# VIETNAM:
## TOWARD A SAFE, CLEAN, AND RESILIENT WATER SYSTEM

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## TOWARD A SAFE, CLEAN, AND RESILIENT WATER SYSTEM

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# Preface

**The overall objective of the** *Vietnam Water Governance Study* is to analyze the current governance of the water sector to inform the development of strategies, provide an integrated view of challenges, and identify the most fundamental shifts needed to achieve national water security. In a first, diagnostic phase, the study analyzes water governance systems and identifies key areas for further work. The second phase will be to work with the Government of Vietnam and stakeholders to identify and develop key policy recommendations.

This is the report on the first phase—the diagnostic. This is essentially a scoping exercise to:

- Analyze current governance structures and associated risks, opportunities, and priorities.
- Assess the economic impact of inaction through a rapid analysis of biophysical and economic aspects.
- Identify key areas for further analysis in the second phase of the study.

## Study process

The study is being conducted by the World Bank Water Global Practice in cooperation with the 2030 Water Resources Group (2030 WRG). The study has been developed with the government and other stake-holders as a joint, consultative process. The World Bank team is working directly with the ministries concerned. Although the first phase was conducted largely as a desk study of the very extensive existing knowledge, several missions to Vietnam have enriched the findings, and an initial workshop (February 2018) brought all the principal actors together to share information and ideas. In parallel, the World Bank conducted several analytical assessments that under-pinned the study discussions. In March 2018, a series of consultations was held with line ministries and the Office of the Government, Ho Chi Minh Academy, private sector and civil society partners. A second round of consultations followed in May 2018. In November 2018, two private sector roundtables were held in Ho Chi Minh City, focusing on agricultural water usage and industrial and municipal water pollution. During the period of January to March 2019, all relevant line ministries were consulted on the final draft report and were requested to provide comments for finalization. Feedback and guidance were received from MONRE, MARD, MPI, MOIT, MOC, MOT, MOH and MOF and have been incorporated into this Report. It is proposed to hold more extensive discussions on the findings of the Report with a wide range of stakeholders within Vietnam. H.E. Minister Ha, Ministry of Natural Resources and Environment, expressed his keen support for the study and for a joint workshop to launch this report and to discuss the detailed findings and recommendations.

## Four complementary studies

The *Vietnam Water Governance Study* forms one of four complementary studies being conducted by the World Bank. In 2017, the 2030 Water Resources Group issued a report *Vietnam: A Hydro-Economic Framework for Assessing Water Sector Challenges*

*in Vietnam* (2030 WRG 2017). That study found that the four river basins that generate 80 percent of Vietnam's gross domestic product—the Red–Thai Binh, Mekong, Dong Nai, and South East River Cluster—are all expected to face water stress in the dry season by 2030 and that there are further water-related challenges to sustainable socioeconomic growth, including ground-water overexploitation, surface- and groundwater pollution, aging water supply infrastructure, emerging water-sharing conflicts, and increasing drought and flood events. The study pinpointed the governance challenges, providing an agenda for the present study. The results of the Hydro-Economic Framework study are incorporated into this Report.

In parallel, in 2018, the World Bank commissioned an economic study of the costs of inaction, called Water-Related Threats to Vietnam's Economy (World Bank 2018g). That study was conducted by consultants using a computable general equilibrium modeling framework. Results of that modeling are also reflected in the present Report. The fourth study—on the impact of water on firms—forms a component of a global survey covering country case studies, of which Vietnam is one. The high-level results are presented in this Report.

Besides these studies, all data have been taken from official reports and peer-reviewed articles – and where possible – were updated by respective line ministries. It was not within the scope of this study to revalidate and reassess data sources.

## Structure of this Report

The first phase of the Vietnam Water Governance Study focuses on the diagnostic assessments, expansion of the evidence base, and the options for actions. The findings are presented in this Report. The second phase focuses on engaging with senior policy makers, private sector and civil society representatives to develop a series of policy notes to catalyze actions.

