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Spain

Country report

This report captures the main messages of a review of the state of play in Spain with regards to closing the finance gap and support compliance with the EU Directives on Drinking Water, Urban Wastewater Treatment and Floods, and to a lesser extent the Water Framework Directive. It reflects OECD analyses, and official and expert opinions expressed at a national workshop held in Madrid, 25 April 2019.
The workshop focused on financing compliance towards the EU water *acquis*. It was co-convened by the Spanish Ministry for Ecological Transition, the OECD and the European Commission (DG Environment). It gathered approximately 50 delegates from national, regional and local authorities, water utilities, research institutions, civil society and financing institutions

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1. Financing compliance with the EU water *acquis* - Recommendations

Spain has one major water management challenge: water scarcity, including the need to secure water supply, manage demand for competing water uses and recover over-exploited water resources, in the face of climate change. This is reflected in water planning and management system in Spain, in order to achieve the water quantitative and water quality objectives of the Water Framework Directive (WFD).

Spain has robust environmental legislation, which adequately incorporate the requirements of the EU water acquis. However, there are several gaps in policy implementation, including in the use of economic instruments and economic regulation to manage water quantity and quality risks, and coordination across sectors (environment, agriculture and energy) and levels of government. There has been a clear progress in measurement of indicators for the WFD, but a slow progress in implementation.

Agriculture remains a key source of pressure on surface and groundwater bodies. The agricultural sector is significantly subsidised (e.g. infrastructure and water), and there is still a significant lack of accountability and incentives for performance of the various players.

In order to ensure long-term water security and to adapt to climate change, there is a need to scale up current efforts to manage water demand and allocate the resource where it creates most value, and to optimise the financial framework of the water sector. Controversial water supply augmentation options, such as dams and other large reservoirs, have largely been exhausted and seawater desalination comes at a high cost.

Complying with the EU water *acquis* delivers multiple benefits for society, the economy and the environment. While some measures can be costly, this report considers options to comply in cost-effective ways, taking account of distinctive capacities and challenges in Spain. This report identifies recommendations to assist Spain with closing the finance gap and complying with the EU water-related Directives, in the context of limited scope for additional public funding from central, regional and local authorities. Priority recommendations include:

- Scale-up demand management efforts (e.g. water abstraction charges, water supply and sanitation tariff reform including incentive pricing and pricing for long-term water security, awareness raising, digital transformation) to drive water use efficiency, recover costs, reduce the need for costly supply augmentation and relieve pressure on already over-exploited water resources. When necessary, strengthen social measures outside of the water bill, or through focalised subsidies to low-income households' demand, to address affordability issues, which are largely explained through low disposable income (household at risk of poverty or social exclusion) rather than water tariff rates.
- Continue strengthening the surface water and groundwater allocation regimes to facilitate the allocation of water to best-value uses (economic and social wellbeing), secure their long-term protection, and align permits with environmental and water conservation objectives. Robust water allocation arrangements are an important dimension of efforts to minimise further investment in costly supply augmentation. This will require an increase in efforts to review, regulate, meter, price and enforce water rights (surface and groundwater) to ensure that licenses in current use are coherent with a sustainable allocation of water resources. It may also require measures to

compensate water users affected by the reform of allocation regimes. Efforts should be prioritised in basins with high water stress and competition of water resources.

- Ensure independent economic water regulation to increase accountability, transparency and incentives for operational efficiency and financial sustainability. Such independent oversight should provide technical support to local authorities, strengthen the transition to full cost recovery tariffs and ensure consistency of tariff models/structures across regions and communities (OECD, 2018b; 2015c). Development of economic regulatory principles, and a plan to encourage aggregation of smaller providers (>8 000 municipalities), may serve as initial steps to establishing economic regulation.
- Prioritise investments in wastewater treatment in sensitive areas that maximise benefits (to society and the environment) over the long term and deliver the highest benefits in terms of compliance with the EU Urban Wastewater Treatment Directive (UWWTD) and the Water Framework Directive (WFD). Encourage reclaimed water use, artificial groundwater recharge, where appropriate and following best practices, to reduce pressures on water bodies.
- Explore options to attract commercial capital for creditworthy borrowers to finance water-related investments. Low interest rates provide an opportune time to do so. This may include exploring how public and development finance and risk-mitigation instruments (e.g. guarantees, credit enhancement instruments) can be used strategically to improve the risk-return profile of investments so that they can attract commercial finance towards compliance with public policy objectives (OECD, 2019d). Domestic commercial finance could be explored for creditworthy utilities.

