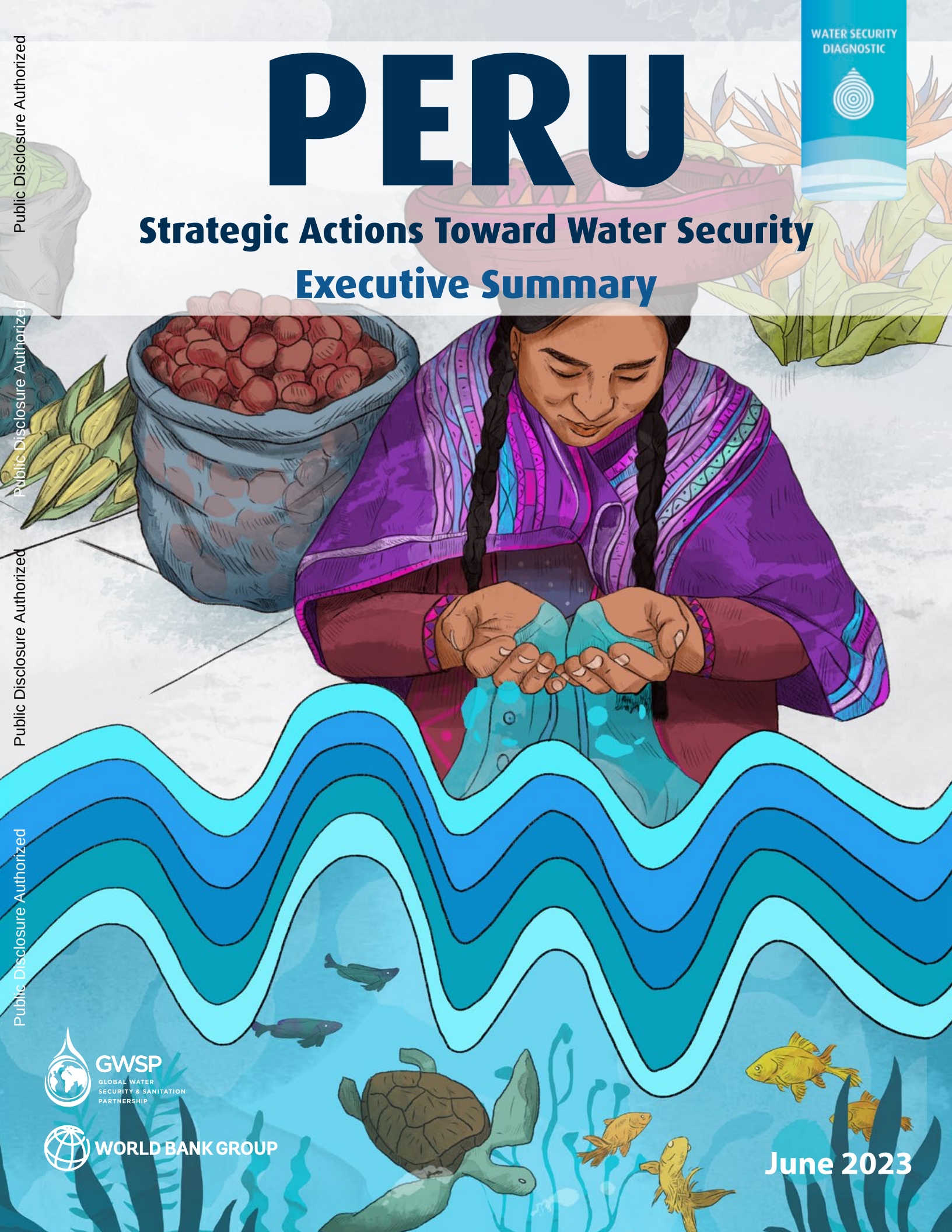
WATER SECURITY DIAGNOSTIC

PERU

Strategic Actions Toward Water Security

Executive Summary



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Contents

Welcome to the Water Security Diagnostic for Peru

This report is part of the World Bank's water security series—a collection of reports analyzing water-related challenges and opportunities that could affect a country's economy, people, and natural environment.

These reports are designed to help countries position water at the center of their national development agendas through evidence-based analytics and multi-stakeholder dialogues. To date, several comprehensive studies have been undertaken around the world, including studies for Argentina and Colombia. The Bank has also conducted regional water security studies for the Middle East and North Africa, and Latin America and the Caribbean.

For more information on the Water Security Initiative, please go to:

https://www.worldbank.org/en/topic/water/publication/water-security-diagnostic-initiative

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Executive Summary

Water security—the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems, and production, coupled with an acceptable level of water-related risks to people, environments, and economies (Grey and Sadoff 2007)—is crucial to Peru's path to shared prosperity while addressing climate risks. Access to this precious resource, however, is increasingly threatened by climate change, pollution, and uncontrolled and inefficient use of existing water resources and infrastructure. Taking strategic action now is critical to ensuring that Peru can sustain its water resource base, continue to deliver water to people and productive sectors of the economy, and build resilience to climatic and non-climatic events.

This Water Security Diagnostic (WSD) provides concrete, strategic actions to strengthen Peru's water security that complement the government's ongoing initiatives. The recommendations are based on the World Bank's knowledge of and experience in the Peruvian water sector, several government studies, as well as specific assessments carried out as part of the WSD to close knowledge gaps. The brief begins by providing an overview of Peru's water systems, then outlines the impact of water on economic and social development, continues with a detailed analysis of the key challenges to achieving water security, and culminates with a list of recommendations to accelerate Peru's path to water security.

Water Security Is at the Heart of Peru's Path toward Sustainable Development

Water is a key driver of economic and social development, and sustainable ecosystems in Peru. Water-intensive sectors account for nearly two-fifths of Peru's gross domestic product (GDP), with about 13 percent from manufacturing, 12 percent from mining and hydrocarbons, 7 percent from construction, 6 percent from agriculture, and 2 percent from water and electricity (BCRP 2022). The mining and agriculture sectors account for 63 percent and 16 percent of Peru's total exports, respectively. The agriculture sector alone employs almost a quarter of the total labor force, and more than half in rural areas (INEI 2020a). This is significant for rural development, given that 46 percent of rural populations remain poor and about 14 percent are mired in extreme poverty (INEI 2021). Water's contribution to Peru's economy and overall livelihoods is further highlighted when considering the impact of electricity— about 57 percent of which is produced through hydropower—on all GDP-contributing sectors (COES 2021). Water is also essential for sustaining Peru's highly diverse ecosystems, which include about 8 million hectares of wetlands and a vast network of rivers and lakes. These in turn contribute to Peru's tourism industry, which accounts for 4.5 percent of its GDP in 2020.

