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# REPORT ON EU WATER POLICIES AND INNOVATION AND EU RECOMMENDATIONS AND LEGISLATION IN WATER SECTOR

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# Contents

# 1 Introduction

The European Union has adopted a set of strategies, plans, directives and legislation related to the water sector, in particular due to the increasing environmental challenges. A systematic overview of the current state of EU legislation in the field of water resource management will be given in the following report. Afterwards, the implementation of this legislation in EU project partner countries will be highlighted.

The final report details the fundamental basis of EU legislation, which will be further used for project initiatives to manage the complexity of water challenges in WB partner countries. In addition, it will be used in preparing trainings for professionals in water sector.

# 2 EU legislation

The EU directives and strategies in the field of water resource management are listed below and described in detail in the following subchapters.

- Water Framework Directive
- Floods Directive
- Drinking Water Directive
- Groundwater Directive
- Urban Wastewater Treatment Directive
- Water Scarcity and Droughts Policy
- Industrial Emissions Directive
- Renewables Energy Directive
- Habitats Directive
- Birds Directive

The EU directives were adopted by the European Parliament and the European Council and afterwards incorporated into national legislation by the member states of the European Union.

## 2.1 Water Framework Directive

The Water Framework Directive (WFD, 2000) – named "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" came into force on the 22nd of December 2000 and unifies the legal framework of water policy in the EU with the aim of a more sustainable and environmental-friendly use of water in future.

Due to the fact that the environmental conditions in the EU are quite variable, the directive is limited to a definition of qualitative objectives and appropriate methods, which should be used to achieve these objectives and to ensure good water qualities.

The overall aim is the definition of pan-European uniform standards.

The following statement is recorded in the introduction of the WFD (2000):

*"Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such."*

### 2.1.1 Purpose of the WFD (Article 1, WFD, 2000)

*"The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:*

*(a) prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;*

*(b) promotes sustainable water use based on a long-term protection of available water resources;*

*(c) aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;*

*(d) ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and*

*(e) contributes to mitigating the effects of floods and droughts and thereby contributes to:*

- *the provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable, balanced and equitable water use,*
- *a significant reduction in pollution of groundwater,*
- *the protection of territorial and marine waters, and*
- *achieving the objectives of relevant international agreements, including those which aim to prevent and eliminate pollution of the marine environment, by Community action under Article 16(3) to cease or phase out discharges, emissions and losses of priority hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances."*

### 2.1.2 Environmental objectives (Article 4, WFD, 2000)

The environmental objectives are defined for surface waters, groundwater and protected areas.

(a) For surface waters

- Prevention of deterioration of the status of all surface water bodies.
- Enhancement and restoration of all water bodies to achieve a good surface water status, which is based on a good chemical and ecological status.

- Enhancement and restoration of all heavily modified water bodies to achieve a good surface water potential, which is based on a good chemical and ecological potential.

(b) For groundwater

- Prevention of input of pollutants into groundwater and prevention of deterioration of the status of all groundwater bodies.
- Enhancement and restoration of all groundwater bodies to achieve a good groundwater status, which is based on a good chemical and quantitative status.

(c) For protected areas

- *"Member States shall achieve compliance with any standards and objectives at the latest 15 years after the date of entry into force of this Directive, unless otherwise specified in the Community legislation under which the individual protected areas have been established."*

Quality elements for the status classification are listed in the Annex of the WFD (2000). An example of quality elements for the classification of the ecological status of rivers is given in Table 1.

**Table 1: Quality elements for the classification of ecological status for rivers**

| Biological elements |
|---|
| Composition and abundance of aquatic flora |
| Composition and abundance of benthic invertebrate fauna |
| Composition, abundance and age structure of fish fauna |
| **Hydromorphological elements supporting the biological elements** |
| Hydrological regime (quantity and dynamics of water flow, connection to groundwater bodies) |
| River continuum |
| Morphological conditions (river depths and width variation, structure and substrate of the river bed, structure of the riparian zone) |
| **Chemical and physico-chemical elements supporting the biological elements** |
| General (thermal conditions, oxygenation conditions, salinity, acidification status, nutrient conditions) |
| Specific pollutants (pollution by all priority substances identified as being discharged into the body of water, pollution by other substances identified as being discharged in significant quantities into the body of water) |

For each quality element listed in Table 1 the status (high, good, moderate) are defined in the Annex of the WFD (2000).

The classification for the quality element "Hydromorphological elements supporting the biological elements" is detailed in Table 2.

**Table 2: Classification for the quality element "Hydromorphological elements supporting the biological elements"**

| Element | High status | Good status | Moderate status |
|---|---|---|---|
| Hydrological regime | The quantity and dynamics of flow, and the resulting connection to groundwater, reflects entirely, or nearly entirely, undisturbed conditions. | Conditions consistent with the achievement of the values specified above for the biological quality elements. | Conditions consistent with the achievement of the values specified above for the biological quality elements. |
| River continuum | The continuity of the river is not disturbed by anthropogenic activities and allows undisturbed migration of aquatic organisms and sediment transport. | Conditions consistent with the achievement of the values specified above for the biological quality elements. | Conditions consistent with the achievement of the values specified above for the biological quality elements. |
| Morphological conditions | Channel patterns, width and depth variations, flow velocities, substrate conditions and both the structure and condition of the riparian zones correspond entirely or nearly entirely to undisturbed conditions. | Conditions consistent with the achievement of the values specified above for the biological quality elements. | Conditions consistent with the achievement of the values specified above for the biological quality elements. |

Based on the evaluation of all listed quality elements (Table 3) an integrated assessment of the quality status in general is possible. Waters achieving a status below moderate shall be classified as poor or bad.

**Table 3: General definition of the quality status for rivers, lakes, transitional waters and coastal waters**

| Element | High status | Good status | Moderate status |
|---|---|---|---|
| General | There are no, or only very minor, anthropogenic alterations to the values of the physico-chemical and hydromorphological quality elements for the surface water body type, compared to those normally associated with that type under undisturbed conditions.<br>The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and | The values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions. | The values of the biological quality elements for the surface water body type deviate moderately from those normally associated with the surface water body type under undisturbed conditions. The values show moderate signs of distortion resulting from human activity and are significantly more disturbed than under conditions of good status. |

| | | | |
|---|---|---|---|
| | show no, or only very minor, evidence of distortion.<br>These are the type-specific conditions and communities. | | |

### 2.1.3 Relevant aspects for river basin management

The main relevant aspects for river basin management are listed below.

- Coordination of administrative arrangements within river basin districts (Article 3, WFD, 2000)

  Member states shall identify their river basins within their territory and assign them to international river basin districts, due to the fact that a river basin often covers the territory of more than one member state. Appropriate administrative arrangements as well as appropriate competent authorities shall be identified by each member state to ensure the achievement of the WFD purposes.

- The combined approach for point and diffuse sources (Article 10, WFD, 2000)

  *"Where a quality objective or quality standard, whether established pursuant to this Directive, in the Directives listed in Annex IX, or pursuant to any other Community legislation, requires stricter conditions than those which would result from the application of paragraph 2, more stringent emission controls shall be set accordingly."*

- River basin management plans (Article 13, WFD, 2000)

  The appropriate instrument for implementation of the WFD is the river basin management plan, which includes all relevant projects and tasks within a river basin. In the case of an international river basin district the member states shall produce a single international river basin management plan.

- Public information and consultation (Article 14, WFD, 2000)

  *"Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the river basin management plans. Member States shall ensure that, for each river basin district, they publish and make available for comments to the public."*

## 2.2 Floods Directive

The Floods Directive (FD, 2007) – named "Directive 2007/60/EC of the European Parliament and of the Council of October 2007 on the assessment and management of flood risks" – came into force on the 23rd of October 2007.

The Floods Directive introductorily states that:

*"Floods have the potential to cause fatalities, displacement of people and damage to the environment, to severely compromise economic development and to undermine the economic activities of the Community."*

*"Floods are natural phenomena which cannot be prevented. However, some human activities (such as increasing human settlements and economic assets in floodplains and the reduction of the natural water retention by land use) and climate change contribute to an increase in the likelihood and adverse impacts of flood events."*

### 2.2.1 Purpose of the FD (2007)

Keeping in mind the introduction statement the purpose of the Floods Directive is given by:

*"The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community."*

### 2.2.2 Contents of the FD (2007)

The Floods Directive is subdivided into the following eight chapters, whereby the chapters 2 to 4 are described in detail below:

Chapter 1: General Provisions

Chapter 2: Preliminary flood risk assessment

Chapter 3: Flood hazard maps and flood risk maps

Chapter 4: Flood risk management plans

Chapter 5: Coordination with Directive 2000/60/EC, public information and consultation

Chapter 6: Implementing measures and amendments

Chapter 7: Transitional measures

Chapter 8: Reviews, reports and final provisions

**Chapter 2: Preliminary flood risk assessment**

*"Based on available or readily derivable information, such as records and studies on long term developments, in particular impacts of climate change on the occurrence of floods, a preliminary flood risk assessment shall be undertaken to provide an assessment of potential risks."*

The preliminary flood risk assessment shall consider and include for each river basin district or unit a description of past floods and a description of significant adverse consequences of similar future events in an appropriate scale. In addition, it shall identify those areas (within a river basin unit) for which a potential significant flood risk exists or might be likely to occur. The assessment had to be implemented until 2011.

**Chapter 3: Flood hazard maps and flood risk maps**

*"Flood hazard maps shall cover the geographical areas which could be flooded according to the following scenarios:*

*(a) floods with a low probability, or extreme event scenarios;*

*(b) floods with a medium probability (likely return period ≥ 100 years);*

*(c) floods with a high probability, where appropriate."*

The flood hazard maps shall include the flood extent, water depths (or water levels) and the flow velocity (or relevant water flow).

*"Flood risk maps shall show the potential adverse consequences associated with flood scenarios referred to in paragraph 3 and expressed in terms of the following:*

*(a) the indicative number of inhabitants potentially affected;*

*(b) type of economic activity of the area potentially affected;*

*(c) installations as referred to in Annex I to Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (1) which might cause accidental pollution in case of flooding and potentially affected protected areas identified in Annex IV(1)(i), (iii) and (v) to Directive 2000/60/EC;*

*(d) other information which the Member State considers useful such as the indication of areas where floods with a high content of transported sediments and debris floods can occur and information on other significant sources of pollution."*

Flood hazard maps and flood risk maps had to be implemented until 2013.

Chapter 4: Flood risk management plans

*"Member States shall establish appropriate objectives for the management of flood risks for the areas identified under Article 5(1) and the areas covered by Article 13(1)(b), focusing on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity, and, if considered appropriate, on nonstructural initiatives and/or on the reduction of the likelihood of flooding.*

*Flood risk management plans shall include measures for achieving the objectives established in accordance with paragraph 2 and shall include the components set out in Part A of the Annex.*

*Flood risk management plans shall take into account relevant aspects such as costs and benefits, flood extent and flood conveyance routes and areas which have the potential to retain flood water, such as natural floodplains, the environmental objectives of Article 4 of Directive 2000/60/EC, soil and water management, spatial planning, land use, nature conservation, navigation and port infrastructure.*

*Flood risk management plans shall address all aspects of flood risk management focusing on prevention, protection, preparedness, including flood forecasts and early warning systems and taking into account the characteristics of the particular river basin or sub-basin. Flood risk management plans may also include the promotion of sustainable land use practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event.*

*In the interests of solidarity, flood risk management plans established in one Member State shall not include measures which, by their extent and impact, significantly increase flood risks upstream or downstream of other countries in the same river basin or sub-basin, unless these measures have been*

*coordinated and an agreed solution has been found among the Member States concerned in the framework of Article 8."*

Flood hazard maps and flood risk maps had to be implemented until 2015.

A revision or update of the mentioned maps shall be done every six years after the first publication.

## 2.3 Drinking Water Directive

The Drinking Water Directive (DWD, 2015) – named "Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption" – came into force on the 3rd of December 1998 and was amended in the years 2003, 2009 and 2015.

### 2.3.1 Objective of the DWD (2015)

The overall objective of the DWD (2015) is defined as:

*"This Directive concerns the quality of water intended for human consumption.*

*The objective of this Directive shall be to protect human health from the adverse effects of any contamination of water intended for human consumption by ensuring that it is wholesome and clean."*

### 2.3.2 Definitions of the DWD (2015)

Special attention is paid to the definition of "water intended for human consumption":

> *"(a) all water either in its original state or after treatment, intended for drinking, cooking, food preparation or other domestic purposes, regardless of its origin and whether it is supplied from a distribution network, from a tanker, or in bottles or containers;*
>
> *(b) all water used in any food-production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption unless the competent national authorities are satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form;*
>
> *'domestic distribution system' shall mean the pipework, fittings and appliances which are installed between the taps that are normally used for human consumption and the distribution network but only if they are not the responsibility of the water supplier, in its capacity as a water supplier, according to the relevant national law."*

### 2.3.3 Relevant aspects of the DWD (2015)

The main relevant aspects for implementing the DWD are listed below.

- General obligations (Article 4, DWD, 2015)

  Member states shall take all necessary measures to ensure wholesome and clean water intended for human consumption meaning that water:

  *"(a) is free from any micro-organisms and parasites and from any substances which, in numbers or concentrations, constitute a potential danger to human health, and*

  *(b) meets the minimum requirements set out in Annex I, Parts A and B;"*

- Quality standards (Article 5, DWD, 2015)

  *"Member States shall set values applicable to water intended for human consumption for the parameters set out in Annex I.*

  *The values set in accordance with paragraph 1 shall not be less stringent than those set out in Annex I. As regards the parameters set out in Annex I, Part C, the values need be fixed only for monitoring purposes and for the fulfilment of the obligations imposed in Article 8.*

  *A Member State shall set values for additional parameters not included in Annex I where the protection of human health within its national territory or part of it so requires. The values set should, as a minimum, satisfy the requirements of Article 4(1)(a)."*

- Point of compliance (Article 6, DWD, 2015)

  The quality standards shall be complied with:

  *"(a) in the case of water supplied from a distribution network, at the point, within premises or an establishment, at which it emerges from the taps that are normally used for human consumption;*

  *(b) in the case of water supplied from a tanker, at the point at which it emerges from the tanker;*

  *(c) in the case of water put into bottles or containers intended for sale, at the point at which the water is put into the bottles or containers;*

  *(d) in the case of water used in a food-production undertaking, at the point where the water is used in the undertaking."*

- Monitoring (Article 7, DWD, 2015)

  *"Member States shall take all measures necessary to ensure that regular monitoring of the quality of water intended for human consumption is carried out, in order to check that the water available to consumers meets the requirements of this Directive and in particular the parametric values set in accordance with Article 5. Samples should be taken so that they are representative of the quality of the water consumed throughout the year. In addition, Member States shall take all measures necessary to ensure that, where disinfection forms part of the preparation or distribution of water intended for human consumption, the efficiency of the disinfection treatment applied is verified, and that any contamination from disinfection by-products is kept as low as possible without compromising the disinfection."*

- Information and reporting (Article 13, DWD, 2015)

  *"Member States shall take the measures necessary to ensure that adequate and up-to-date information on the quality of water intended for human consumption is available to consumers."*

### 2.3.4 ANNEX of the DWD (2015)

Parameters and parametric values intended for quality standards of water used for human consumption are distinguished between microbiological parameters, chemical parameters and indicator parameters and listed in ANNEX 1 of the DWD. The microbiological parameters are exemplarily shown in Figure 1.

*ANNEX I*

**PARAMETERS AND PARAMETRIC VALUES**

PART A

**Microbiological parameters**

| Parameter | Parametric value (number/100 ml) |
|---|---|
| *Escherichia coli (E. coli)* | 0 |
| Enterococci | 0 |

The following applies to water offered for sale in bottles or containers:

| Parameter | Parametric value |
|---|---|
| *Escherichia coli (E. coli)* | 0/250 ml |
| Enterococci | 0/250 ml |
| *Pseudomonas aeruginosa* | 0/250 ml |
| Colony count 22 °C | 100/ml |
| Colony count 37 °C | 20/ml |

**Figure 1: ANNEX 1 – Parameters and parametric values, part A, microbiological parameters (DWD, 2015)**

## 2.4 Groundwater Directive

The Groundwater Directive (GWD, 2006) – named "Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration" – came into force on the 16th of January 2007 and was amended in the year 2014.

The Groundwater Directive introductorily states that:

*"Groundwater is a valuable natural resource and as such should be protected from deterioration and chemical pollution. This is particularly important for groundwater-dependent ecosystems and for the use of groundwater in water supply for human consumption."*

### 2.4.1 Purpose of the GWD (2006)

The Groundwater Directive establishes specific measures, which are stated below, as provided for in the Water Framework Directive in order to prevent and control groundwater pollution:

*"(a) criteria for the assessment of good groundwater chemical status; and*

*(b) criteria for the identification and reversal of significant and sustained upward trends and for the definition of starting points for trend reversals."*

Additional information on the provisions for preventing or limiting inputs of pollutants into groundwater, which are listed in the Water Framework Directive, is part of the Groundwater Directive. The aim is the prevention and deterioration of the status of all groundwater bodies.

### 2.4.2 Relevant aspects of the GWD (2006)

The main relevant aspects of the GWD are listed below.

- Criteria for assessing groundwater chemical status (Article 3, GWD, 2006)

  The following criteria are used for the purpose of the assessment of the chemical status of groundwater bodies (or groups):

  *"(a) groundwater quality standards as referred to in Annex I;*

  *(b) threshold values to be established by Member States in accordance with the procedure set out in Part A of Annex II for the pollutants, groups of pollutants and indicators of pollution which, within the territory of a Member State, have been identified as contributing to the characterization of bodies or groups of bodies of groundwater as being at risk, taking into account at least the list contained in Part B of Annex II."*

- Procedure for assessing groundwater chemical status (Article 4, GWD, 2006)

  The procedure, which shall be used for assessing groundwater chemical status, is described in Article 4 and includes the consideration of a groundwater body with a good chemical status, the choice of the monitoring site and the publication procedure.

- Identification of significant and sustained upward trends and the definition of starting points for trend reversals (Article 5, GWD, 2006)

  The procedure for identifying significant and sustained upward trends and for reversing this trend are described in this Article.

- Measures to prevent or limit inputs of pollutants into groundwater (Article 6, GWD, 2006)

  In Article 6 the identification of hazardous or non-hazardous substances and necessary measures to prevent or limit inputs of pollutants into groundwater are defined.

## 2.5 Urban Waste-Water Treatment Directive

The Urban Waste-Water Treatment Directive (UWTD, 1991) – named "Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment" – came into force on the 29th of May 1991 and was amended in the years 1998, 2003, 2008 and 2013.

In Article 1 of the UWTD (1991) is introductorily stated:

*"This Directive concerns the collection, treatment and discharge of urban waste water and the treatment and discharge of waste water from certain industrial sectors.*

*The objective of the Directive is to protect the environment from the adverse effects of the abovementioned waste water discharges."*

### 2.5.1 Relevant aspects of the UWTD (1991)

The main relevant aspects of the UWTD are listed below.

- Collecting systems (Article 3, UWTD, 1991)

  At the latest by 31 December 2005 member states shall ensure that all agglomerations with a p.e. (person equivalent) of more than 2000 are provided with collecting systems for urban water.

- Secondary waste water treatment (Article 4, UWTD, 1991)

  At the latest by 31 December 2005 member states shall ensure that all agglomerations with a p.e. (person equivalent) between 2000 and 10000 are subject to secondary treatment or equivalent treatment.

- Sensitive areas (Article 5, UWTD, 1991)

  At the latest by 31 December 1993 member states shall identify sensitive areas according to the criteria laid down in the Annex of this directive.

  A more stringent treatment is necessary before discharging into sensitive areas.

- Treatment in small agglomerations (Article 7, UWTD, 1991)

  At the latest by 31 December 2005 member states shall ensure that all agglomerations with a p.e. (person equivalent) less than 2000 are subject to an appropriate treatment

- Reuse of treated waste water and sludge arising during treatment (Article 12&14, UWTD, 1991)

  Whenever appropriate, treated waste water and sludge arising from waste water treatment shall be re-used. Disposal routes shall minimize the adverse effects on the environment.

- Industrial waste water (Article 13, UWTD, 1991)

  *"Member States shall ensure that by 31 December 2000 biodegradable industrial waste water from plants belonging to the industrial sectors listed in Annex III which does not enter urban waste water treatment plants before discharge to receiving waters shall before discharge respect conditions established in prior regulations and/or specific authorization by the competent authority or appropriate body, in respect of all discharges from plants representing 4 000 p.e. or more."*

- Monitoring and publication of information (Article 15&16, UWTD, 1991)

Competent authorities shall monitor discharges and the amount and composition of sludge from waste water treatment plants according to the requirements. Reports about the monitoring shall be transmitted to the European Commission.

### 2.5.2 ANNEX I of the UWTD (1991) – Requirements for urban waste water

The requirements for urban waste water are subdivided into three chapters: (A) Collecting systems, (B) Discharge from urban waste water treatment plants to receiving waters, (C) Industrial waste water. In addition, the reference methods for monitoring and evaluation of results (D) are explained in Annex I.

The requirements for discharges from urban waste water treatment plants are exemplarily shown in Figure 2. The minimum percentage of reduction is defined besides the maximum concentration of a parameter. In addition the reference methods are described.

*Table 1:* Requirements for discharges from urban waste water treatment plants subject to Articles 4 and 5 of the Directive. The values for concentration or for the percentage of reduction shall apply.

| Parameters | Concentration | Minimum percentage of reduction (1) | Reference method of measurement |
|---|---|---|---|
| Biochemical oxygen demand (BOD5 at 20 °C) without nitrification (2) | 25 mg/l $O_2$ | 70-90<br>40 under Article 4 (2) | Homogenized, unfiltered, undecanted sample. Determination of dissolved oxygen before and after five-day incubation at 20 °C ± 1 °C, in complete darkness. Addition of a nitrification inhibitor |
| Chemical oxygen demand (COD) | 125 mg/l $O_2$ | 75 | Homogenized, unfiltered, undecanted sample Potassium dichromate |
| Total suspended solids | 35 mg/l (3)<br>35 under Article 4 (2) (more than 10 000 p.e.)<br><br>60 under Article 4 (2) (2 000-10 000 p.e.) | 90 (3)<br>90 under Article 4 (2) (more than 10 000 p.e.)<br><br>70 under Article 4 (2) (2 000-10 000 p.e.) | — Filtering of a representative sample through a 0,45 µm filter membrane. Drying at 105 °C and weighing<br>— Centrifuging of a representative sample (for at least five mins with mean acceleration of 2 800 to 3 200 g), drying at 105 °C and weighing |

(1) Reduction in relation to the load of the influent.
(2) The parameter can be replaced by another parameter: total organic carbon (TOC) or total oxygen demand (TOD) if a relationship can be established between BOD5 and the substitute parameter.
(3) This requirement is optional.

Figure 2: ANNEX 1 – Parameters and parametric values, part A, microbiological parameters (DWD, 2015)

## 2.6 Industrial Emissions Directive

The Industrial Emissions Directive (IEC, 2010) – named "Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)" – came into force on the 17th of December 2010.

The IEC Directive (2010) aggregates seven separate EU Directives including the Integrated Pollution Prevention and Control - IPPC Directive (2008). The contents of these separate EU Directives are the minimum requirements of the new directive.

The main objective was to make the documents on Best Available Techniques (BAT) more binding for specific industrial sectors.

### 2.6.1 Subject matter of the IEC (2010)

The subject matter of the IEC (2010) is part of Article 1:

> *"This Directive lays down rules on integrated prevention and control of pollution arising from industrial activities.*
>
> *It also lays down rules designed to prevent or, where that is not practicable, to reduce emissions into air, water and land and to prevent the generation of waste, in order to achieve a high level of protection of the environment taken as a whole."*

### 2.6.2 Scope of the IEC (2010)

The scope of the IEC (2010, Article 2) includes industrial activities giving rise to pollution, but excludes research activities, development activities or the testing of new products and processes.

### 2.6.3 Relevant aspects of the IEC (2010)

The IEC Directive is subdivided into seven chapters stated below.

- Chapter I (IEC, 2010)

  The common provisions are listed in chapter I of the IEC including subject matter, scope, definitions and several articles dealing with permits.

- Chapter II (IEC, 2010)

  The provisions for activities listed in Annex I are part of chapter II.

- Chapter III - VI (IEC, 2010)

  Chapters III to VI are directly related to the previous directives dealing with special provisions for combustion plants, special provisions for waste incineration plants an waste co-incineration plants, special provisions for installations and activities using organic solvents and special provisions for installations producing titanium dioxide.

- Chapter VII (IEC, 2010)

Information on committees, transitional and final provisions is stated in chapter VII.

## 2.7 Additional Directives

Several Directives are not directly related to water resource management, but may influence the water sector to a certain extent.

### 2.7.1 Renewable Energy Directive (2009)

The Renewable Energy Directive (RED, 2009) – named "Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC" – came into force on the 25th of June 2009.

The aim of the Renewable Energy Directive is to produce 20% of total energy consumption from renewable sources before the year 2020. Due to the fact that hydropower plants count as renewable source, the water bodies are affected by this directive too.

### 2.7.2 Habitats Directive (1992)

The Habitats Directive (1992) – named "Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora" – came into force on the 10th of June 1992.

The aim of the Habitats Directive (1992) is the protection of 220 habitat types and approximately 1000 species through the establishment of special areas of conservation, which are part of the network of Natura 2000 areas.

### 2.7.3 Birds Directive (1979)

The Birds Directive (1979) – named "Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds" – came into force on the 6th of April 1979.

The aim of the Birds Directive (1979) is the protection of all European wild birds and the habitats of listed species, in particular through the designation of Special Protection Areas (SPAs), which are part of the network of Natura 2000 areas.

# 3 Austria

The implementation of the EU directives and strategies in the field of water resources management in the Austrian legislation is described in the following sub-chapters.

## 3.1 Water Framework Directive

In 2003 the Water Framework Directive was written into national law with the Amendment to the Water Rights Act (WRG Wasserrechtsgesetz, 1959). How and when the goals of the Water Framework Directive shall be reached was laid down in the "National Water Management Plan" (NGP Nationaler Gewässerbewirtschaftung Plan, 2017).

In 2009 the draft on the National Water Management Plan was published and then subjected to public participation for six months. In this way all those interested in the protection and further development of waters, but also all those affected by management measures on waters were actively involved in the planning process. Comments and suggestions were included and in March 2010 the first "National Water Management Plan 2009" was published. It contains all working steps of the planning process, the objectives, the most important results of the status quo analysis and the monitoring, as well as measures to reach the environmental goals.

After six years the second "National Water Management Plan 2015" (NGP, 2017) was published including an evaluation and update of objectives and measures with a view to medium-term and long-term planning. The National Water Management Plan is subdivided into ten different chapters:

Chapter 1: General description of river basin districts

Chapter 2: Risk analysis on the status of surface waters and groundwater based on significant pressures and anthropogenic impacts

Chapter 3: Economic significance of water bodies

Chapter 4: Strategy for the development of monitoring programs for surface waters and groundwater

Chapter 5: Current status of water bodies and objectives until 2021/2027

Chapter 6: Technical measures for the implementation of the specified objectives; appropriate instruments for implementation

Chapter 7: Summary of measures for public information and participation, their results and the resulting changes to the plan

Chapter 8: General information on the administrative and institutional framework as well as international and bilateral coordination

Chapter 9: Brief description of climate change impact on water resources management

Chapter 10: Summary of current knowledge on water scarcity and droughts

Information on the highly relevant chapters 2, 5 and 6 of the National Water Management Plan is presented below.

The risk analysis on the status of surface waters is described in chapter 2 of the NGP (2017). The comparison of the data in the years 2009 and 2015 (Figure 3) shows a decreasing overall definite risk

(51 % → 40 %). The main risk is related to hydromorphological impacts including hydropeaking, residual water, damming, structural alterations and migration obstacles.

