversial. So Germany and the Netherlands made an arrangement in 1960, which regulates the collaboration in the Ems Dollart estuary.

97. Important cities in the river basin are Münster, Osnabrück, Emden and Groningen.

## Hydrology and hydrogeology

98. The Ems basin is mainly characterized by lowland.

99. The long-term (1946 – 2006) mean annual discharge (MQ) at the Versen gauging station is 80,1 m³/s. The gauging station Versen is the last gauging station before the mouth of the Ems without tidal influence. However, the extreme flood event in 1946 at Versen was 1200 m³/s.

100. The elevation in the area of the district ranges from sea level to 331 m a.s.l.

101. The marshland located in the northern section of the Ems basin is characterised by coastal sediments and fluvial deposits over time.

## Pressures

102. The Ems basin is widely characterized by intensive agriculture - some 65% of the surface of the Ems basin is used for agricultural purposes and 15% of the area is covered by pastures.

103. In addition to meaningful, significant (on the basis of emissions) local pressures on sur-face waters, there are also transregional pressures, e.g. as a result of the influx of nutri-ents (nitrogen and phosphor compounds). Emissions from diffuse sources and point sources contribute to these, even though diffuse sources represent no significant local pressure.

104. The restricted passability of the important transregional network of water bodies has led to deficits in long-distance migrating fish. The ecological passability and quality of life of aquatic communities is affected by the extensive morphological alterations (straightening, bank reinforcements, weir controls, and maintenance).

106. Almost 99 % of the total length of the river water bodies and the channels and 9 of the 10 lakes-water bodies assessed do not achieve good ecological status / good ecological po-tential. The two transitional water bodies and 4 coastal water bodies up to 1 sea mile re-veal a poor ecological status. The reason is the quality component macrozobenthos, macrophyte or phytobenthos, followed by the components fish, nutrient substances and harmful substances and in individual cases, also phytoplankton. In the Ems basin, almost 90% of the total length of rivers of canals and 9 out of 10 lakes achieve good chemical status.

107. Both transitional water bodies and one coastal water body in the processing area Ems-Dollart show poor chemical status on the basis of violations of the so-called ‘other harmful substances’.

108. There are still a number of point sources of old pressures — despite the remediation and securing that has been carried out — which will have to be localised and registered in the coming years.

109. In the Ems basin, the diffuse input into the groundwater has primarily been caused by ex-cess use of nutrients on areas used for agriculture. This pressure has been identified as significant for practically all groundwater bodies, and will be further investigated. The basis for these investigations comprises land use data, agricultural statistics, nitrogen balance surpluses and nitrate concentrations in the groundwater.

110. The pressures from diffuse sources were identified as significant, for practically all groundwater bodies. The identified dominant pressure on groundwater bodies in the Ems basin, with nitrates from agricultural use, correlates to early farming forms, which over the past few decades have led to considerable nutrient accumulation in the soil and pressures on the groundwater.

111. A poor chemical status results in 12 groundwater bodies (48.6 % of the total surface area) from nitrate and in 9 groundwater bodies (32.5% of the total surface area) from pesticides (mostly from the past) in the Ems basin.

112. The pressures from water abstraction were estimated as not significant.

## Response

113. Numerous measures are planned for further improvement of the Ems and its tributaries. As already laid down in the 2005 status review, in implementing the measures, steps will have to be taken for integration in other fields including energy, transport, agriculture, fishery, regional development and tourism.

114. The future management of the Ems basin essentially calls for the implementation of additional measures, since the underlying minimum requirements have to a considerable extent already been achieved by binding legal regulations from the Federal States.

115. In respect of surface waters, the point of focus within the Ems basin is on measures to reduce hydromorphological pressure and to recover passability. This includes such measures as structural improvement for crossing structures, barrages, bank strengthening and other civil engineering constructions. Further points of focus are measures to reduce pressures from diffuse sources and point sources. For groundwater, the programme of measures of the Member States/ Federal States is concentrated above all on activities aimed at reducing pressure from diffuse sources.

116. Conceptual measures have been planned to provide support. Advisory measures contribute to reducing the discharges of nutrients and pesticides from diffuse sources. Promotion programmes (agricultural environmental measures) will help to reduce the

infiltration of nutrients into waters. Educational measures, for example for crop maintenance, will also be deployed to improve morphological changes in water bodies.

118. For laying down these measures, one key element was the estimate of the expected effects and costs. Uncertainties relate to whether the necessary measures could actually be implemented, or whether as a result of unavoidable uses for which there was no alternative, technical problems or natural situations, the implementation of the measures will only be possible on a limited scale or not at all, is surrounded by, because developments cannot be predicted sufficiently accurately through to 2015.

119. Transnational cooperation and harmonisation and the accompanying coordination relate to the coherent drafting of reports to the European Commission, the drawing up of a coordinated management plan and the elaboration of coordinated programmes of measures.

120. The Ministers responsible for protection of the waters in the Ems basin in Germany and the Netherlands have decided to draw up a higher, common international management plan for the Ems basin. With that in mind, a work structure was implemented by ministerial correspondence, supported by the Ems office. The international cooperation between the Netherlands and Germany then takes place within special international fora. At the first level, the ‘International Steering Group Ems’ (ISE) is responsible for overall harmonisation and general progress of work. In this forum, the fundamental decisions on collaboration by representatives of the responsible Ministries are taken. At the second level, experts from the Netherlands, from North Rhine-Westphalia and Lower Saxony work within the ‘International Coordination Group Ems’ (ICE). This forum implements the underlying decisions of the ISE, and arrives at specific agreements on joint implementation of the required operational tasks. The International Coordination Group Ems is supported by working groups that in changing form, work on the various themes of the water framework directive.

## Future trends

121. For the Ems basin expectations suggest that in addition to long-term climate changes, annual extremes will increase. The effect will differ from region to region, requiring an approach specific to the entire river basin and in large catchment areas possibly also a smaller scale approach. General predictions for extreme values have to date proven difficult.

122. In the Ems basin the following changes are assumed:

- Increase in average air temperature;
- Sea level rise;
- Increase in precipitation in winter;
- Fall in precipitation in summer;
- Increase in precipitation events;
- Increase in dry periods;

123. As yet, confirmed evidence of these assumed changing trends, in particular for precipitation and precipitation extremes, is not available.

124. Changes to these factors have an immediate effect on essential elements of water management, e.g. on

- coastal protection – due to sea level rise – possible changes in storm intensity and seaway pressures, and the resultant change in damage risks;

- the sea level rise will have consequences for the coastal zone and the tidal zones, in particular the sandbanks that emerge at low tide and their ecological functions;
- flood protection – due to changes in the height, duration and frequency of flood discharges, and the resultant change in damage risks;
- water supply – due to the change in groundwater recharge, groundwater characteristics and groundwater use;
- water protection – due to the change in seasonal discharges and temperature ratios with effects on the substance management of the rivers and lakes and the biocoenose;
- development of waters bodies – due to the change in the dynamic of rivers and lakes, their morphological relationship, their heat management and their ecosystems; and
- use of water bodies – due to changes in particular in the operating methods of flood and drinking water storage, storage areas for raising water levels at low water, hydro-electrical use, navigability of waters, use of water for cooling purposes and use of water for agriculture.

125. Among useful measures and options for actions — despite the uncertainties related to climate change — are improved passability and the morphology of water bodies and the reduction of heat pressure have positive effects on the living conditions and the sustainability of the ecosystems. In respect of groundwater, experience has accrued with managing groundwater abstraction and infiltration, and for example measures for water retention and groundwater recharging can be developed.

# VIII. Wadden Sea (Denmark, Germany, The Netherlands)[16]

*General description of the wetland*

126. The Wadden Sea is a shallow sea of outstanding natural value as it forms the largest coherent tidal flat ecosystem in the world covering over 9,000 km$^2$ (including ~7,500 km$^2$ tidal area). It extends for about 500 km along the North Sea coasts of Denmark, Germany and The Netherlands. It is a very dynamic ecosystem which includes large areas of intertidal sand- and mud flats, partly estuarine, with sand banks, numerous islands, extensive areas of saltmarsh, dunes, heath, beaches and beach plains. The Wadden Sea itself can be divided into three ecological zones: the sublittoral, eulittoral and supralittoral zone, according to their daily inundation regime by sea water. The sublittoral zone mainly includes creeks and channels, while the eulittoral zone includes tidal flats which cover about two thirds of the tidal area and are characteristic for the Wadden Sea. The supralittoral zone, the region above mean high tide levels, includes saltmarshes and dunes. Many important rivers such as the Elbe, Weser, Ems and IJssel, a sidearm of the Rhine River, drain into the Wadden Sea. The size of the catchment area is 231,000 km$^2$.

*Main wetland ecosystem services*

127. Hydrological values of the Wadden Sea include flood control, shoreline stabilization and sediment retention. Due to its high productivity, the Wadden Sea is an essential nursing habitat for several fish species of the North Sea, is important for shrimp and blue mussel

[16] http://www.waddensea-secretariat.org
Ramsar Information Sheets available at: http://www.wetlands.org/rsis/
The Wadden Sea-A shared nature area, H. Marencic, Common Wadden Sea Secretariat

fisheries and crucial for bird migration. Some of the salt marshes are used for cattle and sheep grazing and the surrounding areas are used mainly for agricultural purposes. In parts intensive arable (wheat and rape) farming is practised. It is further used for sand, clay, shell and gravel extraction and the extraction of oil and gas. It is of outstanding scientific and educational value as it contains a great variety of landforms, habitat types and plant and animal species. For the same reasons it is used extensively for tourism and recreation purposes with about 70 million overnight stays per year and a turnover of 2.8–5.3 Billion Euro per year.

*Cultural values of the wetland area*

128. The Wadden Sea landscape is an area of outstanding natural beauty as well as cultural, historical as well as archaeological value. Because of the dynamic geomorphological history of the region many archaeological remains of human settlements are present in the tidal flats. Historically preserved buildings such as lighthouses and towers date back to the 13th century and some settlement types such as the the Halligen in Schleswig Holstein which are built on mounds are unique.

*Biodiversity values of the wetland area*

129. The Wadden Sea offers the full range of habitats typical of tidal flats and thus plays a very important role in the protection of biological diversity. The Wadden Sea is of international importance for birds which breed, moult and winter here, or which use it as a migratory staging area. With about 50 geographically distinct populations of 41 bird species, the Wadden Sea supports more than 1% of the East Atlantic flyway populations. Of these, 29 species occur with more than 10% of their flyway population in the Wadden Sea. Every year 10 to 12 million birds pass through, en route from their breeding grounds in Siberia, Iceland, Greenland and North East Canada to their wintering grounds in Europe and Africa. The salt marshes are the most important breeding areas, followed by the dunes and beach plains of the islands. Bird species typical for the Wadden Sea include the Redshank (*Tringa totanus*), Black-tailed Godwit (*Limosa limosa*), Oystercatcher (*Haematopus ostralegus*), Avocet (*Recurvirostra avosetta*) and a number of species of ducks, geese, gulls and terns. Several species of birds occurring in the Wadden Sea are included in national red lists, e.g. Kentish Plover (*Charadrius alexandrines*), Dunlin (*Calidris alpine*), Ruff (*Philomachus pugnax*), Gull-billed Tern (*Gelochelidon nilotica*), and Little Tern (*Sterna albifrons*). Further, the area is a nursery ground for many North Sea fish species and shellfish due to its high primary production rates. It also sustains the harbour porpoise (*Phocoena phocoena*) and approximately 20% of the world population of harbour seals of the North East Atlantic subspecies *Phoca vitulina vitulina*. Additionally, the salt marshes, marine and brackish areas support about 4,000 species of spiders, insects and other invertebrates with a high degree of ecological specialization, many of the species being endemic. In contrast, only few species of flora and fauna have adapted to the extreme conditions of the tidal flats such as the lugworm *Arenicola marina*, but occur in very high numbers.

*Pressure factors and transboundary impacts*

130. The Wadden Sea suffers from pollution and disturbance. It is affected by the pollution from discharge of nutrient and contaminant rich waters from major rivers and their catchment areas which are highly industrialized and intensively used for agriculture. Further, it is influenced by polluted water from the North Sea south of Denmark. However, it also receives a large part of its pollution through atmospheric deposition from the countries of Northwestern and Central Europe. Further threats include the drainage and cultivation of permanent grassland areas, the increasing impact from recreational activities, exploitation of natural resources such as mussels as well as impacts from transportation and industrial activities such as potential oil spills. Additionally, climate change and the

accelerated sea level rise were identified as one of the future concerns by the Trilateral Wadden Sea Plan.

*Transboundary wetland management*

131. In the 1970s, environmental scientists warned that the Wadden Sea ecosystem could not be divided according to national borders, and called upon politicians from the three Wadden Sea countries to work together in the protection and conservation of the area. This was followed by a “Joint Declaration on the Protection of the Wadden Sea” (which has been renewed in 2010) and the founding of the Common Wadden Sea Secretariat in 1987, which supports, facilitates and coordinates collaboration activities. The Trilateral Cooperation area covers 14,700 km$^2$ of which 11,000 km$^2$ were set aside for conservation. In 1993 the Trilateral Monitoring and Assessment Program (TMAP) was established with the aim to provide a scientific assessment of the status of the ecosystem. This was followed by the creation of the Trilateral Wadden Sea Plan in 1997 which applies to the entire cooperation area and has the aim to conserve the quality as well as the diversity of the habitats and the species that form this dynamic ecosystem. It contains agreements for a joint policy of nature protection as well as activities and projects. It covers agricultural and cultural aspects and even includes areas which are outside of the trilateral cooperation area. Most of the human activities such as agriculture, fishery, hunting, dredging and dumping, sand and clay extraction, tourism, shipping and energy (wind, gas, oil) are regulated following the principle of sustainable use of the wetland area. Currently, almost the entire Wadden Sea is under environmental protection. The Danish parts are mainly protected through their status as Natura 2000 sites and a Natura 2000 management planning process is under implementation. Moreover, the German as well as the Danish parts are mainly protected as National Parks, excluding large river mouths that are important for navigation. The Dutch part is protected under a complex network of protection measures. As of 26th June 2009 the parts of the Wadden Sea in the German federal states of Schleswig-Holstein and Lower Saxony as well as the Dutch part of the Wadden Sea have the combined status as UNESCO-World Heritage Site. While the area has not been formally designated as a transboundary Ramsar Site, most of the area has been listed as internationally important under the Ramsar Convention. The following eight Ramsar Sites are included in the List: Vadehavet (Wadden Sea) in Denmark, Schleswig Holstein Wadden Sea and adjacent, Wattenmeer, Elbe-Weser-Dreieck, Jadebusen & westliche Wesermündung, Ostfriesisches Wattenmeer & Dollart and Hamburgisches Wattenmeer in Germany and the combined site Waddeneilanden, Noordzeekustzone & Breebaart as well as Waddenzee (Wadden Sea) in the Netherlands.

# IX. Rhine River Basin[17]

132. The Rhine connects the Alps to the North Sea. It is 1,230 km long. The river catchment area covering some 197,100 km² spreads over nine states.

Table 10
**Area and population in the Rhine Basin [**

| *Country* | *Area in the country (km$^2$)* | *Country’s share %* | *Population* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Switzerland | 27 930 | 14 | 5 220 000 | 187 |

[17] Based on information provided by International Commission for the Protection of the Rhine (ICPR)

| | | | | |
|---|---|---|---|---|
| Liechtenstein | 200 | 0.1 | | |
| Austria | 2 370 | 1.2 | 580 000 | 244 |
| Germany | 105 670 | 53.6 | 37 120 000 | 351 |
| France | 23 830 | 12 | 3 480 000 | 146 |
| Luxembourg | 2 530 | 1 | 580 000 | 229 |
| Belgium | 800 | 0.4 | | |
| Netherlands | 33 800 | 17 | 11 600 000 | 343 |
| **Total** | **197 100** | | **58 000** | |

133. The source area of the Rhine lies in the Swiss Alps. From there the Alpine Rhine flows into Lake Constance (see the separate assessment). Between Lake Constance and Basel, the High Rhine largely forms the frontier between Switzerland and Germany. North of Basel, the Franco-German Upper Rhine flows through the lowlands of the Upper Rhine (see the assessment of the Upper Rhine Ramsar Site). The Middle Rhine, into which the Moselle flows in Koblenz, starts at Bingen. In Bonn, the river leaves the low mountain regions and becomes the German Lower Rhine. Downstream of the German-Dutch border, the Rhine splits into several branches and, together with the R. Maas, it forms a wide river delta. The Wadden Sea adjacent to Lake IJssel fulfils an important function in the coastal ecosystem (see the assessment of the Wadden Sea Ramsar Site).

## Hydrology and hydrogeology

134. From the climate perspective and under consideration of orographic effects, the River Rhine basin can be subdivided in three main climatic regions, namely the pre-Alps and Alps (the catchment upstream of Basle), the low-mountain ranges and uplands (between Basle and Cologne), and finally the German and Dutch lowland (downstream of Cologne). As a consequence, the discharge regime in River Rhine in the summer months is dominated by melt water and precipitation runoff from the Alps and by precipitation runoff from the uplands in winter.

135. Further downstream, the contribution from the uplands becomes predominating, so that over the whole year the discharge is usually well balanced.

## Pressures

136. The River Rhine is the most intensively used watercourse in Europe. It is an important shipping route - eight hundred km of the Rhine between Rotterdam and Basel are navigable. Major cities and industrial areas are located on the banks of the River Rhine and its tributaries.

137. Moreover, the Rhine provides drinking water for a total of 30 million of the 58 million people living in the basin. For drinking water purposes, several large water treatment plants abstract raw water directly (Lake Constance) or via riverbank filtration, or they abstract Rhine water filtered through the dunes.

138. The Rhine and a number of its tributaries contain sediments some of which are considerably contaminated by industrial and mining activities in the past. As a result, during strong flooding or dredging activities, for navigation purposes for instance, re-mobilised sediments may cause temporary pollution.

