Organisation for Economic Co-operation and Development

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Republic of Cyprus

Country report

This report captures the main messages of a review of the state of play in Cyprus 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 Nicosia, 14 March 2019.
The workshop focused on financing compliance towards the EU water *acquis*. It was co-convened by the Cyprus Ministry of Agriculture, Rural Development and Environment, the OECD and the European Commission (DG Environment). It gathered approximately 60 delegates from national and local authorities, water utilities, and financing institutions.

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

The Republic of Cyprus has two major water management challenges: 1) water scarcity, including the need to recover over-exploited aquifers and finance costly non-conventional water supply (seawater desalination and wastewater reuse); and 2) financing expansion of sewerage and wastewater treatment, particularly in rural areas and small agglomerations. Climate change, agricultural irrigation, and population and tourism growth, are the main factors impacting water availability and demand, and driving the need for water supply and sanitation (WSS) infrastructure investment.

There is an urgent need to rethink and optimise the financial framework of the water sector in Cyprus, especially given that most potable water comes from expensive seawater desalination plants. The 2012 financial crisis, and the ensuing budgetary constraints and difficult trade-offs that had to be made on investment in the water sector, highlight the risk of relying on public taxes. Local authorities, particularly community administrations, have limited technical and finance capacity. Unless necessary additional reforms are implemented, the newly achieved potable water security in Cyprus may be threatened in the medium to long term.

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 Cyprus.

This report identifies a number of recommendations to assist Cyprus with closing the finance gap and managing the transition towards sustainable water management, 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. recent water supply and sanitation tariff reform, abstraction charges, awareness raising) to drive water use efficiency, reduce the need for costly supply augmentation and relieve pressure on already over-exploited water resources. Specifically, this should include:
  - Ensure that WSS tariffs achieve full cost recovery in all administrative regions, including small communities, to drive water use efficiency; this is especially important for a water scarce country like Cyprus. Another option is a seasonal tariff to generate revenue from tourists for WWS services in the peak season (e.g. like in south France and Los Angeles, USA), and better cover the high cost of desalinated water.
  - Aim at reducing non-revenue water to an acceptable level by reducing leakage (for the purpose of this project, 10 or 20% were arbitrarily set at appropriate levels of leakage) and increasing collection of water bills, especially under the jurisdiction of municipal water departments and community boards.
  - Increase the freshwater abstraction charges to all users to signal the value of water and limit the pressure on water resources, particularly groundwater. Groundwater and surface water abstraction charges should be set in a manner coherent with each other, to account for potential substitution effects.

  - Earmark revenues from abstraction charges to fund water restoration activities (such as artificial groundwater recharge or measures to reduce diffuse water pollution).
- Develop a sustainable financing strategy for operation and maintenance of water infrastructure in municipalities and small communities (accounting for the back-log of under-investment in maintenance over the past decades), in cooperation with national and local authorities. This should include ensuring that revenues collected from water supply and wastewater tariffs are sufficient to cover, and earmarked for, the total expenditure (TOTEX) of utilities. Without a financing strategy, delays in implementation of the EU water *acquis* and dependence on EU funding may continue.
- Prioritise investments in sewerage and wastewater treatment (as outlined in the National Implementation Plan), and nature-based solutions for flood management (see **Error! Reference source not found.**, Appendix), that maximise benefits (to society and the environment) over the long-term and deliver the highest benefits in terms of compliance with the EU water *acquis*.

2. Context

The Republic of Cyprus' economy has grown strongly in recent years (4.2% in 2017), at rates well above the EU-28 average (2.4% in 2017) (EC, 2019a). Despite this, GDP per capita in 2017 was 15% below the EU-28 average (EuroStat, 2017). Since the 2012 financial crisis, Cyprus has been under budgetary constraints, with high reliance on funding from, and financial control by, the European Commission (EC), European Central Bank and the International Monetary Fund. GDP growth is projected to slow down to 3.3% in 2019 and 2.7% 2020, but still remains above the EU-28 projected averages of 1.5% and 1.7% (EC, 2019a).

Cyprus - the third largest island in the Mediterranean - is one of the most water-scarce countries in the world with a semi-arid climate and limited natural water resources. Rainfall is highly variable and successive years of drought are common. Climate change is already felt acutely, with a 20% reduction in average rainfall, and 40% reduction in water runoff into reservoirs, since the early 1970s (EC, 2009). This has led to unsustainable levels of groundwater abstraction, and substantial infrastructure investments in dams, seawater desalination and wastewater reuse to maintain water security.