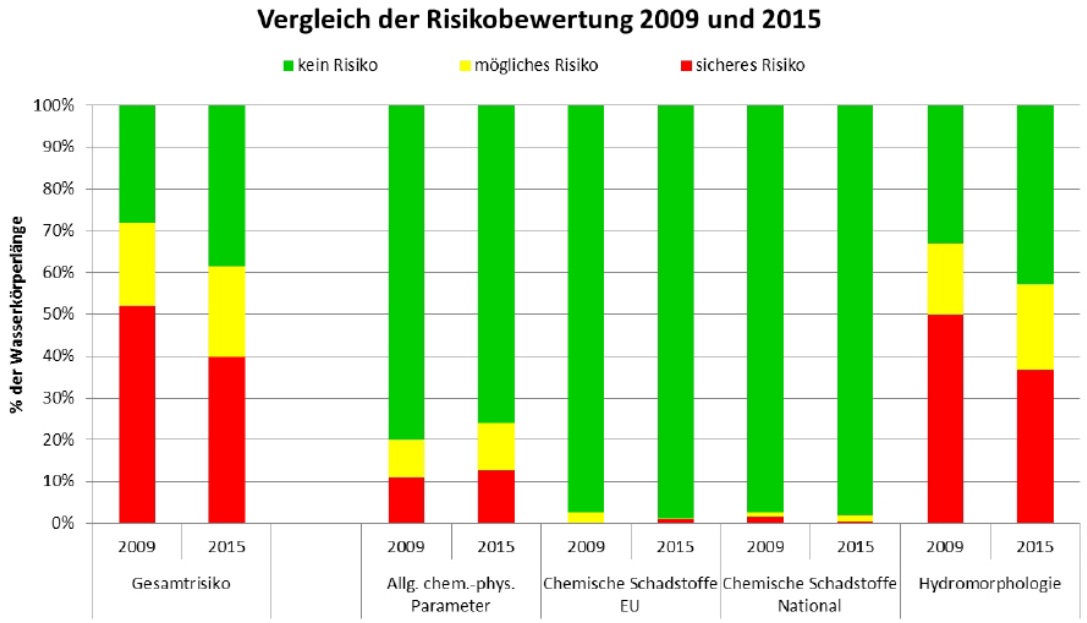



Figure 3: Risk analysis on the status of surface waters in Austria (NGP, 2017)

The ecological status and the ecological potential of rivers with a basin larger than 1 km² are discussed in chapter 5 of the NGP (2017) and are depicted in Figure 4. In Austria around 38 % of the rivers are in a high or good ecological status and around 2 % are in a high or good potential. Especially in the river basin district "Rhein" more than 90 % are in a high or good ecological status (and potential), but in the biggest river basin district "Danube" the percentage is quite lower (46 %).

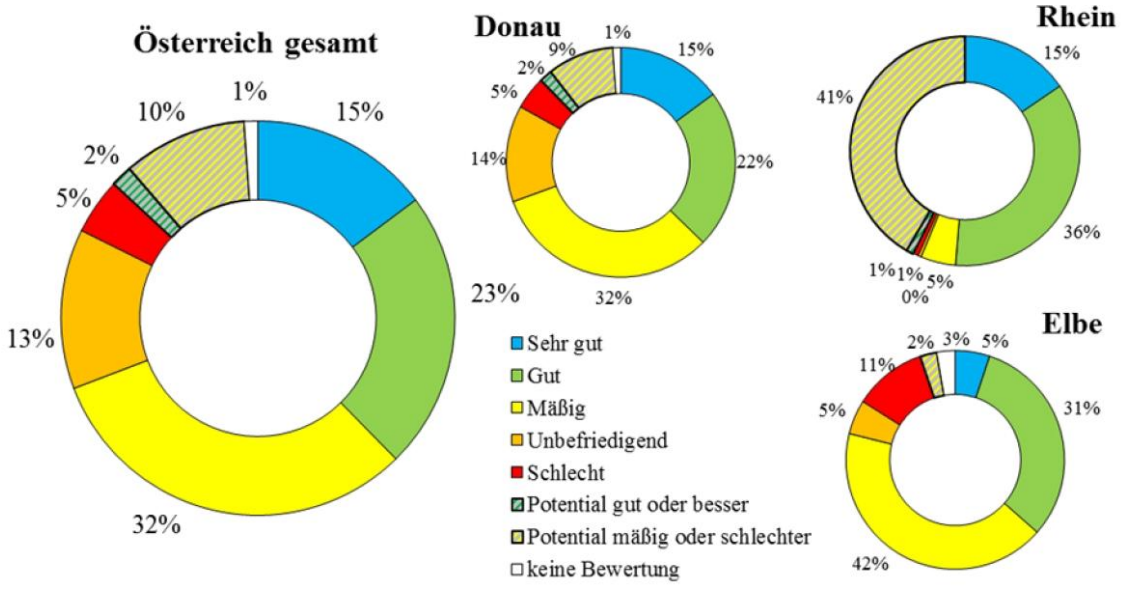



Figure 4: Ecological status and potential of rivers with a basin >1km² in Austria (NGP, 2017)

Technical measures for improving the ecological status/potential of rivers are described in chapter 6 of the NGP (2017). The desired improvements, technical measures, responsible sectors, appropriate instruments and the responsible commission are summarized in tables of which one example detailing migration obstacles is depicted in Figure 5.

| Gewünschte Verbesserung | Maßnahmen | Verantwortliche Organisationen/ Sektor | Umsetzungsmechanismus Instrument und Unterstützung | Zuständigkeit |
|---|---|---|---|---|
| Herstellung der Durchgängigkeit | Errichtung einer aufgelösten Rampe. (G)<br>Umgehungsarm (G)<br>Umgehungsgerinne (G)<br>Naturnaher Beckenpass (G)<br>Raugerinne(G)<br>Technische Fischwanderhilfe (G)<br>Wiederherstellung naturnaher Mündungsbereiche bei abgetrennten Zuflüssen (G) | Hochwasserschutz Wasserkraft | **WRG 1959 – Bewilligung**: Bewilligungspflicht für die Benutzung der Gewässer durch Wasserbenutzungsanlagen z.B. Wasserkraftanlagen einschließlich die Errichtung oder Änderung der zur Benutzung der Gewässer dienenden Anlagen (§ 9) sowie für Schutz- und Regulierungsbauten und für Einbauten an oder in Gewässer (§§ 38, 41).<br>Die Festlegung von Maßnahmen zur Hintanhaltung einer wesentlichen Beeinträchtigung des ökologischen Zustands durch Wanderhindernisse erfolgt im Einzelfall in der Regel durch Auflagen im Rahmen des Bewilligungsverfahrens unter Berücksichtigung der wasserwirtschaftlichen Verhältnisse **(§ 105).**<br>**QZV Ökologie OG**, BGBl. II Nr. 99/2010 zuletzt geändert durch BGBl. Nr. II 461/2010 (**§ 13)**<br>Stand der Technik **(§ 12a)**<br>**§ 30a** Verschlechterungsverbot und Ausnahmemöglichkeit **(§ 104a)**<br>Leitfaden für die Planung und den Bau von funktionierenden Fischaufstiegshilfen- **FAH –Leitfaden (BMLFUW, 2012)** | Wasserrechtsbehörde oder UVP-Behörde |

**Figure 5: Technical measures for improving the ecological status in Austria (NGP, 2017)**

## 3.2 Floods Directive

In 2011 the Floods Directive was written into national law with the Amendment to the Water Rights Act (WRG Wasserrechtsgesetz). Related information including maps and plans are available in the water information system of Austria (WISA Wasser Informationssystem Austria https://maps.wisa.bmnt.gv.at/hochwasser# 2019a).

According to the Floods Directive (2007) a preliminary flood risk assessment was undertaken in Austria. Figure 6 shows an example for areas with a potential risk based on past floods to evaluate possible future risks of floods with rare return periods (HQ300).

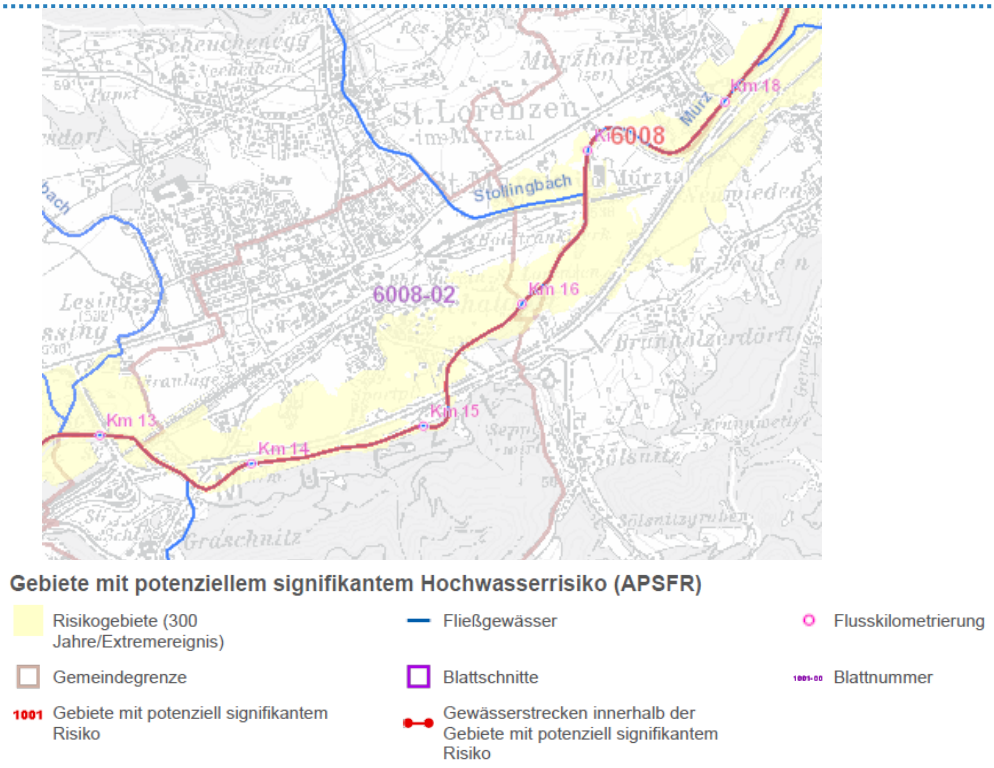



Figure 6: Preliminary flood risk assessment in Austria (WISA, 2019)

In a second step flood hazard maps and flood risk maps were prepared for floods with different return periods (HQ30, HQ100, HQ300) according to the Floods Directive (2007). A flood hazard map depicting water depths at HQ100 is exemplary shown in Figure 7.

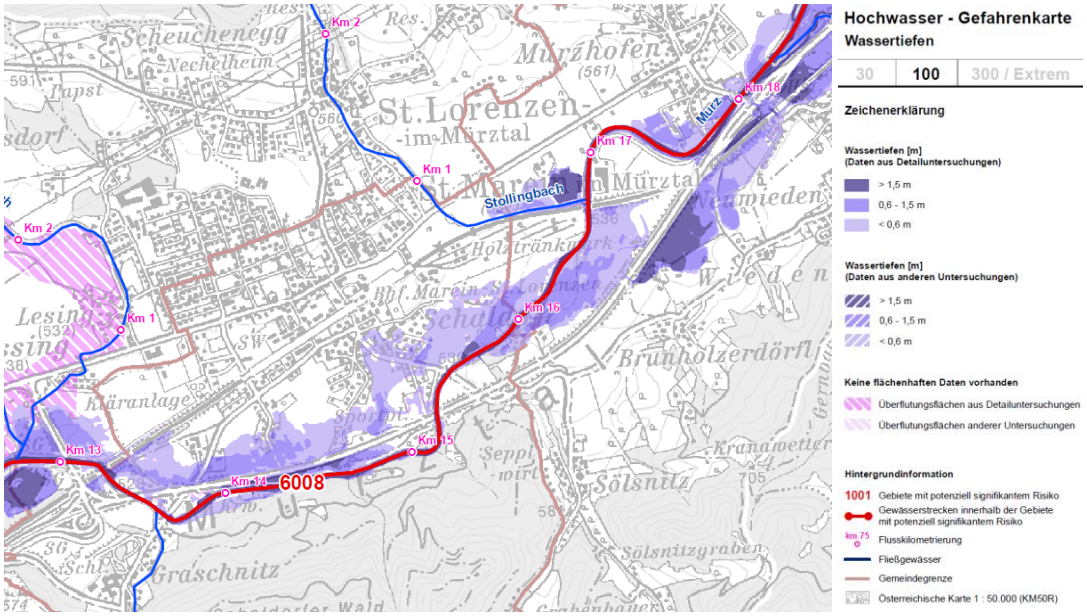



Figure 7: Flood hazard map including water depths at HQ100 – Austria (WISA, 2019)

An example for a flood risk map at HQ100 is shown in Figure 8 including flooded areas with information of the land use, inhabitants in inundation areas, special hazards and public infrastructure (hospital, school, railway station, etc.).

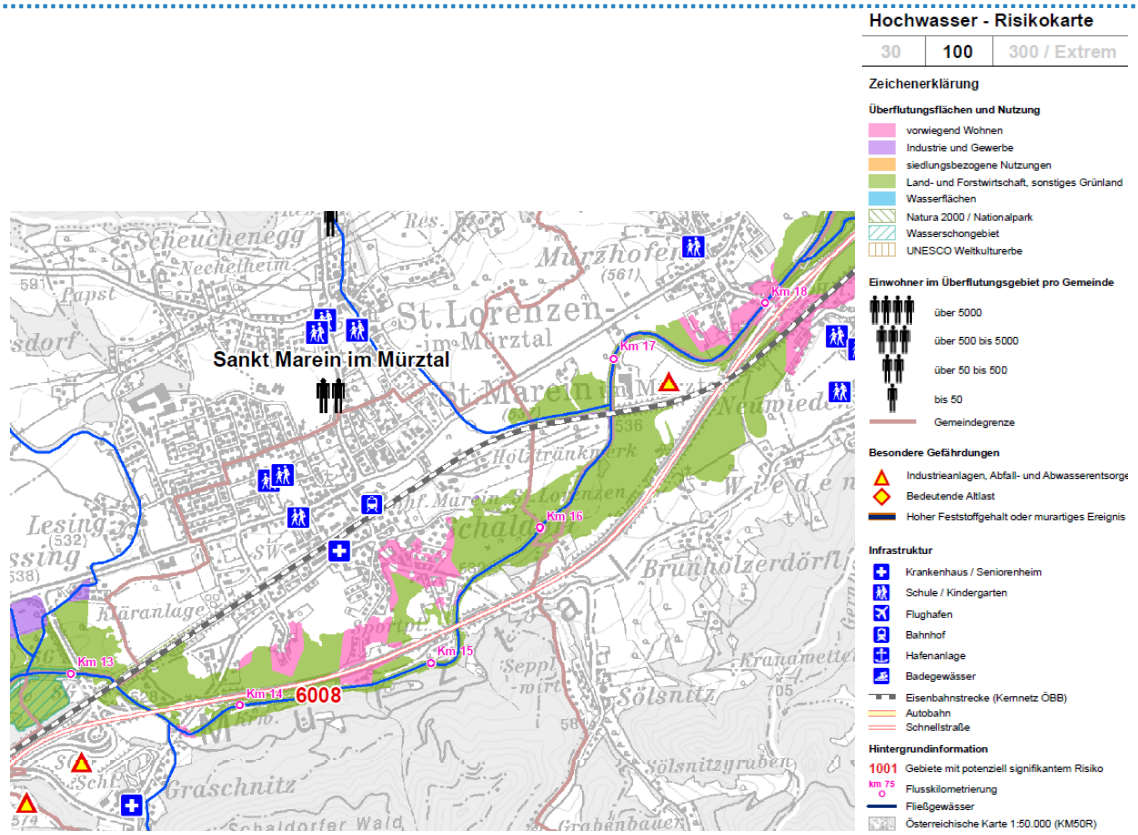



Figure 8: Flood risk map at HQ100 – Austria (WISA, 2019)

Finally, the flood risk management plan was prepared according to the Floods Directive (2007) including different measures, their priority and their current status of implementation (Figure 9).

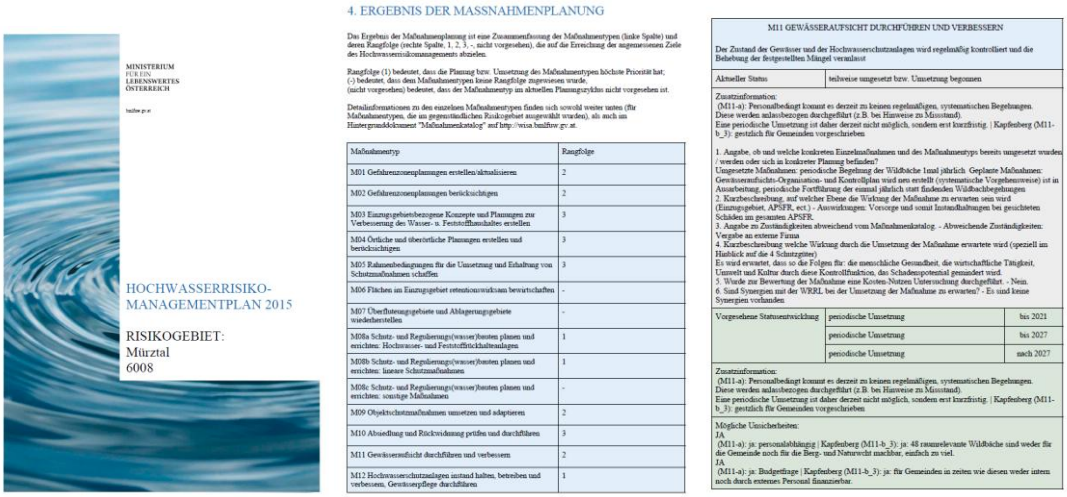



Figure 9: Flood risk management plan – Austria (WISA, 2019)

## 3.3 Drinking Water Directive

Drinking water in Austria is subject to the food safety and consumer protection law (Lebensmittelsicherheits- und Verbraucherschutzgesetz LMSVG BGBl. I Nr. 13/2006, Update BGBl. II Nr. 39/2019). Based on this law the drinking water decree (Trinkwasserverordnung – TWV: Verordnung über die Qualität von Wasser für den menschlichen Gebrauch: BGBl. II Nr. 304/2001,

Update BGBl. II Nr. 362/2017) was issued, which involves the Drinking Water Directive of the European Union.

According to the Drinking Water Directive the general public has to be informed about the drinking water quality, which is done in the Austrian Drinking Water Report (Östereichischer Trinkwasserbericht, BMG, 2015).

Figure 10 depicts the organigram of the monitoring system for drinking water in Austria, which is reported in the Austrian Drinking Water Report (BMG, 2015). The leading role is taken by the federal ministry ("Bundesministerium für Gesundheit") with support of the provincial governors ("Landeshauptmann") and the institutes for food safety ("Institute für Lebensmittelsicherheit der AGES"). Additionally it is shown that to a certain extent self-control services ("Betreiber der Wasserversorgungsanlage") are also part of the monitoring system. The obtained information is transmitted to the provincial associations for food inspection ("Lebensmittelaufsicht"). Finally possible measures are listed for the enforcement of the food safety and consumer protection law.

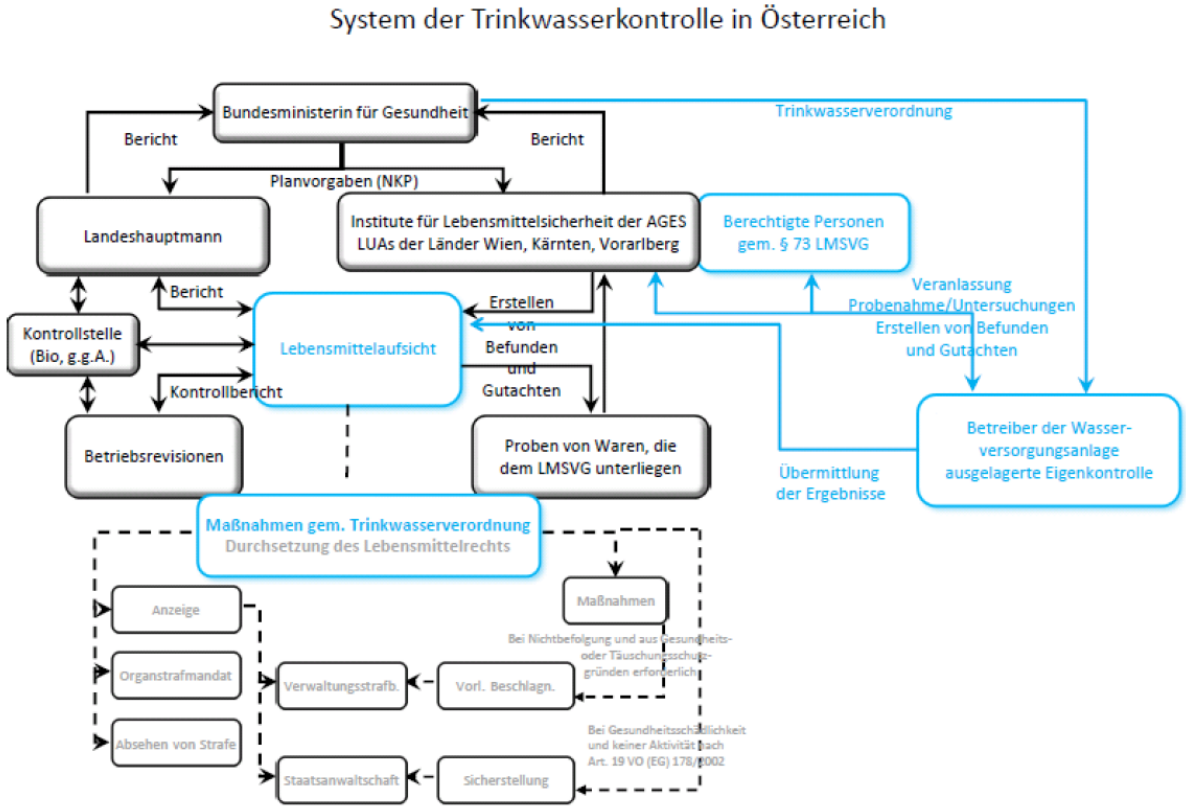



**Figure 10: Organigram of the monitoring system for drinking water in Austria (BMG, 2015)**

The evaluation of microbiological parameters in the years 2011 to 2013 is exemplarily shown in Figure 11. Independent of the parameter, the quality standards were reached in more than 99.7% of the investigations.

**Tabelle 5: Mikrobiologische Parameter – Jahresüberblick 2011, 2012 und 2013 über die Anzahl der Untersuchungen und die Anzahl der nicht entsprechenden Untersuchungen (WVA groß)**

| Mikrobiologische Parameter - Jahresüberblick 2011 | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Wert (Anzahl / Volums-einheit) | Anzahl der untersuchten WVA | Anzahl der nicht ent-sprechenden WVA | Anzahl der Unter-suchungen | Anzahl der nicht ent-sprechenden Unter-suchungen | % der ent-sprechenden Unter-suchungen |
| Escherichia coli | 0/100 ml | 268 | 10 | 9996 | 25 | 99,7 |
| Enterokokken | 0/100 ml | 268 | 8 | 9996 | 10 | 99,9 |

| Mikrobiologische Parameter - Jahresüberblick 2012 | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Wert (Anzahl / Volums-einheit) | Anzahl der untersuchten WVA | Anzahl der nicht ent-sprechenden WVA | Anzahl der Unter-suchungen | Anzahl der nicht ent-sprechenden Unter-suchungen | % der ent-sprechenden Unter-suchungen |
| Escherichia coli | 0/100 ml | 267 | 11 | 10503 | 26 | 99,8 |
| Enterokokken | 0/100 ml | 267 | 9 | 9574 | 23 | 99,8 |

| Mikrobiologische Parameter - Jahresüberblick 2013 | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Wert (Anzahl / Volums-einheit) | Anzahl der untersuchten WVA | Anzahl der nicht ent-sprechenden WVA | Anzahl der Unter-suchungen | Anzahl der nicht ent-sprechenden Unter-suchungen | % der ent-sprechenden Unter-suchungen |
| Escherichia coli | 0/100 ml | 265 | 7 | 9616 | 9 | 99,9 |
| Enterokokken | 0/100 ml | 265 | 4 | 9616 | 4 | 100,0 |

**Figure 11: Evaluation of microbiological parameters in the years 2011 to 2013 in Austria (BMG, 2015)**

## 3.4 Groundwater Directive

The Water Framework Directive includes pan-European uniform quality objectives for a good chemical status of groundwater. Complementary information and further specifications are provided in the Groundwater Directive, which was implemented into the Austrian Water Rights Act (Wasserrechtsgesetz, 1959) in combination with the quality target ordinance on chemicals in groundwater (Qualitätszielverordnung Chemie Grundwasser BGBl. II Nr. 98/2010) and the water status monitoring ordinance (Gewässerzustandsüberwachungsverordnung BGBl. II Nr. 479/2006).

Information on the chemical status of groundwater is presented in the National Water Management Plan (NGP, 2017) including the risk analysis of pesticides in groundwater. A section of the table including metabolites with a calculated annual concentration above 0.1 µg/l in groundwater-near seepage areas at unfavorable soil and weather conditions is exemplarily shown in Figure 12.

TABELLE 2.2-2 METABOLITEN MIT EINER BERECHNETEN JAHRESMITTELKONZENTRATION ÜBER 0,1 µG/L IM GRUNDWASSERNAHEN SICKERWASSER BEI UNGÜNSTIGEN BODEN- UND WITTERUNGSBEDINGUNGEN.

| Wirkstoff | Inverkehr-bringungs-menge[a] 2011 | Metabolit | Anwendung auf Kultur | Berechnete Jahresmittel-konzentration im grundwassernahen Sickerwasser[b] [µg/l] |
|---|---|---|---|---|
| Atrazin | - | Atrazin-Desethyl | Mais | 5 |
| | | Atrazin-2-Hydroxy | Mais | 2 |
| | | Atrazin-Desisopropyl | Mais | 0,5 |
| Azoxystrobin | Mittel | Azoxystrobin-O-Demethyl (R234886) | Winter-getreide | 2 |
| Captan | Hoch | THPAM | Obstbau | 0,3 |
| | | THPI | Obstbau | 0,3 |
| Chloridazon | Mittel | Chloridazon-Desphenyl | Zuckerrübe | 10 |
| | | Chloridazon-Methyldesphenyl | Zuckerrübe | 2 |
| Chlorthalonil | Mittel | Chlorthalonil-Sulfonsäure (R 417888) | Winter-getreide | 4 |
| | | R 611965 (SDS 46851) | Winter-getreide | 1 |
| Chlortoluron | Gering | Chlortoluron-Desmethyl | Winter-getreide | 0,2 |
| Clothianidin | Gering | N-Methyl-N-Nitroguanidin (MNG) | Mais | 0,3 |
| | | 2-Nitroguanidin (NTG) | Mais | 0,6 |
| Cyflufenamid | Sehr gering | 149-F1 | Winter-getreide | 0,3 |
| | | 149-F6 | Winter-getreide | 4 |
| Dichlobenil | - | 2,6-Dichlorbenzamid (BAM) | Wein | > 10 |
| Dimethachlor | Mittel | Dimethachlor-Sulfonsäure (CGA 354742) | Raps | 4 |
| | | Dimethachlor-Säure (CGA 50266) | Raps | 8 |
| Dimethenamid-P | Hoch | Dimethenamid-P-Sulfonsäure (M27) | Mais | 5 |
| | | Dimethenamid-P-Säure (M23) | Mais | 2 |
| Flazasulfuron | Sehr gering | DTPU | Wein | 1 |

**Figure 12: A section of the table detailing metabolites with a calculated annual concentration above 0.1 µg/l in groundwater-near seepage areas at unfavorable soil and weather conditions in Austria (NGP, 2017)**

## 3.5 Urban Waste-Water Treatment Directive

The Urban Waste-Water Treatment Directive is part of the Austrian Water Rights Act (Wasserrechtsgesetz), whereby several ordinances have been established including information, restrictions and requirements in the field of water treatment. Examples of these ordinances are listed below:

- General limitation of wastewater emissions to rivers and public sewers (Allgemeine Begrenzung von Abwasseremissionen in Fließgewässer und öffentliche Kanalisationen (BGBl. Nr. 186/1196))
- 1st General emission ordinance for municipal wastewater (1. Allgemeine Emissionsverordnung für kommunales Abwasser (BGBl. Nr. 210/1996))
- 3rd General emission ordinance for municipal wastewater (3. Allgemeine Emissionsverodnung für kommunales Abwasser (BGBl. II Nr. 249/2006))
- General Emissions Ordinance Bleached Pulp (Allgemeine Emissionsverordnung Gebleichter Zellstoff (BGBl. II Nr. 219/2000))

The requirements for discharges from urban waste water treatment plants in Austria are listed in the "1st General emission ordinance for municipal wastewater" and are exemplarily shown in Figure 13. A comparison between the European standards and the Austrian standards shows that the values in Austria are even more stringent than required by the EU.