Spanish authorities are well aware of the issues raised in this report, and that reform is complex and politically difficult. Long-term planning and continued cooperation and collaboration through all administrative levels (especially within River Basin Authorities) and with a range of stakeholders will be necessary to achieve successful policy reform for improved water security and sustainable growth.

2. Context

Spain has made a successful recovery from the 2009-2013 financial crisis; in the past three years, real GDP grew by around 3%, outpacing most other European economies (OECD, 2018). The public debt to GDP ratio is falling, but remains high (115% of GDP; OECD, 2019c). GDP growth is projected to slow down to 2.3% in 2019 and 1.9% in 2020, but still remains above the EU-28 projected averages of 1.5% and 1.7% (EC, 2019a).

Spain is the third most water-stressed country in the EU[1], with gross freshwater abstraction representing 28% of total available renewable freshwater resources (EuroStat, 2019c). The spatial and temporal distribution of rainfall and distribution of water resources is highly variable within the country, with annual mean precipitation ranging from 2000 mm in the North-West to less than 300 mm in the South-East (Francés et al., 2017). Climate change is anticipated to have a greater impact in Spain relative to most other EU nations (Estrela Monreal et al., 2012; Lázaro-Touza and López-Gunn 2014). Climate change is increasing temperatures and evapotranspiration rates, and significantly altering rainfall, runoff patterns and groundwater natural recharge rates; water resources are projected to reduce by 28-40% by 2050 (CEDEX, 2018). More than 74% of the Spanish territory is at risk of desertification; the regions of Murcia, Valencia and the Canary Islands are the most concerning areas, with a "high" or "very high" risk of desertification across 90% of their territory.

Spain's renewable water resources are 60% below the EU average, and their rate of water abstraction is 62% higher than the EU average (PwC-Acciona, 2014). The main driver of water challenges in Spain – both quantity and quality – is agriculture. In 2016, Spain had the second largest share of irrigable area in agriculture in the EU (15.7%; EuroStat, 2019)[2]. Agriculture accounts for about 80% of water use in Spain (2014 figure; Cifras Ine, 2018), but can be reduced to about 60% under irrigation restrictions in a dry year.

A high demand for water has resulted in challenges with diverse levels of severity: over-exploitation of surface and groundwater resources; extensive development of dams, canals and irrigation systems (with approximately 1 300 dams, Spain has one of the highest number of dams per capita in the world); but also groundwater salinisation (which affects almost 20% of irrigation (Machado and Serralheiro, 2017)); and damage to freshwater ecosystems (reduced environmental flows in rivers, decrease of sediments to deltas, hydro-morphological pressures and nutrient water pollution).

Investment in costly non-conventional supplies (e.g. desalination) and water transfers has been the approach to meet water demand, and continues be so in some basins, especially in 'closed' river basin districts (those where long-term water resources availability does not meet current demands). Conflicts among competing uses are common, and remain unresolved.

Spain enjoys universal connection to water supply and sanitation. However, in sensitive areas, 34% of wastewater is still not treated according to requirements for more stringent wastewater treatment (i.e. beyond secondary treatment). Additionally, 12% of wastewater still does not meet the requirements for secondary treatment, and 0.5% of the wastewater, corresponding to 300,000 population, is not yet

[1] Cyprus, Malta and Spain are the top three most water stressed countries in the EU (EuroStat, 2019c). Climate change already affects agriculture in Spain, with "crops migrating" to areas where they were not grown in the past.

[2] Italy has the largest share of irrigable areas in agriculture of the EU (32.6 %) (EuroStat, 2019).

collected. 1.1% or 725,000 population still apply individual sanitation systems (EC, draft 10th report, 2016 data). In addition, infrastructure is ageing and the rate of renewal is very low (0.62% in 2014; AEAS, 2019) - a reflection that the sector is poorly funded, and evidence of significant leeway for improvement in asset management practices.

Surface water flooding from torrential rainfall is the main flood risk in Spain and is anticipated to increase with continued urbanisation, a lack of sustainable urban drainage systems and extreme rainfall events amplified (in terms of intensity and frequency) by climate change. For example, in south-eastern Spain, September 2019, there were six casualties and thousands of evacuations after record rainfall and severe flash flooding and tornadoes occurred over two days.

Key features relevant to future expenditures for water supply, sanitation and flood protection are presented in Table 1.