Securing water supply and managing demand for a growing and urbanising population[1], as well as increasing tourism, in the face of climate change, will be an ongoing challenge for Cyprus. In the past 30 years, the economy has shifted from agriculture to light manufacturing and services. The services sector, including tourism, contributes over 80% to GDP and employs more than 70% of the labour force. Agriculture is responsible for <3% of GDP[2]; potatoes and citrus are the principal export crops. Both the agriculture and tourism sectors consume large volumes of water (64% and 5% respectively[3]) and there is room for efficiency improvements (Marin et al., 2018).

Despite near universal connection to water supply, significant wastewater collection and treatment challenges remain, especially for rural areas and small agglomerations. Cyprus has one of the lowest rates of compliance in the EU with Article 3 (connection to sewer systems) of the Urban Wastewater Treatment Directive (EC, 2017).

Over-abstraction of groundwater resulting in the depletion of aquifers and saline intrusion is a major problem in Cyprus, and a principle reason the nation fails to achieve the WFD's objectives.

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[1] The current population of Cyprus is 1,196,000 and is expected to increase steadily to 2050. The share of population residing in urban areas is 67% and is projected to increase to 74.5% by 2050 (UN, 2019).

[2] The agricultural sector, while contributing less to overall GDP (due to the rapid growth of the services sector), is still important for the Cypriot economy in terms of social cohesion, countryside and local tradition, and employment. The Cypriot food industry generates 3.6% of GDP, contributes 3.7% to total employment and provides 15.9% of total export value.

[3] These figures are an estimate only; in practice the percentage of water allocated each year to agriculture varies depending on rainfall variability and water availability. In addition, the irrigation water used from private boreholes is unknown. Of note, the tourism sector accounts for approximately 5% of total water use, but 14% of potable water (Marin et al., 2018).

Surface water flooding from heavy rainfall is the main flood risk in Cyprus and is anticipated to increase with continued urban sprawl, a lack of sustainable urban drainage systems and extreme rainfall events associated with climate change (EC, 2015).

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 21 300 (15/28)	Eurostat	2016
	Projected GDP growth	2.2% (14/28)	IMF	2016-2022
	Projected urban population variation by 2050	1.25x (6/28)	UN	2017-2050
Water Supply and Sanitation	Estimated annual average expenditure per capita	EUR 269	Authors based on EUROSTAT	2011-2015
	Population not connected to public water supply	0%	EUROSTAT	2015
	Annual domestic sector consumption per capita	n.a.	EUROSTAT	
	Leakage rate for public water supply	8%	EC	2017
	Non-revenue water	c22%	EurEau	2017
	Compliance with UWWTD Art.3, 4 and 5	65%; 86%; 85%	EC	2017
Flood Protection	Estimated annual average expenditure per capita	EUR 1 (26/27)	EC survey	2013-15
	Population potentially affected in flood risk areas	18%	EC report	2015
	Value of assets at risk (rise 2015-30):	2.47x	Authors based on WRI	2015-2030

Notes: Rank 1 implies best in class among the EU member countries for which data is available for each indicator.

All decisions related to water policies in Cyprus - including tariffs for domestic supply and sanitation[4] services, abstraction charges, and annual allocations of water from dams and other sources - are made at the level of the Council of Ministers. This reflects the strategic importance of water management in a context of extreme water scarcity. It also creates a risk of political interference with priorities not related to water management and service provision; Cyprus does not have independent economic, drinking water or environmental regulation[5]. Local authorities, particularly community administrations, have limited technical and finance capacity. The Water Boards who service the major cities (Nicosia, Limassol and Larnaca) have more able technical capacity and supporting finance policies.

The Water Development Department (WDD) is responsible for the development and operation of dams and reservoirs, desalination, as well as infrastructure needed for the conveyance, treatment and distribution of bulk water to Urban Water Boards, municipalities and communities, who then redistribute to

[4] Wastewater tariffs are approved by the House of Representatives.