**2. Emissionsbegrenzungen gemäß § 1 Abs. 1**

2.1 Mindestwirkungsgrade in Prozent der Zulauffracht

Die einer Abwasserreinigungsanlage der Größenklasse II größer als 1000 $EW_{60}$ oder III oder IV zufließende Fracht an Abwasserinhaltsstoffen ist bezogen auf

| | |
|---|---|
| 1. $BSB_5$ | um mindestens 95% |
| 2. CSB | um mindestens 85% |
| 3. TOC | um mindestens 85% |

zu vermindern.

Die einer Abwasserreinigungsanlage der Größenklasse III oder IV zufließende Fracht an Abwasserinhaltsstoffen ist bezogen auf

| | |
|---|---|
| 5. Ges. geb. N | um mindestens 70% a) |

zu vermindern.

2.2 Maximale Ablaufkonzentrationen in mg/l in Abhängigkeit von den Größenklassen gemäß Z 1.2

| | | I | II | III | IV |
|---|---|---|---|---|---|
| 1. $BSB_5$ | b) | 25 | 20 | 20 | 15 |
| 2. CSB | b) | 90 | 75 | 75 | 75 |
| 3. TOC | b) | 30 | 25 | 25 | 25 |
| 4. $NH_4$ - N | c) | 10 | 5 | 5 | 5 |
| 6. Gesamt - P | | -- | 2 | 1 | 1 |
| | | d) | e) | f) | f) |

**Figure 13: Requirements for discharges from urban waste water treatment plants in Austria (1st General emission ordinance for municipal wastewater (1. Allgemeine Emissionsverordnung für kommunales Abwasser (BGBl. Nr. 210/1996)))**

Figure 14 shows the percentage of connection to sewage treatment plants in Austria. The increasing trend in the last decades is among other measures a success of the implementation of the EU directive.

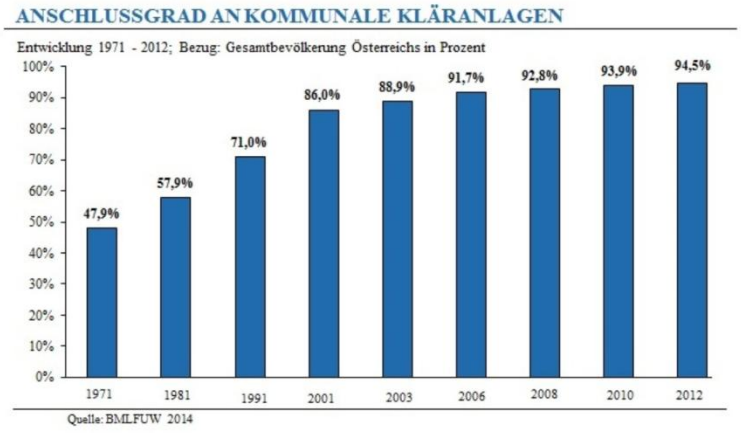



**Figure 14: Percentage of connection to sewage waste water treatment plants related to the total population of Austria (BMNT, 2019b)**

## 3.6 Industrial Emissions Directive

The Industrial Emissions Directive was implemented in Austria in various laws at federal and state level (for example, the Waste Management Act or Air Pollution Control Act).

The Federal Ministry for Sustainability and Tourism established an electronic data management platform (EDM, https://secure.umweltbundesamt.at/edm_portal/home.do 2019c) dealing with complex processes of environmental-related documentation and report obligations. The Industrial Emissions Directive was implemented into the EDM platform (Figure 15).

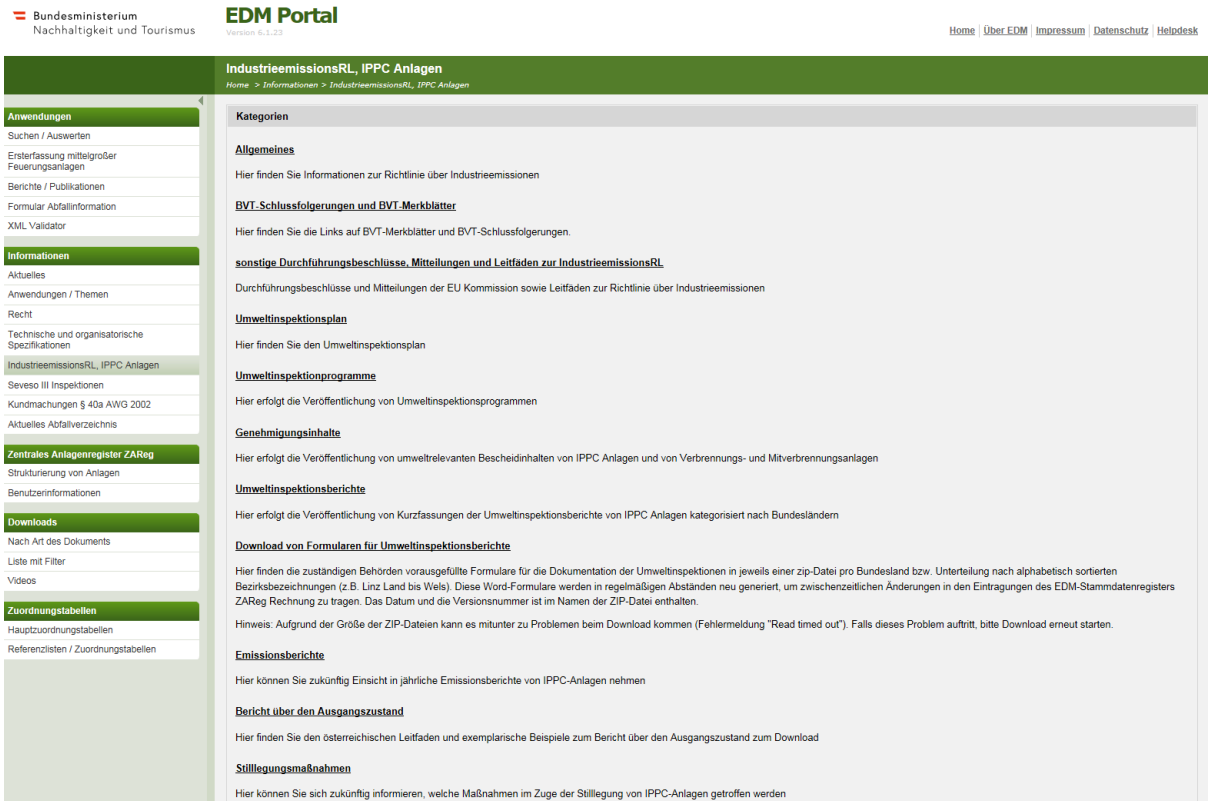



**Figure 15: EDM portal of the Federal Ministry for Sustainability and Tourism in Austria (2019c)**

BAT leaflets, environmental inspection plan and program, reports as well as decision documents are available on the EDM platform.

## 3.7 Additional Directives

The Renewable Energy Directive was considered in the national Green Electricity Act (Ökostromgesetz, 2012) in Austria. Due to the fact that in the reference year (2005) the percentage of renewable energy (23.9%) had been above the requirement of 20%, the objective was set to 34% in Austria, which has to be met until 2020. Until 2016 the percentage had been increased up to 33.5%.

The Bird Directive and the Habitat Directive were implemented in several federal state laws, due to the fact that environmental protection, national parks and spatial planning issues are administrated by federal states in Austria. An overview of existing Special Protection Areas (SPAs) based on these Directives is given in Figure 16. The depicted 204 SPAs occupy 14.6% of the federal territory.

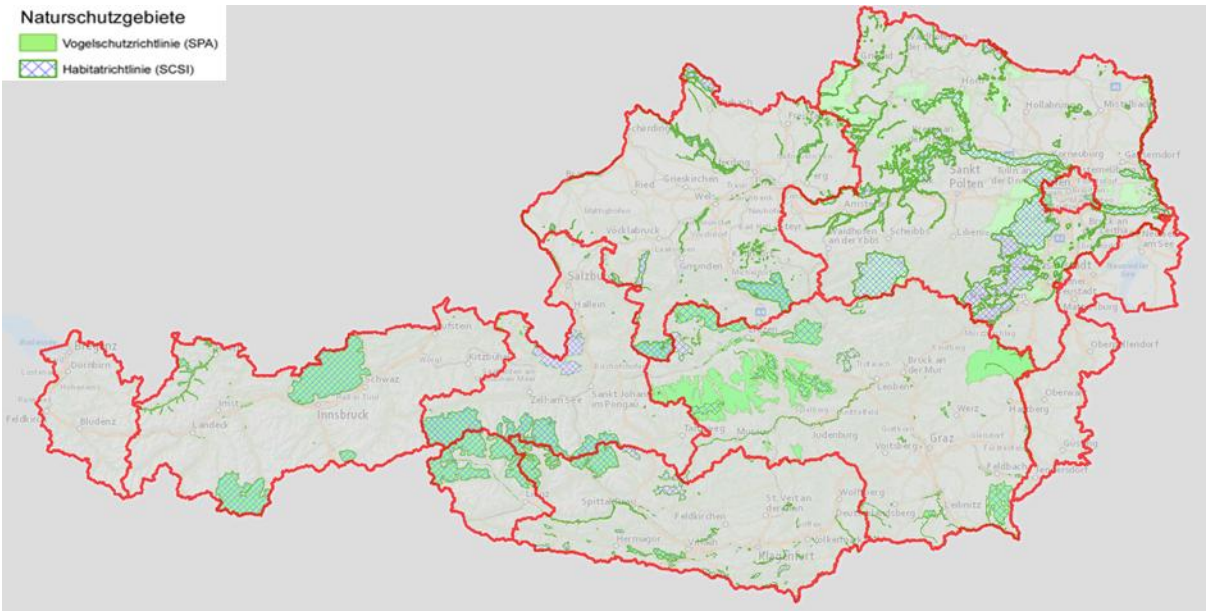



Figure 16: Special Protection Areas based on Birds Directive and Habitats Directive in Austria (www.geoland.at, 2019)

# 4 Bulgaria

The implementation of the EU directives and strategies related to water resources management in the Bulgarian legislation is achieved via numerous acts, laws and ordinances, the most important of which are *Water Act* (from 2000 and following amendments) and the *Environment Protection Act* (from 2002 and following amendments). Three strategic documents related with water sector were approved by the Council of Ministers. namely *National Strategy for Management and Development of Water Sector* (2012), *Strategy for Development and Management of the Water Supply and Sanitation Sector in the Republic of Bulgaria 2014 – 2023*, *Common Strategy for Management and Development of the Hydro-melioration and Protection against Harmful Effects of Water (2015).* More detailed description is provided in the following sub-chapters.

## 4.1 Water Framework Directive

The harmonization of Bulgarian legislation with *Water Framework Directive* 2000/60/EC was done through amendments to *Water Act*, first issued in 2000. As a result of the amendments, the policy on water management at national level is carried out by the Ministry of Environment and Water, assisted by Directorate Water Management. At local (basin) level the water management is done by 4 River Basin Directorates (see Figure 17) and 16 Regional Inspectorates of Environment and Water, that monitor and control waste waters within their respective territorial scope.


**Figure 17: River Basin Directorates in Bulgaria [Draft Common Strategy for Management and Development of Hydro-melioration and Protection against Harmful Effects of Water, the Word bank, 2015]**

The River Basin Directorates (RBDs) are responsible for development of River Basin Management Plans on their respective territories. The first *River Basins Management Plans (RBMP)* of 4 RBDs in Bulgaria were prepared for the period 2010-2015. Second *RBMPs* are for the period 2016-2021. A Programme of Measures is developed together with each *RBMP*. All RBMPs and respective

Programmes of Measures were adopted after public discussions, according to requirements of the *Water Act*.

There is an ongoing procedure for development of the third *RBMPs* for the period 2022-2027. It has to mentioned that all above cited *RBMPs* do not include Flood Risk Management Plans. The latter are separate documents, prepared or approved by RBDs.

## 4.2 Floods Directive

The Bulgarian *Water Act* is harmonized with the *Flood Directive*. The *Flood Risk Management Plans 2016-2021* were prepared by River Basin Directorates and adopted by the Bulgarian government According to the *Floods Directive* a preliminary flood risk assessment was undertaken in all 4 RBDs, on the basis of common methodology. The regions with a significant potential flood risk were established on a basis of common criteria for all 4 RBDs. Maps of floods hazard and flood risk were developed and then the *Flood Risk Management Plans 2016-2021* were prepared. A national catalogue of measures was adopted, based on a methodology for cost and benefit analysis of measures.

The implementation of measures is responsibility of several stakeholders. Irrigation Systems Company (orig. „Напоителни системи“ ЕАД) is a state own entity which is responsible for flood protection for all rural areas. It maintains the river trainings, protection dikes (levees) outside urban areas. It also manages the dams and reservoirs for irrigation purposes. The other stakeholders are municipalities, which are responsible for protection dikes and river trainings within their areas, as well as for maintenance and operation of municipal dams and reservoirs. Enterprise “Dams and Cascades” (orig. Предприятие „Язовири и каскади“), as a subdivision of National Electric Company is taking care and operation of dams and reservoirs for hydroelectric power generation, as well as for other artificial water bodies related to energy production, such as thermo-electric power plants and a Nuclear Power Plant. It is responsible for river trainings downstream of the reservoirs. The Water Supply and Sanitation Companies operate dams dedicated for municipal and industrial water supply.

The control of measures and activities of above-mentioned stakeholders is done by General Directorate of Fire Safety and Civil Protection, a subdivision of Ministry of Interior, together with representatives of RBDs and Municipalities.

## 4.3 Drinking Water Directive

Implementation of the *Drinking Water Directive (DWD)* in Bulgaria assured by means of the *Water Act* and the *Act for Regulation of Water Supply and Sanitation Services* (2005 and following amendments).

*Ordinance Nr 9 from 16.03.2001 for quality of water intended for human consumption*, issued by the Minister of Health, Minister of Regional Development and Public Works and Minister of Environment and Water, is used for harmonization with the *DWD* requirements. The drinking water quality is also a subject of *Ordinance Nr 12 from 18.06.2002 for quality requirements for surface waters intended for drinking water supply*.

The general public is informed about the drinking water quality by the annual *Reports on Drinking Water Quality* issued by each of 4 River Basin Directorates.

With respect to the *DWD*, Bulgaria is the only new member state that scored compliance levels of 95-100% for all three types of parameters (microbiological, chemical and indicators). At the national level water quality is very good. The average compliance rate of water samples in big water

supply zones is 99.6%. There are specific issues with quality of water in small water supply zones, but on national level the water quality is small zones is good – the average compliance rate is 98.4%. Water supply systems abstraction consists of 51% surface water and 49% ground water.

## 4.4 Groundwater Directive

The *Groundwater Directive* in Bulgaria is implemented through the *Water Act* and some ordinances, such as: *Ordinance Nr 2 from 13.09.2007 about prevention of waters from contamination with nitrates from agricultural origins*; *Ordinance Nr 1 from 10.10.2007 for exploration, use and protection of groundwater*, issued by Minister of Environment and Water, Minister of Regional Development and Public Works, Minister and Health and Minister of Economy and Energy.

Water abstraction permits are issued by respective River Basin Directorate, according to available recourse. The water recourses of the groundwater bodies are determined via common methodology, issued by Ministry of Environment and Water.

## 4.5 Urban Waste-Water Treatment Directive

Implementation of the *Urban Waste-Water Treatment Directive (UWWTD)* in Bulgaria is done through *Water Act*. Several ordinances related to waste water, namely *Ordinance Nr. РД-02-20-8 from 17.05.2013 on design, construction and exploitation of sewerage systems*. amended in 2019; *Ordinance Nr 6 from 9.11.2000 on emission standards for the permissible content of harmful and dangerous substances in waste-water discharged into water bodies*; *Ordinance Nr 7 from 14.11.2000 on the conditions and order for discharge of industrial waste-water into the urban sewerage systems*, were amended to comply with *UWWTD*.

The *Strategy for Development and Management of the Water Supply and Sanitation Sector in the Republic of Bulgaria 2014 – 2023* (Figure 18) treats the problem with harmonization with the *UWWTD* and its implementation. The main issue is related with construction of sewerage networks and waste-water treatment plants. For the full implementation of the *UWWTD* requirements, the transitional period was until 31 December 2014. Nevertheless the desired level of service and compliance is not achieved yet.

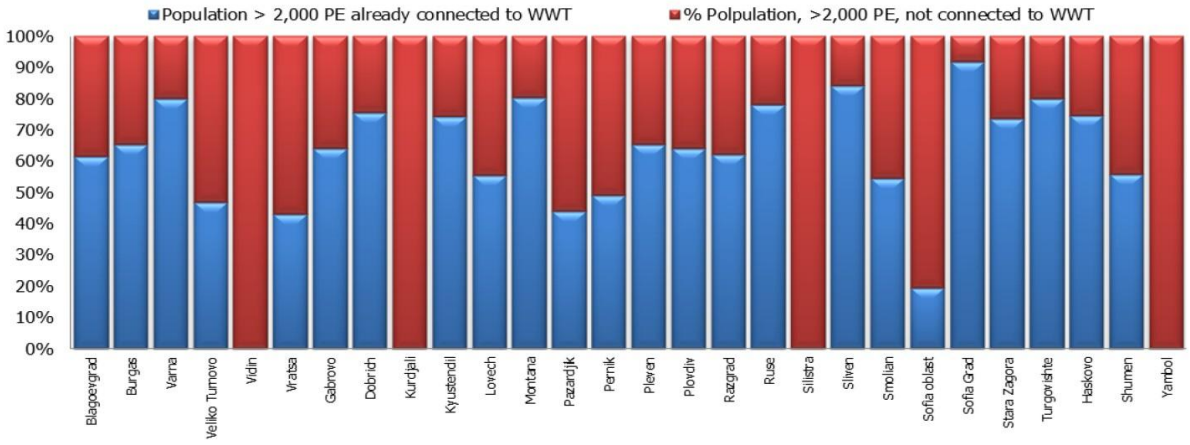



**Figure 18: Population of more than 2000 P.E. connected/not connected to Waste-Water Treatment [Strategy for Development and Management of Water Supply and Sanitation Sector in the Republic of Bulgaria, 2014]**

In Bulgaria 66% of the population is connected to urban wastewater collection and 50% is connected to an urban wastewater treatment plant.

## 4.6 Bird Directive and Habitat Directive

The Bird Directive and the Habitat Directive were implemented through different Bulgarian legislations: *Environment Protection Act* (from 2002 and following amendments), *Bio Diversity Act* (2002 and following amendments) and related *Ordinance on the conditions and order for development and approval of plans for management of protected areas* (2008) (Figure 19).

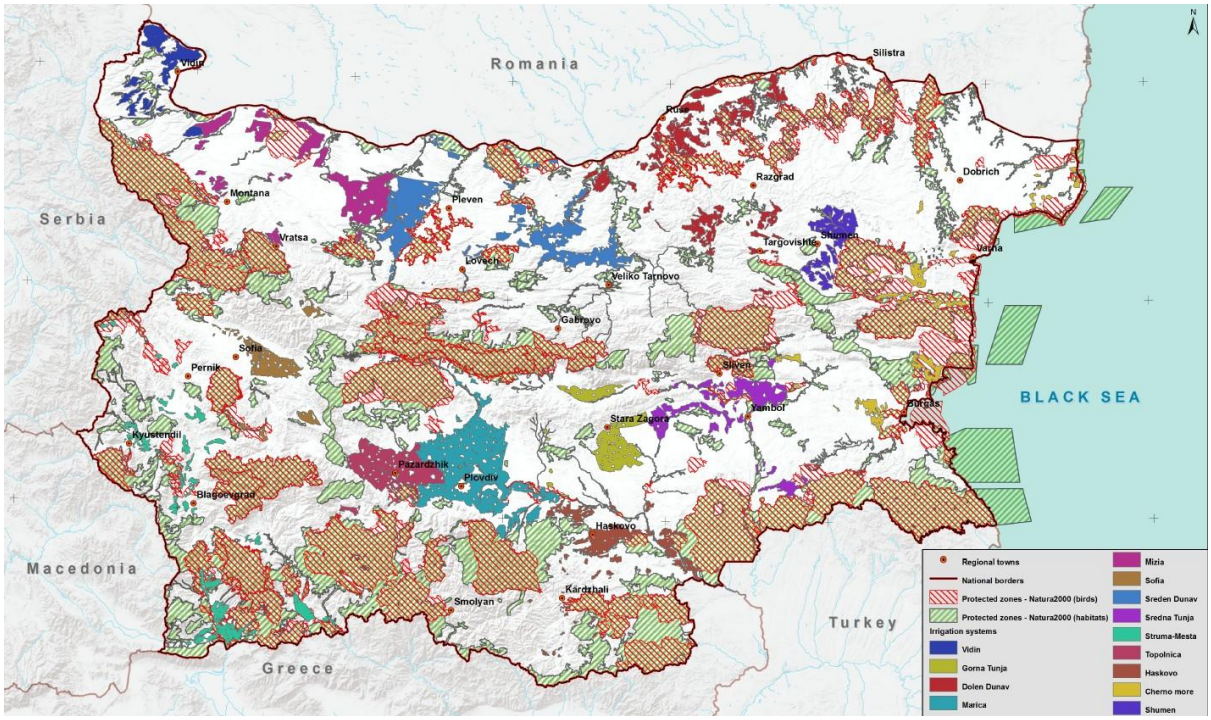



**Figure 19: Protected Zones in NATURA 2000 in Bulgaria [Draft Common Strategy for Management and Development of Hydro-melioration and Protection against Harmful Effects of Water, the Word bank, 2015]**

# 5 Croatia

The implementation of the EU directives and strategies in the field of water resources management in the Croatian legislation are described in the following sub-chapters.

## 5.1 Water Framework Directive

Based on *Water Act* from 1995 (orig. Zakon o vodama, Official Gazette of Republic of Croatia No. 107/95) and *Amendments to Water Act* from 2005 (orig. Zakon o izmjenama i dopunama Zakona o vodama, Official Gazette of Republic of Croatia No. 150/05) the harmonization of Croatian legislation with *Water Framework Directive* 2000/60/EC and other EU water related directives (Floods Directive 2007/60/EC, Drinking Water Directive 98/83/EC, Groundwater Directive 2006/118/EC, Urban Wastewater Treatment Directive 91/271/EEC, Nitrate Directive 91/676/EEC, Dangerous Emissions 2006/11/EC, Bathing water directive (2006/7/EC), Fish directive 2006/44/EC and Shellfish directive 2006/113/EC) has been done in the *Water Act* from 2009 (orig. Zakon o vodama, Official Gazette of Republic of Croatia No. 153/09 from 21/12/2009) taking into account the national, regional, subregional and global water management specificities in the Republic of Croatia and the national water management policy outlined in the Croatian *Water Management Strategy* (orig. Strategija upravljanja vodama, Official Gazette of Republic of Croatia No. 01/2008 from 15/07/2008) (Brežanski, 2010). In the meantime there have been new amandemends to the Water act in 2011, 2013 and 2014 (orig. Zakon o vodama, Official Gazette of Republic of Croatia No.153/09, 63/11, 130/11, 56/13, 14/14).

The first *River Basins Management Plan* (orig. Plan upravljanja vodnim područjima) in Croatia was prepared for the period 2013-2015 (*RBMP 2013-2015*). The *RBMP 2013-2015* had to go through the strategic environmental assessment procedure. It was adopted by the Croatian government on 26$^{th}$ June 2013 (Official Gazette of Republic of Croatia No. 82/2013).

The second *River Basins Management Plan 2016-2021 (RBMP 2016-2021)* that includes the *Flood Risk Management Plan 2016-2021* (orig. Plan upravljanja rizicima od poplava) was adopted by the Croatian government in 6$^{th}$ July 2016 (Official Gazette of Republic of Croatia No. 66/2016). The *RBMP 2016-2021* had to go through the strategic environmental assessment procedure. The public had the possibility to participate in the preparation of the *RBMP 2016-2021* by consultation with the interested public about the *Draft of the RBMP 2016-2021,* and public presentation and discussion of the *Study about strategic environment assessment of the RBMP 2016-2021.*

The *RBMP 2016-2021* consists of 5 Chapters:

Chapter A: Water management framework (territorial framework, legal and administrative structure, description of river basins and natural characteristics of surface water, groundwater and protected areas, list of competent authorities/institutions)

Chapter B: Executive summary of the Plan

Chapter C: Management of water status (pressures form human activities – antropogenic impact, water status, progress evaluation and risk assessment, economic analysis, Programme of Measures summary)

Chapter D: Flood Risk Management Plan

Chapter E: Documentation registry (legislation, more detailed plans and programmes)

According to collected and analyzed data, it is estimated that a satisfactory (at least good) ecological status of surface water was not achieved on:

- ~58% water bodies - rivers, total length 8440 km (66% of the total length of rivers with catchment of more than 10 km$^2$)
- ~54% water bodies – lakes
- ~55% of the area of water bodies - transitional waters
- ~ 12% of the area of water bodies - coastal waters (**Figure 20**)

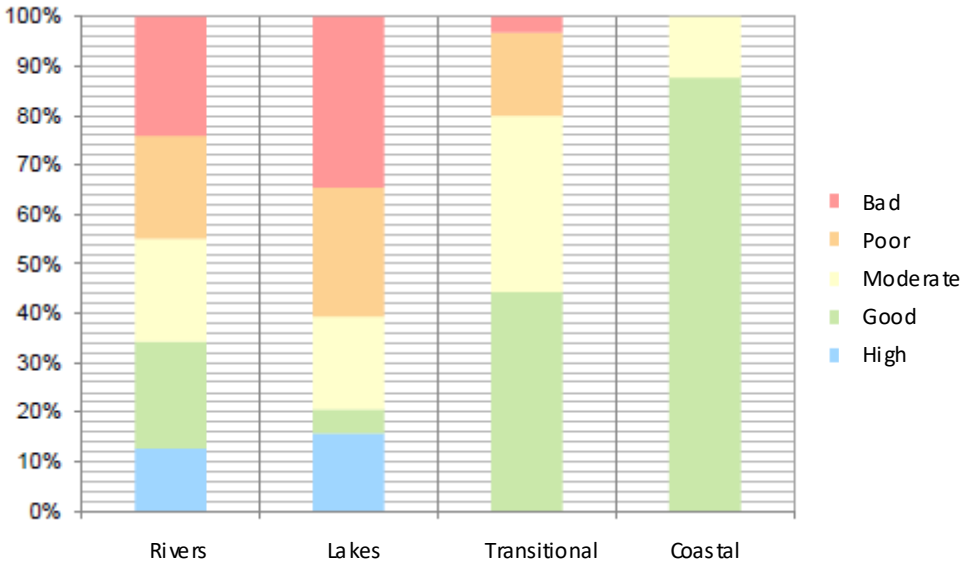



**Figure 20: Estimation of the ecological status of surface waters (by length/area of water bodies), [RBMP 2016-2021, 2016]**

It is estimated that good chemical status of surface water was not achieved on:

- ~8% of 1484 water bodies - rivers, less than 10% of the whole length of rivers with catchment more than 10 km2
- ~15% of the area of water bodies - transitional waters
- ~ 6% of the area of water bodies - coastal waters (**Figure 21**)

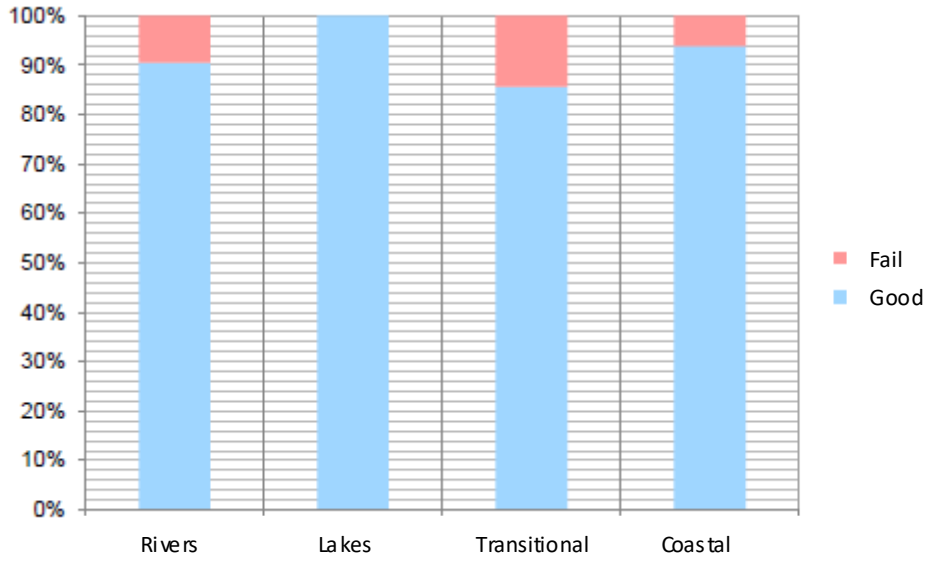



**Figure 21: Estimation of the chemical status of surface waters (by length/area of water bodies), [RBMP 2016-2021, 2016]**

The expected water status by 2015. was based on the simulation of the effect of planed measures for improvement of water status (Figure 22). The first period 2013-2015 was too short to achieve significant improvement in water quality status.