Table 1. Key features relevant to future expenditures for WSS and flood protection

	Indicator	Value (rank if applicable)	Data Source	Year
Economy and Demographics	GDP per capita	EUR 24 100 (13/28)	Eurostat	2016
	Projected GDP growth	1.9% (20/28)	IMF	2016-2022
	Projected urban population variation by 2050	1.14x (14/28)	UN	2017-2050
Water Supply and Sanitation	Estimated annual average expenditure per capita	EUR 122*	Authors based on EUROSTAT	2011-2015
	Population not connected	0%	EC	2015
	Annual domestic sector consumption per capita (l/per capita/day)	132	AEAS	2018
	Leakage rate for public water supply	30%	EC	2017
	Non-revenue water	22%	AEAS	2018
	Compliance with UWWTD Art.3, 4 and 5 (Index)**	83% (22/28)	EC	2014
Flood Protection	Estimated annual average expenditure per capita	EUR 3 (18/27)	EC survey	2013-15
	Pop. potentially affected in flood risk areas	25%	EC report	2015
	Value of assets at risk (rise 2015-30):	0.67x (4/28)	WRI	2015-2030

Notes: A rank of 1 implies best in class among the EU member countries for which data is available for each indicator.
* more recent data communicated by Spain: EUR 149 (AEAS, 2018)
** connection to sewerage network 99%; secondary treatment 85%; tertiary treatment 63%)

Spain is a decentralised state and the design and development of water policies and water resource allocation is made by the Central government and the Autonomous Regions, in close cooperation. However, more independent regulation (to avoid political interference, increase accountability and enhance the level of service) and efforts in policy implementation and coordination processes are required.

In Spain, there is no National Regulatory Agency. Therefore, Spanish regulatory framework is less developed than in other countries. That implies a political and administrative control by every municipality over tariffs, investments, water quality and service (WAREG, https://www.wareg.org/members.php?q=view&id=24). Tariffs are surveyed by Comisiones de Precios (Price Commissions) of each Autonomous Region. Local level administrative authorities have limited technical and finance capacity.

Recent efforts on reporting and transparency are acknowledged and must continue, to ensure the reliability and the consistency of information on water prices, revenue and spending made publicly available. River

Basin Management Plans - in the cost-recovery chapter – include information on water prices, revenues and spending. This information is reported every six years to the European Commission, in line with the Water Framework Directive implementation requirements. Moreover, a national database includes information of the programmes of measures reported in each of the 25 RBMP, including economic information. The database is public and available on the webpage of the Ministry (https://servicio.mapama.gob.es/pphh-web/).

3. Characterising the financing challenge

Spain's non-compliance with the EU water *acquis* relates to a number of factors. These include:

- budgetary constraints, particularly in the aftermath of the 2009-2013 financial crisis;
- a bias towards large investment for supply augmentation (i.e. dams and major diversion projects), with relevant legacy issues;
- administrative problems with local authorities and detrimental political interference. Notably, this includes insufficient use of pricing mechanisms to incentivise efficient use (abstraction charges that reflect the opportunity cost of using water), manage water demand and recover costs for effective water services and management and to ensure long-term water security[3].

An overview of the challenges, current financing strategies and factors driving future investment needs are examined in the following subsections, on water supply and sanitation services, flood protection and the WFD (water quantity and quality).

3.1. Water supply

Spain has achieved close to full compliance with the EU Drinking Water Directive (DWD). Spain has 98% household access to safely managed drinking water supply (UNICEF and WHO, 2019), and demonstrates high compliance (99-100%) with the microbiological, chemical and indicator parameters of the DWD (EC, 2016). Most (approx. 75%) of drinking water is sourced from surface water; groundwater (20%) and desalination (5%) make up the remainder of drinking water sources in Spain (EurEau, 2017).

Water tariffs do not cover amortised costs and renewal. The average price for household water services is less than EUR 2/m^3 (EurEau, 2017); household expenditure on water supply and sanitation services is below 1% of household income on average, one of the lowest in the EU (AEAS, 2018). Water supply and sanitation tariffs are highly variable across the large number of operators (8000 municipalities): tariffs can vary by a factor 5, depending on the city or town (AEAS-AGA, 2019). Such variations are partly explained by physical conditions and actual unit costs of delivery, and partly by a significant level of entropy in tariff setting processes and the use of taxes, charges and fees. Smaller municipalities (30% of the population live in agglomerations smaller than 20,000 people; INE, 2019) face distinct challenges due to lack of capacity, scale, and financial resources, and difficulties derived by population dispersion and affordability.

