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REIMBURSABLE ADVISORY SERVICES AGREEMENT ON TECHNICAL ASSISTANCE FOR DEVELOPING AN ECONOMIC MECHANISM FOR SUSTAINABLE FINANCING OF WATER INFRASTRUCTURE IN ROMANIA

Deliverable No. 2

Report on good international practices to finance national water resource and flood risk management infrastructure

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ADMINISTRAȚIA NAȚIONALĂ APELE ROMÂNE

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Abbreviations

ACUAES	State Comercial Company Aguas de las Cuencas de España
ACUAMED	State Company of Public Ownership Aguas de las Cuencas Mediterráneas
ANAR	National Administration “Romanian Waters”
ASA	Authorized Union Association
AT	Austria
AUP	Single Withdrawal Authorization / Autorisation Unique de Prélévement
Bprw	Management and Development Plan for National Water
CAPEX	Capital Expenditures
CC	Court of Auditors/ Cour des Comptes
CNR	National Company of Rhone / Compagnie Nationale du Rhône
CTWL	Consolidated Text of the Water Law
EC	European Commission
EEC	European Economic Community
ELV	Emission Limit Values
EPCI	Public Establishments for Inter-municipal Cooperation / établissement Public de Coopération Intercommunale
EPTB	Public Territorial Basin Establishments / Les Etablissements Publics Territoriaux de Bassin
EU	European Union
EUROSTAT	The Statistical Office of the European Union
FAO AQUASTAT	Food and Agriculture Organization’s Global Water Information System
FAOLEX	FAOLEX is a database of national legislation, policies and bilateral agreements on food, agriculture and natural resources management administered by Food and Agriculture Organization
FD	Floods Directive
FRMP	Flood Risk Management Plan
GDP	Gross Domestic Product
GDW	General Directorate of Water

GEMA	Management of Aquatic Environments/ La gestion des Milieux Aquatiques
GEMAPI	Management of Aquatic Environments and Flood Prevention / La gestion des Milieux Aquatiques et la Prévention des Inondations
GE-RM	River Basin and Risk Management Concept / Gewässerentwicklungs- und Riskikomanagementkonzepte
GSA	General State Administration
GUS	Central Statistical Office / Główny Urząd Statystyczny
HPD	Hydraulic Public Domain
HWBP	National Flood Protection Program
ICPDR	International Commission for the Protection of the Danube River
ICPE	Installation Classified for the Protection of the Environment
ICPR	International Commission for the Protection of the Rhine
IKSE	International Commission for the Protection of the Elbe River / Internationale Kommission zum Schutz der Elbe
IOTA	Plants, structures, works and activities (Water Law)
IPO	Interprovincial Consultative Body
JORF	Official Journal of the French Republic / Journal Officiel de la République Française
KZGW	Polish Water Management Board / Krajowy Zarząd Gospodarki Wodnej
LIFE	Financial Instrument for Environment/ L'Instrument Financier pour l'Environnement
MCT	autonomous body of the Government of Spain - Mancomunidad de los Canales del Taibilla
METDC	Ministry for the Ecological Transition and the Demographic Challenge
MinI&W	Ministry of Infrastructure and Water Management
MIRT	Multi-year Program for Infrastructure, Spatial Planning and Transport
MS	Member State
MSFD	Marine Strategy Framework Directive
NAS	National Climate Adaptation Strategy

NGO	Non-Governmental Organization
NOVI	National Strategy on Spatial Planning and the Environment / Nationale Omgevingsvisie
NWB Bank	Nederlandse Waterschaps Bank
NWC	National Water Council
NWP	National Water Programme
OECD	Organisation for Economic Co-operation and Development
OFB	Biodiversity Agency / Office De La Biodiversité
OPEX	Operational Expenditures
OUGC	Unique Collective Management Organization / Organisme Unique de Gestion Collective
ÖWAV	Austrian Water and Waste Association / Österreichischer Wasser- und Abfallwirtschaftsverband
PGRE	Quantitative Water Resource Management Plan / Plan de Gestion de la Ressource en Eau
PGW	Water Management Board / Państwowe Gospodarstwo Wodne
PI	Flood Prevention / Prévention des Inondations
pos.	position
Qi	Quarter i
QMNA5	Monthly (M) Minimum (N) Flow (Q) of each calendar year (A) calculated with a return period of 5 years
RAS	Reimbursable Advisory Services
RBDC	River Basin District Councils
RBO	River Basin Organization
RBMP	River Basin Management Plan
RWA	Regional Water Authorities
RWS	Rijkswaterstaat
RZGW	Regional Management Polish Authorities / Regionalnego Zarządu Gospodarki Wodnej
SAGE	The Water Development and Management Plan / Le Schéma d'Aménagement et de Gestion des Eaux

SCHAPI	Central Service for Hydrometeorology and Support for Flood Forecasting / Service Central D'HydrométéOrologie Et D'Appui à La PréVision Des Inondations
SDAGE	Water Development and Management Master Plans / Les Schémas Directeurs d'Aménagement et de Gestion des Eaux
SDES	The Statistical Data and Studies Service / Le Service des Données et études Statistiques
SISPEA	Public Water and Sanitation Services Information System / Système d'Information des Services Publics d'Eau et d'Assainissement
UNEP-DHI	Centre on Water and Environment is a United Nations Environment Programme
USD	United States Dollar
UvW	Union of Water Boards
Vewin	Association of Water Companies
VNF	Navigable Waterways of France / Voies Naviguables de France
VNG	Association of Netherlands Municipalities / Vereniging van Nederlandse Gemeenten
WB	World Bank
WFD	Water Framework Directive
WISE	Water Information System for Europe
WRG	The Austrian Water Rights Act / Wasserrechtsgesetz
ZRE	Water Apportionment Zones

Chapter 1. Report's objective and scope

CONTEXT

1. This Report represents the second Deliverable specified in the Reimbursable Advisory Services (RAS) Agreement signed between the National Administration "Romanian Waters" (ANAR) and the World Bank (WB) on August 8, 2022, which became effective on September 28, 2022, to provide "Technical assistance for developing an economic mechanism for sustainable financing of water infrastructure in Romania".
2. It presents specific national approaches towards sustainable water and flood infrastructure management and funding; sustainable models and practices for establishing and implementing economic mechanisms for operating and maintaining water and floods infrastructure; main water users and "big polluters", including related approaches to tariffs/other charges to cover the costs of services and infrastructure. The document provides an overview of implemented changes and reforms in 5 European Union (EU) Member States (MS) – Austria, France, Poland, Spain and the Netherlands, which have been done to ensure sustainable self-financing of operation and modernization of the national water infrastructure at national and water basin administration levels.

OBJECTIVE

3. The presentation of good international practices for managing and financing water resources and flood risk management infrastructure aims to inform ANAR as well as other key water sector stakeholders in Romania on what other EU MS are doing, what has provided/or not the desired results, existing policies and processes leading to compliance with the EU water directives including financing of the national measures.
4. The Report on good international practices to finance national water resource and flood risk management infrastructure should contribute to making informed decision about the required reforms and changes to bring the existing economic mechanism of ANAR in line with good international practices and lead to improved performance levels.

SCOPE

5. This Report reviews and presents good international practices in managing and financing water resource and flood risk management infrastructure from five EU MS – Austria, France, Poland, Spain and the Netherlands.
6. Despite the fact that the report contain detailed information on national institutional arrangements and responsibilities for managing water resource and flood risk management infrastructure, specific set up and requirements on financing of water resource and flood risk management infrastructure, ongoing national efforts towards achieving sustainable and resilient water infrastructure and etc., the authors do not advise on copying approaches and measures but rather learning from what is providing results elsewhere, adapt, and come up with measures, which reflect the Romanian situation and address its specific issues.

REPORT OVERVIEW

7. This Report has the following structure:

   Chapter 1 of the report describes the report's objective and scope. It also provides an overview of the document.

Chapter 2 presents the institutional arrangements and responsibilities for managing water resource and flood risk management infrastructure in Austria, France, Poland, Spain and the Netherlands. It also details the specific context, implemented changes and reforms to achieve sustainable operation and development of water infrastructure at national and river basin levels in these countries; the legal framework for water resources and flood risk management; institutional set up; responsibilities for operating, managing and modernizing water resource and flood risk management infrastructure as well as the ongoing efforts to improve efficiency of water management and private sector participation.

Chapter 3 looks in detail at what the above-mentioned EU MS are doing for the financing of water resource and flood risk management infrastructure in their respective countries. It outlines the applied approaches and practices for funding operation, maintenance and modernization of water resources and flood prevention infrastructure; tariff setting methodologies and application of 3Ts (tariffs, transfer, taxes) approach for infrastructure funding; the applicable tariffs and other charges/taxes/fines at national and river basin level as well as recent developments in water infrastructure financing, implementation of special instruments, funds (water, environment) etc.

Chapter 4 provides an overview of hydropower electricity production in Austria, France, Poland, Spain and the Netherlands. It presents the organization of hydropower production and payments for the used water resources and/or other fees/taxes etc. that are applied for this subsector in these EU MS.

Chapter 5 of the report covers what the above-mentioned countries are doing to achieve sustainable and resilient water infrastructure. It presents the efforts towards addressing climate related risks; approaches for improved risk management of water infrastructure due to increased water variability as well as the new water asset management requirements, innovations and other challenges/opportunities.

Chapter 6 presents some preliminary conclusions from the management and financing of water resources and flood prevention infrastructure. It outlines the key achievements and remaining challenges including lessons learned, which could be potentially relevant for the Rumanian water sector.

Annex 1 provides information on the reference materials and people consulted for the preparation of this report.

Annex 2 details the experience of France on managing and financing water resources and flood risk management infrastructure.

Annex 3 presents a water map of Poland.

Annex 4 shares more detailed information on how Spain is managing and financing its water infrastructure.

Annex 5 provides additional information on how the Netherlands is managing and financing its water infrastructure.

Chapter 2. Institutional arrangements and responsibilities for managing water resource and flood risk management infrastructure in a few EU MS

2.1 Specific context, implemented changes and reforms to achieve sustainable operation and development of water infrastructure at national and river basin levels

AUSTRIA

8. With an average annual precipitation of around 1,100 mm, Austria is one of Europe's most water-rich countries[1] in terms of quantity and quality. 100.000 km of rivers and streams flow through Austria and along with 25,000 bodies of standing water, 65 large lakes, form the backbone of Austria's "water veins" (Ministry of Water, 2018). Austria´s favorable situation today is premised on its hydrogeological position, to a large extend determined by the Alps and the alpine headwaters of the Danube, and a long history of water resource protection of ground- and surface water[2].

9. Austria is part of three river basin districts (Danube, Elbe, Rhine), all of which are international sharing water courses with the Czech Republic to the north, Germany to the north-east, Slovakia and Hungary to the east, Switzerland and Liechtenstein to the west and Slovenia to the south[3]. Most of Austria falls within the Danube catchment. Austria is an active member of the International Commission for the Protection of the Danube River (ICPDR) based in Vienna.

Figure 1: Austria´s territory in the river basin districts of Elbe, Rhine and Danube – the latter being by far the biggest (picture source: https://ec.europa.eu/environment/water/participation/map_mc/countries/austria_en.htm)

The river Danube does not form state boundaries, but crosses Austria from the West to the East, which makes exploitation, e.g., for hydropower generation, comparatively straightforward.

[1] https://info.bml.gv.at/en/topics/water/water-in-austria.html
[2] https://sos.danubis.org/eng/country-notes/austria/
[3] https://ec.europa.eu/environment/water/participation/map_mc/countries/austria_en.htm

Figure 2: Austria within the Danube catchment (picture source: https://sos.danubis.org/eng/country-notes/austria/)

10. The Republic of Austria is a Federal State composed of nine autonomous federal provinces whereby the federal and provincial governments share the legislative and executive powers. National laws such as the Water Act are implemented by the provincial governor on behalf of the federal minister. On the other hand, provincial laws and laws pertaining to communities, e.g., spatial planning, emergency management, construction legislation, and environmental protection, are passed by the provincial governments. The federal state and the provinces each have their systems of financial management, i.e., budgets of their own, and they may levy taxes in their own right. However, only the federal government can levy important taxes such as income tax or value-added tax. The federal provinces receive funds from the federal government's tax revenue under the revenue-sharing system. The revenue-sharing plan covers only a few years and is re-negotiated regularly[4]. 2093 self-administrated municipalities are responsible for local compliance with provincial laws and water-related duties, such as providing water supply and wastewater treatment services. Municipalities have a degree of autonomy for initiatives regarding flood risk management, for instance, in zoning planning and issuing building permits (Ministry of Water, 2018).

Figure 3: Austria and its federal states (picture source: www.ams.at)

FRANCE

11. France is a water rich country and water has always been very important in the everyday life of people. Since the beginning of the XIX century, organization of water and wastewater services for the citizens is the responsibility of the municipalities. In terms of biophysical situation, France has a wide number of small and big groundwater, which store in total around 2,000 billion m^3. France receives on yearly average 512 billion m^3 of which 200 billion m^3 reaches 270,000 km. of streams and rivers or groundwater. This last is the renewable freshwater which can be used for human activities. Climate change has an impact on it and a recent study from the statistical service of the French ministry of Environment (Dossa-Thauvin, 2022) found that the decline of renewable water resource on mainland France reached 14 percent over the period 2002-2018 compared to 1990-2001. In 20195, Its abstraction reached 31,4 billion m^3 of which 5.3 billion for drinking water, 3.2 billion for agriculture, 2.4 billion for industry, 5.2 billion for channels feeding (56Mt of goods transported) and 15.3 billion for power plant cooling (0.6 billion evaporated).

[4] https://www.parlament.gv.at/en/explore/political-system/the-federal-state-of-austria
[5] https://www.statistiques.developpement-durable.gouv.fr/leau-en-france-ressource-et-utilisation-synthese-des-connaissances-en-2022

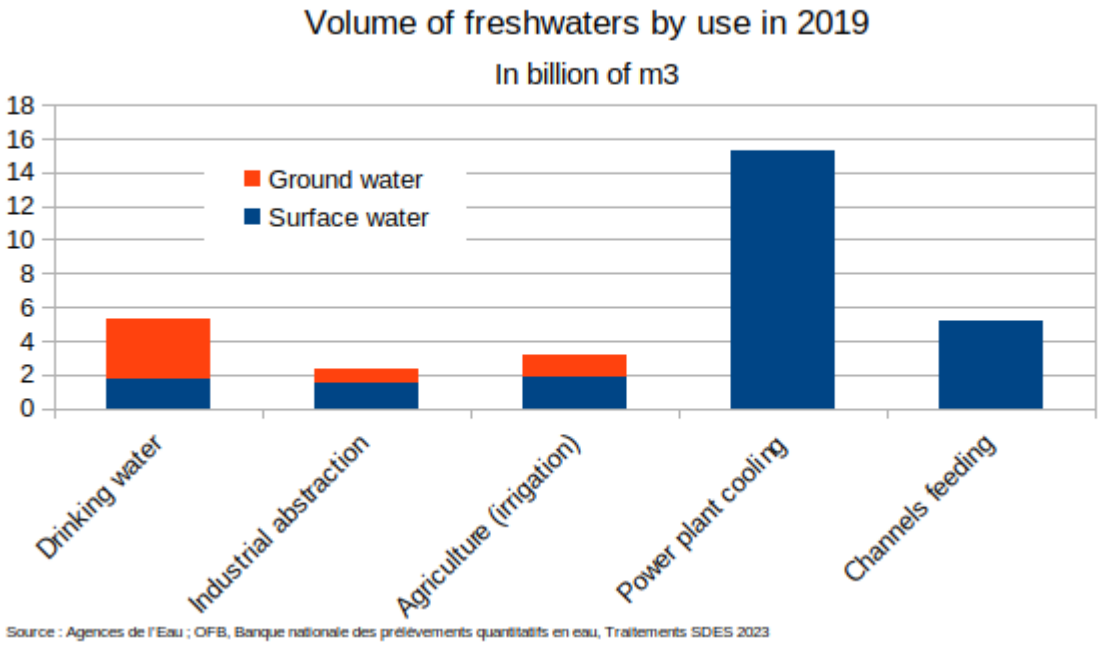
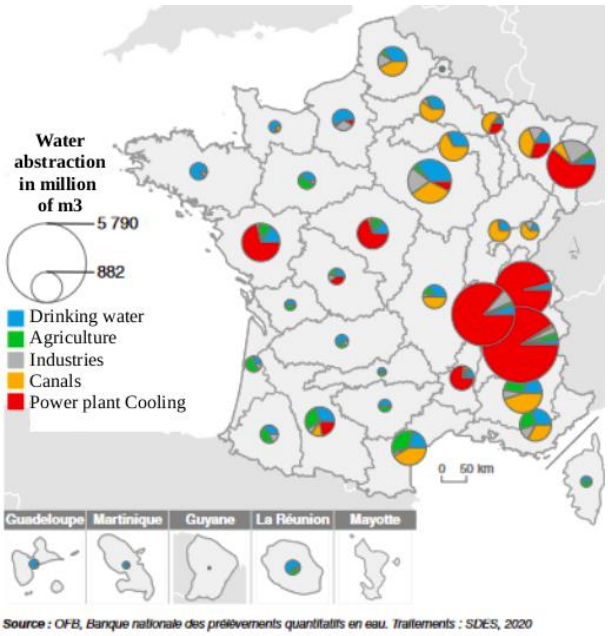


Figure 4: Volumes of freshwater used in France, 2019

12. Abstractions are used to produce drinking water for domestic, industries and services uses, to provide water for industries and power plants for cooling purposes, and for irrigation in agriculture. While abstraction decreased in the last twenty years except for agriculture, this apparent comfortable situation hides large spatial and temporal variability's, some parts of the territory having low groundwater and/or surface water resources, and most of the precipitation volumes (88%) reaching the country during autumn and winter while the highest abstraction (60%) being in many places during summer period where the resources (15%) are at the lowest. More than 80 percent of the water used is abstracted from surface water (rivers, lakes and dams), in particular for feeding water channels and power plant cooling. Industry and agriculture use surface and groundwater and drinking water is using more groundwater than surface water.



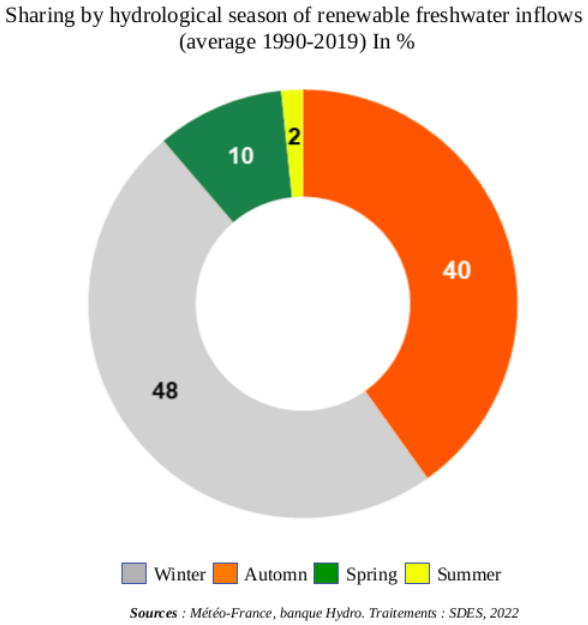


Figure 5: Water abstraction breakdown (first) and hydrological season of renewable freshwater in France (second)

13. In the last ten years the authorities have implemented a structured drought management system with four levels of restriction on water uses depending on the drought situation. It has been activated in a large share of the territory and in some parts at the highest (crisis) level for more than a month each year since 2012. (SDES, 2022)

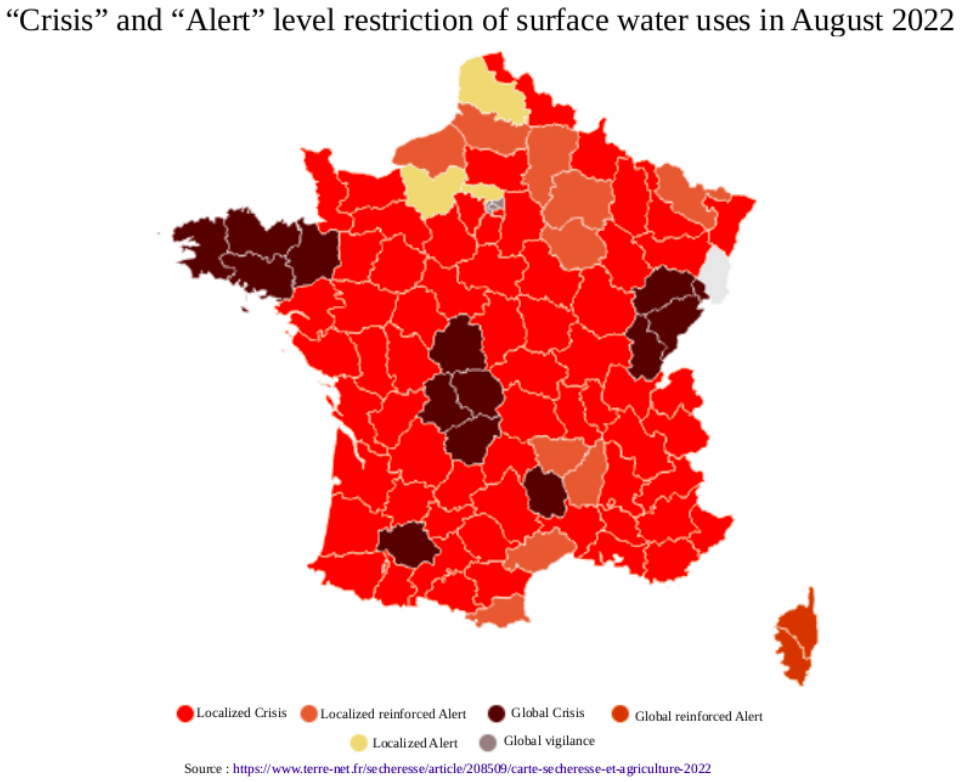


Figure 6: Restrictions of surface water use in August 2022, France

POLAND

14. Poland is a relatively large country in the EU context with an area of 312 thousand sq km (ranked 6th in area within the EU-27) and a population of 37.659 million inhabitants (ranked 5th in the EU-27, EUROSTAT)). Romania is similarly large, with an area of 238,39 thousand sq km (ranked 7th in the EU27) and with a population of 19,042 million inhabitants (ranked 6th in the EU-27, EUROSTAT). After the Second World War both countries were left in the so-called "Soviet Zone" and could only change their political systems to democratic ones in 1989. Poland joined the EU in 2004 and Romania was a participant of the second EU enlargement in 2007. Over the last 30 years, both countries had the opportunity to be on transformative paths to a market economy and implementation of EU standards and regulations (Acquis communautaire).

15. Comparing the economic strengths according to GDP per capita in nominal values (EURO in PPS) and relative value (% of EU-27 average) both countries are very similar: Poland – 77 percent EU GDP per capita (EU=100, EUROSTAT 2021); Romania 74 percent EU GDP per capita (EU=100, EUROSTAT 2021), but they are at same level of actual individual consumption of 84 percent EU (EUROSTAT 2021). Both countries are below the EU average with positions of 19th for Poland and 22nd for Romania in 2021 and due to that fact, they were and are supported in development by EU cohesion policy.

16. From the perspective of renewable water resources, Poland and Romania are ranked among the lowest 5 countries in the EU with 1.800 m3 per inhabitant in Romania (23rd position in the EU) and 1,600 m^3 per inhabitant in Poland (24th position in the EU (Polish Statistical Office GUS – "Poland on the path for development", 2022). Also, according of total water use per capita, Poland and Romania are on similar levels (Poland 763 liter per day, Romania 882 liters per day (Worldmaters.info). On the basis of the ratio of dam storage capacity to mean annual runoff, both countries are also on similar levels (Poland 4,9%, Romania 5,2%). However, taking into consideration dam storage capacity per capita in Romania, it is much higher than in Poland (563 m^3 versus 78 m^3) [FAO AQUASTAT]. Finally, taking into account the flood occurrence indicator[6] Romania belongs to the group of the countries in Europe with the highest value of the indicator (3.8) compared to Poland (2.7) based on FAO AQUASTAT data. This means that the risk of flooding in Romania is substantially higher than in Poland. For all these reasons, the Polish case of transformation and development of water management could be an interesting comparison for Romania to understand lessons learned and the best practices that have emanated from the Polish experience.

SPAIN

17. In Spain in the mid-nineteenth century during the liberal governments, water become public domain through a series of laws that tried to eliminate the traditional regime of feudal and landowner rights. In this process, the use of public water for agricultural purposes was considered by the governments of the time as one of the most effective means to increase agricultural production and national wealth. However, governments left to the private initiative the responsibility to perform the construction works in exchange for making concessions to the use of water for 99 years; even so, not all the necessary construction works were made due to the absence of private investment. This determined that at the end of 1860 and the beginning of 1870, the first criticisms of the liberal approach of non-intervention of the State took place.

18. Thus, in the second half of the nineteenth century in the post-colonial period[7], public intervention played an important role in the country's regeneration project, and the large public hydraulic infrastructures were considered as the instrument for modernization, the State had to intervene because the private initiative was unable to provide the necessary funding, and the State intervention was necessary because it was in the national interest to increase the wealth of the country. This direct intervention of the State was possible based on the Water Law of 1879, which declared natural currents as a public domain of the State, organized the use of surface water and established a decentralized and participatory management, defining the first models of cooperation agreements between water users and the State.

19. The role of the State in the transformation and modernization of the country through the "hydraulic solution" as a means of economic and social reform needed to focus mainly on the creation of a modern and competitive agricultural sector. For this purpose, it had to create its own organizations, integrating the existing economic interests and the need for water users to play an important role as co-founders in the new organizations. In 1926 by Royal Decree-Law of March 1, the Hydraulic Trades Confederations[8], autonomous public bodies, were created as an

[6] The flood occurrence indicator is a normalized indicator of the number of floods recorded from 1985 to 2011, using the total number of floods observed in that period; the indictor was created by the World Resources Institute with range from 0 to 5.

[7] In Spain, the situation was one of growing economic and social crisis with the loss of the war and of the last colonies (Cuba and the Philippines). It was a time of economic slowdown and social tensions. The "regenerationists" believed that large-scale development of water resources would modernize agriculture and promote growth, thus advancing toward social and cultural reform.

[8] Now called River Basin Organizations

organizational method designed to drive the advancement, construction and operation of hydraulic works by the beneficiaries themselves, with the collaboration of the State, and whose financial model to maintain the necessary level of funding was based on the fact that over time these funds would be recovered through the contributions of users, constituted mainly in self-governed Irrigation Cooperatives.

Figure 7: Map of River Basin Organizations (RBOs) in Spain

20. The first River Basin Organizations were founded in the river basins of the Ebro and Segura (1926), Duero and Guadalquivir (1927) and Eastern Pyrenees (1929) rivers. In 1985, Law 29/1985, of August 2, on Water, was approved, which declared the River Basin Organizations (RBOs) called Hydrographic Basins Confederations, as public law entities with their own legal personality and different from the State, attached to the Ministry of Public Works and Urban Planning and with full functional autonomy. Its key role is the planning, management and administration of the hydraulic public domain (HPD)[9]. The Law 46/1999, of December 13, amending the Water Law 29/1985, of August 2, established the User Communities as public law corporations attached to the RBOs and created seven public companies for the development of hydraulic infrastructures in seven water basins, which operated under a private law regime. Subsequently, they merged and became two State companies, ACUAES and ACUAMED (see **Annex 4**). There are currently nine State-owned RBOs attached to the Ministry for the Ecological Transition and the Demographic Challenge (METDC), which are under the supervision of the General Directorate of Water (GDW), METDC's governing body that has State powers over water resources.

[9] In Spain, the situation at the time was of growing economic and social crisis with the loss of the colonial war and of the last colonies (Cuba and the Philippines). It was a time of economic slowdown and social tensions. The "regenerationists" believed that large-scale development of water resources would modernize agricultural sector and promote growth, thus advancing toward the social and cultural reform.

THE NETHERLANDS

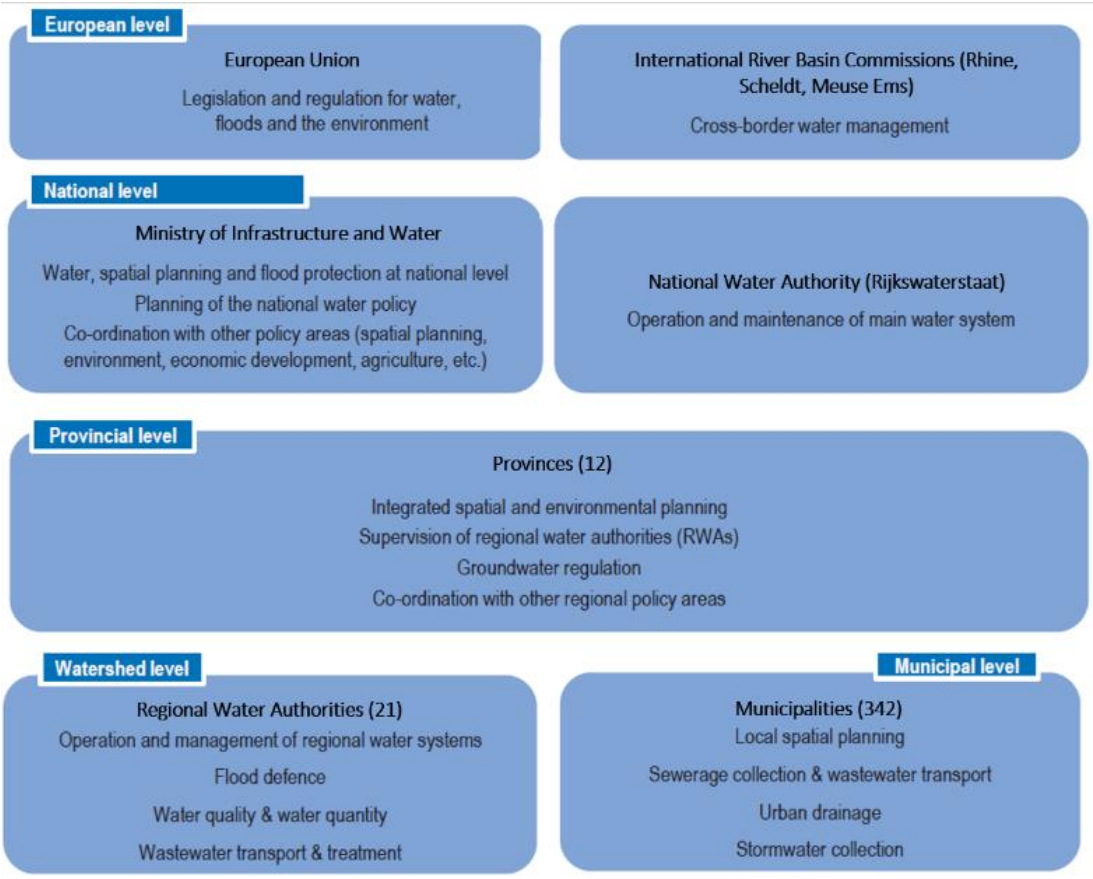


Figure 8: Water management institutions in the Netherlands (adapted from OECD, 2014)

21. Water management in the Netherlands has been regarded as a public responsibility, which is shared by multiple institutions across multiple governance levels (see above): The Ministry of Infrastructure and Water Management is at the national level responsible for national water policy and alignment with other policy areas (spatial planning, environment, nature conservation, economic development, agriculture and horticulture). Rijkswaterstaat is the executing agency of the Ministry and responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands, including the main water system (North Sea, Wadden Sea, Lake IJsselmeer and the major rivers and channels).
22. Regional Water Authorities (21x) manage regional water systems to maintain water levels, water quality and wastewater treatment. They are decentralized public authorities endowed with specific legal personality and financial resources by the Dutch Constitution and operating in areas defined by their physical drainage characteristics. Provinces (12x) are responsible for integrated spatial and environmental planning, supervision of regional water authorities, development of groundwater plans and regulations (they grant permits for the larger groundwater extraction) and alignment with other regional policy areas. Municipalities (342x) are responsible for spatial planning at the local level, sewerage collection and wastewater transport, urban drainage, and stormwater collection in urban areas. In addition, there are ten drinking water companies that provide drinking water supply, operating under private law with public shareholders. Their geographic scope covers on average the area of 2 or 3 regional water authorities and between 20 and 50 municipalities. The presence of NGOs in Dutch water management is limited to the protection of local interests, such as landscape preservation or nature conservation. Knowledge

institutes, universities and universities of applied sciences provide active support to policy development and optimizing operations. **Annex 5** provides and overview of water management responsibilities per theme. Rijkswaterstaat and the regional water authorities show the most similarities to ANAR.

2.2 Legal framework for water resources and flood risk management

AUSTRIA

23. Water policymaking and creating the legislative framework for the sector is a national competence in Austria. The Austria Water Act 1959 (WRG) comprehensively covers the Austrian water policy, revised in 201710. The Water Act is a nationwide legislation, obligating all people and organizations. The Governors of the 9 provinces implement it on behalf of the Federal Minister. The Austrian framework is obviously highly inter-connected with EU water legislation, e.g., the EU Water Framework Directive or the EU Floods Directive, and other sectoral water-related or environmental legislation, which are periodically reviewed by the European Commission and revised as appropriate (UNEP-DHI, 2020). A water policy, in the sense of a distinct document outlining what the Austrian Government and its Ministry of Agriculture, Forestry, Regions and Water Management intend to achieve and how they intend to achieve it, does not exist. However, Austria has comprehensive strategic planning processes documents at the national, regional and local levels and well-elaborated technical guidelines, as summarized in the following table and referred to in greater depth in the subsequent chapters.

Table 1: Planning tools at the national, regional and local level as per Flood Risk Management in Austria (Ministry of Water, 2018)

National Level	**National River Basin Management Plans (RBMP)** and **Flood Risk Management Plans (FRMP)** are designed and revised in a six year cycle in line with processes laid down in the Austrian Water Act. The third and latest RBMP (*Nationaler Gewässerbewirtschaftungsplan NGP*) came out in 2021. The first national FRMP (Hochwasserrisikomanagementplan) was published in 2015 and is under revision.
Regional Level	**River Basin and Risk Management Concept** (Gewässerentwicklungs- und Riskikomanagementkonzepte (GE-RM) form the basis for coordinating possible measures in a catchment or longer stretch of a water body **with need for action** and seeks to identify synergies and avoid conflict.
Local Level	The declaration of yellow and red zones is central in **Hazard zone planning** and forms the basis for spatial planning and building regulations to be effected by municipalities. Hazard zone plans are available to all municipalities, provincial and federal authorities and can be accessed at the municipal offices.

24. Austria is a landlocked country. All national parts of the three big international river basin districts Danube (AT1000), Rhine (AT2000) and Elbe (AT5000), and therefore the entire Austrian territory, are covered by the Austrian RBMP. The National RBMP and FRMP are in line and coordinated with the international RBMPs and FRMPs for the Danube, the Rhine and the Elbe. Aquifers are enshrined in the agreements and plans. All objectives within the national parts' contribution to basin-wide agreements were consistently achieved and are periodically reviewed and revised (UNEP-DHI, 2020).

[10] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010290

FRANCE

25. Water is at the core of many economic and leisure activities and beyond, in many aspects of human life, and its impacts has also to be considered in many situations: infrastructure and land planning, biodiversity and climate change. The centralized nature of the French approach while the biophysical situation is extremely diverse requires careful development of the legal framework to allow for consideration of this diversity. The legal framework and associated legislation related to water is therefore highly diverse and rich and its progressive elaboration has led to a complex picture including a large number of texts and their amendments. Made up of laws (including EU Directives), articles, decrees which have been decided or adopted to regulate all types of actions and activities throughout years, the legal corpus is wide and touches a lot of different sectors. We will also see in the next section that its enforcement is conducted by a wide set of actors and interactions and with the help of various tools (management plans, reporting, performance indicators etc. These constitute the regulation framework which for water covers three main types: risk and sanitary, environmental, and economic and social regulation as illustrated in the following.
26. Nowadays, the French legal framework is largely dominated by the European legislation, in particular the Water Framework Directive (WFD) and the Flood Risk Assessment and Management Directive (FD) which complement the former Directives on urban wastewater treatment, the nitrate directive, the bathing water directive, the fish and shellfish directive, the directive on quality of water intended for drinking water, the drinking water directive and the industrial emissions directive. The Marine Strategy Framework Directive (MSFD) is also important, as France metropolitan territory rivers are discharging in three maritime area with a coast of around 7,000 km. in total, and the far islands and territories of France being located in all Oceans and Sea of the World.

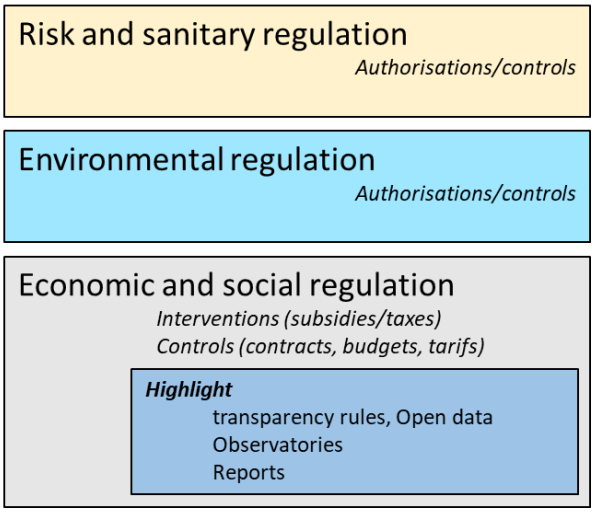


Figure 9: Legal framework in France, source: Marie-Louise SIMONI, 2016

27. The police and justice regulation, or regulation by litigation, while crucial in the enforcement process, is not included here as it constitute a regulation of last resort, and the upstream processes target the of prevention of these disputes. Considering the size of the country and the diversity of economic activities and actors, the EU legal framework is not enough, and the subsidiarity principle is largely applied. Past water legislation resulting from the country history and specific water management needs, related both to the specific biophysical conditions of the country and its socio-economic development have not been repealed by the EU legislation. In all water related fields, the subsidiarity principles have been and is used to articulate the EU legislation with the national legal framework, river basin and local rules. And the national legal framework on water related topics has been very dynamic in the last sixty years. Three main laws have structured the approach of water management: the water law of 1964 which created the water agency system and structured the financing of drinking water and wastewater assets, the water law of 1992 which created Water Development and Management Master Plans (SDAGE) and sub-basin management units plans (SAGE) and the local management plans for wastewater assets, and the water law of 2006 which restructure the role of local authorities for the

management of drinking water and wastewater assets. It should be noted here that the only level at which the legislation can be developed in France is the national level (state and Parliament). While regional authorities (region, department, water agencies) or local authorities (municipalities and inter-communal structures) may have some elected assemblies and some power to define specific rules of implementation, specific fees or taxes and to implement some control systems (including accredited agents to enforce the application), they have no regulatory power. On the other hand, the State has regional and department delegations managed and coordinated by a prefect who can prescribe stricter rules than the national rules where relevant to protect public interest (restriction on water use, on constructions, etc.). To ease the application of the legal framework, a significant effort by the state has been made in the last 20 years to include the up-to-date legal texts and amendments in unified codes and there are currently 78 codes: civil code, trade code, health code, environment code see **Annex 2** on France for more details.

28. In the past twenty years, the legal framework been revised and adjusted at a very intensive pace and the water actors have sometimes difficulties to follow this moving environment. The environment code and its regular revision, allow at least to have an up-to-date view of the situation. While water agencies have never been fully independent from the state, the supervision of the state, its delegations and agencies on the water agencies, as well as the control on their budget, have been reinforced in the recent period. The small water cycle from abstraction to use and discharge has focused much of the attention since the 60's. It changed to some extent to a larger focus on the entire water cycle with the adoption of the Water law in 1992 and of the EU Water Framework Directive in 2000. However, due to relatively easy access to water quantities, much of the attention has been given to pollution and the discharge permits and associated emission limit values (ELVs) are established by considering also the purification capacity of the receiving environment. The climate change will however reduce this through lower flow which will mean lower dilution, lower dissolved oxygen, higher average temperature and longer and more severe low flows with effects on the aquatic fauna and flora which in turn will require lower ELVs.

29. As concerns drinking water and wastewater, the principle of water-user-pays and water-polluter-pays is applied even if the financial contribution of actors to the system does not fully reflect their economic size or their impacts on the aquatic environment, in particular on pollution from diffuse sources which require more elaborated treatment to prepare drinking water. The maintenance in good operational conditions and renewal of the infrastructures becomes more and more an issue with the ageing of the assets and the drinking water price is still increasing at a higher speed than inflation to cover part of the financing. (Maylis Castaignet, 2020). The average rate of network renewal is 0.67 percent for water services and 0.46 percent for sanitation services. (SISPEA 2020).

30. The quantitative management in water scarce situations, i.e., to provide the necessary quantities when they need it to all actors, becomes a more important topic. A recent report from the court of audits ((CC), 2023) raises the increase of local situations of water uses which overpass the capacity of the environment to provide enough water for longer periods and create conflicts and reduce the dilution capacity of the receiving waters and the ability to reach good status. When analyzing the organization of authorities to tackle this specific aspect of water management, the auditors raise the complexity of the current administrative organization, and the lack of relationships between this and the basin organization which complicate the competencies apportionment between the state and the local authorities and the coordination of their actions.

They conclude that the current organization is not adapted to manage the quantitative aspect and suggest some adaptations.

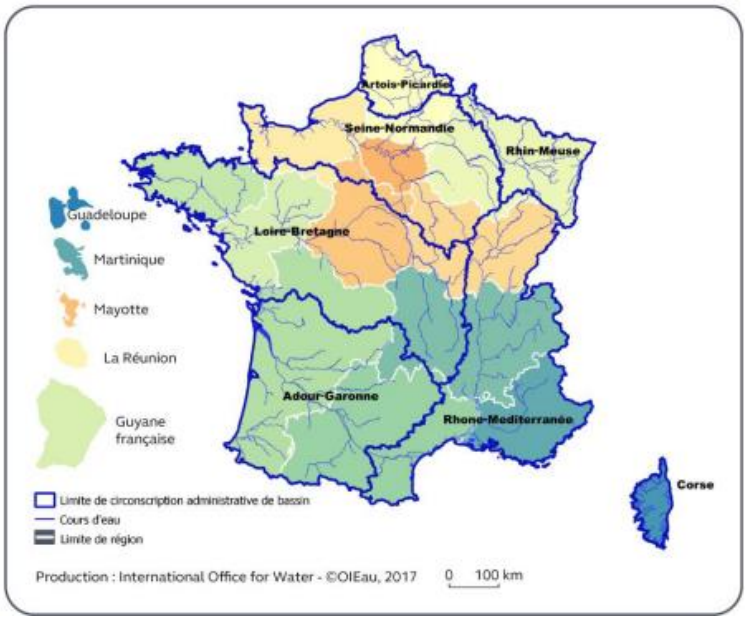


Figure 10: Main rivers and river basins (blue lines) and administrative regions in France

POLAND

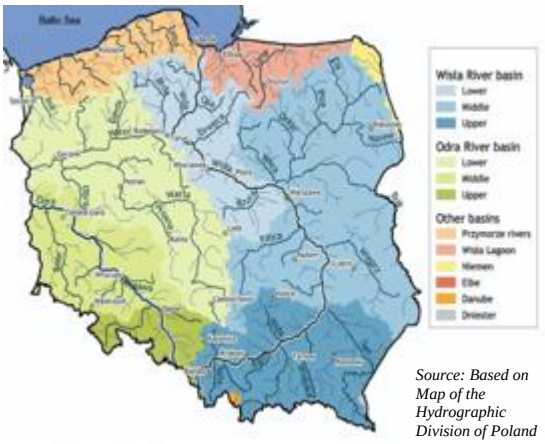
31. To present the institutional arrangements and other aspects of water management in Poland it is necessary to present Poland's hydrography. It is characterized by river networks running mostly from south to north, from mountains to the Baltic Sea. There are two large river basins which cover 88 percent of the country's surface area: the Vistula catchment (54%) and the Odra catchment (34%), which span the length within Poland: Vistula – 1047 km, Odra – 840 km. Both rivers are parts of international basins but are mostly concentrated inside Poland: Vistula (87%) and Odra (89%). The remainder of the country is covered by costal river basins (6,8%), the Pregoła basin (4,2%), and small portions of the Niemen, Danube, Dniestr and Elbe basins (all together approximately 1%). The annual average flows in the two main rivers are:

    - Vistula (1,080 m3/s) with major tributaries Dunajec (86 m3/s), San (129 m3/s), Narew (313 m3/s) and Bug (155 m3/s) and
    - the Odra (567 m3/s) with main tributaries Warta (216 m3/s) and Noteć (77 m3/s).

32. The flow rates in these rivers are characterized by significant seasonal and annual variability creating flood risk in the lowlands in the spring with snowmelt and ice jams while in the uplands high discharge and flood risk occurs between May and August after heavy precipitation in the mountain areas. The 1997 flood on the Odra River affected 200,000 inhabitants and caused USD 5 billion in losses. The 2010 flood in the Vistula basin affected 100,000 inhabitants and caused USD 3 billion in losses. According to the World Bank Global Facility for Disaster Reduction and Recovery, on average, 600,000 people and USD 7 billion of assets are at risk of flooding annually. The expected impacts of a 100-year flood event are only marginally higher than during a 10-years flood (IEC, Poland Water Security Outlook and Action Plan, 2022). The flood risk is the dominating natural hazard risk causing the largest loses for households and the economy. Climate change is

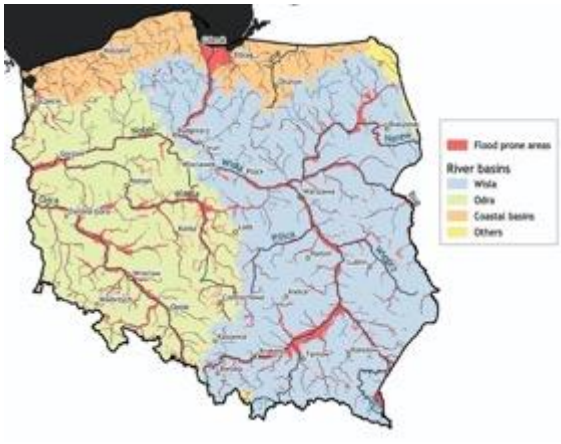
expected to intensify this risk due to extreme rainfall events. The maps below present the hydrographic divisions of Poland and flood prone areas.

Map of the Hydrographic Division of Poland



Source: Based on Map of the Hydrographic Division of Poland

Map of flood prone areas



Source: PGW Wody Polskie, Flood Risk Assessment, 2018

Figure 11: Hydrographic division (first) and Flood prone areas (second) in Poland

33. In addition to flood hazards, there is growing risk of droughts, especially during summer periods, for almost whole the country. The frequency of drought occurrence doubled between 2010-2019 comparing to previous decades and is predicted to continue due to climate change. During periods of hydrological droughts, surface water runoff can reach a low of 35,2 percent of the annual average runoff. According to Drought Effects Counteracting Plan prepared by Polish Waters, 56 percent of Poland's area is at severe risk of drought and 5 percent at extreme risk of drought. Counteracting droughts is a very important area of investment as retention capacities are very low in Poland.
34. The most recent legal framework for water resources was established in 2017 and is regulated by Water Law (Journal of Laws 2021, Pos. 2233 (consolidated version)). This framework came into force on January 1, 2018. The act contains 574 articles described over 423 pages and is composed of 13 Sections:

    1. General provisions;
    2. Use of water;
    3. Protection of water;
    4. Flood risk management and counteracting the effects of drought;
    5. Water construction and water drainage;
    6. Management of the property of the State Treasury;
    7. Water management;
    8. Water authorities;
    9. Water and legal consent;
    10. Water associations;
    11. Compensation liability;
    12. Penal provisions;
    13. Changes in regulations, transitional, adaptation and final provisions.

35. Water Law clearly defines the ownership of waters and lands covered with waters, as well as the principles of managing these components as the property of the State Treasury. These provisions apply to inland waters and internal sea waters, as well as to territorial sea waters in the scope of planning of water management, protection against pollution from land-based sources and protection against flood. Interesting review of Polish Water Law Act is presented in IEC report "Poland Water Security Outlook and Action Plan" (2022) prepared by the World Bank for the Polish Government. The Water Law Act is an implementation of practically all EU directives related to water management[11]. The implementation of the Water Law is supported by a series of governmental (Council of Ministers) regulations approved in years 2019-2021, listed below and concisely described in FAOLEX Database:

- Regulation establishing species of aquatic animals of economic importance and the areas intended for the protection of these species.
- Regulation on the water management information system.
- Regulation on the scope of information from the water management information system which is the subject to disclosure.
- Regulation on the method of keeping records of water melioration devices and drained land and determining the area where water melioration devices have a beneficial effect.
- Regulation on measurements of groundwater and surface waters as well as the quantity and quality of sewage discharged into waters or into the ground.
- Regulation on water profile in bathing water.
- Regulation on the criteria and method for assessing the state of groundwater.
- Regulation on the classification of ecological status, ecological potential, chemical status and the method of classifying the status of surface water bodies as well as environmental quality standards for priority substances.
- Regulation on forms and methods of monitoring of homogeneous surface water bodies and homogeneous groundwater bodies.
- Regulation on the detailed scope of water management plans for river basins.
- Regulation on requirements for surface waters used for human consumption.
- Regulation on substances particularly harmful to the aquatic environment and conditions to be met when discharging sewage into waters or into the ground, as well as when discharging rainwater or snowmelt into water or into water facilities.

[11] EU directives related to water management and implemented by Water Law Act:

- Council Directive 91/271/EEC concerning urban waste water treatment.
- Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy.
- Commission Decision 2006/7/EC concerning certain protection measures in relation to the import of feathers from certain third countries.
- Directive 2006/118/EC of the European Parliament and of the Council on the protection of groundwater against pollution and deterioration.
- Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks.
- Directive 2008/56/EC of the European Parliament and of the Council establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).
- Directive 2008/105/EC of the European Parliament and of the Council on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council.

- Regulation on the permissible quantities of pollutants that may be discharged in industrial wastewater.
- Regulation establishing the list of substances particularly harmful to water environment for which a permission is required to introduce industrial sewage into sewerage devices.
- Regulation on information boards on the water intake protection zone.

36. The latest river basin management plans for all 9 basins (Vistula, Odra, Dniestr, Danube, Banówka, Elbe, Niemen, Pregoła, and Świeża) were accepted and published by the Ministry of Infrastructure November 4/December 2, 2022. Flood risk management plans for all basins and flood risk from the sea were accepted and published in 2022. The last one was agreed with the Ministry of Marine Economy. The other important regulation related to water management is The Act of Inland Navigation established by Polish Parliament on December 21, 2000 (Journal of Laws 2022, Pos. 1097, 2642 (consolidated version)). This regulation was prepared by the Ministry of Transportation when The Water Law was prepared by Ministry in charge of Water Management. Recently both so called "sections of governmental administration" are located in the same ministry and the Ministry of Infrastructure is in charge of both water management and inland navigation

SPAIN

37. In Spain there is a broad regulatory framework. The Water Law of 1897 was repealed by the Water Law 29/1985, dated August 2, however, in order to provide sufficient legal coverage to water management and the protection of river ecosystems, it required various amendments, the most important being the Law 46/1999, dated December 13, amending the Water Law 29/1985, dated August 2, which required the aggregation of all the amendments in a consolidated text, the Royal Legislative Decree 1/2001, dated July 20, for which the Consolidated Text of the Water Law (CTWL) is approved.

38. Subsequently, the most significant reform of the CTWL has been the transposition of Directive 2000/60/EC, which establishes a community framework for action in the field of water policy (Water Framework Directive), through Law 62 /2003, to incorporate it into Spanish Law. The transposition of the Directive related to the evaluation and management of flood risks is established in the CTWL and in Law 2/1985, of Civil Protection and is developed in Royal Decree 903/2010, dated July 9, of flood risk evaluation and management.

THE NETHERLANDS

39. Over the last decades, multiple legislative reforms have supported a transition towards:

- Stronger regional water authorities and procedures (Constitutional Revision 1983);
- Integrated water management (Water Act 2009);
- Adaptive water management (Delta Act 2012);
- Risk based flood protection (Water Act 2017 revision);
- Improved planning procedures and public participation (Environment and Planning Act 2024).

The Table **2** below provides a brief summary of the key legislative reforms in the Netherlands.

Legislative reform	Description
1983 Constitutional revision	Confirmation of the legal position of regional water authorities as autonomous public administrative bodies alongside provinces and municipalities.
2009 Water Act	Integration of eight water related Acts with the purpose of legally operationalizing integrated management of the entire water system: surface water, groundwater, retention areas, flood defenses, and related constructions. The Water Act (2009) is set up to regulate the management of surface water and groundwater, and to improve the cohesion between water policy and spatial planning. In addition, the Water Act was established to reduce the amount of regulation, permit systems and administrative burdens.[12]
2012 Delta Act (Water Act revision)	The Delta Act stipulates that a Delta Program must be drawn up every year to ensure flood protection, adaptation to extreme climate effects and good freshwater supply. The law also stipulates that a Delta Program Commissioner must be in charge of drawing up and implementing the Delta Programme. The Delta Act also provides for a Delta Fund to co-finance the Delta Programme.[13]
2017 Water Act revision	Update of the legal standards for flood risk management from 1953-1960, due to an increase in flood risks as a result of population growth (from 10 million to 17 million) and economic growth (increase in GDP from 17 billion to 400 billion euros), and improved flood risk calculation approaches.[14]
2024 Environment and Planning Act	The Environment and Planning Act bundles and modernizes the laws for the living environment. This includes legislation and regulations on construction, the environment, water, spatial planning and nature. For the time being, the Act will replace 26 existing laws, including the Water Act, the Crisis & Recovery Act and the Spatial Planning Act. The new law aims at a coherent approach to the living environment, enabling local customization and better and faster decision-making. In addition, participation is promoted. For example, by involving citizens and entrepreneurs as much as possible in the development of the living environment. With the help of one single digital counter, it should become easier to start spatial projects. On January 1st, 2024, the new Act will come into effect.[15]

Table 2: Key legislative reforms related to managing water resource and flood risk management infrastructure

40. **Recent policy & organizational reforms:** In 2014, the OECD evaluated the extent to which Dutch water governance is fit for future challenges and outlines an agenda for the reform of water policies in the Netherlands.[16] It concluded that The Netherlands is a global reference for water management, with highly performing systems for water resources management, flood protection and water utilities at an overall cost of 1.26 percent of the country's GDP. The report highlighted some unique characteristics of Dutch water governance and financing, including functional democracies, a specific taxation regime, cost recovery. It was concluded that these "provide a robust basis for several functions of water resources management, such as water supply, wastewater collection, protection against floods, with limited political interference" (p.20). However, the report also pointed out several persistent challenges:

    - Concerns about water quality and freshwater ecosystem resilience, also in relation to low ambition level that is displayed by the Netherlands to implement the EU Water Framework Directive.
    - Check and balances directed at efficient expenditure rather than effective policy implementation.
    - A striking awareness gap among Dutch citizens related to key water management functions, how they are performed and by whom.

[12] https://www.helpdeskwater.nl/onderwerpen/wetgeving-beleid/waterwet/belangrijkste/
[13] https://www.deltaprogramma.nl/deltaprogramma/vraag-en-antwoord/wat-regelt-de-deltawet
[14] https://www.stowa.nl/deltafacts/waterveiligheid/beoordelen-waterkeringen/nieuwe-normering-van-waterveiligheid
[15] https://iplo.nl/regelgeving/omgevingswet/english-environment-and-planning-act/
[16] https://www.oecd.org/gov/water-governance-in-the-netherlands-9789264102637-en.htm

- Economic incentives and cost allocation for efficiently managing “too much”, “too little” and “too polluted” water could be strengthened.

In addition, several emerging challenges were highlighted, including climate change, regional disparities, socio-political trends, and path dependency to its flood protection system. Against this background, the following policy and organizational reforms are implemented over the last 15 years.

41. **National Administrative Agreement on Water Affairs 2011-2021:** In response to the decentralized governance setting of the Netherlands and expected rising water management costs (from €7 billion per year in 2010 to €8-9 billion per year in 2020), the National Administrative Agreement on Water Affairs was established in 2011 to improve the efficiency of water management in the Netherlands. The National Government, the Association of Netherlands Municipalities (VNG), the Interprovincial Consultative Body (IPO), the Union of Water Boards (UvW) and the Association of Water Companies (Vewin) agreed on joint actions towards less administrative pressure, clear responsibilities, smart and cost-effective collaboration[17]. Whilst the objective was to achieve total cost savings of €750 million per year by 2020, the final monitoring report (2021) concluded that these actions together resulted in total efficiency gains of over €1 billion (€668 million in the water supply and wastewater cycle and €404 million in water system management) with equal or improved performance of the “already well performing” infrastructure[18].

42. **National Water Programme 2022-2027:** The National Water Programme 2022-2027 (NWP) replaced the National Water Plan 2016-2021 and sets out the directions for national water policy and execution thereof in the national waters[19]. NWP is established under the Water Act, which requires the national government to develop a national water plan each six years. The NWP 2022-2027 anticipates on the new Environment and Planning Act, which will replace the Water Act in 2024, by combining and aligning a National Water Plan and a Management and Development Plan for National Water (Bprw) into one document. The NWP outlines the current water related challenges and ambitions of the Netherlands. The key challenges that are mentioned are: climate change (sea level rise, an increase of drought during spring- and summertime, more extreme rainfall during summers form the largest climate risks), soil subsidence (up to 2cm per year), surface water and groundwater pollution, biodiversity, and competing spatial claims.

43. The NWP is aligned with the National Strategy on Spatial Planning and the Environment (Nationale Omgevingsvisie - NOVI)[20], in which national government presents its long-term vision on the future development of the living environment in the Netherlands. In the NOVI it is acknowledged that water and soil systems should be guiding spatial developments[21]. Together with the Environment and Planning Act, the NOVI sets frameworks for how water targets should be included in broad taskings for the living environment, which are subsequently translated into further policy considerations in the NWP. Three policy ambitions are distinguished: 1) a safe and climate robust delta, 2) a competing circular and sustainable delta, and 3) a clean and healthy delta with high-quality nature.

[17] https://www.helpdeskwater.nl/onderwerpen/wetgeving-beleid/bestuursakkoord/
[18] BAW (2021) Monitor Lastenontwikkeling en Doelmatigheidswinst Bestuursakkoord Water over de periode 2010-2019; Eindrapportage lastenontwikkeling, doelmatigheidswinst en prestaties in het kader van het Bestuursakkoord Water. https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2021Z09035&did=2021D19837
[19] https://www.helpdeskwater.nl/onderwerpen/wetgeving-beleid/nationaal/nationaal-water-programma-2022-2027/
[20] https://novistukken.nl/english/default.aspx
[21] The role of water and soil in spatial planning is in 2022 emphasized and elaborated in a letter by the Minister for Infrastructure and Water Management to Parliament: https://www.rijksoverheid.nl/documenten/kamerstukken/2022/11/25/water-en-bodem-sturend

The NWP contains three parts:

A) Policy per theme: climate adaptation; flood safety; fresh water security; water quality, drinking water and wastewater treatment, groundwater, navigation, water and the living environment.

B) Management and operations of Rijkswaterstaat.

C) Integration of policy, management and operations into geographic specific areas.

The preparation of the NWP took 28 months from initiation in November 2019 until completion in March 2022. The NWP is the results of a participatory process that actively involved a wide range of actors from the public and private sectors.

44. **National Climate Adaptation Strategy:** The National Climate Adaptation Strategy 2016 (NAS)[22] sets the course for climate-proofing the Netherlands. It provides an overview of the main climate risks and sets priorities based on the six most urgent climate risks. The NAS constitutes the Dutch response to the European Commission's appeal to all the member states to draw up a climate adaptation strategy by no later than 2017. The NAS was submitted to the Cabinet at the end of 2016 and endorsed by the new House of Representatives at the end of 2017. Subsequently, an Implementation Programme 2018-2019[23] was established to assign roles and responsibilities for addressing urgent climate risks. An evaluation of NAS implementation[24] showed that the sense of urgency has increased, but also that the execution of the NAS needs to be faster. Three recommendations have been made to achieve this: 1) Concrete goals must be set and there must be more insight into the progress and effectiveness of the policy; 2) More management and coordination is needed and more implementation power for decentralized authorities. 3) More attention must be paid to the consequences of climate change for people, culture and nature. In reaction, a new Implementation Programme 2023-2030 will be published mid-2023. The program will include actions for the four climate trends (hotter, wetter, drier and sea level rise) within all relevant policy areas. Based on these actions, it is also examined what is still missing within the climate adaptation policy and who should work with it and how.

45. **Delta Programme:** The national government, provincial and municipal authorities, water authorities, Rijkswaterstaat and a range of stakeholder organizations are working on the Delta Program together, led by the Delta Commissioner (an independent government commissioner). According to the Delta Act 2012, the Delta Program sets out a strategy for future flood management, fresh water security, and water-robust and climate-resilient spatial planning. It uses a 100-year planning horizon and anticipates to varying development scenarios. The Delta Program contains Delta Decision that apply throughout the Netherlands:

- Delta Decision for Flood Risk Management: for protecting people and the economy and the economy against flooding from the sea, the large rivers, and the large lakes.
- Delta Decision for Fresh Water: for limiting water shortages and making good use of fresh water.
- Delta Decision for Spatial Adaptation: for the development of water-robust and climate-resilient areas, both urban and rural.
- Delta Decision for the Rhine-Meuse Delta: decisions for flood risk management and fresh water in the Rhine-Meuse delta.