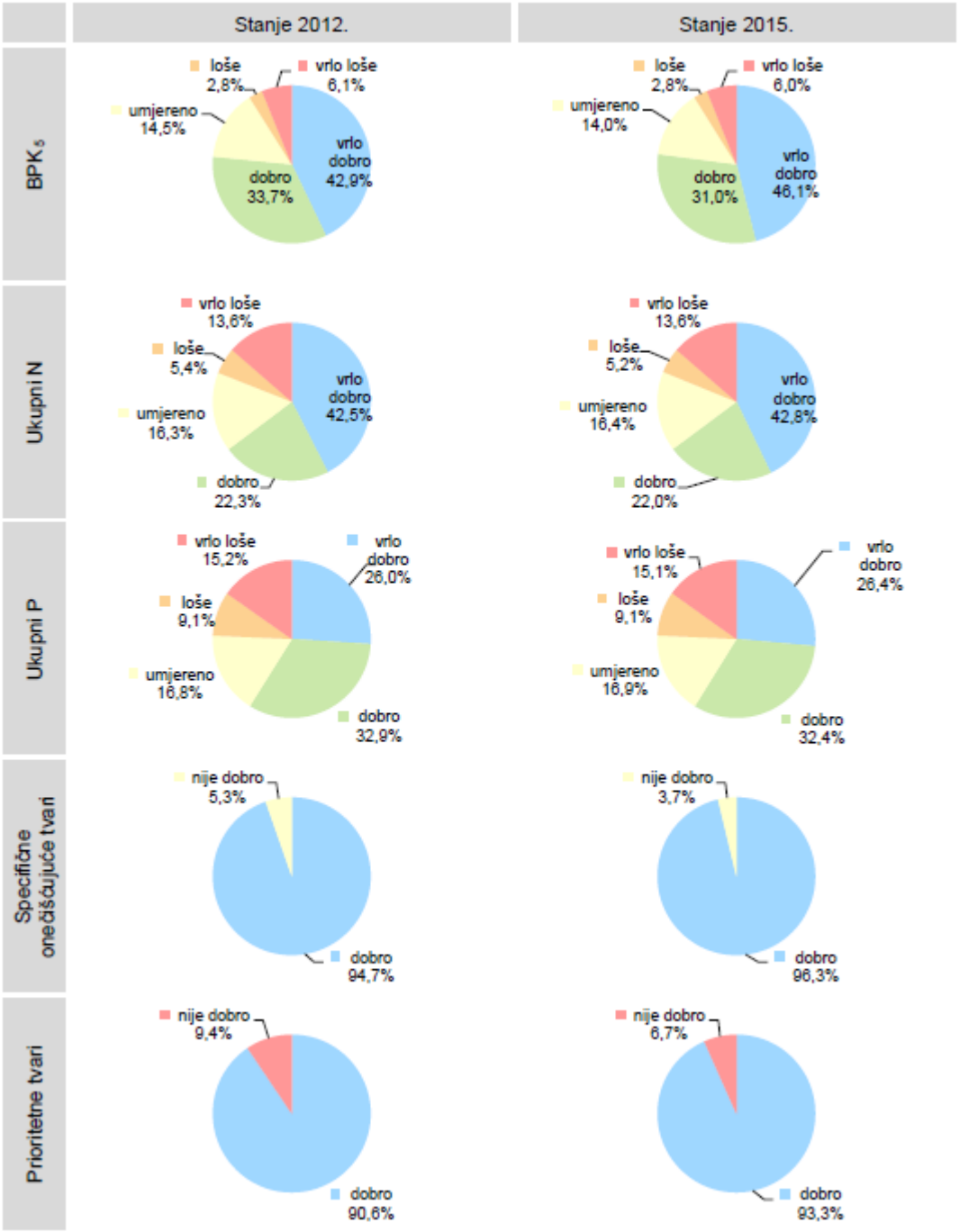



Figure 22: The expected improvement of the status of surface waters by the end of 2015 (by the length of water bodies), [RBMP 2016-2021, 2016]

The assessment of the risk of not achieving the good chemical status of groundwater bodies is presented in Figure 23, five areas are at risk.

The cumulative assessment of the risk of deterioration of the quantity of ground water body in the karstic areas of Croatia shows two areas that are at risk (Figure 24).


Figure 23: The risk of not achieving the good chemical status of groundwater bodies, [RBMP 2016-2021, 2016]


Figure 24: The risk of not achieving the good quantity status of groundwater bodies, [RBMP 2016-2021, 2016]

In the period 2016-2021 it is planned to implement 269 different measures to achieve at least the good status of water bodies (144 basic measures, 116 supplementary measures and 9 (recommended) additional measures). The list of measures is given in Chapter C (Table 4).

**Table 4:** Overview of measures for management of water quality provided by the Programme of measures systematized according to the activities to which the measures relate, [RBMP 2016-2021, 2016]

| | 5.2.1. Mjere povrata troškova vodnih usluga | 5.2.2. Mjere zaštite vode namijenjene za ljudsku potrošnju | 5.2.3. Mjere kontrole zahvaćanja vode | 5.2.4. Mjere kontrole prihranjivanja podzemnih voda | 5.2.5. Mjere kontrole točkastih izvora onečišćenja | 5.2.6. Mjere kontrole raspršenih izvora onečišćenja | 5.2.7. Mjere kontrole i smanjenja hidromorfološkog opterećenja voda | 5.2.8. Mjere kontrole drugih značajnih utjecaja na stanje voda osobito na hidromorfološko stanje | 5.2.9. Mjere zabrane direktnog ispuštanja onečišćenja u podzemne vode | 5.2.10. Mjere eliminacije i smanjenja onečišćenja prioritetnim tvarima | 5.2.11. Mjere prevencije akcidentnih onečišćenja | 5.3.1. Vode namijenjene za ljudsku potrošnju ili rezervirane za te namjene u budućnosti | 5.3.2. Vode pogodne za život slatkovodnih riba i vode pogodne za školjkaše | 5.3.3. Područja za kupanje i rekreaciju | 5.3.4. Osjetljiva područja, slivovi osjetljivih područja | 5.3.5. Područja podložna onečišćenju nitratima poljoprivrednog porijekla, ranjiva područja | 5.3.6. Područja namijenjena zaštiti staništa ili vrsta gdje je održavanje ili poboljšanje stanja vode bitan element njihove zaštite | 5.3.7. Prijedlog nadopune Registra zaštićenih područja | 5.4.1. Dopunska mjera usklađenja monitoringa stanja voda | 5.4.2. Dopunske mjere kontrole točkastih i raspršenih izvora onečišćenja | Ukupno |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | osnovne mjere | | | | | | | | | | | Dodatne mjere | | | | | | | | Dopunske mjere | | |
| stanovništvo | 19 | 15 | 17 | 3 | 25 | 5 | 4 | mjere nisu predviđene | 8 | 2 | 5 | | 5 | 2 | 1 | mjere nisu predviđene | 57 | 2 | | 2 | 172 |
| poljoprivreda | 6 | 2 | 18 | 3 | 10 | 11 | 16 | | 5 | 5 | 2 | | 6 | 1 | | | 56 | | | 3 | 145 |
| klimatske promjene | 3 | | 15 | 3 | 10 | 1 | 4 | | 5 | 2 | 2 | | 5 | 1 | | | 53 | | | 2 | 106 |
| hidroenergetika | 3 | | 15 | 3 | 10 | 1 | 16 | | 5 | 2 | 2 | | 6 | 1 | | | 54 | | | 2 | 120 |
| energetika - ostalo | 3 | | 15 | 3 | 10 | 1 | 4 | | 5 | 2 | 2 | | 5 | 1 | | | 53 | | | 2 | 106 |
| ribarstvo i akvakultura | 3 | | 15 | 3 | 10 | 1 | 4 | | 5 | 2 | 2 | | 6 | 1 | | | 56 | | | 2 | 110 |
| obrana od poplava | 3 | | 15 | 3 | 10 | 1 | 17 | | 5 | 2 | 2 | | 6 | 1 | | | 86 | | | 2 | 153 |
| šumarstvo | 3 | 1 | 15 | 3 | 10 | 1 | 4 | | 5 | 2 | 2 | | 5 | 1 | | | 53 | | | 2 | 107 |
| industrija | 3 | | 15 | 3 | 14 | 1 | 4 | | 8 | 3 | 5 | | 5 | 2 | | | 56 | | | 3 | 122 |
| turizam i rekreacija | 3 | | 15 | 3 | 10 | 1 | 4 | | 5 | 2 | 2 | | 5 | 5 | | | 56 | | | 2 | 113 |
| promet | 3 | | 16 | 3 | 10 | 1 | 17 | | 5 | 3 | 2 | | 6 | 1 | | | 54 | | | 2 | 123 |
| ostalo | | | | | | | | | | | | | | | | | | | 5 | | 5 |
| ukupan broj mjera po poglavlju | 22 | 18 | 21 | 3 | 28 | 15 | 18 | 1 | 8 | 5 | 5 | 1 | 7 | 6 | 1 | 1 | 98 | 2 | 5 | 4 | 269 |
| | 144 | | | | | | | | | | | 116 | | | | | | | 9 | | |

## 5.2 Floods Directive

The Croatian *Water Act* (orig. Zakon o vodama, Official Gazette of Republic of Croatia No. 153/09, 63/11, 130/11, 56/13, 14/14) is harmonized with the *Flood Directive*. The *RBMP 2016-2021* includes the *Flood Risk Management Plan 2016-2021* and was adopted by the Croatian government in 6th July 2016 (Official Gazette of Republic of Croatia No. 66/2016). According to the *Floods Directive* a preliminary flood risk assessment was undertaken in Croatia. Figure 25 shows the map of areas with potentially significant flood risk.

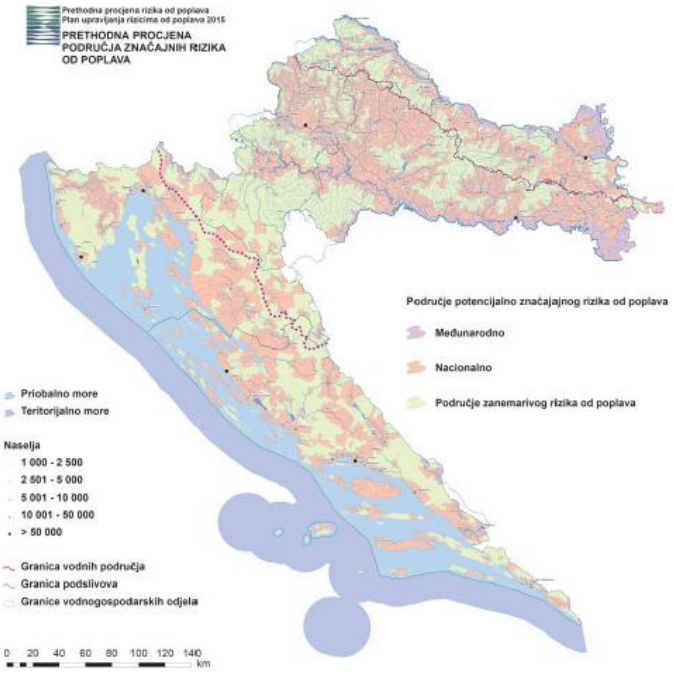



**Figure 25: Areas with potentially significant flood risk, [RBMP 2016-2021, 2016]**

Flood hazard was analysed for 3 scenarios of floods (Figure 26):

- High probability of occurrence
- Medium probability of occurrence (return period 100 years)
- Low probability of occurrence

with information of the water depth (Figure 27).

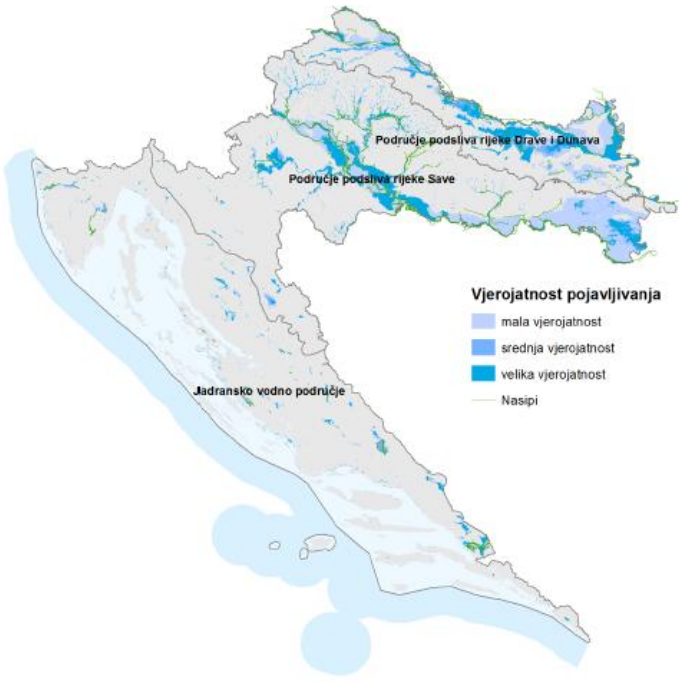



Figure 26: Flood hazard map for high, medium and low probability of occurrence, [RBMP 2016-2021, 2016]

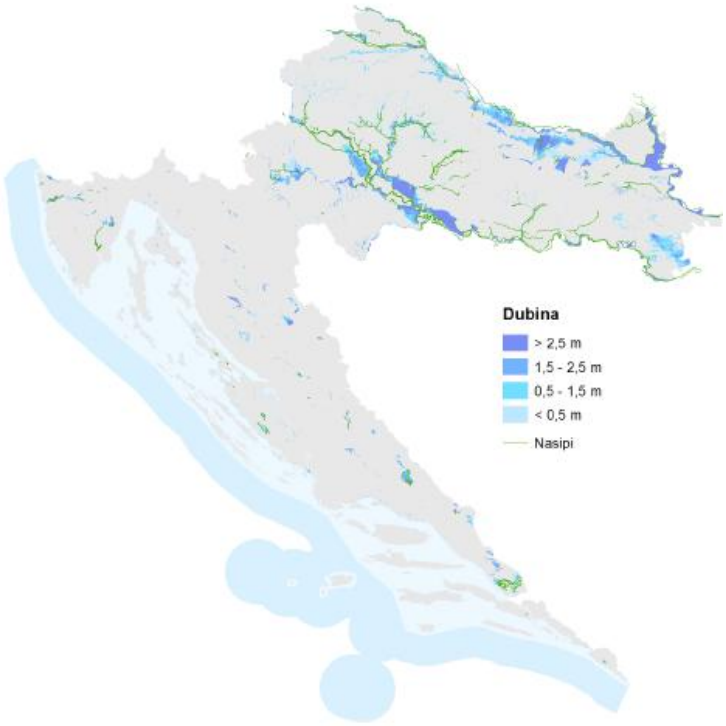



Figure 27: Flood hazard map for medium probability of occurrence with water depth, [RBMP 2016-2021, 2016]

The Preliminary assessment flood risk, flood hazard maps and flood risk maps are available on web page of the Croatian agency for water management – *Croatian waters*: http://korp.voda.hr/ .

An example of a flood hazard map for high probability of occurrence is shown in Figure 28.

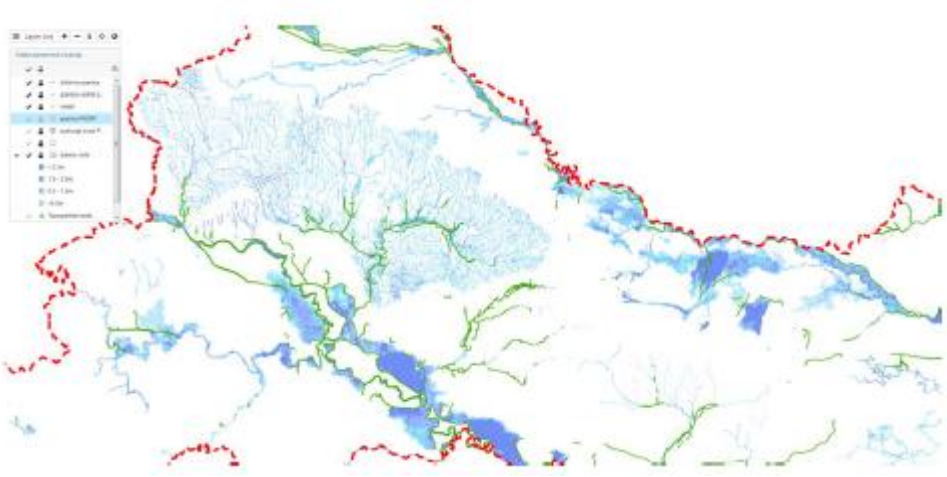


**Figure 28: Flood hazard map for high probability of occurrence in the Danube river basin, [RBMP 2016-2021, 2016]**

An example for a flood risk map for high probability of occurrence including information of the land use and protected areas, inhabitants, infrastructure, etc. is shown in Figure 29.

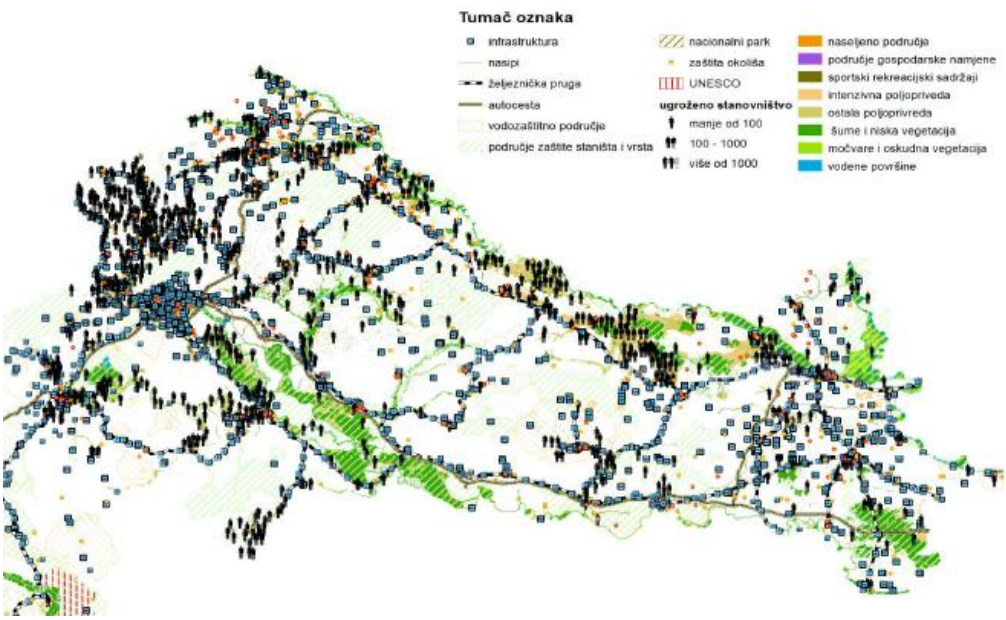



**Figure 29: Flood risk map for high probability of occurrence in the Danube river basin, [RBMP 2016-2021, 2016]**

*Croatian Waters* implement measures for flood risk management according to the *Water Act* and the *National Plan for Flood Protection* (orig. Državni plan obrane od poplava, Official Gazette of Republic of Croatia No. 84/10) according to their obligations, responsibility and available financial resources.

Part of measures for decreasing the flood risk is elaborated in detail in the *Long-Term Programme for Construction of Water Regulation and Protection Structures for Amelioration Structures* (orig. Višegodišnji program gradnje regulacijskih i zaštitnih vodnih građevina i građevina za melioracije, Official Gazette of Republic of Croatia No. NN 117/2015).

## 5.3 Drinking Water Directive

Implementation of the *Drinking Water Directive (DWD)* in Croatia is done according to *the Implementation Plan for Water Utility Directives 2010 – 2023 (IPWUD 2010-2023, revised in 2010)*. For the full implementation of the *DWD*, the transitional period was until 31 December 2018, which was specified and further elaborated in the *IPWUD 2010-2023* that included a list of distribution zones, i.e. water supply areas for which a transitional period was required.

The *Act on water intendent for human consumption* and the *Regulation on parameters compliance and analysis methods for water intended for human consumption* is harmonized with the *DWD* (Council Directive 98/83/EZ form 3.11.1998., and latest amendments including Commission Directive (EU) 2015/1787 of 6.10.2015.; and Council Directive 2013/51/Euratom of 22 October 2013 laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption).

*Act on water intendent for human consumption* in Croatia (orig. Zakon o vodi za ljudsku potrošnju, Official gazette of Republic of Croatia No. 056/2013, 64/15, 104/17, 115/18) regulates the health safety of water for human consumption, the competent authority for the implementation of this Act and the type of reporting to the European Commission on the implementation of this Act, the liability of legal persons engaged in the supply of water for human consumption in Croatia, procedures and reporting in case of deviation from the parameters to check the consistency of water for human consumption, monitoring and other official control of the safety of water for human consumption and their financing, in order to protect human health from adverse effects of any contamination of water intended for human consumption and to ensure the safety of water for human consumption on Croatian territory.

*Regulation on parameters compliance and analysis methods for water intended for human consumption* (orig. Pravilnik o parametrima sukladnosti i metodama analize vode za ljudsku potrošnju, Official gazette of Republic of Croatia No. 125/2013, 64/15, 104/17) defines:

- Parameters of the safety of water for human consumption (microbiological and chemical) and indicator parameters of water for human consumption (microbiological and chemical),
- Frequency of sampling water for human consumption within the system of self-control operators in the food industry,
- Frequency of sampling water for human consumption within the system of self-control by the operators in the food industry, which fill water into bottles or other containers for placing on the market,
- Parameters, the type and scope of the analysis of water samples for human consumption for the implementation of regular and audit monitoring,
- Frequency of sampling water for human consumption for check and audit monitoring,
- The type and scope of the analysis and the number of required samples of water for human consumption in order to test its safety in buildings before issuing a permit,
- Laboratory methods for testing the safety of water for human consumption.

According to the *DWD* the general public has to be informed about the drinking water quality, which is done in the *Report on Drinking Water Quality in Croatia* (orig. Izvještaj o zdravstvenoj ispravnosti vode za ljudsku potrošnju u Republici Hrvatskoj) for each year that is prepared by Croatian Institute of Public Health. The *Report* from 2017. (*Report on Drinking Water Quality in Croatia* in 2017., 2018) states that in Croatia are 551 water supply zones (310 public water supply zones, 241 local water supply zones) and individual water supply zones (Figure 30).

Water for less than 5000 inhabitants or less than 1000 $m^3$/day is delivered in 180 public water supply zones (58,1%). In 184 local water supply zones (76,3%) water is delivered to more than 50 inhabitants.

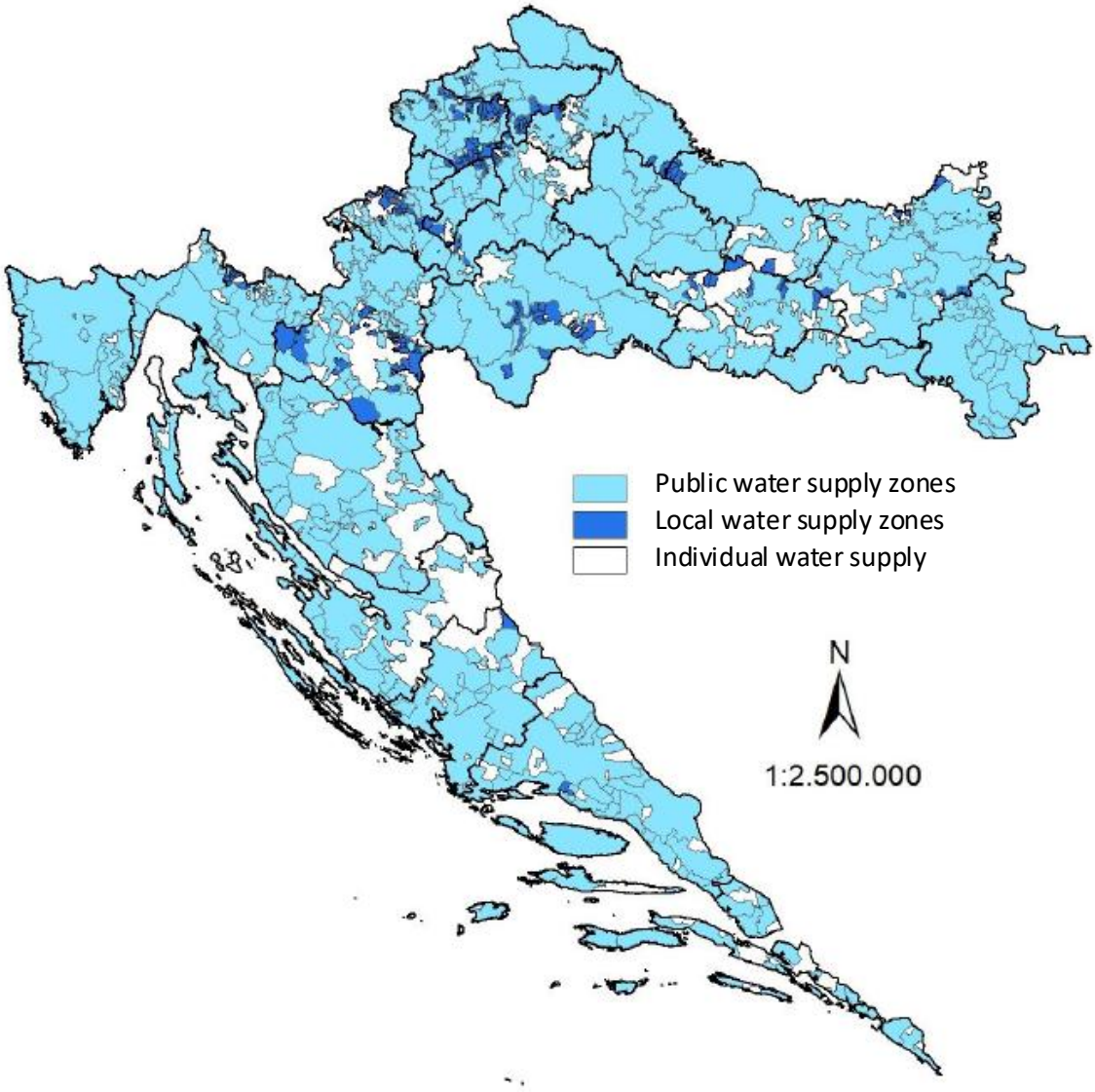



Figure 30: Water supply zones in Croatia in 2017, [Report on Drinking Water Quality in Croatia in 2017, 2018]

In public water supply zones 83% use ground water, 10% surface water, 5% combination of surface and ground water, 2% brackish water.

The results of drinking water analysis in all public water supply systems networks in 2017 is presented in Figure 31 and the percentage of chemical or microbiological non-compliant samples in

public water supply systems networks by county and for the whole Croatia in 2017 is presented in Figure 32.