139. Numerous hydraulic measures in the past have resulted in vast hydro-morphological modifications which have greatly impacted the ecological function of the Rhine. These effects include, among others, the almost complete restriction of river dynamics, the loss of alluvial areas, the impoverishment of biological diversity and obstacles to fish migration. In addition, rectification and river bank stabilisations have shortened the course of the river and, along longer sections, the construction of dikes cuts the floodplains off from river dynamics. As a result there is today a deficiency of natural structural variety and of important structural elements required for natural species diversity and intact biocoenosis.

140. Downstream from Iffezheim (Upper Rhine) to the North Sea estuary, the Rhine flows freely without obstacles. For navigation purposes, hydropower generation and flood protection purposes, the water levels of the main stream of the Rhine are regulated and numerous water constructions, such as sluices, barrages and dikes, have been built. Between the outlet of Lake Constance and Iffezheim, there are 21 barrages in the main stream or bypasses serving the purpose of hydropower generation which do not, or only to a limited extent, grant river continuity for fish, biota and sediments. In the upper reaches of the Rhine (Alps and their foothills) there are numerous reservoirs and barrages serving power generation; during power consumption peaks, the hydropower plants often regulate the water supply according to the need for power supply (“hydropeaking operation”). That means that flora and fauna are not only impacted by interference with river continuity but also by the surge effects of hydropeaking operation.

141. Furthermore, there are more than 100 barrages (often combined with hydropower plants and shipping) with barrage locks in the Neckar, Main, Lahn and Moselle tributaries.

142. The marked mining activities in the Rhine catchment area, particularly in the Moselle-Saar area, in the Ruhr area and the open-cast lignite mining areas along the left bank of the German Lower Rhine are equally relevant. Even though mining activities have decreased considerably and will continue to do so, their effects still remain in many places.

## Status and transboundary impacts

143. As a result of the investments of the states, municipalities and industry in the 200,000 km² catchment area, water quality has considerably improved. More than 96 % of the 58 million inhabitants of the Rhine catchment are today connected to wastewater treatment plants and many industrial sites dispose of modern wastewater treatment plants. The effects of air-borne diffuse water body pollution or pollution eroded from the soil continue to be problematic. Phosphorous and above all nitrogen contents in excess affect the biological quality of water bodies, particularly in the marine environment (Dutch coast, Wadden Sea).

144. In the Rhine catchment, the following pollutants are locally or widely spread in excess of the threshold values called environmental quality standards (EQS):

- Heavy metals such as zinc and copper e.g. from buildings and roads, as well as cadmium
- Polychlorinated biphenyls (PCB), e.g. from transformers and hydraulic fluids and polycyclic aromatic hydrocarbons (PAH), e.g. from combustion plants and which are measured everywhere in the Rhine
- Bentazone, dichloroprop, tributyltin, pentachlorobenzene, diurone, brominated diphenylethers, hexachlorobutadien. These substances are, among others, plant protection agents, conservation agents or industrial chemicals.

145. In 12 % of the water bodies of the main stream of the Rhine the chemical status is good, In 88 % it is not good. In most cases, the cause is PAH concentration exceeding the environmental quality standards.

146. On the whole, the quantitative groundwater status in the Rhine catchment can be said to be good, which means that there is no abstraction in excess. Due to draining measures, the status in the brown-coal mining area along the Rhine is bad.

147. Apart from certain groundwater bodies with a bad status, the chemical status of groundwater bodies is largely good. The reasons for the classification "bad status" are the nitrate pollution due to fertilization in agriculture and intensive livestock keeping as well as inputs of plant protection agents.

148. Biological inventories of the state of flora and fauna in the Rhine have been carried out, which were subsequently compared to earlier investigations.

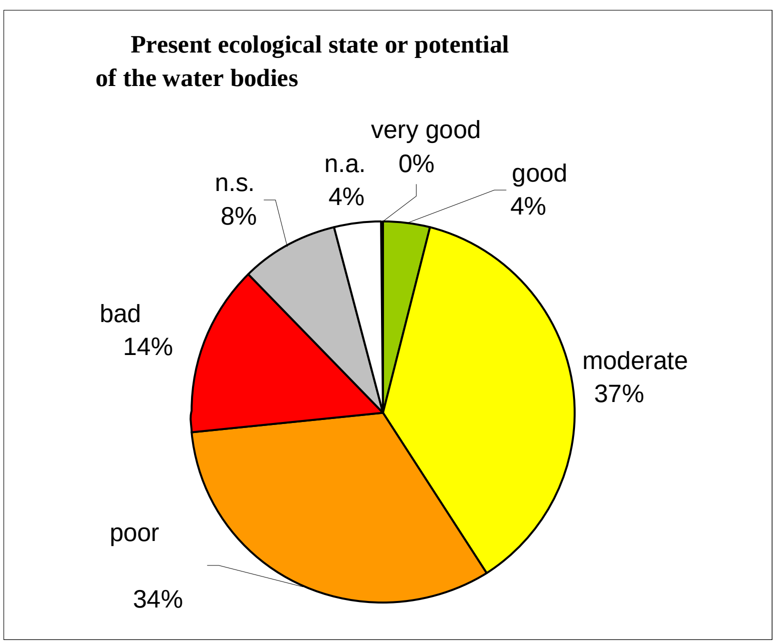
149. According to these inventories the fish species composition in the Rhine is almost complete: Together with the three existing trout varieties (lake trout, sea trout, brook trout) and non-indigenous species, 67 fish species were detected. Thus, all historically identified species except for the Atlantic sturgeon have returned. Improved river continuity and the protection of habitats attract more and more migratory fish returning from the sea for reproduction.

150. The macrozoobenthos (invertebrates living on the river bottom) in the Rhine is closely linked to the substance pollution of the river water. Due to improved water quality it has recovered to such an extent that 560 species have been inventoried. Many species characteristic of the river which were extinct or considerably diminished in the Rhine have returned. However, many species are still absent.

151. On the other hand, invasive species - species which have immigrated to the Rhine catchment - often spread at the expense of the indigenous fauna. Apart from numerous invertebrate species, even some fish species, among others from the Black Sea area have been detected.

152. All in all, 36 water plant species (macrophytes) and 269 fixed diatom species (phytobenthos) have been inventoried in the Rhine.

**Figure 2: Present ecological status or potential of the water bodies of the main stream of the Rhine based on the number of water bodies**
Source: Rhine River Basin Management Plan



## Response measures

153. In 2005, the most important management issues for the whole Rhine basin have been defined in the management plan report according the WFD[18]:

- “Restoration”[19] of biological river continuity, increased habitat diversity;
- Reduction of diffuse inputs interfering with surface waters and groundwater (nutrients, pesticides, metals, dangerous substances from historical contamination and others)
- Further reduction of classical pollution of industrial and municipal origins
- Harmonisation of water uses (navigation, energy production, flood protection, regional land use planning and others) with environmental objectives;

154. Migratory fish are at the same time pilot and indicator species for the living conditions of numerous other organisms.

155. As far as the Lake Constance lake trout is concerned, which is the indicator species for the region of the Alpine Rhine and Lake Constance, a separate Lake Trout Programme is under implementation.

156. The states in the Rhine catchment strive to progressively restore river continuity in the main stream of the Rhine as far as Basel and in certain programme waters.

157. The „Master Plan Migratory Fish Rhine” has been drafted with a view to achieving this target[20] : In order to build a self-sustained stock of salmon and lake trout, access to a maximum number of identified spawning and juvenile habitats in the Rhine catchment must be restored or these habitats must be re-vitalised. Additionally, among others the possibilities of upstream migration must be improved. On the whole, with these measures a total of more than 1,000 ha of spawning and juvenile habitats are supposed to be opened in the Rhine catchment area.

158. The most important fields of action in the main stream of the Rhine and major tributaries will be:

- Improve fish migration at the Haringvliet sluices and at the closure embankment of the Lake IJssel
- The two dams in the Upper Rhine upstream of Gambsheim (Strasbourg by 2015, work in Gerstheim to begin before 2015 in order to open the way into the Elz-Dreisam system in the Black Forest)
- Improve existing fish passages at 4 dams on the High Rhine, a new construction is planned for the Rheinau dam
- Several big dams in the navigable tributaries Moselle (19), Main (6), Lahn (20), Neckar (3), etc.

159. In addition, several hundreds of individual measures will be implemented at smaller barrages in suitable tributaries where the most spawning habitats are found.

[18] Internationally Coordinated Management Plan for the International River Basin District of the Rhine, , International Commission for the Protection of the Rhine, December 2009

[19] As far as possible, river continuity is to be restored.

[20] Master Plan Migratory Fish Rhine, International Commission for the Protection of the Rhine, Report no. 179, www.iksr.org

160. Species diversity may be increased by increasing structural diversity in the river bed and on the river banks. Water maintenance must be environmentally compatible. These measures will contribute towards opening up further habitats for the flora and fauna living in the water, on its banks and in the floodplains. By 2015, various measures for opening up habitats and for increasing structural diversity in the riverwill have been implemented along the main stream of the Rhine, in the old bed of the Rhine, along the big navigable tributaries Moselle, Main, Neckar and along R. Lippe, as well as in many smaller waters in the Rhine catchment.

1161. To improve water quality, 96 % of the about 58 million people living in the Rhine river basin district have so far been connected to a wastewater treatment plant. Many big industrial plants or chemical parks (a considerable part of worldwide chemical production is located in the Rhine catchment area) have their own wastewater treatment plants which are, at the very least, state-of-the-art facilities. As a result of considerable investment in the construction of wastewater treatment plants in all states, point sources now contribute less often to classical pollutant contamination than in the past. The pollutant and nutrient contamination currently being observed is largely of diffuse origin. Agriculture and municipalities have already made efforts to reduce these discharges.

162. Mainly with a view to improve the marine environment, a reduction of the load of total nitrogen by 15 to 20 % as a result of reduction at source is targeted. Measures already implemented will be taken into account. A reduction of input by 10 to 15 % by the first cutoff year according to WFD, 2015, is considered to be achievable.

163. Largely, zinc and copper inputs are of diffuse origin. For some applications, environmentally friendly alternatives are imaginable (e.g. construction sector, car components, antifouling, treatment of animal’s hoofs). No further direct PCB inputs are known. Former PCB pollutions still exist in water sediments and may be released during flood surges or dredging. These pollutions must be rehabilitated to the extent possible. Since PAH mainly get into waters as diffuse air-borne pollution, no considerable improvement is expected by 2015 for this group of substances and thus for the chemical status of the water bodies concerned.

## Future trends

164. With the climate change, the winters are expected to become more humid, while summers will presumably be drier. Regionally, the amount of precipitation falling in a short time may be greater than today. Among other things, for the Rhine this means that runoff levels and water temperature may change. Climate change may impact flood protection, drinking water production, industrial activities, agriculture and nature. In the long run, the increase in temperature will lead to rising sea levels. Since 2007, the ICPR is recording the impact of eventual climate change on the water household and on water temperatures of the Rhine.

165. According to present knowledge, air temperature has risen by about 1 °C during the past 100 years and precipitation in the Rhine catchment has increased. The glaciers of the Alps continue to retreat. There is a tendency towards more humid winters and drier summers accordingly impacting water discharge. The Rhine water temperature has risen by about 1°C to 2.5°C but it is also impacted by cooling water discharges.

166. Sustainable development of the river should be the basis for future policies for international rivers. That means the promotion of a balanced use of the river, respecting all interests and interest groups, now and in future. Precaution and prevention are the most important basic principles for river basin management.

167. During the years to come, the ICPR will work on harmonized adjustment strategies with respect to floods and draughts, water temperature, water quality and ecology in the Rhine catchment. These strategies will be part of the second international Management Plan.

# X. Lake Constance[21]

168. Lake Constance, which belongs to the Rhine basin, is the second largest pre-Alpine European lake and serves as an important drinking water supply for 4 million people. A major tributary to Lake Constance is the Alpine Rhine with its sub-basin in Italy, Switzerland, Liechtenstein and Austria.

169. The lake basin is situated in the Molasse basin of the northern Alpine foreland and was mainly formed by water and ice activity during the last Quaternary glaciation period more than 15,000 years ago. The lake basin area of about 11,000 $km^2$ (~20 times the lake surface) covers the territories of the five European countries: Germany (28%); Switzerland, Liechtenstein and Italy (48%); and Austria (24%). With an area of 572 $km^2$ and a total volume of 48.5 $km^3$, Lake Constance lies 395 m above sea level. Its two major parts are the Upper Lake Constance (472 $km^2$, 47.6 $km^3$, max. depth 253 m, mean depth 101 m), shared by Germany, Austria and Switzerland, and Lower Lake Constance (62 $km^2$, 0.8 $km^3$, max. depth 40 m, mean depth 13 m), shared by Germany and Switzerland. More than 75% of the water inflow originates from the Alps, mainly through the tributaries Alpine Rhine (Alpenrhein) and Bregenzerach. The lake has a water retention time of 4.3 years.

170. The countries bordering Lake Constance cooperate in the International Commission for the Protection of Lake Constance since 1959. As the lake is part of the river Rhine basin, the Alpine Rhine-Lake Constance area of operation is one out of nine such areas in the basin.

171. The phytoplankton succession typically shows a spring bloom followed by the "clear water" phase with very low phytoplankton abundance due to zooplankton grazing. Diatoms contribute up to 90% of the phytoplankton biovolume in spring. Phytoplankton, bacteria and crustaceans are the most important contributors of biomass. During summer, zooplankton is the main food source for most fish in Lake Constance. About 30 species of fish contribute to the fauna of Lake Constance. The dominant species are whitefish (*Coregonus lavaretus L.*) and perch (*Perca fluviatlis L.)* – contributing to 90% of total commercial fishing yield (1032 tons, annual mean for the period 1995–2004).

172. Lake Constance is certified by the Ramsar Convention as a habitat of international importance especially for water and wading birds. It is an intensively monitored hard-water lake with low-phosphorus content. The Upper Lake is almost oligotrophic: phosphorus levels <10 µg/l since 2005). Originally an oligotrophic water body, eutrophication started to threaten the lake in the late 1950s and remarkably affected the species composition of the biota. Starting in the early 1980s, phosphorus concentrations strongly declined, and overall water quality improved. This was due to reduced nutrient loads (more than €4 billion have been invested to improve sewage treatment).

[21] Based on information in the Rhine River Basin District working area Alpine Rhine / Bodensee, International coordination of the management plans and programmes of measures in implementation of the EU Water Framework Directive (2009) and the first Assessment of Transboundary Rivers, Lakes and Groundwaters

173. In recent times, the pressures by rising population figure and industrial and agricultural activities may deserve concern. Today, some 60% of shore and shallow-water zones are characterized as deviating from the natural state, and therefore a main focus is on ecological improvement by shoreline restoration. For this purpose, the International Commission for Protection of Lake Constance has initiated an action programme “Shore-water and Shallow-water Zone” to restore natural shorelines step by step on the basis of a renaturation guidance, commonly established in 2009. The precise renaturation potential and possible measure

174. The biological quality of tributaries discharging into the lake varies from unpolluted headwater rivers to slightly polluted lower reaches. Hydromorphological changes have been severe in these areas, as canalization and artificial riverbeds and banks are common. Recently, revitalization has been undertaken in the floodplains of the Alpine Rhine and several other tributaries of Lake Constance.

175. With regard to the Lake Constance trout and other migratory fish the International Conference of Plenipotentiaries for Lake Constance fishery has started a conservation programme in 2010. The objective is to protect and increase the trout population in the lake and its tributaries.

176. Lake Constance is also facing climate change with increasing winter temperatures and higher precipitation in the form of rain. The summers will be dryer and hotter resulting in lower water levels and changes in the littoral zone. This climatic change might be accompanied by an increasing number of exotic species in the future, which may threaten indigenous biota.

# XI. Upper Rhine / Oberrhein Ramsar Site (France, Germany)[22]

*General description of the wetland*

177. The Ramsar Site “Rhin supérieur/Oberrhein” (designated 2008) extends on both sides of the Rhine over a distance of 190 km from Village-Neuf (France)/Weil-am-Rhein (Germany) in the south to Lauterbourg (F)/Karlsruhe (G) in the north. At its widest point, downstream of the incipient meanders, it is 11 km wide. It stretches over a surface area of 47,500 ha: 22, 400 ha on the Alsace side and 25,100 ha on the side of Baden-Württemberg. Its boundaries coincide with the sites designated under the Birds and Habitats Directives (Natura 2000) on both sides of the river.

178. This densely populated Ramsar Site follows the contours of the Rhine’s natural floodplain and has all the characteristics typical of an alluvial plain: the river itself, its tributaries, groundwater discharging from springsand alluvial plains. Part of the area is covered by alluvial forests composed of softwood (Salici-Populetum) and of hardwood (Querco-Ulmetum) that have lost some of their typical features as a result of manmade changes to the hydrological system (canalization of the river during the 20th century). Beyond the forests, the wet meadows, which once covered a large area, have shrunk as land has been converted for agriculture.

*Main wetland ecosystem services*

179. The plains of the Upper Rhine are home to the largest groundwater resource in Europe used for water supply (50 billion m3). They provide freshwater to 80% of the region’s population, in addition to supplying 50% of the water used by industry and 25% of

[22] *Sources*: www.ramsaroberrhein-rhinsuperieur.eu, www.ramsar.org

the water used for intensive agricultural irrigation. This abundant resource has contributed to the economic development of the region and shaped the industrial and agricultural landscape. In addition, the Rhine plays a crucial role in flood control throughout the length of the Rhine and particularly downstream of the area that has been channelled.

*Cultural values of the wetland area*

180. The Upper Rhine region has long been a crossroads for trade and communications. It has played an important role in European history and geopolitics, literature, technical innovation, and political and economic development. The region is united by a common Rhine cultural and humanist heritage (philosophers, writers, religious personalities, etc.). Entire centuries have been shaped by thinkers from the universities of Basel, Fribourg en Brisgau and Strasbourg. The region was occupied by the Romans who left in their wake Gallo-Roman towns and fortress cities (Strasbourg is over 2000 years old); it was also ruled by the Habsburgs for several centuries. Today, the European Parliament and Council of Europe, which have chosen to make Strasbourg their base, reflect profound changes in the attitudes of a people who were once at war with one another. The Alsatian and “Badois” (Badischer Dialekt) dialects, both of which have their origins in the German language, offer a common point of reference resulting in a common understanding that goes well beyond the differences between the two countries.