[22] https://klimaatadaptatienederland.nl/en/policy-programmes/nas/
[23] https://klimaatadaptatienederland.nl/publish/pages/125102/nas_implementation_programme_1.pdf
[24] https://klimaatadaptatienederland.nl/publish/pages/125102/nationaal_perspectief_klimaatadaptatie.pdf

- Delta Decision for the IJsselmeer area: decisions for flood risk management and fresh water in the IJsselmeer area.

The strategic decision for Sand complements the Delta Decisions. It describes how the sand on the Dutch coast can protect the country in a natural way. In 2014, representatives of the provincial and municipal authorities, the water authorities and the Minister of Infrastructure and the Environment signed the 'administrative agreement for the Delta Programme'. Under the agreement, the government authorities take the delta decisions and preferred strategies into account in their own plans. The national government has set out the Delta Decisions in the National Water Plan 2016 (now National Water Program 2022-2027).

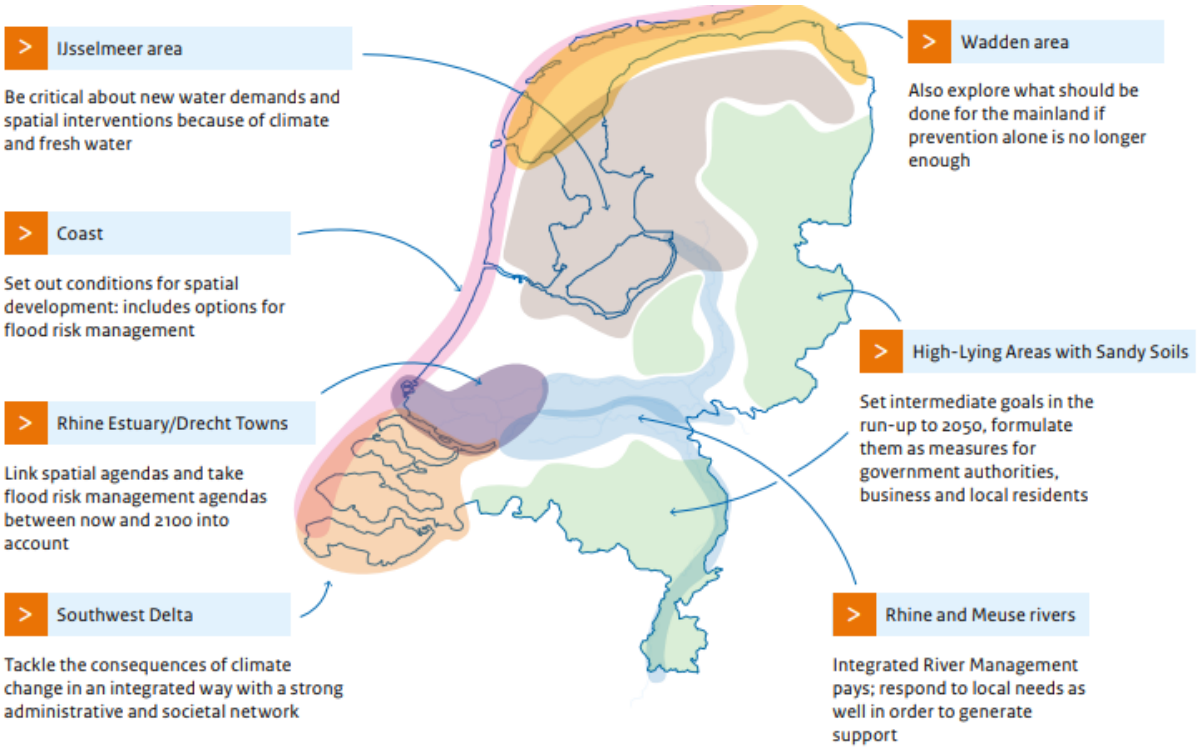


Figure 12: Bird's eye view of the key agendas in the Delta Programme areas (Source: DP2023)

Preferred Strategies for seven areas in the Netherlands are developed in line with the Delta Decisions (**Figure 12**). These are subsequently worked out in Delta Plans that include concrete measures for the implementation of the policy and planning for these measures. Progress made on the elaboration and implementation of the Delta Decisions, Preferred Strategies and Delta Plans is reported each year in the so-called Delta Programme publications. Proposals for possible changes to the Delta Decisions and Preferred Strategies are also included. The Delta Fund is established in 2013 for financing the implementation of the measures of the Delta Programme. The average budget will be 1.5 billion euros in the period 2023-2036. Of this, 52 percent goes to investments, and 48 percent to the costs of organization, management and maintenance. The government extends the Delta Fund annually by one year.

46. **Topsector Water and Maritime:** In 2011, the Topsector approach was initiated in the Netherlands as a reaction to the global financial crisis. The economic downturn caused government budget cuts, investment postponements by companies, and halted innovation. The 'Topsectors' were established with the aim of collaborating to revive innovation and investments in the economy.

The government of the Netherlands has identified the water industry as one of its nine Topsectors, which are considered amongst the world's best. The Topsector-approach is set up to maintain a world-leading position through intensive collaboration between public, private and knowledge agencies on innovation, human capital and positioning the industries internationally. Tools that are used include: investments, scale incentives, guarantees and the removal of barriers[25].

47. Registers: According to the Water Act, all waterways, engineering structures, banks and regional flood defenses in the Netherlands are described in a register. There are registers for national water infrastructure (Rijkswaterstaatswerken)[26] and floodplain vegetation that are managed by RWS as well as flood defenses[27] and water bodies[28] that are managed by RWAs. These registers consists of a formal decision and digital geographic datasystems, including maps that describe the location, shape, dimensions and safety standards of the aforementioned infrastructure. Property is mapped in the cadaster[29]. The registers are publicly available.

2.3 Institutional set up at national and river basin level

AUSTRIA

48. To understand Austria's institutional landscape regarding water service provision, the three administrative levels (national, regional, and local) need to be distinguished while recognizing the principle of subsidiarity. According to Stoa (2014) the subsidiarity principle of water resources management suggests that water management and service delivery should take place at the lowest appropriate governance level. Decentralization of water resources management seeks to ease the burden on central government institutions (and budgets), empower local communities and seem to be attractive to Austria with its existing federal structure. The lack of resources and capacity of small municipalities is compensated for by Technical Assistance by provinces and subsidies to effectively deliver services to the population.
49. **National level:** the policy-making line ministry of the sector is the Ministry of Agriculture, Forestry, Environment and Water Management ("Ministry of Water" in this report) which also sets the technical and subsidizing regulations for water supply, wastewater treatment, flood protection and water resources management. Water bodies apart from waterways and torrents fall under the responsibility of the Ministry together with the provinces. **The Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology** ("Ministry of Climate" in this report) is the policy-making line ministry regarding energy and environmental protection and designs subsidy instruments for these areas. The institutional responsibility for rivers depends on the classification into waterways (federal and border rivers), other rivers and torrents30. The Ministry of Energy is directly in charge of the Danube, March and Thaya waterways and stretches of the Enns and the Traun. Measures on these rivers are funded from federal sources and can leverage beneficiaries' contributions. The Waterways Law of 2004 (Wasserstraßengesetz WaStG) 2004 forms the basis for managing waterways and establishing the via Danube – Austrian Waterways Ltd as a public company to operate and maintain the abovementioned waterways and their infrastructure on behalf of the Ministry of Climate. Via Danube employs about 260

[25] https://www.topsectoren.nl/publicaties/brochures/2016/03/16/hoe-en-waarom-topsector-engels
[26] https://maps.rijkswaterstaat.nl/geoweb55/index.html?viewer=LeggerRijkswaterstaatswerken
[27] Register Flood Defences Waterschap Rivierenland
[28] Register Watersystem Waterschap Rivierenland
[29] https://perceelloep.nl/?gclid=Cj0KCQjw8NilBhDOARIsAHzpbLDW8LZdbqSYFq8uh-cAAk4qbgLbrgpT8n8BTD2Mh7gRlDaJqgE22NQaAqYkEALw_wcB
[30] Issues of torrent control are excluded in this analysis.

employees at the headquarters in Vienna (140 staff), 60 experts in flood control and riverbank maintenance based in service centers along the Danube and 60 staff for supervision of shipping at ten locks. **The Ministry of Finance and Ministry of Health** bear the traditional responsibilities of financing as well as setting tap water quality standards and monitoring drinking water quality compliance which are not further elaborated on here. **The Austrian Water and Waste Association** (Österreichischer Wasser- und Abfallwirtschaftsverband, ÖWAV)[31] is a membership association that channels voices of more than 3000 members at national and international level and offers a portfolio of training and certification.

50. **Regional level:** in line with Austria's federalism, the nine provinces implement and enforce national regulations via their administrative districts and oversee municipalities. The Provinces´ budget is composed by taxes they leva and a revenue allocation by the federal government, which is negotiated (Finanzausgleich) but there is no earmarking towards the water sector. The "impact of federalism on water management" is manifold. Water management issues are cutting across administrative boundaries and institutional responsibilities in several sectors. Combined with the added complexity of having slightly different provincial laws, additional effort is needed to ensure collaboration between national and provincial levels and between adjacent provinces. The organization of how to fulfil the water-related functions within the province administration is slightly different in the 9 provinces. In Lower Austria for example, the legal departments as well as the subsidy management are integral parts of the Water Directorate (Gruppe Wasser) and enhance "one-stop" assistance to municipalities and smooth project implementation. The Water Management Department has a budget for studies to generate and sharpen approaches for pertinent challenges in Lower Austria, which is not the case in all provinces as the political priorities for water can vary in different provinces. The decentralized administrative offices at district level (99 districts) lead to great closeness to municipalities and citizens and a deep understanding of issues and interests. It should not go unmentioned that the national, provincial and municipal political power relations can be quite different, leading to conducive or heavy working relationships between these levels. In this report, we present mainly the experiences from Lower Austria and Vienna. Austria traditionally has a strong and conducive relationship between sector institutions and universities that develop knowledge to respond to pertinent sector questions. The organization of the hydropower sector will be elaborated later on in this Report.

[31] https://www.oewav.at

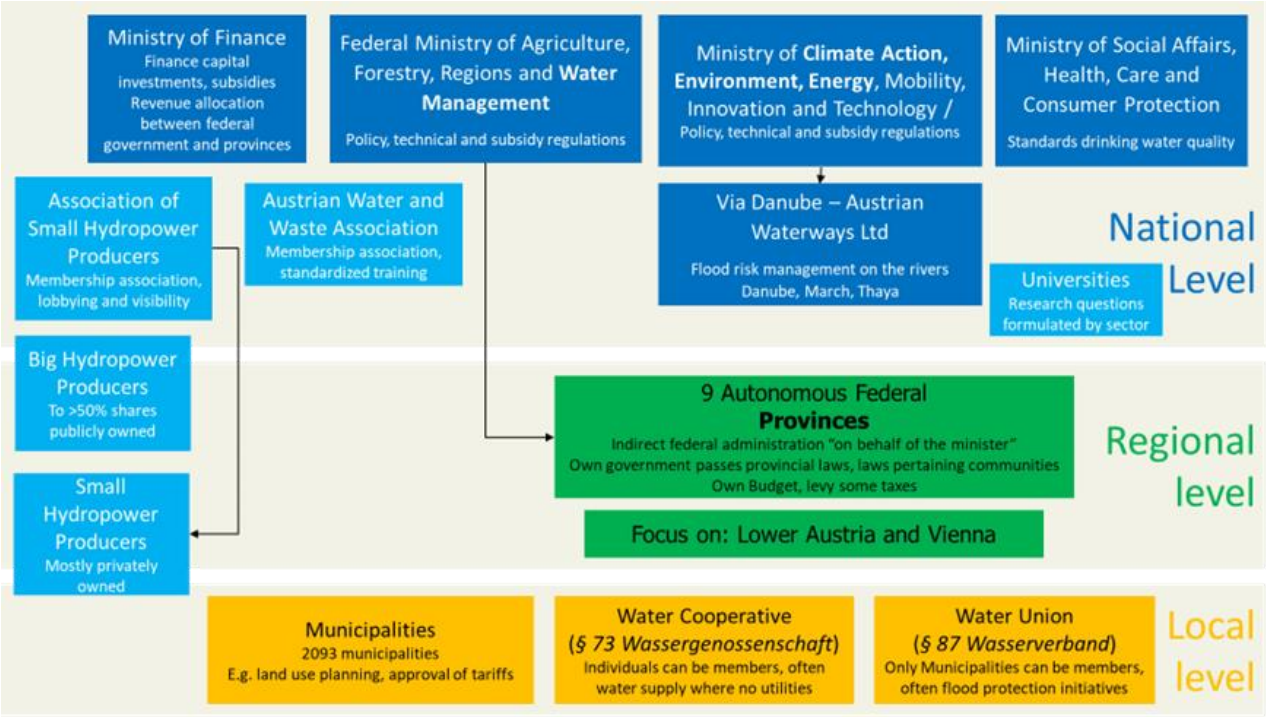


Figure 13: Austria´s water sector relevant institutional landscape (picture source: elaborated for the purposes of this report)

51. **Local level:** alongside their water and wastewater service provision responsibilities, municipalities are in charge of spatial planning and initiating measures (alone or through a §87 Water Union Wasserverband). §73 Water Cooperatives (Wassergenossenschaften) are organization forms the Water Law provides for, which are mostly used for water supply and wastewater service provision. Cooperatives are smaller (than unions) and individuals can become members. The municipal budget is composed of municipal taxes and revenue allocations by the federal government dependent on the size of the municipality. The municipal tax is the most relevant tax revenue municipalities generate and it´s paid by employers and typically constitutes of 3 percent of the employees' gross salary. There are no formally established River Basin Organizations (RBO) in Austria. Apart from Water Unions (formed in line with §87 of the Water Law) which are mostly formed at the occasion of flood protection measures across municipal boundaries, there are very few examples of formally established RBOs in Austria. In some catchments there is basic collaboration based on a joint work program.

52. **Transboundary level:** bilateral cross-border water commissions with all relevant neighboring countries are in place and cover water issues on bilateral local, and regional, coordinated by the Ministry of Water. Furthermore, Austria is a contracting party and active member of the International Commission for the Protection of the Danube River (ICPDR) and an observer in the river protection commissions for the Rhine (ICPR) and the Elbe (IKSE). Furthermore, River Basin Management Plans and Flood Risk Management Plans have been set up in close coordination with International River Protection Commissions.

FRANCE

53. Water management involves a large number of actors – public authorities, local authorities, economic actors and associations and is exercised at different geographical scales (European

framework, national framework, 6 water agencies, 13 regions, 96 departments and more than 35,000 municipalities).

A distinction from the perspective of their territory of action can be made between:

- the administrative organization with at each level an elected assembly and an executive body:
  - the state and its ministries (environment, agriculture, health…), its regional and departmental delegations and their respective services, its research institutes and its agencies of which the French Office for Biodiversity (OFB),
  - the regional authorities[32],
  - the departmental authorities,
  - the municipalities and their inter-municipalities,
- and the river basin organization with a representative assembly and an executive body:
  - the water agencies,
  - their sub-basin delegations,
  - and Public Territorial Basin Establishments (EPTB)

54. When it comes to implementation of the water laws and regulations, the main actors and their relationships can be represented as in the following page. In addition, the state controls the budget of the drinking water and wastewater services, of collective irrigation bodies, of regional development companies, of hydropower concessions, and the sanitary quality of drinking water. However, the size of the country and the diversity of local conditions make it necessary to apply the subsidiarity principle and give the local authorities the responsibility to implement the national framework and adjust it to the local conditions under control of the municipal mayor. The local authorities have to or can implement various public services related to water (drinking water and wastewater are mandatory, many others are not) and have therefore a wide diversity of choice in the overall organization of these services, including in the level of involvement of the private sector.

55. For floods, the municipal mayor is the primary responsible (civil security) together with the land and water related infrastructures owners (responsible of infrastructure security and application of security rules). The responsibility of the mayor is implemented by its Public Establishments for Inter-municipal Cooperation (EPCI) which is responsible for implementation of GEMAPI competences. In addition, a Public Territorial Basin Establishments (EPTB, a group of local authorities) may have a role in facilitating at the level of a basin or sub-basins, the prevention of floods, and where relevant also the defense against the sea. The state has also some responsibilities for developing the watching and warning system, the rescue means and the infrastructures which have a national or regional importance.

56. All these are summarized in the figure of the next page and detailed in **Annex 2**. Implementation is organized around three pillars: the sovereign pillar for laws, regulations, enforcement and police (orange), the financial and technical pillar for technical assistance, subsidies, taxes, fees and prices (blue), and the building and infrastructure owners (light green) and with the help of consultation bodies (dark green).

    Each administrative level has:

[32] Regional and departmental authorities are considered « territorial authorities » while municipalities are local authorities

- responsibilities with a specific thematic coverage to limit the overlaps, including to some extent water but also education, social protection, land use planning and transport, fire and rescue, culture;
- and its elected body (represented in the figure) which controls the action of its services.

On the other hand, the river basin organization is focused on water related aspects, including balanced water use and pollution, protection against floods and droughts, protection of the aquatic environment, and financing, watching and taxing all associated infrastructures.

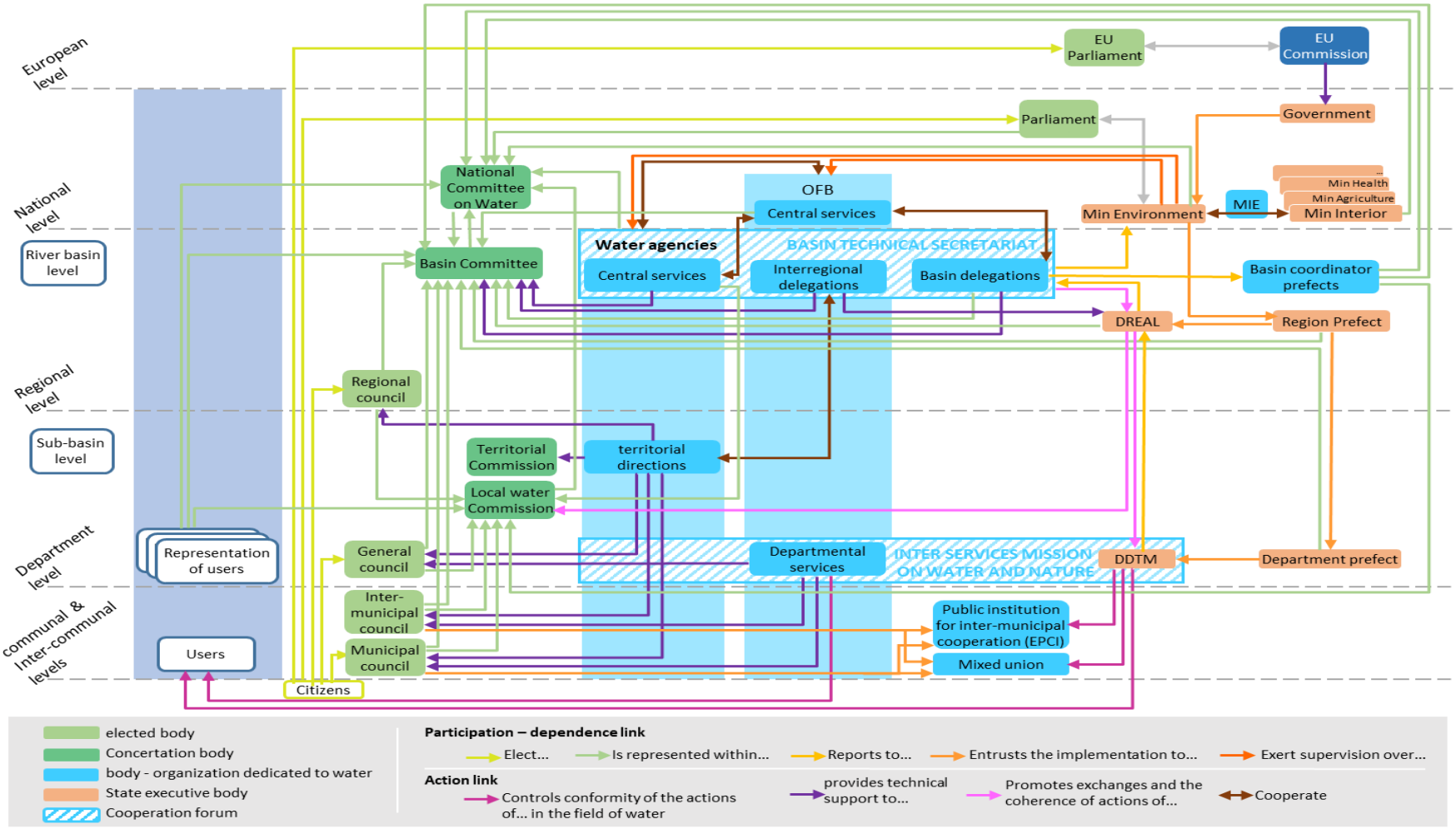


Figure 14: Water law enforcement: interactions between scales and actors, adapted from Faurel, 2019

POLAND

57. To present and explain the institutional set up at a national level it is important to know that starting in 1997 the Polish legal framework contained an Act of Sections of Governmental Administration which decomposes all governmental activities (and an allocated budget) in 37 sections[33] of governmental administration. This legal framework allows the Prime Minister with the flexibility to create ministries, nominate ministers, and allocating the appropriate list of sections. For example, the Minister of Infrastructure today is in charge of 4 sections of governmental administration: transportation, inland navigation, marine economy, and water management. The water management was delegated to the deputy minister of infrastructure. This is a political nomination from winning coalition in the elections. Two separate departments were created to manage water resources:

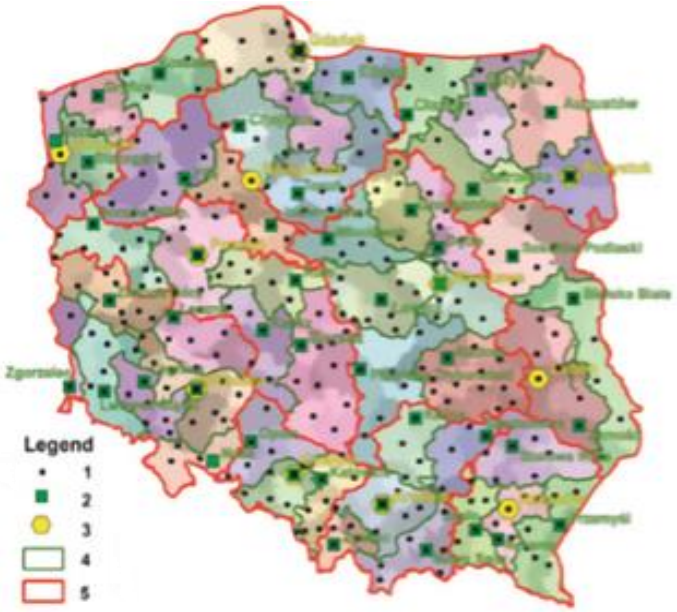
    - Department of Water Management and Inland Navigation,
    - Department of Jurisprudence and Supervision of Water Management.

58. The role of the first department is to support minister duties in the area of policy creation, preparation of legal acts for water management and inland navigation, preparation of opinions to any other governmental initiatives related to both sections of governmental administration and supervise the operations of State Governmental Enterprise – POLISH WATERS (hereinafter referred to as Polish Waters), and also operations of the Institute of Meteorology and Water Management (Polish hydrometeorological services and dam safety inspections) and operations of regional Inland Navigation offices. The other responsibility of this department is international cooperation in the area of water management and inland navigation. The mail role of the second department is control of decisions issued by Polish Waters for water users in case of appeals and issuing water permits for water users. The administration of water management and management of water resources is located in Polish Waters as an independent state legal entity with separate budget and revenue sources. This agency headquarters is located in Warsaw, and the organizational structure is defined by Water Law (Section VII, chapter 2):

    - KZGW – Country Water Management Board,
    - 11 RZGW – Regional Management Authorities,
    - 50 Catchment Management Boards,
    - 330 Water Supervising Committees.

    The territorial organization of Polish Waters presented on the map below (schematic) and in **Annex 3**.

[33] When the act was established in 1997 it was 23 sections of governmental administration, but it was modified many times in last 25 years and the number of sections is now 37.



Source: *PGW Wody Polskie (Kubiak-Wójcicka 2021) Note: (1) Water supervising committee headquarters, (2) Catchment management board headquarters, (3) Regional management authority headquarters, (4) Boundaries of catchment management boards, (5) Boundaries of regional water management authorities.*

Figure 15: Territorial organization of State Water Enterprise POLISH WATERS (PGW Wody Polskie)

59. The organization of the structure is based on delegation of some responsibilities to the lower levels in the structure. KZGW is in charge of strategic planning and management of water resources, finances of the organization and budget distribution to the lower levels in organization (Water Law art. 240, point 2). The lower level RZGWs, Subbasin Managements and Water Supervision Offices are implementing and execution agencies with detailed tasks and competences described in Water Law Act – article 240, points 3, 4 & 5. The system of nomination is very centralized. Minister is nominating president of the Polish Waters and recall him without any restrictions. Deputies of the president in Polish Waters also is nominating Minister, but on the request of Polish Waters President. Nowadays there are 5 deputies. President of Polish Waters is nominating and recalling RZGW directors and deputies. President of the Polish Waters is nominating and recalling directors and deputy directors of Subbasin Managements on the request of appropriate RZGW director. In case of mangers in the Water Supervision Offices, the nomination and recalling of the manager is the responsibility of the appropriate RZGW director at the request of the director of appropriate Subbasin Management and after asking for opinion of the local starosta (head of county self-government). The system is too much centralized and going 2 tiers down with the nomination responsibility. Opinion of the external organizations (local self-government) is only necessary for the bottom level of the organization: managers of Water Supervision Offices.
60. In summary, Polish Waters began its mandate on January 1, 2018, incorporating all governmental water management structures and taking over a vast majority of assets and staff from regional self-governmental structures that already were operating in water management. The starting level of employment was 5,467 in June 2018 and it was growing in following years achieving level 6,520 employees in the end of year 2021. That means in the 3 years following its inception, the increase in staff was 19,26 percent based on reports of the Superior Chamber of Audit from audits for fiscal years 2019, 2020 and 2021.

SPAIN

61. In Spain there is a broad regulatory framework. The Water Law of 1897 was repealed by the Water Law 29/1985, dated August 2, however, in order to provide sufficient legal coverage to water management and the protection of river ecosystems, it required various amendments, the most important being the Law 46/1999, dated December 13, amending the Water Law 29/1985, dated August 2, which required the aggregation of all the amendments in a consolidated text, the Royal Legislative Decree 1/2001, dated July 20, for which the Consolidated Text of the Water Law (CTWL) is approved. Subsequently, the most significant reform of the CTWL has been the transposition of Directive 2000/60/EC, which establishes a community framework for action in the field of water policy (Water Framework Directive), through Law 62 /2003, to incorporate it into Spanish Law. The transposition of the Directive related to the evaluation and management of flood risks is established in the CTWL and in Law 2/1985, of Civil Protection and is developed in Royal Decree 903/2010, dated July 9, of flood risk evaluation and management.

62. The management of the HPD, including the management of water resources and floods, and the bulk water supply services are a state responsibility and are structured through the RBOs, through agents supplying bulk water services (e.g., Mancomunidad de los Canales del Taibilla (MCT)[34]) and by ACUAES and ACUAMED as financing agents for water infrastructure. The User Communities, established in Law 46/1999 as public law corporations attached to the RBOs, can be entrusted with the operation and maintenance of hydraulic works through Agreements, where the conditions of the management delegation are defined, in particular its economic-financial regime, which obliges users to equitably meet the common expenses of operation, conservation, repair and improvement of infrastructures, as well as the corresponding charges/fees and tariffs.

63. The supra-municipal urban supply, sanitation and wastewater treatment services are planned and managed by the regional governments, and the responsibility for domestic water supply of drinking water and sewerage corresponds to the municipalities. There are various consultation and social participation bodies in the field of hydrological planning, such as the METDC's National Water Council (NWC) and the River Basin District Councils (RBDC), as well as the government and management bodies: Governing Board, Assembly of Users, Commission on Dam Water Release and the infrastructure works Boards and Exploitation Boards, all of them dependent on the RBOs.

[34] https://www.mct.es

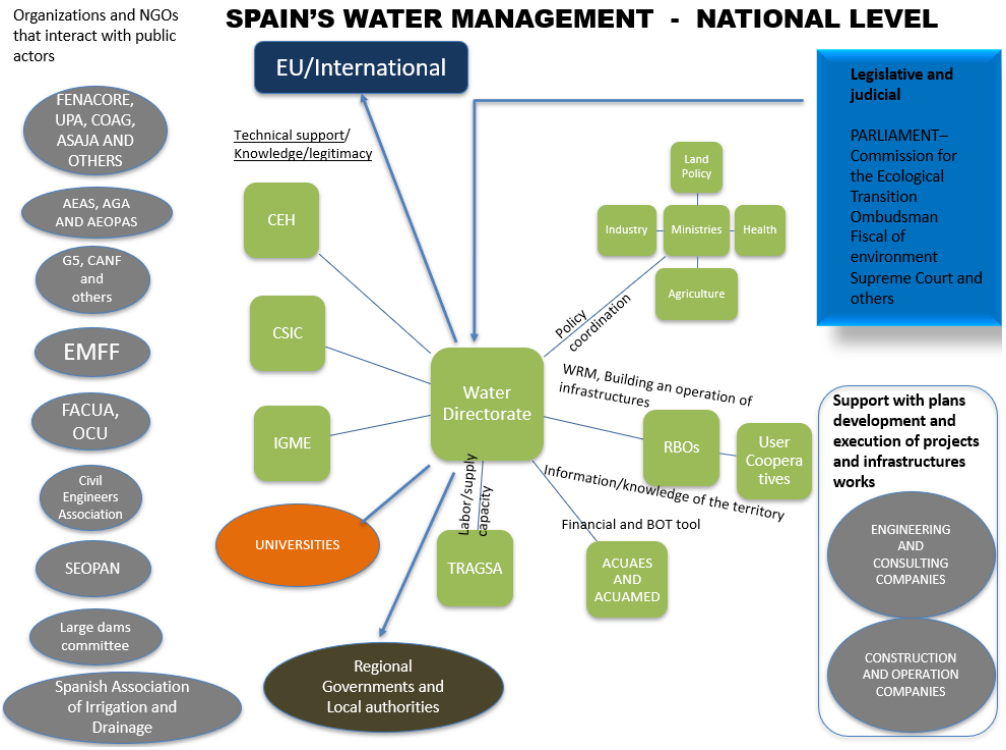


Figure 16: Structure of the water sector in Spain. Source: Libro verde del Agua.

64. Within the framework of the NWC, the GDW articulates the participation of the General State Administration (GSA) and regional and local governments, as well as trade unions, business, professional and economic organizations related to water uses and environment defense organizations. The GDW participates in the processes of development and implementation of water policies in Europe and specifically in the implementation and monitoring of the Water Framework Directive (WFD) 2000/60/EC, of Directive 2007/60/CE, relative to the assessment and management of flood risks, and of Directive 91/271/EEC on the treatment of urban wastewater, for which it compiles existing information in the RBOs and other administrations and sends the data to the common information and monitoring system WISE (Water Information System for Europe).

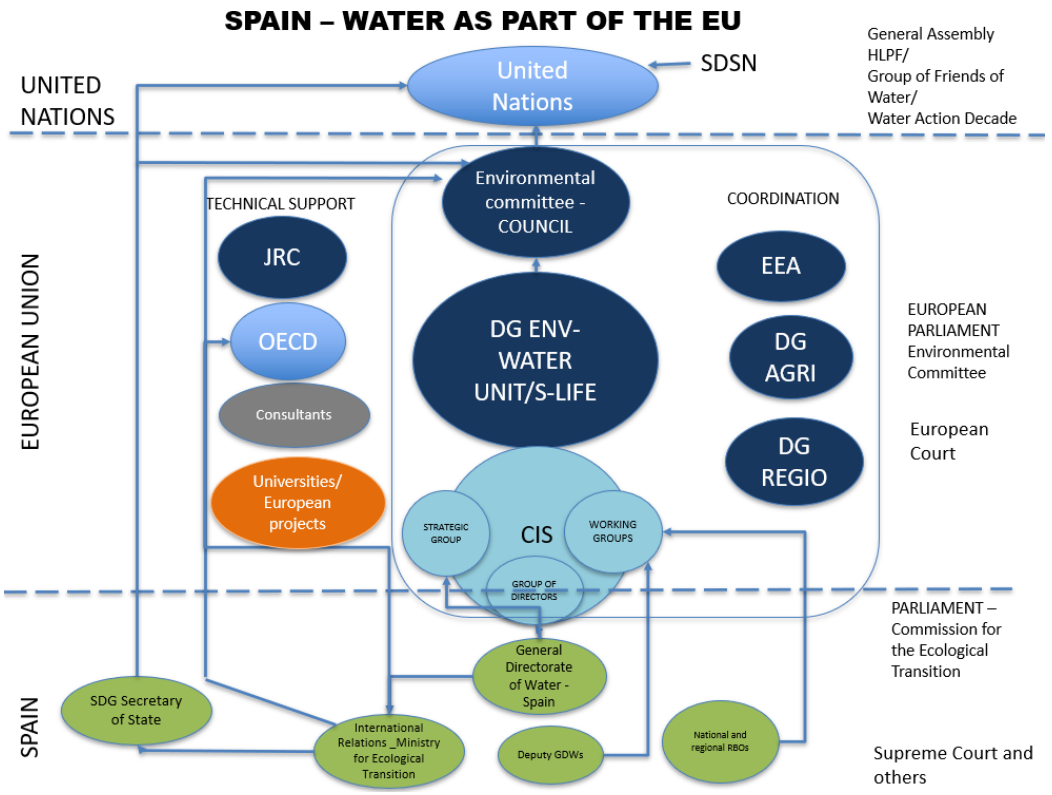


Figure 17: The water sector as part of the European Union. Source: Libro verde del Agua.

65. The water authorities are entrusted with the administration and control of the Water Public Domain made up of:

    - Inland waters, both surface waters and renewable groundwater irrespective of the time of renewal.
    - The beds of natural streams, whether continuous or discontinuous.
    - The beds of lakes and lagoons and those of surface reservoirs in public watercourses.
    - Aquifers, for the purposes of acts of disposal or affection of water resources.
    - Water from the desalination of seawater.

    The land in the riversides subject to maximum ordinary floods is considered public domain and hence they are property of the water authorities. In addition, the RBOs may be given State and Autonomous Community land and assets other than those in the public domain, for their use, administration, and exploitation when they are necessary for RBOs to fulfill the functions entrusted to them.

    Independently of these assets assigned for the fulfillment of their purposes, the RBOs may have their own assets made up of:

    - The assets that appear in their patrimony.
    - Those that they may acquire with funds from their budget.
    - Those that they may receive by any legal title from the State, the Autonomous Communities, public or private entities, or private individuals.

66. Land bordering watercourses is subject, along its entire length, to an easement zone of 5 m wide for public use (in each side) to protect the river ecosystem and the public domain, to allow pedestrian passage, for surveillance, conservation, and rescue work and occasionally for the

beaching and mooring of boats. Several activities and land uses are also subject to a 100 m police zone. The definition of these zones aims to preserve the public domain, prevent the deterioration of river ecosystems, and protect the flow regime during floods. The occupation or use of watercourses, lake and pond beds and reservoirs in public watercourses is subject to licensing and a charge for the use of public water resources.

THE NETHERLANDS

67. As highlighted in above, Rijkswaterstaat and the Regional Water Authorities are the executive water management organizations that are most similar to ANAR. Their major for infrastructure renewal and upgrade are organized in programs. In this chapter, three programs are highlighted: 1) the National Flood Protection Program (HWBP), which is the largest dike reinforcement operation since the Delta works, 2) Room for the River, and 3) Meuse works. Although multi-actor alliances are formed for all three programs, there are fundamental differences between these alliances.

68. **Rijkswaterstaat (RWS):** RWS is responsible for the design, construction, operations and maintenance of the main infrastructure facilities in the Netherlands, including national roads, main waterways and open waters. Rijkswaterstaat is the national water authority responsible for protection from floods by rivers, lakes and the sea (storm surge barriers, dams and major sluices), good environmental status of water bodies, reliable and well-coordinated water management throughout the Netherlands, clean and ecologically healthy water systems and safe and flowing navigation with constant attention to environmental sustainability. RWS operates as an executing agency under the responsibility and supervision of the Ministry of Infrastructure and Water Management (MinI&W). As such, it acts as asset manager and as advisor for the policy that is developed by MinI&W, especially with regards to the policy making, planning and implementation of large water projects including the national flood protection program and the renewal of storm surge barriers, major sluices and weirs.

    In addition to its the operational activities RWS has a role in water-related knowledge, which includes advising the Delta Commissioner in building a knowledge network for the Delta Programme, supporting capacity development of knowledge managers and building synergies with other knowledge institutes such as Deltares, universities and the private sector. In 2020, RWS had a budget of 5.3 billion euros (**Table 3**). RWS's objectives depend on the (often long-term) policy objectives and frameworks indicated by MinI&W. These policy objectives are formulated in the policy articles of the National Government Budget Chapter XII. This budget requires yearly Parliament approval.

Expenditure	Amount (million Euro)	
Capex (Infrastructure Fund)	2.295	
National Roads		339
National Waterways		1.316
National Water System		553
Zuidasdok[35]		86
Capex (Other)	10	
Noise insulation Schiphol Airport		3
Departmental Coordination Centre Crisis Management		7
Opex (network maintenance and operation)	1.692	

[35] https://zuidas.nl/en/zuidasdok/

National Roads		986
National Waterways		389
National Watersystem		279
Other Network Related Opex		38
Opex (organizational costs)	1.283	
Staff cost		993
Equipment cost		260
Other Organizational costs		29
TOTAL EXPENDITURES	**5.280**	

Table 3: Rijkswaterstaat budget 2020 (all amounts are rounded)[36]

Most of RWS's Capex is funded by through the Mobility Fund (until 2021 Infrastructure Fund).[37] The Mobility Fund is part of the national budget from which national roads, rail and water projects are paid. The Mobility Fund is by far the largest cost item of the Ministry of Infrastructure and Water Management (**Figure 18**)[38]. This Fund ensures multi-year availability of funding sources and stability of expenditures. Each year, the duration of the Fund is extended with one year (until 2036 in the budget of 2023) and as a result new budgetary space becomes available for a new year at the end of the duration of the Fund. In addition, the balances (negative or positive) can be carried over to the following year, in contrast to regular budgets. This means, for example, that if a project can start later than planned due to delays in procedures, the funding in the Mobility Fund will be maintained. Each year a budget is drawn up for the Mobility Fund. The financing of projects is laid down in the Multi-year Program for Infrastructure, Spatial Planning and Transport (MIRT) with a horizon similar to the Mobility Fund. Decision making for the investment projects of the program follows a fixed yearly cycle.

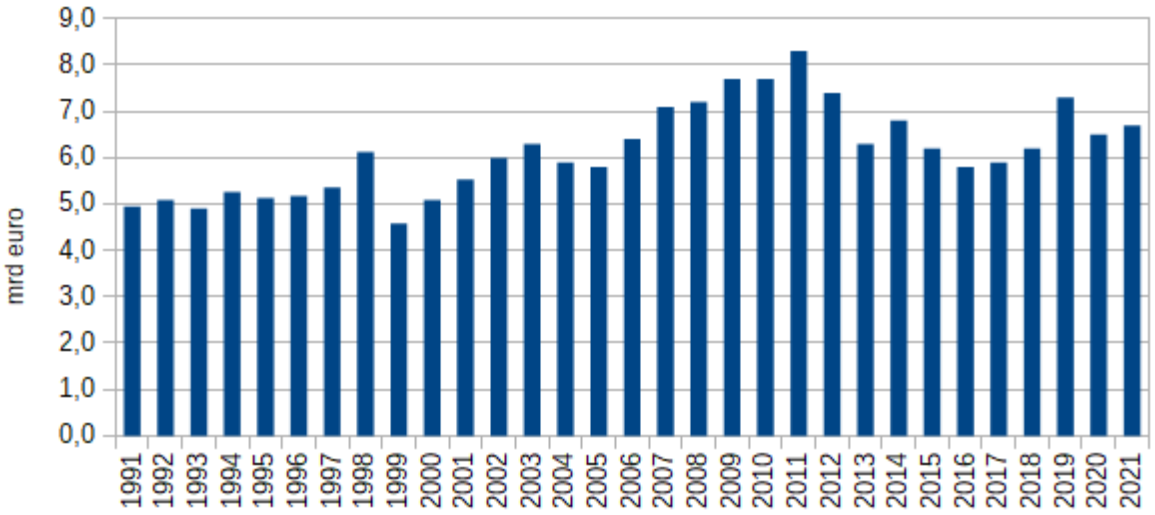


Figure 18: Yearly budget (in billion euros) of the Infrastructure Fund (in 2022 replaced by the Mobility Fund)

[36] Costs for network maintenance and operation relatively high compared to other years due to high production of maintenance works in the context of COVID (i.e., low network use).
[37] In the Infrastructure Fund there was a fixed distribution key between infrastructure modalities, but this was removed in the Mobility Fund because there is a need for flexibility to adapt to rapid technological developments (e.g., smart mobility) and efficiency. However, the multi-year and stability essence of the Fund remained the same.
[38] Capital investments in the national water system are shifted to the Delta Fund after that was established in 2013.

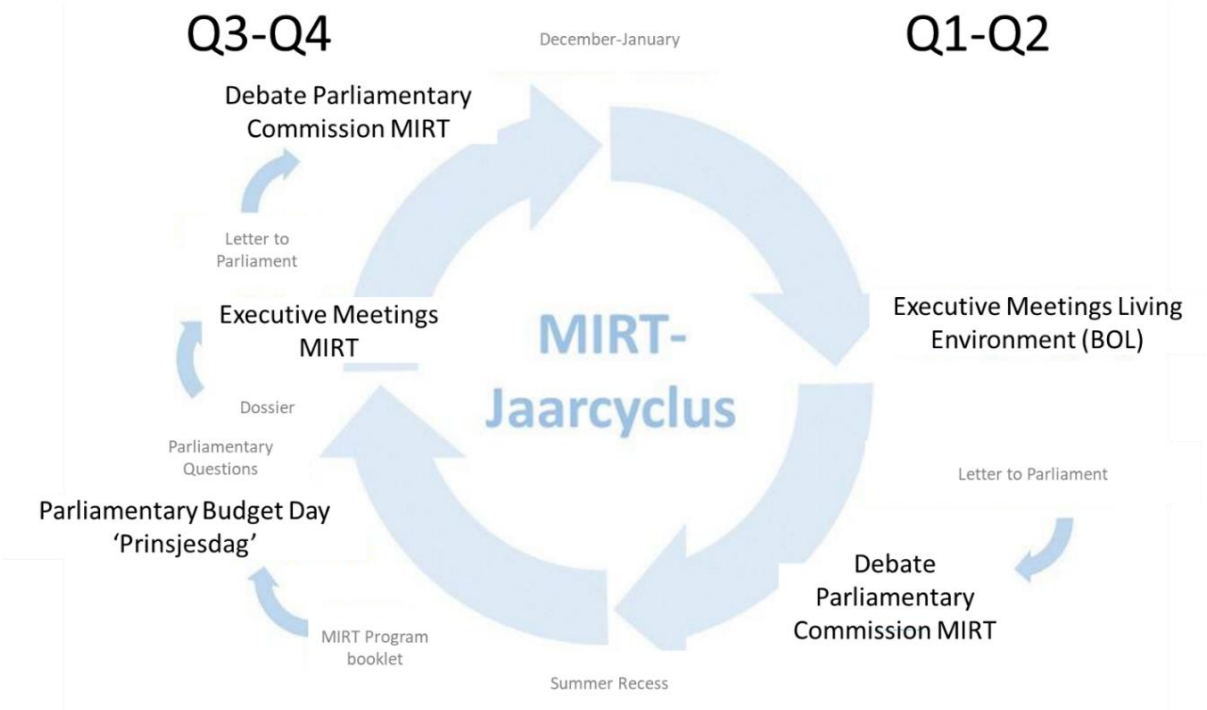


Figure 19: Yearly cycle MIRT (Multi-year program for Infra, Spatial planning and Transport projects)

69. **Regional Water Authorities (RWAs)[39]:** RWAs are functional, decentralized government institutions, with tasks exclusively in the field of water management: managing water defenses, quantity and quality, and navigable waterways. The position of the water authorities is described in the Dutch Constitution, article 133: "1. The establishment and dissolution of water authorities, the regulation of their tasks and structure and the composition of their governing bodies take place in accordance with the provincial bye-laws prescribed by law, if not otherwise provided for by or pursuant to the law. 2. The regulatory and other powers of regional water authorities' governing bodies and the public nature of their meetings are laid down by law. 3. The provincial and other supervision of these governing bodies is laid down by law. Decisions made by these governing bodies can only be annulled if they are in conflict with the law or the public interest." This is further specified in the Regional Water Authority Act (1992). The total number of RWAs has decreased from 2,647 in 1950 to 21 in 2018 due to mergers. The boundaries of the regional water authorities are primarily determined by factors relating to water management: catchment and sub-catchment basins, dike rings, pumping and storage areas, etc. As a consequence they do not usually correspond with municipal or provincial borders. More than half of the RWAs have an interprovincial character. The area managed by the Rivierenland water authority, for example, covers parts of no less than four provinces.

70. The RWAs are the oldest form of democratic government in the Netherlands. The first water authorities date from the 13th century and are established as a means to manage the realization and maintenance of dikes and polders. Nowadays, RWAs are functional decentralized administrations with their own governing body and financing structure. From a hierarchical point

[39] Dutch Water Authorities (2017) The Dutch water authority model. https://dutchwaterauthorities.com/wp-content/uploads/2021/05/The-Dutch-water-authority-model.pdf

of view, the regional water authority has the same status as the municipality, while the provinces carry the responsibility to set up, discontinue, lay down rules for and supervise the RWAs. In 2012, the position of RWAs became subject for debate when the National Government set out a long-term perspective of five regions that would replace the existing twelve provinces. Waterboards would have to be merged with these regions. However, after a review by the OECD (2014)40 that concluded that the multi-level water governance model of the Netherlands is a "global reference" the Government decided that there was no need to advocate administrative or organizational changes in water governance and that administrative upscaling of RWAs would be left to the discretion of RWAs themselves.

71. The board of a regional water authority consists of a governing board (policy setting) and an executive board (policy execution) that is headed by a chairperson (RWA legal representative; see also Annex 2). Each four years, RWAs have elections for the governing boards just like municipalities and provinces. In addition, a number of seats is secured for representatives both agriculture and nature. Holders of these seats are not elected, but determined by the sector organizations for respectively agriculture and nature. RWAs fund their operations primarily through their own taxes. The maintenance of the water system, which includes water defenses, quantity, and quality, is financed through water system levies and to a lesser extent, surface water pollution levies. Additionally, the RWAs utilize revenue from wastewater treatment levies to cover the costs of waste water treatment. The financial system of regional water authority taxes allows them to remain financially independent of national politics and economic changes. Therefore, investments in water control measures are not compromised by competing with other government expenses. This financial stability is a strong assurance of sustainable water governance. Moreover, the autonomy of the regional water authorities creates an advantageous opportunity for acquiring long-term loans from the NWB Bank to fund major investments.

72. **National Flood Protection Program (HWBP):** The HWBP is an alliance between the 21 RWAs and RWS that collaborates on project execution, finance and knowledge development to ensure that the primary flood defenses meet the flood safety standards in 2050. The scope and objectives of the HWBP are set in the Program Plan 2019-2023. At present, it is estimated that the HWBP needs to upgrade approximately 1,500km of dikes and 400 sluices and pumping stations. For this, the RWAs and RWS together transfer €380 million/year to a joint 'dike account'. €10 million/year from the dike account is spent on innovation. A program board is responsible for ensuring that the HWBP is implemented within established frameworks, budget and time. The HWBP program board consists of an equal representation of directors of the water boards and Rijkswaterstaat. In addition, a HWBP program directorate is established for directing, facilitating and testing role in the implementation of the HWBP. On behalf of the alliance, the management ensures the sober, efficient and controlled use of the available resources in order to achieve the program objectives together. The main responsibilities of the Program Director are:
    - Directing the annual preparation of the program.
    - Timely testing of subsidy applications and drawing up subsidy decisions.
    - Guiding and, where necessary, supporting administrators in their projects.
    - Identifying issues in the preparation and realization of projects and ensuring timely decision-making.
    - Signaling bottlenecks in the application of (policy) frameworks for the implementation of the HWBP and ensuring agenda setting and decision-making at the appropriate tables.

[40] OECD (2014) Water Governance in the Netherlands: Fit for the Future? OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264102637-en.

- Prepare progress reports on the program.

73. The program directorate is supported by a council of RWA and RWS directors, a regular meeting of representative officials (RWA and RWS department heads responsible for managing the projects within their respective organizations).

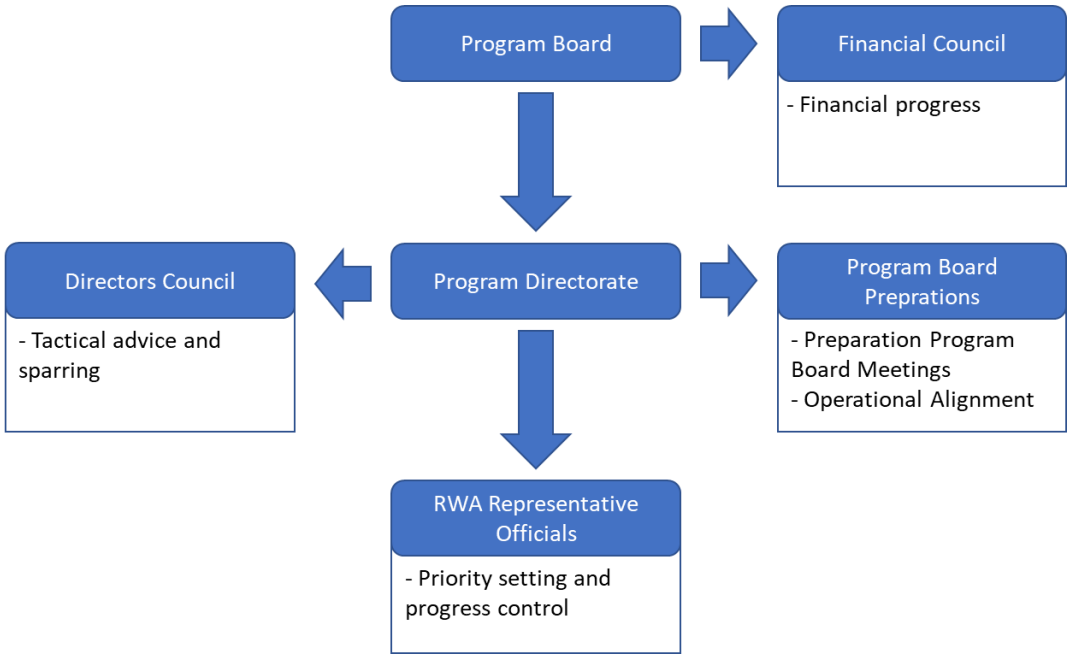


Figure 20: HWBP Governance

74. There is a subsidy scheme for funding the strengthening works of HWBP. On a project level, the National Government funds 50 percent, all waterboards together 40 percent and the respective waterboard who is executing a particular project 10 percent. An independent evaluation concluded that the HWBP subsidy scheme is effective, but that there are opportunities to improve cost efficiency of the program, for example, via clearer regulations for subsidy allocation, improved guidance for land acquisition, improved uptake of Life Cycle Costing, and exploring options for dealing with 'small probability, large consequence' risks[41]. In the elaboration of this, it may turn out that for some points an adjustment of the subsidy scheme may be desirable. A point of concern is the portfolio planning of HWBP projects. On the short term, a 'best for program' planning should be determined, whilst the budget available is insufficient to meet all the demands of RWAs involved[42].
75. **Other programs:** Room for the River and Meuse works: Effective program delivery requires fit-for-purpose governance[43]. Two other programs that are worthwhile to mention are Room for the River and Meuse works. Both were established in the aftermath of the 1993 and 1995 floods to create more space for the river Rhine (Room for the River) and the River Meuse (Meuse works). Whilst Room for the River required €2.3 billion of public investments, Meuse works almost completely covered by the financial gains from the extraction of gravel, sand and clay. Room for the River, consisting of 34 projects, was realized within budget and on schedule. The program

[41] https://zoek.officielebekendmakingen.nl/kst-32698-50.html
[42] https://unievanwaterschappen.nl/terugblik-op-de-commissie-waterkeringen-van-2-november/
[43] Rijke, J. S. (2014). Delivering change: towards fit-for-purpose governance of adaptation to flooding and drought; PhD dissertation, UNESCO-IHE Institute for Water Education, Delft and Delft University of Technology. http://resolver.tudelft.nl/uuid:1e7c1d58-2aa3-47ea-8c2f-33d11b9f9983

employed a mixed centralized –decentralized governance approach to meet its primary flood protection objective (operationalized in terms of centimeters water level reduction) and its secondary objective of enhancing spatial quality (operationalized through process design and mandatory expert reviews). The program was almost completely funded by the National Government as its budget was earmarked for flood protection. Only project add-ons related to recreation or ecosystem restoration were funded by local and regional government agencies. A central program directorate monitored progress on both objectives and facilitated the respective projects involved. The program directorate was staffed by RWS, whilst the projects were managed by municipalities, provinces or RWAs. By doing so, the program has tackled governance pitfalls related to centralized planning approaches that previously impeded integrated water management in the Netherlands[44], particularly those related to collaborative learning and program adaptation[45]. Meuse works relied on a public-public partnership for the Zandmaas and a public private partnership for the Grensmaas. The program consisted in total of 55 flood protection projects in combination with the realization of 1600ha ecosystem restoration and had an important financial basis that was provided by the extraction of 60 million tons gravel, sand and clay[46]. The project budget for Zandmaas was €405 million (approx. €204 million for river widening and €190 million for embankments and dike strengthening)[47]. The total cost of Grensmaas is estimated at €700 million, which is for approximately 80 percent covered by the financial benefits from the extraction of gravel, sand and clay [4648]. A key lesson from Grensmaas, however, entailed that the pace of the project was mainly determined by outlets of gravel and sand instead of a predetermined schedule, meaning that an adaptive approach to contract management was required[49].

2.4 Specific responsibilities for operating, managing and modernizing water resource and flood risk management infrastructure

AUSTRIA

76. Regarding responsibility for hydraulic engineering infrastructure in Austria, the type of river needs to be taken into account, as mentioned in the institutional section above. Also, the presence of structures and the kind of infrastructure (hydropower, flood protection) impacts the responsibility, and this section is structured accordingly. Waterways – “federal” and border rivers. The Ministry of Energy is directly in charge of the Danube, March and Thaya waterways and stretches of the Enns and the Traun. They created the via Danube as their operational arm to fulfil the legal requirements per the Waterways Law of 2004. The responsibilities of via Danube[50] include:
    - Planning and implementation of hydraulic engineering projects;
    - Regulation, conservation and development of water and flood protection systems;

[44] Rijke, J., van Herk, S., Zevenbergen, C., & Ashley, R. (2012). Room for the River: delivering integrated river basin management in the Netherlands. *International journal of river basin management*, *10*(4), 369-382.
[45] Rijke, J., van Herk, S., Zevenbergen, C., Ashley, R., Hertogh, M., & ten Heuvelhof, E. (2014). Adaptive programme management through a balanced performance/strategy oriented focus. *International Journal of Project Management*, *32*(7), 1197-1209.
[46] RWS (2016) 31e Voortgangsrapportage Zandmaas en Grensmaas; 1 juli – 31 december 2016. RWS-2017/710. https://zoek.officielebekendmakingen.nl/blg-803623.pdf
[47] RWS (2019) Factsheet Zandmaas. https://open.rws.nl/open-overheid/onderzoeksrapporten/@60089/factsheets-maaswerken-factsheets/
[48] RWS (2019) Factsheet Grensmaas https://open.rws.nl/open-overheid/onderzoeksrapporten/@60089/factsheets-maaswerken-factsheets/
[49] Twynstra Gudde, Decisio, SWECO (2016) Beleidsmatige tussenevaluatie grote waterveiligheidprogramma's. https://www.helpdeskwater.nl/onderwerpen/@178729/beleidsmatige-tussenevaluatie-grote/
[50] https://www.viadonau.org/en/home

- Measuring, collecting and processing hydrographic data;
- Development of waterway transport at the national and international levels, including new technologies for inland waterways (especially River Information Services);
- Operation of Danube locks, supervision of weirs and water bodies overall.

77. **Other rivers – natural stretches:** the owners of the land adjacent to a river are in charge of stretches where there are no permit holders in charge of maintaining infrastructure. In the interest of the river bank maintenance and to prevent flooding, the owners can be requested to act by official order by the water management administration. Typical works include cutting trees and shrubs that obstruct the available cross-section in case of flooding and appropriate planting on river banks to avoid erosion. Also, correction of bank erosion and the clearance of small channels of woody debris and other objects which impede drainage or promote the deposition of sand gravel, provided that this does not require special expertise and does not involve considerable costs. The municipalities or provinces only support if the work in terms of complexity or magnitude is beyond the capacity of landowners or if there is imminent danger. If the river stretch falls under a designated Natura 2000 area there is a set of rules and obligations to be adhered to in using and managing land adjacent to river banks. Overall, the leverage of the water sector to prescribe land use and management for farmers is small. Apart from the fact that a reduction in the intensity of farming practices can only be agreed upon for a limited number of years, monitoring actual compliance is weak.

Figure 21: Development of newly created side arm over several years – little need for intervention (picture source: Sonja Hofbauer)

78. **Public water reserves:** river beds and flood areas. Riverbeds and flood areas around it are public water reserves if the federal government is the registered owner of the land. Public water reserves are of immense importance for the public in the sense of ensuring ecological functionality, recreational purposes and retention of floods to protect the lives and property of people downstream. In the aftermath of the flood events in 2002 and 2006, the government acquired flood plains that experienced heavy river morphological alterations and integrated them into the public water reserves (240 ha in Lower Austria). Also, other provinces, often in the frame of LIFE projects, could purchase land for the rivers to reconnect flood plains, cut-off channels and riparian forests (Naturschutzbund, 2012). With this, the responsibility for maintenance shifts to the province, which is only possible in areas of immense public interest. With limited maintenance resources, the province administration favors adjacent land and riverbanks being maintained by land owners, often farmers.

Figure 22: After the flood (above) and years later (below): Areas that experienced heavy morphological changes during floods in 2002 were purchased by the province and integrated into the river reserve, for

example, in Stallegg 3ha around a new sidearm at River Kamp, a Danube tributary in Lower Austria (picture source: Sonja Hofbauer (above) and https://www.umweltdachverband.at/themen/wasser/renaturierung-erleben-fluesse-wertschaetzen/kamp-stallegg/ (below))

79. **Rivers with flood protection infrastructure:** at rivers other than federal and border rivers, the process of developing measures to improve flood protection, ideally combined with improvements of the ecological status, is initiated by an "interested party". Typically, this is the principal benefitting municipality or groups of municipalities organized in a Water Union as prescribed by the Water Law §87. Also, beneficiaries such as individual companies located in the flood area or water supply cooperatives (as per §73 of the Water Law). The availability of land for measures determines the technical feasibility. Financing of any measures is a shared between the federal government, the province, and the municipality/union. Setting up a maintenance and repair plan has been an integral part of any flood protection project since 2016 to minimize restoration efforts while ensuring the functionality of the measures throughout its life span (Ministry of Water, 2018). The interested party is in charge of operation and maintenance, with technical and financial support available if the capacity at that level is overstretched. For routine minor maintenance around dams and retentions areas, Municipalities often engage can engage their own staff.

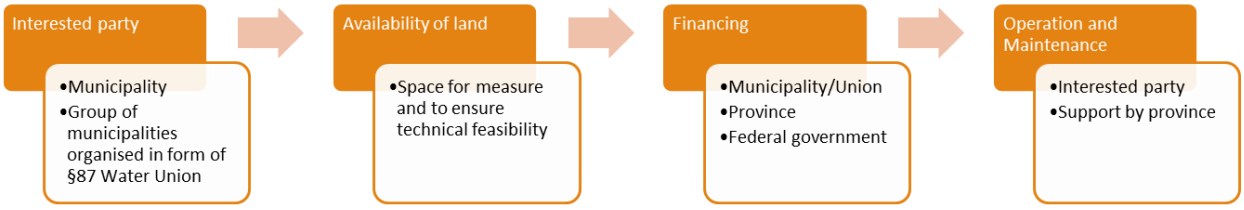


Figure 23: Project process from interest to operation and maintenance (pictures source: elaborated for the purposes of this report)

80. **Stretches with existing permits for hydropower water usage:** a clear responsibility for operation and maintenance of facilities arises if there is an existing permit e.g., for hydropower usage. The permit conditions prescribe the framework for construction and operation. It´s a new structure the authority requires a design that minimizes the impact on the river and compensatory measures to reduce the environmental impact such as compensatory measures if riparian forests have to be cut. For operation, the permit conditions prescribe residual flow and operation in case of floods. The permit holder is in charge of maintaining the assets and the river banks around the plant. For bigger hydropower plants, measures of sediment management and operational monitoring can be agreed upon after implementing measures to improve the ecological status.

81. **Special case ponds on small streams:** along smaller tributaries storage ponds are also created and used for fishing purposes. Some of these use existing barriers previously used for hydropower generation. Since the extreme flood year 2002, in Lower Austria, the authorities require operating regulations for such storage areas and ponds. Among other things, these provide for control of water levels in coordination with authorities and downstream users. In addition, the state of the art is continuously reviewed, especially on older ponds, and improvements are prescribed if necessary. Normally, the maximum permissible water level has to remain 50 cm. below the top of the dam (Matzinger, 2014). In the aftermath of the 2002 flood events, the individual responsibility of at least three competent people for operation of structures was determined in addition to training the voluntary fire brigade to be able to operate in case of imminent danger. Despite the requirements for communication between "adjacent" permit holders, the

coordinated operation of weirs and dams along one river, especially where the backwater of one structure is close to the upstream barrier needs improvement.