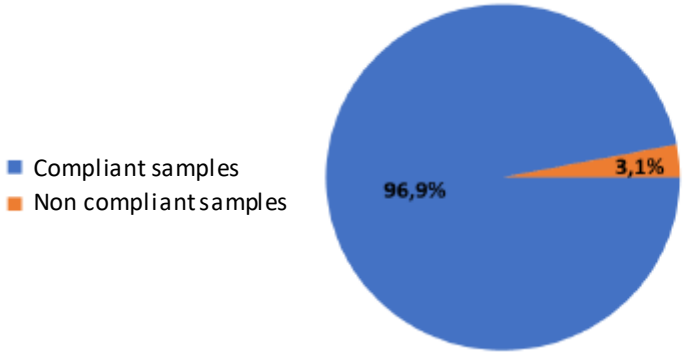



**Figure 31: Results of drinking water analysis in all public water supply systems networks in 2017, [Report on Drinking Water Quality in Croatia in 2017, 2018]**

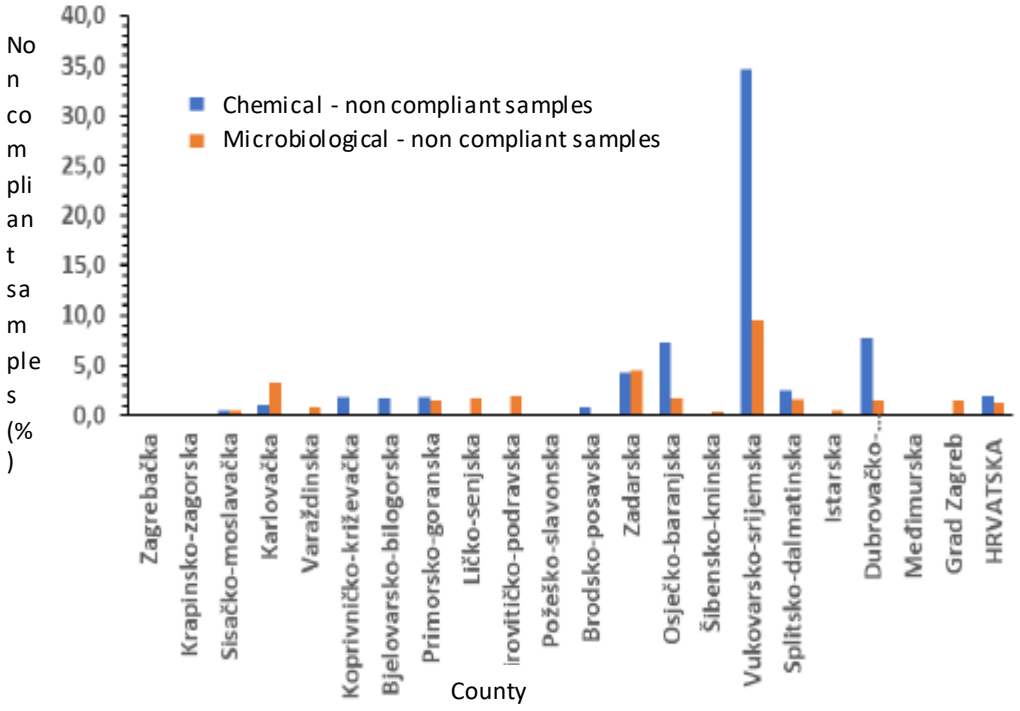



**Figure 32: Percentage of chemical or microbiological non-compliant samples in public water supply systems networks by county and for the whole Croatia in 2017, [Report on Drinking Water Quality in Croatia in 2017, 2018]**

## 5.4 Groundwater Directive

The *Groundwater Directive* in Croatia is implemented through the *Water Act* (orig. Zakon o vodama, Official Gazette of Republic of Croatia No. 153/09, 63/11, 130/11, 56/13, 14/14), but also other regulations and documents like: *Decision on Determination of Nitrate Vulnerable Zones in the Republic of Croatia* (orig. Odluka o određivanju ranjivih područja u Republici Hrvatskoj, Official Gazette of Republic of Croatia No. 130/12), 2nd Action program for water protection from pollution caused by nitrates from agriculture (orig. II. Akcijski program zaštite voda od onečišćenja uzrokovanog nitratima poljoprivrednog podrijetla, Official Gazette of Republic of Croatia No. 60/2017), Law on fertilizers and soil improvers (orig. Zakon o gnojivima i poboljšivačima tla, Official Gazette of Republic of Croatia No. 163/03, 40/07, 81/13, 14/14.

The *Decision on Determination of Nitrate Vulnerable Zones in the Republic of Croatia* , determines zones in which reinforced measures to protect water from contamination of nitrates from agricultural origin have to be implemented (Figure 33).


**Figure 33: Map of Nitrate Vulnerable Zones in the Republic of Croatia, [Decision on Determination of Nitrate Vulnerable Zones in the Republic of Croatia, 2012]**

*2nd Action program for water protection from pollution caused by nitrates from agriculture* contains: who has to apply the measures, requirements and methods for fertiliser application, general principles of fertilizer use, storage and disposal of animal manure, period of application, etc. The allowed quantity of manure that can be used in agriculture (Figure 34).

| Vrsta stajskog gnoja | N | $P_2O_5$ | $K_2O$ | Granične vrijednosti primjene dušika (N) | Najveća dozvoljena količina stajskog gnoja prema graničnim vrijednostima | Sadržana količina hranjiva (kg) | | |
|---|---|---|---|---|---|---|---|---|
| | (%) | (%) | (%) | (kg/ha) | (t/ha) | N | $P_2O_5$ | $K_2O$ |
| Goveđi | 0,5 | 0,3 | 0,5 | 170 | 34 | 170 | 102 | 170 |
| Konjski | 0,6 | 0,3 | 0,6 | 170 | 28 | 170 | 85 | 170 |
| Ovčji | 0,8 | 0,5 | 0,8 | 170 | 21 | 170 | 106 | 170 |
| Svinjski | 0,6 | 0,5 | 0,4 | 170 | 28 | 170 | 142 | 113 |
| Kokošji | 1,5 | 1,3 | 0,5 | 170 | 11 | 170 | 147 | 57 |
| Brojlerski | 3,0 | 3,0 | 2,0 | 170 | 5.5 | 170 | 170 | 110 |
| Goveđi kompost | 2,1 | 2,2 | 0,8 | 170 | 8 | 170 | 180 | 65 |
| Goveđa gnojovka | 0,4 | 0,2 | 0,5 | 170 | 42 $m^3$/ha | 170 | 85 | 210 |
| Svinjska gnojovka | 0,5 | 0,4 | 0,3 | 170 | 34 $m^3$/ha | 170 | 136 | 102 |

**Figure 34: The allowed quantity of manure that can be used in agriculture, [2nd Action program for water protection from pollution caused by nitrates from agriculture, 2017]**

Information on the chemical status of groundwater is presented in the *RBMP 2016-2021* (see Figure 23).

## 5.5 Urban Waste-Water Treatment Directive

Implementation of the *Urban Waste-Water Treatment Directive (UWWTD)* in Croatia is done according to *the Implementation Plan (revised in 2010.) for Water Utility Directives 2010 – 2023 (IPWUD 2010-2023*, orig. Plan provedbe vodno-komunalnih direktiva*)* (https://www.voda.hr/hr/plan-provedbe-vodnih-direktiva).

The harmonization with the *UWWTD* and its implementation relate mainly to the construction of drainage and waste-water treatment systems, and control of municipal waste-water discharges for 294 agglomerations with more than 2,000 PE (Figure 35). The agreed deadlines and the required level of treatment of municipal waste-water depend on the size of the sewerage system and the sensitivity of the waste-water recipient.

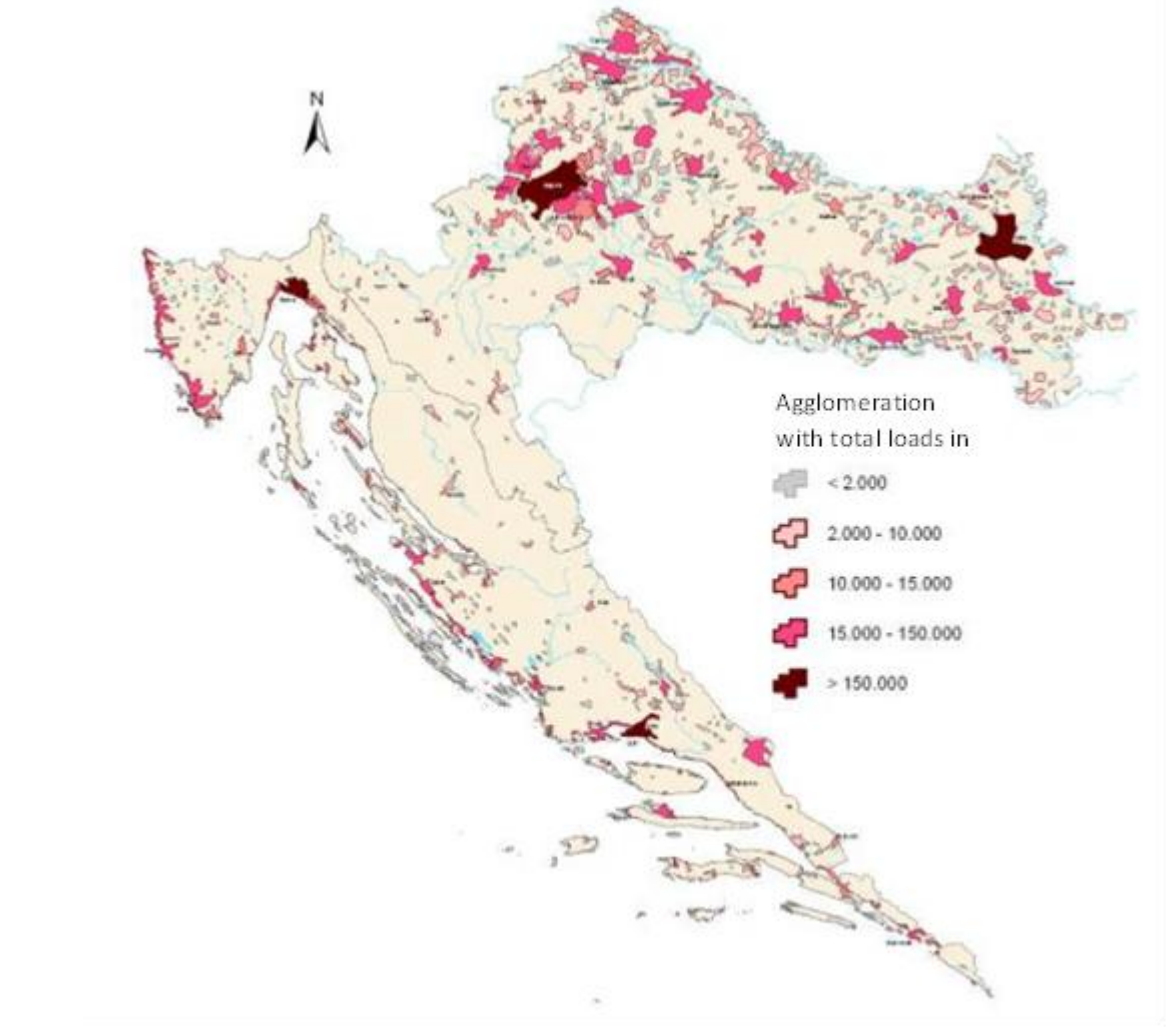



**Figure 35: Agglomerations with more than 2000 PE in Croatia, [IPWUD 2010-2023, 2010]**

Given the current state and the existing concepts for future development of drainage and waste-water treatment systems, the selected most appropriate approach was that the area of one agglomeration is connected to one sewerage system and one wastewater treatment plant.

For the full implementation of the Council's *UWWTD*, the transitional period is until 31 December 2023, as stated and detailed in the *IPWUD 2010-2023*.

*UWWTD* is part of the Croatian *Water Act*, whereby several ordinances have been established including information, restrictions and requirements in the field of water treatment and that are completely harmonized with this Directive:

- *Regulation on water quality standards* (orig. *Uredba o standardu kakvoće voda,* Official gazette of Republic of Croatia No. 73/13, 151/14, 78/15, 61/16 i 80/18),
- *Ordinance on emission limit values for waste waters* (orig. *Pravilnik o graničnim vrijednostima emisija otpadnih voda,* Official gazette of Republic of Croatia No 80/13, 43/14, 27/15 i 3/16,).

**The requirements for discharges from urban waste water treatment plants in Croatia are listed in the *Ordinance on* the *Ordinance on emission limit values for waste-waters* and some are presented in Table 5,**

Table 6 and Table 7.

Table 5: Emission limit values for municipal waste-waters treated with secondary waste-water treatment [Ordinance on emission limit values for waste waters, 2013]

| Indicators | Limit values | The smallest percentage in reduction of loads |
|---|---|---|
| Suspended elements | 35 mg/l | 90 |
| $BPK_5$ (20 °C) | 25 mg $O_2$/l | 70 |
| $KPK_{Cr}$ | 125 mg $O_2$/l | 75 |

Table 6: Emission limit values for municipal waste-waters treated with tertiary waste-water treatment [Ordinance on emission limit values for waste waters, 2013]

| Indicators | Limit values | The smallest percentage in reduction of loads |
|---|---|---|
| Total phosphor | 2 mg P/l (10 000 to 100 000 ES) 1 mg P/l (> 100 000 ES) | 80 |
| Total nitrogen (organic N+$NH_4$-N + $NO_2$-N+$NO_3$-N) | 15 mg N/l (10 000 to 100 000 ES) 10 mg N/l (> 100 000 ES) | 70 |

Table 7: Emission limit values for microbiological indicators for treated municipal waste-waters that are disposed in surface waters that are used for bathing and recreational activities, [Ordinance on emission limit values for waste waters, 2013]

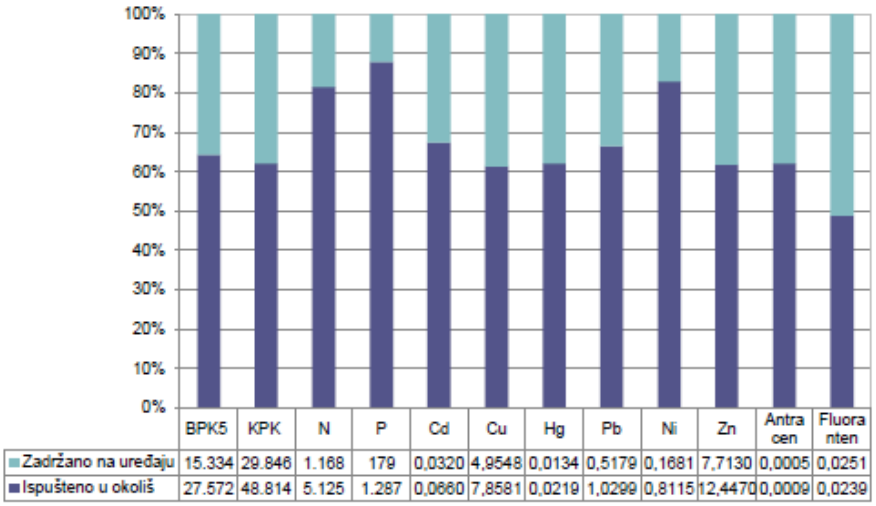
| Indicators | Measurement unit | Limit values | |
|---|---|---|---|
| | | Surface waters | Coastal waters |
| Splanchnic enteroccoci | cfu/100 ml | 400 | 200 |
| Escherichia coli | cfu/100 ml | 1000 | 500 |

In Croatia there are 245 public sewage systems. 46% inhabitants are connected to the sewerage system, and 35.3% have the waste water treated before disposal. In the Adriatic Basin (JVP) the waste-water is treated mostly with preliminary treatment and afterwards disposed in the sea, while in The Danube Basin most waste-water is treated with secondary treatment, Table 8. (*RBMP 2016-2021, 2016*).

Table 8: Overview of public sewerage systems according to the degree of waste-water treatment, [RBMP 2016-2021, 2016]

| | | Bez uređaja | prethodni stupanj | 1. stupanj | 2. stupanj | 3. stupanj | UKUPNO | pročišćava se |
|---|---|---|---|---|---|---|---|---|
| PS Sava | Broj sustava | 58 | - | 8 | 18 | 1 | 85 | 27 |
| | Broj priključenih stanovnika | 216.341 | - | 72.421 | 704.215 | 39.791 | 1.032.768 | 816.427 |
| | Udio u ukupnom stanovništvu | 10,2% | - | 3,4% | 33,1% | 1,9% | 48,5% | 38,3% |
| PS Drava | Broj sustava | 17 | - | 2 | 10 | 4 | 33 | 16 |
| | Broj priključenih stanovnika | 142.465 | - | 3.217 | 86.691 | 25.221 | 257.594 | 115.129 |
| | Udio u ukupnom stanovništvu | 18,4% | - | 0,4% | 11,2% | 3,3% | 33,2% | 14,9% |
| VPD | Broj sustava | 75 | - | 10 | 28 | 5 | 118 | 43 |
| | Broj priključenih stanovnika | 358.806 | - | 75.638 | 790.906 | 65.012 | 1.290.362 | 931.556 |
| | Udio u ukupnom stanovništvu | 12,3% | - | 2,6% | 27,2% | 2,2% | 44,4% | 32,1% |
| JVP | Broj sustava | 60 | 30 | 7 | 28 | 2 | 127 | 67 |
| | Broj priključenih stanovnika | 87.372 | 453.024 | 40.544 | 87.693 | 168 | 668.801 | 581.429 |
| | Udio u ukupnom stanovništvu | 6,3% | 32,8% | 2,9% | 6,4% | 0,01% | 48,5% | 42,1% |
| RH | Broj sustava | 135 | 30 | 17 | 56 | 7 | 245 | 110 |
| | Broj priključenih stanovnika | 446.178 | 453.024 | 116.182 | 878.599 | 65.180 | 1.959.163 | 1.512.985 |
| | Udio u ukupnom stanovništvu | 10,4% | 10,6% | 2,7% | 20,5% | 1,5% | 45,7% | 35,3% |

The pollution load from the population connected to the public sewerage systems is presented in Figure 36 (*RBMP 2016-2021, 2016*).




| | BPK5 | KPK | N | P | Cd | Cu | Hg | Pb | Ni | Zn | Antracen | Fluoranten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zadržano na uređaju | 15.334 | 29.846 | 1.168 | 179 | 0,0320 | 4,9548 | 0,0134 | 0,5179 | 0,1681 | 7,7130 | 0,0005 | 0,0251 |
| Ispušteno u okoliš | 27.572 | 48.814 | 5.125 | 1.287 | 0,0660 | 7,8581 | 0,0219 | 1,0299 | 0,8115 | 12,4470 | 0,0009 | 0,0239 |

Figure 36: Pollution load from the population connected to the public sewerage systems (light blue – load retained at the waste-water treatment plant, dark blue – load disposed in the environment), [RBMP 2016-2021, 2016]

## 5.6 Bird Directive and the Habitat Directive

The Bird Directive and the Habitat Directive were implemented through different Croatian legislations: the *Nature Protection Act* (Zakon o zaštiti prirode (Official gazette of Republic of Croatia No. 80/2013, 15/2018, 14/2019, *Regulation on the ecological network* (orig. Uredba o ekološkoj mreži, (Official gazette of Republic of Croatia No.124/13, 105/15), *Ordinance on conservation objectives and basic conservation measures in the field of ecological network (*orig. Pravilnik o ciljevima očuvanja i osnovnim mjerama za očuvanje ptica u području ekološke mreže, Official gazette of Republic of Croatia No. 15/14), *Rulebook on Assessment of Acceptability for the Ecological Network* (orig. Pravilnik o ocjeni prihvatljivosti za ekološku mrežu, Official gazette of Republic of Croatia No. 146/14).

The ecological network of the Republic of Croatia covers 36.73% of the land territory and 15.42% of sea shore; 30% of land and 3%, of sea area are conservation areas significant for birds - SPA (Birds Directive); 28% for land and 15% sea area are conservation areas significant for species and habitat types - SAC (Habitat Directive), as presented in Figure 37.

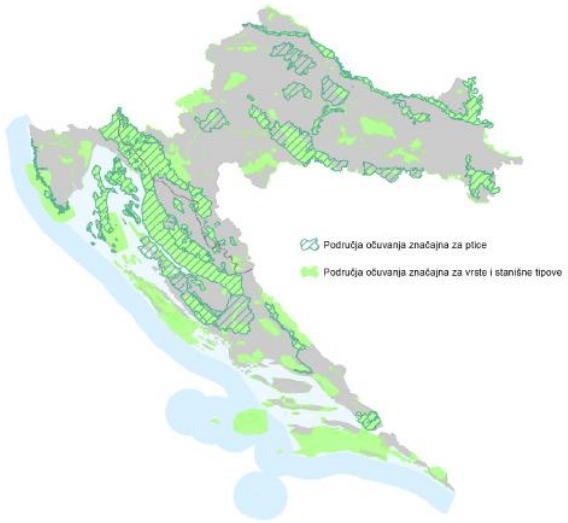



**Figure 37: Special Protection Areas in Croatia, [According to the Register of protected areas, September 2012]**

# 6 Greece

The Special Secretariat for Water, belonging to the Ministry of Environment and Energy, http://www.ypeka.gr/ is the authority, responsible for the development and implementation of all programs related to the protection and management of the water resources of Greece and the coordination of all competent authorities dealing with the aquatic environment.

More specifically the Secretariat is responsible, among others, for:

- the implementation of the Water Framework Directive
- the implementation of the national monitoring program
- the implementation of the Nitrates Directive
- the implementation of the Floods Directive
- the implementation of the Urban Wastewater Directive and reuse programs
- Transboundary and international water issues

The implementation of the EU directives and strategies in the field of water resources management in the Greek legislation is described in the following sub-chapters.

## 6.1 Water Framework Directive

The harmonization of the Greek legislation with the Water Framework Directive 2000/60 / EC was made by the Law 3199/2003 (Government Gazette 280 A / 09.12.2003) N.3199/2003 (ΦΕΚ 280 A/09.12.2003) and the Presidential Decree 51/2007 (Government Gazette 54 / A / 08.03.2007). ΠΔ 51/2007 (ΦΕΚ 54/A/08.03.2007)

The provisions of the above national legislation incorporate the basic concepts of the EU Water Directive and, at the same time, the new administrative structure is established, as well as the competences of the individual bodies, both at national and regional level.

The River Basins and the Water Districts (Figure 38) have been determined by the Decision No. 706 of the National Water Committee of 16.07.2010. Απόφαση της Εθνικής Επιτροπής Υδάτων της 16.07.2010. (Government Gazette 1383/2010) "Determination of the river basins of the country and designation of the competent regions for their management and protection", pursuant to article 3 of the PD. 51/2007, as corrected by the Government Gazette 1572 / B / 2010 and amended by the Government Ordinance no. House 1300 / 24.12.2014 Decision of the National Water Committee (Government Gazette B '3665/2014).


Figure 38: River Basins and Water Districts of Greece

According to the WFD the country has been divided into the above mentioned, 14 Water Districts and National Water Management Plans were developed for every single one of them.

- WD 01: WESTERN PELOPONNESE
- WD 02: NORTHERN PELOPONNESE
- WD 03: EASTERN PELOPONNESE
- WD 04: WESTERN STEREA HELLAS
- WD 05: HEPEIROS
- WD 06: ATTICA
- WD 07: EAST STEREA HELLAS
- WD 08: THESSALY
- WD 09: WESTERN MACEDONIA
- WD 10: CENTRAL MACEDONIA
- WD 11: EASTERN MACEDONIA
- WD 12: THRACE
- WD 13: CRETE
- WD 14: AEGEAN ISLANDS

**The first National Management Plans were approved by the Decision of the National Water Committee (Decision No. 1067, Government Gazette 182 / B / 31.1.2014). Public and interested authorities were requested to submit within 6 months any comments on the available documents of the 1st Update of River Basin Management Plans.**

Mainly the implementation of the WFD includes the following main components:

1. Assessment of the current situation
2. Organization of environmental objectives
3. Preparation of Monitoring Programs
4. Gap analysis
5. Establishment of the Program of Measures
6. Development of National Management Plans
7. Implementation of Program of Measures
8. Evaluation of the Program of Measures
9. Consultation with the public, active involvement of stakeholders

**The Revised River Basin Management Plans concern the 2nd Management Cycle (2015-2021) of the Framework Directive and were adopted on 29 December 2017 (Government Gazette B 4680, B 4679, B 4672, B 4673, B 4675, B 4682, B 4664, B 4674, B 4665, B 4678, B 4681, B 4676, B 4666, B 4677) by the National Water Committee by decision of its President, Deputy Minister of the Environment.**

They included:

(a) Update of the identification and characterization of surface (river, lake, transitional and coastal) and groundwater bodies.

(b) Review and update reference conditions and the assessment and classification of surface, including highly modified and artificial, groundwater bodies, based on the new data available from the operation of the National Water Monitoring Network.

c) Re-evaluation of surface systems with significant hydromorphological modifications (particularly modified (ITT) and artificial (TWS) water systems).

d) Updating the list of significant pressures on water resources and their impacts.

e) Updating the Register of Protected Areas.

(f) Review of environmental objectives for all water bodies.

g) Assessment of the progress of implementation of the original River Basin Management Plans of the country.

(h) Revision of the Basic and Supplementary Measures.

i) Updating the economic analysis of water uses.

(j) Recording the transnational agreements up to now in transnational catchment areas.

The program of measures of the revised Management Plans is a roadmap with legislative, administrative tools and infrastructure projects to support the regional development with the aim of optimizing the use of water resources and protecting ecosystems.

### 6.1.1 National water monitoring ( http://nmwn.ypeka.gr/ )

In line with the provisions of the Water Framework Directive, Greece has established and recently revised a national monitoring program for the assessment of the status of surface water and ground water, in order to obtain a coherent and comprehensive overview of water status within each river basin district.

In compliance with Directive 2009/90 / EC of the European Parliament and of the Council of 31 July 2009 laying down technical specifications for the chemical analysis and monitoring of water status according to Directive 2000/60 / EC of the European Parliament and of the Council Parliament and the Council ", the preparation for the launching of the National Water and Quality Monitoring Network of the country was completed through the adoption of the Joint Ministerial Decision on September 9, 2011 (Government Gazette 2017 B 09.09.2011) KYA 140384/19.8.2011 (ΦΕΚ Β' 2017) on the definition of the National Quantity and Water Quality Monitoring Network specifying the

measuring stations (stations) and the operators obliged to operate pursuant to Article 4 (4) of Law 3199/2003 (A 280) and the Joint Ministerial Decision of 6 September on technical specifications and minimum performance criteria for analytical methods for chemical analysis and monitoring of water status.

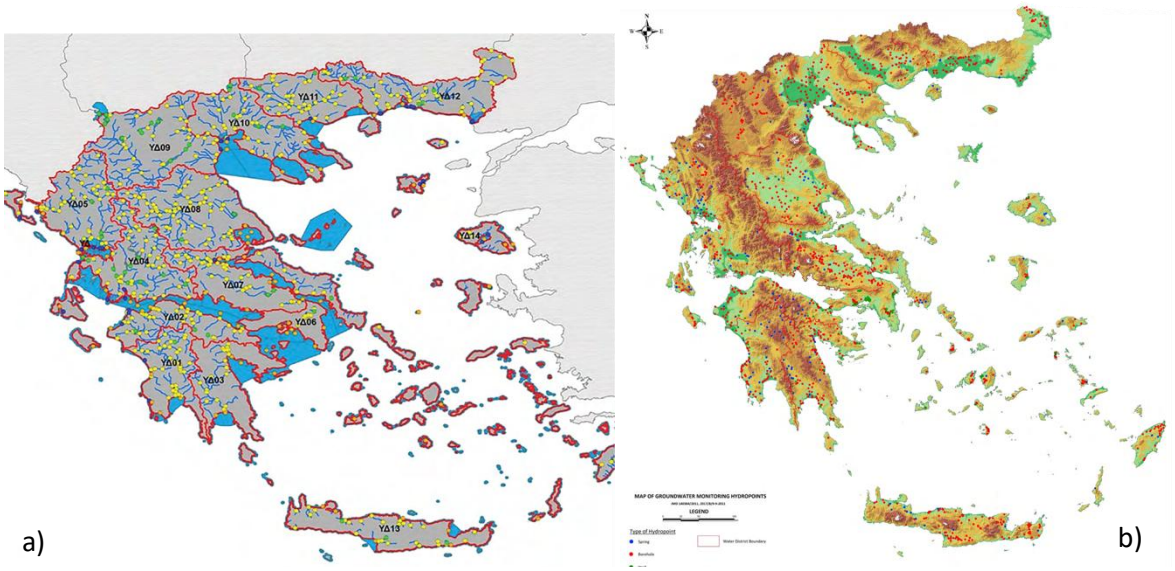
The National Monitoring Network comprises 449 survaillence and monitoring stations in rivers, 53 stations in lakes, 34 in transitional waters, 80 stations in coastal waters and 1,392 stations in groundwaters (i.e. the total number of stations is 2,008, from which 616 refer to surface waters and 1,392 to groundwaters).

Monitoring of groundwater resources in accordance with the EU policy in the field of water management, aimed at the operation of a 'National Network' for monitoring the quality and quantity of the 591 most important groundwater bodies of the country (233 karstic, 216 granular, 102 fracture and 40 mixed) as detailed in the 1st Update of River Basin Management Plans (RBMPs).

The data and information obtained are stored in electronic data bases, including the National Data Bank of Hydrological and Meteorological Information and the National Environmental Information Network and processed for reporting, and dissemination purposes. Furthermore, the necessary software tools have been developed, enabling further data processing aiming at an effective protection and management of the water resources.