Access to water for efficient irrigation contributes to poverty alleviation, food security, agricultural income, and resilience to climate change. Irrigation has positive impacts on productivity and profitability. The World Bank–financed Sierra Irrigation Project reported yield increases of 30 to 70 percent, and net household income per hectare increases of 25 to 100 percent because of improvements in water availability and irrigation techniques.[1] Irrigated yields in Peru are double those of rainfed (dryland) yields (FAO 2022). Nevertheless, only 22 percent of agricultural land—2.6 million hectares—is under irrigation. Most of the agricultural land in Peru's Costa region (along the Pacific coast) is irrigated to sustain commercial agriculture. However, in the Sierra (Andes Mountains) and Alta Selva (high-altitude Amazon), where 50 percent of the rural population lives in poverty, only about 20 percent of the cultivated land is under irrigation. This leaves agricultural production exposed to shifts in rainfall patterns linked to climate variability and climate change. Utilizing irrigation in these areas would improve productivity, encourage farmers to harvest higher-value crops, and build resilience to climate variability.

Access to safe water supply and sanitation (WSS) services is essential for a healthy and productive population. Millions of Peruvians face water insecurity daily. Only 50 percent of the population have access to safely managed water and 43 percent to safely managed sanitation (WHO/UNICEF JMP 2021). Two million Peruvians lack basic drinking water services, and a million rural Peruvians still have no alternative but to defecate in the open. Regional disparities are acute. Sanitation coverage, for example, is particularly poor in the Sierra (65 percent) and Selva, or Amazon, (51 percent), relative to the Costa (90 percent). The people of the Amazon rainforest shoulder the biggest share of the burden associated with unimproved WSS services, reporting double the number of related deaths (14.3 deaths per million people) as those in the Costa (7.4 per million) (Garcia-Morales 2021).

Women and children are disproportionately affected by inadequate access to water and sanitation. In rural areas, women, responsible for overseeing, fetching, storing, and purifying water, work on average 10 hours more than men per week. This often limits their access to education, paid jobs, and decision-making spaces. Women and children's lack of access to adequate sanitary facilities exposes them to risks not only to their health, but also risks to their security, because they become vulnerable to harassment, attacks, and violence. The lack of a hygienic environment for girls and women during their menstrual period or pregnancy can also perpetuate both health and safety risks.

The quality of education is also negatively affected by Peru's coverage gap. Only two-thirds of public schools have adequate toilet facilities, and only 20 percent have access to adequate drinking water (UNICEF 2020). Each year about 900,000 Peruvian children under the age of five develop acute diarrhea directly related to inadequate WSS services, negatively affecting their health and cognitive capacities as well as their future productivity.[2]

Climate change and climate variability are linked to extreme water-related weather events that affect vast swathes of population, with grave implications for the economy and human capital accumulation. Almost half of Peru (46 percent) is highly to very highly vulnerable to natural disasters associated with the El Niño phenomenon and long-term climate change. The country already faces severe water scarcity in the Pacific region, floods and mudslides in the highlands and along the coastline, extreme rainfall events triggered by the El Niño phenomenon, and intense rainfall and floods in the Amazon. Water shocks linked to extreme rainfall and droughts are expected to increase given the continuous deterioration of watersheds, increased precipitation variability, and the acceleration of glacial retraction in the Andes. During the period 1990–2020, 1 percent of the total population was affected by water shocks, causing US$4.2 billion in accumulative economic damages (in 2020 constant prices), equivalent to 2 percent of 2020 GDP (EMDAT 2022). Furthermore, damage caused by floods and droughts have direct impacts on educational outcomes, morbidity and mortality rates, and labor productivity, hampering human capital accumulation (Barron and Moromizato 2020; Garcia-Morales 2021).

Water shocks and limited WSS services cost Peru between 1.3 and 3.5 percent of GDP per year.[3] The cost of water shocks is linked to floods, droughts and restrictions in water supply affecting agriculture, mining, manufacturing, health, and household income. The costs due to limited WSS services are linked to the burden of disease. When production shocks and losses and higher economic costs due to water pollution are also considered, the economic impact ranges from 4.0 to 6.4 percent of GDP per year. This estimate is conservative as it does not consider the spillover effects of water shocks on local economies or losses in value added. Water shocks disproportionally affect the poor, who experience higher rates of water-borne diseases, in part due to lower coverage of WSS services compared to the nonpoor. By 2030 the impacts of water shocks will be exacerbated by climate change, resulting in an income reduction among the bottom 40 percent of the country's income distribution by 5.2 percent. This could push an additional 0.6 percent of the population into extreme poverty (Hallegatte et al. 2016).

Peru is facing a growing gap between its development demands and the quantity and quality of its water resource endowment

Peru's growth is dependent on water, yet the country faces the highest climate variability in the Latin America and Caribbean region and significant rainfall spatial distribution. In terms of freshwater volume, Peru is the eighth-most water-rich country in the world and the third in Latin America. But these water resources are unevenly distributed among Peru's three major hydrographic regions. Watersheds in the Pacific region (the Costa) experience the greatest water deficit yet are positioned in Peru's most populous and productive area. For example, the Rimac Basin, which serves Lima's 11 million residents, provides less than 100 cubic meters of water per person per year. This is the lowest level of water resources per person in the country and classifies as absolute water scarcity. Peru also faces rainfall distribution challenges in much of the Andes and parts of the Amazon. Most precipitation occurs between November and March, resulting in a large dry period with water deficits. Irregular rainfall further complicates Peru's situation; historical data indicate that annual precipitation can vary from a 40 percent decrease to a 50 percent increase between years in key productive basins.

Natural storage in glaciers and groundwater, a key factor to attenuate mismatch between supply and demand and climate variability, is under increasing threat. Glaciers have lost about 43 percent of their surface area since 1970, severely reducing water supply in areas already suffering from water scarcity (ANA 2014). Groundwater, another important form of natural storage, is poorly understood and unsustainably used. Of the country's 95 aquifers, the National Water Authority (Autoridad Nacional del Agua, ANA) monitors only 47, representing less than 1 percent of total groundwater. Several aquifers face depletion, indicating the need for effective water rights regulation enforcement, monitoring, and management.

Climate change will further reduce water availability and increase uncertainty, threatening economic growth and development. By the end of the century, the northwest region of South America, where Peru is located, is expected to experience an increase in the number of days per year of extreme heat and cold, an additional loss of glacier volume and permafrost in the Andean mountains (causing reductions in river flows), and high-magnitude glacial lake outburst floods (IPCC 2021). The lack of a comprehensive and local response increases the vulnerability of Peru's storage systems to these increasingly frequent climatic events.