82. **Stretches with old barriers without permits:** the removal of "ownerless" barriers ("de-damming") in smaller rivers where permits expired years ago are initiatives carried out by the province and fully funded by the federal government. The measures to attain the targets of the National River Basin Management Plan are one-off measures and concern the river reserve, and it is of public interest to remove these barriers. For example, in 2021, five old barriers along the river Kamp in Lower Austria were removed, an investment of 0,5 million EUR, fully paid by the federal government (Ministry of Water, 2021).

83. **Cases of high complexity or imminent danger:** the in-house staff of the Province only gets active if there is imminent danger or the measures to be taken are very strategic or too complex and, therefore beyond the capacity of the land owner. The province has its own staff and equipment but can outsource works depending on size and complexity in line with public procurement regulations.

FRANCE

84. Floods and water resources both relate to the water quantities flowing in the environment, and from environment to economic activities and back. For both, the general framework is presented in previous sections. Technically, the management of natural water resources in terms of quantity is supported by an information system and called Hydroportal (https://www.hydro.eaufrance.fr/), which makes freely available all public data relating to the height and flow of rivers (about 3000 hydrometric stations in activity in 2023), and developed by the SCHAPI (Central Service for Hydrometeorology and Support for Flood Forecasting). The database is used for floods and droughts, including for rapid reaction in high flows and for planning dam releases when the flow are low and water is needed (drinking water, nuclear powerplant cooling etc.).

85. **WATER RESOURCES:** For the management of water resources, the general principle is to balance the needs for humans and the needs for the aquatic environment. To this end, the natural water resources are considered on the one hand, and the human activities with effects on them on the other hand. In granting permits for these activities, the authorities have to ensure the adequate protection of the aquatic environment and they usually use the monthly (M) minimum (N) flow (Q) of each calendar year (A) calculated with a return period of five years (QMNA5). This balance has up to now been possible on a large part of the territory. In the River Basin Management Plans (SDAGE) imbalances between available resources and needs have been identified for some specific parts of the territory and specific actions are conducted to reduce them in close coordination with the various

actors. In addition, France having a wide diversity of biogeographical conditions, some areas suffer from water shortages. In this case, the basin coordination prefect establishes Water Apportionment Zones (ZRE) which are defined as "zones presenting a shortfall, other than exceptional, of resources in relation to needs". In these areas (1/3 of the territory, some parts only for surface water or for groundwater), the authorities have to pay special attention to the management of water quantities and develop territorial strategies which can include restrictions of some uses (Quantitative Water Resource Management Plan, PGRE). In addition, a national framework for information on - and management of - drought periods have been defined with the publication of national daily map[51] covering all municipalities with four levels: vigilance, alert, heightened alert and crisis, each level being linked to specific restrictions.

In France, the main activities related to water are organized along the following human needs: drinking water, water for industry, water for power plants, water for agriculture, water for channels and navigation and water for leisure. For each type, a set of actors are involved with their responsibilities and some aspects are detailed in the following sections.

86. **Water quantities for drinking water:** Drinking water is the responsibility of the municipalities which are qualified “organizing authority”, and they are responsible for all infrastructures related to it, including the building and maintenance of the infrastructures necessary to store volumes of water necessary for producing drinking water. 62 percent of drinking water comes from groundwater, and in such cases the main action is to protect the perimeter around the abstraction point and the abstraction point itself. For the 38 percent coming from rivers, lakes and dams, and corresponding to less than 4 percent of the abstraction points (1393 points), it is necessary to ensure water is respecting minimum quality criteria (water intended to produce drinking water). Abstraction points are often abstracting from large rivers (where possible water is abstracted from river bank, i.e. shallow groundwater), or dams. For rivers, the local authorities mainly have to take care of the abstraction point. For dams if they are multipurpose, the other activities are regulated to take into account the risks they may pose to the quality of water, and if they are dedicated to drinking water production, all other activities are either forbidden or strictly regulated and perimeters are established around the reservoir and the streams landing in the reservoir with specific rules for land use in these areas (agriculture, houses, pathways etc.).

87. **Water quantities for agriculture: i**n France, water has not been a very prominent limiting factor and agriculture is mainly conducted using available rainwater resources. However, some parts of the territory and some crop types are more sensitive to water shortages and irrigation is used on 6 percent of agriculture areas (1.7 Mha), in particular for maize production, for rapeseed and sunflower, on some vineyards, on orchards and for some vegetables. Irrigation is made using individual farmer abstraction wells in rivers, lakes, artificial reservoirs or groundwater. In such cases farmers have to submit a dossier and monitor the volumes they abstract and pay to the water agency an abstraction fee. It can also take the form of a collective organization which takes in charge the investment necessary to build the abstraction point, the infrastructures to transport water from the abstraction point to the fields and the individual counters in the name of its members. This is generally done via Authorized Union Association (ASA) which are administrative public establishments created and controlled by the State.

    In ZRE (about 30% of the French territory, designated for surface water, for groundwater or for both), the water law obliges the creation of single collective management bodies named OUGC and which are responsible for the management and distribution of the volumes withdrawn for

[51] http://propluvia.developpement-durable.gouv.fr/propluvia/faces/index.jsp

agricultural use in a given territory. Each OUGC will hold the global withdrawal authorization on behalf of all the irrigators in the management perimeter, regardless of the resource withdrawn and will allocate the necessary volume to each irrigator. Obtaining the multiannual unique authorization (AUP) requires a sampling study, the cost of which is borne by the irrigators.

88. In the south of France, at the end of the 1950s, the need to secure water provision for all types of human needs (drinking water, industry and agriculture) has led the state and local authorities to launch regional development companies. Regional water management operators with a land-use planning mandate, they have an original status of commercial companies governed by the commercial code with public service missions and a capital share mainly held by the local public authorities. They have a concession right and manage dams and water intakes in rivers, pumping stations, canals and water pipes and irrigation networks and provide water to irrigation perimeters and for drinking water and industrial uses. Financed by public authorities to build and operate a set of infrastructures owned by public authorities and maintained in good operational conditions by these regional companies and dedicated to bulk water transfer.

89. **Water quantities for industry:** in general industries using or willing to use water have to establish a specific dossier to assess the impacts of their activity on water (IOTA) and more generally on the environment (ICPE). The existing nomenclatures define the thresholds, and common rules they have to consider in their dossier including the rules for the environmental impact study, the duration of the permit and many other aspects like the rules they will have to apply in term of monitoring, metering, reporting, ecological flow, or roles and responsibilities during low flow or flooding events. In case of dams, when they are in place, specific rules for maintenance and regular watching (register, periodic watching, auscultation devices, 10-year control visit, specific monitoring equipment…) are linked to size of the lake and height of the dam. In addition, there are also rules for ecological flow and low flow support. New dams are also subject to a full set of prescriptions including for public security, for protection of the aquatic environment, etc.

90. **Water quantities for nuclear and other thermal power plants:** Big industrial facilities, nuclear and other power plants are abstracting significant amount of water in rivers and using it in closed circuit in cooling tower (open circuit is forbidden except in few cases). In this case the evaporated water (40% of the abstracted water, 2.5l/kWh of electricity) has to be compensated, or when circuit bleeding is required. A few are using open circuit and therefore pump much larger amounts of water which is afterwards sent back to the river (or the ocean). As large facilities, they need a lot of water, and the abstraction infrastructure is large and may even include a dam to keep the water level needed for the pumping devices. They are subject to authorization with a full set of prescriptions, in terms of monitoring (T°, volumes, chemical parameters…), metering, reporting, ecological flow, fish ladder or roles and responsibilities during low flow or flooding events. In particular as regards their abstraction and discharge, the facility owner has to monitor volumes of its abstraction and discharge and the river flow, and where relevant consider the specific needs listed in the SDAGE. The discharge does not induce a temperature of the receiving environment higher than 21.5°C for salmon water, 28°C for cyprinid water and 25°C for water intended for the production of drinking water, at the limit of the effluent mixing zone. They also need to consider the management of rainwater falling on the facility and collect and monitor its pollution content, and where necessary treat it before discharge (Journal Officiel de la République Française (JORF), 2012).

91. **Water quantities for navigation:** Rivers and channels are an important means of transport in France and some channels are dated back in the 16th century. At the end of the 19th century, the length of navigable paths (rivers and channels) reached 12,800 km. Part of it has been abandoned

and nowadays it reaches 8,500 km. Voies Naviguables de France (VNF: English: Navigable Waterways of France) is a public establishment (4 700 employees) and manages 6,800 km and about 4,000 structures of which 356 navigation dams, 50 reservoir dams, (total capacity 165 Mm^3), 1,600 waterfall crossing, 364 water intakes (irrigation, industrial use, drinking water) and a wide number of locks, 3,756 km of weirs or pumping stations. In addition, 1,000 km are managed by regions and 700 km by the state. As a main navigable path manager, VNF is responsible for development of navigation both professional and for tourism. A wide number of dams and reservoirs allow keeping the navigation safe and/or feed the channels. It is also used in case of floods to release the water in the river or in low flow to keep enough water for navigation. Infrastructures are also used to produce hydroelectricity via 80 micro hydroelectric power stations (+10 in project). In addition, the Compagnie Nationale du Rhône (CNR) has the concession of the Rhône River and uses it to produce electricity, develop navigation and provide water to agriculture, and although they do not manage flood protection dikes, they also have a role in flood protection by maintaining water levels in the river and their storage dams and dikes and monitoring with their entire stations network the water quantities in the river at high frequencies.

92. **AQUATIC ENVIRONMENT PROTECTION AND MANAGEMENT (GEMA) AND FLOOD PROTECTION AND MANAGEMENT (PI):** a law of 2014 has given the intercommune authorities and their EPCI a major role in the management of the aquatic environment by giving them a mandatory and exclusive competence named [management of aquatic environments and flood prevention] ("GEstion des Milieux Aquatiques et Prévention des Inondations - GEMAPI"). This competence includes:
    - Develop (part of) a watershed, including storage facilities in reservoir lakes;
    - Maintain and develop a watercourse, canal, lake or body of water, including its accesses, for reasons of general interest or emergency, in particular in the event of generalized deficiency of the riparian owners with regard to their obligations of routine maintenance;
    - Provide defense against floods and against the sea, in particular through the construction and management of dykes;
    - Protect and restore sites, aquatic ecosystems and wetlands as well as riparian woodlands, including the restoration of aquatic ecological continuities[52].

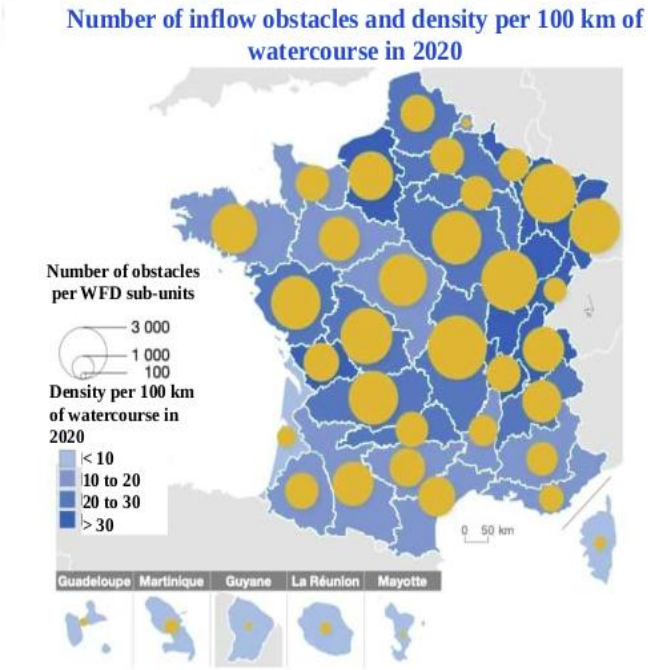
    In recognizing that correct aquatic environment management is contributing also to flood protection and linking them and in giving the main role to the local authority who also manages the urbanization, the law intends to improve the coherence of the management of aquatic environment and floods. The local authority can then lead the activities and even substitute to failing land or infrastructure owners if they do not take care or maintain in good operational conditions their infrastructure, but also develop flood plains, restore natural environment including wetlands or riparian forests, take actions in the watershed feeding its reservoirs. France is a flood-prone country with about 17 million inhabitants and 9 million workers exposed to river flood (and a significant number of inhabitants and workers exposed to marine floods). With its long history of use of rivers and watershed for a wide diversity of economic and leisure uses, a large diversity of used or unused infrastructures exist in the waterbodies but also throughout the major bed, which can influence the flow of water during high water periods.

93. Main types of floods include river floods or overflow of watercourses, floods from runoff, groundwater rise and breach of work. They most often stem from a meteorological event, and can be very diverse in intensity, in rapidity and geographical or temporal extension. They can be

[52] https://www.ecologie.gouv.fr/sites/default/files/PLAQUETTE%20GEMAPI.pdf

increased by snowmelt, breach of infrastructure or vulnerability of buildings. Following the adoption of the European Directive on floods, France has mandated a Joint Flood Commission (CMI) to elaborate a collective and concerted national flood risk management strategy. It is completed for each river basin by a preliminary risk assessment (EPRI) used to elaborate flood risk management plan (PGRI) which sets the main objectives in terms of flood risk management and the objectives specific to certain areas at high risk of flooding (TRI). For these last, local strategies to manage flood risks (SLGRI) are defined no later than 2 years after identification of TRI. This is completed by a natural flood risk prevention plan (PPRi or PPRNi) elaborated by the French national administration at the department level with local authorities and under supervision of the department prefect. To inform the decision makers on situation of water quantities on the territory and risk of floods, the state has created and mandated a public agency, the SCHAPI, which is a central service mandated to watch water flows and stocks and forecast flood events, and coordinates 19 services of flood forecast covering the entire country. SCHAPI manage with them the monitoring stations and all specific devices and forecasting models, in close relationship with Meteo France. (See annex2.4 for more details).

94. **Dams and weirs:** 103,000 works are making an obstacle to free-flowing rivers in France in 2020 of which 90 percent are without current economic use. This entails a very wide number of dams and weirs. Most of the weirs have been established to use hydropower for water mills of all types and only a small number are still active. As regards dams, in addition to allowing storing water for hydropower (see chapter 4), for cooling power plants and navigation, they are also used for irrigation, industry production, drinking water, leisure. Dams have of course an important role in the control of water resources and floods. Therefore, all dams must have a water regulation: Regulation that governs the methods of operation of dams or hydraulic installations in general. Since 1995, approved by prefectural decree, it has been established following a public inquiry. It mentions the rules for managing the structures (minimum flow, reserved flow, release, etc.). For low-flow support structures (in normal and crisis situations), it must make it possible to specify



Notes : la densité d'obstacles par linéaire de cours d'eau est estimée sous forme de moyenne dans les sous-bassins utilisés au titre de la directive-cadre européenne sur l'eau (DCE) ; le recensement des obstacles à l'écoulement reste incomplet et représente une activité continue.
Champ : France entière.
***Source :** OFB et partenaires, Référentiel des obstacles à l'écoulement, 2020. Traitements : OFB, 2020*

how the water resource will be shared between withdrawals and the flow maintained in the rivers.

Figure 24: Number of water obstacles in France

95. **Dikes and other flood protection:** it is commonly admitted around 9,000 km of flood protection dikes exist in France. In the last twenty years, a number of flood events have highlighted significant weaknesses in the management of these: managed by more than 1,000 actors with very different financial and human means, and a lack of coordination, the flood protection was not adequate. This has led the authorities to improve the organization and management of these infrastructures with a first decree in 2007. A law of 2014 has gathered two competences which are complementary: the management of aquatic environment on the one hand and the flood protection on the other hand in a single concept called the "management of aquatic environments and flood prevention" (GEMAPI). The law has identified the municipality as the authority level responsible for it. It was completed in 2015 by a second decree which state flood protection dikes must be part of a containment system, which includes one or more dikes and is defined in direct relation to the area to be protected, and a single petitioner. Local authorities are obliged to manage the containment system but may transfer this to a dedicated public establishment. The framework was clarified with a definition for a dyke and for a containment system, and the ownership which may be public or private. Any owner of a hydraulic infrastructure (dyke, sewer, gate, flap…) is responsible for the damages caused by its properties and therefore to maintain the dyke (and other infrastructures) in good operational conditions. In the absence of an owner, the property is considered the property of the municipality (GEMAPI) which must maintain it in good operational conditions. (France Digues)

96. **Runoff management:** despite not being directly linked to major flooding, runoff management in impervious areas can create significant disorders. City centers in France are often equipped with combined sewers which collect both wastewater and runoff rainwater (around 97,000km) while extensions are often equipped with separate sewers (rainwater sewer: 95,000km). Rainwater retention basins and other storage structures have also been constructed to correct some hydraulic deficiencies and/or treat the water before discharge. Since the water law of 1992, municipalities have to delimit the areas where measures must be taken to control waterproofing and runoff as well as to ensure, as necessary, the treatment of rainwater. The rainwater zoning can define specific management rules including local infiltration, forbid the discharge of rainwater on the public space or limitation on the output rate of the flow. For new projects, the IOTA nomenclature includes thresholds: declaration between 1 and 20 ha of new area and authorization beyond and the area to consider is the entire surface whose water is intercepted by the project and not only the area of the project (considering lateral, longitudinal and vertical continuity). To limit the inflow of rainwater in sewers, the development of more integrated approaches to urban planning have been developed in the last ten years and a set of standard objectives related to the level of rain events have been formalized to guide municipal services.

POLAND

97. Polish Waters as the governmental agency operating in the water management area is responsible for preparation of the strategic planning documents listed in Article 315 Water Law: river basin management plans, flood risk management plans, plans counteracting draughts, water maintenance plans, preliminary flood risk assessment, flood hazard and flood risk maps, preliminary environmental assessment of sea waters, environmental goals for sea waters, program of monitoring sea waters, and program for sea waters protection.

98. Taking into account the flood risk the management, operation and modernization of infrastructure is the responsibility of Polish Waters. This responsibility stems the governmental task described in Water Law Act (Chapter IV). Very important are competencies in the area of spatial planning allowing Polish Waters to counteract flood risk rise or perform water transfer. Areas of particular flood hazard have to be included in spatial plans and administrative decisions related to use of these areas, including permits for construction, on all levels of public administration (local, regional, national) and must be agreed with Polish Waters.

99. One interesting idea introduced in the operations of Polish Waters is the possibility to operate in an open market by offering and delivering services (Water Law, art. 240, point 6):

- design, construction, maintenance and use of water devices/equipment,
- production of electricity from renewable energy sources,
- tourism and education activities related to water management,
- water transportation services of persons and goods,
- any other water related economic activities with exception of water supply and sewage systems for households.

SPAIN

100. The RBOs plan and manage the HPD (including management of water resources and floods) and perform the project, construction, operation and maintenance of the hydraulic works executed with their own funds and the works entrusted to them by the GDW, outsourcing these functions through contracts or agreements with public companies that are the GSA's own means (TRAGSA, IDAE, ACUAES and ACUAMED)53 or through tenders to private consulting, engineering and public work construction companies.

101. The State companies ACUAES and ACUAMED have as their corporate purpose the construction, exploitation or execution of hydraulic public works, the latter specializing in seawater desalination (see **Annex 3**). The IDAE is a public business entity whose functions include technical assistance, management, and execution of works and direct or indirect investment in projects of energy interest such as the construction, operation and maintenance of hydroelectric plants. The company TRAGSA has as its corporate purpose, among others, the performance of all kinds of actions to improve public services and resources and operates and maintains State-owned dams.

THE NETHERLANDS

102. Responsibilities for operating, managing and modernizing water infrastructure were presented in detail above and there are no additional specificities to be mentioned under this section.

[53] https://www.tragsa.es
https://www.idae.es
https://www.acuaes.es
https://www.acuamed.es

2.5 Efforts to improve efficiency of water management and private sector participation

AUSTRIA

103. **Resistance to "be in the driving seat":** in several cases the need for action is recognized, but the initiation of the process is hampered by the fact that no individual municipality or union wants to shoulder the financial burden of contributing to the development cost and the responsibility of operation and maintenance. Solidarity between upstream municipalities and downstream municipalities can often be achieved but is not initially given in many cases. In line with the principle of subsidiarity, the federal government and the provinces prefer the municipalities or unions to be in charge. Concerning issues of aquatic ecology, the resistance is greater than concerning flood protection. Therefore, the Ministry of Water and the provinces make a deliberate effort to inform mayors about subsidy opportunities for ecological improvements of water bodies.

Figure 25: Ministry of Water brochure of 2023 "Aquatic Ecology for my Municipality – Subsidy Levels"

104. **Mixed experience with public participation but new boost:** public participation is, according to §55m Austrian Water Act 1959, foreseen in several stages of the development and for the review of National River Basin Management Plans and National Flood Risk Management Plans. Generally, laws and Regulations are issued in legally defined consultation and participation processes. Also, the update processes for River Basin Management Plans (RBMP) Floods Risk Management Plan 2021 include public consultation. Public participation. There is a mixed experience in public participation processes in river basin planning processes – the efforts were often project-based and stalled if there is no joint and pressing issue that fuels engagement. The River Basin and Risk Management Concept break new ground in Austrian river basin planning. In addition to focusing on entire catchment areas, the conventional planning processes are also partially rethought. A key innovation is the increased public participation in the planning process and the intensive coordination between the sectors and administrative bodies.

Figure 26: Ministry of Water guideline of 2022 "Public Participation in the frame of River Basin and Risk Management Concepts"

105. **Room for improvement in private sector participation:** in water resources and wastewater issues, the Austrian Water and Waste Association stakeholders are represented at national and province levels fora to contribute to strategic water management decision-making. Furthermore, individuals or companies can become members of Water Cooperatives and contribute to initiatives to improve aquatic ecology and flood protection. The form is, however, mainly used for water supply and wastewater. Considering the above and given that River Basin Organizations are not institutionalized in Austria, it seems fair to state there is room for improvement in terms of private sector participation.

106. **Enforcement options of Water Law should be explored to the fullest:** the legal framework and underpinning guidelines in Austria are of high quality. Permits are needed for all water uses (e.g. abstractions and discharges of water). Monitoring and control mechanisms are established. Fees in case of breaches are foreseen. However, some room for improvement regarding enforcing

existing laws was highlighted (UNEP-DHI, 2020). The Water Law envisages several options to initiate flood protection measures (municipalities could be forced into Water Unions) or oblige hydropower producers to undertake measures to achieve the EU Water Framework Directive targets. However, the overall approach of provinces is to support and subsidize rather than to enforce. As a result, existing permits are hardly interfered with substantially, meaning termination of a permit or significant restrictions. In most cases, the permit conditions are only "slightly sharpened", or the permit holder is charged to undertake measures of reasonable magnitude and in relation to the scope and nature of the permit.

FRANCE

107. The centralized nature of the country with regional and departmental representation of the state and the power of the central state, imposing laws to manage water resources, financing national agencies to manage various aspects related to water pollution, navigation, floods… and access to water resources, has made it also the obvious actor to develop the necessary water resources and flood protection, especially on large rivers where the investments are far beyond the capacities of local actors. To this end, the state can act directly or indirectly via its public agencies, build the infrastructure and manage them or transfer them to its public agencies or delegate their management to another actor (including local authorities in charge of GEMAPI), launch concessions for use of its public domain with specific rules or restrictions. The flood protection dike or dams and control reservoirs along the main rivers (Loire, Seine, Rhône etc.), to reduce floods and keep water for low water support, are or have been initiated and partially financed by the state together with local authorities at various levels: region, department, big municipalities etc. Regular investments are made by all these actors, and the floods and drought events are used to analyze problems and their management and take the necessary actions including investments where necessary to improve the situation.

108. In the 60s and 70s the state together with local authorities of various levels have initiated and co-financed big infrastructures necessary to transfer water from big water resources to places where they are needed in the southern part of France (Serre ponçon dam, Provence channel, lower Rhone and Languedoc channel, Gascogne hills and water infrastructures). In the recent period, some flood events have led to reorganize the flood protection and prevention and clarify the responsibilities for the management of protection systems with the GEMAPI, which largely affect the main responsibility to local municipalities. Following this, municipalities have to identify existing infrastructures and their owners, identify the areas exposed to flood risk and protected by these infrastructures and the human activities in these areas and based on these define a level of protection they can afford. Actions can be to maintain the level of protection, increase or decrease it or even destroy the existing infrastructure to allow for hydraulic transparency. In this case and for infrastructures they are not the owner, it will be necessary to force the owner to destroy them. For the existing infrastructures municipalities have to establish agreement with infrastructures owners on who manage and maintain them.

109. With climate change, part of the territory is more and more affected by water shortages. The need to address better water resources management in the SDAGE have led water agencies to develop territorial projects for water management (PTGE) which gather all actors to discuss the water needs on the territory. When the PTGE requires the development of new resources and after having explored alternatives (water savings, shift in technology, etc.), the water agencies can finance the development of reservoirs to store water during high flows for use during the rest of the year (for drinking water, industrial use or irrigation). In general, and according to the various water related laws, local authorities have to manage local water resources and mandatory

and optional public water services (public services are services of general interest managed by public authorities) and since a few years the GEMAPI. To do this, they rely on their EPCI which themselves can act directly or indirectly to develop the service including developing or maintaining their local water resources, secure them by interconnecting their infrastructures with those of neighboring EPCIs, etc. A wide diversity of solutions has been developed and exist in the organization in charge which allow combining the public and private sector. For each organization chosen by the local authorities, all rules are fixed by a legal framework: distribution of roles and power in the organization, the legal and financial duties, the accounting and controls rules etc.

110. For drinking water and wastewater management, the municipalities are the organizers but until the 90s the delegation was the main system used, and the contracts were shared between three main private operators. Various problems identified in the 90s with this system (corruption and excessive profits, low risk for the private sector, lack of infrastructure maintenance, dissymmetric knowledge of the infrastructures…) have led to a complete revision of the framework: strictly defined contracts, contracts of less than 10 years, mandatory reporting… This however did not completely solve the problems and many municipalities (but not all) have progressively stopped the delegation by not renewing the contract and came back to an own management of services (own staff or EPCI staff) or part of them, only delegating some specific aspects. In the 2010s', various reports and assessments have concluded water and wastewater suffer from a lack of investment and the situation and performances are not progressing and, in some cases, even worsening. To tackle this, a new law adopted in 2015 is obliging municipalities to transfer the drinking water and wastewater competences and services to an EPCI covering more than 15,000 inhabitants, with especially for rural areas in view to have bigger services with better quality service, more specialized staff and covering larger areas allowing a better share of investment costs. This should lead to reduce significantly the number of water and wastewater services from 34,700 in 2016 to 2-3,000 when fully implemented, with consequences on the quality and durability of the service but also on the price of water and wastewater and on the management of these services (Direction de l'information légale et administrative, (DILA), 2019). In 2020, France had 10 973 drinking water utilities. 68 percent (42% of the population) of them are public and 32 percent (58% of the population) private. It had 12308 collective sanitation utilities. 75 percent (60% of the population) of them are public and 25 percent (40% of the population) private. It had 2495 non collective sanitation utilities. 89 percent of them are public and 11 percent private (SISPEA 2020).

POLAND

111. **Experience of 30 years of institutional changes:** In the moment of transformation to market economy and political democratic system (1989) the administration for water management consisted of a central level with the Ministry of Environmental Protection, Natural Resources and Forestry and on regional level it was 7 District Directorates for Water Management (ODGW), which do not have too much experience with basin or subbasin delineation. They were responsible for operating and maintaining water infrastructure (reservoirs, weirs, etc.). Under supervision of the Ministry of Agriculture were existing and operating Voievodship54 Water and Melioration Management Boards (WZIR) responsible for drainage and water management operating in very similar areas of water management. In that sense both governmental structures: RZGW and WZIR overlap in some activities in the area of the voievodship.

[54] Voievodship is unit of administrative division of Poland with regional government and state territorial representative; it is also NUTS-2 area in EUROSTAT classification; Poland is divided into 16 voievodships.

112. After transformation in year 1991 there were 7 Regional Water Management Authorities (RZGW) created. These authorities were oriented mostly on planning and environment protection issues subordinated to the same ministry. It created duality in water management and both agencies (RZGW and ODGW) operating in the same areas were overlapping in some activities and competing despite being subordinated to one minister. The third side of water management in the area were WZIR structures subordinated to the state territorial representative – voievod.

113. After the 1997 flooding and the 1999 decentralization administrative reforms, RZGW and ODGW were connected in one governmental authority with the name RZGW - Regional Water Management Authority. Based on French solutions, River Basin Councils were created in each RZGW representing water users and this council was not only the partner for RZGW for discussion about basin managements, but also its competence was to give opinion in case of nominating and recalling of the RZGW director. The borders of RZGW were close to basin and subbasin limitations with the exception for RZGW Gliwice, which was in charge of upper parts of both main Polish river basins: Vistula and Odra due to very strong political pressure and with justification that this area (Slaskie voievodship) covers the Upper Silesia metropolitan area. This region is a heavily urbanized area with approximately 2,7 million inhabitants. Decentralization reform in 1999 transferred WZIR to a newly created regional government and changed the name to WZMiUW – Voievodship Board of Melioration and Water Equipment. Decentralization reform brought additional financing to water management from regional budgets, but unfortunately the division of responsibilities between governmental agency RZGW and regional government authorities WZMiUWs was very chaotic and created the situation that river and the areas between dikes was in administration of governmental agency (RZGW) when the dikes and embankments were in administration of regional government authority WZMiUW (and also sometimes in city responsibility in case of coincident boulevards or roadways) causing many operational problems during flood events and also it created problems in maintenance and modernization of structures.

114. The next and the latest reform occurred in 2017 when total centralization of the water management was introduced by concentrating the water management in Polish Waters as described in Chapter 2.3, including transferring many competences from regional RZGW level to KZGW and president of Polish Waters. Second weakness of this reform was increase of number of RZGW from 7 to 11 and this is causing further fragmentations of the river basin management. Below are maps presenting RZGW delimitation before and after reform 2017:

Source: PGW Wody Polskie web sites

Figure 27: RZGW delimitations before reform 2017 (map on the left) and after reform 2017 (map on the right)

115. In addition, institutional partnership with representation of water users was cancelled by eliminating River Basin Councils from the institutional framework. These reforms separated Polish Waters financing from the state budget, which created and still creates huge disruptions with financing water management, which will be further explained in Chapter 3 below. Another significant mistake relates to the timeline for the implementation of the reform as the new Water Law was accepted by Polish Parliament on July 20, 2017, and the preparation period for implementation was only 4 months long. This did not leave enough time for preparation of all necessary operations on staff, equipment and properties. The implementation of the reform was broadly criticized by NIK – Polish Superior Chamber of Audit in report "Creation and functioning of State Water Enterprise POLISH WATERS" published after the audit activities were completed in 2020 (KSI.430.0062020, Nr ewid. 155/2020/P/19/051/KSI).

SPAIN

116. The efficiency improvement in water resource management and flood risk management in Spain is based on three key tools:
- Planning of water resource infrastructures and management of water resources, as well as flood risk plans;
- Legislative reforms including the simplification of administrative procedures, mainly the concession regime;
- The digital transition in water in the context of the NextGenerationEU fund.[55] This allows to improve the process and, more importantly, to control the use of water.

117. The increase in public water management capacity at the national level, and, specifically, the specialized capacity has been possible thanks to the following:

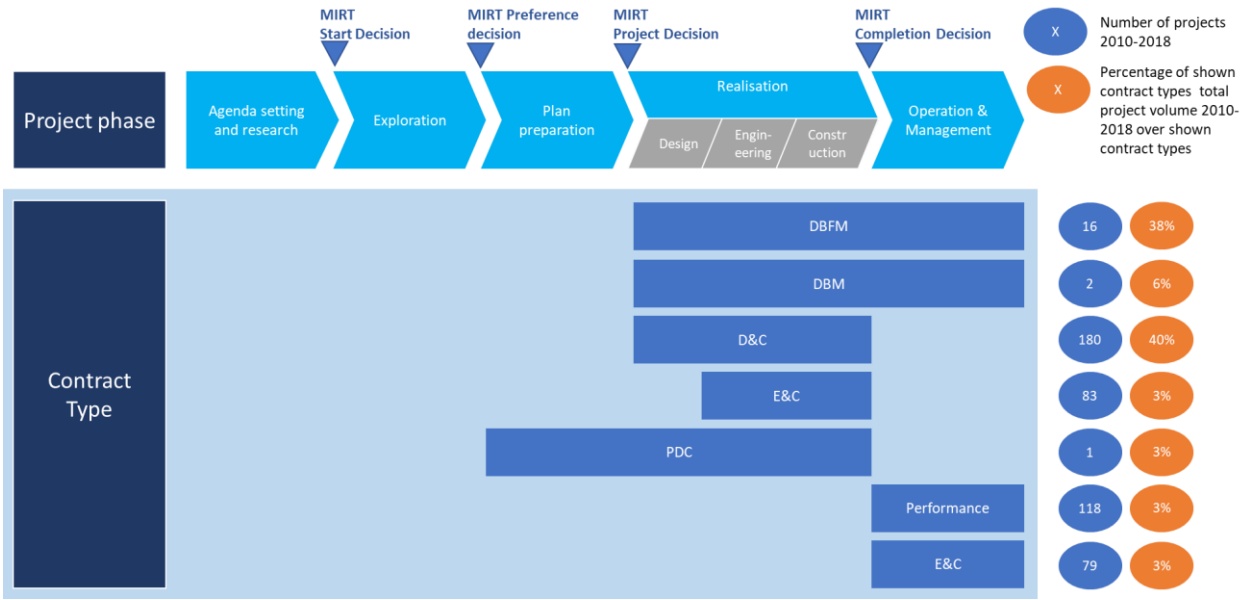
[55] https://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/16062021-Componente5.pdf
https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/memoria_infoseg_2020_tcm30-531935.pdf
https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/5_ic_financiacion_1_tcm30-514161.pdf

- The use of the specialized services company TRAGSA, which supports most of the tasks of the RBOs and the GDW, including the preparation of hydrological plans, construction, operation and maintenance of hydraulic infrastructures, discharge control and water use management. TRAGSA has flexibility in hiring specialized labor. It works with the Government according to the needs, through administrative agreements. As it is not public administration, it cannot intervene in the disciplinary proceedings;
- Hydraulic Administration Collaborating Entities (HACE) that are certified companies by the GDW to perform tasks specialized in control and surveillance of water quality and management of discharges to the HPD, such as analyses and laboratory reports and sampling;
- The growing role of public State companies, ACUAES, ACUAMED and TRAGSA in the construction, operation, maintenance and funding of public works that allows RBOs to focus on water resource management and the implementation of European directives;
- The existence of national organizations specialized in knowledge and development that provide knowledge services to the GDW. These are the Hydrographic Studies Center (HSC)[56] and the Geological and Mining Institute of Spain (GMIS)[57].

THE NETHERLANDS

118. The Dutch water sector is facing a variety of challenges that are becoming larger in size and complexity. Meanwhile, bottlenecks are experienced in the collaboration between public agencies and the private sector. This has spurred new was of collaboration and different relationships between clients and contractors.

119. Projects at Rijkswaterstaat: RWS annually tenders projects and services with a total value of 3 to 4 billion euros. Figure 28 provides an overview of contract types used in public works projects (not only water projects). As RWS wants to make maximum use of the market's creativity, it invests in the development of its capacity in tendering and commissioning and managing projects[58].



[56] https://ceh.cedex.es
[57] https://www.igme.es
[58] Rijkswaterstaat, Rijksvastgoedbedrijf, ProRail, Bouwend Nederland, NLingenieurs, Vereniging van Waterbouwers, MKB Infra, Techniek Nederland, Astrin (2016) De Marktvisie. https://www.marktvisie.nu/wp-content/uploads/2016/12/De-Marktvisie-1.pdf

Figure 28 : Contract types used in public works projects

120. As a result of significant cost overruns in projects such as the reinforcement of the Afsluitdijk and North Sea Sluice IJmuiden, DBFM-contracts have faced severe critique. However, a review of 21 DBFM projects of RWS (not only water related) concluded that the large scope and complexity and required capacity to successfully manage these projects rather than the contract type itself were cause to the problems that were faced: "It is not the contract that determines performance, but the actors that enact the contract and the practices that they develop"[59]. Accordingly, it was suggested that DBFM contracts should only be applied to projects that are "not too risky, not too large, with a great share of new development, not too complex and not too innovative"[60]. In the past, RWS has taken various positions regarding the execution of its responsibilities:

- A strong technocratic approach that heavily relied on a power position and world-renowned engineering expertise, bringing the Dutch fame for major public works such as the Delta Works.
- From the 1970s, intense public debates caused RWS's approach to gradually shift from an all-encompassing technocratic approach towards a more collaborative approach in which engineering and construction activities are outsourced as much as possible. This shift was experienced as a dilemma: it needed its expertise for fulfilling its responsibilities, whilst it needed to move away from it in order to develop into a more efficient and responsive public organization.[61]
- Since the 2010s, the recognition of a tensions between the public and private sectors in the construction industry caused a shift from 'the market unless' towards 'the market and us'[62]. The global financial crisis hit the construction industry, resulting in low bids and lots of issues related to the realization of infrastructural works, which in turn led to cost overruns, losses, incorrect allocation of risks and liabilities and negative publicity for the construction industry at times of increasing public participation, rapid technological developments and increasing complexity. Driven by the desire for cultural change, a 'market vision' was jointly developed by a partnership of public and private organizations that was led by RWS. This vision called for a fundamental shift in interaction and outlined principles for good collaboration and identified specific steps towards a transition agenda.

From	To
Hierarchical client-contractor relations	Network collaboration on the basis of equality, dignity and complementarity, with everyone own role and responsibility and where the task comes first.
Realizing projects	Realizing and connecting tasks
Putting your own interests first	Thinking, working, acting and learning in chains
Send and act reactively	Dialogue and anticipatory action
Fighting relations	Excel in our works that started from real preconditions
Opportunistic behavior	Early discussions about risks, information needs and dilemmas.
Acting on power and steering on contract	Acting on the basis of strength and managing on attitude and behavior
Competitive advantage through possession of knowledge	Competitive advantage through speed of access and application of correct knowledge.
Little room for diversity	An eye for differences and quality and room for customization

[59] Koppenjan, J., Klijn, E. H., Verweij, S., Duijn, M., van Meerkerk, I., Metselaar, S., & Warsen, R. (2022) The performance of public–private partnerships: An evaluation of 15 years DBFM in Dutch infrastructure governance. Public Performance & Management Review, 45(5), 998-1028.

[60] Verweij et al (2021) Evaluatie 15 jaar DBFM-projecten: Gooi de expertise niet zomaar overboord

[61] van den Brink, M. A. (2009). *Rijkswaterstaat on the horns of a dilemma*. Eburon Uitgeverij BV.

[62] https://www.bouwendnederland.nl/actueel/nieuws/30769/rws-voert-vanaf-2023-stapsgewijs-nieuwe-inkoopcontracten-onderhoud-in

Table 4: Shifts in interaction between public and private organizations in the Dutch construction industry as proposed in the joint Market Vision.

121. Projects at RWAs: In view of the large and complex infrastructural challenges that lie ahead for RWAs – the national flood protection program HWBP is, for example, the largest dike reinforcement operation since the Deltaworks – RWAs have also acknowledged the need for good collaboration with the private sector. In their vision documents of 2014 and 2016, RWAs collectively describe the need for further professionalization of in- and outsourcing. Whilst the vision of 2014[63] formulated goals for dialogue and collaboration, knowledge development, tendering, risks, innovation and sustainability, the vision document of 2016 outlined several building blocks for transitioning towards better collaboration[64] Meanwhile, the workforce of RWAs is insufficient to meet the tasks ahead. RWAs have therefore established a Dynamic Purchasing System (DAS) for insourcing. For example, the RWA Rivierenland uses a DAS for hiring automation, purchasing, logistics, marketing, production, engineering, transportation, and legal professionals. 65 Individuals, consultancies, employment agencies need to be registered and approved before they are able to respond to tenders. Whilst the number of freelance professionals is significant (numbers unavailable), there is arguably a trend that entire project phases are being tendered. As the activities then become too large to be handled by individuals, this causes a shift from insourcing to outsourcing.

[63] Dutch Water Authorities (2014) De waterschappen als publieke opdrachtgever. https://www.rijnland.net/documents/359/De_waterschappen_als_publieke_opdrachtgever.pdf
[64] Dutch Water Authorities (2016) De waterschapsmarkt van de toekomst. https://unievanwaterschappen.nl/wp-content/uploads/2021/12/De-waterschapsmarkt-van-de-toekomst-visiedocument.pdf
[65] https://das-service.nl/dynamische-aankoopsystemen/dynamisch-aankoopsysteem-das-waterschap-rivierenland/

Chapter 3. Financing of water resource and flood risk management infrastructure

3.1 Approaches and practices for funding operation, maintenance and modernization of water resources and flood prevention infrastructure

AUSTRIA

122. Core functions sufficiently financed from budget. For example, sufficient budgets for administrative staff at national level, studies, emergency measures and capacity building are available (UNEP-DHI, 2020). Also at province level, staff costs and operational costs to fulfil functions such as allocation and oversight, technical advice are covered by the annual budget. Agencies financed as per the laws of establishment. The via Danube was created as a public company to fulfil the functions as described above and prescribed by the Waterways Law of 2004. The federal government compensates their services with an annual lump sum payment of 5,500,000 euro. In addition, the via Danube acquires additional funding from national and international sources, including EU, for specific projects. Financing of transboundary cooperation. Financing Costs of the secretariats of the International River Protection Commissions are covered by national contributions. Therefore, financial contributions for International River Protection Commissions are ensured. On the other hand, the Provinces cover the costs of bilateral Commissions for coordination of water management issues. Maintaining infrastructure – day-to-day and during floods. Day-to-day operation and minor maintenance have to be covered by the municipality or the interested party. However, major maintenance and re-investments required after damage or when structures reach the end of their life span can be subsidized.

Project example from Lower Austria. The flood retention project Langewiesengraben in the Municipality of Heidenreichstein consisted of the purchase of land, construction of a retention basin with water level management structure, dam overflow area and riverbank stabilization downstream. The total investment cost was about 1Mio. EUR, whereby the municipality contributed 20 percent. For a community with an annual budget of about 10 million. EUR this is a substantial amount, given that they are currently annually spending about 2.5 million. EUR for water supply and wastewater network extension and renewal. The water level control structure is robust and does not require specific operational activities and frequent maintenance. The municipality's maintenance works are mowing the dams (they purchased the equipment needed for that) and keeping critical areas of the intervention free of trees.

Figure 29: Retention basin with outflow structure in upper picture left side and dam overflow area in below image (Picture source: Sonja Hofbauer)

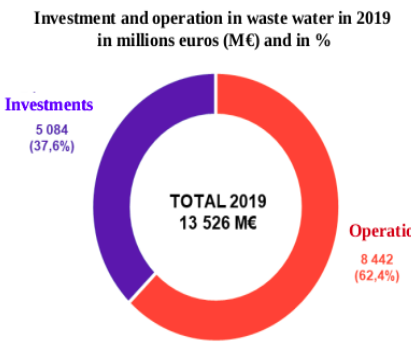
FRANCE

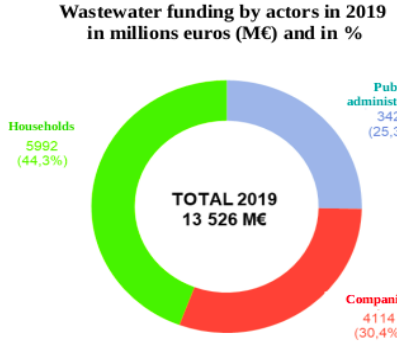
123. **Two general principles are applied for water management in France:** Management of aquatic environment in France relies on two general principles and despite evident focus on pollution, they are not only focused on the small water cycle but relevant for all water related topics:

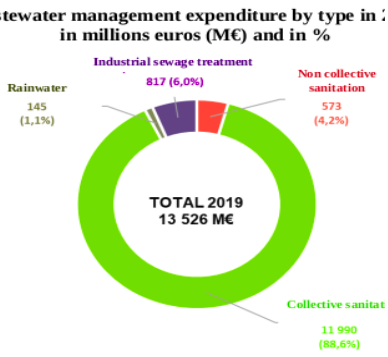
- water pays for water: cost incurred by preparation and distribution of drinking water and collection and treatment of wastewater should be paid by those using these public services.
- and polluter pays: costs incurred by preventive measures, reduction of pollution and fight against them should be supported by the actors who have generated these pollutions: the money collected is used to reduce the pollution and beyond to sustainably manage water.

124. **The small water cycle: a key financial flow** – it is not possible for France to ignore the "small water cycle" restricted to abstraction of raw water, treatment to produce drinking water, distribute it, invoice it and collect, and treat the resulting wastewater produced by inhabitants and other drinking water users. As we will see in the following, this part represents a very significant share of the financial resources allocated to water resource management. Price of water in France including all the taxes, was 4.3 euros/m3 in 2020 and for a household an average water bill of 516 euros per year. The patrimony of water and wastewater is huge and represents 40 percent of the patrimony of local authorities. It has an estimated value for drinking water of 166 billion euro for the network and 30 billion € for the connections (26.9 billion) and 13.4 billion € for plants and 4.5 billion € for storage tanks (8.8 million), and for wastewater of 125 billion € for sewers, 49 billion € for pumping stations (325,000), 24 billion € for connections (19.7 million) and 37 billion € for the treatment plants. (Salvetti, 2022). Up until the 1992 water law, drinking water and wastewater infrastructures investments and maintenance were financed by the general budget of municipalities or intercommune organizations with co-financing from the water agencies and subsidies from department, region, state and EU. They issued invoices for the service to the various water and wastewater users which included also taxes for the state and fees for the water agency. With the 1992 water law, all municipalities have been obliged to collect all the incomes and expenditures in a dedicated budget which had to be balanced and regularly controlled by a public accountant (water price should allow pay all expenditures). Today the annual budget for water and wastewater and transfers between main institutions can be illustrated as follows. The services collect 16.5 billion euro, out of this the water agencies receive almost 2 billion and redistribute 1 billion for various works and use the remaining for monitoring of water quality and actions to preserve or restore aquatic environment of which 400 million are transferred to the French biodiversity agency. The state receives 1 billion included in its overall budget. The smaller municipalities use 300 million from their general budget to co-finance the service and departments, regions and Europe allocate 400 million mainly for construction works.

125. As it is compulsory to report economic information on wastewater, France produces different useful statistics[66] on it regularly updated.







[66] https://www.statistiques.developpement-durable.gouv.fr/la-depense-de-gestion-des-eaux-usees-en-2019

Figure 30: Breakdown of cost drivers (first), wastewater funding (second) and types of expenditures (third) in France, 2019

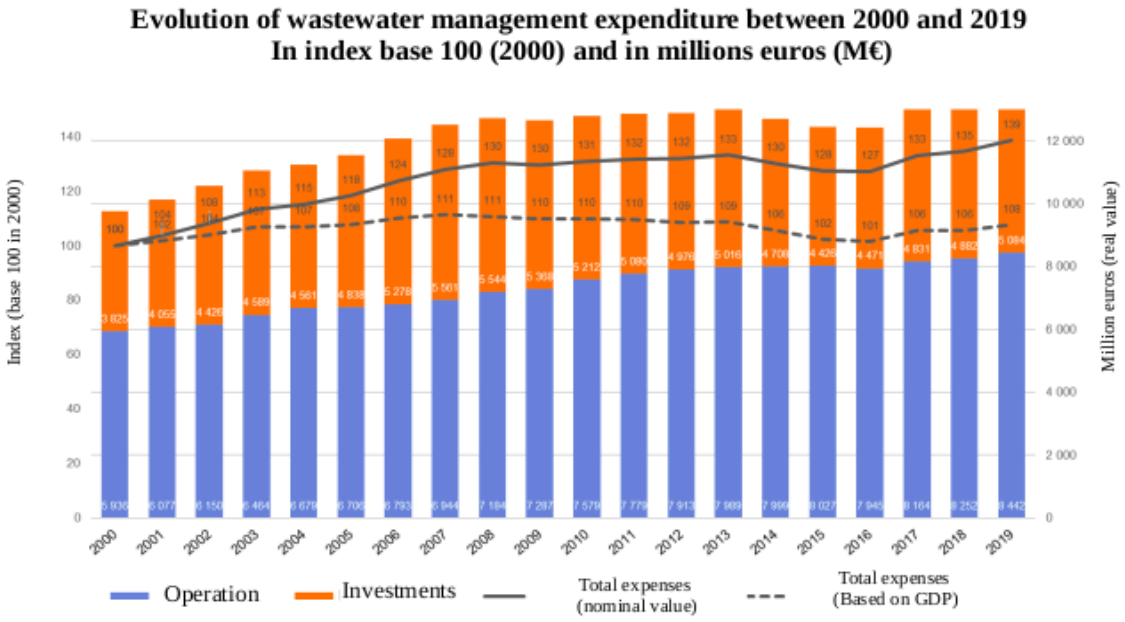


Figure 31: Evolution of wastewater expenditures in France

Concerning drinking water that also represents an important part of the French expenditure on the small water cycle a recent study67 estimated the average investment during the period 2013-2016 to 2,6 billion euros per year. According to drinking water incomes of the water bill (6,6 billion euros in 2019[68]), the operation costs could represent 3.5 to 4 billion euros per year. Despite these significant budgets, the SISPEA indicators still show significant leakages of the drinking water network from abstraction to final counter (on average 20%), a low investment in renewal of drinking water and sewer networks and some problems with wastewater treatment: France is still under threat of European court for not respecting the Urban wastewater treatment directive. Similarly, under WFD the ecological and chemical status of surface water is only reached for 44 percent of waterbodies while for groundwater 88 percent are in good quantitative status and 71 percent in good chemical status. The union of water industries and companies (UIE) estimated in 2022 the lack of investment in the small water cycle to 4.6 billion euros per year to insure the correct renewal, specifically in the network.

126. **KEY ACTORS AND THEIR ROLE:** Water agencies – the water agencies are playing a key role in the funding, maintenance and modernization of the infrastructures because their mandate is to take into account both the small water cycle and the management of river basins in all their dimensions since their foundation in 1964. Their mandate was largely extended by the water law of 1992 which created the SDAGE, even reinforced and adjusted by the WFD. By regularly analyzing the situation and developing management plan and program of actions with priorities at basin level, they drive the water policy in the basin and finance its implementation by a set of subsidies and reimbursable advances. They are working on a cycle of six years, in line with WFD. To apply the above principles, they are collecting various fees, mainly on drinking water and

[67] https://eau-entreprises.org/actualite/patrimoine-de-leau-2022/

[68] 5.3 billion cubic m^3 produced for drinking water with 20 percent of loss and 1.6 euros/m^3 affected to drinking water

wastewater operations for a significant share of the water price (see next section) which provide them a yearly budget of around 2 billion € (12.5 billion for 2019-2024).

127. **Local authorities and their responsibilities:** As seen in the previous chapter, operation, maintenance and modernization of infrastructures of local interest is the responsibility of local authorities which act as quasi-public monopolies: municipalities which must delegate drinking water and wastewater services to their EPCI. Four main topics are covered at this level: drinking water, wastewater, runoff rainwater and GEMAPI. For larger infrastructures which may benefit wider territory, they can group with larger local authorities (department and region) or other actors. For drinking water and wastewater, the French legislation qualify them as industrial and commercial public service (service public industriel et commercial - SPIC) with a separate balanced budget to which the EPCI cannot contribute from municipality general budget. EPCI can conduct the entire set of activities necessary to provide the service by themselves or delegate all or part of it to other actors, including buying raw or treated water. They can use a large set of well framed and controlled legal possibilities from concession, to leasing etc. to do so.

    For runoff rainwater in urban areas, the French legislation qualify them as administrative public service (service public administrative – SPA). This qualification obliges the services to use the municipality budget to finance the building, operation, maintenance and modernization of their infrastructure. Since 2018 however it has been attached to the wastewater budget, also because at least part of the wastewater sewers are collecting this rainwater. The difficulties in dimensioning the infrastructures, the impacts on river pollution of discharges of combined sewer overflows and other significant disorders in the functioning of sewer systems has led authorities to push for separate sewers in the newly urbanized areas, and for disconnection of rainwater from sewers for their management at local level (infiltration, rain garden or other nature-based solutions). For runoff rainwater outside urban areas, the control of rainwater and runoff is part of the missions shared between the different levels of local authorities, insofar it is not related to Gemapi. For Gemapi, it has to be conducted by the EPCI also as administrative public service, hence they have to finance the building, operation, maintenance and modernization of the infrastructure. There is no standard or mandatory approach as regards the financial resources to do this and the three possible sources are: financing from EPCI general budget, from department, region, water agencies and fond Barnier subsidies, from a fee perceived for service rendered, and from an aquatax (GEMAPI tax) they can implement. They can receive from other operators the existing public infrastructures (dikes, dams, weirs), they have to define their main actions for aquatic environment management, to identify all other infrastructures which contribute or may contribute to flood protection (or to flood) and identify the operator to conclude an agreement with them. In all of the above, the water agency can allocate grants, either on the preliminary studies and paperwork or for funding the infrastructures, depending on the water agency priorities

128. **Other public authorities:** In most areas of France, the water resources have been secured in the 60s or 70s by the construction of dams, reservoirs and in some cases transport channels, from which water is pumped, or feeding the river during low flow to have water in the river for abstraction. In some areas and particularly in the south, the development of agriculture was very dependent on water availability and the development of these was key, but many other uses in these areas were also in need of water. Being of general interest because they have multiple uses, these have been constructed by public authorities, either a combination of local department and regional with support of the state, or by EDF to produce electricity with some specific exploitation rules in particular to support low flow. These infrastructures have been kept independent until

now, generally with a specific status of semi-public companies using and managing infrastructures as concession from public authority. At local level also and in particular for drinking water, construction of abstraction wells for groundwater has mainly been done by local authorities.

Since this period, developing new resources has been limited. In the recent past, with irregular rainfalls it has become more necessary to develop new water resources. As the SDAGE are fixing a framework to protect the aquatic environment from additional human impacts, specific steps need to be implemented before to develop new resources. In particular the elaboration of a management plan called PTGE and involving all interested stakeholders is necessary. In the framework of a PTGE, if the need for more resources is identified and after all possible savings have been explored, it is possible to build storage reservoirs which will store water during high flow for use during low flow for the volumes substituted from low flow and water agencies can co-finance. Beyond this, for instance if local users want to extend the use of water during low flow for their own needs (drinking water, irrigation…) and store more water, they have to ask for an authorization by public authorities and apply all the legal framework including pay taxes and fees, guarantee the ecological flow. Apart from water resources, public authorities are developing and managing other services of common interest of which navigation via the public state VNF agency and via more local authorities to build and operate harbor infrastructures, civil security (fire and all kinds of natural risks including floods), protection of natural spaces (lake shores, marine shores, forest, natural parks…), and management of major disasters. For this last, there is a complete process to recognize a natural event as a major disaster, and it is linked to an insurance framework known as “Fond Barnier”. To benefit from the fund, the municipality has to be recognized by the state as having experienced a natural disaster. Flood is one of these possible disasters.

129. **Economic actors:** For a set of specific economic sectors which have a water use at larger watershed scale: irrigation, hydropower, power plant, agro-food industry, chemical industry, other types of big industrial facilities, they often have to find themselves with their own budget how to build, operate, maintain and modernize their infrastructure. For irrigation, and as it is of both economic and environmental interest to build and operate irrigation perimeters of larger scale, farmers have the possibility to group together in collective organizations which may benefit from public subsidies subject to some specific conditions (metering, consideration of the SDAGE requirements, etc.). For the other economic actors, specific conditions may apply which are generally subject to the national legal framework, and they often need to adapt their operation to this and may receive some grants for these. The specific case of hydropower is detailed in Chapter 4.

POLAND

130. Financing of water resources (including flood risk management) is separated from state budget starting from 2018. Since Polish Waters is a legal entity with certain autonomy, sources of revenue, its own assets (including properties) and the possibility to take loans, it is run outside of the state budget. Of course, possible source of income could be and are subventions from the government, but they have to be justified and placed in state budget.

131. **Tariff setting methodologies for water supply and wastewater discharge:** The system of tariffs, fees for water services, payments for the use of inland waterways, penalties and other possible sources of revenue are defined in Water Law Act, Part VI Management of the property of State Treasury, and in very detailed manner in chapters 4 and 5 of this part: management of

the assts of State Treasury and economic instruments in water management (articles 211-314). The revenue distributions recorded in 2021 is presented below:

- payments for water services (regular and increased) – 81.8%
- payments for the use of inland waterways and related infrastructure belonging to State Treasury – 0.19%
- yearly payments for use of water covered surfaces owned by State Treasury – 1.43%
- payments from contracts for inland fishery – 0.98%
- income from agreements for use of the land, assets of State Treasury connected with water management – 2.69%
- Income from participation of other user in costs of operation and maintenance of the water infrastructure – 4.14%
- Donations and income from initiatives organized for water management goals – 0%
- Payments from legalization fees and fees for issuing water permits – 2.27%
- Income from economic activities of Polish Waters – 6.32%
- Other income (not specified) – 0.18%.

It was also declared that Polish Waters income could come from the EU budget, other foreign grants and from State budget. Important source of financing also was the ability to use loans. Income for water services are understood (article 268) as fees for:

- Use of underground and surface water,
- Discharge of wastewater to earth or water,
- Discharge of rainwater or melting snow by sewage system in administrative borders of cities/towns,
- Discharge of land drainage water in administrative borders of cities/towns,
- Intake of underground and surface water for farming fish and/or other water species,
- Discharge of sewage from farming mentioned above.

There are some exclusions for black/brown coal mining when they belong to mine drainage systems. The same case for intakes of water from sea waters. The system of fees consists of two parts: fixed and variable. The fixed fee is established by Polish Waters for withdrawing groundwater and surface water and discharging wastewater according to limitations described in Water Law Act. Other solutions indicate that:

- For use of land covered by waters: only yearly fee based on agreement
- For water services related with water abstraction: fixed and variable fees
- No fixed fees at all: agriculture & forestry for irrigation, inland fishery and hydropower generation, environmental irrigation and fire protection in forests,
- For electricity producers: fee-based on electricity production in case of hydropower and for difference between water abstraction and discharge for cooling systems plus for the total discharge of water taking into account temperature of discharged water,
- For wastewater discharge to water or ground: fixed and variable fees depending on volume, including size and type of contamination.

The variable fee for withdrawing water is calculated by multiplying the unit fee rate by the volume of groundwater or surface water withdrawn, expressed in volume units. In case of wastewater discharge the variable fee is calculated by multiplying the unit fee rate by volume or mass of contamination (BOD-5, COD, TSS or chlorides and sulfates (Cl+SO4), etc.). Here again maximum

unit fees are defined by the law and Council of Ministers is responsible for setting the unit rates by regulations. Further examples of formulas are:

Fixed components

-**for water abstraction**

=Unit price *time (days)*(maximum abstraction in water permit in m/s),

- **For discharge from rainwater systems in cities**

=unit price*time (days)*(maximum discharge in water permit in m/s),

- For a discharge of wastewater

= unit price*time (days)*(maximum discharge in water permit in m/s);

Variable Components:

- **For water abstraction**:
  = unit price * amount of water in m^3,
- **For discharge of rainwater from sewage systems**
  = unit price* (volume of rainwater yearly in m^3 excluding internal retention of the system),
- **For discharge of wastewater**:
  = sum (unit price * mass of pollutants) taking into account BZT5, COD, Cl+SO4 and slime content,

In addition to this there are penalties for content of other pollutants mentioned in the law (phenyls, HCH, CCl4, PCP, HCB, HCBD, CHCl3, EDC, TRI, PER, TCB, mercury, cadmium, zinc, copper, nickel, chrome, lead, arsenic, vanadium and silver) depending on quantity of pollution.

- **For cooling electricity generation plants**

= unit price (depending on temperature) *volume of total water abstraction + unit price * volume (abstraction – discharge),

- **For reduction of natural retention for parcels bigger than 3,500 m^2** [69]
  = unit price * area of lost retention * time (years),
- **For excavation of raw materials (sand, gravel, cane, wicker, etc.)**

= unit price * quantity of raw materials in Mg (cane in m^3).

For increased fees, the basic rules are:

- **For water abstraction and wastewater discharge without water permit**
  = 500% of regular unit variable fees,
- **For use of water services with exceedance of water permit conditions**
  = 1000% of regular unit variable fees for exceedance + regular fees.

There is procedure to estimate water abstraction in case of no measurements available for calculation of increased fees in case of abstraction without water permit. As a rule, the fixed unit price for underground water abstraction is 2 times higher than for surface water.

In case of inland navigation, the system of fees is based on length of the trip:

- **Passengers in commercial tourist/cruise boats,**
  = number of seats* length of the trip,
- **Transport of goods by boats**,
  = unit price *mass of goods * length of the trip in tkm (ton kilometer),
- **Operation of empty boats**,
  = unit price *length of the trip * carrying capacity in tkm,

[69] Here 10% of fees are incomes of local authority

- **Trees floating or towing**,
  = unit price * load in tkm,
- **Use of locks and ramps.**
  = based of individual tariff for lock or ramp.

132. The whole system of payments is described in detail in articles 267-314 of Water Law Act[70] and additional regulations defined by this law. As it is visible from description above this framework of water management financing makes possible implementation of 3Ts (tariffs, transfer, taxes) approach and to create mix that will balance water management costs and incomes taking into account water affordability for inhabitants and controlling the competitiveness of water consuming sectors of industry, as well as productivity in agriculture.