[5] Regulation that is independent of policy-making is important in delivering confidence to consumers, legal services providers, investors and society as a whole. Regulators are key players in the policy arena with an active role in implementing public policies, and overseeing delivery bodies, and are defined “as an entity authorised by statute to use legal tools to achieve policy objectives, imposing obligations or burdens through functions such as licensing, permitting, accrediting, approvals, inspection and enforcement” (OECD, 2016a). More in the importance of, and principles and options for, independent water regulation is provided in OECD (2018).

the final users. A significant number of municipalities and small communities manage their own water resources (mainly groundwater), amounting to 15% of the total drinking water in the country.

3. Characterising the financing challenge

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

- budgetary constraints, particularly in the aftermath of the 2012 financial crisis;
- a bias towards investment for supply augmentation (as opposed to demand management);
- weak capacity to set investment priorities on the basis of benefits in terms of compliance with EU water *acquis*; and
- administrative problems with local authorities (municipalities and communities), particularly regarding capacity to finance, implement and enforce policy, and efficiently operate water and sanitation services. This includes lack of capacity to collect water charges and reduce leakage in the water systems. Notably, revenues from water and sanitation tariffs are not earmarked to finance the operation and maintenance activities of utilities, resulting in decades of under-funding of asset management and deteriorating infrastructure.

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

Cyprus has made significant progress towards implementation of the EU Drinking Water Directive (DWD). Cyprus has 100% access to public water supply, demonstrates high compliance (99-100%) for microbiological and chemical parameters of the DWD, and 96.3% compliance with indicator parameters (EC, 2016). However, maintaining water security in the face of climate change, ageing infrastructure, and population and tourism growth will be a key challenge for Cyprus going forward (the tourism sector already accounts for approximately 14% of total potable water use (Marin et al., 2018)). A strong focus on water supply augmentation (instead of demand management), high levels of non-revenue water and the lack of a sustainable financing system for operation and maintenance of water service infrastructure are issues that need to be addressed.

Most efforts to increase water security have focused on the exploitation of groundwater resources, increasing capacity for water storage (and transfers), seawater desalination and wastewater reuse, particularly in the wake of multi-year droughts:

However, achieving potable water security through supply augmentation has come at a cost:

- Following severe aquifer depletion and the subsequent large-scale development of dams, the flow of non-perennial rivers have been greatly reduced and ecosystems have been disrupted (Marin et al., 2018).
- Given the high rainfall variability and occurrence of droughts, on average, only 30% of the total dams' storage capacity has been used since 1990 (Marin et al., 2018). Furthermore, the

development of dams led to the destruction of many natural habitats in the Troodos Mountains (and in the plains downstream the dams).

- 80% of the total Water Development Department (WDD) budget is dedicated to water supply augmentation, and the operation and maintenance of water infrastructure, a large proportion (50%) of which is used to purchase desalinated water (WDD, 2018). This budgetary allocation leaves minimal scope for meeting the significant investment needs for sewerage and wastewater treatment.
- Energy costs in the water sector account for 35% of the operation and maintenance costs of infrastructure (WDD, 2018). The four large desalination plants together consume a significant proportion of the total electricity generated (Marin et al., 2018). Improving energy efficiency can contribute to minimising O&M costs for WSS users; non conventional energy sources could be used to desalinate water.

Overall, urban water supply and sanitation tariffs in Cyprus (both from water boards and municipal departments) are lower than in most other European countries (Marin et al., 2018). In small communities, 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 wastewater reuse). In principle, water tariffs should include capital, O&M and replacement costs, as well as the costs of negative externalities[6].

Water tariffs in cities served by water boards were revised in 2017 to recover full costs, as per the 2014 Cyprus "Pricing and Mechanisms for Recovering the Cost of Water Services Regulations (KDP128/2014)", which aims to transition water tariffs toward full cost recovery. Potable water tariffs of water boards and municipal departments (which serve about 70% of the population) are based on a progressive volumetric charge, plus a fixed charge, with all customers being metered.

Water tariffs are lower for rural areas and villages served by community boards (which represent about 30% of the population); they vary between EUR 0.10 and 1.2/m^3 (Marin et al., 2018). One barrier to imposing higher tariffs is that the central government does not have significant power to push for full cost recovery in many rural areas and some urban areas; water charges are set solely by community (water) boards and local authorities. As most villages depend on their own boreholes and springs, demand is essentially constrained only by the local water resources (alternative/unconventional water sources are not available in villages).