Pollution is further limiting the water endowment available to the people, the environment, and the economy. Only 25 percent of monitored water bodies in Peru have "good" ambient water quality, meaning they are not harmful to people or ecosystems. The main cause of water pollution in urban areas is the discharge of domestic wastewater into waterways. Only about 60 percent of wastewater generated by urban households is treated at wastewater facilities before being released into the environment (WHO/UNICEF JMP 2021). The impact of untreated wastewater is especially acute along the Pacific coast, where high population densities and low-flow rivers have resulted in a concentration of pollution hotspots. Other sources of pollution include mining effluents, use of agrochemicals in intensive agriculture, and oil production. In inland areas, agricultural pollution has had the most substantial impact on water quality due to the runoff of nitrogen, sediments, and pesticides in large, upstream areas.

Peru's aging water infrastructure and limited implementation of its water management framework have amplified water security risks

Hydraulic infrastructure is essential to tackle the mismatch between water availability and demand and the challenge of high climate variability. But current solutions are not sufficient. Peru has among the lowest dam storage capacity levels in Latin America and the Caribbean, leaving it susceptible to system failures amid rising climate risks. In addition, limited capacity to monitor and manage large hydraulic infrastructure poses access and safety risks. Hydraulic infrastructure, for the most part, was not designed to withstand the forces exerted by floods due to climate change and the El Niño weather phenomenon. Despite Peru's dam safety regulations, very few operators have implemented early warning mechanisms, or safety and emergency protocols for disasters affecting hydraulic infrastructure, to prevent potentially fatal floods or power interruptions. Also, Peru does not legally mandate that the regional governments and private entities that manage most of its hydraulic infrastructure ensure dam safety or follow standards for the construction and operation of large hydraulic infrastructure.

Although Peru has a comprehensive water management legal framework, it has not reaped the benefits of the framework, given low levels of implementation. Over the past two decades, the Government of Peru (GoP) has demonstrated its commitment to strengthening the water sector by developing policies on water resources management, water and sanitation services delivery, irrigation, and disaster risk mitigation. Although the reforms are comprehensive, implementation is lagging due to wider governance challenges pertaining to bias in the allocation of water usage rights, low levels of decentralization, the need for greater collaboration across sectors in water management and disaster management approaches, and limited gender equity in water resources management.

Efforts to close water and sanitation supply gaps have been slower in rural and peri-urban areas than in cities. Peru has made remarkable progress in closing water and sanitation coverage gaps over the past 20 years, yet progress has been much slower in rural and peri-urban areas, where technical and management solutions are more complex due to geographic, sociocultural, and political conditions, as well as low population density and logistical difficulties. The use of traditional solutions in these areas that do not consider territorial and social differences has been a lead cause of stalled water and sanitation investment projects. This is mainly due to high capital and operating costs, lack of ownership from beneficiaries, and limited implementation capacity.

Most of Peru's water and sanitation utilities are locked in a negative cycle in which low revenues weaken the utilities' skills base and operational performance, resulting in water supply outages that further reduce revenues. At the heart of this cycle are low tariffs that do not cover the cost of adequate service, resulting in utilities that are not financially sustainable. On average, utilities apply a tariff of US$0.62 per cubic meter, which is well below the Latin America and Caribbean regional average of US$1.44 (GWI 2020). These tariffs often include large subsidies to users that are not necessarily in need of this financial support. The effect of low tariffs is compounded by frequent water service outages, which cost utilities more than US$500 million each year, equivalent to about 10 percent of the total health budget for 2020. High levels of commercial and physical water losses, and the impact of COVID-19 on household and business finances have further strained water utilities' financial performance. Other issues contributing to utilities' limited operational and financial performance are the highly fragmented nature of service provision that limits economies of scale, and the unplanned urban settlements on the outskirts of cities, which increase the capital and operational costs of service provision.

Deteriorating irrigation and drainage systems and low irrigation coverage are contributing to low agricultural and water productivity. The agriculture sector is Peru's biggest water user, accounting for 89 percent of water withdrawals in the country (the average across Latin America and the Caribbean is 70 percent) (INEI 2020b). The physical efficiency of agricultural water use, however, is between 30 and 45 percent. Approximately 57 percent of Peru's existing irrigation and drainage infrastructure is in poor condition. Only 70 percent of the 2.6 million hectares of agricultural land under irrigation are used to produce crops, and 25 percent of the coastal irrigated areas suffer from salinization. In addition, Peru has only reached 41 percent of its irrigation potential. Irrigation coverage is not expanding at the same pace that agricultural land is expanding. This can be attributed to several factors, including the variability of local conditions, insufficient coordination between various levels of government, limited execution of public investment for the rollout of irrigation (over the past decade, only 60 percent of the assigned budget was executed), and limited performance-based incentives for the entire institutional chain to deliver irrigation efficiently and equitable.

Low budget execution and funding gaps are hindering Peru's achievement of national targets and the Sustainable Development Goals (SDGs) by 2030. In the past five years, Peru allocated about S/. 6.2 billion (US$1.6 billion) per year to the WSS sector (predominantly in basic water and sanitation services) with a budget execution rate between 50 and 60 percent. The 2022–26 National Sanitation Plan estimates that additional annual funding of S/. 10 billion (US$2.6 billion) per year will be needed to achieve universal access to safely managed WSS services as envisaged in SDG targets 6.1 and 6.2 by 2030. In addition, other sources suggest different levels of funding gaps. For instance, the UNICEF-SWA JMP[4] estimates that Peru will need additional investments on the order of US$1.3 billion per year from 2021 to 2030 to deliver universal, safely managed WSS services, whereas a recent study of the Inter-American Development Bank (IDB 2021) estimates that Peru needs to enhance and additional US$2.2 billion to reach this goal.[5] Therefore, when compared with the current budget execution, the funding gap to reach universal access to safely managed WSS services by 2030 is between US$1.9 billion and US$3.2 billion per year. To reach these levels of financing, Peru needs to enhance and accelerate its various financing options and mechanisms and, more importantly, improve budget execution by spending better with cost-effective, innovative solutions.