SPAIN

133. The General Directorate of Water (GDW) and River Basin Organizations (RBO) are responsible for Water Resources and water quality management, building and operating bulk water supply infrastructures and for the development and implementation of the River Basin Management Plans and the Floods Risk Management Plans. The Spanish model of funding bulk water supply, water quantity, quality and flood risk management measures relies heavily on the public budgets allocated to the General Directorate Water (GDW) and the RBO. There are other funding sources such as the European funding and commercial loans that complement the public budgets to implement these activities. The costs of the programs of measures of the River Basin Management plans 2016-2021 was of 21,641 M€ (3,660 M€ per year)[71] and those of 2022-2027 are 22,844 M€ (3,807 M€ per year)[72]. Approximately 1,766 M€ per year are responsibility of central government, which represents 46.5 percent of the total costs of the programs of measures[73]. Public budget: The Water Directorate total 2022 budget was 740 M€, with an investment budget of 452.4 M€ (including 80.7 million of capital transfers to the RBOs). In addition, in 2022 there was a 100 million of capital contributions to the State Public Water Companies: ACUAES and ACUAMED. The evolution of the investment budget and capital transfers shows a sustained reduction of the investment budget from 2015 to 202174 and an increase in 2022 and 2023 budgets[75]. This does not include NextGenerationEU funding.

[70] The detailed description is in section VI - Management of the property of the State Treasury, chapter 5 Economic instruments in water management - on 49 pages of published text of the law and presents precise instructions of fee calculation in fixed and variable components.

[71] https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/memoria_infoseg_2020_tcm30-531935.pdf

[72] Including the costs of the Flood Risk Management Plans

[73] https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/5_ic_financiacion_1_tcm30-514161.pdf

[74] After 2019 the investment budget does not include 40 million of the irrigation investment budget, which from then onwards is in the Ministry's of Agriculture budget.

[75] https://www.hacienda.gob.es/esES/Areas%20Tematicas/Presupuestos%20Generales%20del%20Estado/Paginas/Presupuestos.aspx

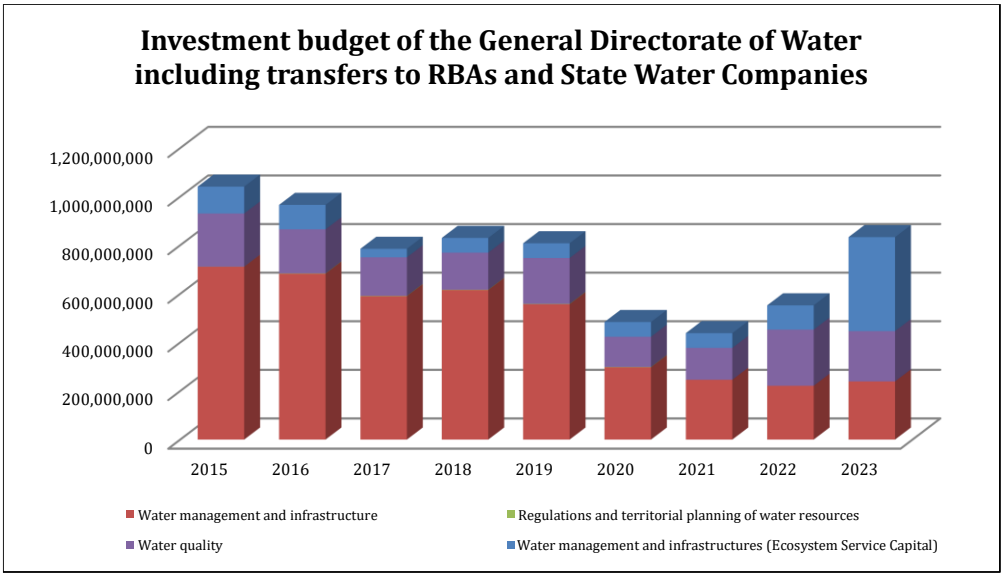


Figure 32: Investment Budget of the General Directorate of Water and State Water Companies in Spain

134. The River Basin Organizations (RBO) are autonomous organizations and as such they have their own annual budgets approved in the yearly General Budget Law. The total annual budget of the nine national RBOs in 2022 was 785 M€. The main expenditure budget line of the RBAs is investments representing 48 percent of the total budget of the RBOs. Operational and personnel costs are 46.5 percent of the total budget. The investment is not the same by RBO having a budget of between 45 and 100 million (e.g., Tajo RBO, Duero RBO, and Guadalquivir RBO), some of them between 21 and 32.5 million and the Guadiana RBO and Cantabrico RBO having less than 20 million as budget. The expenditure budget of the RBOs is balanced with the income budget including tariffs and taxes. For example, 346 M€ is income from the tariffs[76] and taxes charged to users. Up to 2018 the capital transfers from central government decreased due to the financial and economic crisis from 2008. Since 2021 this trend has changed. Note, that the RBOs also receive transfers from the GDW for operational expenditure (26.7 M€).

[76] 2023 State Buget: https://www.boe.es/buscar/act.php?id=BOE-A-2022-22128

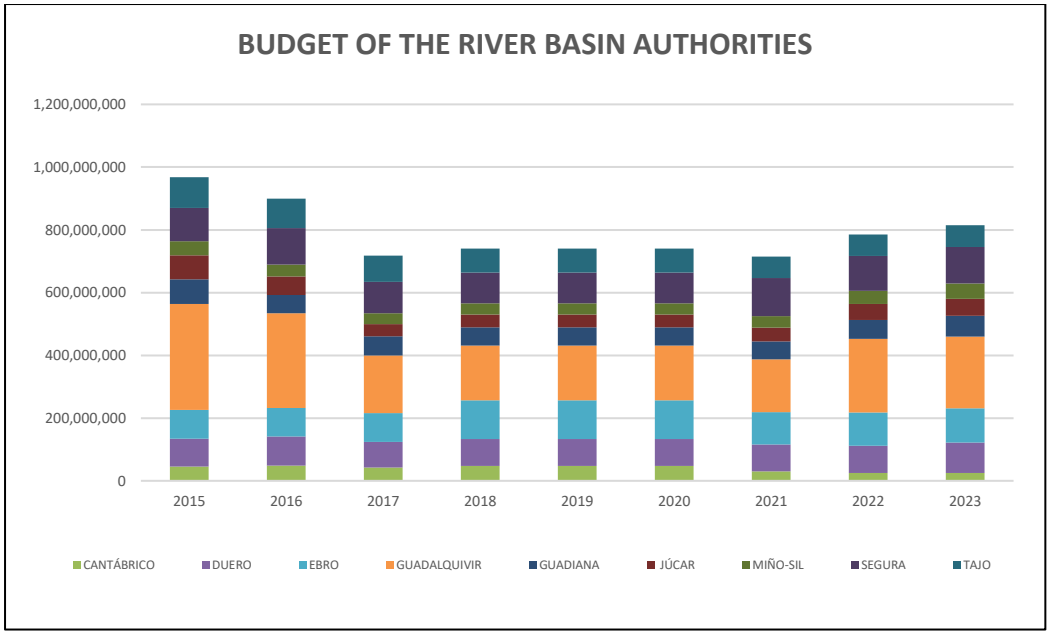


Figure 33: Budget of the River Basin Organizations (RBOs) in Spain

135. European Funding, in the multiannual framework programs of the EU Reginal Development Fund (ERDF) and the Cohesion Fund for the 2000-2006 and the 2007-2013 periods, was of 7,167 M€ and 3,180 M€ respectively. In the period 2014-2020 ERDF funds were reduced to a total of 546.8 M€ for the three programs that finance water investments. The programs for water investments are: (i) improvement of water management, (ii) wastewater treatment (90 projects) and (iii) flood protection (not including preparedness, response and recovery measures). Other financing programs for water projects have been: (i) InvestEU and (ii) the Life program. The Life program mobilized in the period from 2014 to 2020 163.5 M€ with co-financing by the EU of 82.4 M€. The main problem has been capacity to actually spend the existing funding but not the availability of funding. The state public companies (ACUAES and ACUAMED) generally have been more efficient in meeting deadlines and using the full funds allocated than the RBOs. Additional EU funding for water resource and flood management measures has been provided by the NextGenerationEU fund[77], established by the EU in 2021 to recover economic activity from COVID-19. This is providing financing up to 2026 with a total of 1,667 M€ for water projects in 3 lines of action:

1. Sanitation and wastewater treatment, improvement of efficiency and water saving, wastewater reuse and safe and security of the infrastructures 642 M€ (39%);
2. Maintenance and recovery of river ecosystems, recovery of aquifers, and flood risk management measures 800 M€ (48%).
3. Digital transition in the water sector 225 M€ (13%).

Additionally, the "PERTE Digitalización Agua"[78] has been allocated with 1,500 M€ financed through a PPP model.

136. Projects are being implemented directly by the GDW, the RBOs and the State Water Companies (e.g., ACUAES, ACUAMED and TRAGSA). There are also specific transfers from central government to regional governments and targeted calls for proposals (with full or co-funding) for

[77] https://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/16062021-Componente5.pdf
[78] https://planderecuperacion.gob.es/como-acceder-a-los-fondos/pertes/perte-de-digitalizacion-del-ciclo-del-agua

local authorities, domestic water supply companies and other organizations. Some of these calls have been facilitated by the Ministry's Biodiversity Foundation[79,80]. In relation to more specific funding for water resources and flood management projects in the three lines above by NextGenerationEU fund: Dam safety investments have been allocated a budget of 67 M€ and this is implemented by the RBOs; River restoration projects have an allocated funding of 225 M€; Flood risk management projects have a Budget of 225 M€; and the development of alternative resources (i.e: expansion of desalination plants and energy efficiency projects) have a budget of 350 M€[81].

137. In the context of line 3 for the digital transition and the PERTE for Digitalization of Water there has been so far calls for proposals on the following actions:

1) Improving water governance: including the reforms of water regulations and the creation of a National Water Observatory with **10 M€**.
2) Improving digital transformation of the RBOs: with investments in the automatic hydrological information systems (Early Warning Systems - SAIH in Spanish); investments in monitoring of wastewater discharges to the water bodies; and investments in the electronic water use rights registry. This has an allocated budget of **225 M€.**
3) Improving digital transformation of the water users (domestic and irrigation): there is a budget of **1,700** M€ for local authorities and other public entities, water users cooperatives (and organizations) and for water companies. It is expected to mobilize additional investments of 1,120 M€ of Public Private Partnership (PPP).
4) Improving Capacity Development in the use of digital technologies by personnel involved in water management at all levels with a budget of **5 M€** .

138. Funding of the European Investment Bank (EIB) is available, but it has not been widely used. In 2018 it was estimated that EIB funding of projects had been of 42 M€, which would be about 0.5 percent of total funding needs. The main challenge to absorb this type of funding is the low existent capacity for preparing and implementing bankable projects for implementing agents. This is worsened by the fact that other alternative financing sources have simpler requirements. This is even the case for the Natural Capital Facility[82] where the EIB has funding for project preparation, but requirements are not well known by Spanish authorities. Commercial funding has become important source for funding water resources infrastructures through the State Water Companies: ACUAES and ACUAMED, created in the 1990's. In the current ACUAES's Framework Agreement with the GDW, the volume of investment expected to be funded with commercial funding has been of 1,032 M€ for all existing and planned infrastructures. The public companies negotiate a credit line with commercial banks secured by their own equity at an agreed interest rate linked to Euribor. This credit line is activated in Project basis. In 2021, 450 million of the liabilities of ACUAES were loans with commercial banks83.

139. For RBOs commercial loans has been a marginal source of funding and has been used in the past to finance cash flow shortages during the years after the 2008 world financial crisis. For example, the financial liabilities of the Cantabrico RBO in 2016 were 11.5 M€ and those of the

[79] https://www.miteco.gob.es/es/prensa/ultimas-noticias/el-miteco-destina-75-millones-de-euros-a-la-mejora-de-ecosistemas-fluviales-y-la-reducción-del-riesgo-de-inundación-en-entornos-urbanos/tcm:30-545397
[80] https://fundacion-biodiversidad.es/buscador-de-convocatorias/?post_types=convocatorias_del_pr
[81] Information provided by the General Water Directorate
[82] The Natural Capital Finance Facility (NCFF) is a financial instrument which was set up by the European Commission and the EIB. It offers loans and technical support to projects that are expected to have a positive impact on biodiversity and/or adaptation to the impacts of climate change. https://www.eib.org/en/products/mandates-partnerships/ncff/index.htm
[83] https://www.acuaes.com/sites/default/files/informacion-finaciera/cuentas-anuales/ccaa_acuaes_2021_con_informe.pdf

Guadalquivir RBO were 119 M€. However, this is not the preferred or desirable funding source for operational and investment costs when there are unbalances. Normally the GDW proposes solutions, including delaying expenditure or making direct transfers from central government to cover operational or capital costs at the end of the year. Funds for projects included in the Flood Risk Management Plans come from a combination of national public budgets and EU funding mainly (see box below). Other specific sources for financing has been the funds from the PIMA Adapta[84] from the public auction of emission rights. The annual allocation from this source has been on average about 5 M€ (with a peak of 12 million in 2020) for projects on nature, water, and coastal areas. Another source of finance are the Research funds from the EU Framework Program[85] and from the national research programs of the CSIC[86].

Funding of the River Basin Flood Risk Management plans (ongoing)[87]

-Improvement of the Hydrological Information Network (70 M€ funded by the NextGenerationEU fund and 20 M€ for operation and maintenance costs funded with the regular public budget)
-Development and Implementation of 3rd cycle of the Flood Risk Management Plans (30 M€ funded with regular public budgets)
-Improvement and protection measures - including preparedness, response and recovery measures- (94 M€ funded by the NextGenerationEU fund and 57 M€ funded from the regular budget).
-Call for proposals for adaptation to flood risks (20 M€ funded by the NextGenerationEU fund and 3 M€ funded by the regular public budget).
-Flood protection and river restoration in urban areas (149.5 M€ funded by the NextGenerationEU fund).

THE NETHERLANDS

140. In 2014, the OECD published a study "Water Governance in the Netherlands, Fit for the Future?" (OECD, 2014). This study recognized the Netherlands' excellent track record on water management (calling it 'a global reference for water management') in several areas, a track record which developed during a long period of time[88]. The report however also mentioned some weaknesses, such as: weak economic incentives to efficiently manage water; the awareness gap amongst many Dutch citizens; the lack of transparency on the allocation of costs across different categories of water users; the concerns about water quality and the resilience of freshwater ecosystems; and the (increasing) risk of information asymmetry and monopolistic behavior.

141. The OECD study initiated a discussion and studies in the Netherlands on what modifications might be desired in order to arrive at a sustainable and future proof financing of Dutch water management (Twynstra Gudde & Tauw, 2015; Arcadis, 2017, Wing, 2021). The first report by Twynstra Gudde & Tauw also provided a baseline for this discussion, presenting an integrated overview of all costs and sources of finance for the entire Dutch water sector. The figures

[84] https://www.miteco.gob.es/es/cambio-climatico/planes-y-estrategias/pimaadapta2020_tcm30-521929.pdf
[85] https://research-and-innovation.ec.europa.eu/research-area/environment/water_en
[86] https://www.ciencia.gob.es/home/Convocatorias;jsessionid=AB5BB0248E40348DED129BDEEE1A06E6.2
[87] Information provided by the General Water Directorate, Ministry for Ecological Transition and Demographic Challenge
[88] The Dutch Regional Water Authorities (RWAs; or Water Boards) are amongst the oldest democratic institutions in The Netherlands and can be traced back to the 13th century.

presented in this chapter are based on the data collated as a baseline for these studies[89,90,91]. On an annual basis, the Dutch spent some € 8.7 billion on different water tasks and services, which is equivalent to approximately 1.4 percent of GDP[92]. These costs include an estimated € 0.8 billion of expenditures of the private sector (mainly for cooling and processing water). On a per capita basis, the "water costs" equate to a little over € 500 per capita[93]. The Table below presents an overview of the costs of Dutch water tasks and services, as well as its funding.

	Water task and service											
	1. North Sea	2. Cooling water	3. Process water	4. Drinking water	5. Sewerage	6. Water quantity management	7. Water quality management	8. Management of waterways	9. Flood protection (primary system)	10. Flood protection (regional)	11. Wastewater treatment	Total
Costs												
Central Government	38	-	-	-	-	148	88	895	868	-	-	2,037
Provinces	-	-	-	-	-	107	2	152	11	33	-	305
Regional Water Authorities	-	-	-	-	149	727	243	9	172	85	1,043	2,428
Municipalities	-	-	-	-	1,462	76	-	222	-	-	-	1,760
Drinking Water Companies	-	-	-	1,384	-	-	-	-	-	-	-	1,384
Private	-	198	194	-	20	47	-	-	-	-	353	812
Total Costs	38	198	194	1,384	1,631	1,105	333	1,278	1,051	118	1,396	8,726
Sources of funding												
Households	-	-	-	1,010	1,010	*774*	*187*	*8*	*198*	96	1,032	4,315
Industries and businesses	-	40	147	374	374	*116*	*44*	*15*	*11**	13*	363	1,496
Agriculture	-	-	47	-	-	66	20	-	34	9	-	176
Recreational boating	-	-	-	-	-	-	-	13	-	-	-	13
Commercial shipping	-	-	-	-	-			230		-	-	230
Energy companies	-	158	-	-	-	-	-	-	-	-	-	158
General funds - Central Gov'ment	38	-	-	-	-	*148*	*80*	*895*	*868*	-	-	*2,029*
General funds - Provinces	-	-	-	-	-	-	*2*	*110*	*29*	-	-	*141*
General funds - Municipalities	-	-	-	-	-	-	-	*7*	-	-	-	*7*
Total Sources	38	198	194	1,384	1,384	1,104	333	1,278	1,139	118	1,395	8,565

Source: on basis of Twynstra Gudde & Tauw (2014). Those figures are still sufficiently representative for the cost and funding of water today (see also footnote 89).Some inconsistencies in the data may exist. Figures in italics are calculated by the author, on the basis of information on the share of households and industries in the total tax burden.
*) this looks like a (too) low amount.

Table 5: Overview of costs and sources of funding of the different water tasks and services (approx. 2013; in € million.)

[89] No major policy changes have been implemented since the report of Windstar Gudde & Tauw and the costs are still sufficiently representative for the purpose of an international comparison. We also acknowledge that collating different costs from different water entities is not at all an easy task, which may involve solving inconsistencies, gap filling and allocation. The report by Twynstra Gudde & Tauw was supported and acknowledged by the different stakeholders in the water sector. However, we found one major weakness in the cost figures presented in the report: all costs financed by governments (i.e., out of the State, Provincial or Municipal budgets) were allocated to be sourced by households and businesses according to their respective shares in the overall tax burdens of the State, Province and Municipalities, suggesting full cost recovery. We have 'undone' this allocation and have included additional budget lines representing costs which are financed through these general budgets.

[90] We also noticed some (probably) other inconsistencies in the costs presented by Twynstra Gudde & Tauw which we consider not relevant for the discussion and decided not to try to explain or correct.

[91] Of course, we contacted the authors of the report to request the original data, but these were no longer available.

[92] In 2013, € 650 billion (2021: € 760 billion).

[93] In 2013, the population of the Netherlands was 16.8 million.

142. **Costs:** the highest annual costs are for of sewerage (€ 1.6 billion), wastewater treatment and drinking water supply (both € 1.4 billion), management of waterways (€ 1.3 billion), and for flood protection (primary system) and water quality management (both € 1.1 billion). In terms of organizations, the regional water authorities incur the highest annual cost (€ 2.4 billion), mainly for wastewater treatment (€ 1.0 billion), water quantity management (€ 0.7 billion), flood protection of the primary system (€ 0.2 billion), water quality management (€ 0.2 billion) and regional flood protection (€ 0.1 billion). The (direct) cost[94] for the central government amounts to some € 2 billion per year, of which € 0.9 for flood protection (primary system), € 0.8 for the management of waterways and € 0.2 for water quantity management. Municipalities spent in total € 1.8 billion on water per year, of which € 1.5 billion for sewerage, € 0.2 for management of waterways and € 0.1 for water quality management. Provinces spent some € 0.3 billion, mainly on the management of waterways (€ 0.2 billion) and water quality management (€ 0.1 billion).

143. Sources of funding. More than half of the annual cost of public organizations (€ 7.9 billion) is paid for by households (€ 4.3 billion). About one-quarter is paid for by non-households (industries, businesses, agriculture, shipping) and another quarter is paid out of general funds (mainly from governments, € 2.0 billion comprising expenditures for flood protection and management of waterways). Hence, for most water tasks and services, the costs are fully recovered through tariffs or designated levies (see next session). However, cost-recovery does not apply to the central government expenditures on flood protection of the primary system, and to the management of waterways. The water tasks and services most relevant for the 'NEMA' project, are the tasks 6–12, with a total cost of € 5.4 billion per year. The tasks 1-5 are therefore greyed out. To finance its investments, RWAs and other public entities can request loans from different banks, including from the bank, which was founded especially for the RWAs, the NWB Bank, see Textbox below.

After the 1953 flood disaster in the Netherlands, the Nederlands Waterschapsbank was founded in 1954 to help the water authorities raise the enormous investment needed to protect the Netherlands against water. The bank was not founded as an immediate result of the disaster. Plans were already being drawn up to set up a bank for the water authorities in 1939. The final decision to launch the bank was taken in December 1952, just 2 months before the North Sea Flood in February 1953 struck the Netherlands. The founders of the bank wanted to provide risk-free capital to regional water authorities, but also stressed that the bank was open to doing business with other public and semi-public organizations. Soon after the bank was launched, it began to finance municipalities and social housing and became key financer in the public domain.

[94] Indirect costs include the contribution of the central government to the provincial and municipal funds.

3.2 Tariff setting methodologies and application of 3Ts (tariffs, transfer, taxes) approach for infrastructure funding

AUSTRIA

144. In Austria, tariffs only apply to drinking water and wastewater services in terms of payment for products. **Water Supply and Wastewater Treatment:** the sector is financed mainly by revenues from tariffs paid to water and wastewater service providers/utilities. Revenue from tariffs covers operations and maintenance costs and a significant share of investment costs. In addition, the federal government and the province grant some subsidies (funded by national and province taxes) to complement significant investments (Danube Water Program, 2015). **Water Supply:** With 3,67 €/m³, the average drinking water tariff is comparatively low (EurEU, 2020). This is because Austria covers its drinking water needs entirely from protected groundwater. Stringent water source protection provisions are, in collaboration with the landowners and the province authority, managed by the drinking water service provider. **Wastewater generated by households:** the household connected to a sewerage network and treatment facility is liable to pay costs in Austria. The tariff per household is calculated depending on the volume of drinking water consumed (Vienna) or the size of the house (Lower Austria). In some municipalities households that cannot infiltrate rainwater on their own land (but discharge it to the sewer line) are required to pay more. Households within a certain vicinity of a sewer line must connect to the sewer line. **Wastewater generated by companies and industries:** An indirect discharge is any discharge of wastewater of different nature than that of domestic households into the sewer system. The calculation of the tariff is dependent on volume and contamination.

FRANCE

145. The centralized policy management of the country, the specific nature of water and water services which are mainly public services requiring equality of all users of the service, together with the designation of local authority as the main actor responsible for many water related services in a quasi-monopole situation, has led to develop a legal framework with the same rules applying everywhere. Equality applies first at the level of the water service and the implementation of different tariffs for the same service (depending on volume used, on periods of use, on type of user or distance from the facility etc.) is strictly controlled and to a large extent prohibited. For instance, while rural and urban users entail completely different types of investment and maintenance, they all pay the same price. Equality applies also at the river basin level, the water agency fees collected towards all water users are then dedicated to various actions on the river basin, depending on basin priorities and not of the contribution of the various water users.

146. **TARIFFS:** Industry users (including power plants) can either take in charge the abstraction and preparation of the water they need for their own use, in which case they will have to pay water agency fees, VNF fees if relevant, and their own costs, or else use the services of a separate specialized operator who will fix a tariff through a private contract negotiated between both parties. They can also use the local municipal water service and pay the local tariff (and get back the VAT) or benefit from specific conditions (especially in the case they contribute significantly to the budget balance of the service) under the strictly defined national legal framework. If they discharge wastewater in the sewer, authorization is mandatory and specific conditions may also apply (pre-treatment, volumes, …). If they discharge wastewater in the aquatic environment, they will have to obtain a permit which will prescribe the necessary treatment they must implement.

They can either implement on their own or use the services of a separate specialized operator (see above) and pay discharge fees to the water agency (and to VNF where relevant).

147. Agriculture users can also take in charge the abstraction, preparation and storage of the water they need either alone or in a structured organization (ASA, OUGC, regional company: see **Annex 2**), in which case they will have to pay water agency fees and their own costs or that of the collective organization which may be eligible to certain subsidies. They can also use the local municipal water service and pay the local tariff (and get back the VAT) or benefit from specific conditions (especially if they use a large water quantity). In the case they generate wastewater, a similar approach like for industry applies.

148. Navigation users pay a toll to VNF, which is a limited contribution to its activity (2.6% of its budget in 2018). There are two tariffs:

- one for professional transport of goods which considers the size of the boat with 7 categories from <199 tons to >5,000 tons, the size of the network (wide gauge or small) and per ton/km, and specific lockage service rate with 3 boat size categories and two time period (before 22h or after),
- and one for leisure boats in the form of a sticker which considers the duration of the use (4 categories from one day to the year), the length of the boat with 4 categories and a price per meter + a fixed price. In addition, special operations can be charged (harbor parking, tunnels or specific locks).

  https://www.vnf.fr/vnf/app/uploads/2023/03/P%C3%A9age_marchandises_tarifs_2023.pdf
  https://www.vnf.fr/vnf/app/uploads/2021/01/Tarifs_p%C3%A9age_plaisance_priv%C3%A9e_2021_FR-web.pdf

149. Drinking water and wastewater users pay the price defined by the contract established when they have been connected to the service. The tariff can include an initial connection price, a fixed price for access to the service which shall not exceed 40 percent of the annual price, and a price based on the volume of drinking water used and applied to drinking water and wastewater. It must separate the drinking water and (when there is a sewer and treatment plant) the wastewater parts. The authority is allowed to define its own tariffs, but each public service (drinking water, wastewater) must have its own balanced budget. The tariffs must be fixed to cover the expenditures of the public service: operation of assets, and management of assets including their maintenance and renewal, but also taxes and fees for the water agency in which the municipality is situated. The EPCI can also use bank loans (depending on its creditworthiness), in which case the tariffs should also include associated costs. When the public service is delegated to a private actor, the tariffs are fixed by contract between the authority and the private company managing the public service delegation, including the update formula for the duration of the contract. Categorization of users can be made to a limited extent: seasonal variations or variations of the fixed part with diameter of the pipe are allowed but distinction between permanent residents and temporary is forbidden for instance. For domestic wastewater and by simplification, it is considered the volume of drinking water measured at the counter corresponds to the volume of wastewater discharged. Household have two years to connect to the sewer when it exists and to disconnect their individual treatment system.

Some activities which are generating wastewater similar to domestic wastewater (hotels, camping, small shops, education, army camps, head offices…) pay the fee for domestic pollution

instead, and the same drinking water and wastewater price than domestic users. Other activities pay the same price for drinking water (or a reduced price in some cases when they use higher volumes). For wastewater, they are considered to generate non-domestic wastewater and if they are willing to connect to the sewer, they must send a request for authorization to the local authority which describes the technical parameters of this before to connect to the sewer. They may be required to pre-treat it so that wastewater characteristics are closer to a domestic wastewater (no heavy metal, no toxic substance…) to guarantee also a discharge after treatment compatible with the receiving water. In such case the water agency fee is based on net pollution discharged after treatment by the municipal treatment plant and if the activity is not connected by its own sewer to the treatment plant but to the public sewer, a fee for modernization of sewer networks.

150. The prescriptions for wastewater connection to be authorized are linked to 5 key principles: qualitative and quantitative compatibility of wastewater with the sewer, ability of the treatment plant to treat it, no risk for the staff, remaining pollution after treatment compatible with the receiving water, compliance with commitments and transparency between actors. The absence of it is an offense which is punishable by a 10,000 euro fine. For its wastewater, the volume and pollution has to be monitored and reported to authorities and various pollution fees are applied (and paid to the water agency) depending on the pollution parameters and certain thresholds. The public service can issue a price for some specific operations: control of individual treatment systems for areas with no collective wastewater management, connection of a new house, building or economic activity. Rules for setting the price for these additional activities are generally based on the cost of the operation (staff and non-staff costs) or the avoided cost by the beneficiary (as fixed by public health code).

151. **The specific case of bulk water:** France is a water rich country and transport of water for drinking water on long distance is rather limited. When it is needed, the costs are often shared between the various EPCI which benefit from the infrastructure, along the volumes they need. There are however some big water transport infrastructures, for navigation managed by VNF, or for all uses including agriculture, industry and urban areas in the South of France. Abstracting or discharging in VNF infrastructure is subject to a tax (used for maintenance of infrastructures) in addition to water agency fees. The regional companies in charge of water transport infrastructures in the South (BRL, SCP, CACG) have developed drinking water production using the water of the channel and sell this drinking water to local authorities or directly to the end users. Here again, the price is fixed by local authority in close cooperation with these regional companies. They also sell raw water to industries and agriculture and have developed a whole set of services around water provision: management of the irrigation perimeter, provision of irrigation material, treatment of water to provide specific quality of water to the industry… VNF and these regional companies also manage dams to feed their channels and produce hydroelectricity for their own use or sell it.

152. To secure the supply of drinking water, public services have been encouraged to develop interconnection between their own drinking water network and that of neighboring water services. The approach is to allow continue feeding the drinking water network, in case of a pollution or any other problem on one of the water resources of the services (water shortage, etc.). In such case, the price of bulk water is fixed by convention between the services. There is no specific rule for this, but it is of common interest of both public services to increase the security and keep the economic balance of their services and they often share the cost of this interconnection, of the resulting O&M costs and fix a price for the water exchange which is

coherent with their own costs. In all of the above cases and it is a prominent specificity of France, water users have to include in the charges, to elaborate the tariffs, affected fees (their use can only be done for financing water infrastructures or water expenses) paid to public agencies. The two main actors authorized to receive water related fees are water agencies and to a more limited extent VNF. VNF uses the fees to maintain and enhance the navigation infrastructure they manage, while the water agencies use these fees to provide subsidies or reimbursable advances to public water services and a wide diversity of other actors who pay fees.

153. **The water agencies fees and subsidies:** Water agencies collect a set of fees calculated by a simple formula: Amount of the fee = base × rate, the rate being fixed at basin level each year and framed at national level, and the base being quantity of water, of wastewater for domestic pollution and of pollutant for the other polluters, with thresholds fixed to cover a large share of these together with keeping the system manageable. The amount for each fee is fixed annually (and for 6 years, water agency program duration) per cubic meter or pollutant released. There are eight different fees collected by the water agencies, each with its calculation method and thresholds:

- Fee for non-domestic water pollution of which fee for water pollution by livestock activities (58 M€ in 2021);
- Fee for domestic water pollution (1,069 M€ in 2021);
- Fee for modernization of collection networks (528 M€ in 2021);
- Fee for diffuse pollution (189 M€ in 2021);
- Fee for abstraction from water resources (6 main uses, 358 M€ in 2021, of which drinking for 234 M€);
- Fee for water storage during low water periods (0.1 M€ in 2021);
- Fee for the protection of the aquatic environment i.e., fishing fee (7.5 M€ in 2021);
- Fee for hunting (49.7 M€ in 2021).

NB: there was a Fee for obstacle on a watercourse which was deleted in 2020

They are collected by water agency services towards the various water users: public services, companies, farmers, hydropower companies, fishing federations. As they are to a large extent related to quantities of water or of pollutants, water users are motivated to reduce their abstraction and release of pollutant for a reduction of the fees they pay. They are all grouped together in the budget of the water agencies under basin solidarity principle. In total the households are paying 86 percent, industry 8 percent and agriculture 6 percent.

Out of this 2.2 billion €/year, the collected amounts are spent for the following actions:

- Water agencies building and personnel cost (164 M€ in 2021);
- actions for knowledge, planification and governance (145 M€ in 2021);
- collection and treatment of wastewater, technical assistance for water management, improvement of drinking water service (736 M€ in 2021);
- management of rainwater, fight against industrial and agriculture pollution quantitative management of water resources, protection of water resources, restoration and management of aquatic environment (842 M€ in 2021, of which 320 M€ for GEMAPI);
- wastewater treatment performance bonuses (166 M€ in 2021);

- national agency on biodiversity (OFB) in charge of water information system but also of natural parks, of hunting and fishing police, etc. (375 M€ in 2021);
- Exceptionally in 2021 the state decided to accelerate the recovery after Covid with a specific investment plan “Plan France Relance” (255 M€ in 2021).

(Source Jaune2023_agences_eau.pdf https://www.budget.gouv.fr/documentation/file-download/19026)

154. VNF fee: VNF, the navigation agency is managing a large set of infrastructures and rivers. When a user is abstracting water or discharging wastewater in its domain, or using hydropower, the agency can perceive a fee which is used to finance modernization and maintenance of navigation infrastructures. The fee is not applied on hydropower plants which have a concession, rainwater discharges and fire rescue abstractions. The calculation method considers two parameters as follows and an annual update can be made using a combination of price indices for energy and wastewater (December 2021):

A) On the one hand the size of the public navigation domain occupied by the infrastructure in m². The rate takes account of the number of inhabitants of the municipality where the infrastructure is installed:

i) <2,000 inhabitant 1.18€/m²
ii) between 2,000 and 100,000 inhabitants 11.45€/m²
iii) > 100,000 inhabitants 23.01€/m²

- for agriculture use the size of municipality is not considered and the basis is 1.18€/m²
- whatever the use, a discount of 50% is applied for the part of the size of infrastructure between 10,000 and 20,000 m² and of 85% for the part >20,000 m²

B) On the other hand, the abstractable or dischargeable volume. The rate takes into account the final use:

i) agriculture use: 0.35€/1,000 m^3
ii) industrial or commercial use: 5.25€/1,000 m^3
iii) public service for drinking or wastewater: 5.83€/1,000 m^3
iv) other uses: 5.83€/1,000 m^3

In 2018 it represented 23 percent of VNF budget.
(Source: https://www.vnf.fr/vnf/services/calculez-votre-redevance-hydraulique/)

155. **TRANSFERS:** The level of transfer in France is relatively limited. However, there are a set of subsidies which come from the general budget (non-affected) of a set of public actors. Five other actors can participate in transfers, often under a solidarity principle: Europe, State, region, department and municipalities. Municipalities with a size below 3,000 inhabitants can include their water services in their general budget (however a specific budget must be maintained visible) and therefore finance to some extent the services by own resources via transfer.

156. **State subsidies:** The main budget line of the state for territorial collectivities including regions departments and municipalities and there EPCI in relation to water are budget line 113 landscape, water and biodiversity and budget line 181 natural risks prevention. The state also establishes strategic planification contracts with regions which fixes priorities and investments planned for the next seven years. It fixes with each region an overall amount with the contribution of the state and of the region and is composed of six key topics. For water, the two topics of interest are “ecological and energy transition” (5.6 billion € for 2015-2021) and “territories” (4.6 billion €). Depending on eligibility of the EPCI, the state can also reimburse VAT on investments. In the

framework of its environmental policy, the State also uses some specific mechanisms to incentivize investment by citizens for some infrastructures. For water there is a reduced VAT on works and zero interest loan for individual wastewater treatment systems. In addition, the state is financing, via subsidies or contribution to their budget, and for the public services they operate, some national public agencies or institutions:

- involved in research and technological development for water topics or support to policies: Inrae (inland water, water related technologies, agriculture), Ifremer (maritime aspects), BRGM (geological and groundwater aspects), Cedre (inland and marine pollution by petroleum), Ineris (chemical risk and pollution), OIEau (water information system and documentation),
- involved in management of part of the public domain: VNF for navigation, "Conservatoire du littoral" to protect inland and marine shorelines from urbanization (and financed by an affected tax).

NB: VNF, which oversees navigation network, is a public agency and receives subsidies for maintenance of the infrastructures of another public agency in charge to finance transport infrastructures named AFITF (14% of its budget in 2018), and subsidies of the state for public service charges (46% of its budget in 2018).

157. **Flood prevention "Barnier fund":** since 1995, a major natural risks prevention fund was created (known as "Fonds Barnier"). It is financed by a levy on the private insurances, on the natural disaster premium they perceive on household insurance and cars insurance contracts. It can cover (finance) a wide diversity of actions: expropriation, buying of properties, temporary evacuation and relocation of people under threat, study works, infrastructure to reduce or prevent risks of which floods. In period 2011-2019 the fund has contributed 738 M€ for the flood prevention action program. In 2021 it was 120M€ and 167 M€ in 2022 (Jaune2023_collectivites.pdf). The fond Barnier has two objectives: support global approaches to natural risk prevention (of which floods) and provide safety to people exposed to a natural risk seriously threatening human lives (of which flash floods). It provides funds for financing studies, works and equipment. The allocation of funds is subject to some criteria, of which the existence of a flood prevention action program (PAPI), and the level of subsidies for the municipality or its EPCI vary with the status of the natural risks prevention plan (PPRN): 50 percent for studies in all cases but 40 to 50 percent for works or equipment if the plan is approved or 25 to 40 percent if it is only prescribed. Subsidies can also be allocated to individual households for specific protection works, with a limitation to 80 percent of their cost and up to 36,000€ in two cases: when the works are identified in the action program of a PAPI and represent less than 50 percent of the market value of the house, or when the work are required by a flood risk prevention plan (PPRI), and represent less than 10 percent of the market value of the house. For small enterprises (below 20 employees) their properties dedicated to professional use can benefit from subsidies limited to 10percent of the market value of the property exposed to the risk and 20 percent of the protection costs.

158. **OFB:** National agency financed by the water agencies, OFB finances the water information system, various water related research projects, one Life + project (Artisan), manages resources centers (to gather and share knowledge on specific topics: rivers, abstraction, ecological engineering, water and wastewater services observatory Sispea), manages the ecophyto program established to reduce pesticides uses and finance associated projects. It also conducts or finance various studies for improvement of the knowledge on water related topics.

159. **Europe:** Europe via its research program finances a wide diversity of water related research which may involve French partners. The Life+ program can finance a wide diversity of implementation projects (for instance the project "Artisan" managed by OFB for an EU contribution of 8M€). The FEDER but also the FED and the FEADER can co-finance infrastructures like wastewater treatment plants (construction or renewal), drinking water plants, water wells and associated studies in the form of subsidies. The FEDER in particular can participate to the financing of flood plain (land acquisitions, studies) and dyke and overflow works (via the strategic planification contracts with regions).

160. **Territorial collectivities:** Region, Department – the territorial collectivities have a specific role in the water and wastewater sector. The regions are investing on water related topics on their territory in functioning and equipment (324 M€ for 2020). They are supporting in particular harbor and navigation channels (184 M€ in 2020) and flood protection. Four regions have taken an animation role in Gemapi in 2020 but also supporting approved local watershed management plans (SAGE). The departments responsibilities are primarily in the assistance to municipalities on their equipment. For water they participate in the financing and monitoring of projects relating to the preservation of the quality of raw water and the supply of drinking water. Among the mandatory competences they have for water, they must participate to SAGE when they exist, they have to take care of domanial domain transferred to them and manage a specific fund for the poorest which can be used to maintain access to water to the poorest. They can also implement optional actions and most departments have also implemented a technical assistance service for wastewater treatment plant operators (Satese) of rural municipalities (<5,000 inhabitants), and some have even extended this to support for implementation and controls of individual treatment systems. The service is financed by them and the water agency. Some departments have also extended their actions for instance to support maintenance of rivers, monitor water resources on their territory or assist the management of rainwater in cities, or even implement a departmental scheme for drinking water or wastewater to secure supply and distribution and drive improvement programs. (700 M€ in 2019)

https://www.banquedesterritoires.fr/transition-ecologique-des-depenses-en-hausse-de-28-pour-les-regions-en-2020

161. **Local authorities:** For drinking water and wastewater management, it is not allowed to transfer budget from the municipality budget, but there are some exemptions: when a massive investment would lead to an excessive increase of the water price and in a strictly framed context (exceptional cases), and for municipalities below 3,000 inhabitants (or EPCI with no municipality >3,000 inhabitants). For these last, a separate budget has to be identified in the accounting system of the local authorities, but it can include drinking water and wastewater in the same budget and they can use the general budget of the local authority to finance part of it via operation subsidies (300 M€ in 2019). The other municipalities are not allowed to contribute to the water and wastewater budget.

https://www.collectivites-locales.gouv.fr/competences/leau-et-lassainissement

On the other hand, for rain water management, as well as for Gemapi, the municipality or its EPCI have to have a balanced budget which may to some extent or entirely come from the general budget.

162. **TAXES: t**he state is applying VAT on the drinking water and wastewater services. The reduced VAT (5.5%) is applied on drinking water as an essential service, and the normal VAT (10%) is applied to wastewater. VAT does not apply the same way to all services because public water

services can be managed directly by the EPCI or delegated and in this case the EPCI can receive a contribution from the delegate for use of the EPCI infrastructure which is subject to VAT. municipalities or EPCI below 3,000 inhabitants can be exempted from VAT. VAT is applied on total amount of water invoices including water agency fee and where relevant VNF fee. The amount reached 890M€ in 2019. In addition, the state has recently fixed a maximum amount to the annual fees perceived by water agencies. When the total amount overpass this, the excess is transferred to the state general budget and can therefore be considered a state revenue (120 M€ in 2019). To finance GEMAPI, the EPCI can issue an aquatax for a maximum amount of 40€/inhabitant per year, and for a maximum amount which cannot overpass the expenses for the service because the tax is specifically affected to GEMAPI actions. The tax is perceived towards private companies and property owners (amount fixed according to the tax revenue of the previous year). While it took some time to be implemented, it is a fast-growing revenue of EPCI and half of the competent EPCI (1,255 EPCI for 18,724 communes in 2021) have implemented it in 2021. (275 M€ in 2021)

(https://www.collectivites-locales.gouv.fr/files/Accueil/DESL/2023/Bis%20Gemapi%20VF_web.pdf)

163. Payments for Ecosystem Services (PES): There has been some private initiatives to implement such payments for farmers situated on the abstraction perimeter of some important mineral waters, the company paying the farmers to reduce the number of animals grown, or adapt their management system (more grazing, improved fertilization or pests' management, etc). The biodiversity plan adopted in July 2019 has fixed an objective of 150M€ taken from water agencies budget and used to pay agriculture for PES, not waiting for the new CAP which should include such payment. Following this the environment ministry and water agencies have started to develop an aid system which pays the environmental services provided by farmers and encourages the environmental performance of farming systems. Coordinated at water agencies level, it started with call for expressions of interest towards local authorities already engaged in territory management and willing to implement such PSE. The budget can finance studies for definition of the system at local level and up to 100 percent of the PSE. The services cover 2 main topics:

- The management of landscape structures, which concerns non-agricultural areas, in particular agro-ecological infrastructures such as hedges, ponds, etc.
- The management of agricultural production systems, in particular the management of plant cover (soil cover, lengthening of rotations, permanent grassland, etc.) and the management of agroecosystem resources (management of nitrogen, carbon, etc.).

164. **Affordability:** First and by default the principle of equality of users is to be applied except in three cases:

- Differentiated pricing according to the categories of users resulting from the law,
- Objectively appreciable difference in situation between users,
- Necessity of general interest, linked to the conditions of operation of the service.

While on average, affordability is not a major issue in France, water representing less than 1 percent of the expenditures, for the poorest 10 percent of households, the water bill represents 2.2 percent of their income (OECD, 2009). To tackle this, each municipality decides whether it implements social water pricing or not. This is to help people with modest incomes to pay their water bill. The form of the aid may vary depending on the municipality that has implemented

social pricing (modulation of price of water depending on the quantity consumed, water allowance, water check, help to reduce unpaid water bill, help to reduce water consumption, etc.). In 2015, 50 water utilities concerning 11 million inhabitants were involved in an experimentation to implement social pricing95. The average amount of support represented 136 euros/year/household.

165. **Strengths and weaknesses of the current system:** Water is a complex topic at the interface between environment and economy, and with the involvement of a wide set of actors at various geographical level, and a set of structured interactions, the system allows a certain resilience, as also proven by the major drought event of summer 2022 or some local extraordinary flood events which have been taken on board and managed by the various actors. However, as concerns access to water resources, the system being based on priorities to different uses, and not on a price to access the resources, it will have to be adapted to tackle more effectively the conflicts between various users which will probably become more prominent with water shortages. As concerns floods, the adaptations of the system and re-localization of responsibilities closer to the ground will have a positive effect in the management of the flood infrastructures and therefore their ability to protect the properties. However, the high cost of the infrastructures and their inability to protect from all types of events, will require to consider also adaptation and in some cases also to give up and destroy human infrastructures. The fond Barnier was already used in the recent past to do this and finance part of the recovery or adaptations, but the high costs involved may not be financeable in the future and we already see private insurances which do not anymore accept to cover some properties.

As concerns water and wastewater, local prices vary significantly between water services, and the citizen have access to some information on the prices and performances of the services. For instance, public local authorities must publish each year a report on the performances of the services and national authorities have implemented a national observatory (SISPEA) which provides performance indicators and a set of information on the price of the services. But the differences are not easy to understand, and the citizen (and often beyond them the water managers) are not able to understand well what the main reasons for this are. This was accurately pointed in a recent high-level report (Simoni, Roche 2016), “Price formation results, on the one hand, from charges resulting from medium- and long-term objectives relating to the asset management of heavy infrastructure and, on the other hand, from immediate operating and user service expenses. These loads are very diverse depending on the situation and this contributes to the difficulty of evaluating the performance of operators. Information systems are not well suited to answering these questions and the explanations given concerning these discrepancies may thus seem confused.” While the water and wastewater prices will continue to rise (the new drinking water directive and the project for a new urban wastewater treatment directive are raising new ambitions which will have to be implemented and financed), efforts will have to be made to improve the explanations for the reasons behind these different prices (and the above report identify some key reasons not currently well documented with the information collected and makes some recommendations for improvement of this). In addition, a lot can be expected as concerns quality and continuity of the service with the recent laws on organization of the local public services and the mandatory transfer to EPCI. The number of services will be drastically reduced, and the size and technicity of the staff will allow reregulation of costs and prices and improvement in the quality of the services everywhere and the information on them.

[95] https://www.ecologie.gouv.fr/bilan-2019-lexperimentation-tarification-sociale-leau

POLAND

166. Financial situation of Polish Waters is rather difficult as the reform did not ensure the self-financing of the agency from tariffs and taxes and also it does not exist the system of transfers to balance the cost and incomes of the agency. One could observe rather little chaotic and response-driven solution of the minister in charge of water management to keep agency operating and avoiding bankruptcy. The financial situation of Polish Waters in years 2018-2021, that is from the beginning of activities, is presented in the table below:

Positions (in thousand Polish złoty)	Year 2018	Year 2019	Year 2020	Year 2021
1. total revenue	1,136,891.3	1,585,979.0	1,412,499.7	1,563,816.3
1.1 tariffs and taxes	411,243.3	538,574.4	785,096.6	602,847.7
1.2 transfers from State Treasury	658,884.3	910,433.9	419,736.1	789,827.5
1.3 transfer - other public sources	39,126.7	27,986.0	116,769.6	23,753.2
1.4 others	27,637.0	108,984.7	90,897.4	147,387.9
2. costs	1,174,859.3	1,597,301.9	1,578,385.4	2,262,058.1
2.1 amortization	230,437.6	388,487.9	461,792.9	573,406.9
2.2 salaries	287,909.2	361,286.8	375,928.0	408,486.6
2.3 others	656,512.5	847,527.2	740,664.5	1,280,164.6
3. financial result brutto	-37,968.0	-11,322.9	-165,885.7	-698,241.8
4. financial result netto	-38,529.4	-12,064.9	-167,157.0	-702,935.8
5. investments	672,254.5	1,194,207.8	1,166,267.2	1,486,332.7
6. total costs (2+5)	1,847,113.8	2,791,509.7	2,744,652.6	3,748,390.8
7. loans	76,309.9	151,552.6	583,186.8	128,123.6

Table 6: Financial information about Polish Waters/PGW Wody Polskie performance in years 2018-2021 (in Polish złoty; 1 Polish złoty was app. 0.25 USD in the end of 2021)

167. The table is based on data from audit reports for years 2019-2021 prepared by Polish Superior Chamber of Audit. It is visible that financial situation of Polish Waters is worsening with growing loses reaching 44.9% of incomes in 2021 and have negative every year since inception. Tariffs and taxes account for less than 40% of income with the exception of year 2020, when it was 55.6%. The level of transfers from the state budget is very substantial and as a rule higher than incomes from tariffs and taxes, fluctuating and ranging between 419 million Polish złoty and 910 million Polish złoty. Additionally, there were transfers from other public sources. The salaries cost is close to 70% of incomes from tariffs and taxes (with exception of year 2020 when it was 47,9%) and taking into account other fixed costs of agency (energy, services, goods, taxes, etc.) Polish Waters are strongly dependent on transfers from the state budget. It is important to notice that average employee salary in Polish Waters in 2021 was monthly 4,400 Polish złoty and this was 77.7 percent of average salary in Poland. That means the level of salaries is not a reason for deficit of Polish Waters. Investment spending is possible only due to external financing safeguarded by Government. Summarizing it must be noticed that system of Polish Water financing was not properly designed, and it creates problems in functioning water management in Poland.

SPAIN

168. The National Water Law establishes the cost recovery charges and tariffs for the bulk water services provided by the River Basin Organizations. The three most important ones are:

- The Regulation Charge for the recovery of the OPEX and CAPEX[96] of dams and groundwater infrastructures built by the state;
- The Water Use Tariff for the recovery of OPEX and CAPEX of water transportation infrastructures and other infrastructures.
- The Tax for control of discharges to rivers.

169. There are other additional charges such as the Tariff for the use of public domain that charges navigation, embankments, leisure activities and other activities in rivers. There are also fees for other minor administrative services. There are two charges for hydroelectricity users described below.

State-owned cost recovery figure	Service to which it applies	Applicable legislation
Regulation charge	Extraction and storage: (bulk water services)	**Art. 114. CTWL** **Art. 296-303 RHPD**
Water Use Tariff	Driving/transportation: (bulk water services)	**Art. 114. CTWL** **Art. 304-310 RHPD**
Charge for the use of hydraulic public domain assets	Environmental costs associated with various uses: - Navigation through continental waters - Crossing boats and their piers - Aggregate extractions - Felling of spontaneously born trees	**Art. 112. CTWL** **Art. 284-288 RHPD**
Charge for the use of continental waters for the electricity production	Other activities related to water management: Electricity production	**Art. 112 bis. CTWL**
Concession fee: Use of State infrastructures for hydroelectric purposes	Other activities related to water management, electricity production	**Art.132-133 RHPD**
Discharge control charge	Discharges to the public hydraulic domain	**Art. 113. CTWL** **Art. 289-295 RHPD**

Table 7: Cost recovery instruments for the RBOs.

Cost recovery figure	Service to which it applies	Applicable legislation
Fees for reports and other actions	Covering of the expenses that may occur in METDC and in its autonomous entities for the concepts of personnel of all kinds, material and other services: A1. Certification at the request of a party (€17.61) B. Optional reports without field data collection (€64.00) C1. Optional reports with field data collection. First day (€191.45) C2. Optional reports with field data collection. Every subsequent day (€127.39) F. For registration of concessions and administrative authorizations (€86.52)	Decree 140/1960, of February 4, which validates the rate for reports and other actions (updated by Law 17/2012, of December 27 General State Budget).

Table 8: Other fees charged by RBOs.

170. The Regulation Charge is charged once a year to those who benefit from regulation infrastructures (dams mainly) directly or indirectly. Direct beneficiaries are those who have water use rights from a dam or an aquifer. Indirect beneficiaries are those whose water use rights can only be exercised if there are regulation infrastructures upstream. The state is de facto also a beneficiary because of the flood management functions of dams that are considered of general benefit. The charge is calculated yearly for each infrastructure considering the following:

- The operation and maintenance cost attributed to the infrastructure
- A proportion of the general administrative costs of the RBO that can be apportioned to the infrastructure[97].
- 4 percent of the total investment costs for 50 years. This includes the expenditure necessary to comply with the requirements established in the environmental impact assessments.

[96] CAPEX (Capital Expenditure) and OPEX (operational expenditure).

[97] The general administrative costs of the RBA are apportioned on an ad-hoc basis in the Infrastructure Boards.

171. Before calculating the charge to users, some "discounts" are considered to account for the general public benefits of the dams (e.g., flood management and other amenities). These "discounts" can vary with from RBO to RBO, some might not be applying them, others might be considering 80percent discounts (duly justified such as in the Tous Dam[98]) and others (Tajo RBO[99]) applying a flat discount in all infrastructures. On average this "discount" is 30 percent of CAPEX. The resulting costs are apportioned to the different users according to the so-called equivalence tables, agreed by the "Dam Management Board"[100]. These tables reflect the relative benefit obtained by the use of water for the different types of users: domestic, agriculture, industrial. The resulting amount for each type of user is charged by cubic meters for industrial and domestic users and divided by hectares for irrigation farmers. The total yearly income generated by the Regulation Charge is about 123 M€[101] for all RBOs in Spain. The Water Use Tariff is charged once per year to those water users who benefit from specific water transportation infrastructures (or group of them) and other specific water works. The tariff is charged for the infrastructure independently if the actual services are provided or not during droughts and floods. The amount to be paid is calculated in the same way as in the Regulation Charge but considering 25 years of the amortization period.

172. The Law established the possibility for the RBOs applying a correction factor to incentivize efficiency of water use. Those using above or below the baseline allocated water to the different types of users can see their charged multiply up to a factor of 2 or 0.5 depending on the use. As in the case of the Regulation Charge, this Tariff is charged per cubic meter to domestic and industrial users. The difference lies in the tariff for irrigation farmers. This can be per hectare, per cubic meter or binomial. In this last case the charge will have a fixed charge per hectare to cover general costs and the rest will be charged per cubic meter. The current review of the national water law includes the reform of the Water Use Tariff to be able to charge for the costs of other investments carried out by the RBOs such as wastewater treatment and reuse. A problem with this Tariff is that currently does not allow for the recovery of all CAPEX with the existing amortization period of 25 years. The total yearly income generated by the Water Use Tariff, according to the 2023 State Public Budget, is of about 62 M€ for all RBOs in Spain. The Tax for the control of discharges generates income that allows to cover the costs of control of discharges to rivers and other related costs such as studies and protection measures[102]. It is charged to discharge license holders but also to those who do not have a discharge license (in addition to the penalties that may apply in this case).

173. The Tax to be paid is calculated by multiplying the pollution content of the discharge expressed in units of pollution by the value/price assigned to the unit. This value or price of the unit of pollution is calculated by multiplying the "basic price" per cubic meter by a coefficient in a scale from 1 to 5 according to the pollution content of the discharge and the status of the receiving water body[103]. Currently the basic price is 0.01751 euros/m^3 for municipal water and 0.04377 euros per cubic meter for industrial water. The total yearly income generated by the discharge control Tax, according to the 2023 State Public Budget, is about 59 M€ for all RBOs in

[98] See methodology and results in the Jucar River Basin Organization (page 40): https://www.chj.es/es-es/medioambiente/planificacionhidrologica/Documents/Plan-Hidrologico-cuenca-2021-2027/PHC/Version%20Final/PHJ2227_Anejo09_RecuperacionCostes_2023_01_24.pdf

[99] see page 57 http://www.chtajo.es/LaCuenca/Planes/PlanHidrologico/Planif_2015-2021/Documents/PlanTajo/PHT2015-An09.pdf

[100] See example in the Guadiana Basin page 20. https://www.chguadiana.es/sites/default/files/2022-10/AEX-CRT-220001-210922-Proyecto%20CRTUA%202022%20Occidental.pdf

[101] Own elaboration on the basis of the State Budget of 2023

[102] https://www.miteco.gob.es/es/agua/temas/delimitacion-y-restauracion-del-dominio-publico-hidraulico/

[103] https://portal.chebro.es/canon-de-control-de-vertidos

Spain. There is a Tax charge of the RBOs for the use/occupation of the Hydraulic Public Domain (HPD) for rivers and river protection bands, dams, lakes and lagoons. Activities such as navigation, embankments, leisure activities and other activities in rivers are subjected to Taxes. It is required that the income generated by this charge will be used for the protection and recovery of the public domain[104]. The base of the Tax is calculated on the market value of the land, or the benefits obtained by the activity. The rate is 5 percent generally. A 100 percent[105] rate is applied on the value of materials extracted from the public domain.

174. The total yearly income generated by the Tax charge for the use of the HPD, according to the 2023 State Public Budget, is about 11 M€ for all RBOs in Spain. The Tax for the use of continental waters for the production of electricity is charged once per year to the license holders for hydropower generation. The Tax base is calculated for each infrastructure on the basis of the economic value of the energy produced, measured in power plant busbars, according to the electricity market prices. The Tax does not apply to the infrastructures directly managed by the RBOs. This Tax is reduced by 92 percent for small generation plants of less than 50 MW, and by 90 percent for the Pumped storage hydropower. The Tax rate currently applied is 25.5 percent. The 98 percent of the income of this Tax is paid directly to the Treasury and 2 percent is paid to the RBOs. The total yearly income Tax generated for all the nine RBOs in Spain, according to the 2023 State Public Budget, of 72 M€. Note that there are other Water Management Charges (tariffs) for water resources infrastructures defined by the State Water Companies and agreed with the beneficiaries for each infrastructure investment (including desalination plants, dams, water transportation infrastructures). Furthermore, there are other type of Taxes related to water Transfers between RBOs (e.g., Aqueduct Tajo-Segura, tariff for the water transfer of Negratín-Almanzora, tax for the water transfer of Guadalete-Barbate and the tax for the water transfer of Ebro-Campo de Tarragona).

175. Penalties for damages to the water public domain are imposed to those who: a) damage water infrastructures or water bodies; b) those diverting water or digging wells and extracting water without authorization; c) those who breach of the conditions of the water use licenses (concessions); d) those carrying out works or planting anything in the public domain or areas subject to protection; e) those occupying river beds or extracting sand/gravel without authorization; f) those who discharge wastewater without authorization. The penalties stipulated vary between 10,000 euros and 1 M€ depending on the severity of the damage. Independently of the penalties imposed according to the Water Law, the infringer has the obligation to repair the damage caused as regulated by the Environmental Responsibility Law106. This Law also establishes specific penalties:

- For very severe damages there is a penalty of between 50,000 euros a 2 M€ and the extinction or suspension of the authorization for the activity between one and two years.
- For severe damages, the Law establishes a penalty of between 10,000 euros and 50,000 euros and the suspension of authorization for the activity for one year maximum.

[104] https://www.miteco.gob.es/es/agua/temas/delimitacion-y-restauracion-del-dominio-publico-hidraulico/
[105] https://www.miteco.gob.es/es/agua/temas/concesiones-y-autorizaciones/regimen-economico-financiero-del-dph_tcm30-509114.pdf
[106] https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/responsabilidad-mediambiental/

THE NETHERLANDS

176. In the development of water tariff structures, several criteria may need to be considered, including criteria such as efficiency, fiscal robustness, complexity and equity (or justness, fairness) (Dekking & Havekes, 2015). Setting tariffs will almost certainly involve trading-off such criteria. The Dutch have introduced eight different instruments (levies, tariffs) for their different water tasks and services through which the costs of the different water tasks and services are recovered. In addition, a (non-designated) central government tax on drinking water (BOL) has been introduced to stimulate efficient water use, which is not used to directly cover water related costs. Details are presented in the table below.

No	Instrument	Organization(s)	Water tasks and services													
			1 North Sea	2 Cooling water	3 Process water	4 Drinking water	5 Sewerage	6 Water quantity management	7 Water quality management	8 Management of Waterways	9 Flood protection (primary system)	10 Flood protection (regional)	11 Resources from sewage	12 Energy from sewage	13 Energy from surface water	14 Energy from groundwater
1	Pollution levy[1]	State							X							
2	Ground water levy[2]	Provinces						X	X							
3	Water system levy[3]	RWA						X		X	X	X				
4	Wastewater levy[4]	RWA				X	X		X				X	X		
5	Pollution levy[5]	RWA						X	X	X	X	X				
6	Sewerage levy[6]	Municipalities					X									
7	Drinking water tariffs	Drinking Water Companies				X										
8	Fees and permits **)	--see above--			X	X	X	X	X	X	X	X	X	X	X	X
9	Tax on Drinking Water[7]	State				[X]										

Source: On the basis of Twijnstra Gudde & Tauw, 2015. Those instruments are still valid today.
In Dutch: 1/ Verontreinigingsheffing Rijk. 2/Grondwaterheffing;. 3/ Watersysteemheffing; 4/Zuiveringsheffing waterschappen; 5/ Verontreinigingsheffing waterschappen; 6/Rioolheffing gemeenten; 7/Belasting op Leidingwater (BOL)
**) In the baseline report by Twynstra Gudde & Tauw, the exact amount could not be identified. However, those are small amounts of money paid to the different water entities for the use of goods or services from the water entities.

Table 9: Overview of financial instruments (1)

In practice, three of those levies are the most important, generating significant revenues:

- the **water system levy**, covering the costs of **RWAs** for water quantity management (esp. water level management[107]), the management of waterways, and flood protection;
- the **wastewater levy**, covering the costs of **RWAs** for the cost of wastewater treatment (including stormwater) and water quality management;
- the **sewerage levy**, covering the costs of **Municipalities** for collecting waste- and stormwater; and
- **drinking water tariffs.**

107 In Dutch: peilbeheer.

177. In 2022, these four levies and tariffs yielded some € 6.4 billion. See the table below, which provides an overview of the different instruments, with a description, principles, and amount.