The introductory **chapter 1** assesses the degree to which Vietnam is water secure. In **Part 1**, under the theme of boosting efficiency, **chapters 2** and **3** look at water services to agriculture and to urban settlements. **Part 2**, through the lens of reducing threats, looks at how Vietnam manages water quality and pollution issues (**chapter 4**) as well as climate change adaptation, disaster risks, and risks from infrastructure gaps and vulnerabilities (**chapter 5**). **Part 3** focuses on improving water governance, through the water resources management framework and institutions (**chapter 6**), initiatives for strengthening governance (**chapter 7**), and investment, financing and incentives (**chapter 8**). **Chapter 9** discusses the way forward, with an assessment of the likely costs and benefits of action—or inaction—with seven main recommendations of suggested actions for catalyzing on-the-ground change.

**Annex A** gives examples of how other countries have transformed their water sectors to assure water security and discusses the political economy of reform in Vietnam.

**Annex B** provides more in-depth insights into the legal framwork governing water resources and usage.

# Acknowledgments

**This Report, which is the result of close cooperation between the Government of Vietnam and the World Bank, has benefitted from the support of senior decision-takers within government, including H.E. Minister Tran Hong Ha, Ministry of Natural Resources and Environment, and HE Minister Nguyen Xuan Cuong, Ministry of Agriculture and Rural Development.**

The support of senior management and staff of MoNRE is gratefully acknowledged: Mr. Le Cong Thanh, Vice Minister in charge of water resource management; Mr. Hoang Van Bay, Director General, Department of Water Resources; Mdm. Nguyen Thi Thu Linh, Deputy Director General, Department of Water Resources; and Mr. Chau Tran Vinh, Deputy Director General, Department of Water Resources; Mr Nguyen Van Tai, General Director of the Vietnam Environment Administration (VEA); Mr Le Hoai Nam, Director, Department of Environmental Quality Management (VEA); Mr. Nguyen Van Thuy, Director, Center of Environmental Information and Data and former Director of Center for Environmental Monitoring (VEA); Mr Nguyen Minh Cuong, Deputy Director, VEA; Mr. Pham Phu Binh, Director, International Cooperation Department; and Mr. Bui Du Duong, National Center for Water Resources Planning and Investigation (NAWAPI) and their respective staff. Also gratefully acknowledged is the continuous support of senior management and staff of MARD: Mr. Hoang Van Thang, Vice Minister; Mr. Le Hung Nam, Deputy Director General, Department of Water Resources Planning and Rural Water Supply; Mr. Nguyen Van Tuan, Institute of Water Resources Planning; and Mr. Nguyen Tung Phong, Deputy Director General, Vietnam Academy of Water Resources and their respective staff. The contributions of others within government have also been most helpful, including those of: Mr. Pham Manh Cuong, Deputy Director, Department of Agriculture Sector Economy, Office of Government; Mr. Hoang Nghia, Director of International Cooperation Department, Ho Chi Minh Academy; and the staff of MOC, MPI, MOIT, MOT, MOH, and MOF.

During the consultations on the study, invaluable contributions were received from a range of donors and international agencies including from the representatives of Netherlands, Australia, Germany, Sweden, Switzerland, France, and IUCN, as well as from civil society organizations and the private sector.

Within the World Bank the study was commissioned by the Country Director for Vietnam, Ousmane Dione, who contributed both guidance and ideas, as did his staff, including: Achim Fock, (Portfolio Manager); Madhu Raghunath, (Program Leader, Sustainable Development); Sebastian Eckardt, (Program Leader, Economics); Ngan Hong Nguyen, (Communication Officer); Quang Hong Doan, (Senior Economist); Son Duy Nguyen, (Senior Operations Officer), Portfolio Unit; and Huong Lan Dao, (Senior Health Specialist). The team was ably supported throughout by Linh Thi Thuy Tran (Program Assistant).

The study was carried out by the World Bank's Water Global Practice. Acknowledgement is made of the guidance and inputs which have been key to the study from: Jennifer Sara (Senior Director); Steven Schonberger (Director); Richard Damania (Senior Economic Adviser); Sudipto Sarkar (Practice Manager); and Greg Browder (Global Lead, Water Resources Management).

Josette Posadas Vizmanos (Program Assistant) provided valuable support.