Strategic action now can fortify and accelerate Peru's path to water security

The GoP has begun laying the groundwork for water security

Ensuring universal and continuous access to water security is high on Peru's political agenda. To accelerate progress and develop a comprehensive understanding of water issues, the GoP has engaged in three key activities to build water security. First, it engaged in a water policy dialogue with the Organisation for Economic Co-operation and Development (OECD) that elevated the discussion around water security and facilitated high-level stakeholder engagement. The dialogue culminated in a report, *Water Governance in Peru* (OECD 2021), which contained specific recommendations centered on the following three key areas: (i) strengthening multilevel governance to improve water resources management, especially risk management linked to pollution, floods, and droughts; (ii) effectively implementing economic instruments for water risk management, including water abstraction and pollution charges and payment for environmental services; and (iii) strengthening the regulatory framework toward universal coverage of WSS services. Second, ANA is updating the water resources policy to include water security objectives in Peru's national development plans and investment system. Third, the Ministry of Housing, Construction, and Sanitation (Ministerio de Vivienda, Construcción y Saneamiento, MVCS) recently approved the National Sanitation Plan (2022–26), which includes the goal of reaching universal access to water and sanitation by 2040. In addition, the GoP is aligning water-related programs to its Nationally Determined Contribution (climate action plan).

The GoP has further signaled strong commitment to water-related issues in its General Government Policy (2021–26). The policy prioritizes (i) increasing access to water and sanitation services in rural and vulnerable urban areas to ensure social protection; (ii) promoting water security in agriculture through water storage solutions (infrastructure and nature based), water-efficient irrigation systems, and sustainable water approaches that consider social, productive, and environmental uses; and (iii) strengthening environmental protection and disaster risk management and promoting climate change adaptation and mitigation.

Recommendations to accelerate Peru's path to water security

Achieving the sustainability, efficiency, and resiliency that water security requires entails shifting the sector's focus away from infrastructure building and toward service delivery and risk management. Although the GoP has begun developing policies that promote this shift, critical gaps remain. The key to fortifying Peru's approach, however, does not rely solely on ensuring the existence of robust and effective policies and planning material but on their consolidation and implementation. As highlighted in the challenges section, implementation of sector policies is lagging as a result of the need for greater high-level commitment among other factors. Moreover, despite the vast funding needs of the sector (see box ES.1), only a fraction of the budget allocated for water supply, sanitation, and irrigation infrastructure is executed each year. This low level of execution can be attributed to weak implementation capacity within key sector agencies, limited monitoring and evaluation, as well as the use of approaches that do not reflect territorial realities. Therefore, the country needs to optimize its budget execution and implement the cost-effective solutions most appropriate to the sector.

The following nine recommendations, which are derived from the findings of the WSD and dialogues with key stakeholders, focus on shifting Peru's approach to tackling water security issues and ensuring that resources are used in an effective and efficient way. The recommendations respond to the key sector challenges (see figures ES.1 and ES.2) and are grouped around the three pillars of water security: (i) sustaining water resources, (ii) efficiently delivering services for people and production, and (iii) building resilience.

Each recommendation centers on a concrete first step to strengthen Peru's water security, identifies the entity responsible for carrying it out, and specifies the timeline (immediate, short term, or medium term) for implementation. Immediate actions, which can be carried out within the next six months, are not administratively or politically costly. Short-term actions, which can be carried out within six to twelve months, are at the center of dialogue, but may require investment in awareness raising to gain consensus and political support. Medium-term actions, which can be carried out over the course of one to two years, still require significant discussion to determine the next steps to reach their objective.

Box ES.1 Key Investment Needs and Associated Costs of Addressing Water Security Challenges

This box summarizes the estimated costs and infrastructure requirements of addressing the water security challenges identified in the Water Security Diagnostic. Key steps include the:

1) Expansion of safely managed water supply and sanitation (WSS) works to improve public health and contribute to human capital development.
2) Expansion of wastewater management works to improve water quality in main water bodies.
3) Modernization and expansion of irrigation infrastructure to reduce the impact of water shocks on agriculture production and to contribute to rural development.
4) Expansion of integrated water storage solutions to increase resilience to climate variability.

   Expansion of flood control measures and early warning systems to reduce water-related disasters.

Building on national studies—such as the 2021 Climate Change Adaptation National Plan, the 2019 Infrastructure for Competitiveness National Plan, and the 2022–26 National Sanitation Plan—the Water Security Diagnostic provides a more comprehensive estimate of investment costs (in 2021 prices) based on the targets presented in these studies. However, the cost estimate should be considered nominal in nature and should not be used for budgeting purposes. It is important to mention that only key infrastructure investments (not all investments needed to move toward water security) have been costed. The total investment costs for Peru to move toward water security have been estimated at US$32 billion to US$52 billion (in 2021 prices). The estimated ranges of investment costs for water storage, water supply and sanitation, irrigation and drainage, and water-related disasters are shown in table B.ES.1.

Table ES.1 Cumulative Investment Cost Estimate for Priority Infrastructure Measures, 2021–30
(US$ Millions)

Component	Low estimate	High estimate
Water supply and sanitation (including wastewater treatment)	22,000	33,000
Irrigation and drainage	4,300	7,560
Water storage	5,107	11,138
Reduction of water-related disasters	219	639
Total	**31,600**	**52,300**

Investments in water supply and sanitation assume that the country will **reach universal access to safely managed water and sanitation (SDG targets 6.1 and SDG 6.2)** and will **reach full wastewater treatment coverage in urban areas**.[7]

Investments in irrigation, which are aligned with SDG 2 to end hunger and achieve food security, assume that the country will (i) **increase irrigated land between 330,000 and 490,000 hectares** and (ii) increase the efficiency of irrigation water use through off- and on-farm interventions covering **between 250,000 and 280,000 hectares**.[8]

Investments in water storage assume that the country will (i) **develop additional storage capacity** of multipurpose dams ranging **between 1,800 million cubic meters (MCM) and 2,300 MCM**; (ii) **improve the** productivity and safety of existing storage capacity of nonenergy dams estimated at 4,500 MCM; and (iii) protect and conserve between 130,000 and 170,000 hectares to serve as nature-based water storage solutions.[9]

Investments in reducing risks of water-related disasters assume that the country will invest in: (i) establishing **200 early warning systems** and (ii) **undertaking 60 interventions to protect agriculture production against floods**.[10] Investments in both water storage and disaster risk reduction are also aligned to SDG 13 to strengthen resilience and adaptive capacity.