*Biodiversity values of the wetland area*

181. The Upper Rhine is home to a tremendous wealth of species diversity thanks to the presence of dormant and white waters, alluvial forests, cultivated fields and meadows: 9,000 plants, 440 species of Lepidoptera (moths and butterflies), 50 species of Orthoptera (the order including e.g. grasshoppers and locusts), 52 species of Odonata (order of insects including e.g. dragonflies), 250 wild bees, 40 indigenous fish, 23 amphibians, 260 birds, and 49 mammals. 78 of those species are listed under the EU’s Habitats Directive 92/43/CEE. It is a breeding ground for large migratory fishes: Atlantic Salmon (Salmo atlanticus), Trout (Salmo trutta), the Allis Shad (Alosa alosa) and the Sea Lamprey (Petromyzon marinus). It is also an important wintering ground for water birds: 60,000 individuals come to the region in January every year, including 10,000 Mallards (Anas platyrhynchos), 5,000 Gadwalls (Anas strepera), 17,000 Tufted Ducks (Aythya fuligula), 1,300 Common Goldeneyes (Bucephala Clangula) and 25,000 Blackheaded Gulls (Larus ridibundus).

*Pressure factors and transboundary impacts*

182. The Rhine Delta has been significantly reduced and disconnected from the river as a result of development activities (canalization, hydropower development) and many of its characteristic features have disappeared. Agriculture, residential areas, and commercial and industrial activities have developed in much of the area, bringing with them transport infrastructure. This has resulted in the fragmentation and transformation of the landscape. Today, the alluvial gravel deposits are heavily exploited.

183. In addition, pressure resulting from growing demand for leisure activities along the Rhine sometimes creates local problems. Water-based activities along the banks of the Rhine itself or in its former tributaries disturb the wildlife.

*Transboundary wetland management*

184. In light of the important history of the area, the authorities in the Upper Rhine region engaged in transboundary cooperation initiatives very early on: the Tripartite Intergovernmental Conference and the Rhine Council bring together all elected members of the Alsace and Baden Württemberg governments. Similarly, a Ramsar Site steering committee has been in place for several years; it is responsible for coordinating exchanges

and sharing of information on administrative and regulatory practices relating to the management of the natural environment. A series of cross-border activities are being implemented: the Integrated Rhine Programme (IRP), the renewal of concessions for hydroelectric dams, the installation of fish ladders on dams, a programme to revive the Old Rhine (Inter-regional programme), the restoration of Rhine ecosystems (various LIFE and LIFE+-projects), the creation of an association for the promotion of sustainable cross-border tourism (Association Rhin Vivant), and joint educational programmes (Interreg programme).

# XII. Moselle sub-basin and Saar sub-basin[23]

185. The river basin of the Moselle and its largest tributary, the Saar, is one of nine sub-basins of the international River Basin District of the Rhine which makes up about 15 % of the Rhine River Basin District is shared France, Luxembourg, Germany (Saarland, Rhineland-Palatinate, North Rhine-Westphalia) and Belgium (Wallonia region).

Table 11
**Area and population in the Moselle and Saar sub-basin [**

| *Country* | *Area in the country (km$^2$)* | *Country's share %* | *Population* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Belgium | 767 | 2.7 | 38 000 | 50 |
| France | 15,360 | 54.3 | 1 925 000 | 125 |
| Germany | 9,637 | 34.1 | 1 981 000 | 206 |
| Luxembourg | 2,521 | 8.9 | 399 000 | 158 |
| **Total** | **28,286** | | **4 343 000** | **154** |

*Note:* There are a total of 93 towns with more than 10,000 inhabitants in the sub-basins, four of which have more than 100,000 inhabitants (Nancy, Metz, Saarbrücken, Trier)

## Hydrology and hydrogeology

186. The Moselle originates in the Vosges region of France, and flows into the Rhine 520 km later in Koblenz (Germany). Its main tributaries are the Saar (length 227 km, basin area 7,431 km$^2$), the Sauer (173 km, 4,234 km$^2$) and the Meurthe (161 km, 2,900 km$^2$).

187. The precipitation in the river basin ranges from 600 mm in the middle and lower Moselle region to 1,800 mm/a in the Vosges (average for the whole basin 900 mm). Taking into account evapotranspiration, the average annual outflow (surface run-off and groundwater recharge) ranges between 550 mm/a in France and 335 mm/year in Saarland.

188. Some 600 waterbodies have been identified according to the EU Water Framework Directive, including around 30 that belong to two or three different countries. A large proportion of the watercourses in the river basin of the Moselle and the Saar remain in a natural state (87 %), despite extensive anthropogenic interventions, and only 13 % are classified as heavily modified (Heavily Modified Water Bodies - HMWB).

[23] Based on information provided by the International Commission for the Protection of the Moselle and the Saar (ICPMS)

189. In the case of groundwater, variations in the definitions applied have led to country-specific differences in the quantity and size of groundwater bodies. Of the 71 groundwater bodies identified in total in the Moselle-Saar sub-basin, 26 is located in the vicinity of a border.

## Pressures[24]

200. Around half of the river basin is used for agricultural purposes, with equal shares of arable land and grassland. Vines are grown extensively on the slopes above the Moselle in Germany and Luxembourg, as well as along the Saar in Rhineland-Palatinate. Around one-third of the area is wooded.

201. The countries in the sub-basin carried out a joint analysis as a part of implementing the WFD, which has highlighted the following six key transboundary problem areas:

202. Water use along the Moselle and Saar, coupled with local regional planning policy, is not always consistent with the environmental objectives of the WFD, particularly in the areas of navigation, energy generation and flood protection.

203. The biological continuity of the Moselle and Saar is not guaranteed, which impairs fish migration. Common forms of pollution – particularly nutrients (nitrogen and phosphorus) – and diffuse discharges adversely affect the status of surface waters. Levels of pollution with hazardous substances remain too high in certain parts of the river basin. Groundwater is impaired by diffuse pollution (plant protection agents, nitrate, contaminated sites and metals). The ecological equilibrium of the waters is impaired by mining (coal and iron ore basins).

204. Since many decades, the Moselle and the Saar have been developed into major shipping lanes along a large proportion of their length. This has significantly transformed the habitats of flora and fauna. In particular, the 28 locks on the Moselle and a further 6 on the Saar represent a major barrier to fish migration. These physical and biological changes also influence the oxygen balance and hence the water quality.

205. The so-called common pollutants, whether from point or diffuse sources, originate primarily from discharges from wastewater treatment plants and from agriculture.

Table 12
**Number of wastewater treatment plants and annual discharges:**

| | *Number of wastewater treatment plants* | | | | *Annual load (t)* | | |
|---|---|---|---|---|---|---|---|
| | *> 2 000 inhabitants* | *> 10 000 inhabitants* | *> 100 000 inhabitants* | *Total* | *COD* | *Nitrogen total* | *Phosphorus total* |
| France | 80 | 43 | 3 | 126 | 4 912 | 1 120 | 55 |
| Luxembourg | 28 | 9 | 1 | 38 | 3 501 | 1 209 | 104 |
| Saarland (DE) | 30 | 29 | 2 | 61 | 4 900 | 1 427 | 142 |
| Rhineland-Palatinate (DE) | 76 | 39 | 1 | 116 | 1 990 | 580 | 88 |
| NorthRine-Westphalia | 2 | 0 | 0 | 2 | 20 | 4.5 | 0.6 |

[24] For details, please refer to the international river basin management plan, 2009

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (DE) | | | | | | | |
| Wallonia region (BE) | 1 | 1 | 0 | 2 | 76 | 27 | 3 |

206. The following main pressures affect the groundwater of the sub-basin and influence its quality (ranked in order of importance):

- Nitrate pollution
- Pollution with plant protection agents
- chloride and sulphate
- Chlorinated solvents

207. Pollution with heavy metals, polychlorinated biphenyls (PCB) and polycyclic aromatic hydrocarbons (PAH) has been detected across the entire area.

208. Chloride from anthropogenic discharges also continues to pose a major problem in the Moselle downstream of the Meurthe. The lower reaches of this Moselle tributary are affected by salt discharges (or more precisely, calcium chloride discharges $CaCl2$) from the Lothringian salt industry (soda plants).

209. Mining activities have been closed down in both the coal basin and in the iron ore basin. Mining has permanently disturbed and altered the ecological equilibrium of surface waters and groundwater, causing a number of cross-regional problems which will need to be tackled in the long term.

210. The Saar in particular is affected by discharges of industrial wastewater from mining and from decommissioned mines, leading to high concentrations of chloride and other priority substances. Mining-related changes to the soil and subsoil and the discontinuation of mining directly impair the quality of groundwater in the iron ore and coal basin, which in turn affects the water supply to the population at local level.

## Status and transboundary impacts

211. The assessment of the status (also the projected status for 2015) was carried out in close transboundary harmonisation and coordination, particularly with regard to waterbodies in the vicinity of national borders. Despite some differences in assessment methods, particularly with regard to biological aspects, harmonisation was facilitated through discussions between experts and separately documented in the international River Basin Management Plan.

212. In the entire Moselle-Saar sub-basin, based on the data from surveillance monitoring (2007), only 118 surface water bodies out of a total of 620 or 19 %, exhibit a good status, that is, both the chemical status and ecological status are at least "good". This is due to both a bad chemical and ecological status, as only 261 waterbodies (i.e. 43 %) exhibit a good chemical status and 35 % a good ecological status. Polycyclic aromatic hydrocarbons (PAHs) are primarily responsible for the bad chemical status and exceed the environmental quality standards at many monitoring sites. If PAHs were to be disregarded, 85 % of surface waterbodies would exhibit a good chemical status.

213. In terms of quantity, 97 % of a total of 71 groundwater bodies exhibit a good quantitative status. In qualitative terms, 65 % of groundwater bodies exhibit a good chemical status, while 35 % of groundwater bodies are classified as having a bad status due to diffuse pollution with nutrients (nitrate) and plant protection agents.

## Response measures and transboundary cooperation

214. The countries sharing the sub-basins collaborate in the International Commissions for the Protection of the Moselle and the Saar (ICPMS) to ensure the sustainable management of these two rivers. This collaboration also serves to coordinate implementation of the European Water Framework Directive[25] (WFD) throughout the river basin and the RBMP was drawn up documenting the implementation and its international coordination[26].

215. In the Moselle-Saar sub-basin, the sometimes complex transboundary harmonisation of measures and programmes of measures (such as the Moselle-Saar Action Programme 1990-2000) to ensure consistent approaches has the benefit of a long tradition under the umbrella of the ICPMS, supported by its permanent secretariat.

216. Close collaboration between the areas of water management, land use planning, agriculture and forestry makes it possible to develop measures related to water use that fulfil several objectives simultaneously.

217. The basic measures to improve the hydromorphology of watercourses and reduce pollution are derived from the relevant European Directives and corresponding legislation of the Member States. Technical modifications to the Moselle and Saar and many of their tributaries have considerably altered the aquatic living conditions. Measures to improve biological continuity essentially comprise the conversion or demolition of weirs and other obstacles to migration, the construction of fish ladders, guaranteeing the required minimum outflow, and improving habitats. To this end, the ICPMS drafted an inventory of biological continuity in the river basin of the Moselle and Saar in 2010.

218. The pressures from human settlements are to be reduced by a raft of measures on buildings, residential areas, wastewater collection systems and wastewater treatment plants. Improved rainwater management, achieved by building new residential areas with separate sewer systems and by the construction of storm water storage tanks in combined sewer systems, will help to further optimise the purification level of wastewater treatment plants. Public education campaigns are being conducted to raise awareness of the problem of waste disposal via the sewer system.

219. Diffuse pollutants are predominantly due to agricultural practices, but regional and local authorities and private individuals also contribute. One important measure is therefore to provide targeted advice to all user groups on good practices. Diffuse agricultural pollution is also tackled by aiming at optimizing production factors and their sustainability, for example through improving fertiliser management. Another objective is to avoid or reduce the discharge of nutrients and plant protection agents by means of sustainable land management through extensification measures, extended crop rotation and intercropping, as well as soil cultivation measures including environmentally sound soil management to prevent erosion and minimise run-off.

220. Measures to prevent discharges of plant protection agents from agricultural land into rivers have been jointly developed, outlined and evaluated with regard to their effectiveness by the water management and agricultural authorities of all ICPMS Parties. Here too, measures are needed to advise and educate the relevant players, including private consumers. Funding from the European Agricultural Fund for Rural Development

[25] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

[26] For details, the Moselle and Saar River Basin Management Plan should be referred to at www.iksms-cipms.org

(EAFRD) will be used to specifically to encourage the introduction or retention of environmentally sound agricultural management and cultivation practices.

221. PAHs and PCBs are widespread in the Moselle-Saar river basin. Levels of PCB contaminations in suspended matter have been monitored since the early 1990s as part of the international ICPMS monitoring programme, and in 2004 a special monitoring programme with regard to PCB in suspended matter and fish, was devoted to this aspect.

222. It has become evident that it will not be possible to reduce PAH from diffuse sources sufficiently to meet the environmental quality standards (EQS) by the specified deadline. As these discharges are not solely a water management responsibility, and sometimes extend far beyond the national framework, an EU-wide response is needed.

223. For as long as the transboundary mine workings remain flooded, estimated to last 10 years, and thereafter, the development of groundwater levels and quality will need to be monitored by means of a suitable monitoring network. Initial expert reports on this issue have been commissioned. As a final decision on the future form of mine drainage has yet to be reached, and a number of alternatives are still under discussion, it is impossible to predict exactly how the mine workings are to be flooded, and when long-term stability is likely to set in.

224. The monitoring networks for surface waters in place since the mid-1960s have been adapted in line with the requirements of the WFD to obtain a coherent and comprehensive overview of waterbody status. The international monitoring network of the ICPMS currently comprises some 50 monitoring sites. During the course of implementing the Water Framework Directive, a monitoring network for groundwater comprising a total of 401 monitoring sites started operation.

## Future trends

225. Due to their chemical status, only 24 % of bodies of surface water will achieve a good status by 2015 through the implementation of the programmes of measures accompanying the 2010-2015 river basin management plan. However, the proportion of waterbodies with a good ecological status will improve significantly to 56.5 %. In the Moselle-Saar sub-basin, it is expected that 99 % of groundwater bodies will achieve a good quantitative status by 2015, and 75 % a good chemical status.

226. The rise in average air temperatures, the clearest indicator of climate change, will have a tangible influence on the hydrological cycle. Surface waters and groundwater will be affected by changes in the precipitation and evaporation regime. Experts predict that in addition to the long-term changes in current average conditions, annual extremes will also increase. Changes and impacts are expected in key sub-aspects of water management, such as:

- Flood protection, due to the changes in the level, duration and frequency of flood discharges, and the resulting changes in the risk of damage
- Water supply, due to changes in groundwater recharge, groundwater properties and groundwater management and also, in some cases, the management of reservoirs
- Water protection, due to changes in the seasonal discharge and temperature conditions affecting the balance of materials in rivers and lakes as well as the biocoenosis
- Waterbody development, due to changes in the dynamics of watercourses and lakes, their morphological conditions, their thermal regime and their ecosystems, and

- The use of waters, especially due to changes in management techniques for flood and drinking water reservoirs, reservoirs for raising low water levels, hydropower use, the navigability of waters, cooling water use, and agricultural irrigation.

227. The Interreg IV A project FLOW MS (Flood and Low Water Management Moselle - Saar) was launched in early 2009 under the umbrella of the ICPMS. The project, which is scheduled to run for five years with a budget of 3.4 million euro, is 50 % co-financed from ERDF[27] funds. It aims to improve precautionary flood protection, to reduce the potential damage associated with flooding and advance low water management in the river basin of the Moselle and the Saar. Within this framework, the consequences of climate change on the genesis of flooding and low water will be investigated on a transboundary basis. The results of existing climate scenarios, and those currently under development, serve as the basis for analysis using available hydrological balance models (such as LARSIM[28]).

228. The ICPMS will continue to function as an international coordination platform for the implementation of the WFD and the European Flood Risk Management Directive[29] of 2007. In this context, the ICPMS Flood Action Plan, which was adopted in 1998 and which outlines measures up until 2020, will be incorporated into the flood risk management plan under the European Flood Risk Management Directive.

**Table 13 Land use/land cover and selected anthropogenic pressures in the Moselle/Saar sub-basin**

| | *Belgium* | | | *Germany* | *Luxembourg* | *France* | *Total, Moselle/ Saar* |
|---|---|---|---|---|---|---|---|
| | *Wallonia* | *Saarland* | *Rhineland-Palatina* | *NorthRine Westphalia* | | | |
| *Surface area (km2)* | 767 | 2 569 | 6 980 | 88 | 2 521 | 15 360 | 28 286 |
| *Population: inhabitants x 1 000* | 38 | 1 066 | 855 | 4 | 399 | 1 981 | 4 343 |
| *Communities* | 17 | 52 | 792 | 2 | 114 | 1 680 | 2 657 |
| *Towns > 100 000 inhabitants* | 0 | 1 | 1 | 0 | 0 | 2 | 4 |
| *Towns> 10 000 inhabitants* | 2 | 39 | 18 | 0 | 4 | 30 | 93 |
| *Forested area* | 38% | 33% | 46% | 51% | 35% | 30% | 35% |
| *Agricultural grassland* | 40.8% | 15% | 18% | 43% | 25% | 20% | 20% |
| *Agricultural arable land* | 17% | 15% | 19% | 1% | 24% | 27% | 23% |
| *UGBN/ Livestock units (x 1 000)* | 60 | 75 | 215.4 | 5 | 150 | 400 | 961 |

[27] ERDF - European Regional Development Fund
[28] LARSIM - Large Area Runoff Simulation Model (http://larsim.sourceforge.net/index.en.php)
[29] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks

# XIII. Meuse River Basin[30]

229. Belgium (Flanders and Wallonia), France, Germany, Luxembourg and the Netherlands share the Meuse River basin.[31]

Table 14

**Area and population in the Meuse Basin**

| | | | | | Surface water | Groundwater |
|---|---|---|---|---|---|---|
| | *Area (km²)* | *Number of inhabitants (x 1000)* | *Number of bodies of water 'lakes'* | *Number of bodies of water 'waterways'* | *Linear waterways in km* | *Number of bodies of water* |
| France | 8 919 | 671 | 5 | 152 | 3 363 | 13 |
| Luxembourg | 65 | 43 | 0 | 3 | 15 | 1 |
| BE-Wallonia | 12 300 | 2 189 | 12 | 245 | 4 934 | 21 |
| BE-Flanders | 1 596 | 416 | 3 | 17 | 272 | 10 |
| Netherlands | 7 500 | 3 500 | 19 | 133 | 2 688 | 5 |
| Germany | 3 984 | 1 994 | 1 | 227 | 1 6212 | 32 |
| Total | 34 364 | 8 813 | 40 | 777 | 12 893 | 82 |

* The groundwater body of Luxembourg falls under and is managed into the IRBD Rhine.