Water tariffs are too low to fully recover costs (CAPEX and OPEX), or reflect the value of scarce water resources and the marginal cost of non-conventional water supply augmentation (i.e. desalination and reclaimed water) and water transfers. Due to insufficient maintenance and refurbishment, water supply and sanitation infrastructure is ageing prematurely. The distribution losses in the drinking water service

[3] 79% of the municipalities recover costs for operation and maintenance through the tariffs, but not renewal costs (AEAS, 2018). Tariffs - as they are binomial (fixed and variable part) and progressive (increasing blocks of consumption) – send a signal that higher water consumption comes at a cost.

network are about 28% (EurEau, 2017)[4]. The rate of renewal is low: according to AEAS (2018) the average renewal rate was 0.6%, similar as 2016, but lower than in 2014, when it was of 0.9%. The renewal for sewerage is about twice faster.

The water sector is financially dependent on government budgets and EU funding sources, which is not in line with the WFD cost recovery principle[5]. Financing the investment gap will be difficult. The ability to increase public spending and raise tariffs is low; public debt remains high (115%; OECD, 2019c), as is the population at risk of poverty and social exclusion (approximately 22% of the population in 2017; EuroStat, 2019b). In addition, a declining and ageing population will reduce revenue raised from water supply and sanitation tariffs[6].

The OECD estimates that a 49% increase from current spending on water supply and sanitation is needed for Spain to meet the requirements of the DWD and UWWTD[7]. A three-pronged approach of measures to minimise investment needs, optimise investment decisions, and mobilise additional finance will be required for Spain to meet the finance gap:

- Spain would benefit from a robust, long-term national strategy for water-related investment, including a thorough assessment of the state of current assets, priorities for investments, estimates and sources of finance for maintenance and renewal of infrastructure. Investments should be prioritised based on size of agglomerations and the impact on environment (e.g., discharges into sensitive areas)[8]. Engagement of regional and local authorities in investment decisions is required to avoid over-investment.
- Increase investment in targeted asset management to reduce water distribution losses and premature ageing of infrastructure, both of which are important measures to reduce investment needs, and one that Spain should prioritise. Water savings will bring additional benefits, for example by reducing pollution discharges, treatment costs and energy consumption.

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[4] AEAS (2018) estimates that non-revenue water - defined as the difference between the water supplied to the distribution networks and the one measured by the meters - is 22%. Non-revenue water is an aggregate indicator of apparent losses (authorized consumptions that are not measured or billed,; unauthorized consumption; inaccuracies of the meters) and real water losses (leaks in the distribution network and in the connections; losses due to broken pipes).

[5] Article 9 stipulates that member states will ensure an adequate contribution of the different water uses (including households) to the recovery of the costs of water services, taking account of the polluter pays principle.

[6] The 2019 population of Spain is 46.7 million and is expected to decrease by 4.2% by 2050. The current share of the population residing in urban areas is 80% and is projected to increase to 88% by 2050. A low birth rate and high life expectancy will lead to over-65s making up 37% of the population by 2050 (World Bank, 2019). But do old people use less water ?

[7] Two recent reports cover investment needs for renewal of infrastructures of the urban water cycle in Spain (drafted by AGA and Cátedra Aquae - Spanish Distance University) and options to finance them (drafted by PwC, *Towards a more efficient financing of the infrastructures of the urban water cycle in Spain*, for AEAS).

[8] At the time of drafting, The Ministry for the Ecological Transition and the Demographic Challenge was working on a National Plan of Water Treatment, Sanitation, Efficiency, Savings and Water Reuse (DSEAR Plan). The DSEAR Plan and the second cycle river basin management plans (RBMP) (2015-2021) are strongly interlinked, as the strategic objective of DSEAR Plan is to order, clarify and prioritise the measures that Spain is committed to carry out in five major themes (water treatment, sanitation, efficiency, savings and water reuse). Those measures will be revised for their inclusion in the third RBMPs (2021-2027), which are under elaboration. Within the framework of the DSEAR Plan, those measures are going to be updated in order to align with the ecological transition process and, synergistically, to comply with legal European obligations. More information on purpose and scope is available in the roadmap for the DSEAR Plan: https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/pn_dsearmemoria_consultapublica_tcm30-481891.pdf