No	Instrument	Organization(s)	Description	Principle(s)	Total	Year
1	Pollution levy	State	The pollution levy is a levy on the discharge of water directly to the main surface water (Rijkswater)	**Polluter** pays principle € 37.28 per pollution unit (annual consumption of 54.8 kilograms of oxygen) [1),2)]	€ 19 m.	2015
2	Ground water levy	Provinces	The groundwater levy is an earmarked levy. It concerns specific costs of preventing and combating the adverse consequences of extractions and infiltrations and of investigations in relation to groundwater policy.	**Beneficiary** pays principle On the basis of m3 extraction, but only after a certain amount has reached (10,000 m3/year or more) [3)] On average € 0.015 per m3 only.	€ 12 m.	2021
3	Water system levy	RWAs	The water system levy is used to cover the cost of water management of the regional water authorities (e.g., dikes, levees, pumping stations, water quality management, etc.). The water system levy is imposed on both owners of property and users of residential objects. The water system levy for owners is based on the (WOZ)-value of the property while the water system levy for users is a fixed amount.	**Beneficiary** pays principle (owners; % of value) Categories: Buildings Agriculture Nature + **Solidarity** principle (all inhabitants; fixed amount per household) *Additional information* Appendix C: cost allocation Delfland Appendix E: values per RWA	€ 1,779 m.	2022
4	Wastewater levy	RWAs	RWAs use the revenue of the pollution levy to clean waste water from homes and businesses. The pollution levy is calculated in vervuilingseenheden, or 'pollution units'. Every household receives an assessment for 3 vervuilingseenheden (abbreviated v.e.). An exception is made for people who live alone; single households receive an assessment for 1 v.e.	**Polluter** pays principle v.e.: household: 1 or3 business: < 1000 v.e on basis of tables [5)] > 1000 v.e. on bass of measurement RWAs have the option to charge on basis of drinking water use. In practice, this is not done. *Additional information* Appendix D: wastewater coefficients tables Appendix E: values per RWA	€ 1,459 m.	2022
5	Pollution levy	RWAs	The pollution levy is a levy on the discharge of water directly to the regional surface water.	Has no direct relation to the cost, but the levy is set by law equal to the waste water levy.	€ 10 m.	2022
6	Sewerage levy	Municipalities	Municipalities use the revenue of the sewer tax for the maintenance, replacement and renovation of the sewer.	**Beneficiary** pays principle Owners and or users of property. Different models exist: -Fixed amount -On the basis of drinking water use -On the basis of property value	€ 1,772 m.	2022
7	Drinking water tariffs	Drinking Water Companies		**Beneficiary** pays principle Flat rate + rate per m3	€ 1,396 m.	2021
8	Fees and permits				Unclear	

No	Instrument	Organization(s)	Description	Principle(s)	Total	Year
	TOTAL				€ 6,447 m.	
9	Tax on drinking water (BOL)	State	Government tax to stimulate efficient use of drinking water	In 2023 € 0.382 per m3, with a maximum of 300 m3/year per building.	€ 320 m.	2021

1) Artikel 7.3 Waterwet, see https://wetten.overheid.nl/jci1.3:c:BWBR0025458&hoofdstuk=7&paragraaf=1&artikel=7.3&z=2021-07-01&g=2021-07-01

2) Artikel 7.6 Waterwet., see https://wetten.overheid.nl/jci1.3:c:BWBR0025458&hoofdstuk=7&paragraaf=1&artikel=7.6&z=2021-07-01&g=2021-07-01

3) The amount is different per Province. For an overview https://www.ostraka.nl/Ondernemer/Milieuheffing/Provinciale_grondwaterheffing.html

4) https://www.ostraka.nl/Ondernemer/Milieuheffing/Provinciale_grondwaterheffing.html

5) See e.g., https://www.derbg.nl/business/overview-of-taxes/waste-water-treatment-levy-for-commercial-premises/table-of-waste-water-coefficients (also attached as appendix C)

Table 10: Overview of financial instruments (2)

178. On the basis of this table, two observations:

- In the Netherlands, there is **no charge for bulk water supply**. An important aspect of water quantity management is water level management through pumping stations in Dutch polders. The cost for water quantity management is **part of the water system levy**, a levy which is charged to different beneficiaries (including agriculture, owners of nature areas, residents and businesses. The usage of the surface water in the canals, rivers and lakes is free of charge.
- the wastewater levy includes both the cost for treating wastewater, as well as the cost for treating stormwater. Adding the cost for treating stormwater in the levy causes the levy to be about twice as high compared to a levy based on the cost for treating wastewater only (Dekking and Havinga, 2015). This high levy could be an incentive especially for bigger companies to abandon the RWA's communal wastewater treatment and build their own. The Dutch have therefor introduced a dedicated regulation, the anti-abandonment regulation RWAs, see the Textbox below.

The purpose of the anti-abandonment regulation is to prevent capital destruction of investments in wastewater treatment plants (WWTPs) and to prevent an increase in the water treatment levy and the burden on tied dischargers. The regulation contains rules that the water authorities must comply with if they grant a subsidy to companies that discharge at sewage treatment plants and intend to carry out (pre)treatment themselves or have them (pre)treated. The subsidy is guaranteed under the condition that the company delivers the per calendar year certain number of pollution units to the water board's sewage treatment plant. The subsidy is obtained on the water treatment levy to retain these companies for the sewage treatment plant. The annual subsidy guaranteed to a company per pollution unit shall not exceed 50% of the rate per pollution unit and is in line with EU regulation.

Sources:

- https://www.123subsidie.nl/subsidie/anti/ (Google Translate: https://www-123subsidie-nl.translate.goog/subsidie/anti/?_x_tr_sl=auto&_x_tr_tl=en&_x_tr_hl=nl&_x_tr_pto=wapp)
- https://europadecentraal.nl/praktijkvraag/is-het-verlenen-van-een-anti-afhaak-subsidie-in-lijn-met-de-staatssteunregels/ (Google Translate: https://europadecentraal-nl.translate.goog/praktijkvraag/is-het-verlenen-van-een-anti-afhaak-subsidie-in-lijn-met-de-

3.3 Applicable tariffs and other charges/taxes/fines at national and river basin level

AUSTRIA

179. **Water usage for hydropower production:** hydropower producers in Austria do not pay for the volume of water used to produce electricity. A system such as the Swiss Water Usage Levy ("Wasserzins") does not exist. Instead, hydropower producers contribute in kind and to comply with permit conditions in case of application for a permit or permit renewal – more detailed information is presented later on in this report. **Mining of sediments – sand and gravel:** extracted volumes of sand or gravel from rivers are not payable for the beneficiary. The processing of extraction permits is required. Against the background of EU Water Framework Targets, this gets increasingly harder as taking out sediment affects the sediment budget and aquatic habitats and might therefore lead to deterioration of the status or potential of a river stretch. There are very few remaining permits to extract gravel in Lower Austria, e.g., river Ybbs, with stringent conditions the permit holder needs to adhere to and little chances for extension. Extraction is typically only allowed at the beginning of the backwater zone and only above the water. Gravel extracted from backwater stretches by hydropower producers needs to be dumped downstream to maintain a balanced sediment budget. Removal of minor volumes of sediment might occur in the frame of river restoration projects or to maintain important habitats that would otherwise be covered, e.g., by sand at the river Lainsitz. Another justification for extraction is the maintenance of shipping ways. None of these generates any revenue for water resource management.

180. **Water usage for agricultural production:** the water volume extracted for agricultural purposes is not payable in Austria. The current national water demand amounts to about 3.14 billion m^3 per year. While industry and trade require the most water alongside with water supply services, agriculture requires 4 percent for irrigation and animal husbandry. The agricultural demand is to 95 percent satisfied by groundwater resources with regional variations. According to the Water Treasure Scenarios, an 80 percent increase can be expected in future (Ministry of Water, 2022). The abstraction of groundwater to irrigate crops requires a permit, which may be

granted for a maximum period of 12 years[108]. The permit duration is limited, but the amounts extracted are hardly metered. With groundwater levels, especially in the east of Austria (Lower Austria and Burgenland), being 3 m below the usual levels, first measures were taken in terms of additional permit conditions, such as the prohibition of irrigation during the day.

181. **Polluter pays principle:** in general, the polluter-pays-principle is applied in Austria. Polluters can be identified and held liable. Water bodies inspection (Gewässeraufsicht) is a function of the province's water management administration (Wasserrechtsbehörde). Specially trained public servants inspect the adherence to the permit conditions and compliance with the legal framework is controlling. Following reports from citizens, municipalities, water supply or wastewater utilities, and the environmental advocacy office, an inspection is initiated to verify whether there is indeed a case of non-compliance or misconduct. The water management administration needs to get active in any case of damages to water bodies, or violations of conditions prescribed in water permits are reported to the federal province. Pollution can also be identified in the frame of investigative monitoring. Investigative monitoring falls within the competence of the Federal Provinces. It is carried out if, e.g. the extent and the effects of undesired pollution have to be identified or the reasons for exceedances are unknown[109]. **Diffuse emissions by agriculture:** the Nitrate Action Programme Ordinance includes specifications for applying nitrogenous fertilizers on agricultural land. It provides application time restrictions, quantitative restrictions, local restrictions (e.g., near water bodies), regulations on the method of application, specifications for the capacity of manure storage rooms, and farm-related recording obligations in connection with fertilizer application. The effectiveness must be reviewed regularly, and as a result of the latest evaluation, there was a need to tighten up.

FRANCE

182. As explained above, the floods aspects but also the management of aquatic environment are covered by the Gemapi tax and the fund Barnier which will not be repeated here. For the drinking water and wastewater however, the current situation is a lack of investments to renew water infrastructure which is well identified by the public and private sector. While renewal is not systematically a must when infrastructures are well maintained and updated regularly, and some infrastructures can last for very long periods (some drinking water networks have an age above 10 years), there is always a need to watch their status and when too many repairs are necessary, to consider replacement. In both drinking water and wastewater sectors, the renewal is below 0.5% which is generally recognized as insufficient. Limiting investment is a way to keep the price under control at the expense of future higher investments and is more a political decision than a wise technical choice.

183. One of the objectives of the new water plan announced in March 2023 by the French President is to find new financial resources to improve the renewal rate. This will be made a.o. by using the water agency system to increase the co-financing and therefore incentivize services to invest. Using the fees allows to distribute the cost on all drinking water users instead of the state budget, in the principle of water pays for water, together with increasing the state resources as the fees are subject to VAT. An additional option, identified by a set of experts as having a more limited impact on the users is to come back to a reduced VAT (5.5%) instead of the normal VAT (10%) for wastewater, as was the case in the early stage of implementation of the urban wastewater directive. A correct wastewater management is vital to ensure safe water for all uses

[108] https://www.lko.at/wasserrechtsgesetz+2400+2908296

[109] https://info.bml.gv.at/en/topics/water/water-management/monitoring-programme-according-to-the-eu-wfd---the-framework-conditions.html

and it would seem quite logical to come back to this rate, which would free 4.5 percent of the wastewater price to invest in upgrading the infrastructures. On the other hand, the climate adaptation plan[110] that is updated every five years has an objective to finance new infrastructures that are able to face climate change. Several national agencies are engaged in this plan and are launching regularly project calls[111] that could be used for improvement in water infrastructure.

POLAND

184. After the 1997 flood, the Government of Poland was analyzing an introduction of obligatory flood insurance in Poland. However, due to the limited ability to pay insurance premiums by a majority of property owners, this solution was dropped as not implementable under the existing social conditions. Nowadays flood insurance is offered only by private insurers and is used by more rich part of the society. There are no special sources of financing related to exposure to flood risk. Implementation of Flood Risk Management Plans is mostly executed by large multi-annual projects agreed with the World Bank and Council of Europe Development Bank with co-financing from EU cohesion funds allocated for Poland. First large project "Odra River basin flood protection project" was running from 2007 to 2020 with final costs of 891 million EURO. This project substantially increased flood safety in the upper part of the Odra River basin and finalized modernization of monitoring and warning system in Polish hydro-met office IMGW. The second project "Odra-Vistula flood risk management project" with the same partners and similar project financing started in 2015 with estimated costs of 1,200 million EURO and will be finished in 2025. This project is implementation of first edition (2016) flood risk management plans in Odra and Vistula Basins, as all investments were placed there when document was prepared in earlier years.

185. Starting after the 1997 flood, a special position was established in the state budget in disposition of minister in charge of interior affairs for flood disaster recovery, which later changed its name to natural disaster recovery budgetary reserve. This was and still is very flexible and a fast source of long-term and short-term financing of activities related with disaster prevention and recovery. In years when disasters did not occur in large scale this source is used to finance protection and prevention measures, in case of huge disasters all financing is redirected to finance cost of the action and recovery after disaster. From this budgetary reserve were financed majority of flood protection measures in the last 25 years.

SPAIN

186. Applicable tariffs vary from RBO to RBO, as they are calculated according to the different costs of the different infrastructures and economies of scale that apply regarding unit costs. In the Tajo RBO there are widespread differences in the current charges to the different beneficiaries, reflecting as explained above the costs of the different infrastructures:

- For municipal water, the charges for bulk water supply can be as low 0.01 €/m^3 (if they have been already amortized, have low operating costs and there is high population). For more recent investments, the charges for bulk water supply can be more than 1 €/m^3 for municipal users.
- In the case of irrigation, in the Tajo RBO, the charges vary between 8 €/ha per year and 603 €/ha per year.

[110] https://www.adaptation-changement-climatique.gouv.fr/deuxieme-plan-national-dadaptation-au-changement-climatique
[111] https://www.adaptation-changement-climatique.gouv.fr/appels-projet

- In the case of hydropower generation, charges can vary between 0.000093 and 0.004137 € per kWh.

The Tajo RBO has a specific charge for water users in the Segura RBO benefiting for the Tajo's water regulation. These users pay this in addition to the specific water transfer tariff corresponding to the Aqueduct Tajo-Seguraf[112].

TAJO RBO (2023)	MINIMUN	MAXIMUN
Regulation Charge Municipalities (€/m^3)	0.002924	1.037493
Regulation Charge – Irrigation (€/ha)	7.99	603.5
Regulation charge hidroelectricity (€/kWh)	0.000093	0.004137
Regulation charge non consumtive users (€/m^3)	0.000688	0.021364
Water Use Tariff – Irrigation (€/ha)	12.81	482.9
Water Use Tariff – Other users (€/m^3)	0.000111	0.298991

Aqueduct Tajo-Segura Water Transfers 2023	Charge
Regulation charge – Municipal (€/m^3)	0.003099
Regulation charge – Irrigation (€/m^3)	0.003099

Table 11: Tajo RBO summary of charges including water transfers charge for Aqueduct Tajo-Segura.

In the case of the Duero RBO all the infrastructure investments were carried out in a similar period so there is not such variations in the charges applied to the different users. The irrigation water users paid between 17 €/ha per year and 125 euros €/ha per year in 2019. For municipal water supply the charge varies between 667-2,657 €/l/second[113].

DUERO RBO 2019	Minimum	Maximum
Regulation charge – municipalities (€/l/s)	667	2,656.69
Regulation charge – irrigation (€/ha)	16.95	125.17
Water Use Tariff – irrigation (€/ha)	0.29	348.43

Table 12: Duero RBO summary of charges including irrigation.

THE NETHERLANDS

187. There are two major cost items on the central governments' budget for which no costs recovery applies:

- **Management of waterways** (approx. € 0.9 billion per year). Article 3 of the 1868 Mannheim Convention prohibits States levying any toll on navigation on the Rhine. For this reason, no charge is imposed on commercial shipping, which is the main beneficiary of the waterway. The cost is out of the Infrastructure Fund of the central government.

[112] http://www.chtajo.es/Servicios/Recaudacion/TarifasYCanones/Paginas/default.aspx
http://www.chtajo.es/Servicios/Recaudacion/TarifasYCanones/Documents/Tarifas-2023/Tarifas2023.Memoria.Resumen.pdf
http://www.chtajo.es/Servicios/Recaudacion/TarifasYCanones/Documents/Tarifas-2023/Resolución%20de%20aprobaciós%20TUAS%20y%20CANONES.pdf

[113] https://www.chduero.es/web/guest/canones-y-tarifas .
https://www.chj.es/es-es/ciudadano/tasasycanones/Documents/1.%20IMPORTE%20LIQUIDACIONES%202022.pdf

- **Flood protection (primary system, central governments 'share)** approx. € 0.9 billion per year in 2013). Those costs are not recovered but financed from the so-called Delta fund.

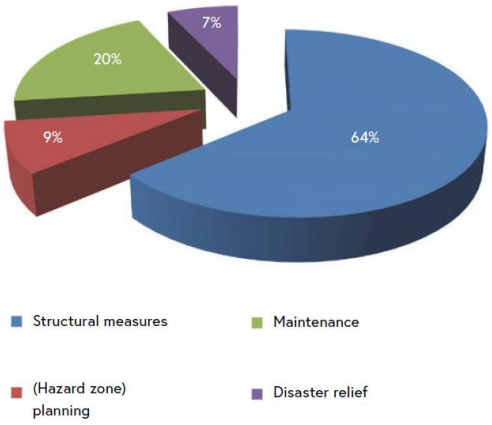
> In 2017, the Dutch decided to implement updated flood protection standards, based on cost-benefit analysis and analyses of casualty risk. The decision to update new flood protection standards was based on robust analyses and took almost 10 years of time to develop. The cost for reaching the standards (ultimately by the year 2050 (!)), would imply strengthening more than 1500 km of primary flood defenses (about 50% of the total length of primary flood defenses), at a total cost of in between € 14 billion and € 25 billion (2022 price level; see Kind (2023)). This has been the basis to provide the budget for the current Flood Protection Program (HWBP) of almost € 400 m. per year. The current HWBP, which is jointly managed by Rijkswaterstaat and the RWAs, is funded for 50% by the Delta Fund. The other 50% share is financed through the RWAs (see also Figure 3-1). Cost sharing arrangement between Rijkswaterstaat and the RWAs are enforced through the Water Act (Articles 7.22 - 7.26)
>
> Sources:
>
> - https://wetten.overheid.nl/BWBR0025458/2021-07-01 (Google translate: https://wetten-overheid-nl.translate.goog/BWBR0025458/2021-07-01?_x_tr_sl=auto&_x_tr_tl=en&_x_tr_hl=nl&_x_tr_pto=wapp#Hoofdstuk7)
> - https://www.dutchwatersector.com/news/dutch-flood-expert-team-wins-2013-edelman-award-with-method-to-calculate-the-economic-optimal
> - Kind, 2023. Over de rol van de dijkversterkingskosten bij het bepalen van de normen voor de primaire waterkeringen (*On the role of the cost of dike strengthening in the determination of standards for the primary flood defenses)*. Client: Rijkswaterstaat.

3.4 Recent developments in water infrastructure financing, implementation of special instruments, funds (water, environment) etc.

AUSTRIA

188. Financial incentives play a central role in funding Austria's water resource and flood risk management. The two main mechanisms, the tax-fueled Disaster Relief Fund and the Environment Aid Act Budget are described in the following. **Hydraulic Engineering Assistance Act** (Wasserbautenförderungsgesetz) states the prerequisites for granting public funds and provides the basis for planning, implementing and maintaining flood risk management measures. These are funded primarily by the federal state (around 56%), and the provinces (around 28%), but beneficiaries and stakeholders such as municipalities, water associations or unions are also required to provide funds (around 16 %). Since the 2002 flood event, the federal state has invested around 200 million Euros per year to protect against natural hazards. The majority is used for structural measures and maintenance, another share for (hazard zone) planning and the compensation of flood damages. Around 400 million Euros are invested annually in flood risk management measures (Ministry of Water, 2018).

189. **The Disaster Relief Fund** is the funding tool for flood risk management receiving allocations from income tax and corporate income tax. It was created to provide additional funding of measures to prevent future damages and to compensate those which occur. The Disaster Relief Fund also partially funds emergency apparatus for fire brigades and the warning and alarm system and subsidies hail insurance premiums. Around 200 million are annually invested for preventive structural measures and maintenance, planning and disaster relief. These measures can also include complimentary activities to improve the aquatic ecology.



190. The fund can be used for measures to improve (i) water management, (ii) protection against water-related disaster, (iii) ecological situation if combined with (i) and (ii). The funding eligibility requires compliance with the technical guidelines for hydraulic engineering as prescribed by §3 of the above law (Technische Richtlinien für die Bundeswasserbauverwaltung, gemäß §3 ABS 2 WBFG114). Furthermore, a guiding document for riverbank management (Gewässerpflegekonzepte Leitfaden, 2020) compliments the support documents available for planners and implementers.

Figure 34: Share of infrastructure development and maintenance within the Disaster Relief Fund (Ministry of Water, 2018)

191. **The Environmental Aid Act** (Umweltförderungsgesetz, UFG) regulates the support of measures to protect the environment through dedicated and negotiated budget provisions. For example, in the water sector, measure to enhance the climate resilience of water supply systems and attain the targets of the national River Basin Management Plan. The budget provision under the environmental aid act for the first national River Basin Plan was sufficient and focused on fish ladders. However, under the second RBMP, the budget available for measures in the water sector was limited and efforts to implement the program of measures faded. Under the current third RBMP, a budget of 200 million EUR has been availed to address residual flow issues broadly and attain morphological improvements.

192. Subsidy rates up to 98 percent for municipalities. To leverage the available subsidies by the federal government (up to 60 percent), the provinces have to contribute and bring the subsidy rate up to 90 percent. Even higher subsidies are achievable from a municipality / "interest party" point of view. If water management measures embrace ecological and biodiversity improvements, the so-called biodiversity fund of the Ministry of Climate can be tapped into, and the required "own" contribution can go down even to 2 percent. The UFG supports research initiatives up to 100 percent. For measures to reduce the negative impacts of small hydropower plants, funding is available up to 50 percent and up to 30 percent for bigger operators. "Huge" undertakings and projects along the waterways (federal and border rivers) need additional resources on top of the above mentioned as these would drain the disaster relief fund and environmental aid act budget for many years.

FRANCE

193. Water infrastructure financing in France was explained in detail above and there are no recent changes or new instruments developed beside those already mentioned in the present Chapter.

POLAND

194. Water infrastructure financing in Poland was presented above and there are no recent changes or new instruments developed beside those already mentioned.

[114] https://www.umweltfoerderung.at/fileadmin/user_upload/umweltfoerderung/betriebe/Wasser_Betriebe/Alle_Dokumente/RIWA-T_2016_finale_Fassung.pdf

SPAIN

195. The fiscal provisions of the Water Law and its regulations regarding the taxes and tariffs for WRM of the RBOs have been under review at least since 2006. There have been different proposals to improve their design to allow for full cost recovery and facilitate their implementation and reduce the administrative burden of yearly calculations. Draft reforms have included proposals to better incorporate diffuse pollution and resource costs and to allow charging for wastewater reuse and desalination. Some of these reforms have been passed recently with the Royal Drought Decree-Law 4/223 which included the possibility of RBO to charge for desalination, wastewater reuse, sanitation and water supply services which they provide (when these are declared as of general state interest). Other reforms have not prospered, especially due to the opposition of the agricultural users.

196. The main innovations on this regard have been carried out by the Regional Governments in Spain who manage the RBOs which lie entirely in their territory. This is the case for the Water Tax of Cataluña, or for the Water Tax of the Basque Country. Cataluña opted for a Tax and nor for a charge to be able to avoid the yearly calculation burdens of the RBOs and to ensure full cost recovery of the costs incurred by the Catalan Water Agency. The Basque Country established a Water Tax with provision for charging for diffuse pollution. This is charged to farmers who could not prove that their practices were in agreement with the programs of measures in Nitrates vulnerable zones and the codes of good practice. Other regional governments with full environmental legal responsibilities have regulated on taxes related to the morphological impact of dams (Basque Country, Galicia and Aragón).

197. For Water Resources Management there are no specific new financing instruments developed other than those tariffs of the State Public Companies which de facto established a parallel system of charges, avoiding the difficulties of changing the Water Law. For the financing of the Flood Risk Management Plans the use of funds from the PIMA Adapta (income from emission trading) is now discontinued because other sources of finance have become available. There are possible future contributions being negotiated with the Insurance consortium115 that are promising for the future.

THE NETHERLANDS

198. **Flood Protection Program and Administrative Agreement:** In 2009, the Dutch Government concluded that major reforms and budget cuts were needed to deal with the economic and financial crisis. In this context, the Government invited the RWAs to come up with a proposal how to relieve the Central Governments' budget for the financing of water management (Dekking and Havinga, 2015). An important constraint was that the proposal by the RWAs should not lead to an increase in the RWAs' levies. The initial proposal of the RWAs included the proposal to finance € 75 million per year of the Flood Protection Program (HWBP) (previously financed entirely by the Central Government), and to take over the muskrat control task of the Provinces (€ 25 million per year) which was paid for by the Central Government through a deposit in the Provincial Fund[116]. In the Administrative Agreement on Water of 2011, the RWAs agreed that they would

[115] https://www.consorseguros.es/web/documents/10184/121530/2_NOTA_OCTUBRE_DICIEMBRE_14022022.pdf/1f4f8c2a-cdaa-4eff-9352-0c91c72ffb1b

[116] The muskrat (*Ondatra zibethicus*) is an invasive species in the Netherlands. Its burrowing habits are alleged to threaten the integrity of the extensive water control infrastructure, posing a public safety hazard in this densely populated, low-lying country. A

further increase their contribution to the HWBP, and offset their higher costs as a result of the contributions to the HWBP with savings as much as possible (especially administrative savings as a result of a closer cooperation with municipalities and drinking water companies).

199. The current finance of the HWBP flood protection program is laid down in the Water Act and illustrated in figure below. Since 2014, the RWAs and central government (Ministry of Infrastructure and Water management) each finance 50 percent of the HWBP. The RWA in whose territory the flood defense is located, finances 10 percent of the total costs. The other 40% of contribution to the HWBP is a solidarity contribution and must be paid annually by each RWA, regardless of whether or not the RWA manages primary flood defenses. The height of the contribution of each RWA to this solidarity fund is based for 50% on the number of inhabitants in the territory of the RWA, and for the other 50% on the total real estate value in the territory of the RWA.

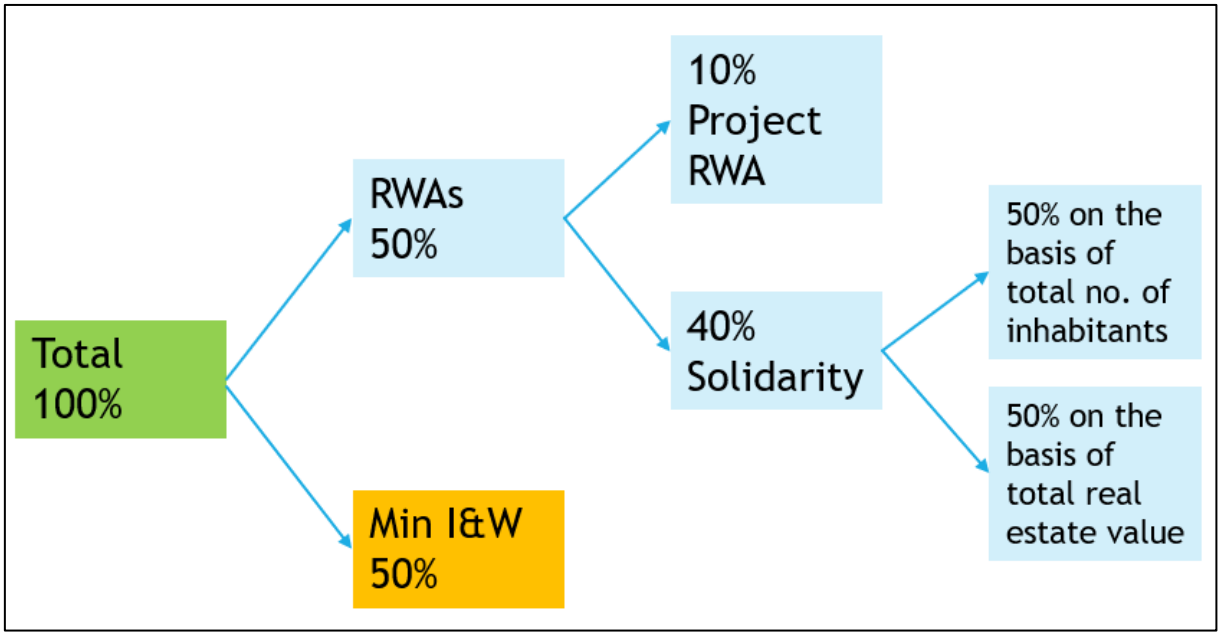


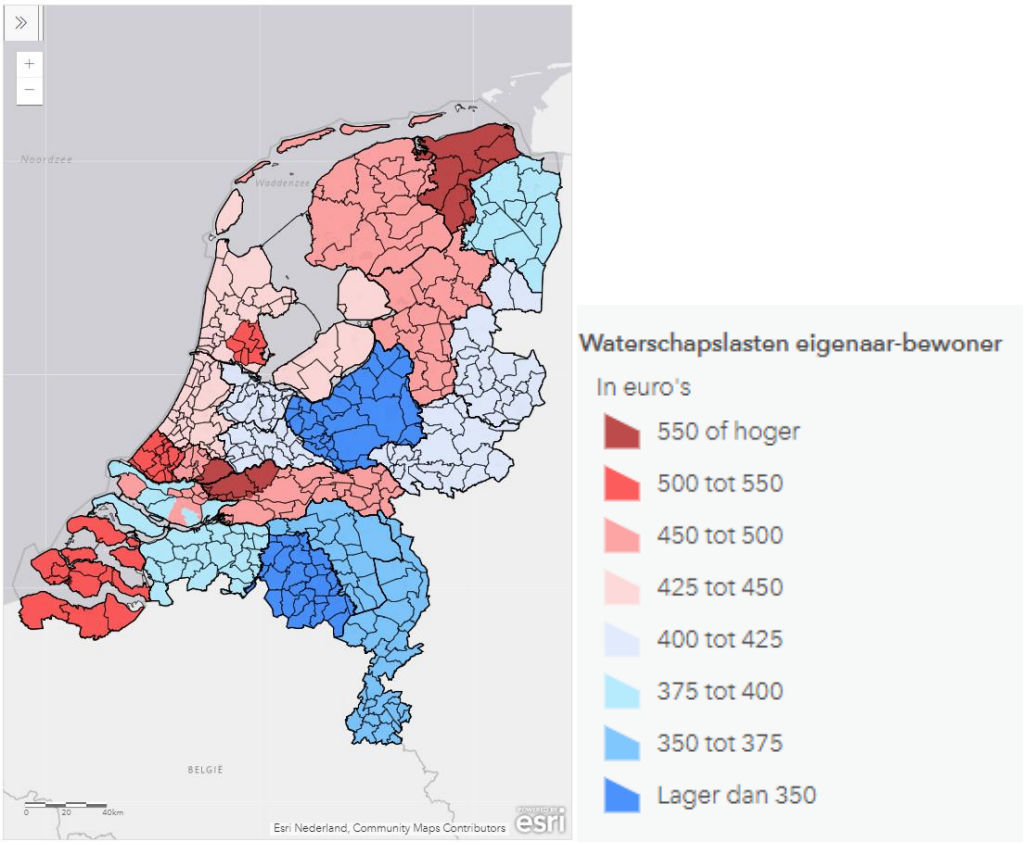
Figure 35: Finance of the HWBP Flood Protection Program, Source: developed for the purposes of this report

national control program currently traps and kills tens of thousands of muskrats each year. The costs (annually about € 35M) as well as concerns raised by animal welfare groups have raised questions about whether the control program could be improved, and even whether it is necessary at all (source https://www.zoogdiervereniging.nl/sites/default/files/2019-12/Lutra%2062%281%29_Ydenberg%20et%20al_2019.pdf).

As already has been implied in the preceding sections, there are no separate flood protection taxes in the Netherlands. Rather, every agent (i.e., residents, businesses, agriculture, nature) pays for flood protection, irrespective of whether the agent is located in a flood prone area or not. The contribution to the cost of flood proceeds in the following ways:

- The governments' share is paid of the general fund (Delta Fund). This is taxpayers' money.
- The RWA's share is financed through the water system levy. Most (40/50) of the cost of flood protection for the primary system is shared amongst all RWAs on the basis of solidarity (Figure 3-1), irrespective of the amount of flood protection infrastructure the RWA manages;
- Every agent pays the water system levy to the RWA, irrespective of the level of flood exposure of the agent.

Regional differences in the water system levies do exist, but those cannot solely be attributed to the cost of flood protection. Other factors which explain cost differences between RWAS include the soil structure, the level of urbanization and the level of the mowing field (i.e., the cost of pumping water out of the polder system). As an example, the figure below shows the average water system levy for owner-occupiers of homes for different RWAs. The average values range between less than € 350,-- and more than € 550,-- per year. More detailed information about the regional differences in the parameters used for the water system ley (and wastewater levy) can be found in **Appendix 5**.



Water system levy (€/year) for owner-occupier, per RWA (2023)

200. **Development of the levy system for RWAs[117]:** In the midst of the previous century, the RWAs managing the water system were in a poor financial position. In 1955, their income from levies was only about € 20 million per year (1995 prices), which would be equivalent to some € 200

[117] This section draws heavily on a paper by Dekking and Havinga (2015).

million per year in prices of today.118 Those levies were almost entirely paid for by farmers. In 1963, The Union of the RWAs (todays Dutch Water Authorities, DWA)[119] made an appeal to the Central Government for a contribution of 30% to the annual operational cost, based on the argument that other beneficiaries (esp. owner and users of real estate) did not contribute to the cost of water management. According to the Union, this justified a contribution from the Central Government, being a representative of this group. After several detours, the Government responded in 1974 that the RWAs should in principle finance themselves out of their own tax system[120]. Meanwhile, in 1970, the RWAs were also assigned the legal responsibility for wastewater treatment.121 This had introduced new categories of paying beneficiaries, i.e., households and businesses. Subsequently, from 1977 and onwards, those categories were not only charged for wastewater treatment, but also for water system management (i.e., dry feet). This has laid the foundation of the current system of wastewater and water system levy which is in place for the RWAs and has been described above. Currently, a proposal has been sent to parliament[122] for some small modifications in the Water Law, amongst others with the aim to strengthen the application of the beneficiary pays principle in the water system levy[123]. The modifications alter some of the costs allocated to different categories of beneficiaries but are too small and too specific to be mentioned here.

[118] This is less than one-tenth of the annual revenues of the RWAs today; see **Error! Reference source not found.**.

[119] In Dutch, Unie van Waterschappen (UVW).

[120] Except when the task of the RWAs also served interests beyond the territory of the RWA, which could be the case with primary flood defense.

[121] Wet verontreiniging oppervlaktewater, Wvo.

[122] https://wetgevingskalender.overheid.nl/regeling/WGK013923/documenten/Tweede%20Kamer/Voorbereidende%20documenten%20gepubliceerd/1 Google translate https://wetgevingskalender-overheid-nl.translate.goog/regeling/WGK013923/documenten/Tweede%20Kamer/Voorbereidende%20documenten%20gepubliceerd/1?_x_tr_sl=auto&_x_tr_tl=en&_x_tr_hl=nl&_x_tr_pto=wapp

[123] Memorie van Toelichting - Algemeen deel en artikelsgewijze toelichting waterschapsbelastingen. https://www.internetconsultatie.nl/wijziging_waterschapsbelasting/document/9372

Chapter 4. Hydropower electricity production

4.1 Organization of hydropower production

AUSTRIA

201. Hydropower is central to Austria´s electricity production. Austria's alpine topography, numerous rivers and high precipitation provide excellent conditions used since the onset of the 20th century. Over the past years, hydropower accounts for 55-67% of power generation dependent on the actual water availability in a particular year (Ministry of Climate, 2022). According to Habersack et al. (2012), there are 5227 hydropower plants in Austria, thereof 2608 very small ones not connected to the grid.

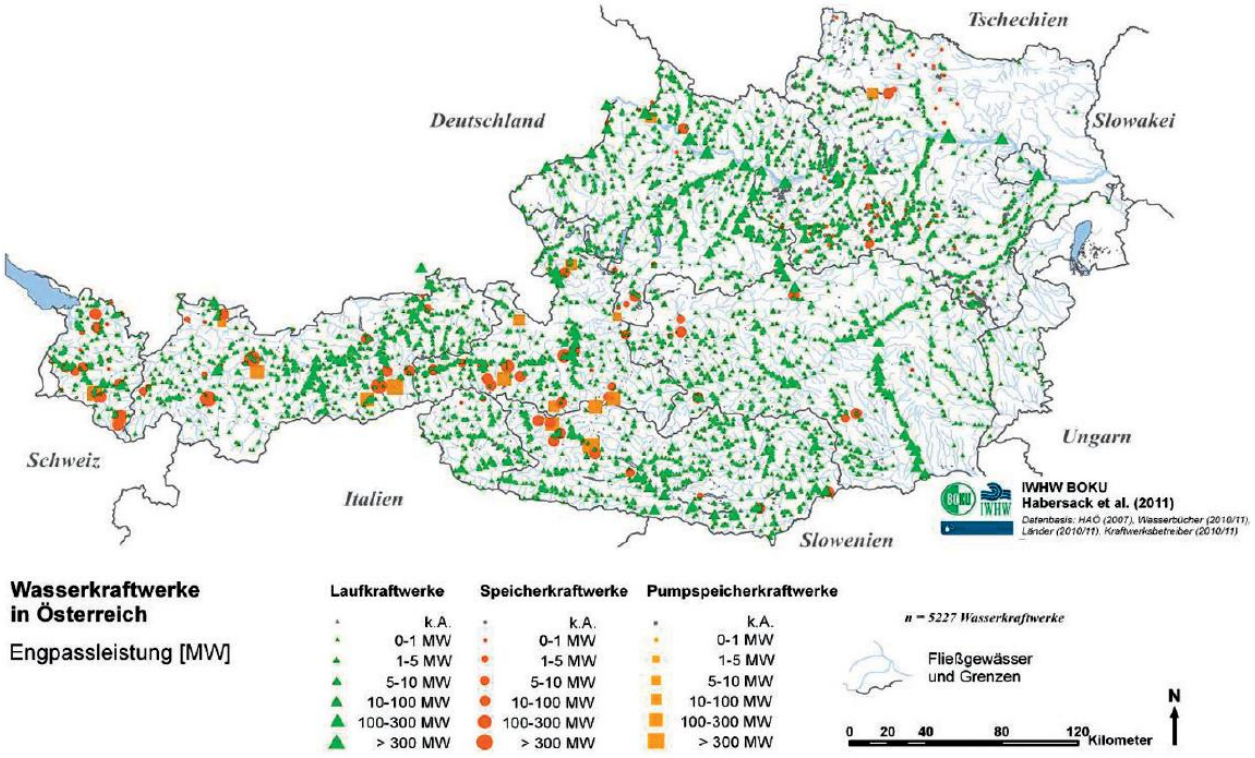


Figure 36: Hydropower plants in Austria classified according to types of plants (run-of-river (green triangles), storage (red circles) and pumped storage (orange squares) and bottleneck capacity (Engpassleistung in MW)

202. A mixture of different types and sizes. 88% of the production is delivered by the big (>10 MW) plants, which comprise 6% of all plants. Small plants, up to 10 MW nominal power, are primarily run-of-river plants124. Run-of-river plants supply electricity reliably and generally without significant fluctuations. They are therefore utilized to cover the majority of electricity consumption, known as the base load. Pumped storage power plants are essential for the energy future as "green batteries". They offer the best technology for storing electricity and can unfold their power within minutes, providing the electricity grid with an additional surge to cover peak load. A unique form (and therefore not further elaborated in this report) of energy production in Austria are "drinking water hydropower plants" using the kinetic energy of drinking water as it

[124] https://positionen.wienenergie.at/wissenshub/energie-dashboard/installierte-wasserkraft-leistung/

gravitated to be used in lower settlements, for example, along the transmission pipelines of the Vienna Waterworks[125].

203. Infrastructure development started more than 100 years – also, with external support. Hydropower development began after the First World War. Many projects initiated before the Second World War were revitalized with the backing of the Marshall Plan initiative (officially European Recovery Program, ERP) after the war. However, large projects came under scrutiny during the 1980s due to environmental and social concerns[126]. The last new Hydropower plant, Freudenau, located downstream of Vienna, was finished in 1998. In line with the requirements of the EU Water Framework Directive, the analyses of the as-is situation and risk of not achieving the targets were undertaken in Austria in the frame of the development of the first National River Basin Plan (Nationaler Gewässerbewirtschaftungsplan, NGP) 2009. The situational assessment and framework for defining measures to attain targets resulted in the realization that four main risk factors were, not surprisingly, all hydropower related: storage, surge / down surge (or sunk), barriers and residual flow. The extreme flood events of 2002 and 2004/5 additionally underpinned the need for action concerning rivers heavily impacted by hydropower usage.

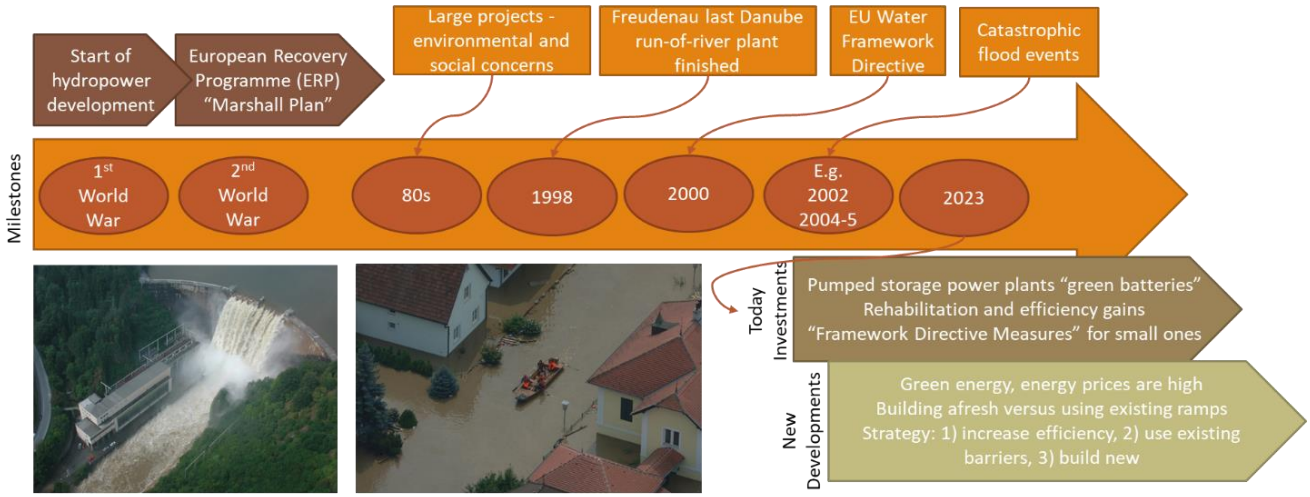


Figure 37: Milestones in Austria´s Hydropower Production (picture source: elaborated for the purposes of this report, photos: Austrian Armed Forces (2005) Press Department/Ministry of Defense)

204. Current and future investments focus on efficiency gains at existing facilities rather than new developments. About ¾ of estimated hydropower potential is currently used. The development of new plants is seen as controversial. The ambitions to enhance renewable energy contradict the EU Water Framework Directive (WFD) provisions, as barriers significantly impact habitats and river morphology. Recent developments are focused on small-scale applications, with a few exceptions, notably pumped storage projects, to balance the enhanced development of green energy sources. Planning new hydropower interventions needs to balance divergent interests carefully. The rehabilitation of existing hydropower plants to ensure functionality and gain efficiency is, together with the utilization of existing barriers, prioritized over new construction.

205. **A mixture of big public and small private plants:** following the partial privatization of energy production in the 80s, the big hydropower producers such as the EVN AG in Lower Austria of the VERBUND are established as companies with a majority of public owners. To give an example, the "Verbund" has been listed on the Vienna Stock Exchange since 1988, with 51% of the share capital

[125] https://www.wien.gv.at/english/environment/watersupply/energy.html
[126] https://www.hydropower.org/country-profiles/austria (last visit 2023-03-08).

held by the Republic of Austria127 and with other shareholder also being public entities, a total of 85% can be considered to be “in public hands”. The EVN AG is 51% owned by the province of Lower Austria and about one-third by the Vienna Municipal Utility, which the City of Vienna owns. The figures below illustrate that ownership structures are complex but overall public to more than 50%. Small hydropower plants are often privately owned; historically, they covered the energy need of grain or saw mills or other productive enterprises, in some cases also municipalities, along the river. Small hydropower producers have an umbrella organization, a member association, to represent their interests and share information[128].

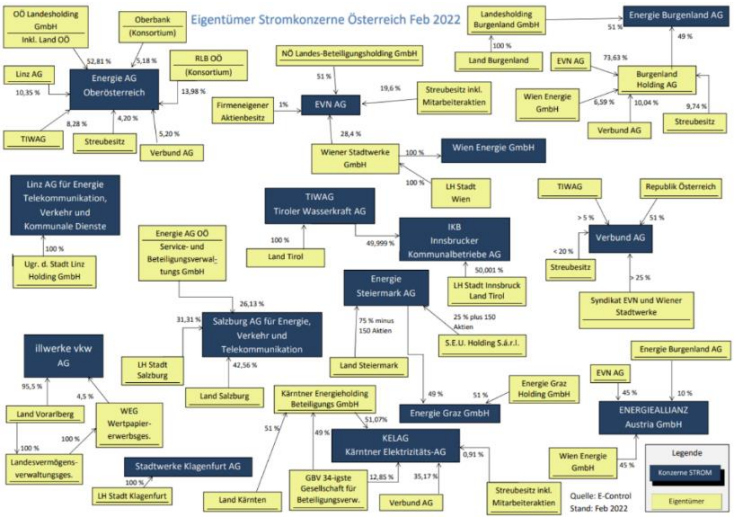


Figure 38: Ownership structure of power producers in Austria (picture source: https://neuezeit.at/stromerzeugung-wer-produziert-strom-in-oesterreich/)

206. Permits - rehabilitation and development. Hydropower usage requires a permit as per the Austrian Water Law. Open-ended permits are no longer issued but existing ones remain valid. In the vast majority of cases, a new permit or modification permit is required for major plant rehabilitation. In any case, a permit will be required if the existing permit expired or if it’s a new development. To facilitate the planning process and decision-making, the Ministry of Water (2012) developed a criteria catalogue for decision support which the Provinces need to use per a decree of the Minister of Water.

207. Hydropower plants generate jobs and thereby income for municipalities through municipal tax. Therefore, the Provinces and Municipalities in Austria pursue a collaborative strategy vis-a-vis hydropower plant owners aiming at win-win situations for energy production and ecology. Applications for new permits or renewal of permits provide opportunities for the authority to interact and attain improvements. Interfering with existing permits is comparatively more challenging. Subsidy levels of up to 30% for big and small power plants and up to 50% are available to incentivize hydropower producers to become active to modernize their barriers to become permeable to both organisms in the river and sediments and to bring the affected river sections to a near-natural state.

FRANCE

208. Hydroelectricity is the second source of electricity production in France behind nuclear power. This sector is important for the electricity system in several respects, particularly in terms of balance and network security. Compared to Romania, it is important to notice that the part of electricity production coming from hydropower in France129 in 2021 is far below (11-12%) than in Romania130 (28%). It represents approximately 20% of the total installed electrical power capacity with approximately 25.7 GW of capacity.

127 VERBUND – Austria's leading electricity company
128 https://www.kleinwasserkraft.at/verein-kleinwasserkraft/
129 https://www.iea.org/countries/France
130 https://www.iea.org/countries/romania

209. During the twenty last years (2003-2022), the average of electricity production in France by hydropower was 63,168 GWh. The peak appeared in 2013 (+22%) and the minimum in 2022 (-22%). Concerning Romania, during the period 2001-2020, the average of electricity production by hydropower is 16,629 Gwh. the peak was obtained in Romania in 2010 (+22%) and the minimum in 2012 (-26%). The annual variation of electricity production is highly connected to the climate situation of the country and specifically the annual and seasonal precipitations. The rainfall deficit in 2022 has had a strong impact on the availability of hydraulic production in France.

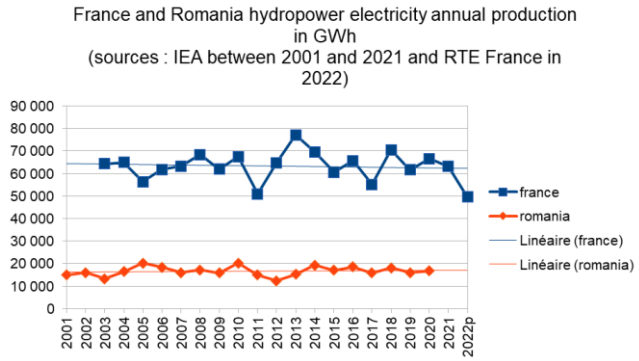


Figure 39: Hydropower electricity production in France and Romania, 2001-2021

210. France has several hydropower facilities: run-of-the-river and lake power plants, pumped-storage hydroelectric power stations (PHES) and one tide power plant. The current challenge in France is to ensure, on the one hand the modernization and compatibility of the hydropower infrastructure with increased safety and environmental requirements, and on the other hand to allow the exploitation in accordance with the objectives set. in the multi-annual energy program.

211. Hydropower regulation: Hydropower regulation in France is mainly coming from Book V of the Energy Code[131]. The main hydropower regulation principle is that "no one may have the energy of the tides, lakes and rivers […] without a concession or authorization from the State" (article L.511-1 of the code). There is a distinction between two legal frameworks for hydroelectric installations according to the capacity of the facility:

- Facilities of less than 4.5 MW: the authorization system

The hydropower facilities under authorization represent an installed capacity of around 2.5 GW for an energy produced of around 4.5 TWh per year.

- Facilities of more than 4.5 MW: the concession system

212. They are owned by the State and built and operated by a concessionaire. For facilities between 4.5 MW and 100 MW, the concession is granted by the prefect, while beyond 100 MW, the Minister in charge of energy grants it. At the end of 2021, the State services managed 349 hydropower concessions which represent more than 90 percent of the total installed hydropower capacity. There is currently an infringement procedure at the stage of a letter of formal notice against France, as the European Commission considers that France is not compliant with concessions covered by public procurement rules directive (Directive 2014/23/EU). French legislation allows some hydropower concessions to be renewed or extended without the use of tender procedures. The renewal of hydroelectric concessions is an important issue for the State, which wishes to optimize the use of the facilities in terms of energy (capacity, modulation capacity), economy (in order to benefit from the amortized facilities) and environment to ensure that the impact of the facilities on aquatic environments is limited.

213. The hydropower objective of the multi-annual energy program 2109-2028 is to increase the hydropower capacity by 1,200 MW by 2028, which should enable additional production of around

[131] https://www.legifrance.gouv.fr/codes/id/LEGISCTA000023987146/

3 to 4 TWh, of which approximately 60 percent through optimization of existing facilities. This program provides the following assessment of the costs of the existing hydropower facilities[132] (in terms of LCOE[133]):

- Between €30 and €50/MWh for large run-of-the-river facilities;
- Between €70 and €90/MWh for high-capacity installations and operation of high falls;
- Between 70 and 160 €/MWh for lower capacity installations.

Under certain conditions, the operation of a hydropower facility may not be profitable. However, to contribute to the integration of renewable energies into the French energy mix, it may be necessary to provide them with support, particularly for small hydroelectricity (power less than 10 MW). Detailed information about concession regulation (environmental protection, safety of hydraulic infrastructure) and facilities investments and operation costs are provided in **Annex 2**.

POLAND

214. Hydropower electricity generation is limited in Poland due to moderate natural conditions for its development. The capacity of storage reservoirs is rather small with capacity to store only 6% of the annual outflow. Poland has 41 large dams (according to ICOLD classification), 120 smaller embankment dams and there are some space for location of small hydro plants.

215. There are 3 large producers: Polska Grupa Energetyczna (PGE, Polish Energy Group), TAURON Polska Energia (TAURON Polish Energy) and ENEA company which together control 62% of installed capacity and generate 66% of the country's energy supply. (World Atlas & industry Guide, The International Journal on Hydropower & Dams, 2020). They are in control of large Hydropower stations (more than 10 MW power), and they are controlled by the Government – Ministry of State Treasure. In PGE and ENEA Government controls more than 50% shares, in TAURON Government and State controlled company KGHM control 40,45 % shares and they control the company as other shareholders are dispersed.

216. Poland's technically feasible hydropotential is 12.000 GWh/year and economically feasible hydro potential is 8.500 GWh/year. Nowadays approximately 19% of this potential is used. Total installed hydro capacity is 2,346 MW (2019) accounting for 5% of total installed capacity. In 2020 hydropower plants produced 2,936 GWh of the electricity generation, which is only 1,9% participation in total electricity generation in Poland (IEA 2021). There are 13 large hydro plants (more than 10 MW). Unfortunately, approximately 80% of them is more than 40 years old. The largest producer from hydro power is PGE company operating 36 plants with total power 1,607 MW. The fast development of renewable energy producers (wind, solar, biomass, etc.) pushed for preparation of a new strategy for peak-pumping hydro plants to support compensation for grid fluctuations as current pumped-storage capacity is not sufficient.

SPAIN

217. At the beginning of the twentieth century, the first large hydroelectric projects were built in Spain. In 1940, 92% of the Spanish electricity demand was covered with hydroelectric power. At the end of the 1970s, the Spanish hydroelectric park was one of the largest in Europe, with an installed capacity of 14,000 MW, which represented 50% of the total electricity demand. The development of hydroelectric plants was constant until the end of the 1960s, being the central

[132] Page 115 Programmation pluriannuelle de l'énergie 2019-2023 2024-2028

[133] The levelized cost of electricity (LCOE) is *a measure of the average net present cost of electricity generation for a generator over its lifetime*. (Wikipedia, 2023)

core of the electrical power production in Spain. From then on, other types of power plants producing electricity are developed with the use of coal and gas as a power source, as well as nuclear power plants.

218. The need to advance renewable energies to the maximum led to regulations being issued in 1985 to facilitate the construction of mini-hydroelectric power stations (less than 10 MW). The annual hydroelectric production in Spain is highly variable and depends to a large extent on rainfall. In wet years it exceeds 40,000 GWh, but in dry years it does not reach 25,000 GWh, with the average of recent years being 32,500 GWh, and representing 17% of the annual gross electricity production. Of the annual hydraulic production, 88%, approximately 29,000 GWh, is produced by the regulation and reversible pumping plants and 12%, approximately 4,000 GWh, by the mini-plants. There are currently over 1,350 hydroelectric power plants, of which 1,200 are mini-power plants. Hydroelectricity is generated in three types of hydraulic power plants:

- Run-of-the-river power plants that take water directly from the river and produce power at all hours.
- Regulation plants that generate the highest quality electrical power, being able to regulate their power very quickly to adjust to the demand curve of the operator of the Spanish Electrical System (SES).
- Reversible pumping stations that use power in hours of lower demand (off-peak hours) and, on the contrary, produce it in hours of greater demand (peak hours).

219. The great development of wind power, as it is an intermittent, non-storable and non-manageable technology, in accordance with the Energy Storage Strategy (ESS)134 is creating distortions in the Spanish electrical system that can only be resolved with non-flowing hydraulic power. It plays a key role in the integration of renewable energies with the electrical system, specifically reversible pumping hydroelectric plants, since they store surplus power caused by the gap between production and demand and regulate it with the power generation with pumped water, guaranteeing the stability of the system. The current situation of hydraulic storage is 5,891 MW of installed power.

[134] estrategiaalmacenamiento_tcm30-522655.pdf (miteco.gob.es)

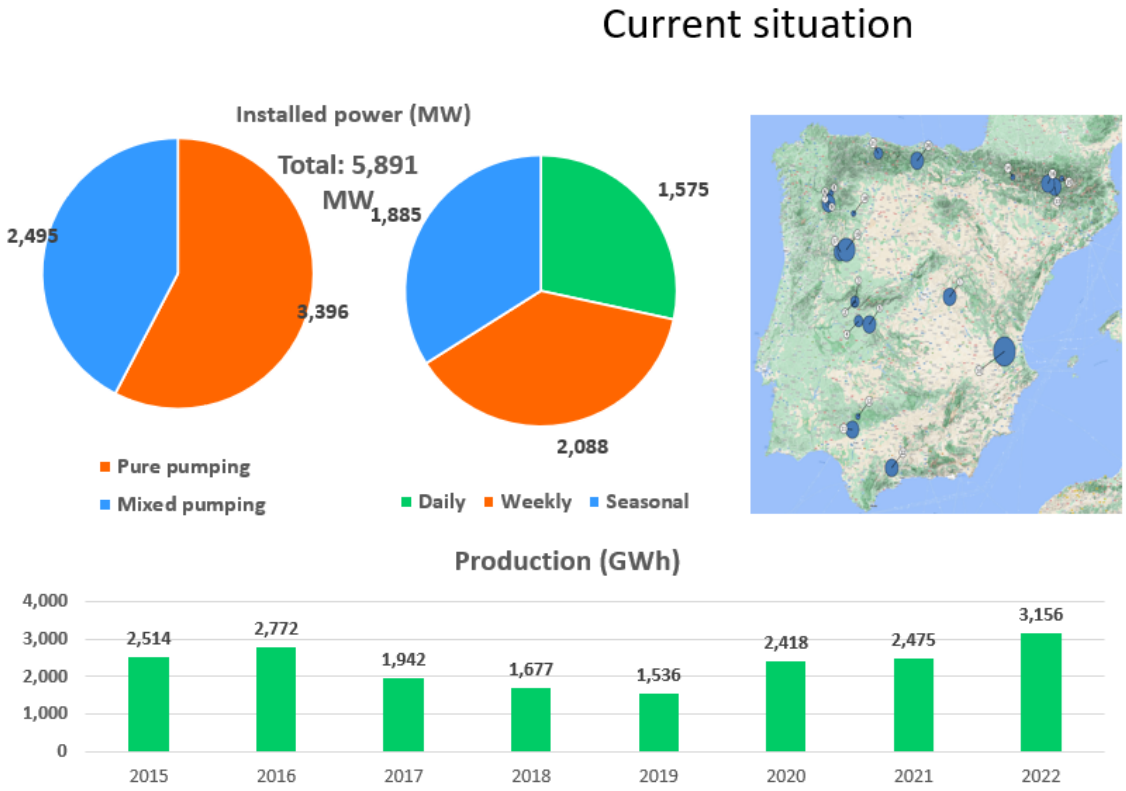


Figure 40: Current situation of installed hydropower in Spain

220. The construction of the dams, the reservoirs that are generated and the associated hydroelectric plants, can be performed by private initiative or by public administrations. The GSA declares these public hydraulic works of general interest, builds and operates them directly with its own means (IDAE, ACUAES, TRAGSA) through the RBOs or with private companies through public tender. The hydraulic infrastructures built for hydroelectric purposes by private companies are granted the use of water for a defined term and the completion of the term entails the reversion to the administration, free of charge and free of charges, of the works and facilities related to that use, built by the company in the HPD, transferring ownership thereof to the State.

221. If the RBOs consider the continuity of use possible and convenient, they require the licensee to deliver the hydroelectric plant in operating conditions. If, on the contrary, they consider it unfeasible or its operation and maintenance are contrary to the public interest, they may require the demolition of what has been built in the HPD. If the construction of a hydraulic infrastructure uniquely affects the economic balance of the municipal area where it is located, a territorial restoration project is implemented to compensate for the condition. An example of territorial restitution actions is the urbanization of the urban center of Ruesta, the purification of wastewater in Urriés and the restoration of the Los Roncales bridge, all of them actions as a consequence of the regrowth of the Yesa reservoir in the province of Navarra.

222. Any electricity production facility requires authorization by Law 24/201, dated December 26, of the Electricity Sector (LES), and the concession of water as a hydraulic resource for power purposes is regulated by the CTWL. The aspects that affect the environment are regulated by Law 21/2013, dated December 9, on Environmental Assessment (LEA) and within the framework of action against climate change by Law 7/2021, dated May 20, of Climate Change and Energy Transition (LCCET). The construction, operation and maintenance, substantial modification and

closure of an electrical power production facility is subject to the prior administrative authorization regime and in relation to the use of water for hydroelectric purposes, to the concession regime. A favorable environmental assessment and a favorable report from the National Energy Commission (NEC) are also required, and if the hydraulic work is a large dam, it must also comply with dam safety regulations.

Authorization for the production of hydroelectric power:

223. The purpose of the authorization regime is for the sponsor to sufficiently guarantee the technical and safety conditions of the facilities and associated equipment, compliance with the environmental protection conditions, the characteristics of the installation site and its legal, technical and economic-financial capacity. The production of hydroelectric power is performed by the producers of electrical power, which are those natural or legal persons that have the function of generating electrical power, as well as those of building, operating and maintaining hydroelectric power plants. The regulation establishes a series of obligations and rights (see Annex 2) and distinguishes the production of electrical power from storage in reversible hydroelectric power plants, with the owners of the latter being natural or legal persons who own facilities where the end use of electricity is deferred at a time after it was generated, or that perform the conversion of electrical power into a form of power that can be stored for subsequent reconversion of this power into electrical power. The construction, operation and maintenance, substantial modification and closure of a hydroelectric power production facility is subject to the following authorization system:

- Prior administrative authorization that grants the authorized company the right to perform a specific installation, is processed with the preliminary project of the installation as a technical document and, where appropriate, together with the environmental assessment as provided in the LEA. The authorization cannot be granted if its owner has not previously obtained the authorization of the point of connection to the transmission or distribution networks of electrical power.
- Administrative construction authorization that allows the owner to perform the construction of the facility, for which he/she presents an execution project together with an affidavit that certifies compliance with the applicable technical requirements.
- Operation authorization that allows, once the project has been executed, to put the facilities under tension and proceed with their operation.