** The Netherlands have also 1 body of transitional water and 2 bodies of coastal water.

Source: Management Plan of the International River Basin District Meuse – Roof report – 22 December 2009.

230. The source of the 906-km long river Meuse is on the Langres plateau in France, at an altitude of 384 m a.s.l. in Chatelet-sur-Meuse. The river Meuse flows from its source in France through France, Belgium and the Netherlands to the North Sea.

231. The most important tributaries of the Meuse — most of them transboundary — are the Chiers, Semois, Lesse, Samber, Ourthe, Roer, Swalm, Niers, Dommel and Mark.

232. The basin of the Meuse comprises a large number of aquifers. Many of these strata run across borders.

## Hydrology and hydrogeology

233. The peak run-off usually occurs in winter and spring. Summer and autumn are mainly characterized by longer periods of low flows.

234. The basin of the river Meuse can be divided into three sections, with differing geomorphologic and physical features and human impacts.

30 Based on information provided by the International Meuse Commission with the following specific sources:: International River District Meuse - Characteristics, review of the Environmental Impact of Human Activity, Economic Analysis of Water Use', Roof report, march 2005; 'International Meuse Commission: Report on the quality of the Meuse', December 2004 ; 'The International River District Meuse: a status assessment, November 2005 ;  Management Plan of the International River Basin District of the Meuse', Roof report, December 2009.)

31The International River Basin District Meuse (IRBD Meuse) is the management unit under the Water Framework Directive (WFD).

235. The first section, from the source to the city of Charleville-Mézières (France), is characterized by low-flow velocity and low pressure from industry and municipalities.

236. The second section, where the Semois, Lesse, Sambre and Ourthe rivers join the Meuse, stretches from Charleville-Mézières to Liège (Belgium). During periods of heavy precipitation, these tributaries contribute substantially to the flow of the Meuse and may cause rapid water level rises. The sub-basins of these tributaries make up the principal natural values of this river section and are especially important as spawning grounds and growth areas for rheophile fish. A few small islands in the river and parts of the banks have remained in their natural condition, offering habitats for a variety of species of plant and animal life. The section has also many heavily urbanized and industrial sites, both along the main watercourse as well as along the Sambre tributary. There was major development of the principal Meuse watercourse to make it navigable.

237. The third section, a flood plain area, stretches from Liège to the mouth. This section is navigable, which limits the possibilities for a natural low-water channel and severely reduces the fluvial dynamics. This region is also characterized by dense population, intensive agriculture and many industries. Areas of great ecological value exist (e.g. woods, heather fields and marshlands), but their area has been reduced and they are widely dispersed. The north-western part offers an attractive and relatively open area that is surrounded by urban harbour areas.

## Pressures

238. Some 8.8 million people live in the IRBD Meuse and use water for drinking and domestic purposes, agriculture and industry, hydropower generation, navigation and recreation. The water of the Meuse also supports surrounding ecosystems, and is exported by pipelines and canals to provide drinking water to people living outside the basin.

239. A number of locks and dams were built in the river for navigation purposes or protection against floods, leading to significant modifications of the natural character of the river in most of its sections.

240. Human impact has altered the natural hydromorphological and ecological conditions. The main driving forces for these alterations are urbanization, industrialization, agriculture, and navigation.

241. There are different types of pressures:

- emissions, losses and discharges of pollutants;
- sluices, weirs and dams (flood protection, navigation and hydropower generation);
- canalisation, artificial banks and dikes;
- water abstractions (i.e. for canals, agriculture, industry and the production of drinking water).

242. These pressures result, sometimes individually, sometimes in combination, in the following potential or observed impacts and consequences:

For surface water:

- impairment of ecosystems, including terrestrial ecosystems that interact with the water;
- hampered circulation of fish;
- eutrophication, especially in the main course of the river and in coastal waters;

- potential risk for water uses

For groundwater:

- influence on terrestrial ecosystems.
- potential risk for water uses.

243. For the French part of the river basin, agriculture is the main driving force.

In Wallonia (Belgium), in the more densely populated and industrialized sub-basins Vesdre Sambre and Meuse aval, urbanization is the major driving force. For the Semois and Lesse rivers, only smaller longitudinal obstacles are present, with no strong driving forces restricting restoration potentials.

244. In the German, Flemish and Dutch lowlands, urbanization and agriculture are the major causes to alterations in hydromorphological characteristics. In the Dutch part of the Meuse River, most pressures derive from flood defence and shipping. Safety and flood control measures (e.g. delta works and the closure of the Haringvliet in the Netherlands) in the 1970s were essential social measures, but deprived the area of tidal dynamics, resulting in a decreased ecological potential. For the smaller tributaries, especially in the Netherlands, agriculture remains a major driving force. In addition to the strongest estimated impact of longitudinal obstacles and changes in river discharge over the basin, local pressures on the habitat quality can seriously affect the ecological integrity of the river.

245. Important management issues in the Meuse basin district that require multilateral coordination:

- Hydromorphological changes (repair of the natural carrier and removal of barriers)
- Water quality
    - Usual pollutants [Chemical oxygen demand (COD), Nitrogen, Phosphorus]
    - Others (heavy metals, micropollutants – particularly priority substances, copper, zinc, PCBs, other pesticides)
- Water quantity
    - High tide (prevent and protect against flooding)
    - Water shortage and sustainable management
- Groundwater (qualitative factors: pollution by nitrates and pesticides)

## Status and transboundary impacts

246. The table shows a picture of the current status of the surface water bodies in the IRBD Meuse and of the status expected in 2015. The number of bodies of water not in a ‘good status’ and the parameters that are responsible for that status are indicated for each State and Region.

**Table 17: Water bodies not reaching good status**

| | | *France* | *Wallonia* | *LU* | *Flanders* | *NL* | *DE* |
|---|---|---|---|---|---|---|---|
| *Number of water bodies* | *Number* | 152 | 245 | 3 | 17 | 133 | 227 |
| | *Length* | 3 363 | * | 21 | 272 | * | 1622 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Number of water bodies not in a good status* | | *Number* | 98 | 121 | 3 | 17 | 133 | 205 |
| | | *Length* | 2 817 | * | 21 | 272 | * | 1 470 |
| *Chemical status* | *Priority substances* | *Number* | 73 | 50 | * | >4 | * | 46 |
| | | *Length* | 2 212 | * | * | 63 | * | 321 |
| | | *Number* | 76 | 114 | 3 | 17 | * | 202 |
| | | *Length* | 2277 | * | 21 | 272 | * | 1 450 |
| | *Chemical & physico-chemical elements decisive for biological elements* | *Number* | 44 | 84 | 3 | 17 | * | 64 |
| | | *Length* | 1 432 | * | 21 | 272 | * | 461 |
| | *Biological parameters* | *Number* | 36 | 95 | * | 17 | * | 198 |
| | | *Length* | 1 722 | * | * | 272 | * | 1 462 |
| Ecological status | *Hydromorphology* | *Number* | 56 | * | * | * | * | * |
| | | *Length* | 1 874 | * | * | * | * | * |

(*) No data, or not determined.

Table 18: Number of water bodies not in a good status in 2015

| | | | *France* | *Wallonia* | *LU* | *Flanders* | *NL* | *DE* |
|---|---|---|---|---|---|---|---|---|
| *Number of water bodies not in a good status in 2015* | | *Number* | 84 | 76 | * | 15 | 124 | 203 |
| | | *Length* | 1 432 | * | * | 232 | * | 1 450 |
| *Chemical status* | *Priority substances* | *Number* | 36 | 38 | * | * | * | 46 |
| | | *Length* | 1 103 | * | * | * | * | 321 |
| | | *Number* | 34 | 72 | * | * | * | 196 |
| | | *Length* | 1158 | * | * | * | * | 1 417 |
| | *Chemical & physico-chemical elements decisive for biological elements* | *Number* | 24 | 57 | * | 15 | * | 64 |
| | | *Length* | 920 | * | * | 232 | * | 461 |
| | *Biological parameters* | *Number* | ** | 69 | * | * | * | 195 |
| | | *Length* | ** | * | * | * | * | 1 409 |
| Ecological status | *Hydromorphology* | *Number* | 27 | * | * | * | * | * |
| | | *Length* | 980 | * | * | * | * | * |

(*) No data, or not determined. (**) Status in 2015 determined on the base of Chemical and ecological status.

247. There are problems in nearly all of the Meuse River Basin due to the pollution of groundwater by nitrate and pesticides from urban and agricultural sources.

248. Owing to water draining from lignite extraction in the German part of the Meuse River Basin, some groundwater bodies have long been in a poor quantatitive or qualitiative status.

### Response measures

249. The monitoring programmes introduced by the parties (pursuant to Article 8 of the WFD) concern both surface water and groundwater. The States and regions set up their surveillance monitoring programmes in parallel to each other in the years 2005-2006. These programmes are tested against each other in the IMC.[32]

250. The riparian countries (including the Belgian Regions) are implementing the decisions of their own Governments as well as the recommendations of the International Meuse Commission (IMC). The IMC has been established under the Agreement on the River Meuse (Ghent, 2002) and acts as the platform for international coordination to implement obligations under the WFD (2000/60/EG) and under the Flood Risk Directive (2007/60/EG) for the IRBD Meuse.

251. In implementing the management plans (programmes of measures) under both directives at their national levels, the parties in the IMC decided to coordinate the following measures, addressing the important management issues identified as requiring multilateral coordination:

- Hydromorphological changes (restoration of the natural character and removal of barriers)

  Measure to be coordinated: restoration of biological continuity.

- Water quality

  - Classical pollutants [organic matter (indicated by Chemical Oxygen Demand, COD), Nitrogen, Phosphorus]

    Measure to be coordinated: Reduction of the emissions from household, industrial and agricultural domains.

  - Others pollutants [heavy metals (a.o. copper, zinc), micropollutants (particularly priority substances, PCBs and pesticides)]

    Measure to be coordinated: Reduction of the emission of micro-pollutants from household, industrial and agricultural sources

- Water quantity

  - High tide (prevent and protect against flooding)

    Measure: Coordinated implementation of European Directive 2007/60/EC on the assessment and management of flood risks. Coordination and pooling of the requirements of 2007/60/EG with the requirements of WFD 2006/60/EC.

  - Water shortage and sustainable management

    Measure: Policy measures to protect the natural environment, to maintain water stocks and to use less water in production processes.

- Groundwater (qualitative factors: pollution by nitrates and pesticides)

[32] This coordination process led to the publication, in March 2007, of the coordinating IMC report "Monitoring on the coordination of the surveillance monitoring programmes in the IRBD Meuse.

Measure to be coordinated: improve the qualitative status (nitrate and pesticides)

Measure to be coordinated: improve the quantitative status.

## Future trends

Table 19: Surface water (rivers): target expected to be reached in 2015

| | *France* | *Wallonia* | *Germany* | *Luxembourg* | *Flanders* | *Netherlands* | *ISGD* |
|---|---|---|---|---|---|---|---|
| *Number of water bodies where the target is reached in 2015* | 72 | 196 | 24 | 2 | 2 | 9 | 278 |
| *Number of water bodies with deadline extension* | 80 | 76 | 196 | 1 | 15 | 124 | 492 |
| *Deadline extension owing to technical unfeasibility* | 75 | * | 171 | 1 | 15 | 118 | - |
| *Deadline extension owing to natural circumstances* | 13 | * | 48 | 0 | 0 | 24 | - |
| *Deadline extension owing to disproportionate costs* | 23 | * | 159 | 0 | 15 | 105 | - |
| ***Number of water bodies with a less strict target*** | **0** | **0** | **7** | **0** | **0** | **0** | **7** |

252. Based on the first provisional estimates, about 35% of the surface water bodies will apparently reach the WFD targets in 2015. For many water bodies, a deadline extension (referred to in Article 4, paragraph 4 of WFD) will be needed, particularly as regards the implementation of measures for improving the hydromorphology.

**Table 20:** Groundwater: target expected to be reached in 2015

| | *France* | *Wallonia* | *Germany* | *Luxembourg* | *Flanders* | *Netherlands* | *ISGD* |
|---|---|---|---|---|---|---|---|
| *Number of water bodies where the target is reached in 2015* | 7 | 16 | 12 | - | 4 | 3 | 42 |
| *Number of water bodies with deadline extension* | 6 | 5 | 10 | - | 6 | 2 | 29 |
| *Deadline extension owing to technical unfeasibility* | 4 | 0 | 0 | - | 0 | 0 | 4 |
| *Deadline extension owing to natural circumstances* | 6 | 5 | 10 | - | 6 | 2 | 29 |
| *Deadline extension owing to disproportionate costs* | 2 | 4 | 3 | - | 6 | 0 | 15 |
| ***Number of water bodies with a less strict target*** | **0** | **0** | **10** | **-** | **0** | **0** | **10** |

253. To attain the right status, deadline extensions beyond 2015 are provided for most groundwater bodies polluted with nitrates and pesticides. This has to do with the long reaction periods for measures to take effect and with the inordinately high costs thereof.

254. For the quantitative problems owing to lignite extraction in the German part, the exemption rule pursuant to Article 4, paragraph 7 of the WFD shall apply.

255. The Interreg IVb project AMICE (Adaptation of the Meuse to the Impacts of Climate Evolutions) is being carried out in the Meuse River Basin. This project aims to define a common strategy for the Meuse River Basin for adapting to the consequences of climate change, and to develop measures for tackling these changes. With climate change, higher discharges and lower river drainage are predicted.

256. The IMC supports the AMICE project and sees to a good exchange of knowledge and information with the working group Hydrology and Inundation of the IMC.

256. The results of AMICE contribute also to the multilateral coordination of the implementation of the EU directive on the assessment and management of flood risks in the Meuse River Basin.

# XIV. Scheldt River Basin[33]

257. The basin of the River Scheldt[34] is shared by France, Belgium (Federal government and governments of the Flemish Region, Walloon Region and Brussels Capital Region) and the Netherlands.

Table 21

**Area, population, population density and urban area per Party in the Scheldt Basin**

| *Country/Party* | *Area (km²)* | *Area (%)* | *Total population (×1,000)* | *Population density (inhabitants/km²)* |
|---|---|---|---|---|
| France | 18,486 | 51 | 4,640 | 251 |
| Walloon Region | 3,770 | 10 | 1,210 | 321 |
| Brussels | 161 | 0,4 | 959 | 5,958 |
| Flemish | 11,991 | 33 | 5,583 | 466 |
| Netherlands | 2,008 | 6 | 463 | 231 |
| District | 36,416 | 100 | 12,855 | 353 |

258. The International River Basin District (IRBD) of the Scheldt comprises two cross-border river basins, i.e. the Scheldt (lenght 350 km) river basin and the Yser (lenght 80 km; basin area 1,749 km²) river basin. The Yser sub-basin is shared by France and Belgium.

259. The main tributaries of the Scheldt are the Lys, Dender, Rupel and Nete.

260. The elevation of the basin ranges from 2 m below sea level, along the southern coast of Schouwen (Prunje region) to 212 m above sea level in the Walloon region (Anderlues) . Because of this mainly flat relief, the rivers of the Scheldt IRBD are lowland rivers with wide valleys and slow current and discharge velocities.

[33] Based on information provided by the International Scheldt Commission

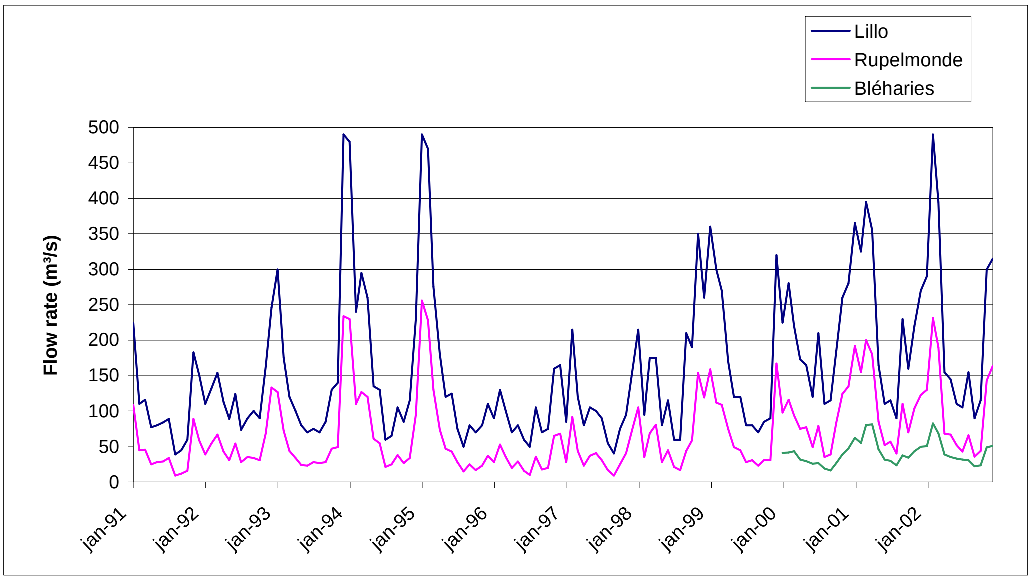
[34] The following adjacent river basins together with the Scheldt river basin, together forming the Scheldt river basin district: Bruges Polders, IJzer, Aa, Boulonnais, Canche, Authie, Somme and Coastal waters. Of the adjacent basins, only the IJzer and the Coastal waters are internationally shared.