- A long-term national strategy for water-related investment would also assist in providing a stable investment environment. With interest rates at a historical low[9], now is an opportune time to make investment decisions. A plan to encourage aggregation of smaller providers (incentives; opportunities to learn from existing experience) would help to improve economies of scale and scope and attract commercial finance; lessons can be learned from the Netherlands in this regard (OECD, 2014). Portugal is also in the process of aggregating smaller providers. There may also be opportunities to connect with broader policy objectives, including climate change adaptation and the circular economy (reclaimed water), with new revenue streams in terms of nutrient and energy recovery. Greater use of water price signals for other users, in particular agriculture, may reduce the need for costly supply augmentation and treatment of polluted water sources.
- Spain would benefit from the establishment of regulatory principles and independent economic regulation for the water sector, and water supply and sanitation tariffs. Independent economic oversight of the tariff setting process is required for robust tariffs that reflect the cost of water services and the level of water scarcity – price levels should be independent of short-term political cycles. Development of economic regulatory principles and benchmarking of the performance of water utilities may serve as initial steps to establishing economic regulation. Independent economic regulation should also promote transparency of the financing system (who pays for what). Lessons can be learned from Portugal in the establishment of an independent economic regulator as part of a transparent, stable, long-term (20+ years) roadmap.
- As tariffs better reflect the cost of the service, strengthened measures to ensure affordability for low income households will be required. Social measures outside of the water bill are the most cost-effective way of addressing affordability issues.
- Strengthening awareness-raising with broader public on the value of water security and the importance of cost-recovery to achieve, and maintain, safe water supply and sanitation services would assist with social acceptance to raise tariffs.

3.2. Wastewater collection and treatment

Spain demonstrates compliance with wastewater collection under the UWWTD; over 99% of agglomerations are compliant with wastewater collection (EC, draft 10th report, 2016 data). However, further progress is required in relation to wastewater treatment and there are extreme regional differences; seven autonomous regions have reached high compliance rates (95 - 100%), while others have large gaps, especially in the application of more stringent treatment in large agglomerations discharging into sensitive areas. On average in Spain, 12% of the wastewater load still needs to meet the requirements for secondary treatment, and 34% of the wastewater load still needs to meet the requirements for more stringent treatment in sensitive areas (EC, draft 10th report, 2016 data).

This results in negative impacts on water quality (compromising efforts to achieve the objectives of the WFD), and a lost potential (or additional costs) for further reclaimed water use (and therefore alleviation of water scarcity and water quality deterioration). Only 10% of the treated wastewater has been reported to be re-used (EC, draft 10th report, 2016 data).

There are five horizontal infringement procedures against Spain due to inadequate application of the UWWTD that cover mostly insufficient treatment in hundreds of Spanish agglomerations (around 900 agglomerations out of 2 000). The EU Court of Justice imposed the first penalties on Spain in 2018: a lump sum of EUR 12 million and daily fines calculated depending on progress. This case currently represents around 1% of the non-compliance gap, and the other four infringement procedures may gradually mature

[9] Long-term interest rates are very low, at 0.2% per annum, as are short term interest rates, at -0.4% per annum (OECD, 2019c).

to this stage (EC, 2018) in the absence of insufficient interventions. In addition, Spain is having difficulties using the EU funds allocated in the current programme 2014-2020. In 2018, there was a decrease of EUR 118 million (17%) of EU European Regional Development Funds made available for wastewater investments (696 million), managed by the central administration, because of difficulties in spending the full sum in due time. Both EU fines and an inability to spend EU funding reduce the disposable budget for water management in Spain[10].

As mentioned above, there is a high need for renewal and maintenance of urban water infrastructure, particularly for wastewater infrastructure (collection and treatment). The OECD estimates a 49% increase from current spending is required to meet the objectives of the DWD and UWWTD.

In addition to the recommendations mentioned in the above section on water supply, the following is recommended:

- Prioritise investments based on size of agglomeration and impact on environment e.g., discharges into sensitive areas, (to achieve co-benefits with the WFD).
- Extend the use of sustainable urban drainage systems (SUDs) and other natural-based solutions upstream to reduce stormwater entering sewerage networks, wastewater treatment plant overflows, and the subsequent need for further investment to increase capacity in the network and wastewater treatment plants. SUDs will also alleviate the risk of surface water flooding in urban areas through attenuating runoff.
- Harness opportunities to collect biogas and other energy fluxes to provide energy self-sufficiency of wastewater treatment plants, and attract commercial finance from the energy sector. Benefit from innovative technologies developed in Spain under the LIFE programme in this area.