The concession of water for the production of hydroelectric power:

224. The construction and operation of a hydroelectric power plant and its associated hydraulic works requires the exclusive use of water, which is why it must obtain the concession for surface water from the RBOs when the power of the power plant is less than 5,000 KVA, above this power is the GDW that grants the concession. The concession is granted for the use of water for the production of electrical power and sets the maximum flow to be derived at the point of intake, the maximum level difference and gross head, the installed power, the technical characteristics of the groups installed, the stretch of affected river, which is the stretch between the levels of maximum normal reservoir at the point of intake and return to the public channel, the maximum term of duration not exceeding 75 years and the amount of the canon for the use of water for electrical power production. The concession for electrical power production, as broadly established in the CTWL, is in third place in the order of preference of water uses, behind supply and irrigation and agricultural use. The concession title, if there is no flow available during the dry season, does not guarantee the availability of the granted flows and, when required by the

availability of the resource and the seasonal forecast, the concession holders in reservoirs larger than 50 hm3 of total capacity, must comply with the operation regime established by the CTWL. To this end, the RBOs establish for each hydrological year a maximum and minimum regime of average flows to be released, a regime of minimum volumes of reserves for each month and a minimum monthly reserve that must remain in the reservoir, to avoid undesirable effects on the fauna and flora of the reservoir and associated water bodies. Likewise, in normal hydrological situations, these flow regimes and water reserves should allow uses of the reservoir linked to sustainable activities in the riverside municipalities.

THE NETHERLANDS

225. Hydropower generation in the Netherlands is limited to the country's flat topography and the relatively low flow velocity of its rivers and streams. The country's total hydropower capacity is approximately 37MW, with four hydropower stations in operation that have a hydropower capacity larger than 1MW. These stations rely on the natural flow of the river/estuary rather than large hydropower dams. In addition, there is a number of small stations that are located near pumping stations, weirs and sluices.

Station	Electricity producer	Turbine	Capacity	Operation
River Meuse, Lith	Vattenfall	Kaplan Turbine	14 MW	Since 1990
River Meuse, Linne	RWE	Kaplan Turbine	11 MW	Since 1989
River Rhine, Maurik	Vattenfall	Kaplan Turbine	10 MW	Since 1988
River Rhine, Hagestein	NUON/Vattenfall	Kaplan Turbine	1.8 MW	1958 - 2005
Oosterschelde Estuary	Tocardo	Free Propellor Turbine	1.25 MW	Since 2015

Table 13: Largest hydropower stations in the Netherlands

226. These hydropower stations are realized and operated by private companies. Construction of a hydropower station in the Netherlands requires a permission under the Spatial Planning Act (to be replaced by the Environment and Planning Act 2024), and in most cases also a water permission under the Water Act (primarily to prevent fish mortality). Depending on the context, a permission under the National Public Works Management Act is also required. Although the potential for hydropower to contribute to national targets that are set for renewable energy by 2030 is recognized and the technologies for hydropower generation are readily available135, widespread uptake is not to be expected unless to a range of financial and institutional barriers is overcome[136]. In summary, we conclude that the context of hydropower generation in the Netherlands does not provide useful insights for improving economic mechanisms of ANAR.

4.2 Payments for the used water resource and/or other fees/taxes etc.

AUSTRIA

227. Hydropower producers in Austria do not pay for the volume of water used to produce electricity. Therefore, a system of Water Usage Levy ("Wasserzins") as in Switzerland or any other mandatory return investments towards aquatic ecology or to the benefit of river adjacent communities are not in place. Big hydropower producers in Austria are more than 50% owned by the public, federal state, provinces or municipalities. As owners, they benefit from generated revenue, and an introduction of a water levy was hence perceived as "shifting" money around"

[135] Witteveen+Bos (2019) Perspectieven elektriciteit uit water; Nationaal potentieel voor 2030 en 2050. For: STOWA, Rijkswaterstaat and Ministry of Infrastructure and Water Management. 22 October 2019, revised 16 August 2021.
[136] Somsen, F.E. (2018) Energietransitie in Nederland: het potentieel van waterkracht. BSc thesis. Radboud University Nijmegen.

by the Ministry of Water and the power producers. Other stakeholders, such as environmental NGOs, would, however welcome the introduction of a water levy.

Water Usage Levy – the case of Switzerland. The right to produce hydropower through the exclusive use of public bodies of water is granted as a licence (water usage levy). This means that licence holders must pay an annual fee to the licence issuer (canton, district, municipality). The cantons specify the levy amount within the limits laid down in the applicable federal legislation. The calculation of the annual amount paid in Swiss Francs by the licence holder to the public licensing authority is based on the facility's mean gross output in kilowatts. There is a complex system of ceilings and exemptions for small producers and guidance on how (part of) the levy should be used to improve aquatic ecology and protection from water-related risks.[137]

228. The proactive approach of the Verbund. After the introduction of the EU Water Framework Directive, the need for action for hydropower producers became evident. The biggest Austrian energy producer, the Verbund, pursued a proactive approach to "in kind" implement measures to attain the prescribed targets. The strategy was developed in close collaboration with the Ministry of Water, and it was accepted that the planned investment from its own resources would reduce the company's revenue. Fish ladders could be easier realised than an increase in residual flow due to its direct impact on energy production capacity. The issue of surge / down surge is, to a certain extent, inevitable as wind and solar power production development increases and pump-storage plants are needed to compensate for fluctuations and cover peaks in energy demand. More research was required to generate knowledge on how to structure residual flow stretches to maintain aquatic habitats during the surge and down surge phases. The Verbund established a fruitful research collaboration with an Austrian University in terms of funding and actively engaged in the research initiatives to interpret results and sharpen research questions. Based on hydraulic modelling, approaches for surge / down surge management and structuring affected river stretches could be developed and implemented, leading to a win-win situation for ecology, power producers and the authorities. Verbund brought back ecology experts into the organization to accompany these processes and to steer monitoring programmes (up to periods of three years) to understand whether the measures taken lead to the intended impact on the aquatic ecology.

Figure 41: Freudenau Hydropower Plant downstream of Vienna with natural fish ladder on the right side of the picture (picture sources: https://www.verbund.com/de-at/ueber-verbund/besucherzentren/freudenau)

229. To date, some of the more prominent producers continue to pursue a proactive approach, some still need to be convinced. The strategy of the provinces is to rely on voluntary action and provide technical support as well as subsidies for investments. Given the ownership, it could be argued that the authorities could substantially impact how "their" companies contribute to maintaining the targets of a good ecological status or potential. Starting with big plants bought time for smaller ones, as positive reports could be sent to the EU. The most pertinent issues along

[137] https://www.bfe.admin.ch/bfe/en/home/supply/renewable-energy/hydropower/water-usage-levy.html

bigger rivers have been addressed (fish ladders, surge/down surge), moving the focus to the upstream tributaries of the Danube and towards the required hydro morphology improvements. This concerns smaller, primarily private producers.

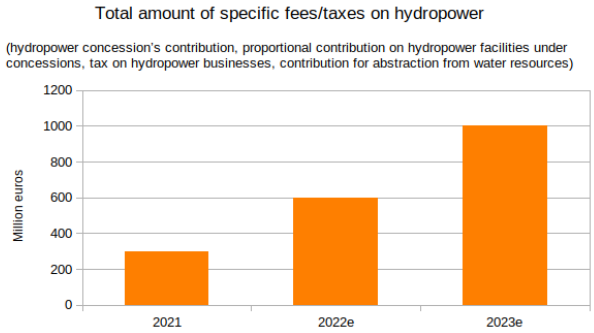
FRANCE

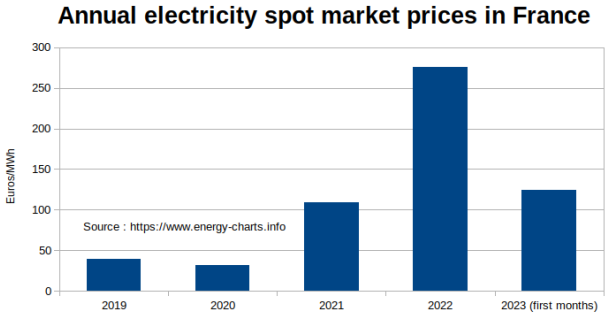
230. France has implemented several national economic contributions based on hydropower that contribute to the national budget or are affected to specific national institutions. The different contributions are the following:

- Contribution that is related to the price of electricity
  - Hydropower concession's contribution ("Redevance hydraulique de concession") based on the State public domain occupation of the concession. It applies on all concessions not yet renewed or extended. The estimated revenues in 2022 are 350 to 400 million euros. (around 160 million euros in 2021). This contribution is totally allocated to the national budget.
- Contribution that is related to the price of electricity and the volume of electricity produced
  - Proportional contribution on hydropower facilities under concession ("Redevance proportionnelle sur les installation hydrauliques concédées") based on kWh production and price of electricity (when concession extended) and related to dividends and profits (when renewed). It applies only on concessions renewed and extended. The estimated revenues in 2022 are 80 million euros (around 10 million in 2021). Half of this contribution is allocated to the national budget and the other half to local authorities, departments and municipalities.
- Contributions based on hydropower capacity installed
  - "Tax on network businesses" ("imposition forfaitaire des entreprises de réseaux (IFER)"). The estimated revenues in 2022 are 80 million euros in 2022 (80 in 2021, 83 in 2023). This contribution is allocated to local authorities: department and municipality level.
- Contribution based on water abstraction
  - Contribution for abstraction from water resources: hydropower plants. Contribution decided by and allocated to river basin agencies. 40 million euros per year during the 9th program of the water agencies.

In 2022 the total amount of specific fees/taxes on hydropower (hydropower concession's contribution, proportional contribution on hydropower facilities under concessions, tax on hydropower businesses, contribution for abstraction from water resources) are estimated to reach 550 to 600 million euros in France (Llss than 300 million euros in 2021 and certainly more than 1 billion in 2O23). This huge variation is due to the two first contributions that are based on electricity prices 138that increased highly in France (and in Europe) in 2021 and 2022.

[138] https://www.energy-charts.info/charts/price_average/chart.htm?l=en&c=FR&chartColumnSorting=default&interval=year&year=2023





Other taxes (information provided by a 2013 study including 2020 prevision[139]):

- Property Tax: A great part of this tax is based on the power capacity. It represents around 200 million euros/year and is totally allocated to municipalities.
- The Territorial Economic Contribution (CET). This contribution is based on turnover and rental value of the property. It represented 224 million euros in 2012 and was to be 250 million euros in 2020. It is allocated to the regional, departmental and municipal level.
- Profits tax: This contribution is based on the profits made. The normal rate is 25%. It represented 380 million euros in 2012 and was to be 505 million euros in 2020. It is allocated to the national budget
- VAT: It represented 737 million euros in 2012 and was to be 958 million euros in 2020. It is allocated to the national budget

These taxes were to be around 1.6 billion euros in 2020 much more than the specific hydroelectric taxes.

POLAND

231. The relations between Polish Waters and energy producers are not easy despite the fact that both are under control of the government, unfortunately by different ministries. In case of permits, the vast majority of hydro plants operate based on permits obtained many years ago and there is not much space for change. The other two areas of difficult collaboration are tariffs and reservoir operations during crisis management when flooding occurs. In the first topic it is necessary to observe that in general tariffs for water did not cover costs of water supply to industry and cost of water management in Poland including maintenance and amortization. In 2017, when water management reform established Polish Waters as only one authority in charge of water management in Poland, a comprehensive analysis of water management in Poland was prepared based on that new system of tariffs for all users safeguarding self-financing of water management from payments by users. This proposal was connected with huge increases in the cost of water for users and was not accepted by the Council of Ministers for social reasons (huge increase of the cost for domestic/residential water use) and economic reasons, as hitting productivity and competitiveness of water consuming sectors in the national economy, including the energy sector, which is using huge amounts of water (responsible for 60% of total water use) for cooling systems in coal-fueled power stations.

232. The other area of collaboration of hydro power producers with Polish Waters are flood protection activities during crisis management activities. As a rule, hydropower plant owners are dam operators and hydro energy production is optimized with high levels of water in retention

[139] https://www.france-hydro-electricite.fr/wp-content/uploads/2019/08/BIPE-2012-Etude-impact-eco-de-lhydro.pdf

reservoirs. In case of risk of flooding and when the state of flood danger is declared by appropriate governmental authorities Polish Waters have the right to take control of reservoir operations, including dictating releases depending on flood risk upstream and downstream of reservoirs. This collaboration is precisely described in the legal regulations and there is no space for dam operators to refuse the water releases as expected and ordered by operational centers in Polish Waters. The eventual losses in electricity production are not covered by the state and they are the risk of the electricity producers. Of course, here is some space for accusing Polish Waters of not operating reservoirs properly, but it has never happened that such difference in opinion after the flood was sent to court.

SPAIN

Participation in the electricity production market

233. Hydroelectric power producers are obliged to make economic offers for the sale of power, through the market operator, which, once accepted, constitute a firm supply commitment. There are different types of contracting: Contracts for the purchase and sale of electrical power, contracts of a financial nature that have electrical power as their underlying asset, and bilateral contracts made directly between consumers and producers, between producers and retailers, and between retailers themselves. These contracts are excepted from the bidding system. Electrical power traded through the daily markets and intraday auctions is remunerated based on the price resulting from the balance between the supply and demand of electrical power offered therein. The electrical power negotiated through the bilateral, physical or term contracting markets is remunerated based on the price of the firm contracted operations, in the aforementioned markets.

Taxes and charges

234. The use of continental waters to generate power is taxed with the most important charge called “canon” for the use of continental waters for the production of electrical power, destined to the protection and improvement of the HPD. Licensees of water for hydroelectric purposes are obliged to make this payment. Some concessions establish an annual power reserved to the State and free supply. Hydroelectric power plants operated directly by the public administration are exempt from it. The taxable base of the “canon” is the economic value of the electrical power produced, measured in plant busbars. The annual amount is the result of applying 25.5 percent to the tax base. The canon is reduced by 92 percent for hydroelectric plants with a power equal to or less than 50 MW and by 90 percent for reversible pumping plants with a power over 50 MW. A total of 2 percent of the “canon” collected is an income of the RBOs, the remaining 98 percent is paid into the Public Treasury. For access to the connection to the transmission and distribution networks of the power produced, a price called the access toll is applied. This toll is intended to cover the cost of the electrical power transmission and distribution activities, in line with the provisions of the Directive 2009/72/CE, on the internal electrical power market. This toll is set and reviewed by the National Commission for the Markets and Competitiveness (NCMC).

Breaches and penalties

235. The CTWL considers breach of the conditions imposed in the concessions to be an administrative infraction, which can be classified as very serious, serious, less serious and minor infractions, also assessing the damages to the HPD. The LES classifies as very serious the construction, commissioning, modification, transmission, temporary closure or definitive closure of hydroelectric facilities without the necessary concession and administrative authorization, as

well as non-compliance with their content when the guarantee of supply or a danger or serious damage to people, property or the environment is generated. Minor offenses are non-compliance with the obligations related to the supply contracts, the Market Rules or the Operation Procedures when this results in prejudice to the functioning of the market or the electrical system.

The LES establishes a range of sanctions:

- Very serious infractions, a fine for an amount not less than 6,000,001 euros nor more than 60,000,000 euros.
- Serious infractions, a fine for an amount not less than 600,001 euros nor more than 6,000,000 euros.
- Minor infractions, a fine of up to 600,000 euros.
- Support for hydroelectric power generation.

There are currently two main support frameworks: The specific remuneration system and the economic system for renewable power (see **Annex 4**). Regardless of other support mechanisms for renewable energies, such as support lines for investment in renewable electrical power co-financed with funds from the European Union, which manages the IDAE.

236. The development of renewable energies constitutes one of the most important pillars of the power transition process that Spain must undertake to achieve the decarbonization of our economy by 2050, thus fulfilling the commitments acquired before the European Union and in the Paris Agreement on climate change, signed on December 12, 2015 (see **Annex 4**). In this context, floating photovoltaic plants located in the PHD allow to increase the capacity for electrical power generation from renewable sources, since they present advantages over terrestrial systems, such as better power performance due to the effects of cooling the water, reducing the evaporation and slowing down the growth of phytoplankton. A Royal Decree is in a very advanced approval process that establishes the procedure for obtaining the right that enables the holders of floating photovoltaic plants in the PHD to install, operate and obtain the corresponding benefits under the conditions established by the Administration.

237. Within the water-power dichotomy, the best power use of the dams is achieved with the operation of reversible pumping hydroelectric plants (see **Annex 4**). In line with making infrastructures sustainable and resilient, the Strategy of Installed Power (SIP) suggests the reuse of the existing hydroelectric plants, by adding pumping systems, whenever this is feasible, taking into account the terrain and that the elevation difference between the reservoirs is adequate, in addition to water availability and environmental impact. At the same time, the SIP proposes the extension of the existing reversible pumping stations, adding new groups with the same hydraulic infrastructure of reservoirs or deposits. It also promotes hybridization, allowing electrical power generation facilities with granted access and connection permits to hybridize said facilities with photovoltaic plants or reversible pumping stations, being able to evacuate electrical power using the same connection point.

THE NETHERLANDS

238. Nothing specific to be added under this section from the country.

Chapter 5. Achieving sustainable and resilient water infrastructure

5.1 Preparation for and addressing climate related risks

AUSTRIA

239. The recent Austria´s Water Treasure study looked into groundwater utilization intensity. This vital indicator shows how much of the available groundwater resources we use. It is calculated by comparing the amount of water extracted from wells to the available groundwater resources. The "unfavorable" Water Treasure Scenario 2050 estimates that some regions, especially in eastern Austria, will exceed the 100 percent mark. In this event, available groundwater resources would no longer meet the well water demand.

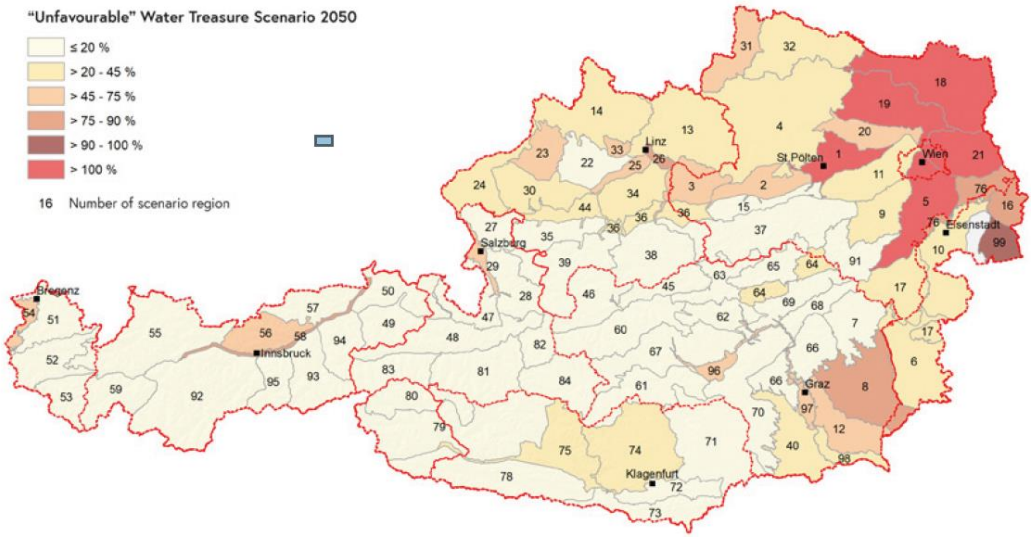


Figure 42: Utilization intensity of groundwater from under unfavorable demand and endowment development by 2050 (picture sources: Ministry of Water, 2022)

These results trigger further investigations of how demand and water resources can be managed at greater scale and how available data and information can be heightened to inform decision making processes and compliance monitoring.

240. **Up-to-date management instruments:** the National Flood Risk Management Plan and the National River Basin Management Plan are high-quality strategic planning documents that are reviewed every 6 years to integrate the experience of the previous phase, new findings on the impacts of climate change and approaches that have been developed meanwhile. **Financing adaptation of water and sanitation infrastructure:** The Environmental Aid Act forms the basis for subsidies and prescribes the basic (10% of the eligible costs) and the peak funding rate (up to 25% of the eligible costs in the drinking water sector and up to 40 percent in the wastewater sector). One of the targets is to make systems fit for future changes, demographic ones but also those related to climate change. Given that the municipal budgets can be quite burdened with the "mere" maintenance of the status quo, higher subsidy levels to invest in more resilient drinking water and wastewater systems might be needed.

241. **From River discharge to max. possible precipitation:** the 100- and 30- year flood events are key in flood risk management planning. For dimensioning bigger structures such as large dams, events with a lower occurrence liability such as the 5000-year flood are decisive. Austria has a decade-long history of water resource monitoring and protection and therefore a dense network of nationwide monitoring stations and programs for quantity and quality of surface and groundwater. Nevertheless, the records of several decades can statistically not yet reflect the

effects of climate change as the measurement period is simply too short. As climate change will lead to heavy rainfall events at local level, the highest possible rainfall events will gain importance in determining the dimension of dams in the future. In flood protection and hydropower planning, this results in a shift towards integrating the results of precipitation-runoff models in the dimensioning process in addition to gauging station records. Hydropower operators have in the recent years, also triggered by the catastrophic flood events in 2002, reinforced dams.

FRANCE

242. The French system has been built on the basis of a resource defined by the legal framework as a "common good". On the contrary to some other resources like energy, where the price and its increase is a way to manage scarcity, France has not implemented a price for access to water resources and water and its scarcity has up to now been largely managed by a state authorization regime in which ascending priorities have been given to the various uses. The agriculture use, which represents the highest amount, has the lowest priority, and the drinking water the highest. With increased scarcity, some uses become progressively restricted or forbidden. This organization takes account of the fact water resources are accessible to all users and the biggest water users are not connected to public water services but abstract directly the water they need. With climate change and longer water scarcity periods, the limited enforcement of the restriction rules and the need to consider the economic viability of the different sectors become more prominent and some weaknesses of the system appear.

243. A recent report from the national accounting court (CC, 2023) pointed for instance the inadequate organization of the institutions and responsibilities for quantitative management. The experts raised that the state fixes the rules but is not fully coherent in its implementation: agriculture ministry want to secure water for agriculture, environment ministry to reach good status of all waters… This is or should be addressed in the interservice missions but by taking account of local realities, they sometime create situations which are not fully coherent along the same watershed. With the water law of 1992, a watershed organization was defined (the SAGE) with an objective to have a similar approach than the river basin at a more local level. The difficulties to gather local authorities in a coherent watershed and the organizational complexities have led to a relatively slow implementation and the French territory is only covered to 54% by a SAGE. It will become more and more necessary to have a leading organization at watershed level to manage both water quality and quantity and involve all local actors in the decision making as regards management of local water resources.

POLAND

244. There is huge experience gained in Poland in last 34 years of political and economic transformation in the area of water management and the most valuable ones are presented below in the lists of good practices and bad experiences. The primary best practices include:

- implementation of 3T (tariffs, taxes, and transfers) system in legal framework, including creation of system of tariffs based on fixed fees and variable fees, where variable fee depends on amount of pollution multiplied by unit price,
- Impact on spatial planning and permits for construction,
- Implementation of WFD & FD,
- Multi-annual large flood protection and risk management projects creation and implementation.

There were also some bad experiences which could be treated as lessons learnt, and the most painful were and are:

- system of water management financing – unbalanced with huge deficit,
- extreme centralization of competences and tasks in governmental agency Polish Waters,
- dramatic reduction of users and public participation in water management decisions,
- on-going fragmentation of basin water management by growing number of regional authorities,
- elimination of regional and local governments from responsibilities (and financing) of water management,
- huge flood investments versus very low (6-8%) implementation level of FRMP measures in first cycle – unrealistic planning approach to measures.

245. The most important key achievement by establishing of Water Law Act, which is an implementation of water-related EU Directive and setting up of a whole water management system in Poland. The system needs further modification, especially in the institutional framework as Polish Waters is a governmental agency with very centralized structure. It is necessary to decentralize the decision-making process inside agency transferring many competences to regional and catchment levels and it is worth analyzing the decentralization of the management and responsibilities back to the regional self-government in case of small creeks and rivers according to subsidiarity principle. The system of financing water management needs further extensive analysis to find a stable and effective solution for covering the costs of operations, maintenance and development using the 3T principle (tariffs, taxes, and transfers) for an appropriate mix of financing components taking into account affordability for the inhabitants and competitiveness of the water-using sectors of the economy, including agriculture.

246. The important key achievement of last 30 years is long-term integrated approach to flood risk management by cooperation with International Financial Institutions (i.e., World Bank, CEB, etc.) to create, implement and operate flood protection infrastructure and to develop non-structural measures supporting flood risk management, especially building a modern early warning system and continue with basin operational centers for the Upper Odra and Vistula catchments for comprehensive water management. The remaining challenge is a continuation of flood protection activities in the lower parts of both catchments, addressing flash floods and urban flood risk and to develop measures to address the drought risk. The most important and difficult challenge is to increase retention capacities by all possible measures including large and small reservoirs and implementing nature-based solutions. Another key achievement is strong and appropriate impact of water management administration on spatial planning decision of all scales (national, regional, local) including requiring permits for construction in areas of high flood risk. Now it is impossible to locate any investments in these areas without acceptance of water administration.

SPAIN

247. The Spanish hydrological regime is characterized by an extraordinary irregularity, which has made it necessary to build large reservoirs and transport infrastructures. Currently, the number of large dams in operation exceeds 1,200 with an approximate capacity of 56,000 million cubic meters, the average age being around 55 years with progressive technical and structural aging. Hydraulic infrastructures are affected by extreme weather events and by changes in hydrological patterns in a world altered by climate change. The Spanish Government has considered that

managing infrastructures with a long-term resilient perspective guarantees that future generations inherit infrastructures that are not compromised by climate change.

248. For this reason, significant investments have been made in the State dams for the preservation and rehabilitation of this fixed capital asset, keeping it in optimal operating and safety conditions. To improve the safety of the State dams, emergency and safety review plans for the dams are being implemented in the RBOs, for an amount of €67M. The aim is to identify, evaluate and manage climate risks to improve the resilience to climate change of existing hydraulic infrastructures and new projects. The dams and their reservoirs are subject to Royal Decree 264/2021 by which the technical safety standards are approved, these are for the project, construction, loading and filling of the reservoirs, as well as for the operation and shutting down of dams. It also establishes the obligation to prepare and implement Emergency Plans and Operation Standards with safety criteria, above other technical, environmental or operational criteria.

249. These obligations are imposed on infrastructures classified as Large Dams, regardless of whether their owner is the administration or a private entity. To help the administration in terms of safety of dams and reservoirs, there are companies that become Collaborating Entities, having to meet a series of requirements to be able to exercise this collaboration. Likewise, in order to provide labor for the operation of the state dams, there is personnel from the public company TRAGSA. The starting point is the application in each regulatory infrastructure of Building Information Modeling (BIM) technology, creating a digital twin consisting of a three-dimensional geometric representation with all the information associated with the different objects, which becomes a single interface for managing all control and operation applications of the dam. An action program is being developed for the digitization of the main hydraulic infrastructures of general interest in BIM.

250. In collaboration with the Spanish State Meteorological Agency (SMA), a climate service called S-ClimWaRe (Seasonal Climate predictions in support of Water Reservoirs management in Spain)140 has been developed, aimed at supporting reservoir management and decision-making. The most outstanding information is the seasonal predictions of precipitation and water contributions to the reservoirs for the extended winter from November to March, a particularly critical period when a large part of the reservoirs are filled, and the determination of the hydrological risk linked to climate variability, generated based on historical series of meteorological and hydrological observations. A phenomenon to take into account is the retention of sediments in the reservoirs and the solutions for their mobilization, with the double objective of maintaining the safety of the dams and the regulation capacity of the reservoirs themselves, avoiding hydromorphological alterations of the channels, which increase the risk of non-compliance with the environmental objectives defined in the hydrological plans in compliance with the WFD and facilitate the transport of sediments to coastal systems to stop the regression of beaches and the subsidence of deltas, especially affected by climate change. For this reason, the River Basin Organizations (RBOs) consider that the management of sediments should not be done individually without taking into account the channels and reservoirs downstream, and they should be managed at the level of the river basin (river basin, transition and coastal waters). The Spanish committee on large dams (SPANCOLD) has published a study on integrated management of sediments that lays out policies to prolong the lifespan of reservoirs.

251. Finally, the reduction of the availability of water resources in the different climate change scenarios requires increasing the water supply. For this reason, some new specific reservoirs, the

[140] https://www.miteco.gob.es/es/agua/temas/evaluacion-de-los-recursos-hidricos/Prediccion-estacional-gestion-embalses.aspx

regrowth of existing dams, the commissioning of underutilized infrastructures and the expansion of water sources of different origins are being considered. Currently, there are about 950 million cubic meters of installed desalination capacity. Spain is the European leader in the volume of reused water, with a current volume of 400 Mm3/year, of which 50 percent is used for agriculture. Most of these resources are used in the basins with the greatest water stress, such as those of the Mediterranean arc and, especially, in the Jucar and Segura rivers.

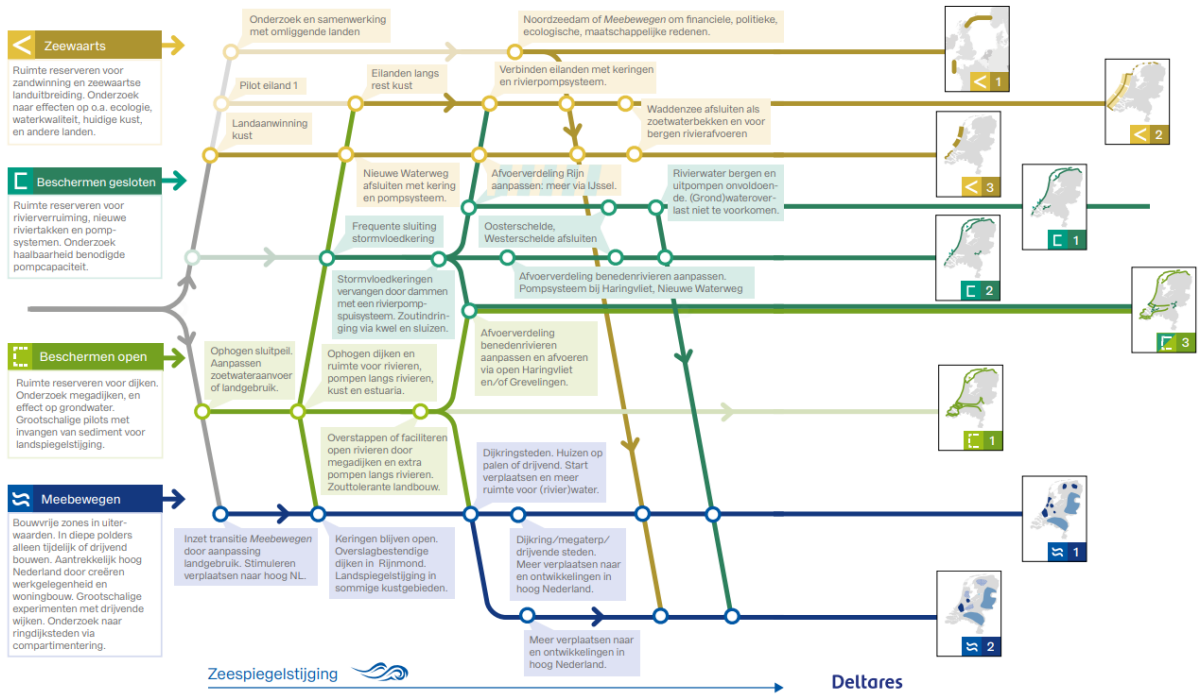
THE NETHERLANDS

252. Being a country largely exposed to coastal and riverine flooding, the Netherlands is paying due attention to preparing for and addressing climate related risks. Maybe the best-known example is the Dutch Delta Program, 141 with the objective to protect the Netherlands from high water and flooding, to ensure a sufficient supply of fresh water, and to contribute to rendering the Netherlands climate-proof and water-resilient. This Program is headed by the Delta Commissioner, whose position is legally anchored in the Delta Act[142] while its finance is secured through the Delta Fund with annually € 1.5 billion per year[143,144]. The Delta Program has also developed four Delta Scenario's for the year 2050 and 2100, in which climate change and socio-economic developments are combined[145] The Delta Scenarios are used to identify and assess adaptation strategies and measures. The Delta Program Signal Group keeps an eye on relevant developments for the Delta Program with a focus on climate change, and it advises the Delta Commissioner annually about how to address these developments[146]. An example how the Dutch work on the adaptation to long-term climate risks, is provided in Texbox below.

141 https://english.deltaprogramma.nl/
142 https://english.deltaprogramma.nl/delta-programme-commissioner
143 https://english.deltaprogramma.nl/delta-programme/delta-fund
144 The Delta Fund is publicly financed (i.e., taxpayers' money).
145 https://english.deltaprogramma.nl/delta-programme/knowledge-development/delta-scenarios
146 https://english.deltaprogramma.nl/news/news/2021/12/09/delta-programme-signal-group-issues-advisory-report-for-2021

In the Sea Level Rise Knowledge Programme (KPP Zeespiegelstijging), governments, businesses, knowledge institutes and civil society investigate the possible consequences of sea level rise for the Netherlands. They also look at different long-term scenarios and explore measures to prepare for the consequences. The program provides knowledge enabling timely choices for the protection and future organization of water management in the Netherlands.

The figure below shows four possible adaptation pathways, based on the long-term adaptation strategies Seawards, (Zeewaarts; with dikes before the shore of the Netherlands), Protection-closed (Beschermen-gesloten; with dikes and mega pumps), Protection-open (Beschermen-open; storm surge barriers) and Managed Retreat (Meebewegen; a.o. relocation). All pathways require short term preparatory measures, research and experiments to test them before (large scale) implementation can take place on the long term. The preparatory measures mainly consist of measures that keep or make space available for the implementation.



5.2 Approaches for improved risk management of water infrastructure due to increased water variability

AUSTRIA

253. **Drinking water quality and quantity:** large areas of the country can be supplied with native drinking water from springs and wells, which is available in great quantity and quality. Some flat parts of Austria are affected by lower precipitation rates, which led to the establishment of water cooperatives to avoid overuse of aquifers by several municipalities. In these areas, there is the need for enhanced coordination among other water users, like agriculture and industry, concerning groundwater quality and quantity (Danube Water Programme, 2015). Water cooperatives and Water Unions, as the Water Law prescribes, form an appropriate framework for enhanced collaboration. With increased pressure on groundwater, protecting it from pollution becomes even more relevant. Protecting resources against pollution from the

agricultural sector and the industry is an ongoing challenge. The Nitrate Action Programme Ordinance, updated in 2022, seems to be a step in the right direction.

254. **Supply security:** all climate scenarios until 2050 show only a small change in precipitation over the year. However, differences between areas have been spotted, and areas with lower yearly precipitation are expected to have even less precipitation in the future147. Based on this knowledge, and due to general (technical) secure supply issues, the water supply systems became more interconnected through pipes and through cooperatives. Because of the high general availability of water in Austria, no water shortage is expected. Overall, water supply for households and industry is seen as secure (Danube Water Programme, 2015). Under unfavorable endowment and demand scenarios, however, regions in Lower Austria and Burgenland will have to manage demand and water resources better and enhance available data and information levels for more evidence-based decision-making. Connecting individual piped water supply systems through transmission mains increases supply security – technically and against the background of climate change.

> **Project example waste supply transmission main.** EVN Wasser, the Lower Austria regional water utility, invests in constructing a 60 km transmission main to safeguard the drinking water supply of 120.000 customers in three districts of Lower Austria north of the River Danube, which relies on fissure groundwater only. The project will be implemented in several phases between 2020 and 2025 and represents a total investment volume of 35 million euro[148].

255. **Climate-resilient wastewater service provision:** during the last decades, a huge amount of money has been invested in water supply and wastewater infrastructure maintenance. Maintaining these assets in technically sound conditions is necessary to provide reliable services. However, especially the sewer network maintenance burdens municipal budgets. More emphasis and funding for the adapting the sewer systems to manage heavier rainfalls due to climate change remains a challenge in the future.

256. **Hydropower production:** hydropower production in Austria naturally fluctuates with changes in the annual standard capacity of 8-9 percent. The impact of climate change on hydropower production will hence not be seen in a reduction of the standard yearly capacity but rather in a shift of the periods then. Today, a lot of electricity is produced in spring and summer, but in the future, this might shift to autumn and winter. However, overall the production will remain at a similar level throughout the year149. Having well-maintained hydropower plants to maximize efficiency and investing in pumped storage plants seems to be the right strategy against the background of Climate Change.

FRANCE

257. France is more and more affected by climate change. For water, two key phenomena are of particular importance: water scarcity and drought, and floods. Higher water scarcity periods in summer but also in winter can create drinking water cuts and resource tensions between users and increase the risk of forest fires and other water related natural risks (landslides, invasion of alien species such as tiger mosquitoes, rivers run more and more dry in some periods, groundwater levels decrease, etc.). Following this, tensions on water resources become more and more obvious (ex: summer restrictions reaching in 2022 more than a month in a significant

147 Compare also: https://climateknowledgeportal.worldbank.org/country/austria/climate-data-historical

148 https://www.evn.at/home/presse/erster-abschnitt-der-trinkwasser-versorgungsleitung-im-waldviertel-sichert-die-trinkwasserkapazitate

149 https://www.derstandard.at/story/2000140456350/wie-die-kleinwasserkraft-ausgebaut-werden-koennte

portion of the territory) and the management framework will need to be adapted: selection of more resilient crops, reduced meet production, increased infiltration, increased water retention in soils and groundwater, lack of impermeabilization etc.).

258. Higher risks of floods are also to be expected, and the revision of the framework with responsibilities for infrastructures closer to the ground should contribute to a better resilience but may also lead to limit the flood protection due a.o. to costs and to invest in adaptation of the infrastructures to become more resilient to floods. The French President announced at the end of March a new water resource sobriety and efficiency plan[150] with 53 new measures that aim at rewriting the water management policy to adapt it to the challenges of climate change. This plan has two objectives:

- in the short term: prepare for next summer and avoid drinking water cuts as much as possible;
- by 2030: achieve 10% water savings in all sectors.

Among the different measures announced there will be an annual increase in the water agency budget by 450 million euros. It will be financed by an increase in the different water taxes and among them the water bill. All these measures are detailed in **Annex 2**.

POLAND

259. At the request of the Polish Government and with support of the World Bank comprehensive study analyzing water management situation and perspective was prepared by IEc in 2022 – "Poland Water Security Outlook and Action Planning Framework". The report presents the following general recommendations addressing the main challenges of water management in Poland:

Infrastructure: Increasing the availability and reliability of water resources will require a combination of storage and conveyance infrastructure investments, and increased use of groundwater. Investments in new irrigation schemes using both surface and groundwater has high potential in most agricultural areas. However, expensive infrastructure interventions such as large-scale reservoirs and artificial groundwater recharge have limited feasibility and show high potential only in specific locations. The conversion of the five coal-fired power plants with open cooling systems in the Odra and Upper Wisla rivers basins to water-efficient technologies will yield significant benefits. Improvements to water supply networks will save significant volumes in the same catchments.

Institutions: To achieve potential increases in irrigation, further coordination between the Ministry of Agriculture and Rural Development, Polish Waters, and other water-related ministries (at present, in particular, the Ministry of Infrastructure) will be necessary. New infrastructure developments may require the establishment of new administrative entities, such as water user associations or irrigation districts, which may require technical and financial support. Water savings can likely be obtained from institutional strengthening and rationalization of local water utilities, particularly those in rural areas.

Information: The enhancing and refinement of all data sources should be promoted by government agencies in order to improve the capabilities of all stakeholders, including ensuring wide access to data at minimal or no cost. Serious data gaps exist in the conditions and performance of existing water supply and sewage infrastructure as well as in local water utility operations and capabilities. This data is necessary for effectively planning a country-scale policy to improve water use efficiency at a municipal scale.

[150].https://www.ecologie.gouv.fr/sites/default/files/MAR2023_DP-PLAN%20EAU__BAT%20%281%29.pdf

260. The following issues are key to ensuring that the long-term needs of society are met in ways that bring benefits to all sections of society and ensure that solutions are sustainable.

Inclusivity: Less capital-intensive interventions should be prioritized to ensure improved water use in areas where expensive capital projects may not be economically feasible. For example, national plans for introducing drought-resistant crop varieties and improving soil moisture retention by farmers would be appropriate everywhere, not just in high agricultural output regions, and contribute to food security across Poland. Investments in flood control measures should factor in the socioeconomic conditions of populations at risk, as lower income groups have reduced means to cope with extreme events.

Innovation: Nature-based solutions for flood control should be piloted in areas where high economic gains could be obtained, and thereby illustrate the benefits of these methods for other parts of the country. Increasing groundwater uptake for uses other than human consumption will require a revision of water use priorities and allocations specified in Polish Water Law, as well as revisions to the maximum abstraction rates that still meet safe yield requirements.

Integration: The performance and success of each intervention depends on the implementation of an integrated approach that considers simultaneously increasing supply without disrupting the sustainability of the ecosystem, reducing pressure on existing resources by managing demand, avoiding losses and maximizing reuse.

These recommendations are quite general and could be also adaptable and applicable in case of Romania's water management. Discussion about the financing of water management was outside of the scope of IEc study.

SPAIN

261. The climate change scenarios in Spain contemplate that available water resources will decrease by the end of the century by an average of 24 percent. Reduction to 40 percent in the east and south and approximately 12.4% in the northern river basins[151]. In addition to the fact that there may be recurring episodes of droughts and floods. The latter already cause numerous personal tragedies and large material losses, estimated at approximately 800 million euros/year on average[152]. This is a major challenge for Spain. For this reason, in order to adapt to climate change, the Government of Spain has drawn up "strategic guidelines on water and climate change" so that they can be used for planning and managing water. The main lines of action are the following:

- To properly implement the regulatory framework and EU policies
- To plan for water within a framework of adaptation to climate change to recover, restore and protect rivers, lakes, aquifers and wetlands
- To increase water security
- To improve in sanitation and water treatment
- To fight against diffuse pollution
- To advance in flood risk management through the Flood Risk Management Plans (FRMPs)
- To advance in drought risk management through the Special Drought Plans (SDPs)
- To recover emblematic areas
- To innovate, research and apply new technologies
- To promote sustainable economic activities

[151] https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/plan-nacional-adaptacion-cambio-climatico/agua-RRHH.aspx

[152] https://www.miteco.gob.es/es/agua/temas/gestion-de-los-riesgos-de-inundacion/

- To strengthen financing
- To build a transparent, equitable and participatory water governance model
- To promote the international water agenda

262. For the management of extreme weather events, the most relevant management tools are those that are included in the SDP and the FRMP. The Special Drought Plans (SDP)[153] include measures, supported by scarcity and drought indicators, which are negotiated in advance with users, such as the reduction of water allocations, emergency wells that are only put into service in drought situations, interconnections of reservoirs within operation systems, execution of emergency works, replacement of resources with others from other sources (desalinated, recycled, underground water) and the commissioning of assignments of water rights between concession holders or through the RBO exchange centers. With regard to drought management, users discuss the measures to be taken in relation to the allocations, in the Exploitation Boards for each water resources system (integrated system of interconnected infrastructures) and it is the Commission on Dam Water Release that approves the water release regime and the minimum annual volumes to be stored. These decisions are finally analyzed and approved by the Governing Board of the RBOs. One of the legislative instruments are the Royal Decrees of Droughts of METDC and the Ministry of Agriculture, Fisheries and Food (MAFF) in which, in addition to emergency works, other measures are proposed, such as the exemption of infrastructure fees and rates, and other support measures for the agricultural sector[154][155]. As an example, to face the current drought period, a Royal Decree-Law has recently been approved by METDC allocating €1,400 million to build new hydraulic infrastructures such as emergency pumping, adaptation of water supply intakes and new desalination plants fed mainly by photovoltaic solar parks, as well as to increase the reuse of urban water and reduce charges and tariffs of the affected agricultural holdings.

263. For irrigators who this 2023 suffer a reduction in their water allocation, an exemption will be applied to the regulation charge and to the water use tariff. This exemption will be 50 percent if the allocation decrease is from 40 to 60 percent, and 100 percent if it exceeds that 60 percent. Cities with more than 20,000 inhabitants are required to have emergency plans that allow prioritizing/restricting non-essential uses within the cities themselves and enforcing emergency and awareness measures from the pre-alert phase. Water systems that have access to desalinated or recycled water are more resilient, and having redundant systems is a good measure, although cost must be evaluated. In Spain, groundwater has a high strategic value in the management of droughts because it consists of “underground reservoirs” and, thus, in accordance with the strategic guidelines of METDC, it is considered essential to make sustainable use of them, for which it is necessary to manage the extractions by reversing the trends in the decrease of the piezometric levels of the aquifers, establishing protection perimeters mainly of the water supply intakes and acting against nitrate contamination, establishing limitations to the agricultural activity.

264. The Flood Risk Management Plans (FRMP)[156] have the objective of managing floods, increasing the perception of the flood risk of the population and improving administrative coordination between all the stakeholders involved in risk management, optimizing the forecast capacity and knowledge. To this end, the plans establish the necessary coordination with land use

[153] Special Drought Plans (PES) – Citizen Observatory of Drought (observasequia.es)
[154] https://www.miteco.gob.es/images/es/pp-proyecto-rd-declaracion-situacion-de-sequia-prolongada-en-dh-gualdalquivir-dic-2017_tcm30-437213.pdf
[155] https://www.boe.es/buscar/doc.php?id=BOE-A-2022-4136
[156] Flood Risk Management Plans (miteco.gob.es)

planning to reduce exposure in flood-prone areas (including the information in the Land Registry regarding the flooding risk of real estate) and establish measures such as optimization of flood protection systems against existing floods, fluvial restoration and hydrological-agroforestry restoration of basins, reservoir management, conservation work on existing infrastructures, and prevention actions on the coast.

265. One of the important tools in flood management are dams, which, as they are regulation infrastructures, allow flood control. With meteorological, hydrological and hydraulic data, floods are modeled so that, through decision support systems, operation maneuvers are carried out in previous days, for example, to increase the reserves, increasing the reservoir capacity. Likewise, in order to maintain the good ecological state of the river downstream, dams discharge a minimum flow, and in the oldest ones that do not have drainage elements, intake towers are built to perform this maneuver, also avoiding flooding downstream. The Pitma-Adapta-Agua Program[157] of the GDW to improve fluvial connectivity has executed works since 2015 to recover the river morphology and has the objective to improve knowledge and monitor the impacts of climate change. This is part of the Spanish National Plan for Adaptation to Climate Change (NPACC)[158]. The Spanish National River Restoration Strategy (NRRS)159 proposes actions based on nature, mitigation and adaptation to the effects of climate change. These actions include the reforestation of riverbanks or the recovery of longitudinal connectivity of rivers, allowing their connection with the floodplain, eliminating longitudinal and transversal barriers and obstacles (dikes, flood protection infrastructure, breakwaters and abandoned weirs).

THE NETHERLANDS

266. The Netherlands is prone to risks of flooding, water scarcity and pollution. Extreme events in the past few years showed the impact of these: for example, the 2018 drought caused between 900- and 1.650-million-euro damage[160], and the Limburg floodings of the summer of 2021 caused approximately 383-million-euro damage[161]. Recognizing that water and soil are the fundament for the wealth of the Netherlands, the Minister for Infrastructure and Water Management has sent a Letter to Parliament that sets out that the water and soil systems are facing limitations to meet user demands: livability can only be maintained in the context of a changing and volatile climate by letting water and soil play a structuring role in spatial planning. For this, several policy principles are defined:

1. No transfer of problems/costs to future generations, other areas, other functionalities, or from the private to the public realm;
2. Anticipating to extremes (rainfall, drought, heat);
3. Integrated management of water and soil in the context of flooding and drought;
4. Multilayered flood safety (Figure 44) for primary and secondary water systems. In the aftermath of the 2021 Limburg floods it was learnt that, additionally, rapid recovery and water awareness are important to avoid economic impact and societal disruption;
5. Less impermeable surface, excavation and pollution of soil;

[157] https://www.miteco.gob.es/.../planes-y-estrategias/PIMA-Adapta
[158] National Plan for Adaptation to Climate Change (miteco.gob.es)
[159] National River Restoration Strategy (miteco.gob.es)
[160] Ecorys (2019) Economische schade door droogte in 2018. Commissioned by Ministry of Infrastructure and Water Management. https://zoek.officielebekendmakingen.nl/blg-916915.pdf
[161] Letter to Parliament 30-01-2023 Afhandeling schade wateroverlast juli 2021. https://open.overheid.nl/documenten/ronl-9114d2e3b7b29d31fbc0c97eeff6f21dfdf5edbd/pdf

6. Integrated approach to the living environment by connecting soil and water to other policy domains, such as urbanization, residential development (Figure 43, right), agriculture and energy;
7. Comply or explain. This provides possibilities to align activities and project planning to achieve policy objectives with local contexts.

In addition, the Letter outlines a policy framework for future water and soil management. In the coming years, this will be specified.

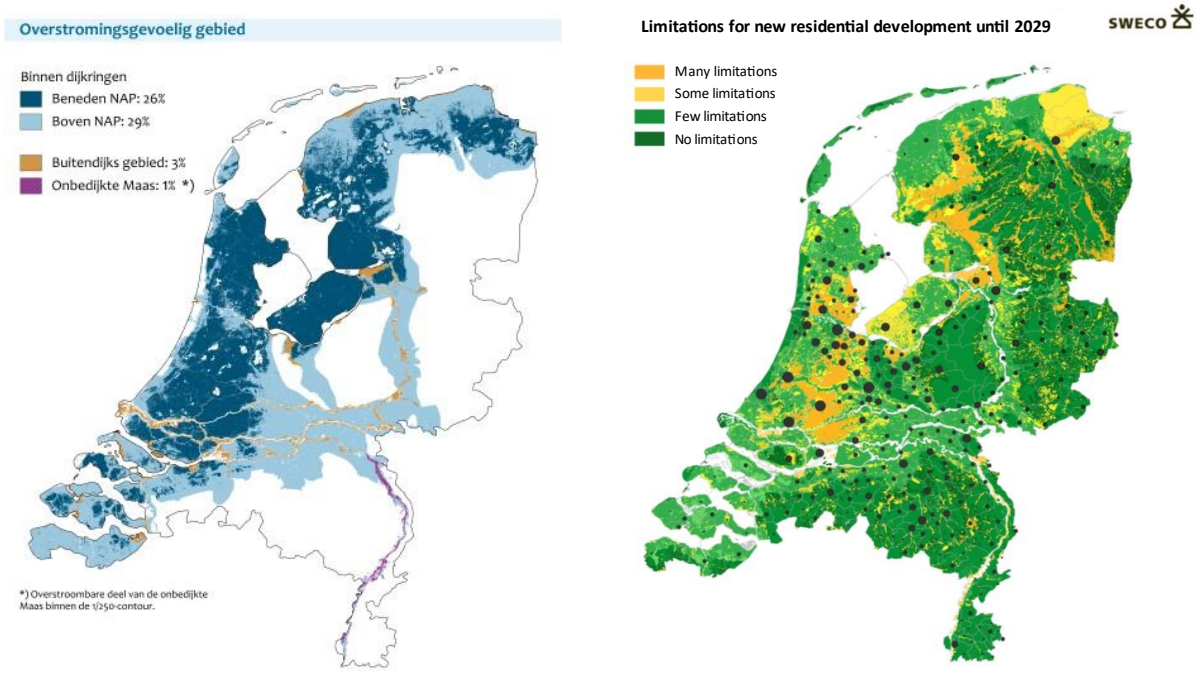


Figure 43: Left: Flood prone areas (26% below MSL, 33% prone to fluvial flooding). Right: Limitations for new residential developments that are planned until 2029.

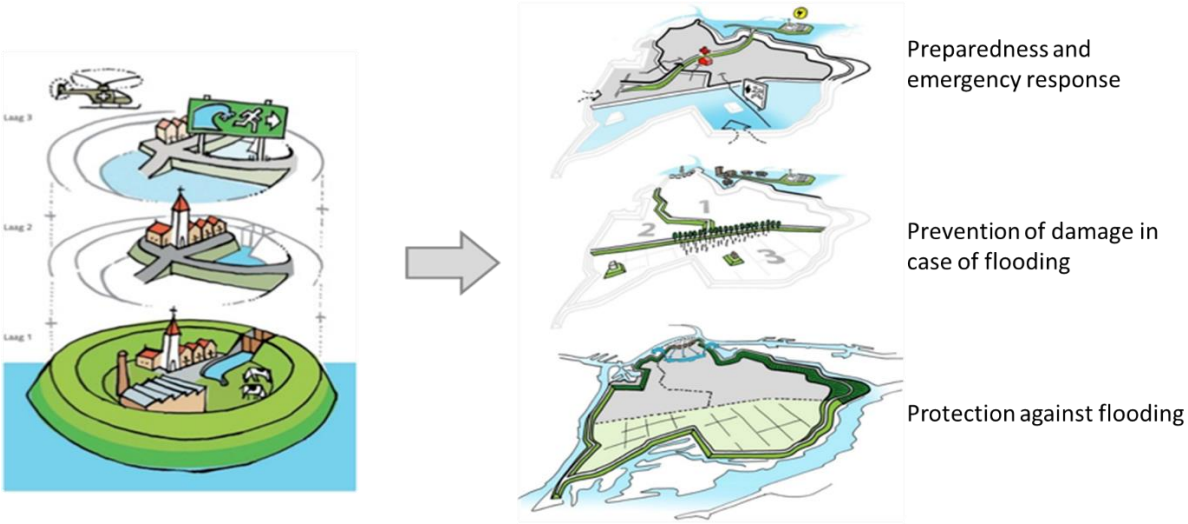


Figure 44: Multi-layered safety to flooding

267. Climate adaptation is not only a government affair. Driven by the European Central Bank's conviction that commercial banks should take a strategic, forward-looking and comprehensive approach to considering climate-related and environmental risks, the Dutch banking sector has started to explore the macro-economic impacts of flooding in the Netherlands. A first analysis by ABN AMRO, which was part of the climate stress test of its mortgage portfolio, revealed that severe flooding could impact economic activity (2% GDP due to a one-month standstill) and a housing price shock of 30 percent[162].

268. Flood insurance: In the NL, there is (virtually) no flood insurance for major flood events (i.e., dike breaches). The reinsurance of large damages on the international insurance market is expensive. A comparable damage as in 1953 (10% of GDP) would nowadays mean a damage of € 80 billion. Flood insurance for other flood events does however exist. Reimbursement for damages due to disasters Act (Wet tegemoetkoming schade bij rampen, Wts)[163, 164]. This act provides the basis for reimbursement for damages due to disasters (such as flood). The reimbursement is only available if the national government declares the Wts act applicable to the disaster. The Wts is meant for both citizens and entrepreneurs, as well as foundations and associations. The following conditions apply:

- you can only apply for reimbursement for material damages that cannot be insured, that are not preventable, or damages that are not recoverable. The government appoints an executive body to implement the measure;
- first the extent of the damage must be determined (appraisal). If your request is granted, the designated executive agency will pay out the reimbursement. Please note that a reimbursement does not mean damages will be fully compensated.

269. After the 2021 flood in Limburg a total of € 63.6 million was paid (1601 claims). 165 This included a courtesy arrangement for uninsured victims of water damage. Although compensation only applies to damage for which no insurance can reasonably be purchased, due to the exceptional situation, the extensive damage and the great suffering that the flooding has caused for the victims, a one-off compensation was also applied for damage that was in principle reasonably insurable. Several efforts over the last years to introduce broader flood insurance coverage against major flood events (like dike breaches) have failed. The latter is partly due to the extreme low-probability/high-impact nature of flood risks in the Netherlands that results in relatively high premiums for limited commercial flood insurance coverage. New proposals are however being prepared and the discussion has not ended. See the Textbox below.

[162] ABN AMRO (2020) Economic impact assessment of future flooding in the Netherlands. https://www.abnamro.com/research/en/our-research/economic-impact-assessment-of-future-flooding-in-the-netherlands

[163] https://business.gov.nl/subsidy/reimbursement-damages-disasters/

[164] https://wetten.overheid.nl/BWBR0009637/2021-07-01 Google translate: https://wetten-overheid-nl.translate.goog/BWBR0009637/2021-07-01?_x_tr_sl=nl&_x_tr_tl=de&_x_tr_hl=nl&_x_tr_pto=wapp

[165] https://www.rvo.nl/subsidies-financiering/waterschaderegelingen-juli-2021/wts/beeld (March 10, 2023). Google translate https://www-rvo-nl.translate.goog/subsidies-financiering/waterschaderegelingen-juli-2021/wts/beeld?_x_tr_sl=nl&_x_tr_tl=de&_x_tr_hl=nl&_x_tr_pto=wapp&_x_tr_hist=true

In the opinion of the ENW (the Dutch Expertise Network for Flood Protection, see https://www.enwinfo.nl/secundaire-navigatie/english/) compulsory insurance by private individuals will lead to higher costs in a macroeconomic sense than the current system, whereby the government de facto acts as an insurer in case of a major flood event. Moreover, in the Dutch system of spatial planning there is no freedom of choice when it comes to choosing a place of residence. Insurance will therefore have no effect on the place where people live, especially if this insurance is mandatory.

This is different from the opinion of the Dutch Association of Insurers, who wants everyone to be able to insure themselves against water damage after a major flood from 1 January 2025. From then on, insurers want to be the designated party after a flood event.

Sources:

- https://www.enwinfo.nl/adviezen/advies-verzekeren-overstromingen/ (translation by Google: https://www-enwinfo-nl.translate.goog/adviezen/advies-verzekeren-overstromingen/?_x_tr_sl=auto&_x_tr_tl=en&_x_tr_hl=nl&_x_tr_pto=wapp
- https://www.verzekeraars.nl/en/publications/news/dutch-association-of-insurers-and-royal-haskoningdhv-sign-partnership

5.3 New water asset management requirements, innovations and other challenges/opportunities

AUSTRIA

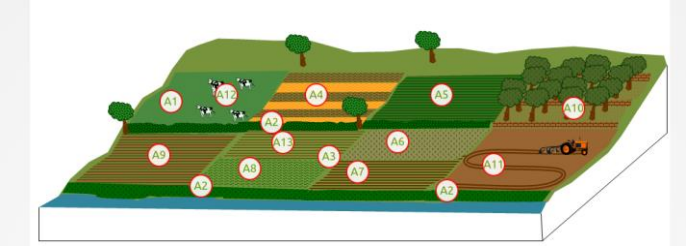
270. **Integrated approaches:** the implementation of the EU Water Framework Directive principles has been focused on rivers and riverine areas. However, more landscape-based approaches detached from projects and urgencies would be needed for integrated water resource management. This would, for example, enhance groundwater recharge at a larger scale, connect habitats of different natures and foster a coordinated operation of water facilities of one water body (e.g. chains of weirs on one river not owned/operated under one framework). Heightening the role of water unions and incentivising this financially through available subsidies could be one of the avenues.
271. **Local level effects:** the increase of maximum possible precipitation at the local level underpins the need to understand potential impacts more. These could be in terms of surface runoff, landslides, river discharges higher than calculated 100 yearly floods, changed hydraulic drainage conditions (shooting drain versus flowing drain) and the resulting danger of the erosion of river banks and around structures such as bridges. More research is needed in this area to impact planning and management guidelines and practice in the long run.
272. **Individual level preparedness:** increasingly, local precipitation events lead to large amounts of surface runoff within minutes. Climate change additional increases the occurrence and intensity of these heavy rainfall events. In settlement areas with high degrees of sealed surface, the soil can only absorb and store fractions of the precipitation within a short time. Therefore, the Ministry of Water and provinces increased efforts to enhance awareness and individual-level preparedness not only for flood events but also surface water inundation incurred by rainwater

FRANCE

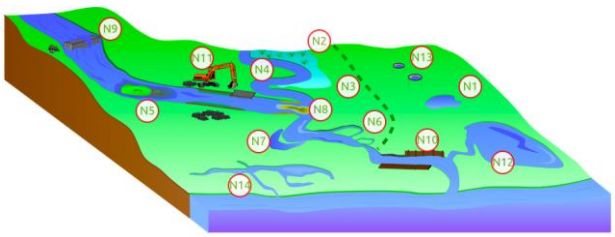
273. These measures that are nature-based solutions for watershed, are highly encouraged at national level and were reaffirmed by the French President when he announced the water plan in March 2023. They are also pushed at EU Level. OIEau has developed a specific website[166] for

[166] http://nwrm.eu/

the European Commission to encourage all EU Member States to go in this direction. All these measures are described in the **Annex 2** and have to be implemented as soon as possible because it has very positive and multi benefit impacts. They concern rural and urban areas, agriculture and forests and the space along rivers and lakes.

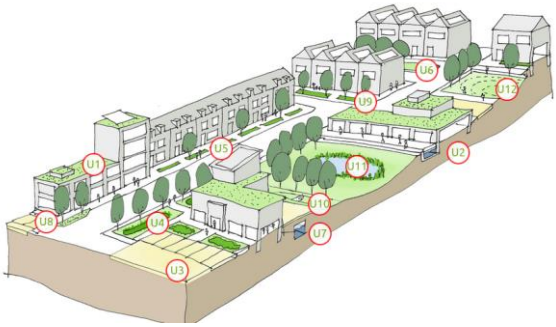


Hydromorpology



Agriculture

Forests



Cities

274. **Development of floating solar plants:** developing floating solar plants is a way for France and all countries to face the variation of hydropower production and the revenues related to this energy. It will contribute to increasing the revenues of the "Tax on network businesses" (see chapter 4.2.3.) and more than will have a lot of benefits (see **Annex 2**). In France, the global surface of the main reservoirs of the hydro power plants represents 762 km2[167]. If only 10% of this surface would be covered by solar plants it would represent a total power capacity of 15 GWc and produce 20 TWh per year and during the peak consumption hours, 4% of the total electricity production in France. The existing solar power capacity in France is 13,6 GWc and rapidly growing. Considering also the tax on the network business on photovoltaic solar plants, currently at a level of 3,2 euros per kWc, it should increase the annual revenues of the IFER by 45 million euros.