## Hydrology and hydrogeology

261. The 350-km long Scheldt[35] originates near the village of Gouy-Le-Catelet, in northern France. The Scheldt then flows through the Walloon Region, the Flemish Region and the Netherlands, discharging into the North Sea at Vlissingen. Long stretches of the river are canalized: upstream of Ghent over a 138 km stretch. On the Scheldt, as well as on its tributaries and on the canals of the district, there are more than 250 weirs and locks.

262. The Scheldt estuary is approximately 160-km long. The Scheldt and a number of its tributaries downstream are subject to the tides: At Vlissingen, twice a day, more than 1 billion m³ water flows in and out of the river, while the annual river discharge is approximately 4 billion m³. The tidal range decreases from 3.86 m in Vlissingen towards Ghent to about 2 metres, where the tidal wave, at 160 kilometres from the mouth, is stopped by the weirs in Gentbrugge.

**Figure 3: Evolution of the Scheldt flow rate at the flow meter stations in Bléharies, Rupelmonde and Lillo for the period 1991-2002**




263. The flow rate of the Scheldt varies greatly. In the period 1991-2002, the (estimated) average flow rate at Lillo (Belgian-Dutch border) was 161 m³/s. Peek flow rates are usually registered in winter (Nov-Feb). The wide and flat valleys in the Scheldt district suffer from numerous floods, especially in late winter, when the groundwater level is highest.

264. The international co-ordination implied the comparison of 42 transboundary groundwater bodies on a total of 67 in the IRBD. The comparable groundwater bodies were clustered into 22 cross-border aquifers. Fourteen out of the 22 aquifers are spread over two states or regions, whereas 8 of them are spread over three states of regions. Twenty of the 42 contiguous groundwater bodies are mainly used for drinking-water production and they cover 13 aquifers. The international co-ordination was especially focused on 3 cross-border

[35] As far as Ghent, the river is called the ‘Bovenschelde’, between Ghent and Antwerp the ‘Zeeschelde’ and beyond Antwerp it is referred to as the ‘Westerschelde’. The Zeeschelde and the Westerschelde form the Scheldt estuary.

aquifers for which clearly defined water management issues had been worked out in terms of cross-border relations:

- The Carboniferous Limestone's aquifer which covers parts of France, the Flemish Region and the Walloon Region, and where problems are mainly of a quantitative nature, with a possible negative influence on the quality (impacts on sulphates and fluorine, possibly due to a rising groundwater level;
- The Brusseliaan aquifer, which covers parts of the Brussels Capital Region, the Flemish Region and the Walloon Region, and featuring increased or constantly increasing nitrate and pesticides contents;
- The Oligocene aquifer, which covers parts of the Netherlands and the Flemish Region, and in its Flemish part problems are mainly of a quantitative nature.

## Pressures

265. Shipping, urbanization and agriculture are the three main operational usages for which hydromorphological changes have been made to the water body.

266. Major pressures in the Scheldt basin include those from domestic areas, industry, agriculture and transport (see table 22)

Table 22

**Estimate of the intensity of the pressures of the relevant driving forces per cluster[36]**

| | *Population* | *Industry* | *Agriculture* | *Transport networks* |
|---|---|---|---|---|
| Scheldt upper course | ++++ | +++ | ++++ | ** |
| Scheldt middle course | +++ | ++ | ++ | *** |
| Scheldt lower course | ++++ | ++++ | ++++ | *** |
| Nete | ++ | +++ | ++++ | ** |
| Zenne | ++++ | ++ | ++ | *** |
| Dijle-Demer | ++++ | ++ | ++ | ** |
| Dender | ++ | ++ | ++ | ** |
| Leie | ++++ | +++ | ++++ | ** |
| Bruges Polders | ++ | + | ++++ | ** |
| IJzer | ++ | + | ++++ | ** |
| Aa | ++ | ++++ | ++++ | ** |
| Channel coastal basins | +++ | ++ | +++ | * |
| Somme | +++ | ++ | ++++ | * |

*Notes*: from + to ++++ : from low to very high pressure

*** > IDBD average,

** = only some indicators are higher,

* = of little importance

[36] For the purposes of EU WFD Article 5 status report (analysis of pressures), a number of the river basins of the Scheldt IRBD is further divided into 31 hydrographical units and regrouped into 13 clusters

267. On the basis of data from the year 2000 (or 2002 for the Flemish Region), it appears that the waste water of 53% of the population is collected and treated in urban waste water treatment plants (UWWTP).

268. In general, the non-collective treatment is mainly at the source of the domestic waste load. For nitrogen, suspended solids and phosphorus, the clusters with the highest domestic load correspond to the most populated areas: Zenne, Leie, Scheldt lower course, Scheldt upper course and Dijle-Demer. They had less treatment plants than the other clusters. For a limited number of parameters, high loads are also registered in less populated areas. In certain clusters (such as Scheldt lower course where 75% is connected), very high waste loads are observed due to a lack of tertiary processing in the treatment plants.

269. In addition to a high level of urbanization, the Scheldt IRBD is also characterized by a high level of industrialization, with a number of major industrial zones. The industrial sectors with the strongest presence are the food industry and metallurgy. Other important sectors are the chemical industry and the textile sector. The chemical sector is positioned in third place, with 14% of the number of companies, far behind the first two sectors. Among European Pollutant Emission Register (EPER) companies, the chemical industry, with one third of all EPER companies, heads the list of the most important activities in the Scheldt district. Metallurgy comes second.

270. The largest emissions of macro-pollutants (nitrogen, phosphorus, Total Organic Carbon (TOC)), discharged by EPER companies in the Scheldt district, are located in the clusters Leie, Scheldt lower course, Somme and Scheldt middle course. The chemical and food industries in the Scheldt district are those contributing most to the emissions of macro-pollutants by EPER companies.

271. Salt emissions (chlorides, cyanides and fluorides) are by far the most important in the Scheldt lower course. The chloride emissions are also very important in the Nete cluster, the cyanide and fluoride emissions in the Aa cluster. Chloride emissions are mainly produced by the chemical sector (93%), cyanides by metallurgy (47%) and the materials sector (42%), fluorides by metallurgy (53%) and the chemical sector (46%).

272. Some 61% (22,077 km²) of the total area of the district is used for agricultural purposes. The agricultural activities in the district include both crop production (in the south) and livestock production (the main agricultural activity in the north). In the northern part of the district, livestock is the major agricultural activity, in the south of the district, agriculture is more oriented towards crop production.

273. On the basis of the farming activity, the greatest load caused by agriculture is found in the clusters Leie and IJzer (a lot of livestock and crop farming), Scheldt lower course (mostly livestock with also crop farming), Scheldt upper course, Somme and Aa (mostly crop farming with also livestock), Nete and Bruges Polders (mainly livestock breeding).

274. For more than half the hydrographical units (based on a still incomplete analysis), the sediment quality is deemed to have a highly adverse effect on the aquatic environment or on the use over a medium-sized to large area.

275. Because of the high level of urbanization of the Scheldt river basin district and the strong presence of agriculture, vast forest and nature areas have become scarce. Moreover, the remaining forest and nature areas are very fragmented. The number of wetlands and other nature areas is very small.

276. Regarding pressures on groundwaters, most pollution cases occur in surface water and then spread to groundwater. In addition to the major diffuse pressures from agriculture (nitrate and biocides), other pressures assumed as significant for groundwater are polluted sites. The most relevant pressures are the direct groundwater abstractions. Managed aquifer recharge — known also as artificial recharge — is of secondary importance at district level.

Table 23

**Annual groundwater abstraction quantities, overall and for the drinking water supply, per region**

| *Country/Party* | *Abstracted volume ($10^6$ m³/year)* | *Abstracted amount for the drinking water supply ($10^6$ m³/year)* |
|---|---|---|
| France | 418 | 303 |
| Walloon Region | 175 | 137 |
| BCR | 3.5 | 2.5 |
| Flemish Region | 218 | 115 |
| Netherlands | 30 | 24 |
| **DISTRICT** | **844.5** | **581.5** |

277. The largest volume of groundwater is abstracted in France (especially in the chalk strata), while in proportion to the area, the abstractions are most intensive in the Walloon Region.

## Status and transboundary impact

278. The ISC already started in 1998 a joint homogenous monitoring network for the Scheldt basin which has proven a useful tool in following the evolution of water quality in the Scheldt helping also coordination between the Parties.

279. In the 10 years' measuring period, the number of waste water treatment plants in the Scheldt river basin as well as the reduction by those plants have increased and the treatment plants' average efficiency was improved, demonstrated by lower nitrogen and phosphorus. The decontamination of industrial emissions has had a positive influence on the oxygenation conditions.

280. The Homogeneous monitoring network's results reveal the water quality characteristics in the area around Eswars (France) are improving. Little, however, has changed in the French-Belgian border region (Fresnes-Warcoing). The two main improvements occured in the downstream areas between Pottes (Wallonia) and Schaar van Ouden Doel (Dutch-Flemish border). In the most downstream area, the Western Scheldt (Netherlands), less improvement is to be noted. The most striking improvement is the bottom-line oxygen concentration's increase, yet nitrogen and total phosphorus concentrations have decreased considerably too.

281. Amongst heavy metals, cadmium shows the strongest decrease. This goes, be it to a lesser degree, for copper and zinc too. PAHs remain problematic in the river basin, but they mainly come from air pollution. Pesticides and herbicides show a relative improvement. For too, The concentrations of diuron and isoproturon are high, mainly in winter.

282. Low lindane concentrations are still being registered, whereas atrazine and simazine are found to be below the limit.

Table 24
**Evaluation de the ecological status – in numbers of water bodies - of freshwater rivers in 2007**

| *Country/Party* | *Bad* | *Poor* | *Moderate* | *Good* | *High* | *No information* |
|---|---|---|---|---|---|---|
| France | 17 | 8 | 19 | 14 | 0 | 0 |
| Walloon Region | 29 | 23 | 16 | 1 | 0 | 10 |
| Brussels | 66 | 49 | 46 | 0 | 0 | 0 |
| Flemish | 1 | 1 | 1 | 0 | 0 | 0 |
| Netherlands | 0 | 0 | 1 | 0 | 0 | 0 |
| District | **113** | **81** | **83** | **15** | **0** | **10** |

## Response

283. The international co-ordination for the Scheldt is stipulated in the International Scheldt treaty (2002; see annex II in document ECE/MP.WAT/WG.2/2011/8–ECE/MP.WAT/WG1/2011/8). The International Scheldt Commission has no supra-national power, it serves as the platform for international coordination on the IRBD level.

284. Bi- or trilateral issues are treated in the appropriated bi- or trilateral fora as foreseen in Art.4 §5 of the Scheldt Treaty. So are the treaties, memoranda and agreements between the Flemish Region and the Netherlands concerning the policy and management, deepening, nautical aspects, safety and nature of the Scheldt estuary a matter of the Vlaams Nederlandse Schelde Commissie (VNSC) or Flemish-Dutch Scheldt Commission[37]. This cooperation has been formalized in the Treaty of December 21, 2005 on co-operation in respect of policy and management in the Scheldt estuary. The VNSC replaces the Technical Scheldt Commission (°1948).

285. Within the International Scheldt Commission an operational Warning and Alarm System of the Scheldt river basin district (WASS) is active since 1998, which includes the procedures to be followed in case of possible cross-border pollution.

286. All Parties have proposed to spread the implementation of measures defined with a view of the objectives of WFD on certain water bodies for the sake of technical feasibility, ecological circumstances and disproportionate costs. Term extensions lead to more realistic programmes of measures.

287. The programmes of measures and monitoring of the status according the WFD, are executed by each Party (as a Member State of the EU) taking into account the results of the issues on which is agreed to co-ordinate at the IRBD level.

288. The International Scheldt Commission is responsible for the coordination, involving as tasks for example exchange of information between parties on progress of the implemention of the Programme of Measures, an update of the database of measures (catalogue of measures) and its use of the catalogue as an instrument for comparison and co-ordination. Regarding the improvement of biodiversity and fish migration a « masterplan fish in the Scheldt river" is planned, concerning the Warning and Alarm System

[37] http://www.vnsc.eu/english/

Scheldt (WASS) an emergency exercise; yearly workshop with operators warning centers; and a database of notifications are foreseen.

289. Regarding the implementation of the Flood Directive the Scheldt Commission is responsible for improving the knowledge on interaction between flood from coastal waters and rivers; Definition of significant risk and significant increase of risk as well as production of maps.

300. Due to the success of the Scaldit-project (2003-2005)[38], the partners introduced a new Interreg IVB NWE project[39] in the Scheldt International River Basin District which aims at finding the best available measures to improve the ecological status of surface water, sediments and groundwater. It includes the following activities:

- implementation and monitoring of a number of transnational river ecosystem development measures and the elabaration of a transnational inventory on priority fish migration barriers;
- the transboundary monitoring of sediment loads in order to feed a sediment delivery model and the construction of a sediment pond;
- the transboundary monitoring and modelling of 2 transboundary groundwater systems as a basis for a joint declaration on transboundary groundwater management;
- the development of a common set of indicators on the level of the Scheldt IRBD to assess the execution of programmes of measures, including costs, effects and benefits of measures;
- the dissemination of information on transboundary integrated water management in the Scheldt IRBD by means of events, website, newsletters, information packages.

## Future trends and challenges

- The coordination of the programmes of measures;
- Reaching the quality objectives for groundwater and surface waters;
- Co-ordination of the flood directive;
- Evaluate the impact of climate change (flood, drought, water quality, salinization);
- Ecological restoration, fish migration and bio-diversity in general;
- Economic analysis and indicators.

301. The Scheldt basin does not suffer from chronic water scarcity but has to deal with temporary water shortages (drought); exception made for the over exploited Carboniferous Limestone’s aquifer. Salt intrusion from the coastal areas due to the rise of the sea level is another impact of the changing climate.

302. The Scheldt Commission formulated three recommendations for future work on climate change:

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[38] The Scaldit (**Scald**is (Scheldt in Latin) **I**ntegrated **T**esting) project involved testing — as the only pilot and only complete IRBD — all the guidance documents developed by the European Commission in consultation with the member states to support the implementation of the Water Framework Directive. The results of the transnational description of the state of the aquatic environment were the first steps towards a common Scheldt River Basin Management Plan (2009)

[39] http://www.scaldwin.org/scaldwin-2

- Maintain a task team for managing drought: identify vulnerable sectors and mapping of it;
- Share results of scientific research on expected impact of climate change on low water;
- Exchange information on a regularly base of the hydrology within the IRBD

# XV. Bidasoa River Basin[40]

303. The basin of the river Bidasoa is shared by Spain and France. The river has its source in Pirineo Navarro and discharges to Eastern Atlantic Ocean. The transboundary part of the basin is represented by the estuary of Hondarribia and Endaya (see the assessment of the Txingudi Ramsar Site).

Table 25
**Area and population in the Bidasoa sub-basin**

| *Country* | *Area in the country ($km^2$)* | *Country's share %* | *Population* | *Population density (persons/$km^2$)* |
|---|---|---|---|---|
| Spain | 750 | | 93 000 | 124 |
| France | | | | |
| **Total** | | | | |

Source: Fuente INE (2006 y 2008).

## Hydrology and hydrogeology

304. Surface water resources generated in Spain part of Bidasoa river basin are estimated at $464 \times 10^6$ $m^3$/year and groundwater resources at $247 \times 10^6$ $m^3$/year, adding up to a total of $712 \times 10^6$ $m^3$/year (average for the years 1980 to 2005). Total water resources per capita in the basin: 7.647 $m^3$/year/capita (average for the years 1980 to 2005).

Table 26
**Discharge characteristics of the river Bidasoa at Endarlaza - about 9 km upstream from the river's point of discharge to the Atlantic Ocean**

| *Discharge characteristics* | *Discharge ($m^3/s$)* | *Period of time or date* |
|---|---|---|
| $Q_{av}$ | 24.5 | 1968 - 2008 |
| $Q_{max}$ | 921 | 26 Dec. 1993 |
| $Q_{min}$ | 0 | 1968 - 2008 |

No transboundary aquifers of importance have been identified.

## Pressures, status and transboundary impact

Table 27
**Land use/land cover in the Bidasoa sub-basin**

[40] Based on information provided by Spain

| *Country* | *Water bodies (%)* | *Forest (%)* | *Cropland (%)* | *Grassland (%)* | *Urban/industrial areas (%)* | *Surfaces with little or no vegetation (%)* | *Wetlands/ Peatlands (%)* | *Other forms of land use (%)* |
|---|---|---|---|---|---|---|---|---|
| Spain | 0.2 | 63.1 | 1.7 | 32.7 | 2.2 | | | |
| France | | | | | | | | |

Table 28

**Total withdrawal and withdrawals by sectors (per cent)**

| *Country* | *Total withdrawal* $\times 10^6$ *m*$^3$*/year* | *Agricultural %* | *Domestic %* | *Industry %* | *Energy %* | *Other %* |
|---|---|---|---|---|---|---|
| Spain, 2005 | 0.015560 | 5.07 | 90.68 | 4.25 | [a] | |
| Spain, forecast 2015 | 0.015478 | 4.95 | 90.79 | 4.26 | | |
| Spain, forecast 2027 | 0.015342 | 4.9 | 90.81 | 4.29 | | |
| France | | | | | | |

[a] Non-consumptive water use for hydropower is $1.063 \times 10^6$ m$^3$/year. The volume is expected to stay unchanged until 2017

305. Hydroelectrical plant dams, weirs (height 2-3 m), protection of river banks and especially in the estuarine zone cause hydromorphological changes locally, but these are assessed as only moderate with the exception of the transboundary estuarine zone where the changes are severe. Diversion systems to other rivers or by-passes are also lacking for some hydropower plants/dams.

306. The only pressures described as severe (but local) are fertilizer pollution and pollution from insufficiently treated urban wastewater (Oronoz and Narbate as well as other urban centres (1,780 equivalent inhabitants). Particularly high pressure level from wastewater discharges has been detected on the estuarine transboundary reach of the Bidasoa.

## Response measures and transboundary cooperation[41]

307. In Spain, the National Sewer System and Water Treatment Plan and the new National Water Quality Plan have involved measures aimed at addressing wastewater discharges and agricultural pollution.

308. The Agreement between Spain and France on water management, signed in 2006, sets the framework for transboundary cooperation on the Bidasoa River.