The production of thematic maps, through an interactive website, visualize the results from the operation of the National Monitoring Network (Figure 39), and it is ensured that the public is informed immediately about the status of each country's water system.

Monitoring of waters in Greece




a) b)

Figure 39: Monitoring Network stations of surface water (a) and groundwater (b) resources

By virtue of the provisions of Law 3199/2003, individual Decisions, such as Joint Ministerial Decision 140384 / 19.8.2011 (Government Gazette B'2017), have been issued "Definition of a National Network for monitoring the quality and quantity of waters by determining the locations (s) and the entities that are obliged to operate according to article 4, paragraph 4 of Law 3199/2003 ", the

Decision 706 / 16.07.2010 (Official Gazette B 1383/2010) of the National Water Committee" Determination of River Basin country and designation of the relevant Regions for their management and protection ", in application of Art reaches 3 PD 51/2007, as in force after the approval of the River Basin Management Plans of the 14 Water Districts of the country for the 1st Management Cycle (2009-2015).

Directly related to the implementation of the Directive is the institutional framework incorporating later or subsidiary Directives, such as Joint Ministerial Decision 39626/2208 / E130 / 25.9.2009 (Government Gazette B '2075), laying down measures for the protection of underground pollution and degradation, pursuant to the provisions of Article 17 of Directive 2000/60 / EC of the European Parliament and of the Council on the protection of groundwater against pollution and deterioration, EC.

The National Water Record Register has been set up and operates, which records the water quantity available from the water abstraction points licensed for various uses in the 14 Water Districts of the country.

The Interim Progress Reports "Implementing the River Basin Management Plan Measures Programs" have been prepared by the Special Secretariat of Water (December 2014) and submitted to the EU.

## 6.2 Flood Directive

The Directive 2007/60/EC is carried out in coordination with the Water Framework Directive, notably by flood risk management plans and river basin management plans being coordinated, and through coordination of the public participation procedures in the preparation of these plans. All assessments, maps and plans is made available to the public.

The Κ.Υ.Α. Η.Π. 31822/1542/Ε103/2010 (ΦΕΚ 1108 Β'/2010) is the Joint Ministerial Decision which incorporated into the national law the Community Directive 2007/60 / EC of the European Parliament and of the Council of 23 October 2007 on "Evaluation and Managing Flood Risks ".

The first stage of the implementation of the Directive 2007/60/EC is the preparation of the Preliminary Flood Risk Assessment for each river basin and the designation of areas with significant probability of flooding (Areas of Potential Significant Flood Risk)

The second stage of the implementation of the Directive 2007/60/EC concerns the preparing of the Flood Hazard Maps and the Flood Risk Maps inside the Areas of Potential Significant Flood Risk, as they emerged from the Preliminary Flood Risk Assessment and in which the negative consequences of floods (for human health, the environment, cultural heritage and economic activity) are depicted.

All available information - historical flood recordings (historical floods / significant historical floods) and causing significant negative impacts as well as the High Level Flood Potential Areas for the whole territory are available on the following websites:

- http://cdr.eionet.europa.eu/gr/eu/floods,
- http://maps.ypeka.gr

and in the European Environment Information and Observation Network at the following address:

http://cdr.eionet.europa.eu/gr/eu/floods/ (Reportnet) for all (14) Water Districts in the country (Figure 40).

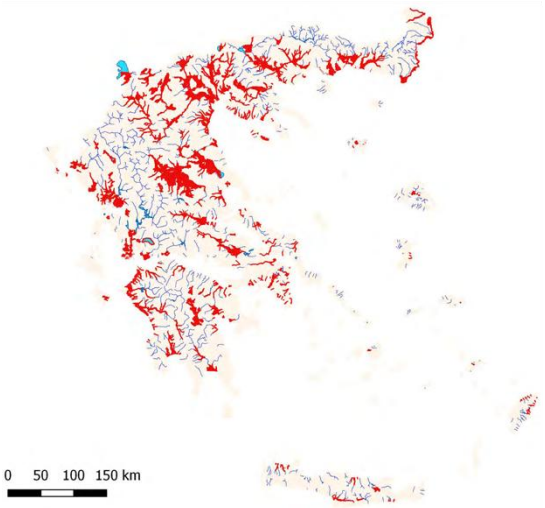



Figure 40: Flooded areas for 100 year return period

In the context of the flood risk management plans (Figure 41), a special methodology for flood risk assessement was developed and applied in all River Basin Districts. The aim is the evaluation of flood risk within the flooded areas as they came out from the hydraulic analysis performed for different return periods (T50, T100 και T1000), taking into consideration the flood hazard (depths, flow rate) and the vulnerability (based on potential impacts) of uses and activities in the flooded areas.

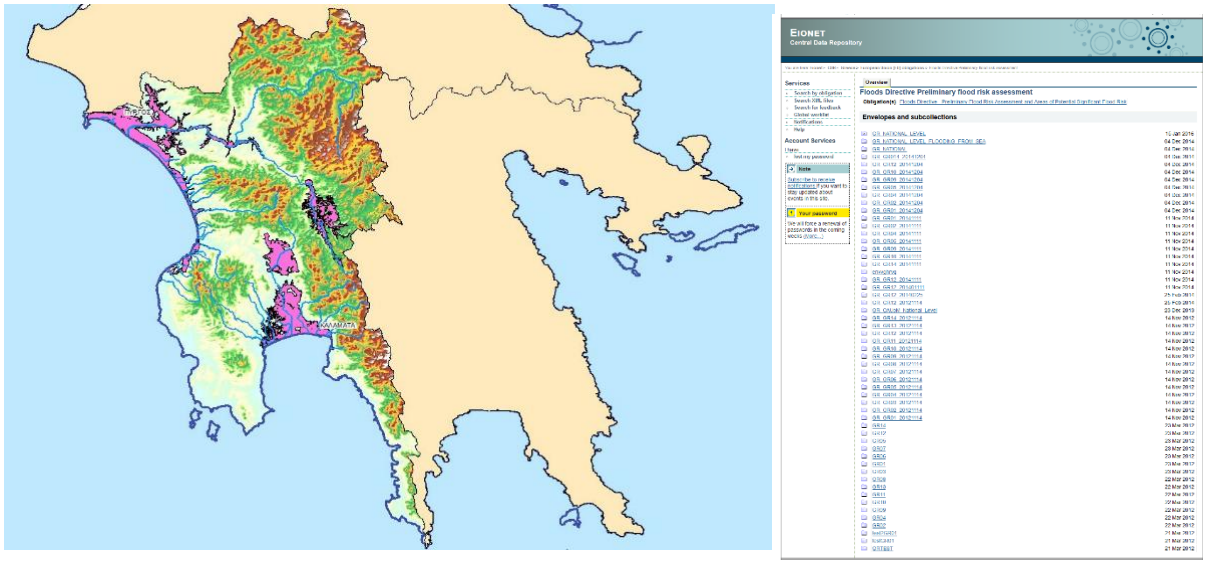



Figure 41: The Flood Risk Management Plans of Greece floods.ypeka.gr

During the third stage of the implementation of the Directive 2007/60/EC the preparation of Flood Risk Management Plans takes place for the Areas of Potential Significant Flood Risk. Taking into consideration the provisions of the Directive 2007/60/EC and the relevant guidelines, the following General Targets were determined at a national level during the 1st cycle of implementation of the Directive 2007/60/EC:

- Moderation of the exposure to flood
- Reduction of the possibility of flood
- Enhancement of preparedness for flood response
- Improvement of restoration mechanisms for the affected areas

For the achievement of the General Targets, there is a Program of Measures in the Flood Risk Management Plans for each River Basin District that covers all management aspects.

Also Drought Management Plans have been developed which form an integral part of the River Basin Management Plans. These plans define the appropriate indicators used for the timely diagnosis of drought to minimize adverse impacts.

## 6.3 Nitrate Directive

**Nitrate Pollution**

Agriculture is, on an EU level, the largest single source of nitrate (runoff, leaching) pollution, although households and industries also contribute to some extent. As a consequence, the nitrate pollution problem is addressed within the European Union mainly by the Nitrates Directive (91/676/EEC), regarding nitrate pollution caused by agricultural practices, supplemented by the provisions of the Urban Wastewaters Directive (91/271/EC), related to sensitive recipients and the Groundwater Directive (2006/118/EC). An important provision of the Nitrates Directive is the obligation of Member States to report every 4 years on the monitoring results of ground and surface water quality. Furthermore, Member States are compelled to designate the so-called Nitrate Vulnerable Zones (NVZs).

*Vulnerable zones in Greece*

Using the quality data of surface and groundwater and in accordance with the criteria of Directive 91/676 / EEC, were established by Joint Ministerial Decision 19652/1906/1999 (ΦΕΚ Β' 1575/05-08-1999) as areas vulnerable to nitrate pollution from agricultural areas (Figure 42), the areas of the Thessalia, the Copaid Field, the Argolic Field and the Pinios (Ilias) basin.

In September 2001, the list of vulnerable zones was updated and supplemented by Joint Ministerial Decision 20419/2522 / 18-9-2001 (ΦΕΚ 1212Β/14-9-2001) including the areas of the Basin of Stymonas, Kampos, Thessaloniki, Pella, Imathia and Pediadas, Arta-Preveza.

After more revisions, the Greek authorities, taking into account the new vulnerable zones proposed by the European Commission, the elaboration of the results of the National Surface and Groundwater Monitoring Network as well as the 1st Cyrcle of the Water Basin Management Plans of the Water Districts of the country, identified with the Joint Ministerial Decision 190126 / 17.04.2013 new areas vulnerable to nitrification in compliance with the requirements of Directive 91/676 / EEC on the protection of waters against pollution caused by nitrates from agricultural sources (Government Gazette 983 B / 23.04.2013).

Distribution of the average over-concentration of nitrates per ground water system for the years 2012-2015 are depicted in Figure 43.

Figure 42: Map of Greece where vulnerable to pollution caused by nitrates from agricultural sources zones are depicted with pink color (Source: SSW/Ministry of Environment and Energy)

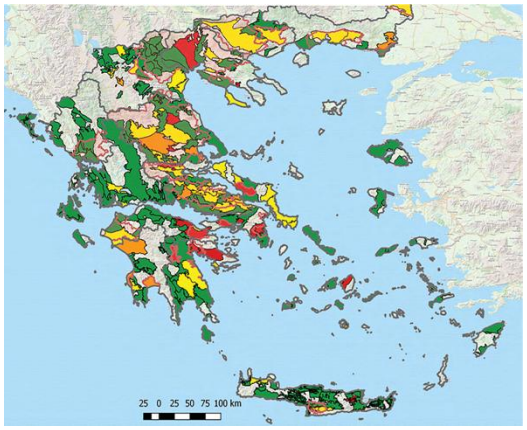



Figure 43: Distribution of the average over-concentration of nitrates per ground water system for the year 2012-2015

For the update of existing and development of new action plans for all nitrate vulnerable zones, a relevant project was launched in April 2017, in the framework of the Rural Development Program 2014-2020, and is currently at the final elaboration stage.

## 6.4 Urban Wastewater Directive and reuse programs

With regard to Greece's compliance with the requirements of Directive 91/271/EC, following the priority given, over the past decades, to the construction of wastewater collection and treatment facilities in medium and large urban centers, (agglomerations of Priority A and B) the compliance rate for these settlements today is around 95%. The compliance rate to the Directive's obligations regarding collection and treatment infrastructure for smaller agglomerations (priority C agglomerations) is lower. According to the data submitted to the EU, in the context of the National Reports for the year 2016, by Special Secretariat for Water, 455 agglomerations were reported under Directive 91/271 / EEC with a total population equivalent of 11,803,450 p.e. Graph 4.13. below shows the percentage of the population equivalent per category of settlements that is in compliance with the Directive for the year 2016.

Reuse of waste waters remains limited. However, the legal framework in place describes the terms, conditions and procedures for the reuse of treated waste waters. Reuse of waste waters is expected to be adopted increasingly in the coming years.

## 6.5 Transboundary Issues

In Greece about 25% of surface waters in the form of lakes and rivers are transboundary waters which extend or come from our neighboring countries Bulgaria, Albania, North Macedonia and Turkey.

The UNECE Water Convention constitutes the overarching legal and institutional framework of transboundary water cooperation in the European Union.

*According to the WFD, "For international river basin districts the Member States concerned shall together ensure this coordination and may, for this purpose, use existing structures stemming from international agreements. At the request of the Member States involved, the Commission shall act to facilitate the establishment of the programmes of measures. Where a river basin district extends beyond the territory of the Community, the Member State or Member States concerned shall endeavour to establish appropriate coordination with the relevant non-Member States, with the aim of achieving the objectives of this Directive throughout the river basin district. Member States shall ensure the application of the rules of this Directive within their territory."*

The WFD refers to transboundary river basin management denoting that if both countries are Members of EC they should develop a common management plan along the whole river basin whereas if the transboundary water basin is shared between EU and non EU countries they should cooperate anyway but can develop separate management plans according to their respective legislation.

it is worth mentioning the promotion of Greece's ratification of the United Nations Convention on Transfrontier Rivers (1997 Convention on the Law of the Use of International Watercourses) and the important agreement between Greece, Albania and the GDR , with the participation of the European Union, signed by the relevant Environment Ministers on 2 February 2010 on the protection and sustainable development of the Prespa Park area ("Joint Declaration on the Protection and Sustainable Development of the Prespa Park" 2010 ).Also in May 2010, a "Joint Declaration on the protection of the river Evros" was signed between Greece and Turkey, while on 27 July 2010 the Greek and Bulgarian Environment Ministers signed a Joint Declaration "on understanding and cooperation in the field of use of water resources in the respective territories of the Common River Basin Districts shared by the Republic of Bulgaria and the Hellenic Republic ", which provides for the coordination of actions for the preparation of Management Plans of transboundary river basin, in line with the principles and teachings of Directive 2000/60 / EC.

River basins and basin agreements in the European Union can be found *in http://ec.europa.eu/environment/water/water-framework/facts_figures/pdf/Transboundary-cooperation- %202012.pdf (Source: European Commission)*

## 6.6 Other relevant Directives / Issues

### 6.6.1 Natura 2000 network

At the heart of the Birds and the Habitats Directives lies the creation of the Natura 2000 network - a Europe-wide ecological network of nature conservation areas. All 28 Member States have designated Natura 2000 sites to help conserve the rare habitats and species present in their territory. Natura 2000 map of Greece is depicted in **Figure 44**.

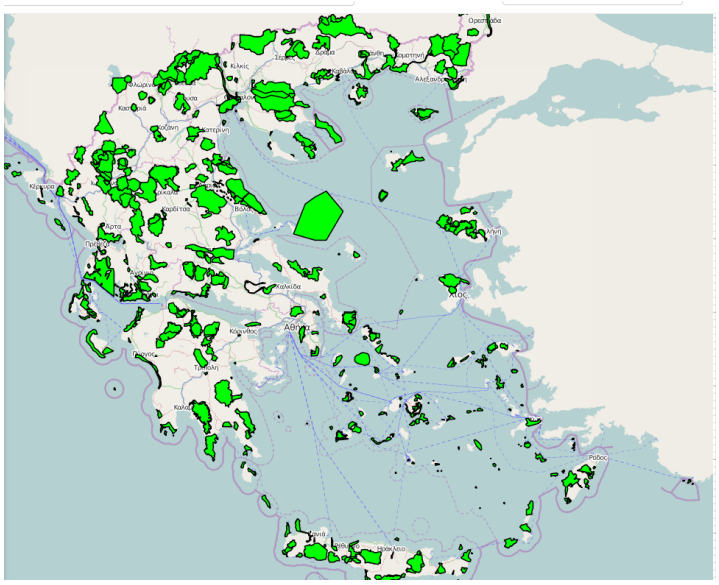


**Figure 44: Natura 2000 Map of Greece - KYA 50743/2017 (Government Gazette 4432 / B / 2017) "Review of the national list of Natura 2000 European Ecological Networks"**

### 6.6.2 Climate Change

The study by the Bank of Greece (EMEKA, 2011) has shown that changes in the frequency and intensity of extreme events will be one of the main impacts of climate change on Greece with consequent negative impacts on the vulnerability of societies and ecosystems due to their exposure to new intensive environmental risks.

More specifically, summer drought is expected to increase even further, leading to a prolongation of drought periods and pressures on water reserves of areas with already increased vulnerability. At the same time, heavy rainfall is expected to become more frequent over the next 70 years, with the consequence that in urban areas sudden floods are becoming more common7 due to heavy local rainfall.

In 2016 the Ministry of the Environment and Energy drafted the National Strategy for Climate Change and Adaptation, which sets out the general objectives, guiding principles and means of implementing a modern, effective and strategic adaptation within the framework set by the United Nations Convention on Climate Change, European Directives and international experience. The National Climate Change Adaptation Strategy identifies actions and measures per sector affected by climate change and thus for water resources as well.

## 6.7 In Progress

• The annual reports on the qualitative and quantitative status of the surface (river, lake, transitional and coastal) and groundwater of each Water Department are compiled on the basis of data from the National Monitoring Network.

• A study on costing and pricing of water services is being prepared by the SSW.

• It has been established, the First National Committee of the Special Secretariat of Water to determine the methods for the classification of the ecological status of all categories of surface water (12th Dec. 1282 / 19-12-2014) (ADA: 7AYH0-NBB) Decision of the Special Secretary of Water.

• Studies on the preparation of the Flood Risk Management Plans under Directive 2007/60 / EC, which are expected to set additional environmental objectives and measures for the protection and management of water bodies from flood risks, are being prepared based on the requirements of the Directive 2000/60 / EC

## 6.8 Discussion

Generally, regarding the management of water resources, the quality of water is good. Coastal water systems are achieving predominantly high to good ecological status, rivers good to moderate status, while lakes and transitional waters are predominantly in moderate and / or unknown condition, due to insufficient data and lack of observation station. In terms of chemical status, all categories of surface waters are predominantly in good condition. Finally, groundwater resources are in good condition in their vast majority, both in qualitative and quantitative terms.

From an ecological status point of view, coastal water bodies are mainly in high or good status, rivers in good to moderate status, while lake and transitional waters are mostly in moderate and/ or unknown status, due to lack of data and lack of monitoring stations. From a chemical status point of view all the categories of surface water bodies are mainly in good status and only a small percentage remains in an unkown and/or lower than good status. Finally, concerning groundwater bodies, the vast majority is in good qualitative (85%) and quantitative (80%) status. Quantitative degradation of groundwater resources is mainly, due to the nitrates pollution because of the intensive farming and the irrational use of fertilizers and pesticides, and also a result of the salt water intrusion (exceedances of chorides) as a consequence of over-exploitation and over drilling of coastal groundwater bodies.

*Part of this information is published in the "Greece: State of the Environment Report" (2018) by the National Center of Environment and Sustainable Development (NCESD) http://ekpaa.ypeka.gr/*

# 7 Norway

The implementation of the EU directives and strategies in the field of water resources management in the Norwegian legislation is described in the following sub-chapters.

## 7.1 Particular circumstances relevant for understanding the section

According to Statstics Norway the population of Norway was 5 213 985 people on 1st January 2016. The whole population has access to improved drinking water according to WHO standards. For approximately 600 000 persons there is little or no information about the water supply systems in use and the water quality as such. For the remaining 4.6 million persons information about the water supply systems and the water quality is registered in "MATS".

Norway has a high number of small drinking water systems serving between 50 and 500 persons (Figure 45). Many of these small systems have difficulties linked to competence, maintenance and water quality. Larger plants are more professionally managed but challenges occur here as well. The larger systems are naturally located to the cities. According to Norwegian Food Safety Authority's system MATS about 2/3 of the systems is owned by the local municipalities, the rest by private companies.

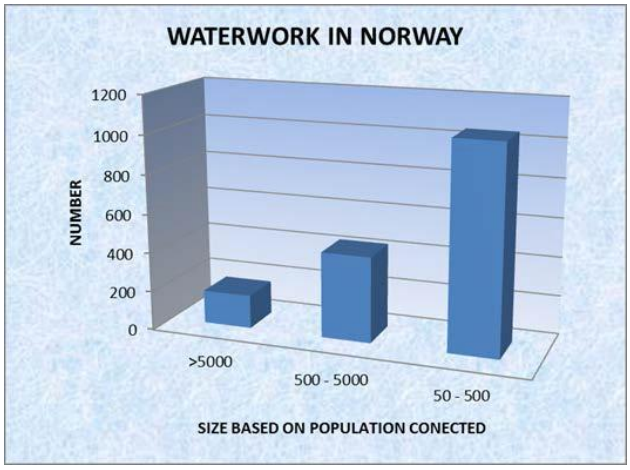



Figure 45: Waterwork in Norway

Most of the sanitation systems with a capacity of more than 50 persons are owned by the municipalities. About 17% of the households are served by mostly private systems serving less than 50 persons.

Norway has to a large extent a decentralized management system. Local authorities are therefore responsible for necessary actions in order to follow up the targets. Financial constraints may be an obstacle for the smallest municipalities because of high costs per capita.

Norway is a member of the EEA. Through the EEA agreement Norway adheres to the EU water legislation. The Norwegian legislation is therefore based on the Water Framework Directive, the Drinking Water Directive and the Waste Water Directive.

## 7.2 Water Framework Directive

The WFD was formally taken into the EEA-agreement in 2009, granting the EFTA countries extended deadlines for the implementation. EFTA-counties reporting obligations are to the EFTA Surveillance Authority (ESA).

The WFD was transposed into the Norwegian Regulation on a Framework for Water Management, normally referred to as Vannforskriften (The Water Regulation), entering into force in 2007. Norway has taken full part in the Common Implementation Strategy (CIS) for the WFD since it was established in 2001. Norway performed a voluntary "pilot phase" 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 in the pilot phase were adopted by the County Councils in 2009, and approved by the national Government in June of 2010. 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.

Based on principles in the EU Water Framework Directive Norway is divided into 11 river basin regions (Figure 46). Each river basin region has one river basin region authority and a network of other authorities joint into a river basin committee. Each of these river basin regions shall follow up the obligations that are set in the Water Framework Directive. That includes making plans for actions to obtain clean water in the region and to report back to EU (ESA).

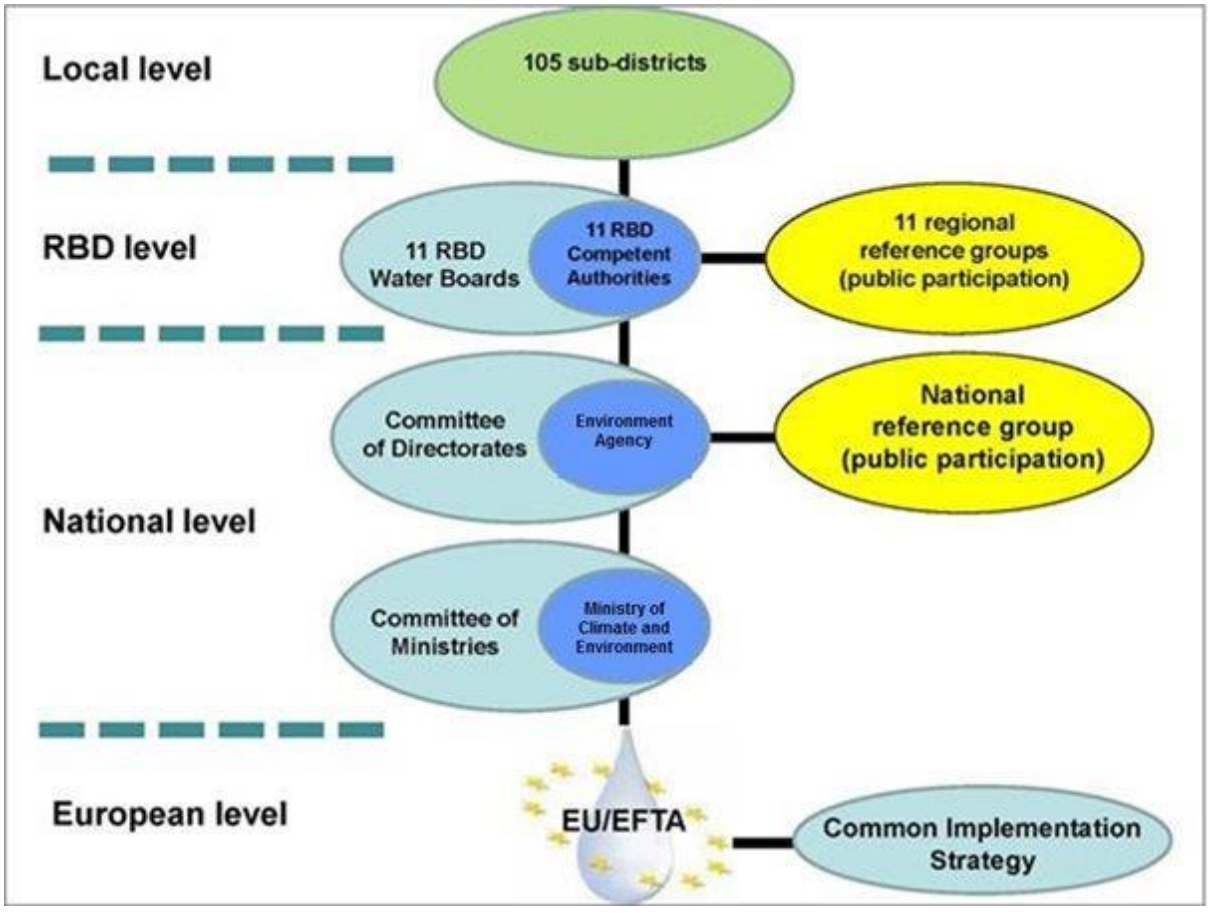



Figure 46: Division of River Basins in Norway based on principles in the EU Water Framework Directive

Most raw water sources that are used for drinking water supply for approved waterworks, shall be protected according to the needs that are identified in terms of treatment and the size of the water source and supply.

Annual reporting for wastewater plants to the central authority provides an overview showing to what degree the requirements are complied with. Findings through frequency based supervision is followed up through imposition of corrective measures and audit of permits when required.

Discharges from treatment plants and overflows are normally considered in order to prevent user conflicts. There are however less control of leaks that end up in recipients via storm water outlets. Discharges from single houses may be in conflict with wells used for drinking water.

The ecological and chemical status of surface water bodies are depicted in Figure 47.

**Ecological status of surface water bodies**

| *Percentage of surface water classified as:* | *Baseline value (specify the year)* | *Value reported in the previous reporting cycle (2011)* | *Current value (2015)* |
|---|---|---|---|
| High status | | 11 % | 21,0 % |
| Good status | | 38 % | 41,6 % |
| Moderate status | | 24 % | 21,9 % |
| Poor status | | 9 % | 6,7 % |
| Bad status | | 2 % | 1,8 % |
| **Total number/volume of water bodies classified** | | 22741 | 26568 |
| **Total number/volume of water bodies in the country** | | 27186 | 28580 |

**Chemical status of surface water bodies**

| *Percentage of surface water bodies classified as* | *Baseline value (specify the year)* | *Value reported in the previous reporting cycle (2011)* | *Current value (2015)* |
|---|---|---|---|
| Good status | | 2 % | 2,1 % |
| Poor status | | 1 % | 0,8 % |
| **Total number/volume of water bodies classified** | | 689 | 829 |
| **Total number/volume of water bodies in the country** | | 27185 | 28580 |

Figure 47: Ecological and chemical status of surface water bodies in Norway

The Nordic countries - Sweden, Denmark, Finland, Iceland and Norway – have joined forces to harmonize the implementation of the WFD in the Nordic countries. This project and a series of annual workshops have received funding from the Nordic Council of Ministers.

A report to the Nordic Council of Ministers in 2013 concludes that a major outcome of the Nordic collaboration project is:

• Examples of best practice for implementations of various articles of WFD are identified between countries.

• Similar challenges and issues are handled in other countries, and solutions partly solved with different approaches, which needs administrative, scientific or environmental solutions.

• The similarities are more common than the differences.

• A common interpretation, handling and approach is more accepted than a single country approach

• Further common development of e.g. monitoring, classification, measures and ICT are needed.

## 7.3 Floods Directive

This Directive is not a part of the EEA agreement.

## 7.4 Drinking Water Directive

The EU drinking water directive (98/83/EC) is incorporated in the Norwegian drinking water regulations. The National Food Safety Authority does not have a complete overview of the number of people receiving drinking water from the different sources or the quality of the water received.