A broad panel of Peer Reviewers provided critical inputs and guidance to the study team. At the Quality Enhancement stage (QER) the peer reviewers were: Greg Browder (Global Lead, Water Resources Mgt.); Victor Vazquez (Sr. Water Supply and Sanitation Specialist); Halla Qaddumi (Senior Water Economist); Scott Moore (Water Resources Management Specialist); Sergiy Zorya (Senior Economist, GFA02); Franz Gerner (Lead Energy Specialist, GEE02); Christoph Jakob (Private Sector Operations Officer, 2030 WRG); Bill Young (Lead Water Resources Management Specialist, GWA06); and Dzung Huy Nguyen (Senior DRM Specialist, GSU08). At the stage of the Decision Meeting, further peer review inputs were provided by: Greg Browder (Global Lead, Water Resources Management); Victor Vazquez (Sr. Water Supply and Sanitation Specialist); Halla Qaddumi (Senior Water Economist); and Scott Moore (Water Resources Management Specialist).

Further technical inputs, guidance on specific topics and support were provided by: Eileen Burke (Senior Water Resources Specialist) on transboundary issues; Victoria Hilda Rigby Delmon (Senior Counsel) on private sector participation – PPP; Dr. Dao Trong Tu (Senior Advisor 2030 Water Resources Group); Fook Chuan Eng (Lead Water Supply and Sanitation specialist) on regional water security; Lilian Pena Pereira Weiss (Senior Water Supply and Sanitation specialist) on rural water supply and sanitation; Steven Jaffee (Lead Agricultural Economist) on rice marketing; Jennifer M. Gulland (2030 WRG) on integration of the 2030 WRG hydro-economic analysis performed for Vietnam; Eisse Wijma (Water Resource Management Specialist); Cuong Hung Pham (Senior Water Resource Management Specialist); Huong Thi Lan Tran (Senior Public Sector Specialist) on governance; Mr Tung Hoang Duong (consultant) on Vietnam's legislative framework; Huyen Thi Phuong Phan; Jason Daniel Russ (consultant) on the survey of firms and impact on firms; Dr. Isabelle Learmont; Antonia Ward; Dr. Trinh Hoa (consultant, 2030 WRG) on a wide range of issues, including water quality data; Diji Chandrasekharan Behr (Environmental Specialist); Quang Hong Doan, who contributed to the CGE model; Alexander Danilenko and Aroha Bahuguna who contributed to urban water supply analyses; and Jenny Jing Chao on the analysis of private sector participation in the water sector in Vietnam.

The study team was led by the task team leader Abed Khalil (Senior Water Resources Management Specialist) and co-task team leader Cuong Hung Pham (Senior Water Resources Management Specialist). The report was researched and written by Christopher Ward (Fellow, University of Exeter), Abed Khalil, Richard Damania, Jennifer M. Gulland, Dr Thang Nam Do (Visiting Fellow, Australian National University), Dr. Trinh Hoa, Cuong Hung Pham, and Eisse Wijma. The modelling inputs were provided by Brent Boehlert, Kenneth Strzbepek, Charles Fant, Robert Davis, and Dirk van Seventer.

The report was edited by a team at Communications Development, led by Bruce Ross-Larson and including Joe Brinley, Joe Caponio, Mike Crumplar, Meta deCoquereaumont, and John Wagley.

# Executive Summary

**Prudent economic policies, combined with the enabling conditions created by a high endowment of water, have transformed Vietnam from a low income to a middle-income country within two decades.** With annual growth in gross domestic product (GDP) averaging about 6.4 percent over this period, Vietnam has experienced among the fastest—and most equitable—trajectories of development in the world. Rapid economic expansion has been accompanied by strong export growth, large inflows of investment, improved access to health and education services, and provision of life-sustaining piped water to cities. From the early 1990s, when over half the population lived on less than US$1.90 a day, the rate of extreme poverty has fallen to 3 percent—among the fastest declines in poverty ever recorded. This transition has made Vietnam the textbook exemplar of sound development approaches.