309. Taking into account the short length and low importance of watercourses that flow between rance and Spain, and in view of indications cited in Article 3 of EU's Water Framework Directive (WFD), the competent authorities in the sense of the WFD did not consider it necessary to define an international river basin district or establish an international basin Commission. The two signatories have agreed that each State is responsible for implementing the WFD and ensuring the management in its territory.

[41] Detailed information is available in the Eastern Cantabrial Region River Basin Management Plan, 2011 (www.chcantabrico.com)

### Future trends

310. As described in the assessment of the Mino, implementation of several relevant national plans in Spain is expected to improve the status of the Bidasoa River.

311. . It is projected that due to climate change there could be an increase of 1ºC in the annual average temperature by 2027 with no impact on precipitation. River discharge could decrease on average over 2% and groundwater level is predicted to decrease in the same period.[42]

## XVI. Bidasoa estuary/Txingudi (Spain, France)[43]

*General description of the wetland*

312. The Bidasoa estuary (Txingudi) is located in a transboundary area between Spain and France. Administratively it belongs to the municipalities of Irun and Hondarribia (Gipuzkoa, Basque Autonomous Community) and Handaye (Aquitaine, Pyrénées Atlantiques). It is a coastal wetland, a system of estuaries and marshes in the fluvial-marine interface of the mouth of the River Bidasoa. The estuary is approximately 11 km long. The Ramsar site covers an area of 130.03 hectares that are distributed as follows: Plaiaundi: 39.06 ha, Vega de Jaizubia: 61.68 ha, Bidasoa Islands: 29.29 ha. It holds 8 habitats contained in Annex I of the Habitats Directive 92/43/CEE, of which two are considered priorities (1150 Coastal lagoons and 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)). There is one waterfowl species, Aquatic Warbler (*Acrocephalus paludicola),* classified as Vulnerable by IUCN. Additionally, there are at least 15 threatened bird species included in different national catalogues (National Catalogue of Threatened Species, Red Book of Birds of Spain) and four breeding species included in the Basque Catalogue of Threatened Species: Little Ringed Plover (*Charadrius dubius)*, Water Rail (*Rallus aquaticus)*, Reed-Warbler (*Acrocephalus scirpaceus)* and Little Grebe (*Tachybaptus ruficollis)*. There are also three fish species classified as endangered and/or vulnerable by the "Red Book of Continental Fish of Spain": Atlantic Salmon (*Salmo salar)*, River Herring (*Alosa alosa)* and Sea Lamprey *(Petromyzon marinus)*.

*Main wetland ecosystem services*

313. The estuary is overpopulated (Irun, Hondarribia and Hendaye together have a population of nearly 100,000), and has lost about 60% of its original surface due to human occupation. Given its strategic location, land use is mostly urban and industrial (housing, infrastructure, communication), which puts a strong pressure on the ecosystem. In addition, it is intensely used for recreation (marinas in Hondarribia and Hendaye) and less intensively for fishing.

*Cultural values of the wetland area*

[42] Source: National Plan to Adaptation of Climate Change, Ministry of the Environment, Spain, 2009.

[43] Sources: www.euskadi.net/txingudi
www.txingudikopadurak.blogspot.com
www.cpie-littoral-basque.eu
www.abbadia.fr
Txingudi EKOETXEA, Basque Government, Department of Environment, Planning, Agriculture and Fisheries. Biodiversity Directorate Department for Environment, Spatial Planning, Agriculture and Fisheries. Biodiversity Directorate

Txingudi is a traditional transit area of different civilizations that have occupied the territory. Due to its transboundary nature the area has seen many wars but it has been also the setting chosen for other historic events as important as the signing of the Treaty of the Pyrenees, which established the borders between Spain and France. At present, it enjoys a high social recognition due to its environmental value and its status as a restored wetland committed to conservation, and due to its high educational value, especially among local population. Eductional work is mainly carried out in two visitor facilities focusing on nature conservation: Txingudi Ekoetxea (Plaiaundi, Irun, in the Ramsar area) and Larretxea (Domaine d´Abbadia, Hendaye).

*Biodiversity values of the wetland area*

314. Management by the Basque Government includes monitoring and evaluation of wildlife, habitats and processes (water quality, etc.)

315. The salt-tolerant vegetation stands out with small size herbaceous formations, mostly grasses, reeds and sedges. In Txingudi, 46 significant flora species have been found, 33% of the species mentioned in the Basque Country, of which 24 (37.5%) are considered rare or very rare in the regional Catalogue of Flora. There is a prominent occurrence of Water Chickweed (*Myosoton aquaticum),* Pyrenean scurvygrass *(Cochlearia pyrenaica ssp. aestuaria),* Broadleaved Pepperweed *(Lepidium latifolium),* Yellow Loosestrife *(Lysimachia vulgaris), Common Water Plantain (Alisma plantago-aquatica), Eelgrass (Zostera marina),* Gibbous Duckweed *(Lemna gibba), Softstem Bulrush (Scirpus lacustris ssp. tabernaemontani)* and Many-stalked Spike-rush *(Eleocharis multicaulis).*

316. Some 86% of the vertebrate fauna of the rias[44] is found in the estuary Txingudi. Most individuals (67%) use it temporarily during the migratory seasons and also for wintering.

317. Fish species can be found in the estuary that are rare in the Basque coastal systems, such as River Herring (*Alosa alosa)* and Brown Trout *(Salmo trutta trutta)*, or unique within the east Cantabrian riverbeds, such as Atlantic Salmon (*Salmo salar)*. The site is important for the reproduction of the Three-spined stickleback (G*asterosteus aculeatus),* a species included in the Basque Catalogue of Threatened Species.

318. The Natter jack Toad (*Bufo calamita)* stands out, a species included in the Basque Catalogue of Threatened Species.

319. Of mammals, *the Southwestern Water Vole (Arvicola sapidus)* and European Polecat (*Mustela putorius)* are noteworthy.

320. Birds stand out over other fauna groups with a strong seasonality as it is a strategic migratory hotspot with an average of 175 species per year and a cumulative total (1998-2010) of 254 species in the area of Plaiaundi-Jaitzubia. It is also the major wintering place for waterfowl in Gipuzkoa and one of the most important wintering places in the Basque Country.

321. Txingudi regularly supports 1% of the individuals of the East Atlantic population of the Eurasian Spoonbill (*Platalea leucorodia)* with 120 individuals and an annual average occurrence of 1,078 specimens during autumn migration (data updated in 2010).

*Pressure factors and transboundary impacts*

322. The main direct and indirect impacts are caused by occupation and transformation of the land due to urban and industrial pressure (urban growth, transportation infrastructure,

[44] Ria is a coastal inlet formed when a river valley submerges partially

etc.). Its border location prompts major strategic projects for transportation of people and goods. There are also impacts from recreational use (sailing, rowing, fishing…) as well as illegal fishing. Invasive species such as Nutria (*Myocastor coypus), Red Swamp Crayfish (Procambarus clarkii), Pampas Grass (Cortaderia selloana)and* Eastern Baccharis *(Baccharis halimifolia)* pose a problem, but control programs are underway.

*Transboundary wetland management*

323. The estuary as a whole belongs to the Natura 2000 Network with areas designated as Special Protected Area (SPA) (Txingudi ES0000243) and Site of Community Interest (SCI) (Txingudi-Bidasoa ES2120018) in Spain, and SCI Baie de Chingoudy (FR7200774) in France, both adjacent to each other. The Ramsar site (c.130 ha) roughly coincides with the SCI and SPA in Spain. In the early 1990s the "Plan Especial de Txingudi" was signed, which is the base for the rehabilitation of the enclave and inlcudes projects Plaiaundi (1998) and Jaitzubia (2005), managed by the Basque Government. This Plan has yet to be completed; meanwhile the management plan for the prospective SPA Txingudi is in its approval phase. There is a cooperation agreement between the natural protected areas "Marismas de Txingudi" (Basque Government) and "Domaine d´Abbadia" (CPIE Littoral Basque and Conservatoire du Littoral), in terms of exchange and collaboration of management experiences. Their collaboration has been developing since 2001 when the Txingudi Ekoetxea (Environmental Education Centre associated with marshes) was established, covering different aspects. The main joint activities include environmental education and awareness-raising; celebration of anniversaries such as World Wetlands Day and World Day of Birds; and additionally, exchange of professional experiences between the two teams, which is very valuable.

# XVII. Mino River Basin[45]

324. The basin of the river Miño[46] is shared by Spain and Portugal. The river has its source in Spain in the Meira Mountains (elevation 750 m) and discharges to the Atlantic Ocean at Caminha. For its last 76 km, the Mino River forms the Spanish-Portuguese border.

Table 30
**Area and population in the Mino sub basin**

| *Country* | *Area in the country (km$^2$)* | *Country's share %* | *Population* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Spain | 16 230 | 95 | 858 310[a] | 18 |
| Portugal | | | | 92 |
| **Total** | **17 080** | | | |

*Source:* Spanish National Statistics Institute, year 2005
[a] A lumped value for Mino and Lima/Limia basins

[45] Based on information provided by Spain and the first Assessment of Transboundary Rivers, Lakes and Groundwaters
[46] The river is also known as Miño (in Spain) and Minho (in Portugal).

## Hydrology and hydrogeology

325. Surface water resources generated in Spanish part of Mino river basin are estimated at 6.74 $km^3$/year and groundwater resources at 4.31 $km^3$/year, adding up to a total of 11,050 $\times 10^6$ $m^3$/year .

326. In the Spanish part of the Mino River basin there are 47 reservoirs. The biggest ones are the Belesar reservoir (Mino River – water storage volume 654 $\times 10^6$ $m^3$), the Las Portas reservoir (Camba River – 536 $\times 10^6$ $m^3$) and the Bárcena reservoir (Sil River - 342 $\times 10^6$ $m^3$), being also important, because of its closeness to the border with Portugal, the Frieira reservoir.

327. No transboundary groundwater bodies are shared between Spain and Portugal.

## Pressures, status and transboundary impacts

Table 31
**Land use/land cover in the Mino Basin**

| *Country* | *Water bodies (%)* | *Forest (%)* | *Cropland (%)* | *Grassland (%)* | *Urban/industrial areas (%)* | *Surfaces with little or no vegetation (%)* | *Wetlands/ Peatlands (%)* | *Other forms of land use (%)* |
|---|---|---|---|---|---|---|---|---|
| Spain | | 51 | 0.6 | 12 | 0.5 | | | |
| Portugal | N/A | 62.7 | 30.8 | N/A | N/A | N/A | N/A | N/A |

Table 32
**Water use in different sectors (per cent)**

| *Country* | *Total withdrawal $\times 10^6$ $m^3$/year* | *Agricultural %* | *Domestic %* | *Industry %* | *Energy %* | *Other %* |
|---|---|---|---|---|---|---|
| Spain | 436 | 75 | 15 | 8 | | 2 |
| Portugal | | | | | | |

*Notes:* Hydroelectric, milling, power station cooling, aquaculture and agriculture Groundwater abstraction: 25.65 x $10^6$ $m^3$/years for agriculture and 14.5 x $10^6$ $m^3$/years for population supply. Groundwater abstraction has more widespread impact than surface water withdrawal

- Use of nutrients (nitrogen and phosphorous) in agriculture and from livestock, and resulting eutrophication of waters (widespread but moderate)
- Biodegradable/non biodegradable and IPPC / non IPCC industrial waste
- Pressure from urban wastewater is assessed by Spain as widespread but moderate.
- Highly regulated basin: 59 dams (more than 10 m.), 946 dams (2 to 10 m.), 156 loggings, 91 transfers and diversions, 13 margin protection reaches; the related hydromorphological changes are assessed by Spain as widespread but moderate

### Response measures

328. The Convention on cooperation for the protection and the sustainable use of the waters of the Spanish-Portuguese (signed 1998 and revised since) to is the framework for cooperation between the Governments of Portugal and Spain related to transboundary river basins, including the Mino. For information on the Convention and the subsequent international river commission, please refer to the assessment of the Tagus River.

329. In the Spanish part of the basin, planned management measures follow the directions set in the National Water Quality Plan (2007-2015), the Spanish National Action Plan on River Restoration and the basin Hydrological Plan 2010-2015. Autonomous Community Action programmes aim at reduction of fertilizers in agriculture,

### Future trends

330. In the Spanish part of the basin, the implementation of the forthcoming New Basin Hydrological Plan[47] as well as the National Plan for Sludge from Sewage Treatment Plants the National Sewer System and Water Treatment Plan and the new National Water Quality Plan is expected to further improve the status of the Mino river basin.[48]

## XVIII. Frieira Reservoir[49]

331. The Frieira Reservoir is situated in Spain in the Mino River basin in the border area between Spain and Portugal. The dam was constructed for hydroelectric power production. The reservoir is quite shallow, and a surface area of 4.66 $km^2$ and a relatively small water storage capacity (0.044 $km^3$). The mean inflow is 9.524 $km^3$/year and the minimum outflow 3.7 $km^3$/year. The status of the reservoir is “mesotrophic”.

Spain and Portugal manage it jointly on the basis of the 1998 Convention between countries

## IXX. Limia River Basin[50]

332. The basin of the river Limia is shared by Spain and Portugal. The river has its source in Spain at Lake Beon (975 m) and it discharges to Atlantic Ocean at the city of Viana do Castelo. The river Castro Laboreiro is the main transboundary tributary.

Table 33
**Area and population in the Limia sub basin**

| *Country* | *Area in the country ($km^2$)* | *Country’s share %* | *Population* | *Population density (persons/$km^2$)* |
|---|---|---|---|---|
| Spain | 1 300 | 52 | 853 310 | 49 |

[47] Management Plan Proposal For The Spanish Side Of The River Basin District Of Miño, Sil and LIMA River Basin”- Hydrological Plan 2010-2015, public consultation issue, December 2010.
[48] *Source*: Hydrological planning office. Hydrographic Confederation MIÑO-SIL (Oficina de Planificación hidrológica. Confederación hidrográfica del MIÑO-SIL).
[49] Based on the first Assessment of Transboundary Rivers, Lakes and Groundwaters.
[50] Based on information provided by Spain and the first Assessment of Transboundary Rivers, Lakes and Groundwaters. The river Mino and its tributary Sil, and the Limia Basin together form a River Basin District, implying that the majority of the information available is aggregated for this area.

| | | | |
|---|---|---|---|
| Portugal | 1 180 | 48 | 130 |
| **Total** | **2 480** | | |

*Source*: Portuguese National Institute of Water (Instituto da Agua, INAG) and the publication Freshwater in Europe – Facts, Figures and Maps (UNEP/DEWA-Europe, 2004).

## Hydrology and hydrogeology

333. Surface water resources generated in Spain part of Limia river basin are estimated at $460 \times 10^6$ $m^3$/year and groundwater resources at $300 \times 10^6$ $m^3$/year, adding up to a total of $760 \times 10^6$ $m^3$/year .

Table 34

**Discharge characteristics of the river Limia at puente Linares (Alto Lindoso Reservoir) in Spain**

| *Discharge characteristics* | *Discharge ($m^3$/s)* | *Period of time or date* |
|---|---|---|
| $Q_{av}$ | 9.7 | 1972 - 2007 |
| $Q_{max}$ | 142 | 09 Jan 1996 |
| $Q_{min}$ | 0.29 | Monthly mean 1972 - 2007 |

334. In the Spanish part of the Limia River basin there are four reservoir, two actually operated for hydropower production: Salas reservoir (Salas River – $87 \times 10^6$ $m^3$) and Las Conchas reservoir (Limia river - $78 \times 10^6$ $m^3$), finally The Alto Lindoso Reservoir is on the border between Spain (upstream country) and Portugal.

335. No transboundary groundwater bodies are shared in the Lima Basin between Spain and Portugal.

## Pressures

Table 35
**Land use/land cover in the Limia sub basin**

| *Country* | *Water bodies (%)* | *Forest (%)* | *Cropland (%)* | *Grassland (%)* | *Urban/industrial areas (%)* | *Surfaces with little or no vegetation (%)* | *Wetlands/ Peatlands (%)* | *Other forms of land use (%)* |
|---|---|---|---|---|---|---|---|---|
| Spain | | 51 | 0.6 | 12 | 0.5 | | | |
| Portugal | 1.6 | 70.9 | 25.4 | | | | | |

Table 36
**Water use in different sectors (per cent)**

| *Country* | *Total withdrawal $\times 10^6$ $m^3$/year* | *Agricultural %* | *Domestic %* | *Industry %* | *Energy %* | *Other %* |
|---|---|---|---|---|---|---|
| Spain | 37.5 | 30-80 | 7.5-19 | 0.2-1 | 0[a] | |
| Portugal | | 90 | 4 | 6 | | |

[a] Zero refers to consumptive use for energy purposes. The volume of non-consumptive use at a reversible hydroelectric power plant is $263 \times 10^6$ $m^3$/year

- Use of nutrients (Nitrogen and Phosphorous) for agriculture and livestock
- Biodegrable non IPCC industrial waste
- Overall hydropower plants
- dams (more than 10 m.), dams (2 to 10 m), loggings, transfers and diversions, margin protection reaches
- Urban waste
- Agriculture and population supply
- Status and transboundary impacts

336. The most serious water-quality problems are: organic pollution, bacterial pollution, eutrophication, and pollution from agriculture.

### Response

337. Transboundary cooperation on the Limia River Basin is carried out on the basis of the bilateral agreement (so-called “Albufeira Convention” from 1998 and its revision in 2008). Please refer to the assessment of the Tagus or annex II of document ECE/MP.WAT/WG.2/2011/8–ECE/MP.WAT/WG1/2011/8 for more information.

### Future trends

338. As described in the assessment of the Mino, implementation of several relevant national plans in Spain is expected to improve the status of the Limia River.

By 2027, an average decrease of over 2% in river discharge is predicted. [51]

## XX. Douro River Basin[52]

339. The basin of the river Douro53 is shared by Spain and Portugal . The river originates in Sierra de Urbión (2,080 m) in central Spain, crosses the Numantian Plateau, reaching, after 572 km, the Spanish-Portuguese Border. The international reach —along which the river forms the border between Spain and Portugal — has a length of 112 km. Douro River discharges to the Atlantic Ocean at Foz do Douro (city of Porto).