Figure ES.1 Recommended Actions to Achieve Water Security for All

Water security key element	Recommendations	Key actions (first step)	Responsible	Timeline
Sustain water resources management and improve water quality	1 Consolidate and implement integrated water resources governance at the national and basin levels.	Reinstate the interagency water commission to complete the water governance implementation plan.	PCM	Immediate
	2 Improve the ANA's technical capacity to pro-actively build water security.	Finalize and approve updates to the 2015 Water Resources Policy and begin updating the 2015 Water Resources National Plan.	ANA CEPLAN	Short-term
	3 Improve and expand wastewater management to address water quality in critical basins.	Develop a wastewater management strategy.	MVCS	Short-term
Deliver services for people and agricultural production	4 Utilize differentiated, territorial approaches to increase access to safely managed water and sanitation services for Peru's most vulnerable.	Prepare and implement a comprehensive water and sanitation policy and strategy for rural and peri-urban areas.	MVCS	Medium-term
	5 Establish financial incentives to improve the efficiency, service quality, and sustainability of WSS service providers	Prepare and adopt a performance-based financing policy for water-related capital investments.	MVCS	Short-term
	6 Implement a comprehensive approach to deliver sustainable, efficient, and equitable irrigation and drainage services.	Develop a detailed national irrigation strategy and plan.	MIDAGRI	Medium-term
	7 Strengthen capacity to effectively utilize budget allocation for WSS and irrigation services.	Provide capacity building and technical assistance for government implementation units.	MVCS MIDAGRI	Short-term
Build resilience to ever-increasing climate extremes	8 Invest in integrated water storage solutions to increase productivity and resilience.	Develop an integrated water storage strategy.	ANA	Medium-term
	9 Integrate DRM policies in existing sectoral planning instrument.	Develop a pilot program for local water organizations to incorporate DRM measures into sectoral instruments.	ANA, MIDAGRI, and MVCS	Medium-term

Note: ANA = National Water Authority (*Autoridad Nacional del Agua*); CEPLAN = National Center for Strategic Planning *(Centro Nacional de Planeamiento Estratégico)*; MIDAGRI = Ministry of Agricultural Development and Irrigation (*Ministerio de Desarrollo Agrario y Riego*); MVCS = Ministry of Housing, Construction, and Sanitation (*Ministerio de Vivienda, Construcción y Saneamiento*); PCM = Presidency of the Council of Ministers (*Presidencia del Consejo de Ministros*).

Figure ES.2 Linking Challenges with Recommendations

	Challenges	Linkage with recommendations
Water resources endowment challenges	Demand outpaces supply in key economic regions.	1 2 3 8 9
	Groundwater is poorly understood and unsustainably used.	2
	Climate change will further reduce water availability, threatening economic growth, development, and stability.	2 8 9
	Pollution is further limiting the water endowment available to people, the environment, and the economy.	3
Infrastructure and water management challenges	Limited storage capacity and insufficient attention to securing the safety of existing large hydraulic infrastructure are compromising efforts to boost water security.	8
	Centralized and inadequately managed water governance is hindering policy rollout.	1 9
	Efforts to close supply gaps have been slower in rural and peri-urban areas.	4
	Water and sanitation utilities are in operational and financial distress.	5
	Deteriorating irrigation and drainage systems and low irrigation coverage are contributing to low agricultural and water productivity.	6
	Budget execution and funding gaps are hindering the achievement of national argets and SDGs.	7

These action-oriented first steps lay the necessary groundwork for efficient, effective, and sustainable infrastructure investments. Key infrastructure improvements center on reaching universal access to safely managed WSS services, expanding wastewater treatment to improve water quality, expanding access to efficient irrigation solutions, and increasing integrated water storage solutions to build resilience to water security challenges. The level of financing required to achieve these improvements, however, depends on many variables, including the actual goals and targets the GoP establishes. For instance, the GoP may decide to provide only basic water and sanitation services or may decide to utilize high-cost technology. Box ES.1 provides greater detail on infrastructure needs and costs.

Sustain water resources

To sustain water resources, Peru must accelerate its capacity to respond to growing threats from climate change, pollution, and increasing demand through proactive water resources management.

Recommendation 1. Consolidate and implement integrated water resources governance at the national and basin levels.

To overcome its many water resources endowment challenges (high climate variability, water pollution, and a mismatch between demands and water availability among others), Peru will need to employ strong water governance, adopt integrated water resources management strategies at the local and basin levels, and ensure that there is coordination and harmonization across water-related agencies. Although Peru has a comprehensive legal framework for water resources management, it has not reaped the benefits of the framework given low levels of implementation. Through implementing the existing legal framework, Peru will be better positioned to safeguard its water resources endowment from both controllable (i.e., pollution, degradation, and water overexploitation) and uncontrollable (i.e., climatic change, climate variability, and natural disasters) factors.

Implementing the legal framework will require shifting from centralized governance to inclusive, properly decentralized, responsive governance. In particular, ANA requires greater independence to fulfill its role and employ a comprehensive and multisectoral approach to water. The authority's current position under the Ministry of Agricultural Development and Irrigation (Ministerio de Desarrollo Agrario y Riego, MIDAGRI) limits its capacity to operate independently with the full recognition from all water users and all government institutions. To overcome these challenges, the GoP formed an interagency water commission in 2019 as part of an OECD water governance dialogue and was tasked with drafting an implementation plan based on the OECD's recommendations. The process, however, stalled due to political instability. Strong political will and commitment are needed to overcome this core challenge.

First step: Reinstate the interagency water commission to complete the water governance implementation plan based on the findings from the OECD water governance report and this WSD (see additional guidance below). Once complete, the interagency commission may submit the implementation plan to the Presidency of the Council of Ministers (Presidencia del Consejo de Ministros, PCM) and the National Water Resources Management System (Sistema Nacional de Gestión de Recursos Hídricos, SNGRH) for high-level approval. After approval, the PCM might want to establish a monitoring system to track progress.

Responsible entity: PCM
Timeline: Immediate

The implementation plan would do well to:

- Ensure that ANA is a neutral, institutionally autonomous entity. ANA's irrigation functions should also be transferred to MIDAGRI.
- Improve the SNGRH's ability to coordinate water-related policies and programs efficiently across sectors and government levels by systematically involving high-level officials in meetings, ensuring adequate staffing and financial resources for water resources management, and strengthening coordination between river basin management plans and regional and local development plans.
- Strengthen local water resources management by increasing the effectiveness of ANA's decentralized entities to: (i) implement regulation policies linked to water abstraction and pollution discharge permits; (ii) facilitate cross-sectoral and stakeholder participation and water conflict resolution mechanisms; and (iii) design and implement river basin management plans. The GoP could also further the decentralization process by accelerating the formation of the 17 remaining (out of 29 planned) river basin councils.

Recommendation 2. Improve the National Water Authority's technical and planning capacity to integrate risk management, improved information systems, and efforts to address climate change into water resources management.