As a result of insufficient cost recovery in small communities, and the fact that revenues collected accrue to local government budgets (for expenditure not related to water services), the water sector is financially dependent on central and local authority tax revenue for both capital costs (especially for bulk potable water and wastewater reuse). Premature ageing of water infrastructure (including pumping stations) and high leakages (non-revenue water) in some areas (up to 50%) is a reflection of the absence of a sustainable financing system for O&M, including a lack of reinvesting revenue from tariffs back into O&M. Given Cyprus' scarce water resources and reliance on desalination, leakages represent an expensive waste of resource and a lost revenue opportunity. Earmarking of revenue from tariffs as a secure source of finance for maintenance of infrastructure is necessary to prevent leakages and premature ageing of infrastructure. In small communities, a sustainable financing model is required, linking volumetric consumption to tariffs that recover all costs (including for expansion of infrastructure and for the back-log of under-investment in maintenance) and to create sufficient incentives for water conservation.

[6] In accordance with Article 9 of the WFD, water tariffs for all users should allow for the adequate cost recovery of water services, including environmental and resource costs. Prices should be proportional to the pressures imposed on aquatic ecosystems, and must provide adequate incentives for users to use water resources efficiently and thereby contribute to the environmental objectives' of the WFD.

The OECD estimates that a 28% increase from current spending on water supply and sanitation is needed for Cyprus to meet the DWD and UWWTD. A three-pronged approach of measures to minimise investment needs, optimise investment decisions, and mobilise additional finance is required to close the finance gap. In addition to the priority recommendations in the first section, Cyprus should consider the following:

- Create a single, comprehensive information framework about assets, costs and levels of performance of water infrastructure to support the Water Development Department (WDD) and local authorities to prioritise investments effectively, inform investment appraisals and find ways to reduce the costs of meeting legislative requirements of the EU water *acquis*. Understanding marginal costs and benefits is required to take full advantage of available finance, improve choice selection of investment decisions, and gain the support of the Ministry of Finance and the Council of Ministers.
- Establish benchmarking and public reporting of operators of water supply and sanitation services to increase accountability, transparency and incentives for operational efficiency and financial sustainability. Aim at reducing non-revenue water by reducing leakage and increasing collection of water bills, especially under the jurisdiction of municipal water departments and community boards. Independent economic oversight could provide technical support to local authorities, strengthen the transition to full cost recovery tariffs and ensure consistency of tariffs across regions and communities (OECD, 2018; 2015d). 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.
- Explore mechanisms to enable further agglomeration of municipal and local services in Cyprus to improve the operational efficiency and financial sustainability of WSS services. 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 Portugal or the Netherlands in this regard (OECD, 2014).
- Further increase overall WSS tariffs, especially in small communities, to ensure adequate funding for WSS service providers and control water consumption; overall, urban water supply and sanitation tariffs in Cyprus (from water boards, municipal departments and small communities) are lower than in most other European countries (Marin et al., 2018). Any affordability concerns should be addressed outside of the water bill, with targeted social measures. Consider a seasonal tariff to generate revenue from tourists for WWS services in the peak season. For example, in Los Angeles, US, the tariff is progressive (two blocks), seasonal (higher in the three summer months, and also all year-round in a drought year)[7] (OECD, 2015). Some tourist locations in France also have seasonal tariffs for WSS services, designed to solve the cost recovery problem without having to increase the fixed part too much.
- Explore options to attract commercial capital for creditworthy borrowers to finance water-related investments. 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 that can attract commercial finance (OECD, 2019).

3.2. Wastewater collection and treatment

After Cyprus joined the EU in 2004, the investment required in wastewater collection and treatment to meet the requirements of UWWTD was estimated by Cyprus to be EUR 1.4 billion. However, in the aftermath of the 2012 financial crisis (and the ensuing restrictions on the national budget), the sewerage investment effort to comply with the UWWTD largely came to a halt. Investment needs in wastewater-collecting

[7] Note that tariffs are also adjusted to lot size (large properties are considered as having larger “essential” needs for their gardens and have a larger first block), which actually risks to subsidise more well-off households.

systems and treatment plants are forecast to reach about EUR 750 million by 2026 (EC, 2018). Compliance in small agglomerations and rural areas will require significant efforts, not just financially (high marginal cost of increasing access to sanitation to the last agglomerations), but also to address local capacity gaps (including enhancing staff capacity for in-house planning, economic analysis, environmental monitoring, enforcement and stakeholder engagement).