**Vietnam's abundant water endowment has shaped its development fortunes.** With nearly 3,500 rivers of more than 10 kilometers (km) in length spread across 16 major river basins and with plentiful rainfall—almost 2,000 millimeters (mm) a year—the country is rich in water resources. Water features extensively in the country's history, art, and traditions. Rivers have determined the location of settlements and cities, and they power the country's industry. Their ample waters irrigate more than 4 million hectares (ha). A vast network of 7,500 dams stores and diverts water to thousands of irrigation schemes, making Vietnam one of the world's rice baskets. Hydropower accounted for about 37 percent of electricity in 2018, with an installed generation capacity of about 17 gigawatts (GW), and planned to expand to 21.6 GW by 2020 and to 25.4 GW by 2030 (Revised Power Master Plan VII).

**There are, however, risks inherent in the water resource.** With about 10,200 cubic meters ($m^3$) of renewable freshwater per capita, Vietnam's water availability is high by regional and global standards, though these resources are unevenly distributed across the country and seasons. In addition, two-thirds of Vietnam's water is transboundary and so is beyond its direct management. Vietnam is also vulnerable to water's great destructive power. With more than 70 percent of the population at risk from water-related natural disasters, it is one of the most hazard-prone countries in the East Asia and Pacific region, with a growing pattern of alternating flood and drought.

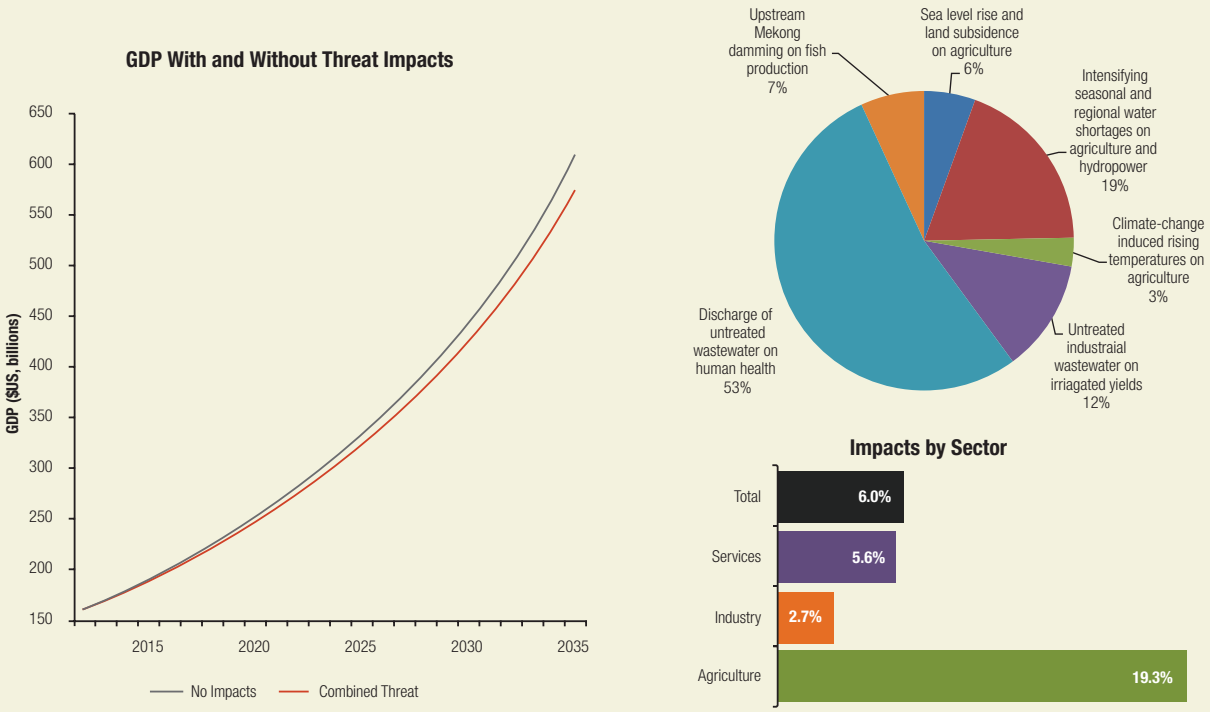
**Vietnam aspires to become a modern, industrialized economy by 2035.** The many achievements since the launch of the Doi Moi (Renovation) reforms have contributed to achieving this ambitious goal. But economic growth will need to adapt to become more resource efficient and to address the consequences of climate change. Unless decisive shifts are made, Vietnam will face serious threats as growth is held back by water shortages, businesses lose competitive edge as supply outages proliferate, farmers are kept poorer by low water productivity, floods and droughts destroy livelihoods, and the environment and people's health are damaged by mounting levels of pollution.