275. **Involving local citizens in the production of renewable energy:** a way to reduce conflicts between contractors of hydro, solar, wind power plant projects is to involve national and local citizens in the development and benefits of these projects. France has implemented a specific regulation with participatory bonus in the various calls for tenders of the Ministry of Ecological Transition. There is a bonus in the tariff of energy paid by the State to encourage this approach.

276. **Rebuilding cities on cities with densification:** an easy way to spare the cost of new networks and the related operational costs is to densify cities where existing networks are already in place.

[167] https://fr.wikipedia.org/wiki/Liste_des_lacs_de_barrage_de_France

It will compensate for the decrease in drinking water consumption without increasing operational costs. This is true for all the networks in cities (electricity, gas, telephone, roads, etc.)

277. **Using IA to prioritize renewal of drinking water infrastructure:** Artificial intelligence using data mining is more and more a way to identify areas where drinking water pipes have to be renewed in priority. A French society Altereo has developed different IT tools168 to allow local authorities to target the networks cause the most water leaks. It is ten times more efficient than a classic renewal.

278. **Developing wastewater reuse:** France has only a rate of wastewater reuse less than 1%. The new 2023 water plan has focused on increasing the reuse rate to 10% by 2030. Littoral wastewater treatment plants are targeted in priority as fresh waters have no quantity impacts on littoral water bodies. Specific detailed studies have to be implemented to have a look at the economic interest to go in this direction. It depends highly on the length of the pipes and the type of treatment infrastructures that have to be built to allow this reuse.

279. **Developing social tariffs:** Increasing the water bill and other water taxes is an easy way to increase the financial resources of water policy. Developing social pricing is a way to reduce this impact on poor households. The new French water plan includes this approach.

POLAND

280. Nothing to be specifically added for Poland under this topic, besides what has already been mentioned in the report.

SPAIN

281. The LCCET since May 2021 requires that hydrological planning and management, for the purposes of its adaptation to climate change, have the objectives of achieving water security for people, for the protection of biodiversity and for socioeconomic activities, in accordance with the hierarchy of uses, reducing exposure and vulnerability to climate change and increasing resilience. The Law establishes that the necessary adaptation of water uses must be considered so that these uses are compatible with the available resources, once the impacts of climate change, especially extreme events, and the maintenance of the conditions of good status of water bodies have been considered, analyzing the level of exposure and vulnerability of socio-economic activities and ecosystems and developing measures to reduce this exposure and vulnerability. In Spain, this analysis is a priority in agricultural activity, mainly in crops and in the agronomic needs of water for irrigation. To this end, hydrological planning and management is being adapted to include, among others, the impact on water balances, water demands and ecosystems of changes in the rainfall regime and temperatures, as well as the frequency of flood events and droughts, as well as the increase in water temperature. The development of renewable energy projects in the desalination and water reuse facilities is also being considered so that they contribute to their energy optimization and the reduction of costs. In addition, advancing in the integrated water resources systems, which contemplate the set of conventional and non-conventional resources and facilitate the management of the RBOs, especially in the territories with greater water imbalances, is also being considered.

282. Another innovative aspect is the digital transition of the sector, facilitated by the NextGenerationEU Funds and which is essential to advance in the knowledge and management of water. The technological improvement of the information system on the status and quality of

[168] https://hpo.ai/en/home/

the waters (NABIA)169 of the GDW is being developed and implemented, in addition to investing in the technological development of the Early Warning Systems called in Spain Automatic Hydrological Information System (SAIH)[170] in the RBOs, since it is a real-time tool for the prevention and management of floods, in coordination with civil protection and drought management organizations, allowing its monitoring and the effectiveness of the measures implemented. Likewise, the SAIH helps to manage the hydraulic infrastructure system knowing in real time the existing water storage in the reservoirs and the circulating flows in the rivers. The main innovations in digitization that are being considered are the following:

- To update systems for monitoring the status and quality of water, developing surveillance, forecasting and early warning systems for floods and droughts and improving the information available on the Ministry's web services.
- To advance in the digitization of hydraulic infrastructures, incorporating new management tools such as drones or Big Data analyses, which will add also remote sensing and the use of geographic information systems.
- To improve modeling studies of the hydrological cycle in order to anticipate future scenarios, which will allow correct decision-making.
- To incorporate into the Automatic Hydrological Information Systems (SAIH) the control of flows supplied to water users and connecting with systems of other organizations and entities and developing Decision Support Systems (DSS) for the management of overflows and floods.
- To advance in the forecast of long-term droughts, to complement the existing system of monitoring indicators for droughts and to allow the establishment of early measures.

283. The importance of nature-based solutions is being considered both in the management of droughts and floods, with sustainable drainage plans in cities and an improvement in the protection of groundwater sources and resources, in order to protect and improve water storage and systems resilience. In order to develop this type of action, more decentralized systems are necessary. Thus, the Libro Verde (Green Book) initiative mentioned before also (see Chapter 6) has proposed that reforms related to the revision of the legal system, taxation and financing, and the organization of water and collaboration and cooperation structures are necessary, as well as the structures for the promotion of co-responsibility, knowledge and the use of information and communication technologies. Some of them are in progress as explained above.

THE NETHERLANDS

284. The Netherlands adopts legal flood protection standards for its primary flood defenses (dikes, dams and dunes). These standards have recently been revised in 2017. For 90 percent of the dike segments, the height of the standard is either based on cost-benefit analysis, or on local individual risk, operationalizing considerations on equity (Kind, 2022).

[169] Page 3 https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua/23redesdeseguimientodelestadodelasmasasdeaguassuperficiales_tcm30-215788.pdf
[170] SAIH Systems (miteco.gob.es)

Figure 45: Flood protection standards in the Netherlands (probabilities per year) (signaling values) (source: https://waterveiligheidsportaal.nl/#!/nss/nss/norm)

285. When flood probabilities exceed the legal standards, dikes are usually reinforced (higher and wider), or loads are reduced, for example through river widening (Room for the River, Meuseworks). Also, the consequences are reduced by, for example, compartmentalization. Since a number of years, interest has emerged to a fourth possibility for risk reduction: reinforcing or 'transforming' the dike body and zone itself in such a way that the consequences of an unexpected breach are relatively small. A recent modelling study has shown that such 'risk averse' dike design leads to risk reduction, the smaller space requirement, and the smaller sensitivity to uncertainties such as climate, but possibly also higher cost (compared to sandy dikes with clay cover) and issues related to a fair distribution of risks and investments[171].

[171] den Heijer, F., & Kok, M. (2022). Assessment of ductile dike behavior as a novel flood risk reduction measure. *Risk Analysis*.

Chapter 6. Conclusions

6.1 Key achievements and remaining challenges

AUSTRIA

286. Austria´s water management systems can be described as well advanced. However, given the privileged situation regarding water endowment and the country's economic situation, one could also claim that progress could be even more advanced. The first part of this chapter sheds light on Austrian issues, while the second part tries to summarize issues that could be relevant to the Rumanian sector from the author's point of view. The country has achieved high levels of strategic planning and great availability of data and information. While Austria is privileged in terms of endowment and a good economic overall position, attaining EU Water Framework targets wasn´t straightforward. This had financial and technical reasons.

287. Despite stringent provisions of the Water Law, the approach remained to support and incentivize. It could be argued that the "low-hanging fruits have been picked", and a more prescriptive approach is needed to reach the last-mile targets. For example, agriculture is a "powerful" sector in Austria that gives water resource management a relatively low priority. Many stakeholders felt that the water management authorities are not exhausting all legally possible means for land management around rivers and groundwater bodies and to improve soil health and extensive practices. The European Commission (2019) recommends that "Austria should continue the use of green infrastructure and/or natural water retention measures that provide a range of environmental (improvements in water quality, flood protection, habitat conservation, etc.), social and economic benefits."

288. The lessons from implementing the first and second River Basin Management Plans were that the ecological status has often not improved with measures solely focusing on fish ladders and reducing surge / down surge. The third plan, therefore, focuses on hydro-morphologic measures, an area where more knowledge and tailored measures need to be developed. After interventions, extended monitoring periods are required to generate learning on the long-term effects of the actions and the development of new approaches. The Austrian approach was to start from the major rivers like the Danube and work "upwards". Given that the targets aren´t yet attained in upper catchments, there are few opportunities to revisit rivers targeted a few years ago, use improved approaches, and implement more landscape-based approaches generally.

289. Austria applies principles of water user and beneficiary contributions and subsides at relatively high levels using the two tax and budget-based instruments. The European Commission (2019) spotted some room for improvement regarding financing. It recommended that "Austria should apply cost recovery for water use activities having a significant impact on water bodies or justify any exemptions […]. It is recommended to present in a transparent manner how financial, environmental and resource costs have been calculated and how the adequate contribution of the different users is ensured. It should also transparently present the water-pricing policy and provide a transparent overview of estimated investments and investment needs."

FRANCE

290. France has progressively developed a high level of ambition to implement water policy in a more and more integrated way, with numerous financial resources and a wide diversity of financial paths, but also relying on public engineers and experts and agencies to guarantee the public interest in the dialogue with private companies. This allows to maintain the functioning of the system and needs to be adjusted regularly. The citizen and other drinking water users are a

core financer of the entire system, in particular of the water agencies fees which represent a major source of financing but comes largely back in the system for investing in the small water cycle which is very capital intensive. Despite this, there is a lack of financing to renew expensive infrastructure such as sewage, rainwater management and drinking water pipes, and some concerns on the financing of other important infrastructures such as dams… New challenges appear to face climate change with increasing risks of drought and flooding that may require innovative management and new financial resources.

291. New measures are proposed under the new French water plan but there is still a lot to do to adapt to climate change specifically in agriculture with a model that has to be changed to reduce its consumption, or in electricity production with a model which is highly dependent on water resources, and in cities with increasing risks of damage to buildings due to sea level rise and flooding. New financial resources will have to be found such as using the carbon tax to adapt to climate change. All new financial approaches will have to take into account poor people that suffer the most from the impact of climate change and are the least responsible for it. Specific measures will have to be taken to be sure that the new measures taken will not affect them. To be sure that they will not be affected it should be relevant to ensure that all water policy measures contribute to eradication of poverty. It is written in Paris Agreement that climate action must be elaborated in the context of poverty eradication and in the Glasgow pact that "recognizes the need to ensure just transitions that promote sustainable development and eradication of poverty, and the creation of decent work and quality jobs". Water policy should now be elaborated taking into account eradication of poverty.

POLAND

292. Nothing to be specifically added for Poland under this topic, besides what has already been mentioned in the report.

SPAIN

293. The most important achievements of the Spanish model are the following: River Basin Organizations: Water management by river basins has been key for the development of water infrastructures, for the management of water uses and quality, and for the implementation of the Water Framework Directive, the Floods Directive and other Directives related to water. RBOs are the true protagonists of water management in Spain. Their design as autonomous organizations has allowed them flexibility and adaptation to local issues, which would not have been possible from the capital of the country. There are some outstanding challenges at this time, including:

- The adaptation of the State contract law to facilitate public procurement to third parties and the application of the EuropeanNextEU Funds.
- The improvement of the public participation model, balancing the composition of the participation organizations, to include a greater representation of other levels of civil society that represent interests other than socio-economic interests.
- The capacity enhancement in terms of human and financial resources.
- The necessary change in the water legal framework to, among other purposes, make the concession regime more flexible so that these rights are contingent on the availability of water.
- To ensure the financing of the operation and maintenance costs of the RBOs when the hydraulic infrastructures are amortized, using the renewable energy potential of the state reservoirs.

- To ensure greater control of water uses based on the digitization plan, in the context of the decrease in resources due to climate change.

294. Structured financial model: The financial model is a structured model based on different sources of financing and incorporating a cost recovery regime. A dual model has been developed, distinguishing between the financing of the actions performed by the GSA, whose financing is provided by the General State Budget and European funds, and the actions performed by public companies (ACUAES and ACUAMED) that are financed with their own resources or by turning to the financial markets. In both cases there are cost recovery tools. The sale of hydroelectric power at State facilities provides additional funding to RBOs. The most important pending challenge on the financial model, includes the dependence on European Funds to be able to make the investments proposed in the River Basin Management Plans (RBMPs), since the system of charges and tariffs does not allow generating resources to meet their costs. Therefore, it is necessary to modify the financial economic regime of the CTWL. Investments financed with European funds are not recovered and the design of the water use tariff only allows for 50% recovery, in addition to other "discounts" applied to investments that are recovered through tariffs. The incentive effect of the current tariffs is limited, especially in agriculture since it is charged per hectare regardless of actual consumption.

295. Flood and Drought Management: The flood and drought management model is based on anticipation/planning, on permanent monitoring and prediction, in coordination with the regional and local administrations, establishing the negotiated measures ex-ante in accordance with different scenarios in the special drought plans and in the municipal emergency plans, and incorporating actions at the local level. There are remaining challenges that include:

- The need to advance in digitization in order to better control the uses of water.
- The forecast of long-term droughts.
- The improvement of the forecasting and management of floods in small torrential rivers.
- To remove obsolete obstacles in the HPD that have significant social opposition.
- To solve the problem of untreated rainwater that is discharged into rivers through spillways.
- To incorporate to a larger scale the nature-based solutions in flood and drought management.

THE NETHERLANDS

296. The Netherlands has been successful in developing a sustainable water finance infrastructure, in which the democratic chosen RWAs cooperate with Rijkswaterstaat to carry out the different water tasks and to provide the water services. Most of the costs are recovered through levies, which are based on a combination of solidarity, polluter-pays and beneficiaries-pay principles. An important part of the cost for flood protection, and the cost for the maintenance of waterways, is paid out of the general budget. Flood protection in the Netherlands really gained momentum after the flood of 1953, which killed about 1800 people and led to a loss equivalent to about 10 percent of GDP. Before 1953, it was already known in the Netherlands that many flood defenses were in a poor condition, but due to other priorities at that time, the necessary funds were not made available. Only after the flood of 1953, the Dutch decided that such disaster should 'never happen again' and the public funds were made available to build the Delta Works.

297. Apart from drinking water tariffs, the water levies in the Netherlands are mostly not based on the volume of water consumed or discharged. The role of price incentives to stimulate efficient water use and reduce pollution is very limited. And even then, some options for optimizations exist. For example, at this moment, farmers pay through the water system levee approximately between € 60 and € 90 euro per ha, while the payment for owners of nature is € 5 euro per ha.

Organic famers contribute to nature and biodiversity, hence lower levees may be warranted[172]. Like in many other countries, institutional fragmentation creates a key water governance challenge in the Netherlands[173]. Whilst there have been strong and continued legislative and policy efforts towards integrated approaches for flood management and (surface) water system management, fragmentation remains a key challenge for water quality and groundwater management[174].

6.2 Key lessons potentially relevant for the Rumanian water sector

AUSTRIA

298. **Sediment mining might threaten the ecological status:** sediment mining might pose a risk to the ecological status or potential by disturbing valuable aquatic habitats and the sediment budget thereby contradicting the EU Water Framework principles.
299. **Core funding for core functions:** the water management authority, its offices and public agencies receive sufficient funding to fulfil their core functions prescribed by the legal framework. Additional resources for specific projects are quired on top of this.
300. **Putting municipalities in the driving seat:** municipalities, however, are often faced with financial constraints to contribute to investment projects. The ownership and lead role of municipalities is critical for success of measures and their sustainability, but the framework needs to be conducive for mayors to take that role and foster collaboration among municipalities.
301. **Landowners and permit holders are required to take responsibility:** in terms of bank management of smaller, non-border rivers, the land owners are in charge. The water users (hydropower) and beneficiaries (flood protection) are required to contribute in line with their permit condition and "in kind" to the management of river banks, and upstream and downstream areas of plants.
302. **Big public hydropower and small private hydropower are required to contribute realistically and in relation to their economic possibilities:** hydropower plants that are more than 50 percent publicly owned need to be proactive and contribute above the "bare and required minimum" from their revenue towards measures that improve flood protection and the targets of the national RBMP. Private operators receive greater technical and financial support to take measures to improve the ecological condition and potential

FRANCE

303. Water has so many dimensions that a wide diversity of financial sources but also of trustable actors in charge of the management of the different components, including for the legal framework enforcement is necessary to ensure a reliable, adaptable and resilient system is implemented. To do this, the French legal authorities have identified the main types of regulation needed, have delineated the main human needs related to water and environment needs related to water, have developed a flexible organization combining on the ground responsibilities for local authorities watershed and river basin responsibilities and support from the state, its delegations and agencies and the other administrative levels (region, department, …). And to support this, the financial system combining tariffs, transfers and taxes is defined at a national level with some local flexibility, and the operational implementation is supported by a wide

[172] https://www.veld-post.nl/artikel/643510-awp-wil-lagere-waterschapsbelasting-voor-biologische-boeren/
[173] FAIR (2020) Adaptive asset management for flood protection. FAIR End Report. EU Interreg NSR. https://fairproject.org/results/
[174] Havekes, H.J.M. (2023) Successful decentralisation? A critical review of Dutch water governance. Inaugural Lecture, Utrecht University. Deventer: Wolters Kluwer 2023.

diversity of possible organization and share of responsibilities between various public administrations and the private sector under strictly defined rules fixed by the legal framework.

304. Public authorities are responsible for the services and some key aspects of them but may delegate via various approaches all or part of their responsibilities. To support such a complex system, a set of common, open, shared and well managed information systems are necessary to allow informed decision making. From the investigations it appears some adaptations will be in particular necessary on this aspect. While drinking water users can continue to take a significant part in the system, in particular because good quality drinking water needs efforts, they will have to be convinced that the money will be effectively used for financing the necessary investments and not for other missions. In particular, in the recent period, a significant share of the collected fees has been diverted to finance the biodiversity agency with a wide set of missions outside water, or to feed the state general budget. A revision of the information system to make more obvious the key components of the local price of water will be necessary to allow keep the trust of the users in the quality and well management of the public water services.

305. The French system is a complex system which combines centrally defined legal framework and enforcement, locally trustable and - controlled for their financial situation - municipalities and EPCIs, with a wide set of intermediate level actors allowing considering general interest with the more specific interests of economic actors and of the aquatic environment. The system was developed and adapted progressively considering a balanced view of the economic importance of different water users, often organized in collective representation, the interest of citizen and of the environment in public interest perspective. To this end, France developed some framing water laws to give the overall framework, and well-defined management plans with their financial resources. This was not implemented in one stop, but progressively elaborated and adjusted to correct some deficiencies identified along the implementation. Regular assessments, clearly explained from the start to allow informed management by the operators, and - were necessary - revisions of some aspects have allowed this. It is not possible to anticipate all, and it is therefore recommended to implement systems which can start with simple solution and maybe revised easily along their lifetime and can start already without waiting for a set of conditions to be met. In this respect, the use of self-surveillance validated by public accreditation allows to reduce the effort by public authorities. It relies on confidence from public authority that the operator will work along its duty but using an accredited system for which the public authority is able to guarantee the quality and can ask to see the results.

POLAND

306. For Poland, this topic can be summarized to:

- Poland is still on the way to find a model for water management, now testing an extreme centralized model,
- The Polish reform implementation experience indicates that the preparation period should be adequately long to avoid problems and mistakes,
- Obligatory flood insurance – analyzed after flood 1997 was rejected by government,
- Successful implementation in law of 3T principles (user and polluter pay) – problems with effective execution due to a lack of measuring devices by users,
- Development of more sophisticated tariffs depends on measuring abilities – they are under development until 2027,
- The most recommended good practices are connected with development of flood protection infrastructure, flood risk prevention competences in spatial planning & permits for construction,

- Real growing challenge are flash floods and urban floods due to climate change and increased probability of heavy rainfalls with high intensity,
- Water supply and wastewater treatment were outside of the scope of this study – in Poland it is competence of local government.

SPAIN

307. The most important lessons are:

- The importance of water resources planning in order to develop diagnoses and programs of joint and focused measures of the competent authorities (and not only of the Central Government) based on the defined scheme of important issues and water balances, including climate change scenarios. Especially the planning of flood and drought management in the context of climate change. This has served to have prepared responses already agreed upon with socio-economic interests, avoiding social conflict.
- The importance of developing information, monitoring, modeling (including forecast) and control systems for good management of water resources, floods and droughts that allow an adequate response to extreme events and their forecast. The incorporation of digitalization to water use control by RBOs -in process- is essential to control water uses in a context of climate change.
- The importance of the formulas for the incorporation of additional human capacity, through agreements with specialized public companies (TRAGSA, ACUAES, ACUAMED and IDAE), management delegations to user communities and the formula of collaborating companies in hydraulic administration that have allowed Spain to have a specialized capacity that adjusts to ad-hoc needs.
- The importance of having actions and maintenance protocols for existing infrastructures in a country with an important hydraulic infrastructure heritage built in the last century to a large extent and that requires constant maintenance, retrofitting and replacement.
- The paradigm shift in some important aspects on which results are still being evaluated include issues such as:
  - Flood management shifting from a model based on gray infrastructures in rivers for flood mitigation, to a model that aims to provide space for the river and use nature based solutions.
  - Change of the infrastructure financing model from a fundamentally public model to one that also incorporates trade finance and income from the sale of hydroelectric energy, promoting cost recovery.
  - Inclusion of measures such as nature-based solutions in demonstration projects such as the Ebro Resilience[175], the Life-Duero[176] and within the framework of priority actions to recover the Mar Menor[177].
  - Paradigm shift in policies, especially in supply policies, and greater control of water uses favored by the NextGenerationEU Funds[178] and the digitalization PERTE179.
- Improving the efficiency in the use of European funds through a greater dedication of these funds to large projects with a significant investment, managed by specialized agents such as ACUAES and regional public companies.

[175] https://www.ebroresilience.com
[176] https://www.lifeduero.eu
[177] https://www.miteco.gob.es/es/ministerio/planes-estrategias/mar-menor/
[178] https://www.prtr.miteco.gob.es/es/ayudas/ayudas-gestion-del-agua.html
[179] https://www.prtr.miteco.gob.es/es/perte/perte-digitalizacion-ciclo-agua.html

- The participation of the RBOs in the energy market, taking advantage of the generation of hydroelectric energy in the dams, making use of regulation or reversible pumping plants and in hybrid facilities of photovoltaic and hydroelectric energy. This allows River Basin Organizations to generate additional resources to finance their operating expenses.

308. The recommendations for the improvement of water resources management in Spain have been collected in the context of the work on the Green Book on Water Governance in Spain[180], where, through an open co-creation process, complemented by technical reports from experts, proposals have been identified and made. Some of the most prominent proposals are:

- The modification of the economic-financial regime of the CTWL and the reform of the legal text to guarantee the functionality of the law regarding climate change, incorporating the new regulations on the matter (Climate Change and Energy Transition Law, among others). Modifying the objectives of planning and eliminating the serfdom of hydrological planning to sectoral policies.
- With regard to the reform of the concession regime, it is considered a priority to condition the availability of the flows granted to their evolution for natural reasons or for climate change reasons and to the achievement of environmental objectives. It is also prioritized to require the mandatory concessional review in cases of modernization of irrigation, modernization of urban infrastructures or due to population decrease.
- With regard to the reform of the groundwater concession regime, it is considered a priority that private water with rights prior to Law 29/1985 become HPD, that a tax on the use of these waters is established and that the uses of less than 7,000 m3 per year that are currently only authorized are integrated into the concession system.
- It is necessary to ensure a publicly accessible Water Users Registry linked to the use of regular telematic declarations to inform about the use of the HPD in the conditions of the concessions.
- In relation to the tax reforms and the financing of water, it is considered essential to modify the formula for calculating the costs of the regulation charge and the water use tarriff and to broaden the object and taxable subject thereof. Progress must be made in the recovery of environmental and resource costs, especially in the case of diffuse pollution. Likewise, it must be determined that the tax base to calculate the charge for the use of water for hydroelectric purposes, is the derived water flow to pass through the turbines, instead of the economic value of the energy produced measured in central busbars.
- Regarding the funding of water resources management in Spain, it would be necessary to use State and regional public companies in a generalized way for the construction of all water management infrastructures so that they can later be operated and maintained by river basin organizations.
- In relation to the reorganization and strengthening of water administration, it is considered a priority to promote and strengthen the evaluation of the economic, environmental and social viability of works of general interest. It is considered necessary and easily implementable to strengthen the participation of stakeholders beyond those that represent socio-economic interests.
- In relation to the participation and co-responsibility of society in water management, the priority proposals are to encourage the creation of communities of groundwater users and

[180] https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua/libro-verde-gobernanza/

to promote volunteering and river contracts181 or management agreements between public and private stakeholders.

- In relation to the improvement of knowledge and application of technology in the administration and management of water, the improvement of sensorization in the water status and water use monitoring networks (smart meters, drones, etc.), the use of Artificial Intelligence and format standardization of the different data sources regarding water and the implementation of a comprehensive training plan for civil servants in this area are considered a priority.

THE NETHERLANDS

309. The Netherlands has developed a transparent system of water levies with relatively low administrative cost. With a total land area of 55% prone to flooding from rivers, sea or lakes, the system receives general support from the public and the major stakeholders do not see urgent needs to implement major reforms. The water quality of surface waters, however, is poor. Most likely, EU-WFD requirements will not be met in 2027 in which case the Netherlands will be confronted with fines from the EC. The water finance system, which is in place in the Netherlands, does not have incentives to reduce pollution. Virtually no charges for the extraction of surface water and groundwater exist. Due to intensive agriculture and climate change, water shortages in the Netherlands are likely to more and more frequent. In those periods, supply restrictions are implemented using a priority system (de Verdringingsreeks)[182]. Because agriculture is assigned a low priority, this system works quite well and serves as an incentive for farmers to think about more efficient water use and alternative sources for agricultural water, without having to implement water charges (and water meters). The cost for urban developments does not take the cost of water management properly into account. Those costs are often transferred to other agents who face increasing costs for water management.

310. Following the above achievements and lessons learned, we formulate the following recommendations to ANAR based on water finance and governance in the Netherlands:

- Ensure that water is considered as a fundament for sustainable development and establish an integrated policy and regulatory approach that enhances investments in water infrastructure as leverage towards other achieving policy objectives of related domains such as climate adaptation, energy, nature, and spatial development.
- Establish a strong partnership with the private sector and knowledge institutes to stimulate innovation, develop a human capital agenda and professionalize project management.
- Establish a multi-year fund for the development, management and operation of water infrastructure.
- Organize water infrastructure upgrades in programs that allow for portfolio management, continuous learning and knowledge sharing, proactive risk management. Establish fit-for-purpose public-public or public-private alliances for the effective delivery of these programs.
- Look for instruments which stimulate more efficient water use.
- Stronger implementation of polluter pays principle, especially for agriculture.
- Take the cost of water management into account while deciding on new locations for urban development.

[181] https://www.miteco.gob.es/es/agua/temas/sistema-espaniol-gestion-agua/07-informe-tematico-corresponsabilidad-agua_tcm30-517273.pdf

[182] https://iplo-nl.translate.goog/thema/water/beheer-watersysteem/verdringingsreeks/?_x_tr_sl=auto&_x_tr_tl=en&_x_tr_hl=nl&_x_tr_pto=wapp).

Annex 1: References

AUSTRIA

1. Legal documents - acts

Government of Austria: Austrian Water Act 1959 (*Wasserrechtsgesetz*), latest revision in 2017, available at https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010290 [last visit on 2023-03-07]

Government of Austria: Hydraulic Engineering Assistance Act 1985 (Wasserbautenförderungsgesetz), latest revision 2018, available at https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010472 [last visit on 2023-05-05]

Government of Austria: Environmental Aid Act 1993 (*Umweltförderungsgesetz*, short UFG), latest revision in 2018, available at https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010755 [last visit on 2023-03-09]

Government of Austria: Waterways Act 2004 (*Wasserstraßengesetz*), latest revision in 2017, available at https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20003901 [last visit on 2023-05-05]

2. Legal documents - ordinances

Government of Austria: Ordinance of the Federal Minister of Agriculture, Forestry, Regions and Water Management on the Action Programme for the Protection of Waters against Pollution by Nitrates from Agricultural Sources *(Verordnung des Bundesministers für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft über das Aktionsprogramm zum Schutz der Gewässer vor Verunreinigung durch Nitrat aus landwirtschaftlichen Quellen (Nitrat-Aktionsprogramm-Verordnung – NAPV)), latest revision in 2022*

3. Documents

Danube Water Program (2015) A State of the Sector Country Note Austria
Online available at: https://sos.danubis.org/eng/country-notes/austria/

European Commission (2019) COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans - Member State: Austria, Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans
Online available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2019:0036:FIN:EN:PDF

EurEU (2020) The governance of water services in Europe 2020 edition
Online available at: https://www.eureau.org/resources/publications/5268-the-governance-of-water-services-in-europe-2020-edition-2/file

Habersack H., Wagner B., Hauer C., Jäger E. (2012): Wasserkraft in Österreich – aktueller Bestand und Decision Support System (DSS WASSERKRAFT)

Federal Ministry for Agriculture, Forestry, Regions and Water Management / *Bundesminsterium for Land- und Forstwirtschaft, Regionen und Wasserwirtschaft* (2012) Austrian Water Catalogue, Protect Waters – Use Waters, Criteria for Assessment of Sustainable Hydropower Water Use / Österreichischer Wasserkatalog Wasser schützen – Wasser nutzen Kriterien zur Beurteilung einer nachhaltigen Wasserkraftnutzung
Online available at:
https://info.bml.gv.at/dam/jcr:debcf252-b506-4802-a98b-1afd0e2bc815/Erlass%20Kriterienkatalog.pdf

Federal Ministry for Agriculture, Forestry, Regions and Water Management (2018) Flood Risk Management in Austria Objectives – Measures – Good Practices
Online available at: https://info.bml.gv.at/service/publikationen/wasser/Flood-Risk-Management-in-Austria.html
Federal Ministry for Agriculture, Forestry, Regions and Water Management / *Bundesminsterium for Land- und Forstwirtschaft, Regionen und Wasserwirtschaft* (2022) Environmental Investment of Federal Government – Water Management Measures 2021 / *Umweltinvestitionen des Bundes - Maßnahmen der Wasserwirtschaft 2021*
Federal Ministry for Agriculture, Forestry, Regions and Water Management (2022) Austria's Water Treasure Protecting and using our groundwater sustainably
Online available at: https://info.bml.gv.at/service/publikationen/wasser/austrias-water-treasure---protecting-and-using-our-groundwater-sustainably.html
Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology / *Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie (BMK)* (2022): Energy in Austria, Figures, Data and Facts / *Energie in Österreich, Zahlen Daten Fakten*
Matzinger, T. (2014) Teiche in der Landschaft Bedeutung, Funktionen & Gefährdung, Schriftenreihe des Bundesamts für Wasserwirtschaft Band 36, Gebharts 2014
Naturschutzbund (2012): Auenland - Das Aueninventar als Grundlage einer österreichweiten Auenstrategie
Online available at
https://info.bml.gv.at/dam/jcr:496a17ac-1561-4559-b22e-90edc29be2a2/Auenland_Broschuere.pdf [last visit on 2023-05-01]
OECD (2013), OECD Environmental Performance Reviews: Austria 2013, OECD Environmental Performance Reviews, OECD Publishing, Paris, https://doi.org/10.1787/9789264202924-en.
Online available at https://read.oecd-ilibrary.org/environment/oecd-environmental-performance-reviews-austria-2013_9789264202924-en#page4 [last visit on 2023-05-01]
Ryan Stoa (2014): Subsidiary in Principle: Decentralisaion of Water Resource Management, Volume 10, Issue 2 (May) 2014, Utrecht Law Review, http://www.utrechtlawreview.org
UNEP-DHI (2020): Country Survey Instrument for SDG Indicator 6.5.1, Austrian report, Federal Ministry of Agriculture, Regions and Tourism
Online available at http://iwrmdataportal.unepdhi.org/country-reports [last visit on 2023-03-03]

4. Internet sources used in the text, sources of pictures and referred to in footnotes

International Hydropower Association (IHA): https://www.hydropower.org/country-profiles/austria [last visit on 2023-03-08]
https://portal.cor.europa.eu/divisionpowers/Pages/Austria-Water-Management.aspx
https://info.bml.gv.at/en/topics/water.html
https://www.eea.europa.eu/data-and-maps/figures/hydropower-plants-in-austria
https://info.bml.gv.at/en/topics/water/water-in-austria.html
https://ec.europa.eu/environment/water/participation/map_mc/countries/austria_en.htm

SPAIN

ACUAES (2021), *Annual accounts and management report for the financial year 2021,* ACUAES.
ACUAES (2003), *Framework Agreements in BOE 264 of 4 November 2003, BOE*.
ACUAES (2023), *Agreements with users.*
Center for Hydrographic Studies (2017), *Evaluation of the Impact of Climate Change on Water Resources and Droughts in Spain,* CEDEX.

Consortium of Insurance Compensation (2022), *Second Information Note on the floods produced from the end of October to December 2021 in very diverse places of the Spanish geography,* Consorcio de Seguros
Duero RBO (2019), *Life- IP Duero, Synthesis Report 2019*.
Ebro RBO (2023), *Discharge Control Charge,* in Portal Chebro.
Ebro RBO (2020), *Life Ebro Resilience P1,* Ebroresilience.com.
Fernández Clemente, Eloy (2004), *"From the utopia of Joaquín Costa to state intervention: a century of hydraulic works in Spain"* in Contributions to the Economy, Grupo Eumen.net.
Fernandez Clemente, Eloy (2000), *One Century of Hydraulic works in Spain,* University of Zaragoza.
General Directorate of Water (2020), *Improvement of Financing of the Programme of Measures of the River Basin Management Plans, Additional Report,* MITERD.
General Directorate of Water (2017), *Aspects to highlight of the new special drought plans,* MITERD.
Guadiana RBO, *Regulation Charge and Water Use Tariffs (advance) for Year 2022*.
Júcar RBO, *River Basin Management Plan 2022-2027, Annex 9 Cost Recovery of Water Services*.
Maestu, Josefina (2003), *"Reflecting changes in external and self-created context -Public Participation in River Basin Management in Spain"* in Harmonicop workpage 4, https://www.harmonicop.uni-osnabrueck.de/_files/_down/Spain.pdf
Maestu, J., del Vilar A. (2018), *Review of Economic analysis of river basin plans in Spain,* University of Alcalá.
Maestu, J. et al (2017), *"How have we used the economic analysis in the preparation of the River Basin Management Plans? Can we do better?".* Revista de Obras Públicas. Engineering Association of Spain.
Maestu, J. et al (2017), "Financial Perspectives of the River Basin Authorities in Spain". The Future of the River Basin Authorities. Edited by Antonio Embid, University of Zaragoza.
Maestu, J. et al (2016), *The costs of desalination, Do we save by not producing?.* iAgua blog. http://www.iagua.es/blogs/josefina-maestu/costes-desalacion-ahorramos-no-produciendo.
MAFF (2022), *Royal Decree Law 4/2022 of adoption of urgent measures to support the agrarian sector to be able to cope with the drought.*
Ministry of Finance and Civil Service (2022), *General State Public Budget 2023, in BOE 308, of 24/12/2022*
MITERD (2020), *Green Book of Water Governance in Spain*, MITERD
MITERD (2020), *Monitoring Report of River Basin Plans in Spain*, MITERD
MITERD (2022), *Digitalization PERTE*, Government of Spain
MITERD (2020), PIma-Adapta: *knowledge and action in the face of the risks derived from Climate Change*, MITERD.
MITERD (2023), *Seasonal forecasting for the management of reservoirs*, MITERD.
MITERD (2022), *Flood Risk Management*, MITERD.
MITERD (2018), *Draft Royal Decree declaring a prolonged drought situation in the Guadalquivir RBO and adopting exceptional measures for the management of water resources*. MITERD.
MITERD (2022), *Executive summary of the second cycle flood risk management plans (2022-2027) in the interregional River Basins*, MITERD, (2021).
MITERD, (2021) *National Plan for Climate Change Adaptation 2021-2030*, MITERD.
MITERD (2021) *Work Programme 2021-2025 of the National Plan for Climate Change Adaptation*, MITERD.
MITERD (2022), *Draft National River Restoration Strategy,* MITERD.
MITERD (2023), *Automatic Hydrological Information System, in Spatial Data Infrastructure*s, MITERD.
MITERD (2022), *Framework of Priority Actions for the Recovery of the Mar Menor,* MITERD.
MITERD (2021), *Subsidies for sanitation and purification for small agglomerations phase 1, in PRTR*, MITERD.

MITERD (2020), *National Integrated Energy and Climate Plan 2021-2030,* MITERD.
MITERD (2020), *Economic and Financial Regime of the Public Water Domain.*
Monge, Cristina and Perero, Eduardo (2020), *Report on co-responsibility: fostering social co-responsibility in water management in Spain,* MITERD.
National Electricity Network (2021), *Reversible Hydroelectric Plant, Salto de Chira,* Red Eléctrica Española.
Presidency of the Government (2021), *Recovery, Transformation and Resilience Plan, Government of Spain*.
Secretary of State for Energy (2021), *Energy Storage Strategy*, MITERD.
Tajo RBO (2023), *Tariffs and fees, in Citizen Services*, Tajo RBO

THE NETHERLANDS

Arcadis, 2017. BOUWSTENEN VOOR EEN DUURZAME EN TOEKOMSTBESTENDIGE FINANCIERING WATERBEHEER. Achtergronddocument fase 3. 10 juli 2017.
Dekker, Gert, Bas Wullems and Pui Mee Chan. Verantwoordelijkheden bij risico's van extreem weer in een veranderend klimaat. Verkenning verantwoordelijkheden en ontwikkelagenda. Ambient. 19 november 2020.
Dekking, Wijnand en Herman Haveke (2015). HISTORISCHE SCHETS ONTWIKKELING BELASTINGSTELSEL WATERSCHAPPEN. Water Governance, 04/2015.
Havekes, Herman, Martin Koster, Wijnand Dekking, Rob Uijterlinde, Willem Wensink and Ron Walkier, 2017. WATER GOVERNANCE/ THE DUTCH WATER AUTHORITY MODEL. Dutch Water Authories.
OECD (2014),Water Governance in the Netherlands: Fit for the Future?, OECD Studies on Water, OECD Publishing. http://dx.doi.org/10.1787/9789264102637-en
Tweede Kamer, vergaderjaar 2021–2022, 32 698, nr. 71
Twynstra Gudde and Tauw, 2015. Toekomstbestendige en duurzame financiering van het Nederlandse waterbeheer. fase 1a: Huidige financiering. fase 1b: Trends en ontwikkelingen. 30 juni 2015.
Verder met ons water, 2021 . Monitor Lastenontwikkeling en Doelmatigheidswinst Bestuursakkoord Water over de periode 2010-2019 Eindrapportage lastenontwikkeling, doelmatigheidswinst en prestaties in het kader van het Bestuursakkoord Water. Mei 2021
Verder met ons water, 2022. De staat van ons water. Rapportage over de uitvoering van het waterbeleid in 2021
Verder met ons water, no data. Financien en doelmatigheidswinst 2019. Jaarlijkse rapportage over de kosten en doelmatigheidswinst in het waterbeheer.
Wing, 2021. Op weg naar een toekomstbestendige financiering van het waterbeheer. Eindadvies. 23 Septembre 2021

Annex 2: Detailed information on France

THE ENVIRONMENT CODE

As explained in the report, France is a large country with a set of institutions in charge of the legal framework. The Parliament is issuing regularly new laws and the government, and its delegations are completing this corpus with decrees and other legal acts to allow implementation on the territory. All these texts are also evolving with time, with repeal of some rules, adjustments or creation of new rules. For complex topics such as water, it may become difficult to find the most up to date state of the art.

To make water legal framework and the rest of the environment legislation clearer and well-articulated, it has been organised in a structured system called "environment code" by an ordinance in 2000 (legal part), and the code was progressively elaborated and enriched for its regulatory part in the period 2000-2005. The code allows to have at a single place the set of laws, decrees, ordinances and amendments which currently apply for the country and for all environment-related matters.

The code has now three parts: a legislative part which fixes the legal framework, a regulatory part which gathers all regulatory texts taken in application of the laws, and annexes. The two first parts entail the following seven books:

1. Common provisions,
2. physical environments,
3. natural areas,
4. Fauna and Flora,
5. Prevention of pollution, risks and nuisances,
6. Provisions applicable in New Caledonia, French Polynesia, Wallis and Futuna, French Southern and Antarctic Lands and Mayotte,
7. Environmental protection in Antarctica. (Parliament, 2023)

The books are divided into titles, chapters, sections, subsections and paragraphs.

The environment code is related to a set of other codes such as urbanism code, health code, commercial code, customs code, rural and marine fishing code, mines code, civil code…

For water, the main books and titles are the following:

Book I: Common provisions:

- Title 1 – general principles: water is part of the common heritage of the nation, preserving, restoring and managing the ecosystem services it provides are of common interest. Some general principles should be used: precautionary principle and preventive actions, no net loss of biodiversity, polluter pays principle, access to public information, participation of the citizens, ecological solidarity, sustainable use, complementarity between environment, agriculture, aquaculture and forestry, non regression.
- Title 3 – Institutions: creation (2019) of the French Office for Biodiversity, in charge of balanced and sustainable management of water, of surveillance, preservation and management of biodiversity (including freshwater fauna of which fishes and terrestrial wildlife). It supports administrative and judicial police including with its own accredited agents. It develops the knowledge on biodiversity related topics, support elaboration, implementation and assessment of water policies, manage and restore natural spaces (including nature parks), communicate, train and raise awareness on biodiversity protection. It is

competent on the entire territory, as well terrestrial as also coastal and marine, and should coordinate its actions with that of other local authorities. Its resource come from the state and state public agencies, from affected taxes, from subsidies, from its own sales and fees for the services provided, etc.

- Title 7 - Common provisions relating to checks and penalties:
- Chapter I - Administrative checks and administrative police measures: agents in charge, access rights, technical means including experts, reporting and fines.
- Chapter II - Investigation and observation of infringements: environment inspectors, roles, accreditation, access to installations, investigation means, minutes, seize.
- Chapter III – Penal sanctions

Book II: physical environments: water, air, General attacks on physical environments and soil

- Title 1 - Water and aquatic and marine environments: water is part of the common heritage of the nation and its protection, its enhancement and the development of the usable resource, while respecting natural balances, are of general interest. Access to drinking water is a right, costs related to the use of water are borne by the users
- Chapter I - General scheme and resource management: Balanced management of water resources, with eight main provisions to be considered (flood prevention, aquatic ecosystems preservation, fight against pollution, water quality restoration, development of water as an economic resource, water storage, water use efficiency, ecological continuity). Priority order with first priority to health, public sanitation, civil security and the supply of drinking water to the population. Preservation of wetland, of water quality and rules for the distribution of water, so as to reconcile the interests of the various categories of users, rules to preserve water quality including forbid of discharges, and of selling of some polluting products, forbid of some water uses, action program to protect water quantity or quality, irrigation perimeter, action programs in eutrophication vulnerable zones, protection perimeters for drinking water abstraction, roles of local river basin and regional authorities, specific rules for the use of soils near watercourses.
- Chapter II – planning:
  - Section 1 – River Basin Management Plan RBMP (SDAGE)
  - Section 2 – River Management plan RMP (SAGE)
- Chapter III - Administrative and financial structures:
  - Section 1 - national committee on water
  - Section 2 bis - basin coordinator prefect
  - Section 3 - basin committee and water agencies
  - Section 4 - Project management bodies of which public authorities for basin management (EPTB)
  - Section 5 - Water and biodiversity committees and water offices of overseas departments
  - Section 6 - Standing Technical Committee for Dams and Hydraulic Structures
- Chapter IV - Activities, facilities and use: this is an important chapter referring to activities, installations, works and workplaces likely to present dangers to public health and safety, to impair the free flow of water, to reduce water resources, to significantly increase the risk of flooding, to seriously impair the quality or diversity of the aquatic environment, particularly fish stocks. A specific very rich and detailed nomenclature (named “Infrastructures, ouvrages, travaux et activités, (IOTA)”) is linked to it and entails duties and prescriptions to protect water from these adverse effects. It was introduced by the water law of 1992.
  - Section 1 - Authorization or declaration regimes
  - Section 2: Movement of machines and boats

- Section 3: Water distribution and sanitation
- Chapter V - Provisions specific to non-state watercourses:
- section 1 – riparian owners' rights: use of water, ownership of riverbed and material extraction, rules in case of riverbed movements, right of way and compensation,
- Section 2 - Police and water conservation: definition of a watercourse, rules to protect common interest and rights and obligations of the land owner including as regards installations or facilities on these watercourses, authorization to use water, requirement to maintain the watercourse and riparian vegetation, and to let public authorities access the riparian zone in case of a coordinated action on the watercourse, definition of a watercourse management plan and its main actions.
- Chapter VI - Provisions relating to checks and sanctions
- Section 1: Administrative measures and sanctions
- Section 2: Penal provisions: recording of offense and who is in charge, and penal sanctions

Book III: Title VII – Green frame and blue frame: the blue frame is focussed on ecological continuity and ecological corridors to allow circulation of biodiversity (fauna and flora).

Book V: Prevention of pollution, risks and nuisances (biggest book)

- Title I on installations classified for the protection of the environment (ICPE): this is a broad concept applied to a large number of factories, workplaces, depots, construction sites or facilities identified in a dedicated nomenclature and for which depending on their size and effects, the owner has to ask for an authorization, for recording, for declaration or declaration with periodic controls by an accredited body. All cases are subject to the submission of a dossier which may include an environmental study on its impacts. Authorization may entail a public survey and is generally associated to specific prescriptions to limit its negative impacts on the environment, including retention means, wastewater treatment, maximum allowable discharges, monitoring programme, etc… during and after the exploitation if relevant.
- Title VI – prevention of natural risks –
- Chapter I: measures to safeguard population: State expropriation rights, major natural risk prevention national fund and targeted spendings
- Chapter II - Prevention plans for foreseeable natural risks: all types of risks are covered. For the case of floods, a specific plan called "Plan de Prévention du Risque d'Inondation (PPRI)" *[Flood Risk Prevention Plan].* Elaboration by the state, steps to follow to create or revise a plan, actors to involve, content of the plan including specifications of areas exposed, rules to prevent, protect and safeguard including measures to apply to constructions, works and cultivated land, and legal status and timing for implementation.
- chapter IV floods forecast: the State is responsible for organising the monitoring, forecasting and transmission of information on floods. A master plan for flood forecasting is established for each basin to ensure the consistency of the local systems with the national system, and access to state and state agencies data is free of charge.
- Chapter VI Assessment and management of flood risks: assessment of the situation for each river basin, elaboration of a national strategy to manage flood risks and reduce their negative impacts, development of a flood risk management plan and its measures: key orientations and provisions in coordination with river basin management plans, monitoring, forecasting and information, actions to reduce vulnerability, information and education. (Parliament, 2023)

In the above, we listed the legislative part. It is linked to a regulatory part with a lot of application texts including decrees, orders and application circulars which are not further detailed here. For the enforcement, the authorization and declaration regimes of classified installations (book V Title I), articulated with activities, installations, works and workplaces (Book II Title I Chapter IV) force water users to submit a dossier towards regional or departmental representation of the state, and report regularly on the situation of the installation. They have to implement auto surveillance in a dedicated framework which entails accredited material and methods for sampling, analysis and exchange of information and accredited laboratories.

The whole system is based on mutual confidence in a clear, transparent, proportionate and structured framework. Water being the final recipient, water surveillance provides a safety net allowing to identify any deviation

A wide diversity of public agents from various public authorities are also accredited to act as water and environment police to record violations, draw up reports and associated fines.

Some additional specific points:

A recent law has defined the so called “management of aquatic environments and flood prevention” (GEMAPI) which is a competence of the public establishments for intermunicipal cooperation (EPCI) and entails four missions:

- Development of a catchment area or part of a catchment area,
- The maintenance and development of a watercourse, canal, lake or body of water, including access to this course of water, to this canal, to this lake or to this body of water,
- Defense against floods (and against the sea),
- The protection and restoration of sites, aquatic ecosystems and wetlands as well as riparian woodlands.

The EPCI can issue a GEMAPI tax of up to 40€ per inhabitant to finance these missions.

Details on Institutional set up at national, river basin and other relevant levels in France

- **Interministerial mission for water**

Chaired by the director of water, it periodically brings together representatives of the ministries to give opinion on all draft laws, decrees and regulatory orders relating in whole or in part to water-related issues and draft texts relating to the organization of the decentralized services of each ministry in the field of water. It also gives its opinion on the investment programs and the distribution of resources and means allocated to water, to be included in the budget of the various ministerial departments or organizations concerned. (Parliament, 2023))

- **National Water Committee**

National body whose mission is to give its opinion on all important issues in the field of water and aquatic environments (bills, draft regulatory texts, developments, SDAGE, etc.) and reports to the Minister responsible for the environment. It is composed of 166 members appointed for six years (except deputies and senators and members of economic and social council) with three main groups: representatives of the State and its public establishments, representatives of local authorities, representatives of water

users, but also two deputies, two senators, two members of the Economic and Social Council, the presidents of basin committees, two presidents of local water commissions and up to eight qualified personalities.

- **Basin committee**

The basin committee is a consultation body which draws up a water management policy reconciling the needs of the territory constituted by a basin district with national guidelines. Created by the water law of December 1964, first as a consultative body, its role was enlarged with the water law of 1992 to the elaboration of the river basin management plan (SDAGE), and further clarified by the water law of 2006. It must include three colleges, with 40% of representatives of general and regional councils and of municipalities or their competent groups in the field of water, 40% representatives of water users and aquatic environments, socio-professional organizations, approved environmental protection and consumer protection associations, representative fishing bodies and qualified persons and 20% of representatives of the State or of its public establishments concerned.

It is seen as a real "local water parliament" which must give priority to the collective interest in the basin,and which supervise the water agency as the executive body responsible for implementing this policy. A prefect and a basin delegate coordinate the actions carried out in the various departments and regions of the basin.

- **Basin coordinator prefect**

In each basin, the prefect of the region where the basin committee has its headquarters chairs it and leads and coordinates State policy in terms of policing and water resource management and assessment and management of flood risks subject of chapter VI of title VI of book V of environment code. (Parliament, 2023) He approves the water development and management master plan (SDAGE) previously adopted by the basin committee, decides on and updates the program of measures and the program for monitoring water status, the preliminary assessment of the risks of flooding and the list and map of territories in which there is a significant risk of flooding. He draws up and approves flood risk management plans in coordination with updated SDAGE.

- **Basin delegate**

Regional director of the state regional delegation on environment (DREAL), he assists the basin coordinator prefect and provides the secretariat of the basin committee. He is responsible, under the authority of the basin coordinator prefect, for the following missions: contributing to the development, implementation and monitoring of the SDAGE, the measures, the water status monitoring program and the water information system; coordinate the actions necessary for water resource management and flood risk prevention; ensure the consistency, at interregional level, of the exercise of water police, the protection of aquatic environments and fishing; monitor the action of the water agency or, in the overseas departments, of the water office; prepare the programming and the distribution of the decentralized credits of the ministry in charge of the environment for the interregional programs concerning the basin or group of basins.

- **Basin technical secretariat**

Technical body bringing together the basin delegate DREAL, the water agency and the National Office for Water and Aquatic Environments. The basin technical secretariat (STB) is responsible for proposing the technical content of the draft master plan for water development and management (SDAGE) to the basin

committee and for developing the draft program of measures and monitoring program on behalf of the basin coordinator prefect, all these documents being drawn up in application of the water framework directive (WFD).

- **French Office for Biodiversity (OFB)**

The OFB is a public establishment of the State dedicated to the protection and restoration of biodiversity as well as balanced and sustainable water management in mainland France and overseas, under the supervision of the Ministries of Ecological Transition and Agriculture and Food. 77% of its budget comes from water agencies. The OFB manages a lot of natural parcs and reserves and is responsible for 5 complementary missions:

  - environmental including water police and wildlife health police,
  - knowledge, research and expertise on species, environments and their uses,
  - support for the implementation of public policies on water and biodiversity,
  - management and support for managers of natural areas,
  - support for stakeholders and mobilization of society.

- **Water agency**

In France, a water agency, formerly called a basin agency, is a public institution of an administrative nature which participates in the management of water in an administrative basin district, the limits of which correspond to a large hydrographic basin. There are six, all instituted by the law on water of 1964, specified by the law of January 3, 1992. The hydrographic basins of the overseas departments of Guadeloupe, Guyana, Martinique and Reunion have a Water Office, with equivalent missions. For local actions and representation, their territory is divided in sub basin, each with a territorial direction.

- **Water agency territorial commission**

The territorial commissions are consultation body made up exclusively of members of the three colleges of the basin committee representing the sub-basin: the president and vice-presidents of each territorial commission are elected by the basin committee. Its secretariat is provided by the territorial management of the water agency of the sub-basin concerned. The number of territorial commissions varies between the water agencies depending on their size and biogeographic situation and their role is to propose to the basin committee the priority actions necessary for the sub-basin and ensure the application of these proposals. It promotes the participation of sub basin stakeholders in water policy.

- **Local water commission**

Created by the prefect, the local water commission (CLE) is a consultation body chaired by a local elected representative and is made up of three colleges: local authorities, their groups and local public establishments (50%); users (farmers, industrialists, etc.), landowners, professional organizations and associations concerned (minimum 25%); the State and its public establishments (maximum 25%). The CLE is responsible for developing, revising and monitoring the application of the water development and management plan (SAGE). Once the SAGE has been adopted, it ensures the proper application of the recommendations and prescriptions listed in the SAGE, as well as the implementation of actions.

- **Public Territorial Basin Establishment (EPTB) and public water development and management establishment (EPAGE)**

An EPTB is a group of local authorities at the level of a basin or a grouping of hydrographic sub-basins. Its role is to facilitate the prevention of floods and defense against the sea, the balanced management of water resources, as well as the preservation and management of wetlands and to contribute, where appropriate, to the development and monitoring of the SAGE.

An EPAGE is a group of local authorities competent at the scale of a watershed of a coastal river subject to recurrent flooding or of a sub-catchment area of a large river with a view to ensuring, at this level, the prevention of flooding and submersion as well as the management of uncontrolled watercourses domains.

- **Public establishment for inter-municipal cooperation (EPCI)**

The EPCIs, public establishments for inter-municipal cooperation are establishments resulting from a grouping of municipalities. This grouping forms a coherent geographical whole, in one piece and without enclave, which can be located in one or more departments. Two main categories of EPCI exist: those with their own taxation (urban community, municipalities, agglomeration, metropolis, etc.) and whose major difference between them lies in the demographic size of the municipalities and those without their own tax system (mainly mixed unions). Each EPCI also has an assembly, the community council, made up of some of the elected representatives of all the constituent municipalities. Their role is to allow the management of territorial projects or specific skills on the most coherent geographical scale. They can have multiple mandatory and optional competences. Among the mandatory competences all water related topic of local interest are included, i.e., management of drinking water and wastewater and of aquatic environments and flood prevention (GEMAPI).

- **Mixed Unions**

A mixed union is a public institution for local cooperation (and not an EPCI) which can associate territorial authorities as well as groupings of local authorities with other legal persons governed by public law, and pool resources in order to carry out one or more activities of general interest together. On the contrary to EPCI, mixed unions do not exclusively associate municipalities.

Managing and modernizing water resource and flood risk management infrastructures

- **Water resources**

The identification of human activities with an effect is based on a very detailed nomenclature (IOTA) which allows fix the detailed rules depending on the type and size of human activity with four main impacts identified: abstraction, discharge, impact on aquatic environment or public security, and impact on marine environment. Based on the nomenclature and the impacts the person willing to implement such an activity has to submit a detailed impact assessment and a dossier and the public authority can then deliver the necessary authorization.

For assessing the situation as regards water quantities, authorities are using a certain number of values coming from this national database to fix the water law permit prescriptions, the main one being the objective low flow rate corresponding to the QMNA5. The QMNA is the monthly (M) minimum (N) flow (Q) of each calendar year (A). It is the value of the monthly low flow reached by a watercourse for a given year. Calculated for different durations (5 years...), it makes it possible to statistically assess the smallest flow of a river over a given period. Abstraction, derivation, retention… rights are fixed in

reference to the QMNA5 which should be the minimum flow still possible despite all abstractions in the basin.

In addition, and despite France is a water rich country, some areas are presenting shortfall of resources. Since 2010, the river basin management plans have identified as a priority to reduce quantitative imbalances, one of the conditions for achieving good water status imposed by the Water Framework Directive and to consider the impacts of climate change.

To this end, identification of territories with quantitative imbalance was followed by an evaluation study of overall abstractable[183] volumes (EVPG study) on these territories, to collect the necessary information for action. Based on it and considering the human development issues present in the basin (urban, agricultural and industrial) and the associated future water needs, a Quantitative Water Resource Management Plan (PGRE) is elaborated with, in view, to guarantee sustainable development of the territory and reduce the imbalances. These PGRE are real action plans for water quantities. They may include:

- contractual management plan to define territorial apportionment, rules for management of the resources, and share between users,
- operational actions with water saving measures, improvement of drinking water network performance, substitution of water resources or other equipment works or monitoring,
- and regulation aspects with water apportionment zones (ZRE), Unique Collective Irrigation Management Body (OUGC) or revision of abstraction authorizations.

They also include quantitative objectives (flowing volumes) to be reached in the rivers at SDAGE strategic references points and local points. (Eaufrance, 2022)

On regulation aspects, the basin coordination prefect establishes Water apportionment zones (ZRE) which are defined as "zones presenting a shortfall, other than exceptional, of resources in relation to needs" and cover surface and groundwater in the perimeter. In these areas, the authorities have to pay specific attention to the management of water quantities to reduce the pressure and adapt the activities to the available resources. This is made via the development of territorial strategies (quantitative water resource management plan, PGRE) with the aim of reducing the impacts of withdrawals on water resources and developed within local consultation bodies with the participation of all users. These strategies comprise three steps: define abstractable volumes, distribute these between the main user categories and by hydrologic (hydrogeologic) entity, and revise authorizations so that the sum is below the total abstractable volume.

And finally, in the recent period, a national framework for management of drought periods have been defined. It is based on the level of severity of the situation. The assessment of the level of severity of the drought is based on hydrological data and field observations (reduction in the flow of rivers, drop in the level of groundwater tables, observations of drought, reduction in stocks of low water support). The department prefect can then publish orders restricting the use of water. They can only be prescribed for a limited period, on a determined perimeter. There are four levels: vigilance, alert, heightened alert and crisis, and each is linked to specific restrictions, the crisis level being linked to some forbids to

[183] volume that the environment is capable of supplying under satisfactory ecological conditions

preserve priority uses for health, civil security, drinking water and sanitation. The number and duration of these restrictions has significantly increased in 2022.

- **Flood protection and management: details on organization and information system**

Following the adoption of the European Directive on floods, France has mandated a Joint Flood Commission (CMI) to elaborate a collective and concerted national flood risk management strategy.

Three priority objectives have been defined:

- increase the safety of exposed populations,
- stabilize in the short term, and reduce in the medium term, the cost of flood damage,
- significantly shorten the time needed to return to normal in the affected areas.

Once the strategy was adopted, an action plan was launched with various activities. Among them two working groups developed specific guidance: one developed a National flood vulnerability benchmark to be used to elaborate a flood vulnerability diagnosis at local level and use this to elaborate an action plan, and one developed a guidance to consider agriculture activities and natural spaces for the management of flood risk and take better account of the impacts of transfers of exposure to floods on agricultural activity.

To implement the Flood Directive, a preliminary risk assessment (EPRI) is conducted at river basin district level and used to elaborate flood risk management plan (PGRI) which sets the main objectives in terms of flood risk management and the objectives specific to certain areas at high risk of flooding (TRI). For these last, local strategy to manage flood risks (SLGRI) are defined no later than 2 years after identification of TRI.

The French national administration at the department level and under supervision of the department prefect must elaborate with local authorities a natural flood risk prevention plan (PPRi or PPRNi). It is a planning document which is mandatory to be considered in urban planning and that allows:

- define the areas exposed to flooding risk and associated prohibitions or specific prescriptions (relating to constructions, works, facilities, operations, etc.) so as not to aggravate the risk for human lives;
- to delimit the zones which are not directly exposed to the risks but where prohibition measures or prescriptions (for constructions, works, facilities or operations) so as not to aggravate the existing risks and not to cause new ones;
- to set prevention, protection and safeguard measures to be taken or implemented, in these two types of areas, by various actors (public authorities, individuals, owners, operators, users).

The French government also launched a flood prevention action program (PAPI): a call for projects contributing to the prevention of flood risks dedicated to local authorities with some national co-financing and covering seven axes to be included in the programme (improved knowledge and awareness of risk; monitoring, forecasting floods and inundations; alert and crisis management; taking flood risk into account in town planning; reduction of the vulnerability of goods and people; flow management; management of hydraulic structures). (Cerema, 2017)

- **The information system:**

The Central Service for Hydrometeorology and Support for Flood Forecasting (SCHAPI) was created in 2003. It is a central service mandated to forecast flood events in France. The service collects the monitoring data on river flows and heights in the HYDRO database and makes them available on the hydroportal website. They support the 19 flood forecast services (one per main river basin) and make available on a dedicated website (vigiecrues) information from continuous monitoring of the high flow risk over 23,000 km of rivers covering 75% of the population living in flood zones. This is made by a combination of hydrologic data with meteorological forecast to derive a high flow risk. High flow risk maps are published twice a day (or more often in critical periods). The “high flow” vigilance comprises 4 levels from green to red (no vigilance, high flow risk with overflows, high flow risk with important overflows and high flow risk with major overflows). This allows local authorities, in particular prefects and mayors, as well as the public, to put themselves in a position to react appropriately if the danger becomes clearer, and to manage the situation in better conditions.