Box 3.1. Water in the circular economy in Spain

AEAS (2018) includes as new indicators related to water and circular economy:

- The energy consumption of the integral water cycle per household is 117 KWh, 10 times lower than the energy used by heating water in homes
- The generation of energy by urban water services is around 456 GWh/year, equivalent to providing electricity for a year to a population of 150,000 inhabitants
- 72% of operators of urban water services have devices for energy recovery, 40% of this energy goes to self-consumption
- 63% of operators of urban water services calculate their carbon footprint. CO2 emissions are of 30.08 kg of CO2 equivalent/inhabitant/year, equivalent to 0.434% of total Spanish emissions.
- The annual production of sludge is of 701.751 tons of dry matter -90 kilos of sludge/person/year-, of which 85% are used in agriculture (biosolids), gardening and forestry; 10% for incineration or energetic valorisation; and 5% go to landfill
- 138 Nhm³/year of biogas were produced in WWTPs, which represent 4% of the total volume of gas consumed by households in cities equipped with such facilities.

[10] EU fines are passed on from Treasury to municipalities.

3.3. Flood protection

Climate change, urbanisation and a lack of sustainable urban drainage systems are increasing the risk of surface water flooding in urban areas. Spain has carried out a preliminary assessment of river basins and coastal areas at risk of flooding and produced comprehensive flood risk maps as requested by the Floods Directive (Francés et al., 2017). Flood risk management plans includes measures that address climate change impacts. Eight national objectives are set, and the flood risk management plans then prioritise these based on local circumstances. Flood risk management plans for Spain's Canary Islands have not been yet endorsed (EC, 2019d).

The vast majority of funding for flood protection measures come from the national budget; regional and local authorities have limited funds (taxes to water users at regional level only account for about 2% of funding). The Consorcio de Compensación de Seguros (CCS) (insurance compensation pool) mandates direct insurance for flood risks in property, life and personal accident policies issued by private companies. Premiums charged to households and businesses are generally flat (i.e. do not vary with the level of risk) (OECD, 2016). Spain also has a National Joint Insurance Compensation Agreement and the National Entity for Agrarian Insurance, which insure against flood risks in agriculture only (EC, 2019d).

Spain could benefit from increasing the National Fund for Climate Change Adaptation to scale-up and replicate pilot projects. The multiple benefits of nature-based solutions (see Box 2, Appendix) should be factored into investment decisions. For instance, Spain could consider the introduction of stormwater taxes to property developers for impermeable surfaces to raise revenue for flood protection measures and incentivise nature-based solutions, such as sustainable urban drainage systems. France has (limited) experience with the introduction of a tax on impervious surfaces to finance urban drainage (see OECD, 2015d). Restrictions on land development in flood plains, including wetlands, could also be introduced. For example, Canada has a "No-net-loss" wetland policy, meaning if a wetland is lost due to development, if must be off-set by investing in a wetland elsewhere.

3.4. Water Framework Directive: water quality and quantity management

Overall, the proportion of Spain's surface water bodies that fail to achieve good ecological water quality status reported in the second RBMP was 45% (year of assessment 2014) (EC, 2019e). The majority (> 95%) of surface water bodies are expected to reach good ecological water quality status by 2027 (EC, 2019e). The proportion of surface water bodies reported reaching good chemical status in the second RBMP was 87% (EC, 2019e). A large proportion of surface water bodies have been designated as heavily modified or artificial (for example, 20% of rivers) (EC, 2019e).

Some aquifers are over-exploited and degraded, particularly in South-Eastern Spain where irrigated agriculture is a key industry (both in terms of GDP and employment). Overall, 25% of groundwater bodies failed to reach good quantitative status, as reported in the second RBMP. As groundwater levels decline, pumping costs, concentration of pollution and saline intrusion all increase. Over one-third of groundwater bodies (35%) are assessed as being at risk of failing good chemical status; nitrates and salinity are the main pollutants affecting groundwater quality status. The expected date of achievement of good chemical and quantitative status of groundwater in Spain is beyond 2027 (EC, 2019e).

Spain has the largest number of exemptions in the EU linked to prolonged drought under the WFD (nine river basin districts) (EC, 2019c). Spain also applies exemptions to permitting and/or registering for small water abstractions (EC, 2019c). Although this lowers the administrative burden, it may be advantageous to remove such exemptions in areas of high water stress where a high proportion of groundwater bodies do not achieve good quantitative status, which may be due to the accumulation of small abstractions. In January 2019, the European Commission deferred Spain to the European Court of Justice over a failure

to take adequate measures to protect the groundwater bodies that feed the Doñana Wetlands, which is required as part of the both the WFD and the Habitats Directive[11] (EC, 2019b).

Addressing the poor quality of surface and groundwater related to agricultural activities is a significant challenge for Spain in achieving the WFD's objectives (EC, 2019c), and has received far less attention in policy than water quantity risks. Two of the most significant pressures on water bodies in Spain are diffuse agricultural pollution (34% of surface water bodies, 56% of groundwater bodies), and abstraction or flow diversion for agriculture (22% of surface water bodies, 32% of groundwater bodies) (EC, 2017a). Progress in implementing river basin management plans has been slow; many river basins cannot afford to implement the programme of measures outlined in plans.