Table 37
**Area and population in the Douro sub basin**

| *Country* | *Area in the country ($km^2$)* | *Country’s share %* | *Population* | *Population density (persons/$km^2$)* |
|---|---|---|---|---|
| Spain | 78 859 | | 2 210 541 | 28 |

[51] Management Plan Proposal for the Spanish Side of the River Basin District of Miño, Sil and Lima River Basins. Hydrological Plan 2010-2015, Public Consultation Issue.

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

[53] The river is known in Spain as the Duero.

| | | |
|---|---|---|
| Portugal | | 98 |
| **Total** | **17 080** | |

*Source:* Spanish National Statistics Institute, year 2005

## Hydrology and hydrogeology

340. Surface water resources generated in Spanish part of Douro River Basin are estimated at 8.648 km$^3$/year and groundwater resources at 3.737 km$^3$/year, adding up to a total of 12.385 km$^3$/year (average for the years 1980 to 2006). Total water resources per capita in the basin are 5,600 m$^3$/year.

Table 38
**Discharge characteristics of the Douro at the Saucelle Reservoir in Spain**

| *Discharge characteristics* | *Discharge (m$^3$/s)* | *Period of time or date* |
|---|---|---|
| $Q_{av}$ | 8962 .10$^6$ | 1956 – 2008 |
| $Q_{max}$ | | |
| $Q_{min}$ | | |

341. No transboundary groundwater bodies are shared between Spain and Portugal within the Douro river basin boundaries. Although in the Inventory of Transboundary Groundwaters by the UNECE Task Force on Monitoring and Assessment (1999) the Aquifer 02.19 Ciudad Rodrigo-Salamanca, was considered to be transboundary, the extension is irrelevant in Portugal compared to Spain. For the new planning processes according to the EU WFD, no shared groundwater bodies have been identified/defined.

## Pressures, status and transboundary impacts

342. Cropland makes up some 11 per cent of the Spanish part of the basin.

Table 39
**Water use in different sectors (per cent)**

| *Country* | *Total withdrawal ×10$^6$ m$^3$/year* | *Agricultural %* | *Domestic %* | *Industry %* | *Energy %* | *Other %* |
|---|---|---|---|---|---|---|
| Spain | 4 883 | 92 | 4 | 1 | | |
| Portugal | | | | | | |

343. The main pressure factors in the Douro Basin include the flow regulation: There is about 8,000 hm$^3$ total capacity for water storage in the basin. The International reach of the Douro River has been harnessed for hydropower production. There are some 3,600 barriers with various degrees of permeability for fish population. Canalized reaches 600 bank reinforcement actions

344. Extensive use of irrigation and diffuse pollution from the use of nutrients (nitrogen and phosphorus) in agriculture and from livestock also exert pressure. Discharges of insufficiently treated urban wastewater are the main point pollution sources.

### Response

345. The 1998 Convention on cooperation for the protection and the sustainable use of the waters of the Spanish-Portuguese river basins has provided the framework for transboundary cooperation also on the Douro basin. For more information, please refer to the assessment of the Tagus River.

### Future trends

346. By 2027, Spain predicts agricultural water withdrawal to increase relatively, by two per cent units, to 94 per cent. By the same year, the total withdrawal is predicted to increase by about 12 per cent, compared with the 2005 level.

347. In the Spanish part of the basin, the implementation of the forthcoming New Basin Hydrological Plan[54] as well as the National Plan for Sludge from Sewage Treatment Plants the National Sewer System and Water Treatment Plan and the new National Water Quality Plan are predicted to further improve the status of the river basin.[55]

## XXI. Tagus River Basin[56]

348. The basin of the river Tagus[57] is shared by Spain and Portugal. The river has its source in east-central Spain in the Sierra de Albarracín at an altitude of 1,590 meters and discharges to the “Mar de la Paja”, Atlantic Ocean near Lisbon.

349. The basin has a pronounced lowland plateau character in its Spanish part with an average elevation of about 633 m a.s.l.

350. Major transboundary tributaries include the rivers Erges and Sever.

Table 40
**Area and population in the Tagus Basin**

| *Country* | *Area in the country (km$^2$)* | *Country's share %* | *Population* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Spain | 55 781 | | 7 273 871 | 130 |
| Portugal | | | | |
| **Total** | | | | |

*Source:* Spanish National Statistics Institute, year 2005

### Hydrology and hydrogeology

351. Surface water resources generated in the Spanish part of Tagus river basin are estimated at 8.3 km$^3$/year and groundwater resources at 1.65 km$^3$/year, adding up to a total

[54] The Douro River Basin Management Plan, Proposed Draft, December 2010
[55] *Source*: Hydrological planning office. Confederation of the Duero basin
[56] Based on information provided by Spain and the first Assessment of Transboundary Rivers, Lakes and Groundwaters
[57] The river is also known as Tejo (in Portugal) and Tajo (in Spain).

of 9.95 $km^3$/year (average for the years 1980 to 2006). Total water resources per capita in the Spanish part of the basin are 1,367 $m^3$/year (average for the years 1980 to 2006).

Table 41

**Discharge characteristics of the Tagus at the Cedillo reservoir in Spain**

| *Discharge characteristics* | *Discharge ($m^3/s$)* | *Period of time or date* |
|---|---|---|
| $Q_{av}$ | 226 | 1975-2006 |
| $Q_{max}$ | | |
| $Q_{min}$ | | |

Table 42

**Discharge characteristics of the Tagus at the gauging station Almourol in Portugal**

| *Discharge characteristics* | *Discharge ($m^3/s$)* | *Period of time or date* |
|---|---|---|
| $Q_{av}$ | 316 | 1973-2006 |
| $Q_{max}$ | 13,103 | 1973-2006 |
| $Q_{min}$ | 0 | 1973-2006 |

352. No transboundary groundwater bodies have been defined as shared between Spain and Portugal within Tagus River Basin.

Table 43

**Aquifer Moraleja: Type 1, Silty sands; Quaternary and Tertiary, dominant groundwater flow is from higher points in the watersheds to the rivers Rivera de Gata and Tinaja**

| | Spain | Portugal |
|---|---|---|
| Area ($km^2$) | | 224 |
| Renewable groundwater resource ($m^3$/d) | | |
| Thickness in m (mean, max) | | |
| Groundwater uses and functions | Irrelevant groundwater resource (most of the water supply from the reservoirs) | |
| Other information | | |

## Pressures and transboundary impacts

Table 44
**Land use/land cover in the Tagus sub basin**

| *Country* | *Water bodies (%)* | *Forest (%)* | *Cropland (%)* | *Grassland (%)* | *Urban/industrial areas (%)* | *Surfaces with little or no vegetation (%)* | *Wetlands/ Peatlands (%)* | *Other forms of land use (%)* |
|---|---|---|---|---|---|---|---|---|
| Spain | | 39.1 | 4.6 | 21.6 | 2.6 | 0.8 | <1 | |
| Portugal | N/A | 51 | 44 | N/A | N/A | N/A | N/A | N/A |

Table 45
**Water withdrawal in different sectors (per cent)**

| *Country* | *Total withdrawal* $\times 10^6$ *m*$^3$*/year* | *Agricultural %* | *Domestic %* | *Industry %* | *Energy %* | *Other %* |
|---|---|---|---|---|---|---|
| Spain | 2 882[a] | 68 | 27 | 2 | 3 | |
| Portugal | | | | | | |

*Notes:* Some 135 × $10^6$ $m^3$ of groundwater is abstracted annually, mainly for irrigation.

[a] The figures are for year 2005.

353. The most significant pressures (ranked as widespread and severe) are water scarcity and drought periods as well as high level of river water pollution from the Madrid Metropolitan Area affecting the main river course. Some sewage collection and treatment facilities need to be adapted to comply with the EU WFD and the EU Directive 91/271/EEC concerning urban waste-water treatment.

354. Flow in the basin is highly regulated (total storage capacity 11,000 × $10^6$ $m^3$) and the high number of hydropower plants has implications to ecological flow.

355. Irrigational agriculture relies on the use of fertilizers and pesticides, and of local groundwater.

## Response measures

356. Among the management measures implemented in Spain[58] are development of the National Water Quality Plan (2007-2015) to address pollution from e.g. municipal wastewater discharges, Autonomous Community Action programmes on reduction of fertilizers in agriculture. A Special Drought Plan has been developed for the River Tagus basin[59]. Actions related to ecosystems have been identified in the Spanish National Action Plan on River Restoration[60].

[58] For information on measures for this river basin, please refer to Refer to Programme of measures within Preliminary Draft "Hydrological Management Plan"(www.chtajo.es)
[59] " Plan especial de sequías del Tajo", (www.chtajo.es)
[60] Estrategia Nacional de Restauración de Ríos, http://www.mma.es/portal/secciones/aguas_continent_zonas_asoc/dominio_hidraulico/conserv_restaur/

357. The Convention on cooperation for the protection and the sustainable use of the waters of the Spanish-Portuguese river basins was signed in Albufeira in 1998 to improve the cooperation between the Governments of Portugal and Spain related to transboundary river basins. Key provisions of the Convention are information exchange, public information and consultation, assessment on transboundary impacts, warning and emergency systems, water quality and river flows. In particular, as the Agreement and its Additional Protocol define, for each main shared river, the minimum water resources that should be received by the lower riparian country and to the river final outlet. A revision of this Convention was done at done in Madrid and Lisbon on 4 April 2008[61].

358. The former Convention of Albufeira counts with two bilateral government bodies: The Conference of the Parties with a high political level, and The Commission for the Development and Application of the Convention on cooperation for the protection and the sustainable use of the waters of the Spanish-Portuguese river basins[62] . The Commission, composed of two delegations with parity composition, meets ordinary twice a year and may establish sub-commission and working groups deemed necessary.

### Status and future trends

359. The Spanish Tagus river basin administration body, Confederation of the Tagus River basin with other local and state administrations have made a significant economic effort to implement various measures to improve both quantity and quality water resources. These measures come out from different actions plans, such as the National Hydrological Plan, the Tagus River Basin Hydrological Plan (passed 1998) as well as the National Plan for Sludge from Sewage Treatment Plants the National Sewer System and Water Treatment Plan and the new National Water Quality Plan (2007-2015). The water quality has improved in the last decade due to these action plans, and is constantly improving and water availability is increasing. Nevertheless, still a lot of effort and investment needs to be done to comply with the EU Water Framework Directive requirements, although the economic situation will reduce investment.[63]

## XXII. Cedillo Reservoir[64]

360. The Cedillo[65] Reservoir in the Tagus River basin, constructed for hydropower is located on the border between Spain and Portugal. The surface area of the reservoir is 14 $km^2$ and the volume is 0.260 $km^3$, the mean inflow equals 10.265 $km^3$ and the minimum outflow should not be lower than 2.7 $km^3$. Most of the total basin area of the reservoir — 59,000 $km^2$ — is in Spain (55,800 $km^2$).

361. The main human activities in the proximity of the reservoir are livestock farming and hunting.

362. The reservoir has had a high, but highly variable mean concentration of phosphorus.

[61] BOE. 16 January 2010 , Spanish Oficial Gazzette. www.boe.es
[62] For detailed information, please refer to the web site www.cadc-albufeira.org
[63] *Source*: Oficina de Planificación hidrológica. Confederación hidrográfica del Tajo
[64] Based on the first Assessment of Transboundary Rivers, Lakes and Groundwaters
[65] The reservoir is also known as Cedilho.

# XXIII. Guadiana River Basin[66]

363. The basin of the river Guadiana is shared by Spain and Portugal. The river has its source in Spain at Campo Montiel (1,150 m) and discharges to the Atlantic Ocean.

364. The rivers Gévora, Caya, Alcarrache, Ardila, Múrtigas and Chanza are major transboundary tributaries.

365. The basin has a pronounced lowland character with an average elevation of about 550 m a.s.l.

Table 46
**Area and population in the Guadiana Basin**

| *Country* | *Area in the country (km$^2$)* | *Country's share %* | *Population* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Spain | 55 527 | 83% | 1 452 603 | 20 |
| Portugal | 11 500 | 17% | | 17 |
| **Total** | **67 027** | | | |

*Sources*: INE, register 2005; Portuguese National Water Plan (Instituto da Agua, INAG, 2002)

## Hydrology and hydrogeology

366. Surface water resources generated in Spanish part of the Guadiana River Basin are estimated at 4,187 × $10^6$ m$^3$/year and groundwater resources at 533 × $10^6$ m$^3$/year, adding up to a total of 4,791 × $10^6$ m$^3$/year . Total water resources per capita in the basin are 3,298 m$^3$/year/capita (average for the years 1980/81 to 2005/06).

367. Relevant transboundary aquifers (or groundwater bodies) have not been identified both by Spain and Portugal.[67] In the Spanish part of the basin, groundwaters are mainly in karstified permeable aquifers, but there are also a few important aquifers in Quaternary and Tertiary unconsolidated aquifers

Table 47
**Discharge characteristics of the river Guadiana at gauging station Azud de Badajoz in Spain**

| *Discharge characteristics* | *Discharge (m$^3$/s)* | *Period of time or date* |
|---|---|---|
| $Q_{av}$ | 767 | 1995 - 2010 |
| $Q_{max}$ | | |
| $Q_{min}$ | | |

368. A total of 66 dams with capacity exceeding 1 million m$^3$ is located in the Spanish part of the Guadiana Basin The summed-up total reservoir capacity is 9,436 million m$^3$.

369. The reservoir of the Alqueva Dam (operational since 2002), in Portugal is 82 km long and has a surface area of 250 km$^2$ (63 km$^2$ in Spain). The reservoir's total capacity is

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

[67] The Aquifer of Las Vegas Bajas (UH 04.09), described as a transboundary aquifer in the Inventory of Transboundary Groundwaters by the UNECE Task Force on Monitoring and Assessment (1999), is considered to be irrelevant for the current planning process and has therefore not been identified as a shared unit.

4,150 million $m^3$ (useful capacity 3,150 million $m^3$). There are 9 other reservoirs with capacity exceeding 10 million $m^3$, with a total additional capacity of 508 million of $m^3$.

## Pressures

Table 48
**Land use/land cover in the Guadiana Basin**

| *Country* | *Water bodies (%)* | *Forest (%)* | *Cropland (%)* | *Grassland (%)* | *Urban/industrial areas (%)* | *Surfaces with little or no vegetation (%)* | *Wetlands/ Peatlands (%)* | *Other forms of land use (%)* |
|---|---|---|---|---|---|---|---|---|
| Spain | 0.96 | 21.9 | 5.2 | 25.52 | 0.7 | 0.19 | 0.18 | 0.06 |
| Portugal | | 29 | 69 | | | | | |

Table 49
**Water use in different sectors (per cent)**

| *Country* | *Total withdrawal ×10⁶ m³/year* | *Agricultural %* | *Domestic %* | *Industry %* | *Energy %* | *Other %* |
|---|---|---|---|---|---|---|
| Spain | 2 220[a] | 88 | 9 | 1.9 | 0[b] | |
| Portugal | | | | | | |

[a] The figures are for 2005

[b] Zero refers to consumptive use. The volume of non-consumptive use for hydropower is estimated at 2,293 × $10^6$ $m^3$/year.

370. Pressures assessed in the Spanish part of the Guadiana Basin as widespread but moderate are hydromorphological changes in rivers due to urban areas and croplands, nitrate and phophorus pollution by wastewater discharges and diffuse pollution by fertilizers. Pressure factors ranked as local but severe include mining and quarrying as well as intense rainfall events impacting on cities and cultivated areas. Severe problems are observed related to groundwater abstraction for agriculture use in the Upper Guadiana River Basin. All other pressures including those caused by contaminated sites are judged as minor.

## Response and transboundary cooperation

371. Saltwater upconing in the estuary and suspended sediments/mud flows are addressed in the Programme of Measures through the application of ecological flows. Improvement of efficiency of nitrogen application in agricultural production is also among the measures.

372. Transboundary cooperation on the Guadiana River Basin is carried out on the basis of the bilateral agreement (so-called “Albufeira Convention” from 1998 and its revision in 2008). Please refer to the assessment of the Tagus or annex II of document ECE/MP.WAT/WG.2/2011/8–ECE/MP.WAT/WG1/2011/8 for more information.

### Future trends

373. By 2015, the total withdrawal in the Spanish part of the basin is expected to decrease very slightly (0.4%) compared with the level of withdrawal in 2005. By 2021, withdrawal is predicted to have increased by 0.9% compared with the withdrawal in 2005. From 2005 to 2021, withdrawal for domestic use is predicted to increase by 9% and for industrial use increase by more than three times. In absolute terms, withdrawal for agriculture is predicted to decrease in the same period, by 7.5%. Non-consumptive use for hydropower is predicted to decrease.

374. The implementation of several relevant national plans in Spain — as described in the assessment of the Mino — is expected to improve the status of the Guadiana River also.

375. Regarding climate change, an increase of 1ºC in annual average temperature and a 5% precipitation decrease by 2030 is predicted. By 2060, the annual average temperature could increase by 2.5ºC, accompanied by a decrease of 8% in precipitation. The river discharge is predicted to decrease by 11% by 2030 and by 17% by 2060. A decrease of groundwater level is also predicted to result from climate change, as well as an increase in agricultural water withdrawal.[68]

## XXIV. Erne River Basin[69]

376. The Erne River Basin is one of the two principal river basins within the North Western International River Basin District (RBD) that are shared between the Republic of Ireland and Northern Ireland (a region of the United Kingdom)the other river basin being the Foyle. There is also a smaller shared river basin Lough Melvin that is fed by the County and Roogagh Rivers.

377. The 120 km-long Erne River[70], rises from Lough Gowna in County Cavan (Republic of Ireland) and flows north west through.County Fermanagh (Northern Ireland) where the river expands to form two large lakes, the Upper Lough Erne (16 km long) and the Lower Lough Erne (29 km long). The river exits Lower Lough Erne flowing westwards through Ballyshannon in County Donegal (Republic of Ireland) and discharges to the Atlantic Ocean at Donegal Bay.

378. Along the Erne and its tributaries there is a number of fisheries and Erne is very popular for trout fishing and boating. Hydroelectricity is produced along the 46 m drop in the river’s course between Belleek and Ballyshannon.