Cyprus has one of the lowest rates of compliance with Article 3 of the UWWTD in the EU[8] and has been referred to the EU Court of Justice for failure to ensure that all agglomerations with a population of more than 2,000 inhabitants have adequate collection and treatment systems for urban wastewater[9]. In addition, this results in negative impacts on water quality (compromising efforts to achieve the objectives of the WFD), and a lost potential for further wastewater reuse (and therefore alleviation of water scarcity).

Revenues from sewerage charges and from selling reclaimed wastewater are insufficient to recover all costs for wastewater collection and treatment; Cyprus is reliant on government funds and EU funding.

As mentioned above, the OECD estimates that a 28% 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, Cyprus should prioritise investments in sewer networks and wastewater treatment that maximise benefits (to society and the environment) over the long-term and deliver the highest benefits in terms of compliance with the EU water *acquis*. For instance, prioritise investment in wastewater services of larger agglomerations and in ecologically sensitive areas to maximise positive impact. As compliance with the UWWTD increases, expand wastewater reuse, where appropriate, to reduce pressure on groundwater reserves.

3.3. Flood protection

Climate change, urban sprawl and a lack of sustainable urban drainage systems are increasing the risk of surface water and riverine flooding in urban areas. According to OECD projections in this study, urban damage from flooding and the value of assets at risk is expected to increase by 250% by 2030. The cost of Flood Risk Management Plan (FRMP) programme of measures in Cyprus is estimated at EUR 19 million; the lowest amount in the countries assessed in the EU (EC, 2019d), in part a reflection of the size of the nation. The main source of funding for the proposed programme of measures is the central government (i.e. general taxes), with co-finance from EU structural funds (Cohesion Fund and Regional Development Fund).

Until recently (2014), Cyprus had no flood risk maps, with development in flood plains permitted and no designation of protection zones for rivers. Nineteen significant flood hazard areas have been identified. The target is to protect existing urban areas at risk of a 20-year flood with levees and dams; this is still a low level of protection. Cyprus has made efforts to raise awareness, and promote the use, of flood insurance schemes with local authorities (EC, 2019d).

There is a need for policy coherence and coordination of spatial planning to reflect flood risks; urban sprawl and misalignment of urban planning with flood risks translates into additional, and unnecessary, exposure and vulnerability to flood risks, and therefore a financial burden. Despite the 2010 Integrated Management

[8] According to the latest EC report on the implementation of the UWWTD (EC, 2017), Cyprus' compliance with Article 3 in 2014 (latest year) was 65%; only Bulgaria (26%) and Slovenia (61%) were worse off.

[9] In March 2019, the EC referred Cyprus to the Court of Justice for failure to ensure that all agglomerations with a population of more than 2,000 inhabitants have adequate collection and treatment systems for urban wastewater, as required under UWWTD. Full compliance with the UWWTD is not expected by the Cypriot authorities before 2027 (EC, 2019b); the final deadline for Cyprus to reach compliance was 31 December 2012. Although some progress has been made, 31 agglomerations remain without wastewater collection or appropriate wastewater treatment (EC, 2019b). Cyprus will have substantial legal work and planning to do on how to respond to the EC infringement.

Law and the 1st Cyprus Flood Risk Management Plan which have measures to encourage cooperation, there is no effective coordination mechanism that collectively manages flood risk: the Ministry of Interior manages flood planning; municipalities manage urban development planning; and a mixture of local authorities, sewerage boards and stormwater boards manage flood risks. Local authorities rely heavily on central government grants and EU structural funds (dams) for flood protection, and have shown a preference for expensive grey infrastructure solutions that require minimal land use (in comparison to nature-based solutions).