Water abstraction charges for irrigation remain low in Spain (and in some cases there are no charges, especially from groundwater sources) and do not incentivise reductions in water use or increases in water use efficiency, or raise sufficient revenue for cost recovery (in particular concerning opportunity costs and the cost of negative environmental externalities). Irrigation with desalinised water, blended with other sources, is charged at the same low price – regardless of costs of supply and local water scarcity - for "fairness" reasons. Low water prices have encouraged capital misallocation to water intensive, low productivity uses in the agricultural sector (e.g. some farms have low-value crops and negative margins), weighing down on productivity[12] (OECD, 2017b). Illegal groundwater abstractions[13] and senior water rights constrain an already complex and controversial water allocation system. Barriers including restrictions on who can buy and what rights can be sold are impediments to the efficient reallocation of water rights to their highest value uses.

While there have been efforts to move towards a more coherent approach on irrigation, balancing agriculture and environmental objectives, the government still relies on technical irrigation efficiency improvements with EU (CAP) funding that will not likely be sufficient (and could bring little water savings). Combining all available technological solutions will not be sufficient for agriculture to withstand climate impacts (de Roo, 2019 *pers comms*.).

The following is recommended to reduce pressure on Spain's water resources:

- Prioritise investments to maximise environmental and social benefit. For example, target pollution hotspots, sensitive water streams and investments that provide multiple benefits (e.g. nature based solutions to achieve objectives of both the WFD and Habitats Directive). Integrate uncertainty and future projections into infrastructure design; historical patterns are no longer a robust basis for future planning.
- Introduce cost-effective water pricing to signal the value of water and limit the pressure on water resources. Groundwater and surface water abstraction charges should be set in a manner coherent with each other, to account for potential substitution effects. Reclaimed water use charges should be below freshwater charges to encourage wastewater reuse and avoid a switch to groundwater pumping. Where water abstraction is metered, a volumetric charge should be applied. If abstraction is unmetered, a flat abstraction charge or one based on a proxy, such as area of irrigated land, can be used as a more rudimentary alternative in the interim (Ambec et al., 2016). The price should reflect the trade-off between mining water now or in the future (OECD, 2017). Increase collection

[11] The water-dependent wetlands - among the largest in Europe with a great diversity of ecosystems - have deteriorated due to large amounts of water being diverted for agriculture and the needs of local tourists (EC, 2019b).

[12] If resources are under-priced relative to their full economic and environmental cost firms will over-invest in inefficient production processes and activities resulting in poor productivity performance, especially once environmental damage is taken into account. For example, over 30% of irrigated water in 2015 was being used for low value cereal and rice crops in 2015 (Magrama, 2015).

[13] Estimates range from 25 000 to 510 000 illegal or unofficial wells (Refer to OECD, 2015e for more information).

of water bills, particularly for illegal abstractions. Earmark revenues from abstraction charges to fund water restoration activities. Lessons learned from Israel, particularly regarding differentiated water pricing based on the cost of the resource (including reclaimed water), are relevant (OECD, 2017b; Gruère et al. 2018).