Although ANA has made progress toward setting up a system for managing information on national water

resources, developing six river basin management plans, and creating a technical dam safety unit, it needs to scale up these efforts to sustain water resources for current and future generations. ANA would do well to continue strengthening its knowledge base and analytical capacity on water security at the national and basin levels.

First step: Finalize and approve updates to the 2015 Water Resources Policy and begin updating the 2015 Water Resources National Plan to integrate water security and climate change elements. These steps will facilitate resource allocation and the prioritization of activities related to water security in ANA and in water-dependent sectors.

Responsible entity: ANA
Timeline: Short term

The Water Resources Policy and Plan might include measures to:

- Ensure that information regarding water security gaps and related indicators linked to social, environmental, and economic outcomes are included in the national strategy development plan, the concerted regional development plans, and the national budgeting and public investment system (invierte.pe) through strong coordination with sectoral agencies, the Ministry of Finance, and the National Center for Strategic Planning.
- Put in place a monitoring and evaluation process to track the implementation of water security measures under three pillars (sustaining water resources, delivering efficient and equitable water services, and building resilience) in coordination with the Ministry of Economy and Finance (MEF) and the National Center for Strategic Planning.
- Strengthen knowledge of groundwater to inform regulations for its management, with an initial focus on overexploited aquifers, and to identify potential areas for groundwater development. This will help promote the use of both surface water and groundwater in regions with water stress.
- Establish a regulatory framework for dam safety, modernize dam safety instruments, and implement dam safety plans and their respective emergency action plans in key dams. The capacity of ANA's Dam Safety Technical Unit should also be strengthened.
- Strengthen existing information management systems and planning tools by integrating remote sensing technologies, using drones to complement information systems, and using water balance modeling (and other planning methodologies that take a risk management approach) to better understand system uncertainties and to support robust decision-making.

Recommendation 3. Improve and expand wastewater management to address water quality and quantity in critical basins.

Pollution due to economic growth and rapid urbanization has decreased the quality and availability of water resources, affected public health, and is posing serious threats to the environment. Given the complexity of the problem, this diagnostic recommends that ANA and the Ministry of Environment (Ministerio de Ambiente, MINAM) work together to: (i) identify pollution hotspots, point sources (domestic, mining, and other industrial wastewater discharges), and nonpoint sources (agricultural runoff) of pollution; (ii) implement targeted source control measures in the identified hotspots; and (iii) enforce adequate treatment solutions where pollution cannot be prevented at the source. Given that the main cause of water pollution is the discharge of domestic wastewater into surface water bodies, this diagnostic proposes the development of a wastewater management strategy led by the MVCS as a first step to overcome this challenge.

First step: Develop a wastewater management strategy and pilot, at the basin level, sustainable programs for wastewater treatment that utilize circular economy approaches.

Responsible entity: The MVCS in close collaboration with MINAM and ANA
Timeline: Short term

The strategy could aim to:

- Rehabilitate and optimize existing wastewater treatment plants to ensure effective and efficient wastewater treatment.
- Align financing and investment programs for new wastewater treatment systems with public health and water quality objectives at the basin level. Including successive targets and standards that are realistic given investment needs and operation and maintenance costs will be central to achieving this objective.
- Utilize non-networked solutions in accordance with SDG target 6.2 in areas of low population density that do not have sewerage networks.
- Strengthen the regulatory and incentives framework for circular economy approaches through establishing (i) methodological guidelines to study reuse alternatives; (ii) market demand and reference prices for the commercialization of water reuse and biosolids; and (iii) incentive programs and technical assistance for service providers.

Deliver services for people and agriculture

To ensure secure water for human consumption and agriculture use, Peru must improve the efficiency of water services; employ differentiated, territorial approaches for service delivery; and ensure the financial sustainability of operations.

Recommendation 4. Utilize differentiated, territorial approaches to increase access to safely managed water and sanitation services for Peru's most vulnerable.

Peru still has significant work to do to improve water and sanitation services in rural and peri-urban areas, especially in regard to achieving drinking water quality standards and providing access to basic sanitation. Tackling such challenges will improve the health and capacity of citizens and promote opportunities for social mobility. Reaching these areas, however, requires a differentiated, territorial approach that considers geographic, sociocultural, and political conditions and takes into account population density and logistical difficulties.

First step: Prepare and begin implementation of a comprehensive water and sanitation policy and strategy for vulnerable populations in rural and peri-urban areas that includes strong community participation in the selection of technical and management solutions, promotes handwashing and hygiene, and utilizes innovative financial strategies.

Responsible entity: MVCS
Timeline: Medium term

The policy would do well to:

- Improve the existing public sector investment approach to ensure poverty and low human capital indicators are used when selecting project interventions.
- Include guidelines and incentives for cost-effective, innovative technical solutions and management models that reflect Peru's geographical and cultural differences. To ensure that the solutions are adequate, the process will require community participation, close coordination with local officials, and knowledge of urban plans and risk management regulations.
- Coordinate across sectors to prioritize and plan access to water and sanitation services for health care facilities and schools, initially focusing on areas most vulnerable to COVID-19 (in other words, areas with high population densities and limited access to safe water and adequate toilet facilities).

Recommendation 5. Establish financial incentives to improve the efficiency, service quality, and sustainability of water and sanitation service providers.

To ensure continued WSS access and to improve overall service quality, service providers must improve their efficiency and achieve financial sustainability. Despite several water and sanitation policies directed at improving performance and efficiency of water service providers, including tariff regulations that allow for cost recovery and aggregation of service providers, overall performance has not improved given low adoption and implementation of the policies at the local level. To ensure more sustainable WSS service delivery, the WSD recommends aligning existing policies with financing incentives.

First step: Prepare, adopt, and begin implementation of a performance-based financing policy for water-related capital investments.

Responsible entity: MVCS, in close coordination with service providers and local governments
Timeline: Short term

The proposed policy might:

- Allocate investment funds based on operational and commercial efficiency, application of adequate tariffs, aggregation of service providers, and improvements in service quality.
- Ensure transparency and the efficient allocation of resources for investments through simple procedures accompanied by technical assistance.
- Ensure that internal renumeration policies attract qualified, experienced professionals who are capable of leading efficient and sustainable utilities. Human resources must be equitable and promote gender equity in utilities given the low representation of women in senior and key decision-making positions.

Recommendation 6. Implement a comprehensive approach to deliver sustainable, efficient, and equitable irrigation and drainage services.

Investing in modernizing and developing irrigation and drainage systems and developing the technical and institutional capacity to improve service delivery will increase agricultural efficiency and productivity. Irrigated agriculture is critical to achieving better food security, producing higher-value crops, and increasing resilience of agriculture to climate change, especially in drought seasons. Irrigation-related investments, however, have not kept pace with the expansion of agricultural land in Peru. The country requires a comprehensive approach to enable irrigation expansion to the most vulnerable and

improve the efficiency, reliability, flexibility, adequacy, and equity of irrigation and drainage services following performance-based mechanisms.