**Though growth has produced vast benefits, it has also placed unrelenting pressures on water resources, which in turn lead to economic stresses.** Vietnam's economy has grown so rapidly, and its water

endowment is so large, that it has been easy to overlook the challenges that this success has created:

- There is an emerging **mismatch between supply and demand** in certain locations and seasons, with consequent water stress that inevitably cascades through the economy. In coming years, these stresses are likely to intensify, unless action is taken now.
- As the economy grows and water development continues unabated, **competition between needs** is intensifying tradeoffs that call for greater scrutiny of the way water resources are managed and allocated. Around 90 percent of water used nationwide is allocated to irrigation and aquaculture. Today, increased demand from hydropower, coal-fired power plants, industry, municipalities, inland water transport and other fast-growing and higher-value uses is creating conflicting demands, which current water resource management institutions cannot easily resolve.
- There is a significant **gap between the potential and actual value that can be derived from each drop of water.** Agriculture could produce much more value through greater efficiency, water productivity and targeted crop choices, which are essential to boost farmers' incomes and agricultural value added. Current resource management arrangements do not create the incentives needed to generate the greatest feasible value from water. For example, incentivizing farmers to value water through water charges would promote greater efficiency in water use, while optimizing hydropower cascades on a river as a system could yield significantly higher power production and higher revenues.
- There is a **deterioration in water quality, and pollution loads are mounting.** Pollution is fouling surface and groundwater. Very little municipal and industrial wastewater is treated, and most sewage, industrial effluent, and solid waste find their way into watercourses. Some rivers - once clean - in and

**FIGURE ES.1: The potential economic impact of inaction against water threats**




**The rising level of water-related threats could reduce GDP by 6 percent by 2035 against a scenario in which steps *are* taken**

An economic model developed for this study quantified the consequences of four key water-related pressures on the economy: spatial and seasonal water shortages, urban water pollution, climate change–induced flooding on the Red River and its impacts on rice yields, and the effects of flow impediments on fisheries. The greatest economic damage would be from water quality, which could reduce GDP by 4.3 percent annually.

Even then, these estimates are conservative because they do not consider the full range of water-related threats and are based on optimistic assumptions about the ease with which water and other factors of production can move between sectors in response to economic pressures.

*Source:* World Bank 2018g.

around major cities have turned into contaminated streams. Rising sea levels, coupled with declining river flows, have led to the intrusion of saltwater into surface water and groundwater. Unregulated abstraction of groundwater is "mining" the resource, causing land subsidence in some areas.

- Climate change is increasing the risks and costs from droughts and floods, with recent disasters revealing infrastructure gaps and low levels of resilience.
- These vulnerabilities are heightened by obstacles and shortcomings in institutions, management, and infrastructure, constraining water services and forfeiting value through suboptimal allocation and use of water.

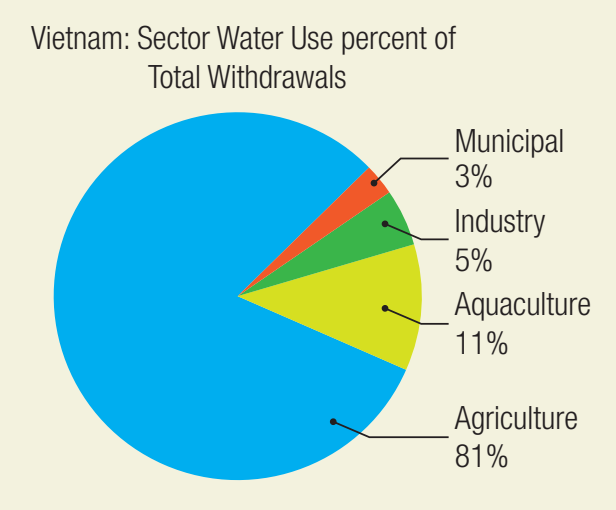
Vietnam is rapidly moving further into middle-income status, and if the water sector is to continue to support the nation's rapidly expanding economy, it will need to overcome three critical challenges: boosting efficiency to meet rising demand and increase income per unit of water consumed ("dong per drop"); reducing threats from "too dirty, too little, and too much" water; and improving governance policies, institutions, and financing.