The biggest challenge when it comes to the quality of drinking water is associated with the small water supply systems which serve less than 50 persons. These are not registered in the waterwork register (MATS). Of those water supply systems which reported to the NFSA in 2009 95 % did not exceed the parameters set for E.coli and colour. This is selfreported data from the presumptive best water suppliers. When inspected by the NFSA the compliance is weaker.

Most water sources in Norway used for potable water have "good status", but 3.5 % of the water sources in use had E.coli >= 10 count/100 ml. The median value was 0 (year 2014).

## 7.5 Groundwater Directive

This directive is not a part of the EEA agreement.

The status of groundwater and the total number of groundwater bodies with a poor chemical status are depicted in Figure 48.

**Status of groundwaters**

| *Percentage of groundwaters classified as* | *Baseline value (specify the year)* | *Value reported in the previous reporting cycle (2011)* | *Current value (2015)* |
|---|---|---|---|
| Good quantitative status | | 25 % | 52 % |
| Good chemical status | | | n/a |
| Poor quantitative status | | 1,4 % | 1,1 % |

| *Percentage of groundwaters classified as* | *Baseline value (specify the year)* | *Value reported in the previous reporting cycle (2011)* | *Current value (2015)* |
|---|---|---|---|
| Poor chemical status | | | n/a |
| **Total number/volume of groundwater bodies classified** | | 333 | 734 |
| **Total number/volume of groundwater bodies in the country** | | 1260 | 1381 |

Figure 48: The status of groundwater and the total number of groundwater bodies with a poor chemical status

## 7.6 Urban Waste-Water Treatment Directive

Discharges from the larger municipal treatment plants which have sea as recipient (most often) is seldom a problem for the recipient or other user interests if the discharge is led out to a good conductive area. Discharges to freshwater recipients are entitled to treatment of phosphorus and organic matter, through enforcement of the pollution regulations and the Planning and Building Act.

17 percent of the households in Norway in 2010 was connected to facilities with capacity below 50 persons-equivalents. The Municipalities are the Pollution Control Authority and shall supervise that the provisions and decisions made accordingly are followed. There may be problems with discharge from overflow and discharge from smaller plants, especially plants that are not connected to the public main system. There is a need to follow up the municipalities as authority on its own facilities and with their handling of outlet from separate houses.

There are almost no plants that disinfect their discharge in order to protect the drinking water. Such user conflicts are to be resolved by the coordination of the discharge site and raw water intake point. In addition, there is a strategy to build up adequate hygienic barriers in potable water systems to ensure the necessary security. There is at present no intention to put forward a requirement for disinfection as a treatment processes in sewage plants. However, there is a need to improve internal control and risk and vulnerability analyses in this area. It should be done by 2015 for those plants that do not have established good enough systems.

For small plants regular conflicts between drinking water wells and discharges are identified. This is often due to infiltration systems that do not work, poorly planned discharge locations or in adequate treatment in other facilities.

## 7.7 Industrial Emissions Directive

This Directive is not a part of the EEA agreement.

## 7.8 Bathing Water Directive

Most marine water sources in Norway used for bathing have “Excellent quality” or "Good quality" according to EU directive 2006/7/EC although the directive is not a part of the EEA agreement.

## 7.9 Administrative responsibility

The Ministry of Health and Care Services is responsible for the drinking water quality and for the Norwegian drinking water regulation. The Ministry of Health and Care Services have two directorates with tasks important for drinking water. That is the Norwegian Food Safety Authority and the Norwegian directorate of Public Health. Of these two the Norwegian Food Safety Authority is the main directorate concerning regulation and inspections of the drinking water systems.

The Ministry of Climate and Environment is responsible for all kinds of outlet from the municipalities, for conservation policy and environmental management. The Directorate for Nature Management is an important directorate under this ministry.

The Ministry of Petroleum and Energy is responsible for the water as a natural recourse, and also responsible for Hydro Power plans and regulation of lakes and rivers. They are also responsible for the Petroleum activities. Norwegian Water Resources and Energy Directorate is the main directorate.

The owners of the private drinking water systems and the municipalities when systems are owned by the municipalities, are responsible for handling of the regulations that are set by the Ministry of Health and care services. The municipalities are responsible for carrying out regulations regarding sanitation.

# 8 Portugal

## 8.1 Water Framework Directive

The transposition of the Water Framework Directive into Portuguese national law was executed in 2005 and was used as an opportunity to review the whole legal framework on water management. Two new laws were published. Law nº 54/2005 repels a century-old Water Law, from 1919, and redefines the ownership of water resources and the entitlement of water use rights, while Law nº 58/2005 transposes the WFD to the national law and establishes a new institutional framework for water management. Law mº 28/2005 was later revised and changed by Decree-Law nº 13/2012. Additionally, two decree-laws were published in 2006 (Decree-Law nº 77/2006 complementing Law nº 58/2005) and in 2007 (Decree-Law nº 227-A/2007 establishing the rules to use water resources).

With the publication of this legislation, the Water Institute (later integrated in the Environment Agency) was reaffirmed as the National Water Authority and 7 River Basin Agencies were established to manage 10 hydrographic regions (Figure 49). Two of these River Basin Agencies are incorporated in the regional authorities of the autonomous regions of Madeira and Azores Atlantic archipelagos.

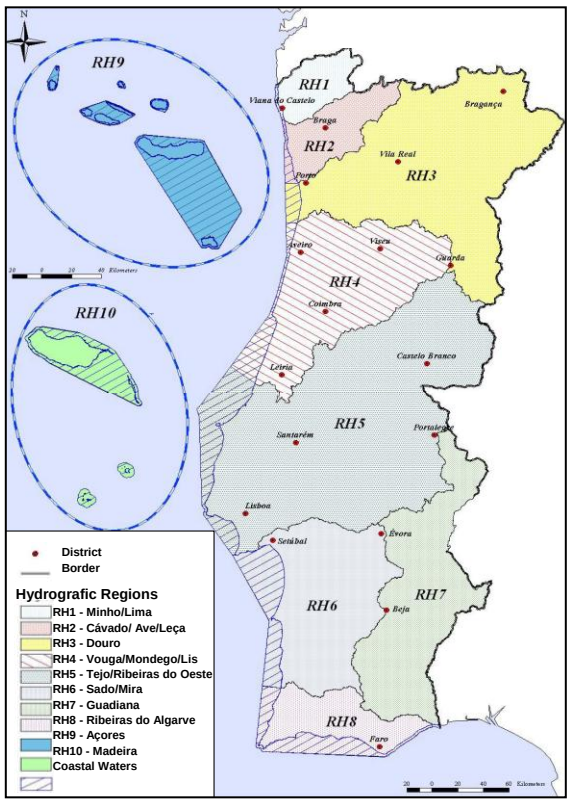



Figure 49: Hydrographic regions of Portugal

The first set of River Basin Management Plans (one for each of the 10 hydrographic regions) mandated by the WFD were published in 2012, after being subjected to public participation for six months. These plans substituted previous plans from 1990s (prior to the WFD) and remained valid until 2015. The second set of RBMP developed under the WFD were published in 2016 (Figure 50 and Figure 51) and are valid until 2021. Portugal is now in the process of reviewing this second set of plans and designing a third, which will be in force from 2022 to 2027.

In additional to the regional water management plans, the Portuguese Law establishes the requirement to elaborate a National Water Plan defining the national strategy for integrated water management and setting the broad options of the national water policy and the principles and rules of orientation of that policy, to be applied by river basin management plans and other water planning instruments. The current National Water Plan for 2016-2021 was published in 2016 (Decree-Law 76/2015), substituting a former version from 2002 (prior to the Water Framework Directive).

Currently, the RBMPs define 1914 water bodies, which include 98 groundwater bodies and 28 artificial water bodies. Around 54% of these water bodies are classified as having a good or high ecological status, with the percentage being higher for the groundwater bodies (84% groundwater bodies with good status versus 53% of superficial water bodies with good or high ecological status). This assessment has not changed much from first to the second planning cycle.

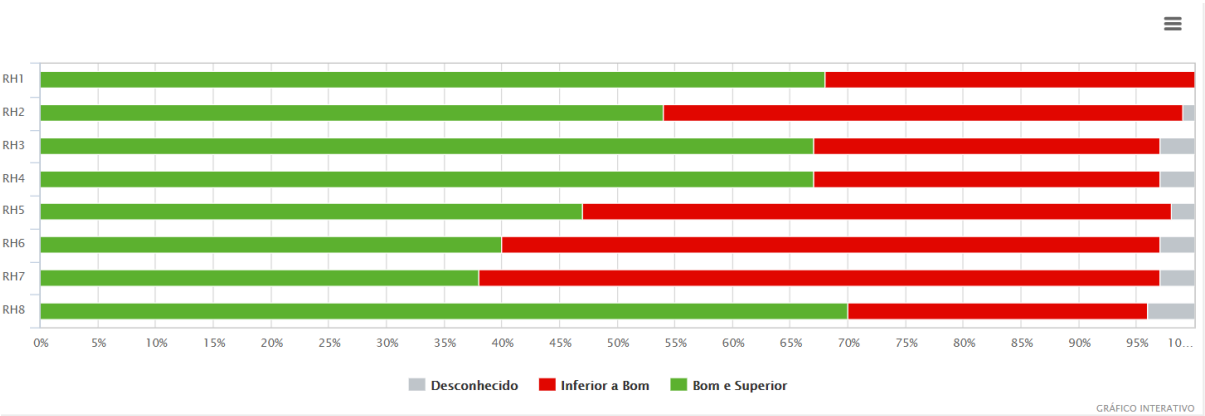



Figure 50: Global status of the superficial water bodies of continental Portugal, according to the RBMPs of 2016.

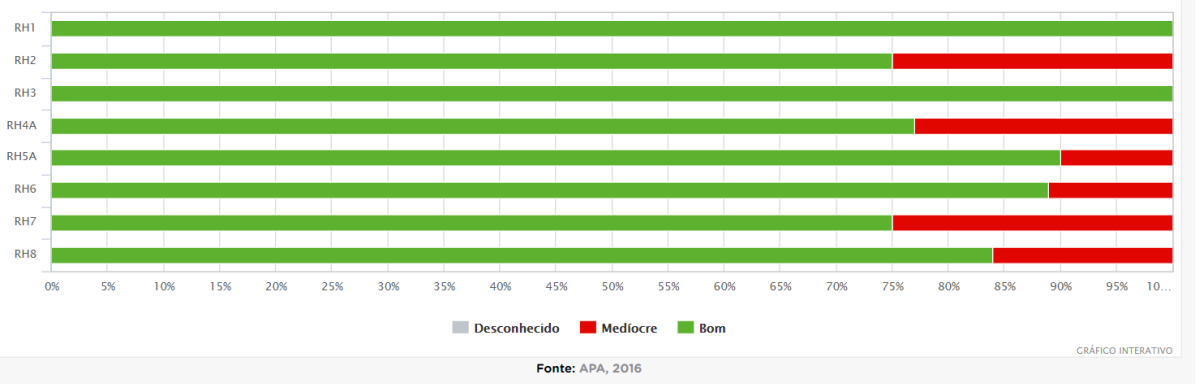



Figure 51: Global status of the groundwater bodies of continental Portugal, according to the RBMPs of 2016.

The Program of Measures of the current RBMPs include more than 1000 measures, divided into structural works, legal compliance measures and monitoring and evaluation studies. The number of structural works that have been completed, such as the building of waste water treatment plants, is quite significant which has led to an important reduction of pollution loads into the environment. In other areas the level of execution of the planned measures is insufficient.

## 8.2 Groundwater Directive

Decree-Law no. 208/2008 of 28 October establishes the regime for the protection of groundwater against pollution and deterioration and has transposed into national law Directive 2006/118 / EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration.

In its review under Article 10 of that Directive, the European Commission considered that there was no information to justify the inclusion in Annex I and for any pollutant of new quality standards for groundwater, but considered it necessary to in accordance with Article 8, to a number of technical adaptations in Annex II, which are set out in Commission Directive 2014/80 / EU of 20 June 2014, which is now transposed. It was found that - in addition to the nitrates already included in Annex I to Decree-Law No 208/2008 of 28 October and ammoniac nitrogen, included in Annex II to the same Decree-Law nitrogen and phosphorus present in groundwater represent a high risk potential for eutrophication for associated surface waters and for terrestrial ecosystems directly dependent on them, and nitrites should therefore be taken into account when setting the thresholds taxpayers for total nitrogen and total phosphorus or phosphates. With the adoption of this decree-law, methodologies are also defined to facilitate the comparability of thresholds by applying common principles for the determination of geochemical background concentrations. Finally, the information deemed necessary for the pollutants and indicators for which thresholds have already been established is reviewed, in particular as regards methodologies for assessing the chemical status of bodies of groundwater used in the first river basin management plans. This amendment aims to ensure better understanding and comparison of results, as well as the harmonization of methodologies for setting thresholds for groundwater at European Union level

## 8.3 Floods Directive

According to the Directive 2007/60/EC on the assessment and management of flood risks, all European Member States undertook a preliminary flood risk assessment aiming to identify the areas with significant potential flood risk. From these areas, flood hazard maps and flood risk maps were produced for those with real risks of flood damage, with a medium likely hood of flooding at least a 1 in 100-year event. Finally flood risk management plans were also drawn up for the same areas.

The Directive 2007/60/EC was transposed to the Portuguese legal framework by the Decree-Law n.º 115/2010 and a National Commission for Flood Risk Management (CNGRI) was created. In Portugal, the first preparatory stage of the flood directive implementation included the identification of the critical flooding areas (2013), the flood hazard and risk mapping (2015), and the flood risk management planning (approved in 2016).

The information collected at the first preparatory stage was made public via website under the responsibility of the Portuguese Environmental Agency (APA): the SNIAmb (Environmental Information National System) – Figure 52.

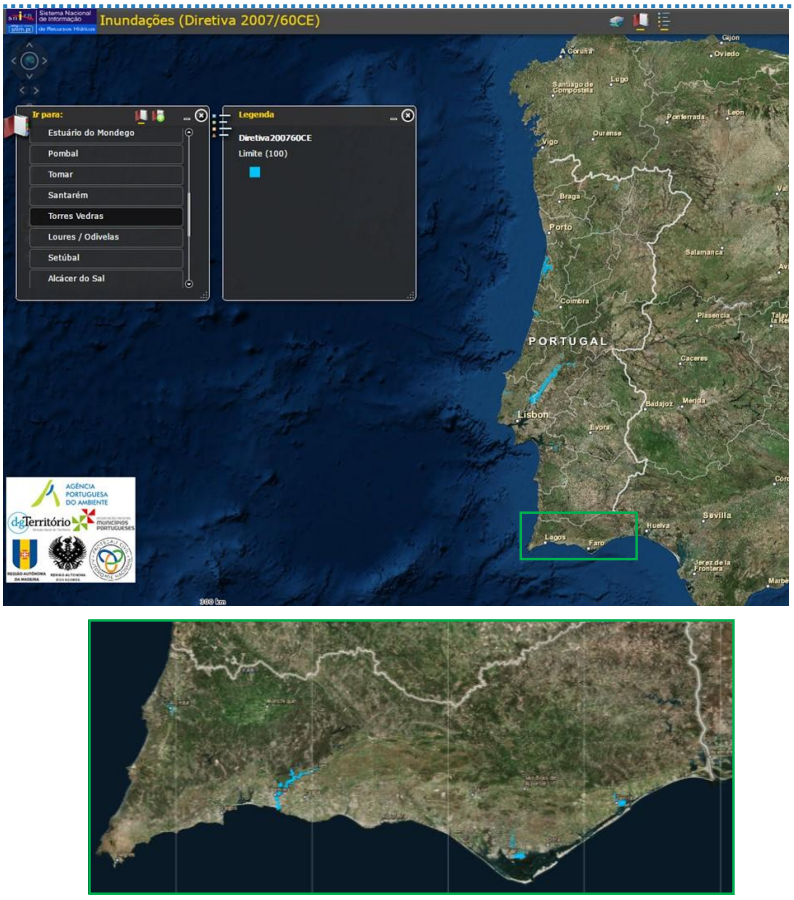
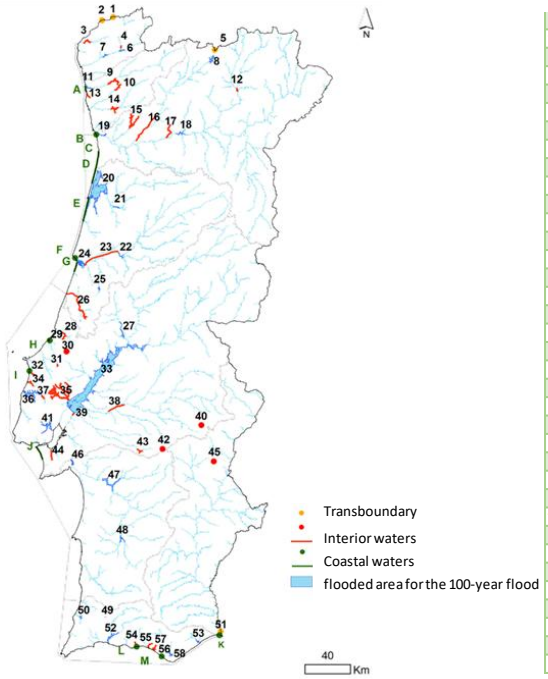



Figure 52: Public assessment to the results from first preparatory stage of the flood directive implementation (http://sniamb.apambiente.pt/Diretiva60CE2007)

The flood directive and consequently the correlated Portuguese Decree-Law requires cyclical reviews be carried out on a rolling 6 year cycle. As a result, in 2018 the preliminary assessment of the flooding risks for mainland Portugal was revised and updated, based on a comprehensive characterization of the historical flood events, done also with the support and collaboration of the local communities, such as the municipalities, and of the CNGRI members. Thus, 71 areas with significant potential risk regarding the floods (ARPSI), including areas prone to coastal flooding, were identified – Figure 53. Those areas will be further studied, aiming at ascertaining the flooded areas, their risk classes and cartography.




| | | | | |
|---|---|---|---|---|
| Monção | 1 | RH5A | Alenquer | 35 |
| Valença | 2 | RH5A | São Martinho do Porto | H |
| Caminha | 3 | RH5A | Areia Branca | I |
| Ponte da Barca | 6 | RH5A | Caldas da Rainha | 31 |
| Arcos de Valdevez | 4 | RH5A | Coruche | 38 |
| Ponte de Lima | 7 | RH5A | Cova do Vapor – Fonte da Telha | J |
| Esposende | 11 | RH5A | Dois Portos | 37 |
| Braga Padim da Graça | 9 | RH5A | Torres Vedras | 36 |
| Braga Este | 10 | RH5A | Estremoz | 40 |
| Póvoa de Varzim | 13 | RH5A | Évora | 42 |
| Santo Tirso | 14 | RH5A | Loures e Odivelas | 41 |
| Ofir Apúlia | A | RH5A | Lourinhã | 32 |
| Amarante | 16 | RH5A | Montemor-o-Novo | 43 |
| Baião - Douro | 17 | RH5A | Samora Correia | 39 |
| Chaves | 8 | RH5A | São Martinho do Porto | 29 |
| Chaves TR | 5 | RH5A | Seixal | 44 |
| Porto – Foz | B | RH5A | Tomar | 27 |
| Espinho-Esmoriz | C | RH5A | Vimeiro | 34 |
| Lousada – Rio Sousa | 15 | RH6 | Setúbal | 46 |
| Mirandela | 12 | RH6 | Alcácer do Sal | 47 |
| Porto (Vila Nova de Gaia) | 19 | RH6 | Santiago do Cacém | 48 |
| Régua | 18 | RH7 | Alandroal | 45 |
| Águeda | 21 | RH7 | Vila Real de Santo António | 51 |
| Aveiro | 20 | RH7 | Vila Real de Santo António | K |
| Coimbra | 22 | RH8 | Albufeira | 54 |
| Esmoriz-Torreira | D | RH8 | Aljezur | 50 |
| Cova Mira | E | RH8 | Faro | 58 |
| Tamargueira | F | RH8 | Inatel-Albufeira | L |
| Cova Gala Leirosa | G | RH8 | Faro-Mar | M |
| Estuário do Mondego | 24 | RH8 | Loulé | 55 |
| Leiria | 26 | RH8 | Monchique | 49 |
| Montemor-o-Velho | 23 | RH8 | Quarteira | 57 |
| Pombal | 25 | RH8 | Quarteira Vale de Lobo | 56 |
| Abrantes, Santarém, Vila Franca de Xira | 33 | RH8 | Silves | 52 |
| Alcobaça | 28 | RH8 | Tavira | 53 |
| Alcobaça (Benedita) | 30 | | | |

**Figure 53: 71 Areas classified in 2018 as ARPSI (APA, 2018)**

## 8.4 Droughts

Although for the time being there is not an European directive on droughts, the Resolution n.º 80/2017 (7 of June) of the Portuguese Council of Ministers created the Permanent Commission for the Prevention, Monitoring, Following-up and Contingency of Drought Effects (or simply Drought Permanent Commission). The Commission includes Government members from different sectors. The main ones are the Ministers of Environment and of Agriculture, Forestry and Development which jointly coordinate the following governance areas: finance; internal administration; local administration; labour, solidarity and social security; health; economics; and sea.

The composition of the Commission can be extended to other governmental areas, as well as to municipalities, according to the specific subjects under analysis or to the need for specific actions resulting from a particular drought occurrence. The Commission is technically advised by a Drought Working Group. The organizational structure of the Drought Permanent Commission is shown in Figure 54.

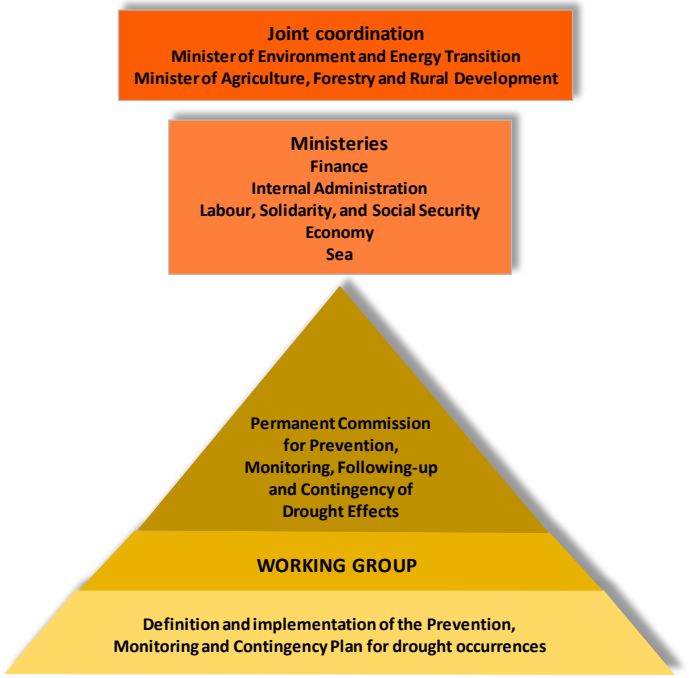



Figure 54: Organizational structure of the Drought Permanent Commission.

The tasks committed to the Commission are (1) approval of a Plan for Prevention, Monitoring and Contingency of Drought Occurrences and follow-up of its implementation and (2) establishment of political guidelines related to drought.

## 8.5 Drinking Water Directive

The Drinking Water directives 98/83/CE and 80/778/CEE have been transposed into Portugal law by Decree Law 236/98 and 243/2001. The application of these directives is the responsibility of Portuguese Water and Waste Services Regulation Authority (ERSAR), which also works with health authorities to resolve water quality problems that may arise.

ERSAR goals are to:

- Ensure the protection of the water and waste sector users, always trying to avoid abuses resultant from the exclusive rights, focusing on the control of the quality of the services provided and supervising the tariffs charged to the end-users;

- Ensure equal and clear conditions in the access to the water and waste services and the operation of these services. This principle also applies to all the contracts signed;

- Reinforce the right to general information about the sector and about each operator.

ERSAR annually approves the water quality control programs (Figure 55) that each managing entity is obliged to prepare, monitors the reliability of the laboratory results in coordination with the Portuguese Accreditation Institute and supervises the entities that manage the public supply systems to verify if all the requirements of the legislation are fulfilled.

In the last decades, Portugal has witnessed a very positive evolution in drinking water quality with the safe water indicator reaching 98.7%, meaning the almost all the population of Portugal can be assured that they can drink tap water with confidence.

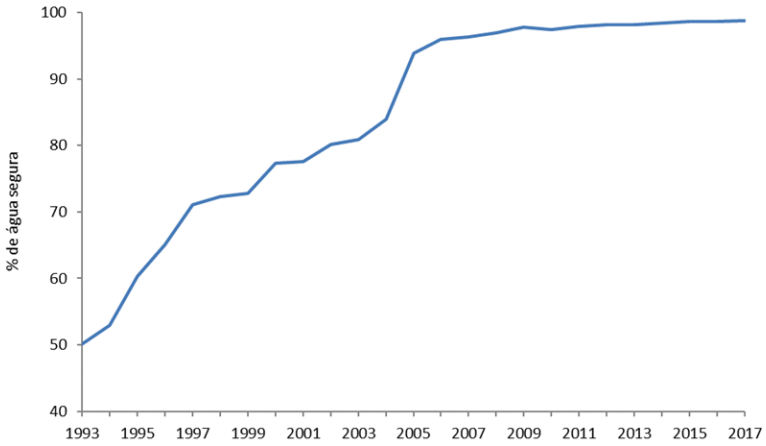



Figure 55: Evolution of the safe drinking water indicator from 1993 to 2017 (source: ERSAR)

## 8.6 Urban Waste-Water Treatment Directive

The European Directives 98/15/CE and 91/271/EEC concerning urban waste-water treatment were transposed into the Portuguese Law by Decree Laws nºs 149/2009 and 152/97.

The pollutant load from urban areas of Continental Portugal is estimated as 15.6 million population equivalents. This load is treated in WWTP mostly managed by municipalities, autonomous services or public companies with different treatment levels (Figure 56).

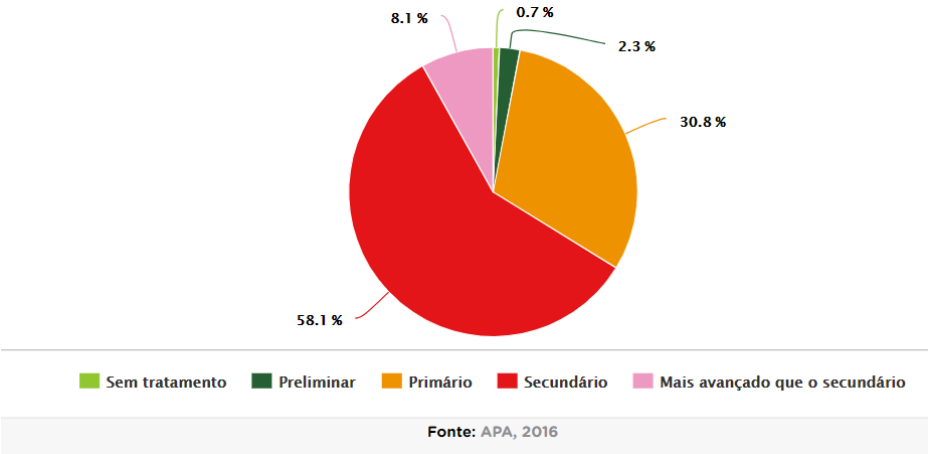



Figure 56: Waste water treatment plants in continental Portugal, according to their treatment level

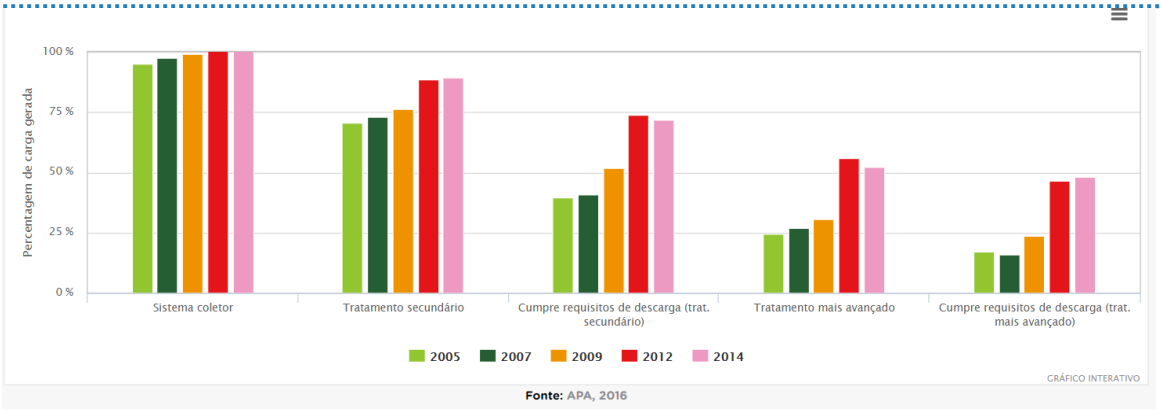



**Figure 57: Evolution of the waste water treatment level for urban areas with more than 2000 e.p., discharging into inland waters, or with more than 10000 e.p., discharging into coastal waters**

Of the cargo generated, 89% is subjected to secondary treatment, which represents, in terms of compliance with the discharge requirements, about 78% of the agglomerations and 72% of the load (Figure 57). It should be noted that secondary treatment for 100% of the generated load but only for about 93%, since the rejections in less sensitive areas do not have this obligation. As for the most advanced treatment, 52% of the generated load is subjected to tertiary treatment, representing, in terms of compliance with discharge requirements, about 32% of the agglomerations and 48% of the load.