First step: Develop a detailed national irrigation strategy and plan that considers water storage, equitable water allocation, modernization of irrigation systems, and differentiated irrigation approaches to allow for the expansion of irrigation systems in undeveloped areas with irrigation potential.

Responsible entity: MIDAGRI, in close coordination with ANA
Timeline: Medium term

In addition, the irrigation strategy and plan would do well to:

- Prioritize the upgrade and expansion of efficient irrigation and drainage systems, especially for small- and medium-sized family farms in areas with high seasonal water variability.
- Couple irrigation and drainage projects with complementary activities linked to cropping systems, innovation and technical assistance, and the production and marketing stage of produced crops to support agricultural productivity and rural development.
- Strengthen MIDAGRI's information management system by integrating water resources, climate, agricultural, and land use information in a single knowledge management center.
- Develop capacity and financial incentives programs linked to public investments for regional and local governments to improve the design, implementation, and performance of irrigation and drainage projects.
- Develop technical assistance programs to strengthen the ability of water user organizations to improve the quality, efficiency, and sustainability of irrigation and drainage services and to access local and international markets.
- Encourage private sector investment in irrigation through farmers' and water user organizations. In addition to technical assistance programs, MIDAGRI could support land titling and registration of water use rights to encourage investment and create incentives for public-private partnerships in small- and medium-sized farms.

Recommendation 7. Strengthen capacity to effectively utilize budget allocation for water, sanitation, and irrigation services.

Strengthening the technical and project management capacity of national, local, and regional agencies to implement public investments in the water, sanitation, and irrigation sectors is key to accelerating efforts to close service gaps and expand access to irrigated agriculture.

As detailed in the challenges section, the budget execution for the water and agriculture sectors is low despite the high need for financing.

First step: Provide capacity building and technical assistance to strengthen project implementation units to support the design and implementation of water and sanitation and irrigation projects and to enhance the capacity of government staff.

Responsible entity: MVCS and MIDAGRI
Timeline: Short term

Technical support might be needed to:

- Conduct a systematic audit of investment bottlenecks and develop and standardize processes and tools to assist with overall project management activities.
- Provide targeted assistance to local, regional, and national agencies in the preparation and approval of feasibility studies, following social and environmental safeguards.
- Prepare a capacity-building action plan that includes activities such as virtual learning, certification programs with accredited local institutions, and twining and internship arrangements.
- Accompany new hydraulic infrastructure with reliable water resources studies and environmental and social assessments.

Build resilience

To build resilience to ever-increasing climatic extremes, Peru must focus on improving the productivity and safety of existing dams, developing additional multipurpose and integrated water storage capacity, and strengthening disaster risk governance at the national and local levels.

Recommendation 8. Invest in integrated water storage solutions and improve resilience of existing hydraulic systems.

Peru faces water stress in the Costa region and significant interannual and seasonal variability of surface runoff in the Selva and Sierra regions. Regulation of surface runoff is even more critical in the context of climate change and impacts on the frequency and severity of floods and droughts. To build resilience to extreme droughts and floods, Peru must invest in integrated water storage measures and improve management of existing hydraulic infrastructure. To respond to this challenge, the GoP needs to employ an integrated approach that goes beyond infrastructure.

First step: Develop an integrated water storage strategy focused on ensuring risk-based management

of existing hydraulic infrastructure, increasing water storage capacity, and facilitating multipurpose arrangements.[6]

Responsible entity: ANA, in close collaboration with water users
Timeline: Medium term

It is advisable that the water storage strategy:

- Prioritize rehabilitation of aging hydraulic infrastructure and strengthen risk management measures—including dam safety protocols, sediment management, operation and maintenance systems, and catchment management programs—to reduce vulnerability and increase the longevity of infrastructure.
- Promote investment in water storage systems that utilize nature-based solutions, use groundwater during drought periods, and optimize multipurpose water storage and regulation of river flows.
- Develop institutional arrangements and flexible water allocation mechanisms to facilitate and optimize multipurpose water storage, particularly for the energy and agricultural sectors.
- Support the development of capacities to improve information management systems for long-term planning, and monitoring resilience of water systems and services in an integrated platform.

Recommendation 9. Build resilience, in the face of an uncertain future, into existing sector planning instruments.

Peru has a national disaster risk management (DRM) legal framework that focuses on improving prevention of and building resilience to disasters, but adoption by water-related agencies at the local level has been slow. A concerted, multisectoral effort to develop harmonized guidelines, provide technical assistance, and offer incentives is needed to ensure that local governments, service providers, and river basin counsels incorporate DRM policies into their existing sectoral planning instruments and operational procedures. Given that several studies have been conducted to include DRM in river basin plans, to accelerate adoption of nature-based solutions for climate resilience and incorporate decision-making under deep uncertainty in water master plans, the WSD recommends working with ANA, MVCS, and MIDAGRI to develop a targeted pilot program to include DRM practices within local water organizations' planning instruments.

First step: Develop a pilot program for local water organizations, including river basin councils, water and sanitation service providers, and water user organizations (irrigation) to incorporate DRM measures into existing sectoral planning instruments and operational procedures.

Responsible entities: ANA, MIDAGRI, and MVCS
Timeline: Medium term

The pilot program could focus on the following:

- Drought and flood preparedness and emergency plans in selected water user organizations (irrigation) and asset inventory and management programs in selected urban water utilities.
- Natured-based solutions for water source protection in selected water user organizations (irrigation) and water service providers.
- Application of decision-making under deep uncertainty in water supply master plans and in river basin management plans to support short- and long-term investment planning and project design to manage water-related risks in select water utilities and river basin councils, taking into account the interconnected water uses and sources at the local level.

The results of the pilot program should be documented and used to inform the development of policies and programs to scale up these resilience-related practices across the water sector. To incentivize these practices, public funds for investments could be subject to specific DRM and resilience-building requirements (refer to Recommendation 5).