To provide insight into the consequences and economic costs of inaction today, a study assessed the economy wide effects of some projected threats and of the impacts of inaction by 2035. The study modeled the overall GDP impact of the threats by 2035 compared with the scenario in 2035 without the threats (World Bank 2018g). The overall GDP impacts for the different threats range from 0.2 percent to 3.5 percent, which when conservatively applied to Vietnam's 2016 GDP is between US$400 million and US$7 billion per threat impact. When modeled, all threats (except increased climate change–induced flooding in the Red River basin) combined have a total impact on GDP of nearly 6 percent annually (see figure ES.1).

## Boosting efficiency: Rising demand and the need to increase "dong per drop"

**Economic growth is a thirsty business.** With growing cities, rapid industrialization, and an expanding agriculture sector, the demand for water will continue to climb. Water resources are abundant but not limitless, and water availability varies across regions, years, and seasons, with variability exacerbated by climate change. By use, 81 percent of surface water goes to agriculture, with a further 11 percent to aquaculture, 5 percent to industry, and only 3 percent to municipal uses (see figure ES.2). In addition, energy demand is rising and is expected to increase by 2.5 times between 2015 and 2035. Coal-fired power plants are expected to meet a growing share of energy demand. The high water use of these plants will increase risks both to the resource and to the security of energy supply if water shortages arise. Inland waterway transport conveys approximately 48% of the total national tonnage being transported, and with increased competition for resources may also be impacted.

**FIGURE ES.2: Water withdrawals by sector in Vietnam**




*Source:* 2030 WRG (2017).

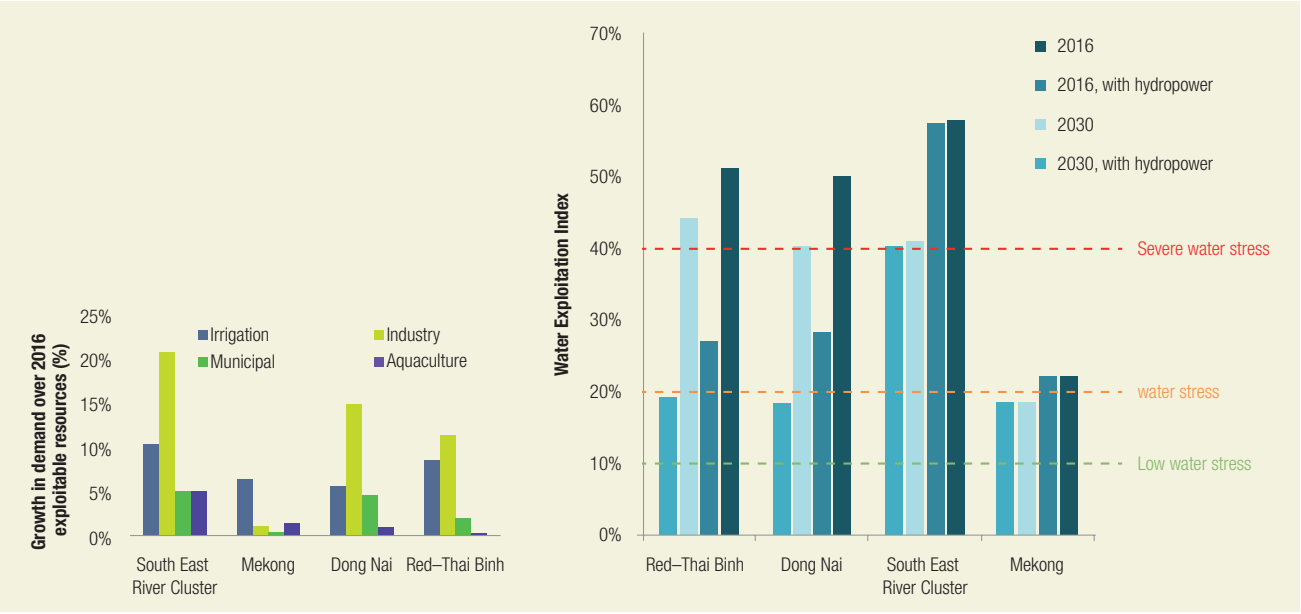
*Note:* Energy water withdrawals are not included.