Table 50
**Area and population in the Erne Basin**

| *Country* | *Country’s share km²* | *Country’s share %* | *Number of inhabitants* | *Population density (persons/km²)* |
|---|---|---|---|---|
| Northern Ireland | 1,900 | 59.3 | | |

68 Comprehensive Assessment of the Impacts of Climate Change in Spain. Ministry of the Environment, 2005 (in Spanish)

69 Based on information provided by Ireland and on the first Assessment of Transboundary Rivers, Lakes and Groundwaters and on information published by Ireland’s Environmental Protection Agency at www.epa.ie.

70 The river is also known as Ûrn.

| | | | | |
|---|---|---|---|---|
| UK | | | | |
| Republic of Ireland | 2,800 | 40.7 | | |
| **Total** | **4,700** | | | < 40 |

## Pressures

379. Diffuse agricultural sources continue to be the main threat to the quality of Erne system particularly phosphorus. Pollution from other diffuse sources (urban land use, transportation, unsewered single house dwellings, peat exploitation and forestry) also create pressure on the system. Discharges from point sources, such as urban wastewater treatment plants, stormwater overflows, sludge treatment, IPPC industries[71] and non-IPPC industries, add to this pressure.

380. Hydromorphological changes due to the level being artificially controlled to support hydoelectic power generation at Ballyshannon along with reservoirs, water abstraction, channel alterations, agricultural enhancements and flood defence, also exert pressure on the Erne basin.

381. Zebra mussels and of other invasive alien species have continued to spread in the Erne system especially in the lakes, and this a cause for concern. Zebra mussels are known to impact on other biological elements, with unfavourable repercussions for the water ecology.

### Lough Melvin

382. Lough Melvin is a unique and internationally significant lake located in the counties of Leitrim (Republic of Ireland) and Fermanagh (Northern Ireland) and is described as " one of the few remaining natural post-glacial salmonid lakes in northwestern Europe". The lake covers an area of 2.2 km$^2$ and as a oligo-mesotrophic (low-medium nutrient) lake is renowned for its unique assemblage of fish species and diversity of flora and fauna. The Lake is fed by a number of small rivers rising in County Leitrim and Sligo in the Republic and of Ireland that represents the majority of the catchment and the Roogagh River that rises in County Fermanagh (Northern Ireland). The river in drained by the River Drowes the flows westwards through County Leitrim and Donegal and discharges to the Atlantic Ocean at Donegal Bay.[72]

Table 51
**Area and population in the Lough Melvin Basin**

| *Country* | *Country's share km$^2$* | *Country's share %* | *Number of inhabitants* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Northern Ireland UK | 60 | 15 | | |
| Republic of Ireland | 353 | 85 | | |
| **Total** | **413** | | 3080 | 7.5 |

71 Industries that fall under the Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control.

72 *Source*: Lough Melvin Catchment Management Plan, Emer Campbell and Bob Foy, June 2008 (www.nrfb.ie)

## Pressures

383. The health and status of the Lough Melvin is vulnerable to human activities particularly increases in phosphorus loadings from housing, forestry and agriculture. Currently phosphorus concentrations in the lake to have increased by over 40% in almost a decade and monitoring indicates phorphorus loadings are continuing to increase.

## Status

384. Eutrophication due to phosphorus enrichment has been identified as a problem resulting from diffuse pollution. With controls on agriculture and nutrient reduction at the larger wastewater treatment works the situation has been improving.

385. Annual mean nitrate values, which have been recorded for the Erne during the study period of 1979-2006, have been slightly increasing in the last few years of the study (2000-2006). Annual mean phosphate values have been slightly fluctuating over the study period but mainly remained under "good status".

386. Overall in the Republic of Ireland's rivers there was a slight decrease in the amount of channel classified as seriously polluted when compared to the 2001 – 2003 period. Between the years 2004-2006, biological status of the Erne channel was assessed to be mostly in good status, 25 per cent moderate, some in poor status and very little as bad.[73]

387. According to the UK classification, the ecological status of both the upper and lower Lough Erne was classified as moderate ecological potential[74]. The ecological status was affected by phosphorus levels and plant growth (macrophytes) and the management of the levels to support hydro power and flood defense. Information on the general status of water bodies within the river basin district is covered by the information on the Foyle basin.

388. Freshwater pearl mussels are present in some of the tributaries to the Upper and Lower Lough Erne and these are subject to protection and an improvement programme to promote recruitment of the mussels.

389. The North Western River Basin Management Plan assesses the majority of the rivers flowing into Lough Melvin at of Good to High status and Lough Melvin varies between good and moderate status however the phosphorus levels pose risk to its status as a mesotrophic lake and its is considered to be in unfavourable status as a result.

## Response measures

390. The Erne is monitored and reports on state of the environment and water quality have been produced regularly. Also groundwater monitoring networks have been developed. Following the publication of the North Western River Basin Management Plan an action plan has been developed for the Lower Lough Erne sub-basin and action plan will be developed during 2011 for the Upper Lough Erne sub-basin. A further action plan for the Melvin and Arney sub-basin will be developed in 2012.

391. A bilateral flood-control scheme is operational to manage the water level in the Upper and Lower Lough Erne lakes.

[73] According to Ireland's Water Quality Report 2004-2006.

[74] *Source*: North Western International River Basin Management Plan Summary, December 2009

392. A catchment Management Plan has been developed for the Lough Melvin sub-basin along with the North Western River Basin Management Plan. These will support actions to address the pressures within the basin.

### Future trends

393. Recent years have seen more intensive rainfall events occurring that pose a risk of flooding in the area. Management of the levels within the Erne basin are a critical factor and need to be kept under review. It is also proposed to develop ecological modelling tools to assist with lake management. The action being taken to manage waste in agriculture should assist in reducing phosphorus loads within the Erne river basin.

## XXV. Foyle River Basin[75]

394. The North Western International River Basin District is shared by the Republic of Ireland and Northern Ireland (a region of the United Kingdom). The river basin district is bounded to the north and west by the Atlantic Ocean and to the east by the Neagh Bann International River Basin District and to the south lies the Shannon International River Basin District. The Foyle river basin has its source in the Sperrins mountains in the County of Tyrone in Northern Ireland where the River Strule is fed by a number of tributaries. This is joined by the river Derg that rises in County Donegal in the Republic of Ireland and further downstream the River Finn that also has its source in County Donegal. After the confluence with the River Finn the river is known as the River Foyle and is estuarine in nature as it flows through the city of Londonderry/Derry into Lough Foyle that discharges to the Atlantic Ocean.

Table 52
**Area and population in the North Western River Basin District[**

| *Country* | *Country's share km$^2$* | *Country's share %* | *Number of inhabitants* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Northern Ireland (UK) | 7,400 | 60.2 | | |
| Republic of Ireland | 4,900 | 39.8 | | |
| **Total** | **12,300** | | < 500,000 | < 40 |

395. The Foyle basin and valley are fertile and support intensive cattle, sheep, pig and arable farming. In the mountainous regions of the Foyle basin there is coniferous forest and some sheep and cattle grazing. The Foyle river system is recognised as an important and popular fishery for Atlantic salmon and has protected status.

396. Pressures in the Foyle River basin are principally due to diffuse agricultural sources and increased pressure from growing populations to support industry and disposal of urban wastewater and water abstraction. There are also hydromorpological pressures due to water

[75] Based on information provided by Ireland and Northern Ireland Environment Agency, and on the first Assessment of Transboundary Rivers, Lakes and Groundwaters.

abstraction, agriculture enhancements and flood defense. Pressures in the estuary complex (Lough Foyle wetland area) are described below.

397. According to the UK classification[76], the status of the Foyle River is of moderate ecological potential (MEP). This is due to elevated nitrogen levels and modifications at the lower end of the estuary to accommodate harbour and navigational operations. The UK status assessment for the North Western RBD as a whole is 0.5 % high, 30 % good, 54.5% Moderate or MEP, 15 Poor or PEP.[77] Biological class of the Foyle was assessed by Ireland in 2004; 47 % in good, 28 % in moderate and 25 % in poor status.[78]

398. Part of River Foyle and its tributaries situated in Northern Ireland are included in Area of Special Scientific Interest (ASSI). These areas are notable for the physical diversity, naturalness of the banks and channels, and for richness and naturalness of its plant and animal communities.[79]

399. According to the Groundwater Action Programme in the North-Western International River Basin District (IRBD) Management Plan, quantitative, chemical and overall status of groundwater is classified as good.

# XXVI. Lough Foyle wetland area in the Foyle Basin

*General description of the wetland area*

400. The Lough Foyle wetland area is shared by United Kingdom (Northern Ireland) and Ireland. Lough Foyle[80] is a diverse estuarine wetland complex with a string of habitats both below high water and above. It is a 26-km long inlet on the northern coast of Ireland and is shared between Ireland and Northern Ireland. 'The Tuns' - a large submerged sandbank system forms the northern boundary of the lough, outer part of which has a more exposed character. The area belonging to Ireland in the West is made up of rocky shores, fishing villages with little harbours, small woodlands, grassland for sheep and cattle grazing and small tourist resorts with beaches and sheltered coves. In contrast, the Northern Ireland side is dominated by soft coast and low lying hinterland with larger agricultural holdings behind sea embankments. A large sand dune system in the North adds to the biodiversity value. The tidal upper estuaries are set in extensive floodplain wetlands with reedbeds, fresh water and salt marshes and embanked slob lands – especially on the Northern Ireland inner lough side. There are also many (~1/km) small direct inflows of streams from the hinterland reflecting Ireland's high rainfall which can have a major influence on the inner lough salinity and nutrient levels.

*Main wetland ecosystem services*

401. The area is important for fishing with mixed inshore sea fisheries, seasonal wild salmon fishing and passive gear for lobster and crab. In the extensive intertidal area periwinkles and cockles are gathered. Mussel bottom culture has since its start in the 1990s boomed with fully mechanized dredgers used to bring in mussel seed, relay and harvest. Apart from ferry traffic recreational uses range from bathing and boating to wildlife

[76] *Source*: North Western International River Basin Management Plan Summary, December 2009

[77] *Source*: Northern Ireland Environment Agency (NIEA), United Kingdom (http://www.ni-environment.gov.uk)

[78] According to Irelands Water Quality Report 2004-2006. (http://www.epa.ie)

[79] *Source*: Northern Ireland Environment Agency. (http://www.doeni.gov.uk)

[80] The watershed of the lough covers an area of approximately 3,700 $km^2$ and includes the three main rivers Foyle, Faughan and Roe as well as their tributaries fanning out to the South and East.

watching and educational 'tourism'. While large parts of the low lying lands are embanked, there is still substantial flood retention value in the wetlands.

*Cultural values of the wetland area*

402. There are historic settlements on the western shore of the lough with shell middens and other archaeological features. Derry is one of Europe's walled cities.

*Biodiversity values of the wetland area*

403. The lough is a highly productive area. Due to geology, exposure, salinity and current it offers a wide range of habitats, with rich mudflats, both rock and biogenic reefs, seagrass beds and is particularly rich in molluscs and fish - attributes which attract high numbers of wintering wild fowl and waders. Further, the river Foyle and tributaries have the largest Atlantic salmon population in NI and high genetic diversity.

*Pressure factors and transboundary impacts*

404. Several pressure factors lead to the decline of shared natural resources within the Lough area. Water pollution from agriculture, industry and sewage impact the inner eutrophic lough. In terms of modern mollusc fisheries, especially mussel bottom culture affects areas of native oyster beds through dredging and introduction of large quantities of seed mussels from the Irish Sea. Gigas oysters, now an invasive species, have been imported and changed the local hydrology. Shellfish Herpes virus has been introduced and is now affecting native oysters.

405. While new transport related construction pressure is now on the decline, construction for green infrastructure – wind and water energy – is starting. In the immediate hinterland fragmentation is caused by roads, flood defenses and housing developments. In terms of the entire river basin, agricultural intensification and wetland loss are pressures which are recently increasing again caused by the rise in market prices for agricultural products. This comes on top of the European Commission's Common Agricultural Policy payments for farmers which are provided for land in good agricultural condition, but withheld for wetlands. This measure provides incentives to drain or fill in existing wetlands, especially as planning law is too weak. Further, there are control problems in terms of sand and gravel extraction from rivers and estuary. Additional pressures identified are water abstraction, the damming of rivers, peat harvesting and forestry. Finally, climate change associated increased erosion risk of vulnerable shores and rising sea levels which may inundate low lying lands is likely to cause further flood and erosion defense works.

*Transboundary wetland management*

406. The River Foyle is a transboundary wetland and now designated a SAC under the EU Habitats Directive on both Ireland and NI sides, due to its abundance of salmon, as well as lamprey and otter. It is managed by the two responsible governments, local authorities and the cross border Lough Agency — with responsibility for fisheries —set up by agreement between the two states. Both governments claim the lough up to mean low water mark of the other. This is one of the reasons why there is no mechanism for designating the entire lough as Natura 2000/Ramsar Site although much of the rim of the lough has been designated as Area of Special Scientific Interest (ASSI) under UK regulation, SPA, as well as Ramsar site.

407. Water quality monitoring of the lough and its watershed and associated fish monitoring, is carried out by the Lough Agency. The county councils on both sides also monitor selected parameters like bathing water quality and discharges where licensed permits have been granted. The EPA and NI Environment Agency monitor the larger integrated pollution licenses.

408. Existing protected areas urgently require management plans and measures, implementation responsibilities need to be clarified.

409. SWAN – the umbrella organization of environmental organizations in the Ireland produced submissions on a draft River Basin Management Plan for the North Western International River Basin District which lies along the western shore of Lough Foyle on the IRELAND side.

410. While there is no climate change adaptation strategy for the lough, each government is developing own climate change strategies which include plans for green energy - wind, tidal and wave. Both have commissioned offshore energy SEAs.

# XXVII. Neagh Bann River Basin[81]

411. The Neagh Bann River Basin District covers and area of around 6,000 km$^2$ of Northern Ireland (a region of the United Kingdom) and drains 38% of the land area, a further 2,000 km$^2$ is within the Republic of Ireland. Most of the surface water collected by the river systems within the basin drains to Lough Neagh, the largest freshwater lake in the British Isles, before discharging to the Atlantic Ocean, north of the island via the Lower River Bann. Only a small portion of the River Basin District, at the Southern end of the catchment is shared with the Republic of Ireland. This is principally the River Blackwater system that rises in County Fermanagh in Northern Ireland and flows eastward, skirting the border with Co Monaghan in the Republic of Ireland, before turning northwards to drain into Lough Neagh, in Northern Ireland. Smaller river basins that are shared between the two countries at the southern end of the Neagh Bann River Basin District are the Castletown and Fane Rivers draining into the Irish Sea at Dundalk Bay.

412. Land around Lough Neagh (surface area 396 km$^2$) is typified by improved pasture but it also includes some important wetland habitats. The main land use around the Blackwater River basin is improved grassland and arable horticulture with fruit growing in the eastern part of the basin..

413. The river is important for salmon and eel fisheries.

Table 53
**Area in the Neagh Bann River Basin District**

| *Country* | *Country's share km$^2$* | *Country's share %* | *Number of inhabitants* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Northern Ireland (UK) | 5,740 | 97.1 | | |
| Republic of Ireland | 2000 | 2.9 | | |
| **Total** | **5,600** | | | |

[81] Based on information provided by Ireland and the Northern Ireland Environment Agency, and on the first Assessment of Transboundary Rivers, Lakes and Groundwaters

Table54
**Area and population in the River Blackwater River Basin**

| *Country* | *Country's share km$^2$* | *Country's share %* | *Number of inhabitants* | *Population density (persons/km$^2$)* |
|---|---|---|---|---|
| Northern Ireland (UK) | 1 100 | 97.1 | 38 000 | 35 |
| Republic of Ireland | 550 | 2.9 | | |
| **Total** | **5 650** | | | |

*Source*: http://www.doeni.gov.uk/niea/workingtogether_managingoursharedwaters_nbirbd.pdf

## Hydrology and hydrogeology

414. The average discharge of the Upper Bann (upstream from Lake Lough Neagh) is approximately 5.4 m$^3$/s at the Dynes Bridge and of the Lower Bann 92.1 m$^3$/s at the Movanagher. [82]

## Pressures and status

415. According to UK River Basin Management Plan status assessement (2009), the River Blackwater Local Management Area (LMA) which equates to the Blackwater River Basin in Northern Ireland had 12% of its water bodies at good status, 42% at moderate status (2% of these being heavily modified resulting in moderate ecological potential, 35% at poor status (6% of these being PEP) and 12% at bad status (4% of these being BEP).

416. This results in 88% of surface water bodies within River Blackwater LMA in Northern Ireland being classified as less than good status. Many of the rivers failed to achieve good status due to low levels of dissolved oxygen and elevated levels of phosphorous. Invertebrates have also been heavily impacted.

417. There are a number of pressures that may prevent some waters reaching good quality. The main ones are considered to be:

- Abstraction and flow regulation
- Diffuse and point source pollution
- Changes to morphology (physical habitat)
- Invasive alien species

418. According to EPA, Ireland, the waters in the portion of the Neagh Bann IRBD situated south of the border are the most polluted and represents one of the most polluted regions in Ireland. The impact tends from slight pollution, mainly seen as eutrophication with an increasing trend to moderate usually characterized by marked organic and severe eutrophication effects.

419. The overall status of the Neagh Bann River Basin District was assessed in 2008 by the UK and Republic of Ireland giving initial classification results; 23% of waters at good

[82] The discharge values are based on Marsh, T. J. and Hannaford, J. (Eds). 2008. UK Hydrometric Register. Hydrological data UK series. Centre for Ecology & Hydrology.

or better class, 71% of water bodies less than good, with the remaining 6% yet to be assessed.[83]

420. According to the Groundwater Action Programme in the Neagh-Bann International River Basin District (IRBD) in Ireland, quantitative status is classified mostly as good and small part (7 %) as poor. Chemical status of groundwater is classified as good and overall status as good.

421. An action plan will be drawn up during 2011 for the River Blackwater LMA to address those water bodies that are of less than good status.

[83] According to United Kingdoms Neagh Bann Draft River Basin Management Plan http://www.doeni.gov.uk/niea/neaghbann_draftrbmp_tier2.pdf.