Notes

1. The Sierra Irrigation Project closed in 2017: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/595941505485032273/peru-sierra-irrigation-project.
2. Data calculated from the Institute of Health Metrics and Evaluation's Global Burden of Disease Results Tool (http://ghdx.healthdata.org/gbd-results-tool) and from Peru's 2018 Demographic and Family Health Survey (Encuesta Demográfica y de Salud Familar).
3. Includes losses due to water pollution and production shocks.
4. The Water Supply, Sanitation, and Hygiene (WASH) SDG Costing Tool uses data from the Joint Monitoring Programme (JMP) and is a joint publication of the United Nations Children's Fund (UNICEF) and Sanitation and Water for All (SWA). The data by country can be accessed at: https://www.sanitationandwaterforall.org/tools-portal/tool/sdg-costing-tool.
5. The range of additional investments required come from different sources. The JMP estimates US$1.3 billion based on a narrow set of least-cost sanitation technologies. The highest estimate of US$2.6 billion comes from the National Sanitation Plan (2022–26), which incorporates all sanitation projects with a larger set of technologies and options. The UNICEF-SWA JMP estimates (US$1.3 billion)

represent 16 percent of the trade balance of the country in 2020, whereas the IDB estimates (US$2.2 billion) represent one-quarter of all 2020 imports of consumer goods in the country. Calculated based on data from: https://www.bcrp.gob.pe/eng-docs/Statistics/quarterly-indicators.pdf.

6. Operational and legal arrangements so that storage can serve multiple functions and provide multiple services and uses.
7. The cost estimate for WSS services is based on the 2022–26 National Sanitation Plan, and the cost range to reach safely managed WSS services is based on the data estimates of the UNICEF-SWA JMP (lowest) and IDB's 2021 study (highest). The cost range estimated in the 2019 Infrastructure Plan for Peru is close to US$25 billion.
8. Irrigated land targets are based on MIDAGRI's Multiannual Plan for the period 2015–21 (40.8 percent of the cultivated land in 2012) and the long-term target under the National Infrastructure Plan is 490,000 hectares at a unit cost ranging between US$10,000 and US$12,000 per hectare (expert estimates). The target established under the National Climate Change Adaptation Plan for increasing efficiency of irrigated land with on-farm irrigation equipment (such as sprinkler or drip irrigation) is between 250,000 and 280,000 hectares (equivalent to 20.1 percent of total irrigated land) at a unit cost ranging between US$4,000 and US$6,000 per hectare (expert estimates).
9. Development of water storage is estimated based on the water deficits data obtained from the 2015 National Water Resources Plan and from the water balance study conducted for this diagnostic. A unit cost between US$2.2 and US$4.2 per cubic meter was used to determine the investment cost based on the recent Chancay-Lambayeque River Basin Plan. Improving the productivity and safety of existing storage capacity of nonenergy dams is estimated at 4,500 MCM. Hectares and unit cost for nature-based solutions are estimated based on information provided by the National Climate Change Adaptation Plan.
10. The target of early warning systems and the number of interventions to protect agricultural production against floods, as well as unit costs, are calculated based on information in the National Climate Change Adaptation Plan for the period 2021–30.

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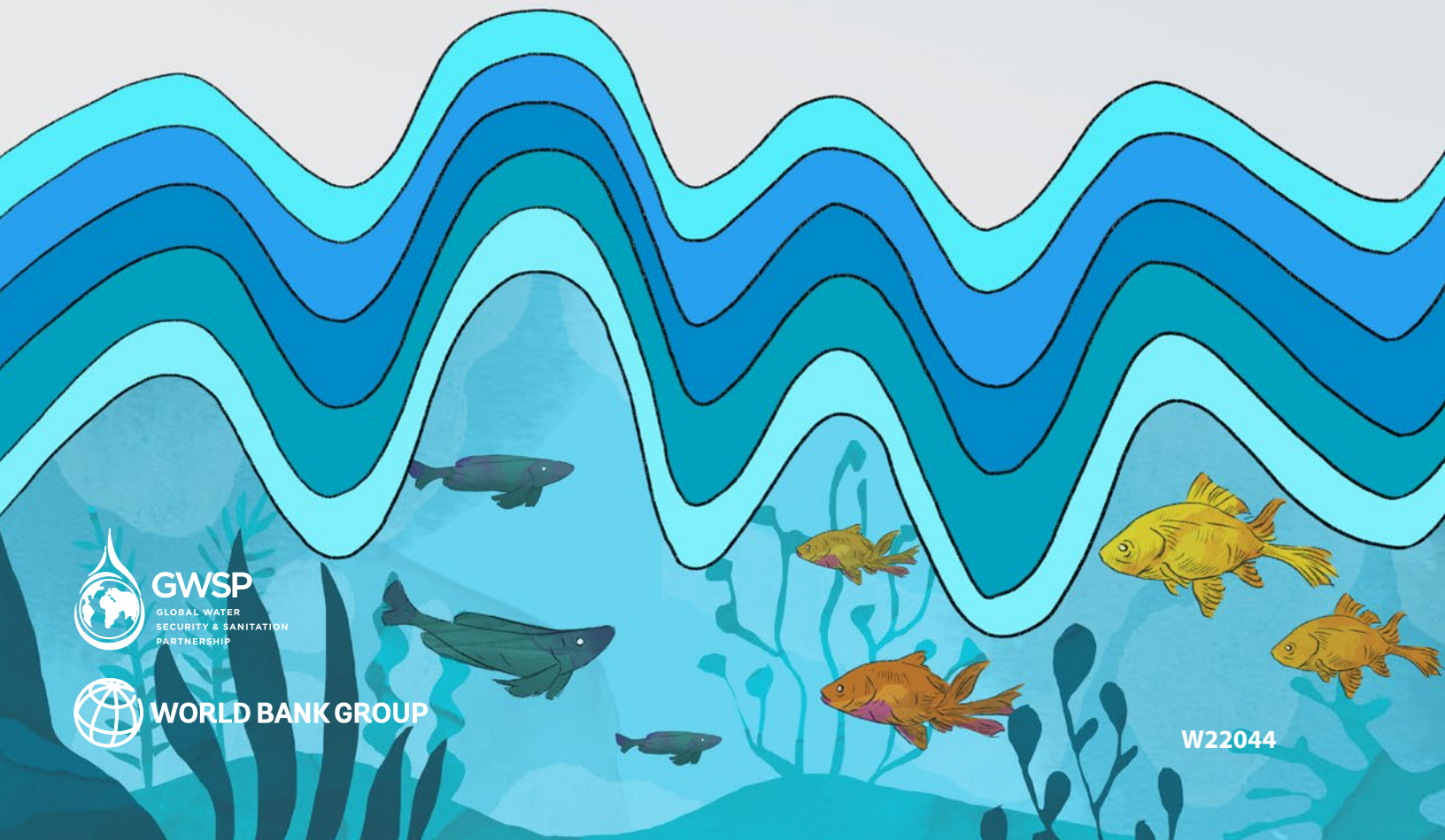

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