Cyprus could benefit from the following recommendations to improve flood management:

- Improve coordination between land use planning and flood management to manage urban sprawl and flood hazards, and minimise investment needs for flood protection. There may be options to align incentives through insurance schemes and value-capture mechanisms (such as local taxes on property value) and insurance schemes. Lessons can be learned from other countries with mature insurance markets, as there is a wide variety of approaches, with clear trade-offs. In some countries, such as Germany, private insurance companies offer coverage for flood-related damages and losses, either as part of standard property and business interruption policies, or available as an optional add-on to such policies. In others, such as France, coverage for flood damage is covered by insurance companies; the damages from large floods can be covered by a "cat nat" fund, replenished by insurance companies. Different approaches to insurance achieve different policy objectives, such as broad availability and affordability of coverage, solidarity in terms of loss-sharing across regions, or establishment of clear incentives for risk reduction and/or significant transfer of risk to private markets (OECD, 2016b).
- Expand the use of nature-based solutions, such as restoration of wetlands and natural floodplains, and sustainable urban drainage systems (SUDs), to alleviate flood risks. Lessons can be learned from the Dutch 'Room for the River' policy (OECD, 2014) and payment for ecosystem service schemes in the UK (OECD, 2017b). Taxes on impervious surfaces in urban areas or to property developers can incentivise reductions in stormwater runoff and finance a greater proportion of urban land to be connected to a drainage system with stormwater treatment. In Austin, Texas, drainage fees are used to reduce risks of flash flooding, erosion and water pollution (OECD, 2017b). In addition to alleviating surface flooding, nature-based solutions can reduce stormwater entering sewer networks, combined sewer overflows, and the subsequent need for further investment to increase capacity in sewerage and wastewater treatment plants. They also provide a host of other co-benefits including recreational, water quality, carbon sequestration and biodiversity benefits (see **Error! Reference source not found.**, Appendix).

3.4. Water Framework Directive: water quality and quantity management

Overall, the proportion of Cyprus' surface water bodies in good ecological water quality status reported in the second RBMP was 58% (year of assessment 2013) (EC, 2019e). Diffuse pollution affects most (70%) surface water bodies that fail to achieve good ecological water quality status of the WFD. Hydromorphological pressures (water abstractions, habitat alterations) affect over 40% of water bodies (Dörflinger, 2019).

The proportion of rivers reported reaching good chemical status in the second RBMP was 86%. For lakes, 13% achieved good chemical status; the water quality status of 88% of lakes is unknown. Most water bodies that were classified, were classified with low confidence (58%); a significant number of water bodies

(approximately one-quarter of rivers and one-third of lakes) were classified in the absence of monitoring data[10] (EC, 2019e).

Aquifers are over-exploited and degraded. Agriculture is a major pressure on aquifers in Cyprus; 70% of groundwater consumption is used for irrigation and diffuse pollution affects the quality of groundwater. Only 24% of groundwater bodies were reported to reach good quantitative status in the second RBMP; a reflection of groundwater abstraction exceeding the total available groundwater resource. The expected date of achievement of good quantitative status in Cyprus is beyond 2027 (EC, 2019e). As groundwater levels decline, pumping costs, concentration of pollution and saline intrusion increase. One-third of groundwater bodies (33%) are assessed as being at risk of failing good chemical status.

Cyprus has established drinking water protected areas (i.e. protected upstream catchments) but sites are not monitored or reported on (EC, 2019c). The use of recycled water is promoted for irrigation (low tariffs) and the recharge of aquifers to minimise dependency on rainfall and diminishing groundwater reserves.

Two common barriers to implementation of supplementary measures to meet the requirements of the WFD (art. 11.4) in Cyprus include: lack of investigative/research work (which is associated with limited staff and capacity); and insufficient funding/finance (Dörflinger, 2019; WRc, 2015). This is demonstrated with high levels of unknown water quality status, inadequate groundwater management, and lack of monitoring and reporting on environmental quality (including drinking water protected areas). Weak water allocation policies and lack of enforcement also impede implementation of the WFD.

Abstraction charges for freshwater and reused water remain low in Cyprus (Table 2). Price is differentiated based on the type of use, and reused water is highly subsidised. In 2016, groundwater abstraction fees for private boreholes were established as part of the 2014 "Pricing and Mechanisms for Recovering the Cost of Water Services Regulations (KDP128/2014)". However, revenue collected from abstraction charges by the WDD are not earmarked for water restoration; revenue goes to the Ministry of Finance. Challenges remain in implementing the new policy. The quantity and status of boreholes is unknown; some are abandoned and others illegal. Some irrigation licences have unlimited abstraction from ephemeral rivers. Dealing with these legacy issues will be a difficult task. The WDD in the process of verifying, and transferring to digital records, 122,000 licenced boreholes inherited from the Ministry of Interior in paper form. The aim is to develop a water management plan for each of the aquifers and surface water bodies in Cyprus to bring the system into compliance with the EU water *acquis*.