- Improve the water allocation and trading regime to reduce water stress, particularly in basins where water is over-allocated or over-used. Recent temporary measures introduced by decree law in 2015 in response to drought that allow the sale of water rights to a wider set of users and the sale of water rights not used in the previous year (e.g. following the 'use-it-or-lose-it' clause that prevails in US Western States), go in the right direction and should be made permanent, provided encompassing measures are adopted to avoid moral risk. An additional measure to consider is making it obligatory to give up a proportion of water when water rights are traded. Application of the OECD Health Check on Water Resources Allocation (Box 1, Appendix) may identify other areas for improvement in Spain's water allocation regime, as can the recent reform in England and Wales (DEFRA, 2019). Define a viable strategy for irrigated agriculture in line with sustainable surface and groundwater management, and the requirements of the EU Water Framework Directive, as part of reforming the water allocation regimes.
- Groundwater bodies with over-abstraction problems are well identified in Spain. Extend metering, water abstraction controls and review of licenses and water abstraction registers, including small abstractions in high water stress areas. Aquifer recharge with reclaimed water could be further promoted, to reduce pressure on groundwater resources and reduce salinity, following best practices. Lessons can be learned from Tucson, Arizona, where demand management and artificial groundwater recharge with reclaimed water has helped to eliminate groundwater mining (OECD, 2017c).
- Take advantage of diverse funding sources (e.g. climate adaptation funds, EU Natural Capital Facility, insurance premiums).
- Broaden the environmental tax base to the recovery of environmental and resource costs associated with damage or negative impact on the aquatic environment, according to the polluter-pays principle. Consider the introduction of fertiliser and pesticide taxes to reflect environmental externalities associated with water pollution. Revenues from an environmental tax in Spain could be earmarked for measures that facilitate the transition to sustainable farming practices that contribute to good ecological status of water bodies (e.g. education and advisory services to develop and support implementation of farm irrigation and nutrient management plans) or to cover costs of river basin authorities. Lessons can be learned from Norway on the use of a tax that reflects the environmental and health-related risks and costs of pesticides (OECD, 2017b). Lessons can also be learned from Portugal who established a Portuguese Water Resources Tax in 2008 (modified in 2017) as way of addressing recovery of environmental and resources costs as required by the WFD. The tax is "an economic and financial instrument aimed at compensating the benefits resulting from the private use of the public water resources, the environmental cost inherent to activities which are susceptible of having a significant impact on water resources, and the administrative costs necessary for the planning, management, surveillance and assurance of water quantity and quality". The tax is paid for the following: i) private use of public water; ii) pollutant discharges, direct or indirect, which are likely to have significant impacts; iii) extraction of inert materials from the water public domain (e.g. sand from river beds); iv) occupation of land or water surface belonging to the national "public water domain"; and v) all uses of water that are subject to public planning and management which can have a significant impact (Ana Albuquerque, *pers comms.*, 2019). Also, the confederaciones hidrograficas could adopt the same polluter-pays and abstractor-pays principles as the French Agences de l'Eau.

Appendix

Box 1. "Health Check" for Water Resources Allocation

1. Are there accountability mechanisms in place for the management of water allocation that are effective at a catchment or basin scale?
2. Is there a clear legal status for all water resources (surface and groundwater and alternative sources of supply)?
3. Is the availability of water resources (surface water, groundwater and alternative sources of supply) and possible scarcity well-understood?
4. Is there an abstraction limit ("cap") that reflects in situ requirements and sustainable use?
5. Is there an effective approach to enable efficient and fair management of the risk of shortage that ensures water for essential uses?
6. Are adequate arrangements in place for dealing with exceptional circumstances (such as drought or severe pollution events)?
7. Is there a process for dealing with new entrants and for increasing or varying existing entitlements?
8. Are there effective mechanisms for monitoring and enforcement, with clear and legally robust sanctions?
9. Are water infrastructures in place to store, treat and deliver water in order for the allocation regime to function effectively?
10. Is there policy coherence across sectors that affect water resources allocation?
11. Is there a clear legal definition of water entitlements?
12. Are appropriate abstraction charges in place for all users that reflect the impact of the abstraction on resource availability for other users and the environment?
13. Are obligations related to return flows and discharges properly specified and enforced?
14. Does the system allow water users to reallocate water among themselves to improve the allocative efficiency of the regime?

Source: OECD (2017c), *Groundwater Allocation: Managing Growing Pressures on Quantity and Quality*, OECD Studies on Water, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264281554-en

Box 2. A Boosting investments in nature-based solutions

Nature-based solutions (NbS) involves the use of natural or semi-natural systems that utilise nature's ecosystem services in the management of water resources and associated risks (OECD, 2015c). NbS are increasingly part of the response to water-related risks. For example, conservation or expansion of floodplains can increase water infiltration and reduce flooding risks to cities, while simultaneously supporting agricultural production and wildlife, and providing recreational and tourism benefits. Likewise, permeable pavements and the creation of green spaces can enable surface water to infiltrate the soil, replenish aquifers, and reduce polluted stormwater runoff. The equivalent traditional engineered ('grey') infrastructure solutions include dams, dykes, artificial groundwater recharge, and wastewater treatment plants.

In certain cases, it has been shown to be cost-effective for cities to combine investments in both NbS and grey infrastructure (OECD, 2015a). Apart from having a lower environmental impact, investments in NbS are generally: less capital intensive; have lower operation, maintenance and replacement costs; avoid lock-in associated with grey infrastructure; and appreciate in value over time with the regeneration of nature and its associated ecosystem services (as opposed to the high depreciation associated with grey infrastructure). NbS can also avoid or postpone the costs of building new, or extending existing, grey infrastructure. They can therefore help communities stretch their infrastructure investments further by providing multiple environmental, economic and social benefits.

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