### Economic and population growth fuel increased demand for water

**If the country continues along its present path— business as usual—water stress is expected to emerge in regions where the bulk of the country's GDP is generated.** Economic growth, changing patterns of consumption, and demographic pressure will continue to drive up demand for water. As Vietnam continues growing and industrializing, it will inevitably continue urbanizing. Nearly two-thirds of the country's residents live in the three primary river basins: the Red–Thai Binh, the Mekong Delta, and the Dong Nai. Within 25 years, the population in urban areas is expected to require twice the daily water supply that current systems can provide.

**Rapid increases in demand are projected to bring water stress to 11 out of 16 basins in Vietnam by 2030.** A 2017 report by the 2030 Water Resources Group highlights the challenges that Vietnam will face (2030 WRG 2017). Under a business-as-usual scenario, the report projects a 32 percent increase in water demand by 2030 during the dry season. If nothing changes, this will lead to all but five river basins facing water stress by 2030—with the most severe stress in the key economic basins (see figure ES.3, map 1.3). As measured by a common metric of water stress, the Water

**FIGURE ES.3: Growing demand and emerging water stress by river basin**



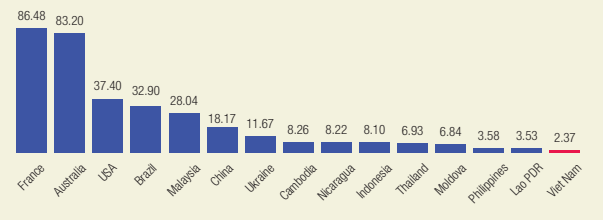

*Source:* 2030 WRG 2017.
*Note:* The Water Exploitation Index is the ratio of water withdrawals to water availability.

Exploitation Index (the ratio of water withdrawals to water availability), water abstractions in the Red–Thai Binh, South East River Cluster (SERC), Mekong and Dong Nai basins are already fast approaching unsustainable levels (see figure ES.3). These basins account for 80 percent of Vietnam's GDP.

## Water productivity is low

**Vietnam could generate far greater economic benefit from its water than at present.** From each unit (cubic meter) of water, Vietnam produces just US$2.37 of GDP against a global average of US$19.42—almost 10 times as much (see figure ES.4). Where water availability is limited, a greater emphasis on productivity—more value per drop—along with a reduction in overall water demand is warranted.

**FIGURE ES.4: Water productivity per unit of water in selected countries (US$ of GDP)**




*Source:* World Bank 2018g.

**Vietnam's agriculture sector has grown rapidly.** Agriculture accounts for 18 percent of GDP and employs 48 percent of the labor force. Its growth has been strong, particularly in rice, of which Vietnam is the world's second-largest exporter. Vietnam is also the largest producer of pepper, the second-largest producer of coffee (after Brazil), and the third-largest producer of aquaculture products.

**However, agricultural productivity typically lags that in many comparator countries.** Agricultural water use follows largely traditional practices. Although yields are quite high, quality and value are low. Already, stress and drought are constraining dry season production. Projections suggest that with climate change, annual rice production could be reduced by 3–9 million tons by 2050 and the highly productive coffee plantations could become unsuitable for cultivation.