The system is completed by a system watching 30,000km part of the headwaters not covered by the vigicrue monitoring because of the rapid reactivity of these watersheds to rain events. The system is based on an automatic system dedicated to flash floods and around 16,000municipalities are watched (vigiecrues flash).

Water organizations possible for local authorities

Several organizations are possible:

- management by the public organization in charge of the service (the state itself, a public agency of the state, a regional, departmental, intercommune or municipal service),
- management by a group of public authorities gathered together in a common public organization with or without its own taxation (EPCI, mixed union…),
- delegation by one of the above of the public service or a part of it to a private company,
    - concession of an area to develop infrastructure, maintain in good operational conditions and pay the public domain use via fees, rent or taxes,
    - leasing (concession of built infrastructures),
    - interested management,
    - mixed economy companies (association of public and private partners in a common company in charge of public services).

FINANCING OF WATER RESOURCE AND FLOOD RISK MANAGEMENT INFRASTRUCTURE

Use of money collected by Water Agencies

- for water agency O&M costs and staff costs (1500 staff),
- for transfer to the OFB and other public agencies (around 400M€),
- for studies, monitoring, planification (SDAGE…) and governance,
- for the small water cycle sewer networks and treatment, technical support on wastewater management and on improving drinking water quality,
- to support projects of pollution reduction by economic actors including agriculture, to manage runoff rainwater, to manage quantities of water, to protect aquatic resources and to restore aquatic environment.

Except for the two first, the other actions take generally the form of grants or repayable advances, according to priorities fixed by the water agency administration council and basin committee and following general rules for subsidies.

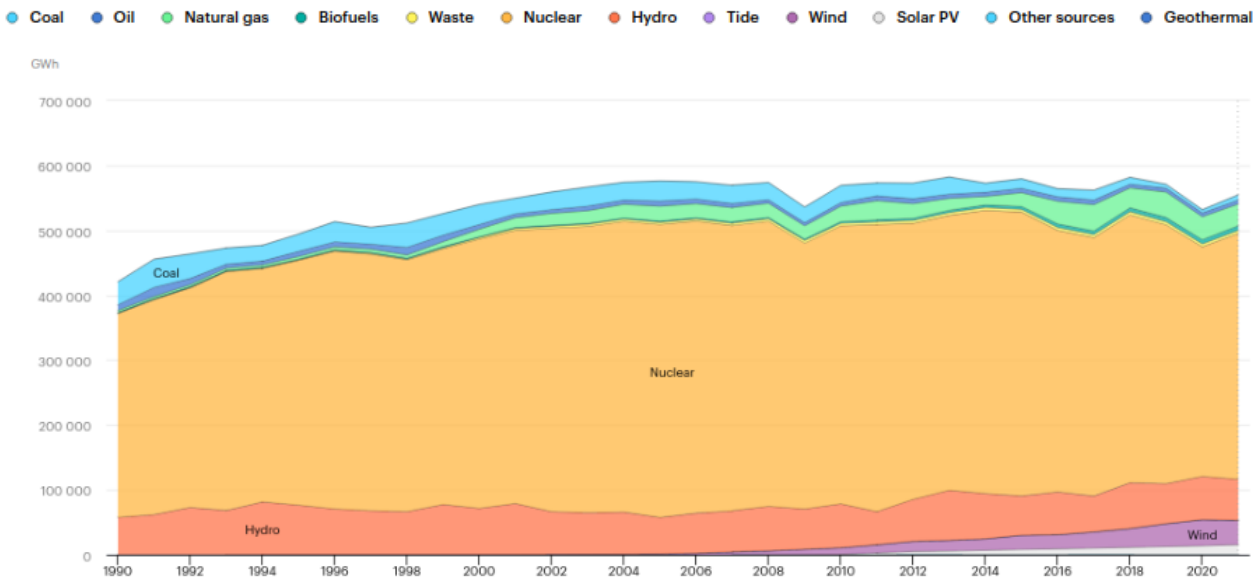
Local authorities and their responsibilities:

The SPIC qualification allow the services to use their own funds, loans from banks and subsidies or reimbursable advances from water agencies and local authorities (department and region) and where possible from the state and the EU for funding the operation, maintenance and modernization of the systems. The public services are responsible for the continuity of the services, for the equality of all users of the public service (including participate equally to the financial cost resulting from the service) and to ensure continuous adaptation to the legal framework (quality of drinking water, pollutant discharges…) or other necessary adaptations (energy savings have become a hot topic in the recent period). The services are therefore investing on a regular basis for maintaining or improving the services. Investment in water and wastewater infrastructure are heavy and the co-financing from water agency play generally a key role in the investment decision. The conditions to be eligible to these and the amount are changing regularly and often lead to significant variations of investment between years.

Graphs hydropower capacity and annual production:

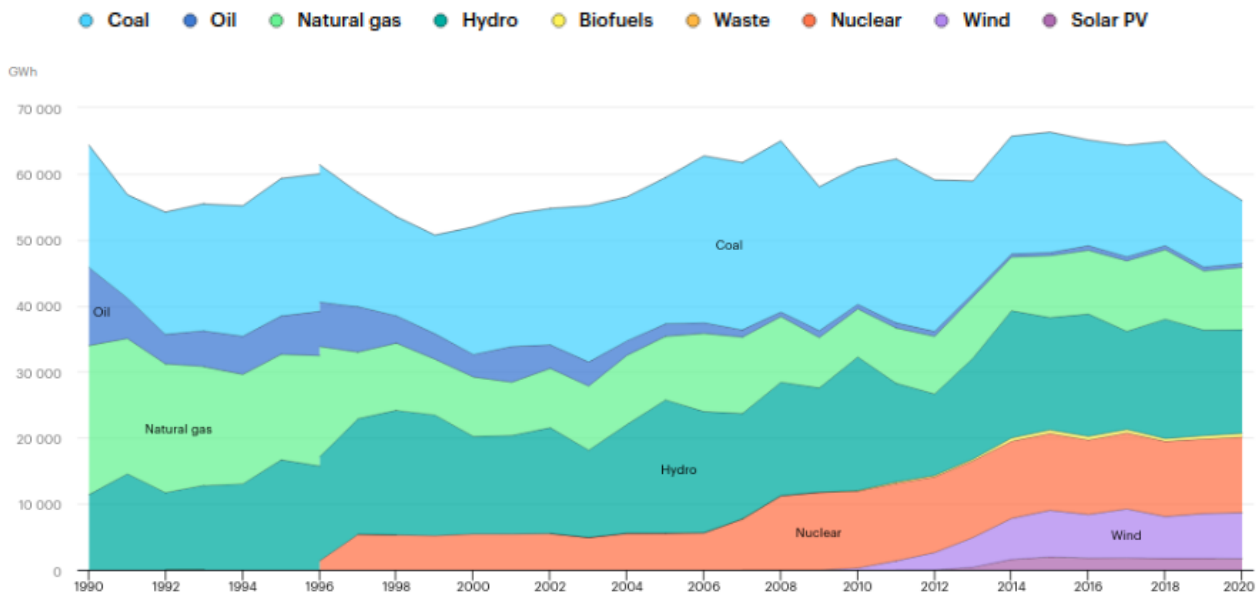
	Capacity (GW)	Annual production Twh 2022 [184]
Run-of-the-river and locks	10,8	32,3
Lakes and dams	10,3	10,5
PHES	4,6	6,7

Capacity and average production according to the type of hydropower facility



Electricity generation by source in France 1990 - 2021 (source : iea)

[184] https://analysesetdonnees.rte-france.com/bilan-electrique-production#Hydraulique



HYDROPOWER REGULATION – INVESTMENT AND OPERATION COSTS

- Facilities of less than 4.5 MW: the authorization system

They are usually owned by individuals, small businesses or communities. They need an environmental permit issued by the prefect for a limited period. The operating rules depend on the environmental issues of the site concerned.

- Facilities of more than 4.5 MW: the concession system
    - Concession Management

The duration of the concessions must take into account amortization of the initial investments made by the concessionaire. The concession system transfers the responsibility for investment, construction, operation and maintenance of a hydroelectric facility to a third party who is remunerated by benefiting from the operation of the facilities throughout the duration of the concession. In return, the concessionaire pays a fee, grants water and energy reserves and must, at the end of the concession, return free of charge the goods needed to operate the concession to the State, which can then decide to renew the concession. These obligations are written in the specifications of the concession, which binds the concessionaire to the State.

Distribution of the value of the concessions depending on the concession's deadlines[185]

Deadline of the concession	Value of the concession in million euros
2030-12-31	25 484
2031-01-01 to 2040-12-31	7 879
2041-01-01 to 2050-12-31	7 895
2051-01-01 to 2060-12-31	6 645
After 2061-01-01	2 516

[185] Page 40 Compte général de l'État (CGE) 2021 https://www.budget.gouv.fr/documentation/file-download/15370

- The perimeter of hydropower concession

The public hydroelectric domain granted is made up of all the land, works or installations, watercourses and lakes included in the perimeter of a hydraulic concession.

- Specific hydropower concessions

A semi-public company may be formed for the granting of a concession. In this case, the prefect first informs the local authorities territorially concerned by the concession of his intention so that they can organize themselves to be able to constitute the public entity of the concession.

The call for tenders is then launched with the information that a hydroelectric semi-public company will be formed with the public persons constituted during the concession and the share that this company represents in terms of capital and voting rights. After selection of the private operator, a "prefiguration committee" is set up until the creation of the semi-public company.

- Management of hydroelectric concessions

The regional levels of the state (DREAL) are in charge of controlling hydropower concessions. They supervise the construction, management and maintenance work.

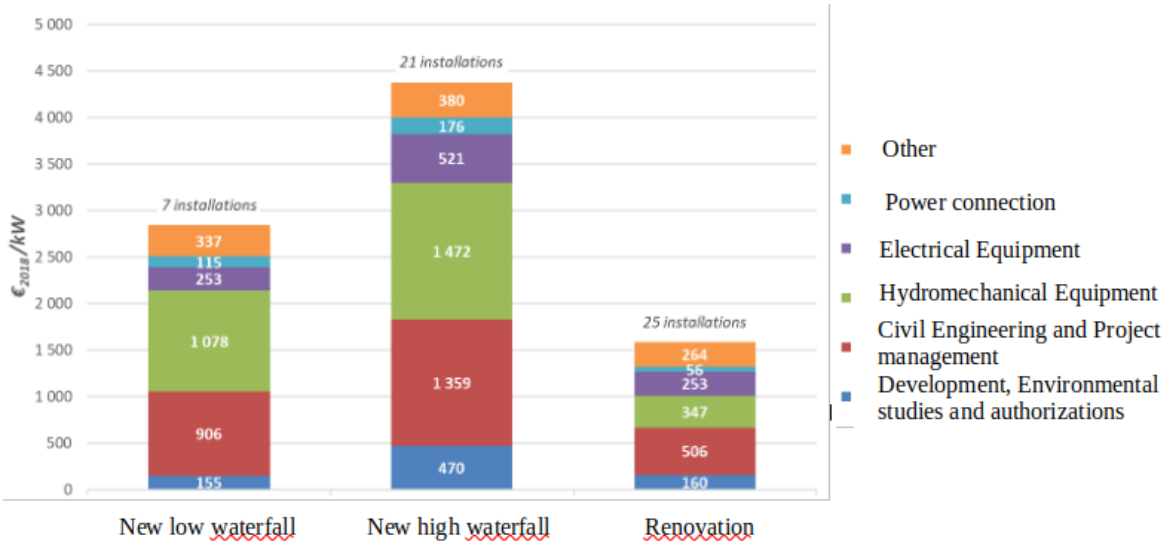
- The granting and renewal of hydroelectric concessions

The State will choose for each concession the best offer taking into account the following three criteria:

- the energy optimization of the exploitation of the fall: the call for competition will encourage the candidates to propose significant investments for the modernization of the existing installations, and new equipment to increase the performance of this renewable energy.
- The environmental criterion: by the respect of a balanced and sustainable management of the water resource allowing the reconciliation of its various uses, the candidates will have to propose a better protection of the ecosystems while respecting the uses of water other than energy (protection aquatic environments, low water support, irrigation, etc.)
- the economic criterion by selecting the best economic and financial conditions for the State and the local authorities: the candidates must propose a rate for the royalty proportional to the turnover of the concession, the benefit of which will go to the State and to the local communities.

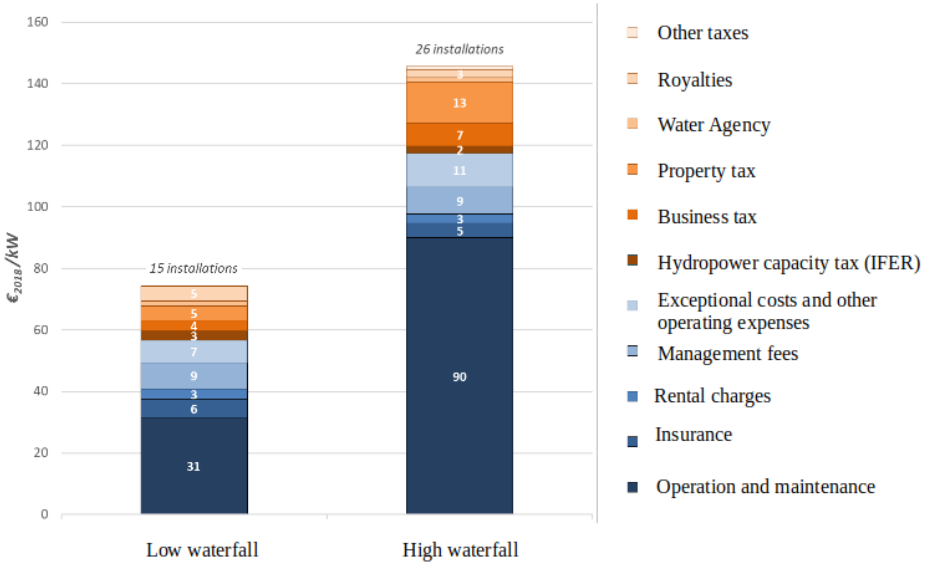
The figures below that comes from an Energy Regulatory Commission's study[186] in 2020, give interesting information concerning investments and operations costs of hydropower facilities.

[186]Page 24 Coûts et rentabilités de la petite hydroélectricité en métropole continentale



Average investment for all recent facilities

The graph below shows that the economic profitability strongly depends on the price of electricity and some facilities are not profitable without a minimum purchase price.



Average operation costs

- **Environmental protection**

  Hydropower facilities have an impact on water resources and on ecosystems. This is why they must limit their impact on ecological continuity, in particular by:

  - Maintaining a minimum flow in river waterbodies (“ecological instream flow”) allowing at least to guarantee the conditions necessary for the development of life in the section short-circuited by the installation.
  - Preserving passages or management methods for species (migratory fishes and invertebrates) and for sediments, for example by installing fish ladders to allow them to move up and down rivers.

These issues are taken into account in the examination of projects under the authorization and declaration regime of the Environment code or during the examination of a concession request.

- **Safety of hydraulic infrastructure**

  Hydropower facilities are subject to specific monitoring and to significant security and safety obligations when the production of electricity uses a dam or requires a penstock.

  The safety of hydraulic infrastructures is the responsibility of operators. Control relies locally on decentralized State services (The SCSOH). It is managed nationally by the National Hydraulic Works Safety Center (PoNSOH) , which is a service with national competence attached to the General Directorate for Risk Prevention of the Environment Minister. The necessary technical expertise on which services in the regions can call is provided by several institutions: the Centre for Studies on Risks, the Environment, Mobility and Urban Planning (Cerema), the national institute Research Center for Agriculture, Food and the Environment (INRAE) or the PoNSOH itself, which is responsible for coordinating this technical support for the benefit of the regional control services. There is also a permanent technical committee for dams and hydraulic structures, with experts, which is asked to deal with complex issues concerning the safety of hydraulic structures being rehabilitated and also on the occasion of the first impoundment of new category A dams. (Depending on their height and volume, dams are in fact classified in categories A, B or C by the regulation. Each category sets increasing obligations for managers in terms of safety (the strongest concern class A), specified in the environment code and the energy code.)

  The obligations of dam managers in terms of safety are as follows:

  - Design and monitoring of works by an approved project manager, with compliance with the technical requirements set by the regulation;
  - Periodic achievement of a hazard study (class A and B dams);
  - Implementation of monitoring, maintenance and technical inspections in compliance with guidance, with the obligation of associated periodic reports;
  - Implementation and monitoring of auscultation devices, with the associated reports;
  - Declaration of important events for hydraulic safety.

  At regional level, the SCSOH's mission is to ensure, through the authorization procedure that the concessionaires have properly designed and carried out their infrastructures that they maintain and monitor them correctly, and, in general, that they comply with the regulations. Administrative penalties are possible under the energy code or the environment code in the event of failure by operators to comply with their obligations. They intervene on the decision of the prefect after a prior formal notice remained without effect.

- **Support mechanisms for hydroelectric production**

  Under certain conditions, the operation of a hydropower facility may not be profitable. However, to contribute to the integration of renewable energies into the French energy mix, it may be necessary to provide them with support, particularly for small hydroelectricity (power less than 10 MW).

  Support for licensed facilities can take two forms:

  - for any installation of less than 1 MW, which may be awarded a purchase obligation or additional remuneration contract depending on its power and depending on whether it is a new or renovated facility;

- via yearly calls for tenders organized by the Energy Regulation Commission(CRE), for the other installations according to the specific conditions defined in the specifications. They aim to promote:
  - the construction of new complete facilities (dam + hydroelectric plant),
  - equipping existing dams or weirs, which do not currently produce electricity.

The concession facilities can also be supported when necessary: when the concession is granted, additional remuneration can be put in place to balance the operation of the facilities, if the market prices do not allow a profitability of the concession.

A public consultation was held in March and April 2023 to examine the possibility to grant a support mechanism for pumped-storage hydroelectric power stations. Storage capacities are more and more needed to store energy when there is too much electricity produced and to generate electricity when needed. Pumped-storage hydroelectric power stations are totally adapted to that need.

- **Multiannual energy program 2019 – 2028**

Measures included in the program to reach its objectives :

- Optimize the production and flexibility of the hydroelectric facilities, in particular through over-equipment and the installation of hydropower facilities on existing dams that are not equipped;
- Set up a support mechanism for the renovation of power plants authorized between 1 MW and 4-5 MW;
- Launch the granting of new concessions on a few sites whose potential will have been identified;
- Launch calls for tenders for small hydroelectricity

HYDROPOWER FEES AND TAXES

- **Hydropower concession's contribution** based on the State public domain occupation of the concession (Article R123-1[187] of the Energy Code)
  The Hydropower concession's contribution depends on the electricity price and the hydropower capacity installed.

  The formula that calculates this contribution is the following :

$$\frac{(RN - DN)}{16} \times 2{,}25\ \%$$

RN represents the sum capitalized at a rate of 8% of the total estimated revenues during the duration of the concession based of the annual generating capacity in kWh and the current purchase tariff of these kWh

DN represents the sum capitalized at a rate of 8% of the expenses of the concession during the duration of the concession. It includes an annual increase of 2% of the operating expenses to take into account the aging of the facility.

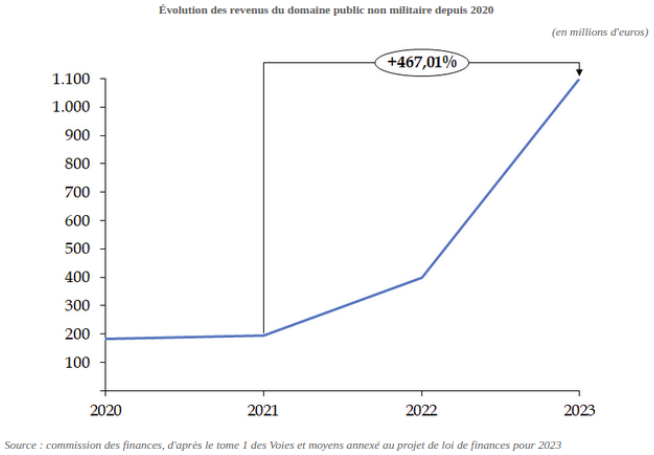
This annual contribution is revised every ten years.

It was relatively stable until 2021 at around 160 million euros but it is expected to increase highly in 2022 due to the increase in the price of electricity. It should reach an amount between 350 and 400

[187] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000042233601

million euros. In 2023, the estimation shows a potential income of more than 1 billion euros. I should decrease highly in 2024 if the prices of electricity in 2023 remains at the level of the first months.

Estimated evolution of the revenues of the non-military public domain based of the draft budget bill of 2023[188]. The hydraulic concession's contribution represents the main part of these revenues.



Source : commission des finances, d'après le tome 1 des Voies et moyens annexé au projet de loi de finances pour 2023

- **Proportional contribution on hydropower facilities under concession"** based on kWh production and related to dividends and profits (Article R123-3[189] of the Energy Code)
  The formula that calculates this contribution is the following
  $R = n \times EL \times 1{,}428.10^{-6}$ euros

  n represents the annual production of electricity minus the electricity used for the facility and EL is an industry price index named "Electricity sold to final consumer companies"

  One third of this contribution is allocated to the Departments, One twelfth to municipalities and one twelfth to inter-municipalities.

  It is revised every ten years using this new formula

  $R = n \times EL \times 1{,}798.10^{-6}$ euros

  In 2022 the amount of the proportional contribution is estimated to **80 million euros**

	2020	2021	2022
Total revenues	9,2	9,7	80
State Part	4,6	4,85	40
Department Part	3,1	3,2	26,7
Municipalities and inter-municipalities Part	1,5	1,6	13,3

Incomes related to the proportional contribution on hydropower facilities between 2020 and 2023.

This contribution is going to increase highly due to two factors**:**

- **Increase in price of electricity in 2021 (applied in 2022) and 2022 (applied in 2023)**

[188] http://www.senat.fr/rap/l22-115-21/l22-115-215.html#fn701
[189] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000042233601

- **Number of concessions extended instead of being renewed**

As for the hydropower concession's contribution it will certainly **reach a peak in 2023.**

- **"imposition forfaitaire des entreprises de réseaux (IFER)" "Tax on network businesses". Tax on hydropower and photovoltaic plants.**

  Different businesses are concerned and among them tax on hydropower and photovoltaic plants. In the French Budget there is no separation between them, and the incomes are estimated to be 125 million euros in 2022. This tax concerns only the hydropower plants that have a capacity more than 100 kW. When all electricity is self-consumed there is no tax applied. For hydropower, the amount of IFER is set at €3.394 (€3.254 in 2022,€3.206 in 2021) per kW of hydropower installed on January 1 of the year concerned. The specific hydropower incomes are around **80 million euros in 2022.** This amount is relatively stable as the total hydropower capacity increases slowly (0,1 GW per year). The variation of the price set per kW is the only way to increase this amount. The amount per kW is changed each year by the finance law.

  As this contribution is coupled in the budget with total photovoltaic capacity, it will globally increase thanks to the increased perspective in the photovoltaic plants capacities. As explained in chapter 5.2 a way to increase the revenues related to this contribution is to implement floating photovoltaic solar plants on the reservoirs of the hydropower plants.

  This tax is allocated to departments (50%) and municipalities (50%) where the power plant is located. When it exists an "Établissement public de coopération intercommunale (EPCI)", a public institution for inter-municipal cooperation, the allocation can reach 70% for the EPCI.

- **Contribution for abstraction from water resources: hydropower plants**

  This contribution is allocated to the budget of each water agency and decided by each agency. The total amount is estimated to be 40 million euros per year. As the calculation is related to the volume of water used for electricity production this amount is subject to climate variation.

Water Agency	Calculation Formula	Amount estimated/year during the 11th program millions euros
Seine-Normandie	€0.5 / Mm3/ m of fall	0,06
Adour-Garonne	€0,97 /Mm3/m	7,5
Loire Bretagne	€0,804 /Mm3/m	0,7
Rhin-Meuse	€0,507 /Mm3/m	2
Rhône-Mediterrannée-Corse	€1,1 /Mm3/m	30
Artois Picardie	€0,36 /Mm3/m	0

Amount of contribution for abstraction from water resources: hydropower plants Source 11th program of each water agency

MEASURES OF THE NEW NATIONAL WATER PLAN

These measures are organized under three main targets:

- **Manage Sobriety of uses for all stakeholders**
  - <u>-10% water resource abstracted before 2030</u>
    - implementation of a sobriety plan,
    - 50 biggest water consumers in the industry sector followed,

        - reduction in water consumption in new buildings,
        - 30 million more in the agricultural sector to encourage best practices that reduce water consumption
        - Sobriety approach in public administration to be exemplary
        - Citizens to be encouraged to save drinking water and to collect rain water.
        - Launch a public communication campaign to save water
        - Reinforcement of child education on this topic
    - Better planification
        - Implementation of a climate adaptation plan in each big river basin that will announce reduction targets adapted to the resource evolution and uses
        - Specific reduction targets will be implemented in the 1100 river basin management plans.
        - Progressive stop in the abstraction authorization when the global abstraction is more than the renewable of the resource.
    - Better measurement
        - Numeric water meters installed for all abstraction point under authorization with automatic transmission
        - Lowering the reporting threshold for declaration procedure.

- **Optimize water resource availability**
    - Reduce leakages and secure drinking water supply
        - €180 million more per year for 170 municipalities that have a leakage rate of more than 50% and for 2 000 municipalities that already faced drinking water tensions.
    - Encourage non-conventional water resources (1% To 10% waste water reuse until 2030, 1000 projects implemented before 2027)
        - Regulation simplification to encourage this practice
        - Better Support for wastewater reuse projects
        - Implementation of a water reuse observatory
        - Specific calls for project concerning coastal municipalities
        - Collecting rainwater from the roofs of agricultural buildings encouraged
    - Improve water storage in soil, underground waterbodies, artificial infrastructures
        - Reinforce protection of wetlands with €50 million more per year
        - Implementation of a hydraulic investment fund with €30 million/year to modernize existing water storage infrastructures and developed new projects taking into account the balance of the resources
        - Implementation of a national strategy to ease aquifer recharge

- **Preserve Water Quality**
    - Prevent pollution
        - all drinking water catchment areas will have a management plan
        - promote agro-ecological projects in the drinking water catchment areas
        - Better management of pesticides in the drinking water catchment areas
        - €50 million more per year for improvement of wastewater treatment plants
    - Restore the great water cycle to restore nature's filter function
        - 70 major nature based projects to fight against scarcity, restore wetlands and surface waterbodies will be implemented
        - €100 million for projects to make soil permeable again
        - develop ecological engineering sector

Measures are also implemented to implement the previous targets

- Improve water governance
    - each sub-basin will have a consultation body

        - each sub-basin management plan will be modernized taking more into account water resource management
        - simplification of technical engineering support from the departmental administration
        - An ultramarine territory will implement the flood competences
        - National water committee will welcome new users and representatives of the youth
    - Ensure adequate pricing and level of funding for water resource management
        - The river basin agencies will have €450 million/year more to implement the plan.
        - The river basin agencies expenditure limit will be suppression
        - €35 million/year more in the French ultramarine territories
        - The "banque des territoires" French territory bank will implement new loans at subsidized rates
        - Progressive water pricing will be encouraged
        - Natural heritage will be eligible to national funds
    - Invest in research and Innovation
        - Water Footprint will be calculated in integrated in the sale of certain products
        - Improvement of tools necessary for water resource prevision
    - Being able to answer better to scarcity crisis
        - A tool will be developed to easy know what water restrictions are in place in each area
        - The water restriction guidance will be updated
        - Tools will be developed to improve water restriction anticipation
    - Dashboard published each six months to follow the implementation of the plan

NATURAL WATER RETENTION MEASURES AND FLOATING SOLAR PLANTS

Natural water retention measures

The multi-benefits impacts of these measures are the following:

- **Biophysical impact**
    - store runoff
    - slow runoff
    - store river water
    - slow river water
    - reduce pollutant sources
    - Intercept pollutant pathways
    - Reduce erosion and/or sediment delivery
    - Improve soils
    - Create aquatic habitat
    - Create riparian habitat
    - Create terrestrial habitat
    - Enhance precipitations
    - Reduce peak temperatures
    - Absorb and/or retain CO2
- **Ecosystem service benefits**
    - Water storage
    - Fish stocks and recruiting
    - Natural biomass production
    - Biodiversity preservation
    - Climate change mitigation and adaptation
    - Groundwater/aquifer recharge
    - Flood risk reduction
    - Erosion/sediment control
    - Filtration of pollutants
    - Recreational opportunities

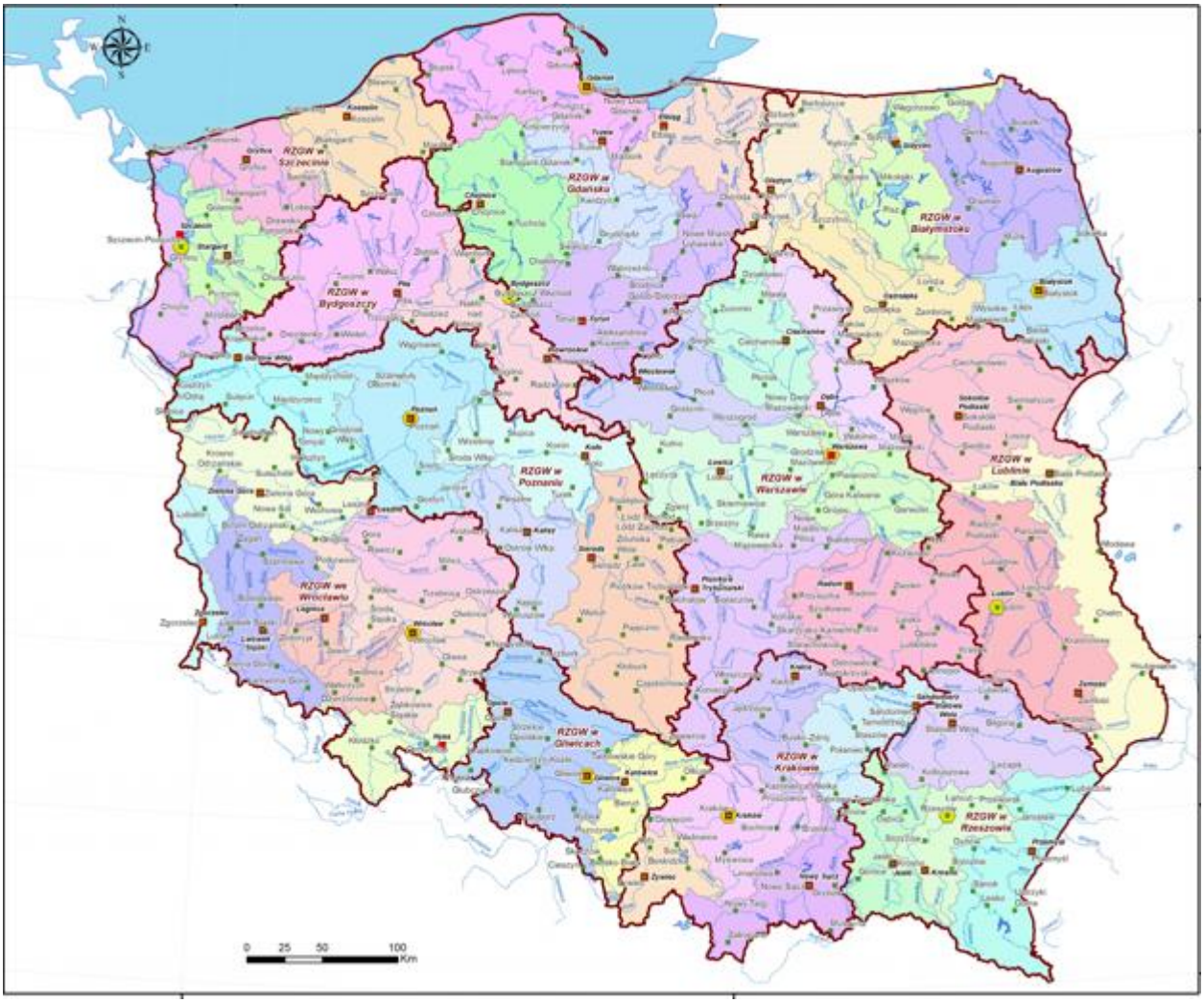
        - Improve air quality
        - Improve health of people
        - Aesthetic/cultural value
        - Navigation
        - Energy production
    - **Policy objectives**
        - Achieve good surface water status (WFD)
        - Achieve good groundwater status (WFD)
        - Prevent deterioration (WFD)
        - Take adequate and coordinated measures to reduce flood risks (Flood Directive)
        - Protection of important habitat (Habitats and Birds Directives)
        - Better protection for ecosystems and more use of green Infrastructure (Biodiversity strategy)
        - More sustainable agriculture and Forestry (Biodiversity strategy)
        - Better management of fish stocks (Biodiversity strategy)
        - Prevention of biodiversity loss (Biodiversity strategy)

Development of floating solar plants

The floating solar plans will provide the following benefits:

- Preserve natural terrestrial areas from implementing solar power plants
- Coupled with hydropower plants they can reduce water abstraction during the day and allow to use hydropower plants more during the peak production in the morning and the evening
- During the summer season, it can contribute to reduce highly the need to use water resource from the reservoirs of the hydropower plants.
- The solar power plant can benefit from the existence of the electricity network and can be directly connected to it without specific investments. reduce evaporation of the waterbodies
- presence of water reduces the temperature of the panels and reduce the dust which increases the efficiency of the panels
- decrease temperature of the waterbodies
- Create an artificial protection for fishes
- reduce algal blooms

Annex 3: Map of Poland - location of Polish Waters offices and boundaries of RZGW and catchment management boards



Note: water supervising committee headquarters - , catchment management boards headquarters - , regional water management authority headquarters - , boundaries of regional management authorities - , main rivers - , main lakes -

Source: PGW Polish Waters website

Annex 4: Detailed information on Spain

ACUAES is a public company resulting from the merger of different river basin companies created since 1997. It is an instrument of Central Government (the Ministry for Ecological Transition and Demographic Challenge (METDC)) for building, operating, and financing water infrastructures. It is part of the Public Corporation Group (Public Patrimony), which owns shares of all public companies. The capital of ACUAES is 1,520 million Euros. This operates as a revolving fund.

The Shareholders Board of ACUAES is chaired by the president of the Management Board and includes a delegated member of the main shareholder. The Board approves the annual accounts, the increases and decreases of Capital and the designation of the members of the Management Board.

The Management Board is the governing body of the company. It has eleven Members proposed by the Ministries of Finance, and economics mainly. The METDC appoints three of its members. The METDC also appoints the president of the Board (acting as vice president of the company).

The Management Board meets once a month, which is the decision and contracting body of the company. It approves annual accounts, biannual investment plans, agreements with users, bidding documents, decisions on contracts. It also oversees the functioning of the company. Under the Management Board. Furthermore, it operates the Audit and Control Commission composed by three designated members of the Management Board.

The company has to elaborate yearly accounts and is required to have independent audit reports in accordance with the Commerce Code and the General Accountancy Regulations established by the Ministry of Finance/Treasury. The financial and economic management of the company is subject to the control of the Ministry of Finance appointed body.

ACUAES has a model for ethical management and a protocol for fighting corruption and fraud. This includes an ethical code, a complaints channel, and an Ethics committee. It has established a Directorate for Audit and Internal Control to define protocols and ensure compliance.

According to its statutes the company realizes the following activities:

- Promotes, contracts, and operates all types of water infrastructures and associated public works.
- Manages water infrastructures, including environmental management and preparatory and complementary activities derived from the above.
- Manages contracts for the preparation of studies, projects, building, acquisition and operation of the public works
- Realizes other activities of administration necessary for the above tasks.
- These tasks can be delivered directly or indirectly though financing or participating in the social capital of companies that can be constituted to carry out the above tasks.

The CTWL establishes that the relationship between the Central Government and the Company is agreed in the "**Direct Management Agreement**" (Framework Agreement) approved by the Council of Ministers [190].

This agreement includes: a) general issues such as the procedure for technical project approval; b) the listing and a description of the infrastructure and its estimated budget; c) the general financial scheme to be applicable to each of the infrastructures.

For each infrastructure ACUAES drafts an **agreement/contract**[191] **with the users/beneficiaries** of the projects. The content of the agreement incorporates some technical information on the projects and:

- The financing scheme with the proportion to be assumed by the company's own resources, the EU funds, transfers for public budgets and commercial funding.

[190] https://www.boe.es/buscar/act.php?id=BOE-A-2003-20254.
https://www.boe.es/buscar/doc.php?id=BOE-A-2001-14276.

[191] https://www.acuaes.com/corporacion/convenios

- The tariffs to be established to pay for capital costs, operational cost, and financing costs.
- The guaranties to be provided by the beneficiaries of the infrastructure.
- The payment schedule and amortization period.
- The agreement on the operation of the infrastructures whiles funds are being repaid to ACUAES.
- Others such as dispositions on the transfer of the ownership of the infrastructure at the end of construction.

The company requests reports from the State attorney general and the public corporation group (asset owner) on the Framework Agreement, Agreement/contract with users, the bidding documents and the decisions on the offers, before these are submitted for approval by the Management Board.

To finance building and operation of infrastructures ACUAES functions primarily as a financing instrument for blending finance: The funding for the different projects is ad hoc and depends on the availability of funding including:

- ACUAES equity (initial capital and capital transfers from the RBOs). This may not be used when there is EU funding available. Maximum 50% of total financing.
- European Funds (ERDF, Cohesion Funds and now NextGenerationEU funding). In some cases, this is up to 80%.
- Capital transfers in advance from water users benefitting from the infrastructures or regional governments supporting them.
- Loans from commercial banks.

EU funding has been allocated to the different projects in the "Framework Agreement". The total EU funding managed by ACUAES from ERDF operational programme 2014-2020 has been 240 million (44% of the total funds allocated to water projects to be implemented by Central Government) for 23 projects.[192]. NextGenerationEU funding allocated to projects to be implemented by ACUAES is 311 million Euros. ACUAES will be doing 9 infrastructures for Wastewater treatment, reuse, improve efficiency in transportation channels and aquifer regeneration.

Acuaes equity is 1,520 million euros. The company finances 26% of the total investments with a maximum of 50% in each of the projects. These is fully charged through tariffs. It is not a subsidy. It needs to be repaid considering a money update index but without financing costs (interest) [193].

Access to commercial funding is also a main source of funding. The Company negotiates a line of financing with commercial banks secured by its own equity. This is activated in project basis. The loans are long term loans linked to the operational period of 25 years and a variable rate of interest linked to the Euribor. Banks also apply an update index for the loans along the project repayment schedule. The volume of investment assigned in the Framework Agreement for commercial funding has been 1,032 million euros. In 2021 450 million of the liabilities of the company were loans with commercial banks.

In summary, the advantages of the ACUAES Model are:

- Provides a Turnkey service. It does all the administrative and management tasks of getting EU funding, prepare projects, Prepare Terms of Reference, contracting building and operation, blended financing, guarantees,
- The company can access to more resources blending commercial financing with its own resources, the users financing and EU funding allowing it to scale up investments.
- The company acts as:
  - *Project Facility for project preparation*
  - *Project Manager* managing building and operation
  - *Project Finance*, with a structured finance based on flows generated by each of the projects. It also facilitates access and absorption of EU funding.

[192] https://www.dgfc.sepg.hacienda.gob.es/sitios/dgfc/es-ES/ipr/Paginas/inicio.aspx.

[193] https://www.acuaes.com/sites/default/files/informacion-finaciera/cuentas-anuales/ccaa_acuaes_2021_con_informe.pdf

- All this is done with specialized personnel that oversee the implementation of contracts with private engineering and construction firms. In 2021, ACAES counted with 84 employees and offices in 8 locations in Spain.

HYDROELECTRIC POWER

There are currently two main support frameworks: The specific remuneration system and the economic system for renewable power.

- The specific remuneration regime is regulated in Royal Decree 413/2014, of June 6, and is granted through power auctions in which a remuneration is bidded.
- The economic regime of renewable energies is regulated in Royal Decree 960/2020, of November 3, and is granted through competitive bidding procedures where the supply variable is the price per unit of electrical energy, and the product that is auctioned is installed capacity, electrical energy or a combination of both.

a) Specific remuneration regime.

Hydroelectric energy production facilities have a Specific Remuneration Regime that they may receive during their regulatory service life, in addition to the compensation for the sale of energy valued at market prices, a specific compensation made up of the following terms:

- A term per unit of installed power that covers, when appropriate, the investment costs for each standard facility that cannot be passed on for the sale of energy in the market, which is called remuneration for investment.
- A term for the operation that covers, where appropriate, the difference between the operating costs and the operating income of the corresponding standard facility, which is called remuneration for the operation.

The specific remuneration regime, charged to the General State Budget and through competitive bidding procedures, in accordance with the provisions of the LES, is established to promote production from renewable energy, to achieve energy objectives derived from European regulations, or to reduce energy costs and external energy dependence.

This specific remuneration regime, in addition to the remuneration for the sale of generated energy valued at the production market price, is made up of a term per unit of installed power that covers, when appropriate, the investment costs for a standard facility that cannot be recovered from the sale of energy in the market and a term to the operation that covers, where appropriate, the difference between the operating costs and the income from the participation in the production market of said standard facility.

A standard facility is an efficient and well-managed company with standard values of income, costs and initial investment.

The parameters of the specific remuneration are set taking into account the cyclical situation of the economy, the electricity demand and the adequate profitability for this activity for regulatory periods that are valid for six years.

b) Economic regime of renewable energies.

In order to promote predictability and stability in income and financing of new hydroelectric energy production facilities, another remuneration framework is established, called the Renewable Energy Economic Regime, which is based on the long-term recognition of a fixed price for the energy, and it is granted through competitive bidding procedures in which the product to be auctioned is electrical energy, installed power or a combination of both and the variable on which it is offered is the remuneration price of said energy.

The owners of facilities covered by the renewable energy economic regime will freely participate in the daily and intraday markets and will be able to participate in the processes of the system operator, avoiding unnecessary distortions in the electricity markets while integrating electricity from renewable sources in the market. For access to the connection to the transmission and distribution networks of the power produced, a price called the access toll is applied. This toll is intended to cover the cost of the electrical power transmission and distribution activities, in line with the provisions of the Directive 2009/72/CE, on the internal electrical power market. This toll is set and reviewed by the CNMC.

In development of the LES, RD 413/2014, of June 6, which regulates the activity of electricity production from renewable energy sources, cogeneration and waste, establishes a specific remuneration regime for hydroelectric power plants and the rights and obligations of hydroelectric power producers.

Likewise, RD 1183/2020, of December 29, on access and connection to electricity transmission and distribution networks regulates access and connection to electricity networks and participation in the daily electricity production market.

- Rights and obligations

The rights of hydroelectric energy producers are:

- To contract the sale or purchase of electricity.
- To evacuate the energy produced, through the system operator.
- To have access to electricity transmission and distribution networks.
- To receive the remuneration negotiated through the daily markets and intraday auctions, or through bilateral contracting.
- To access to a specific remuneration regime in addition to the remuneration, for the sale of the generated energy.
- To access to another remuneration framework based on the long-term recognition of a fixed price for energy.
- To receive the compensation to which they may be entitled for the costs incurred in cases of alterations in the operation of the system established by the Government.
- To have priority access and connection to the network, based on objective, transparent and non-discriminatory criteria, without prejudice to the security of supply and the efficient development of the electrical system.

The obligations of hydroelectric energy producers are:

- To perform all activities required to produce electricity under the terms provided in its authorization and in the water concession and with regard to security, availability and maintenance of installed power and compliance with environmental conditions.
- To apply safety standards, technical regulations and approval or certification of facilities and instruments.
- To submit to the administration and the National Commission for the Markets and Competitiveness (NCMC) information on production, consumption, sale of energy and the electricity term contracting instruments, both physical and financial, that it has signed.
- To submit hydroelectric energy sale offers to the market operator that manages the system of purchase and sale offers in the daily electric energy market.
- To evacuate the energy produced through the transmission or distribution network, according to the conditions established by the system operator, or, where applicable, the distribution network manager.
- To pay the toll to the distribution or transmission company to which you are connected for pouring energy into their networks approved by the NCMC.

The great development of wind power, as it is an intermittent, non-storable and non-manageable technology, in accordance with the Energy Storage Strategy (ESS)[194] is creating distortions in the Spanish electrical system that can only be resolved with non-flowing hydraulic power. It plays a key role in the integration of renewable energies with the electrical system, specifically reversible pumping hydroelectric

[194] estrategiaalmacenamiento_tcm30-522655.pdf (miteco.gob.es)

plants, since they store surplus power caused by the gap between production and demand and regulate it with the power generation with pumped water, guaranteeing the stability of the system.

The activity of producing electricity from renewable energy sources is of fundamental importance in achieving the objectives of improving the environment, energy supply security and technological development and innovation.

In recent years there has been a very important development of technologies for the production of electrical energy from renewable sources. This growth has been possible, in part, thanks to the existence of successive support regulatory frameworks that establish economic incentives for the production of electrical energy with these technologies. Also, and increasingly, facilities that do not receive support, and that freely participate in the market in any of the ways contemplated by the sector's regulations are being built. Spain has assumed some ambitious objectives in relation to the development of renewable energies in its proposal for the National Energy and Climate Plan (NECP)[195] 2021-2030, which involve the installation of close to 5,000 MW/year of new capacity in the next decade.

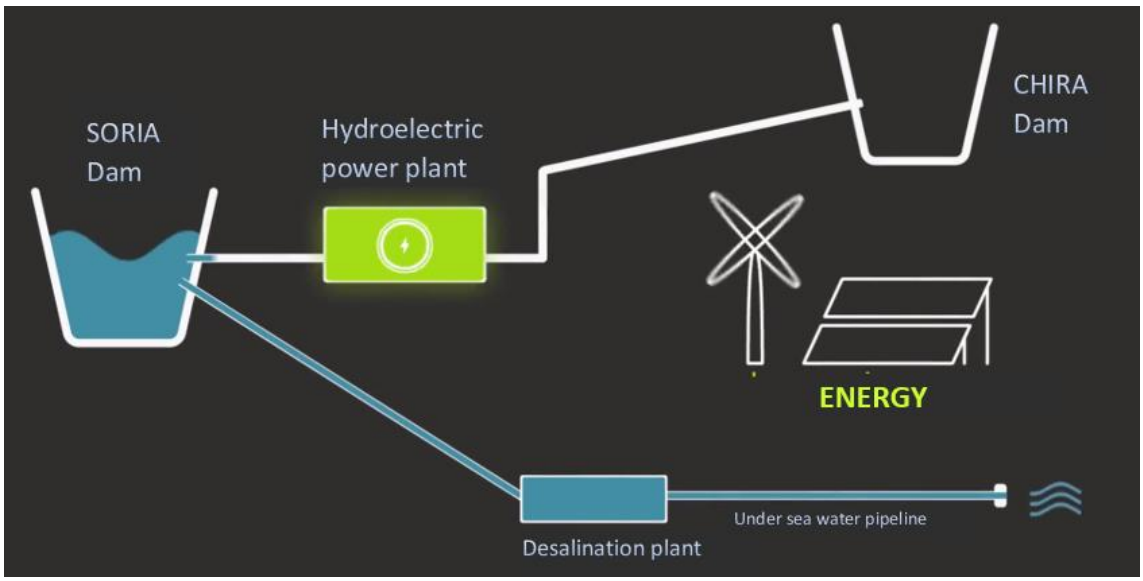


Diagram of a reversible hydropower plant with renewable energy. Source: Spanish Electricity System (SES)

Energy storage is an effective electrical system operation tool to improve supply guarantee, system security and the integration of renewable energies. A project in progress is the Salto de Chira reversible pumping hydroelectric plant in Gran Canaria[196], which takes advantage of the existence of two large reservoirs (the Chira and Soria dams) located in the interior of the island, to build a hydroelectric pumping plant between them of 200 MW (equivalent to approximately 36% of the peak demand of Gran Canaria) and 3.5 GWh of storage. As water is a scarce resource in the Canary Islands, the necessary flow in the reservoirs is achieved through a seawater desalination plant.

Legislation:

- Directive 2000/60/EC establishing a framework for Community action in the field of water policy. OJEU 2000/L327/1, dated 20-Dec-2000.
- Law 46/1999, of December 13, amending Law 29/1985, of August 2, on Water. BOE no. 298, of 14-Dec-1999.
- Law 29/1985, of August 2, BOE no. 189 of 8/1985. (Repealed).

[195] https://www.miteco.gob.es/es/prensa/pniec.aspx

[196] http://www.ree.es/es/actividades/proyectos-singulares/central-soria-chira

- Royal Legislative Decree 1/2001, of July 20, which approves the Consolidated Text of the Water Law. BOE no.176, of 24-Jul-2001.
- Royal Decree 907/2007, of July 6, which approves the Hydrological Planning Regulation. BOE no.162, of 7-Jul-2007.
- Royal Decree 903/2010, of July 9, on flood risk assessment. BOE no. 171, of 15-Jul-2010.
- Law 2/1985, of January 21, on civil protection. BOE no. 22, of 25-Jan-1985.
- Directive 91/271/EEC concerning urban wastewater treatment. OJEU 1991/ L135/40, of 30-May-1991. (Under review).
- Law 62/2003, of December 30, on fiscal, administrative, and social order measures. BOE no. 313, of 31-Dec-2003. (WFD transposition).
- Law 7/2021, of May 20, on climate change and energy transition. BOE no. 121, of 21-May-2021.
- Law 21/2013, of December 9, on environmental evaluation. BOE no. 296 of 11-Dec-2013.
- Law 24/2013, of December 26, of the Electricity Sector. BOE no. 310, of 27-Dec-2013.
- Royal Decree 198/2015, of March 23, which develops Article 112 bis of the Consolidated Text of the Water Law and regulates the fee for the use of continental waters for the production of electrical energy in inter-community demarcations, BOE no. 72, of 25-Mar-2015.
- Royal Decree 1183/2020, of December 29, on access and connection to the electricity transmission and distribution networks. BOE No. 340, of 30-Dec-2020.
- Royal Decree 413/2014, of June 6, which regulates the activity of electricity production from renewable energy sources, cogeneration, and waste. BOE no. 140, of 10-Jun-2014.
- Royal Decree-Law 23/20, of June 23, which approves measures in the field of energy and other areas for economic reactivation. BOE no.175, of 24-Jun-2020.
- Directive 2007/60/EC on flood risk assessment. OJEU 2007/ L288/27, of 6-Nov-2007.
- Order TEC/1399/2018, of November 28, which approves the revision of the special drought plans. BOE no. 311, of 26-Dec-2018.
- ORDER MAM/985/2006, of March 23, which develops the legal regime of the entities collaborating with the hydraulic administration in terms of water quality control and monitoring and management of discharges into the Public Hydraulic Domain. BOE no. 81, of 5-Apr-2006.
- Order TED/XXX/2023, of xx, which develops the legal regime of entities collaborating with the hydraulic administration in terms of water use and protection in the public hydraulic domain. (In process).
- Royal Decree 960/2020, of November 3, which regulates the economic regime of renewable energies for electricity production facilities. BOE no. 291, of 4-Nov-2020.
- Royal Decree 264/2021, of April 13, which approves the technical safety standards for dams and their reservoirs. BOE no. 89, of 14-Apr-2021.
- Order by which the legal regime of the collaborating entities of the Hydraulic Administration in terms of the safety of dams and reservoirs is developed. (In process).

Royal Decree establishing the regime to which the installation of floating photovoltaic plants must be subject in reservoirs located in the public hydraulic domain in river basins whose management corresponds to the General State Administration, and which modifies the Regulation of the Public Hydraulic Domain that develops the preliminary sections I, IV, V, VI, VII and VIII of the Consolidated Text of the Water Law, approved by Royal Legislative Decree 1/2001, of July 20. (In process).

Annex 5: Detailed information on the Netherlands

Extracted from: Dutch Water Authorities (2017) The Dutch water authority model.
https://dutchwaterauthorities.com/wp-content/uploads/2021/05/The-Dutch-water-authority-model.pdf

Flood protection

Flood protection is the responsibility of the central government and regional water authorities. The State is entrusted with the care of the Dutch coast (maintaining the coastline) and with the management of the dams that protect the estuaries in the west of the country. The other infrastructural works (dykes, dunes and storage basin embankments) are managed by the regional water authorities. This involves a total of over 3,600 kilometers of primary flood defences and 14,100 kilometees of other dykes. Flood protection is primarily regulated in Chapter 2 of the Water Act, which has been further elaborated in the Water Decree, the Water Regulation and in provincial and regional water authority bye-laws.

Water quantity

The State manages the main system in terms of water management (the major rivers, the IJsselmeer lake, the North Sea, Wadden Sea and a number of canals). The management of the quantity of water in the bodies of water that are of regional and local interest is the responsibility of the regional water authorities. Approximately 3,550 pumping-stations play an extremely important role in this. The exact management boundaries between the central government and the regional water authorities are indicated in an appendix to the Water Regulation. Water quantity management is regulated in the Water Act, which includes a number of legal instruments (standards for flooding, the basis for the 'water distribution priority sequence' for periods of water shortage, water agreements, water-level decisions, and a system of permits for discharging, withdrawing, supplying and draining away water. Here, too, further elaboration has taken place in the Water Decree, the Water Regulation and provincial and regional water authority bye-laws.

Water quality

Central government and the regional water authorities play a primary role in the management of water quality. The government's task is to manage the aforementioned main water management system, whereas the regional water authorities manage the regional and local waters. The management of water quality has been laid down primarily in Chapters 6 and 7 of the Water Act, which has several instruments, such as a system of permits and levies, and general rules for certain kinds of discharges of wastewater.

Groundwater

Unlike surface water, the responsibility for groundwater has been allocated to various government organizations in accordance with the Water Act. This law does mean that operational groundwater management is now largely the task of the water authorities. In pursuance of Article 6.4 of the Water Act, the issuing of permits for three large withdrawals, namely industrial withdrawals of more than 150,000m^3 per annum, the drinking water supply, and 'soil energy systems', is still the responsibility of the provincial governments. And in pursuance of Article 7.7 of the Water Act, the provincial government is authorized to introduce a groundwater tax. Furthermore, care for urban groundwater (and rainwater run-off) has been entrusted to the municipalities (see Articles 3.5 and 3.6 of the Water Act). Care for the groundwater quality is closely related to the many activities that take place in or on the ground. This is why this aspect

is part of the soil protection policy and is primarily provided for by the Soil Protection Act, the implementation of which lies with provinces and municipalities.

Control of muskrats and coypus

In mid-2011 an amendment was passed in which the task of preventing damage to waterworks structures by muskrats and coypus was transferred from the provincial government to the regional water authorities. With this amendment to the Water Act and the RWA Act, the law regulating this provincial task was repealed.

Waterways

The management of waterways is carried out by central government and the provinces, who, in turn, sometimes delegate this task to regional water authorities. The nautical aspects of waterways management (setting 'traffic rules') are laid down in the Shipping Traffic Act;

Roads

Care for the roads is the task of the State, provincial governments, municipalities and five water authorities in the western part of the country. These five water authorities manage 7,500 km of roads. Care of the roads is laid down in the Roads Act.

Sewerage

The task of sewerage lies with municipalities and is regulated in the Environmental Protection Act, by which the municipalities are charged with the construction, management and maintenance of sewerage systems. This Act also obliges municipalities to draw up sewerage plans. With the sewerage system, the municipalities collect rainwater and wastewater and transport it to the regional water authority's wastewater treatment plants. The municipalities can fund this task as well as their duty of care for rainwater run-off and urban groundwater (see Articles 3.5 and 3.6 Water Act) by means of a sewerage charge. The municipal council will have to introduce a bye-law for this in pursuance of the Municipalities Act.

Drinking water supply

The drinking water supply is managed by ten The Dutch water authority model 25 water companies and is regulated in the Drinking Water Act. With the exception of the Amsterdam Waternet, which is a non-profit foundation, water companies are private businesses, but because the Drinking Water Act prescribes that the shares of these businesses must be in public ownership, they can be treated as semi-public organizations.

The RWA governance structure consists of three elements:

- A governing board: Has the authority to regulate and manage in order to promote the tasks entrusted to the RWAs (Article 56 of the RWA Act). The governing board consists of 18-30 representatives of categories of stakeholders who have an interest in the tasks executed by the regional water authorities. According to Article 12 of the RWA Act residents, owners of open land (especially farmers), owners of nature areas, and businesses must each be represented on the governing board.
- An executive committee: The executive committee is charged with executing the day-to-day business of the RWA. It consists of the chairperson and usually four or five other members to be appointed by

the governing board. Article 40 of the RWA Act stipulates that at least one member must come from the specific interest categories. Each member of the executive committee should have the support of the entire governing board (Article 41 of the RWA Act).

- A chairperson: The chairperson is responsible for the proper representation of the regional water authority's tasks and chairs the meetings of the governing board and the executive committee. He/she is the legal representative of the RWA (Article 95 of the RWA Act) and is accountable to the governing board. The chairperson is not a member of the governing board and therefore does not have voting rights there. However, the chairperson is a member of the executive committee and does have voting rights there. The chairperson is appointed by the Crown for a period of six years. The governing board makes a recommendation that is sent to the Minister of Infrastructure and the Water Management through the Provincial Council (Article 46 of the RWA Act).

Article 2 Cost allocation of water system management

The costs for water system management are allocated to the categories subject to the levy as follows:

a. 47% to all residents;

b. 4.06% to the right-holders of unbuilt immovable property, not being nature areas;

c. 0.01% to the right-holders of nature areas;

d. 48.93% to the right-holders of built immovable property;

The fair value of the immovable property referred to in the previous paragraph, under b, c and d, is determined according to the value of the immovable property on the value reference date, according to the state and capacity in which they are on that date;

The valuation date is January 1, 2020.

https://lokaleregelgeving.overheid.nl/CVDR666628

Wastewater coefficients table

This table of waste water coefficients is part of the Delfland Purification Levy Regulation and the Schieland and Krimpenerwaard Purification Levy Regulation.[197]

Below are the waste water coefficient table and the old waste water coefficient conversion table. The conversion table shows which business units fall into which class of the new waste water coefficient table. Look up the industry of your business activities and read from the table which class and coefficient applies to your company. The waste water coefficient is a number. This number is multiplied by the water use. The result is the number of pollution units.

Table of waste water coefficients

Class	from – through	waste water coefficient
1	0 – 0.013	0.0010

[197] https://www.derbg.nl/business/overview-of-taxes/waste-water-treatment-levy-for-commercial-premises/table-of-waste-water-coefficients/ (accessed April 11, 2023)

Class	from – through	waste water coefficient
2	> 0.0013 – 0.0020	0.0016
3	> 0.0020 – 0.0031	0.0025
4	> 0.0031 – 0.0048	0.0039
5	> 0.0048 – 0.0075	0.0060
6	> 0.0075 – 0.012	0.0094
7	> 0.012 – 0.018	0.015
8	> 0.018 – 0.029	0.023
9	> 0.029 – 0.045	0.036
10	> 0.045 – 0.070	0.056
11	> 0.070 – 0.11	0.088
12	> 0.11 – 0.17	0.14
13	> 0.17 – 0.27	0.21
14	> 0.27- 0.42	0.33
15	> 0.42	0.5

Values for the water system level and wastewater treatment levy (2023)

Water boards	Water system levy Water system levy residents (euros per housing unit)	Water system levy unbuilt-on land (euros per hectare)	Water system levy nature areas (euros per hectare)	Water system levy built-up land (% WOZ value)	Wastewater treatment levy (euros per pollution unit)
Waterschap Groot Salland (WS)					
Waterschap Rijn en IJssel (WS)	79.91	58.74	5.36	0.03362	62.76
Waterschap Veluwe (WS)					
Waterschap Vallei & Eem (WS)					
Waterschap Regge & Dinkel (WS)					
Waterschap Zeeuws-Vlaanderen (WS)					
Waterschap Zeeuwse Eilanden (WS)					
Waterschap De Dommel (WS)	50.20	69.03	3.43	0.01879	56.28
Waterschap Roer en Overmaas (WS)					
Waterschap Rivierenland (WS)	123.46	120.23	6.27	0.03680	65.68
Waterschap Peel en Maasvallei (WS)					
Waterschap Hunze en Aa's (WS)	78.07	74.47	6.48	0.03877	75.27
Waterschap Noorderzijlvest (WS)	105.05	96.19	7.63	0.04839	77.17
Waterschap Reest en Wieden (WS)					
Waterschap Velt en Vecht (WS)					
Waterschap Zuiderzeeland (WS)	93.55	118.49	11.34	0.03520	66.00
Waterschap Brabantse Delta (WS)	70.45	90.68	5.23	0.02952	68.81
Waterschap Aa en Maas (WS)	68.21	96.53	6.06	0.03160	52.08
Waterschap Hollandse Delta (WS)	114.39	114.93	6.11	0.02486	75.99
Waterschap Scheldestromen (WS)	134.96	91.53	10.87	0.05423	72.08
Waterschap Vallei en Veluwe (WS)	59.42	58.97	3.27	0.01734	65.19
Waterschap Vechtstromen (WS)	86.07	64.66	4.73	0.03079	63.67
Waterschap Limburg (WS)	71.61	75.59	4.09	0.02280	67.96
Waterschap Amstel, Gooi en Vecht (WS)	136.48	106.26	3.55	0.01252	62.37

Source: CBS (https://opendata.cbs.nl/#/CBS/en/dataset/80892ENG/table?searchKeywords=water%20system%20level) (accessed April 13, 2023).

Note: In 2023, the Netherlands has 21 RWAs. Not all of them show values in this table. It is unclear why this is the case (the same applies to the year 2022).

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