Cyprus anticipates receiving EUR 213.79 million in funding from the EC for the second Programme of Measures in the River Basin Management Plan (RBMP).

[10] The classification of unmonitored river water bodies is undertaken using a grouping procedure, where river water bodies of same river type and same pressure level are grouped (based on a statistical procedure combining pressures indices with monitoring/status data). However, not all groups of water bodies are monitored.

Table 2. Freshwater and reused water prices for raw water supplied by the WDD, 2017

Use	Water selling price (EUR/m^3)	
	Freshwater	Reused water
Industry	0.25	
Individual users (farmers)	0.17	0.07
Irrigation associations	0.12	0.02
Livestock	0.17	
Football grounds and golf courses	0.36	0.12
Green areas and parks	0.23	0.17
Water for irrigation over the quota	0.45	Increase by 50%

Source: Marin et al. (2018).

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

- 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, and maximise economic, social and environmental welfare. 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, report and enforce abstractions (surface and groundwater) to ensure that abstraction licenses in current use are coherent with a sustainable allocation of water resources. Small abstractions exempted from abstraction charges should be reviewed in areas with significant abstraction pressures. **Error! Reference source not found.** (see Appendix) provides a checklist for Cyprus to evaluate their water allocation regime.
- Define a viable strategy for irrigated agriculture in line with sustainable aquifer management and the requirements of the EU Water Framework Directive, as part of reforming the water allocation regimes.
- Introduce integrated, cost-effective water pricing to signal the value of water to all users and limit the pressure on water resources, particularly groundwater. Groundwater and surface water abstraction charges should be set in a manner coherent with each other, to account for potential substitution effects. Cyprus should make efforts to transition to metering of water abstraction so that a volumetric charge may be applied (Ambec et al., 2016). The price should reflect the trade-off between abstracting water now or in the future, particularly for non-renewable groundwater resources (OECD, 2017). Increase collection of water bills, particularly for unregistered abstractions and deal with illegal abstractions. Earmark revenues from abstraction charges to fund water restoration activities (e.g. artificial recharge of groundwater).
- As part of reforming water pricing for surface and groundwater resources, there is scope to increase charges for wastewater reuse for irrigators to contribute to the costs of wastewater treatment plants and reused water distribution networks. This is justified given that reused water is highly subsidised and that demand for this reliable irrigation source currently outstrips supply for farmers. However, water reuse charges should remain below, and competitive with, freshwater charges to avoid a switch to groundwater pumping. Lessons learned from Israel, particularly regarding differentiated water pricing based on the cost of the resource, are relevant (OECD, 2017b).
- Enforce regulations to comply with the EU Nitrates Directive (1991), which aims to protect water quality by preventing nitrates from agricultural sources polluting ground and surface waters, and by promoting the use of good farming practices. Consider the introduction of fertiliser and pesticide

taxes to reflect environmental externalities associated with water pollution. 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). Revenues from taxes could be earmarked for measures that facilitate transition to sustainable farming practices, or contribute to good ecological/chemical status of water bodies.

- Identify and address national policy misalignments that affect water availability, quality and demand (including price-distorting policies). Exploit synergies and combined investment opportunities with other sectors (e.g. urban development, food security, energy security, tourism) that reduce water-related risks and path dependency.

Appendix

Box 1. "Health Check" for Water Resources Allocation

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

Further explanation of the above check list, and examples of best international practice, are provided in OECD (2017) and OECD (2015a).

Source: OECD (2017), *Groundwater Allocation: Managing Growing Pressures on Quantity and Quality*, OECD Studies on Water, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264281554-en
OECD (2015a), *Water Resources Allocation: Sharing Risks and Opportunities*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264229631-en.

Box 2. 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.

Sources: OECD (2016c), Water, Growth and Finance: Policy Perspectives. https://www.oecd.org/environment/resources/Water-Growth-and-Finance-policy-perspectives.pdf
OECD (2015b), *Water and Cities: Ensuring Sustainable Futures*, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264230149-en
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