Agglomerations above 10,000 e.p. which discharges into sensitive areas are obliged to have tertiary treatment. The number of sensitive areas that legal protection is 25, mostly corresponding to reservoirs and estuaries. In 2014, of the 42 agglomerations with this obligation, 71% met the discharge requirements, representing 82% of the load generated in these agglomerations.

## 8.7 Nitrates Directive

### 8.7.1 Introduction

The Nitrates Directive - Directive 91/676 / EEC of 12 December 1991 on the protection of waters against pollution caused by nitrates from agricultural sources was transposed into the Portuguese legal framework by Decree-Law No 235/97, (amended by Decree-Law no. 68/99 of 11 March) and Regional Legislative Decree no. 6/2005 of 17 May 2005 for the Autonomous Region of the Azores.

This Directive aims to reduce water pollution caused or induced by nitrates from agricultural sources and prevent the spread of pollution in bodies of water. The aim is essentially to protect the sources of water for human consumption, aquatic systems and safeguard other legitimate uses of water.

The main principles of this Directive are:

- Control the concentration of nitrates in surface fresh waters (inland surface waters) and in groundwater, and examine the eutrophic state of surface freshwater, estuarine, coastal and marine waters;
- Identify polluted and susceptible waters, and the list of vulnerable areas should be reviewed at least every 4 years;

- Develop action plans for vulnerable areas. The deadline for drawing up these programs is two years from the initial designation and one year from each new designation. The execution period is 4 years from the date of preparation;

- Develop a code or codes of good agricultural practice to be applied voluntarily by farmers and compulsorily under the action plans, as well as training and information programs for farmers to promote the application of good agricultural code (s).

- Monitor the effectiveness of the implementation of action plans for vulnerable Areas.

### 8.7.2 Vulnerable areas

Vulnerable areas are the areas that drain into polluted or nitrate-polluted waters and where there are agricultural activities that can contribute to pollution. For the identification of polluted waters and water at risk of being contaminated by nitrates of agricultural origin (if appropriate measures are not taken), the following criteria, inter alia, shall be taken into account:

- Groundwater containing or likely to contain a concentration of nitrate greater than 50 mg/L;

- Inland surface waters (rivers or reservoirs), particularly those used or intended for the production of water intended for human consumption which contain or may contain a concentration of nitrates in excess of 50 mg / l;

- Inland surface waters (rivers or reservoirs), estuaries, coastal and marine waters that are eutrophic or may become eutrophic in the short term.

The nine vulnerable zones of the Continent were published by Ordinance No. 164/2010, of March 16, with the following designations from north to south: Esposende - Vila do Conde, Estarreja - Murtosa, Litoral Centro, Tejo, Beja, Elvas, Estremoz - Cano, Faro and Luz de Tavira (Figure 58). All vulnerable zones designated so far in mainland Portugal concern groundwater and cover only 4.5% of the continental territory.

For the Vulnerable Zones currently demarcated on the continent, the Program of Action published by Ordinance No. 259/2012, of August 28, was prepared. As an example of measures contained in the Action Program, it refers to the existence of quantitative limits on the application of nitrogen fertilizers, as well as their non-application in certain periods, especially during the rainy season.

### 8.7.3 Assessing groundwater bodies chemical status including concentration of nitrates

In Portugal the methodology for assessing groundwater chemical status consisted of the application of the following procedure:

- comparison of mean values of Susceptibility Index, quantification of diffuse pressures and risk of contamination in the recharge area in order to assess vulnerability to contamination;

- aggregation and analysis of monitoring data between specific dates;

- comparison of the mean values calculated for the different parameters with the threshold values, as defined by the national water authority (2009), with values of groundwater quality standards and natural concentration values.

The Susceptibility Index (SI), an adaptation of the DRASTIC method, was developed with the intention of evaluating aquifer vulnerability with respect to diffuse agricultural pollution in hydrogeological settings typically found in Portugal. The main difference is the addition of a parameter defining land cover, thus abandoning the concept of a purely intrinsic vulnerability assessment method. The principal types of land use and their assigned ratings were provided by a team of Portuguese scientists. Three DRASTIC parameters were deliberately left out of the construction of the Susceptibility Index which include soil (S) and unsaturated zones (I), thus suggesting that their direct influence on the contamination linked to agricultural practices is of little importance. The last DRASTIC parameter not incorporated in the SI is the hydraulic conductivity of the aquifer as is already qualitatively represented by the aquifer media (A), resulting in an excessive weight of this factor in comparison with the others. The weight string for the SI was also determined by the team of Portuguese scientists.

According to this procedure eight groundwater bodies at risk were identified in Portugal ZV1-Esposende and Vila de Conde, ZV2-Aveiro, ZV3-Faro, ZV4-Mira, ZV5-Tejo, ZV6-Beja, ZV7-Elvas- Vila Boim, ZV8-Luz-Tavira (Figure 58). For each of them, intervention plans were drawn up with a view to eliminating or minimizing as far as possible the risks of diffuse pollution of agricultural origin which are based on the application of a Code of Good Agricultural Practices  It establishes measures to rationalize the practice of fertilization and a whole set of operations and cultural techniques that directly or indirectly interfere with the dynamics of nitrogen in agricultural ecosystems, in order to minimize their losses in the form of nitrates and thus protect the groundwater of this form of pollution.

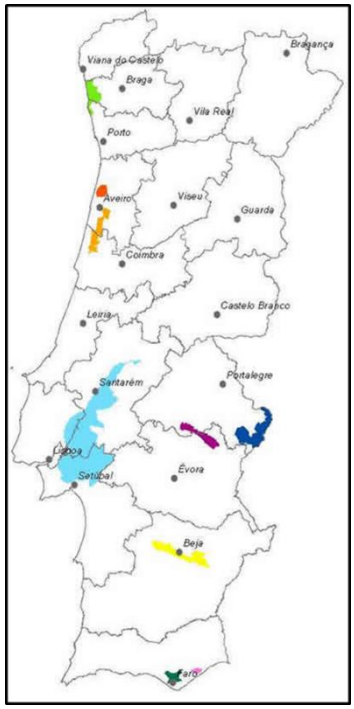



Figure 58: Vulnerable areas in Portugal

The set of measures and actions, which are highlighted by their impact on groundwater resources are: (1) provide favorable conditions for an efficient absorption of nitrates by the crop roots; 2) apply adequate water volumes; 3) apply the irrigation water as uniformly as possible on the soil avoiding areas with excess water; 4) watering before the plants begin to suffer from water shortage; 5) apply the quantities of nitrogen according to expected production; 6) promote or stimulate the in-depth expansion of crop roots; 7) adopt the most appropriate irrigation method and process.

### 8.7.4 Assessment of Trend Analysis for Increasing the Concentration of Pollutants in the Groundwater Bodies and the Reverse of the Trend in Portugal

The methodology used in Portugal to assess the trend analysis evaluates the following behaviors of the time series:

- Time trend of the series: in this case, the methodology should detect the statistical significance of a downward or upward trend of values over time and their range of change;
- Trend reversal: the methodology should detect the occurrence of a reversal of a trend and mark the date on which this reversal occurred;
- Applicability of the methodologies to the context of APA (Environmental Protection Agency of Portugal) are easily integrated with preference being given to solutions that are included in free software packages
- Correction of seasonality: The methodologies to be selected should correct the seasonality in the series, that is, this variability should not influence the final result.

In view of the above objectives, the following methods with the potential for this type of statistical analysis were selected:

- Mann Kendall with seasonal correction and Theil-Sen slope calculation
- LOWESS (Locally Weighted Scatterplot Smoothing) operator
- Singular Spectrum Analysis

These methods were used to assess the trends for increasing the concentration of nitrate in the groundwater bodies of Portugal (Figure 59) and the reverse of the trend.

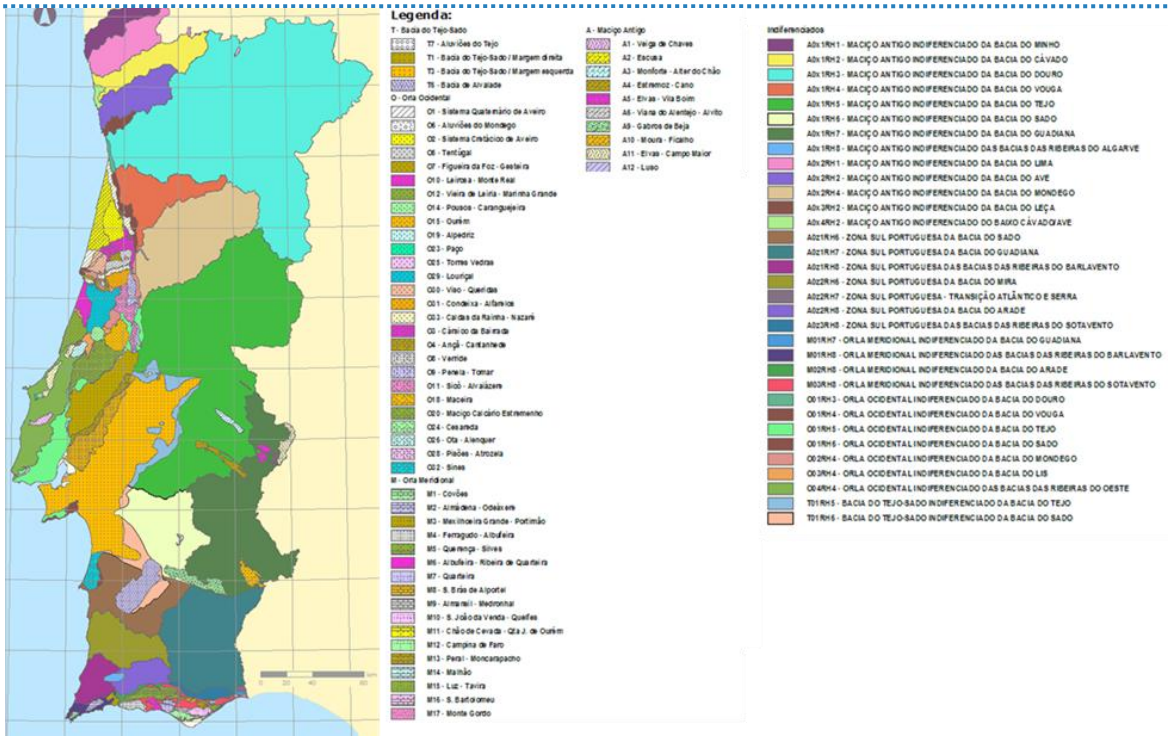



Figure 59: Groundwater bodies of Portugal

Figure 60 shows the percentage of monitoring stations with downward trend, no trend and upward trend of nitrate concentration per groundwater body and per year

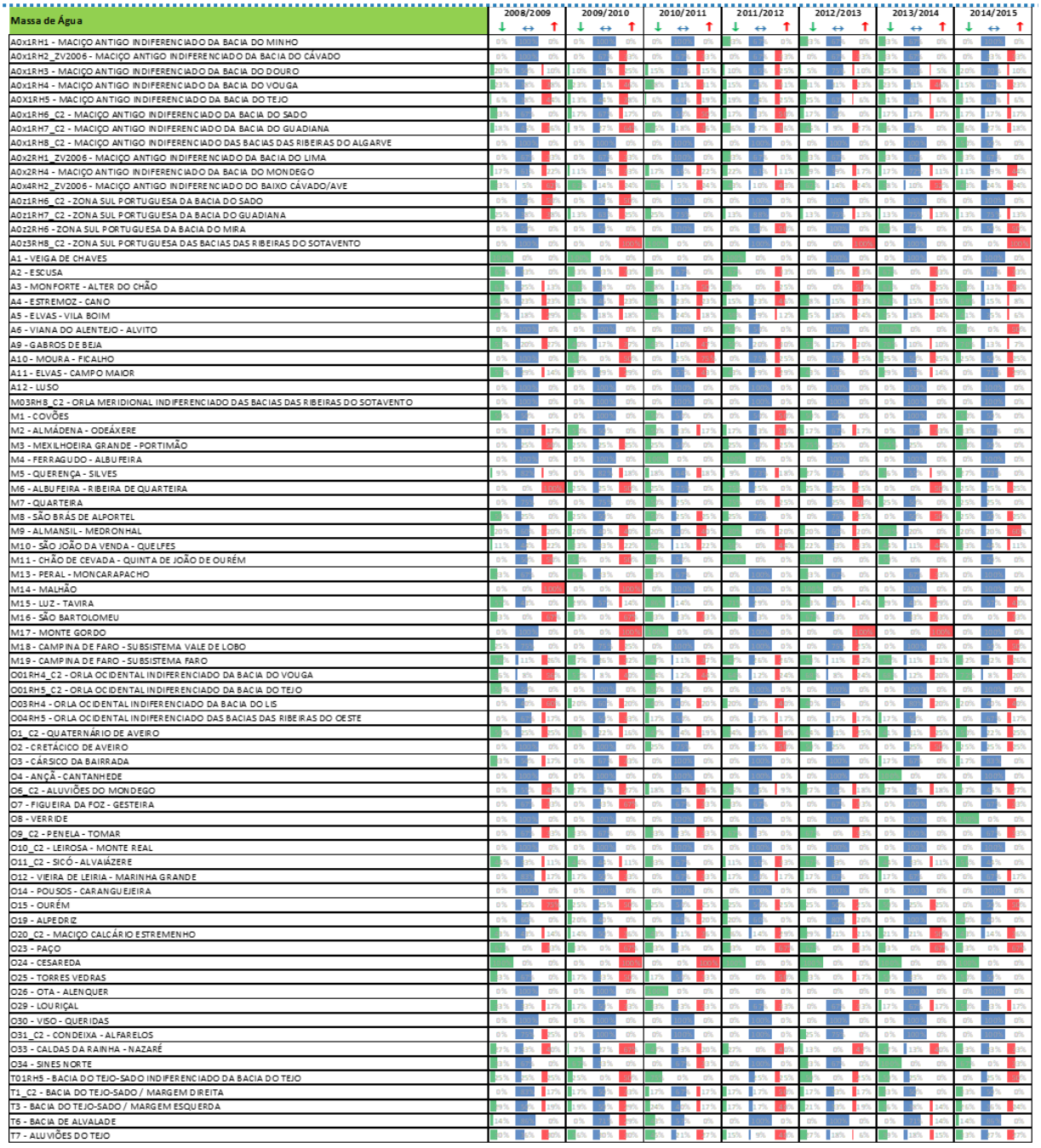



**Figure 60: Percentage of monitoring stations with downward trend, no trend and upward trend of nitrate concentration per groundwater body and per year**

## 8.8 National System of Classified Areas (SNAC)

The National System of Classified Areas (SNAC) comprehends the Natura 2000 Network, the National Network of Protected Areas (RNAP) and the other areas classified under international commitments assumed by the Portuguese State – Figure 61.

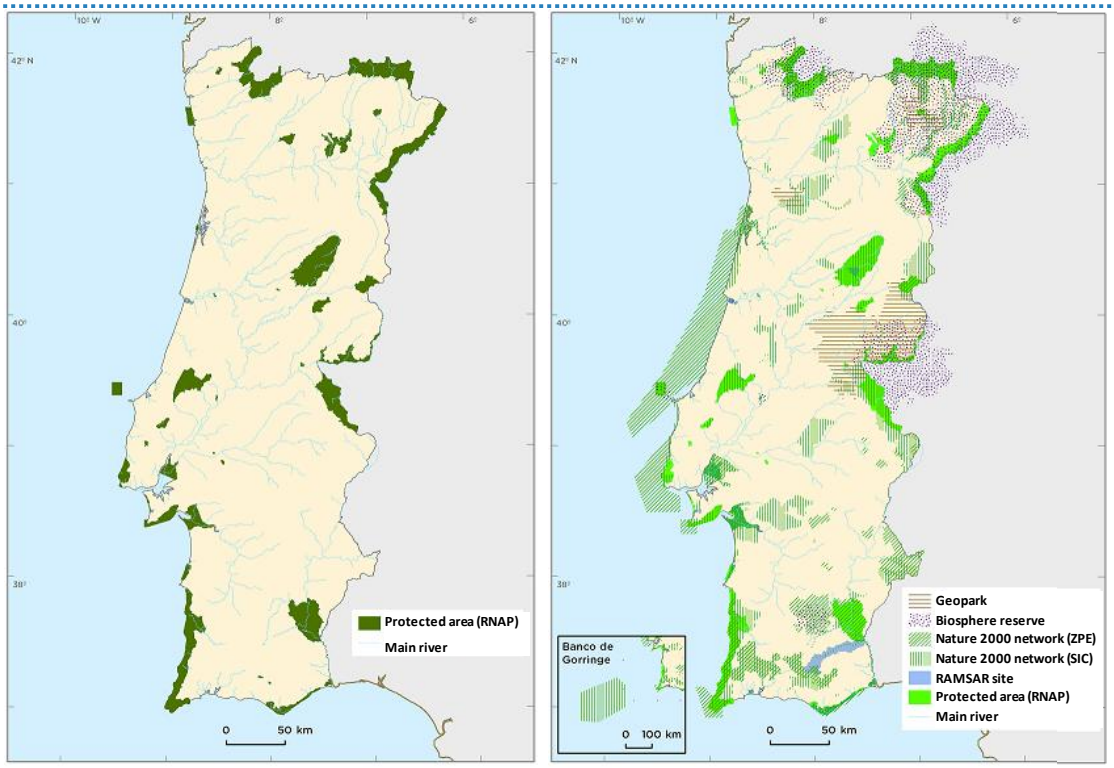



**Figure 61: Portuguese National System of Classified Areas (SNAC). On the left side, only the RNAP areas; on the right side, different types of classified areas.**

The Natura 2000 network – Directive 79/409 / EEC (Birds Directive), repealed by the Directive 2009/147 /EC, and Directive 92/43 / EEC (Habitats Directive) – aims to ensure the long-term conservation of Europe's most endangered species and habitats, thus helping to halt the loss of biodiversity. The Natura 2000 Network, which also applies to the marine environment, includes:

- Sites of Community Importance (SIC)
- Special Protection Areas (ZPE) - established under the Birds Directive
- Special Zones (ZPE) - set up under the Habitats Directive, with the purpose of contributing to biodiversity conservation through conservation of natural habitats and habitats of species of wild flora and fauna with a threatened status

In the previous areas human activities should be compatible with the preservation of the natural values, aiming at sustainable management from an ecological, economic and social points of view.

Other areas, also classified under international commitments, include the Biosphere Reserves, the Ramsar Sites and the Geoparks.

RNAP occupies an area of c.a. 793 086 ha, with 739 465 ha located on mainland Portugal, and 53 622 ha, in the Atlantic Ocean.

In Portugal, the Natura 2000 network spreads over 57733 $km^2$, of which 24881 $km^2$ are terrestrial (representing around 27% of the total area of Portugal, including Madeira and Azores Archipelagos) and 32848 $km^2$ marine.

## 8.9 Additional Directives

Table 9 establishes the relationship between the European legal framework relevant to water resources management and the Portuguese legislation.

**Table 9: Transposition of the European legal framework relevant to water resources management to the Portuguese legislation**

| | Subject | European legislation | Portuguese legislation |
|---|---|---|---|
| General | Water Framework Directive establishing a framework for Community action in the field of water policy | 2000/60/EC | L54/2005, L58/2005 |
| | Protection of groundwater against pollution and deterioration | 2006/118/EC, 2014/80/UE | DL 208/2208 |
| Water uses requirements | Surface water intended form the abstraction of drinking water | 2006/60/EC | DL 236/98, DL 243/2001 |
| | Management of bathing water quality | 2006/7/EC | DL 135/2009 |
| | Waters supporting fish life and shell fish life | 2006/60/EC, 2006/44/EC | DL 236/98, DL 243/2001 |
| | Drinking water directive – Quality of water intended for human consumption | 98/83/EC, 80/778/CEE | DL 236/98, DL 243/2001 |
| Control of pressures | Integrated pollution prevention and control | 2008/1/EC | DL 194/2000, DL 173/2008 |
| | Control of major-accident hazards involving dangerous substances (Seveso) | 2012/18/EC | DL 164/2001, DL 254/2007 |
| | Determines priority substances in the field of water policy | 2013/39/UE<br>2008/15/CE | DL 218/2015, DL 102/2010 |
| | Protection of waters against pollution caused by nitrates from agricultural sources | 91/676/EEC | DL 235/97, DL 68/99, Port 164/2010 |
| | Urban waste water (also defines sensitive areas) | 98/15/CE, 91/271/EEC | DL 149/2009, DL 152/97 |
| | Pollution caused by certain dangerous substances discharged into the aquatic environment<br>Limit values and quality objectives for mercury and cadmium discharges | 2006/11/EC<br>2008/105/EC | DL 208/2008 |
| Nature protection | Conservation of wild birds | 2009/147/EC | DL 49/2005, DL 140/99 |
| | Habitats directive (Natura 2000 sites) | 92/43/EEC | |
| Flood risks | Assessment and management of flood risks | 2007/60/EC | DL 115/2010 |

## 8.10 Transboundary issues

From mainland Portugal area (c.a. 89 000 km$^2$), 64% is occupied by transboundary rivers whose springs are located in Spain (Figure 62). As a result of this special location, the agreements between the two countries regarding the transboundary waters always had a relevant role. The first convention for industrial use of transboundary waters dates from 1912. In 1968 a new treaty was signed strictly aiming at dividing the hydropower potential of the international rivers between the two countries, which means that only the aspects related to water quantity and energy production were considered.

| Main river | Basin area | | | | |
|---|---|---|---|---|---|
| | In km$^2$ | | | In percentage | |
| | Spain | Portugal | Total | Spain | Portugal |
| **Minho** | 16230 | 850 | 17080 | 95 | 5 |
| **Lima** | 1300 | 1180 | 2480 | 52 | 48 |
| **Douro** | 79000 | 18600 | 97600 | 81 | 19 |
| **Tejo** | 55800 | 24800 | 80600 | 69 | 31 |
| **Guadiana** | 55300 | 11500 | 66800 | 83 | 17 |
| **Total** | **207630** | **56930** | **264560** | **78** | **22** |


Figure 62: Transboundary basins

In 1994 the Governments of the two States decided to launch the negotiations for a new water convention that should address new concepts, never considered before, such as water bodies, sustainability, sustainable uses, environment protection, and environmental impacts. For that purpose, both countries decided to perform a comprehensive characterization of each shared river basin, to inventory all its present and future uses (for different time horizons), to perform backwards reconstitution of the river flows under pristine conditions and to develop hydrologic and hydraulic studies to simulate future conditions for different scenarios.

As a result, in 1998 an "Agreement on the cooperation for the protection and the sustainable use of Spanish and Portuguese transboundary basins", also known as the Albufeira Convention was signed by Portugal and Spain. It came into force in 2000.

The key issues of this new convention are cooperation, coordination, environmental protection, sustainable development, exchange of information, consultation, impact mitigation, and water allocation reliability. The key challenges are water demand/water allocation, water quality/biodiversity, and water scarcity.

One of the most important actors according to the Albufeira Convention is the Conference of the Parts which includes representatives of the Spanish and Portuguese Governments aiming at

coordinating all issues related to the management of the water transboundary and related cooperation issues.

## 8.11 Climate change

In Portugal, climate change is increasingly a national priority, as southern Europe is a highly vulnerable region. The main concerns are desertification, drought, forest fires, erosion of the coastline due to the rise in average sea level and the increase of storms, the decrease in agricultural productivity, the difficulty in maintaining agricultural systems more sensitive to water limitations or of traditional production, the spread of vector-borne diseases, among other threats.

The first major study on the impacts of climate change in Portugal and on the need to adapt was the SIAM project, performed in 2002 by multidisciplinary team which included water resources experts. Since then several more studies have been developed at national, regional and municipal level both to evaluate possible climate change impacts on different economic sectors, as well as to plan the adaptation effort.

Water plays a vital role on how society feels climate change impacts and this fact is fully recognized in Portugal. Climate change has direct impacts on the availability, timing and variability of water supply, and these impacts have profound implications on many sectors of our society. Water is used for human consumption, industrial purposes, irrigation, power production, navigation, recreation and waste disposal, as well as for the maintenance of healthy aquatic ecosystems. Its availability and the occurrence of extreme events like floods and droughts condition the location of cities, industrial and agriculture areas, power generation plants and trading centres. Adding to these direct impacts of climate change on water resources, there are the indirect impacts, those derived from changes in economic and social activities which may lead to new pressures of the water systems, namely a water demand increase, a pollutant load increment or a significant change in the way we use our land and distribute our activities. These indirect impacts may also affect our capacity to satisfy water needs and to protect humans and its activities, while protecting and promoting the quality of the water bodies and the health of the aquatic ecosystems. The impact of climate change on water resources depends not only on changes in the volume, timing and quality of stream flow and recharge, but also on the system characteristics, the changing pressures on the system, how the management of the system evolves and what adaptation measures to climate change are implemented. In some cases, non-climatic changes may have a greater impact on water resources than climate change itself.

According to all studies, Portugal will likely experience a general decrease of overall water availability, an increase of seasonal and spatial asymmetries, an increase of flood risk and an increase of water quality problems. The impacts of climate change on sea level may also affect the groundwater levels and the groundwater quality, thus influencing the water resources availability, as well as increasing the risk of urban flooding. Furthermore, the decreased runoff in the Spanish part of the transboundary river basins is likely to accentuate even further the expected decrease of water availability in the Portuguese territory. In general terms this aggravation of the impacts is expected from the Northern region of Portugal, with Atlantic influence, towards the South, with Mediterranean characteristics.

To face these threats, various policies and strategies have been developed and implemented in recent years that promote the transition to a low carbon economy and increase the resilience of

society to climate change. Among the most relevant, the Strategic Framework for Climate Policy sets out the vision and objectives of the national climate policy for the 2030 horizon, and includes:

(i) the National Adaptation to Climate Change Strategy (ENAAC) revised in 2015 for the period up to 2020, which has as its main objectives information and knowledge on adaptation, reducing vulnerability, and increasing responsiveness, as well as promoting participation, awareness raising, dissemination among various social actors, and international cooperation;

(ii) National Program for Climate Change 2020/2030 (PNAC 2020/2030), aimed at ensuring compliance with national targets for climate change mitigation within the cross-cutting and integrated intervention areas.

Other strategic programs are:

(iii) Roadmap for Carbon Neutrality (RNC) 2050, which covers studies on the technical and economic feasibility of trajectories for reducing GHG emissions in Portugal, leading to a low carbon (or zero carbon) economy by 2050, including guidelines (energy, transport, waste, agriculture, forestry and land use), with the objective of achieving a zero balance between GHG emissions and their removal from the atmosphere;

iv) National Integrated Energy-Climate Plan (PNEC 2030), which focuses on energy security, energy market, energy efficiency, decarbonisation, R & I and Competitiveness, and which will combine the National Action Plan for Renewable Energy (PNAER) with the National Action Plan for Energy Efficiency (PNAEE);

v) National System for Policies and Measures (SPM), which aims to monitor the implementation of mitigation policies and measures, and in parallel to promote and reinforce sectoral responsibility for sectoral policies.

# 9 Conclusions

Several EU Directives addressing issues in the water sector have been adopted by the European Parliament and the Council in recent years. A systematic overview of the current state of EU legislation in the field of water resources management is given in this report.

All EU Member States have committed to implementing these EU Directives into national law. The EU partners of the SWARM project gave a short overview about implementations in their states including related findings and consequences. An additional view is given by the consideration of EU Directives in the Non-EU partner Norway, which is also part in the SWARM project and has a close relationship to the European Union.

This report of EU legislation serves as basis for the WB partner countries for further project initiatives in managing water-related challenges.

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