**More efficient rice production and crop diversification have the potential to boost incomes and generate more value per unit of water used while reducing total agricultural water demand.** Agriculture has considerable scope to improve incomes and value added, particularly through quality improvement in rice and through diversification to higher value crops. As dry season water stresses grow and agriculture has to reduce dry season water use, the challenge will be to ensure that farmers have the incentives and means to get the maximum value out of less water. Agriculture will need not only to use water more productively, but also to use water in ways that are coordinated with other sectors and demands such as hydropower, industry, cities, and river transport. As demand grows for other higher-value and growth-inducing uses for water in industry and cities, mechanisms will need to be established for flood risk mitigation and inter-sectoral transfers that protect all stakeholders.

### Supply deficits are due to neglected maintenance

**Vietnam has invested heavily in a vast irrigation infrastructure, but underinvestment in operation and maintenance (O&M) has contributed to deteriorating water service and a loss of productivity.** The bulk of public spending in agriculture has been on water infrastructure for rice cultivation, endowing Vietnam with a vast irrigation network and dam schemes for dry season cultivation and extensive flood defense systems for wet season cultivation. A Public Expenditure Review conducted in 2017 found that public expenditure on new irrigation investment increased dramatically between 2009 and 2012 but that the allocation to O&M declined. The irrigation system is degraded, meeting only about 50–60 percent of its design capacity (World Bank 2013). Countrywide, only 26 percent of canal lengths are fully functional, and about 1,500 small and medium-size dams and reservoirs need to be rehabilitated and modernized. Lack of O&M has made the water infrastructure failure-prone. Deteriorating water service means low value added and a reduction of income for smallholder farmers. Similar trends of lack of O&M are visible in the inland waterway transport sector, as well as in water pollution prevention.

**There is scope to rebalance budget allocations more toward recurrent expenditure through multiyear programs and to make farmers pay a larger share of O&M costs.** This would reduce the cost burden on the state budget and strengthen incentives to farmers to increase their water productivity. The legal framework for a revival of farmers' contributions is in place, with a legal basis for an irrigation fee (even though an irrigation fee waiver was introduced in 2008, leading to forgone annual revenue of about US$250 million at 2012 prices) (UNEP 2015). The 2017 Law on Hydraulic Works calls for reinstating market-based irrigation service pricing. As irrigation fees are introduced, impacts on households should be gauged and conditional fee exemptions to promote other policy objectives could be considered—for example, to promote technology and husbandry practices that would improve water efficiency, as well as to support the transition from low value, but high water intensive crops to high value and low water intensive crops.

### Water is needed for settlements and business growth

**Water is critically important for urban and rural settlements, but second-generation challenges are emerging.** Vietnam has an excellent record in the provision of water services to settlements: 95 percent of urban dwellers and 70 percent of the rural population have access to at least "basic" water services. With rapid urbanization, however, a new generation of challenges has emerged. For one, sourcing water is becoming a problem in some locations. For example, salinity intrusion is making it hard to secure freshwater supplies for cities in the delta, and supply costs are likely to rise sharply. Supplies from groundwater are at risk from depletion and pollution. Corporatization and partial privatization of water utilities have accelerated, but there are challenges in cost recovery, affordability, and financial sustainability, and the accompanying program to strengthen governance of urban water has stalled.

**Unplanned development and poorly coordinated infrastructure have left rural and urban centers highly vulnerable to risks from river flooding, poor drainage, sea-level rise, and sudden-onset coastal flooding.** In the Mekong Delta, for example, climate change has created an existential threat to the region, and poorly planned urban development has aggravated flooding in cities. City plans rarely reflect climate risks or disaster risk resilience—and the poor are most at risk.

**Poor water service also hurts businesses.** Reliability of water supply has slumped in recent years, leading to higher business costs. Water outages increased nearly threefold between 2009 and 2015, with most occurring in the South East, a region encompassing Ho Chi Minh City, the largest economic center in the country. Water disruptions can have harmful impacts on firms, with daily water shocks reducing the revenues of formal firms by 8.7 percent and those of informal firms by 34.8 percent (World Bank 2017n).

## Reducing threats: Too dirty, too little, too much

**Both the quality and the quantity of Vietnam's water resources face growing threats.** The country's rapid development, combined with the emerging threats of climate change, have created a new constellation of threats, particularly costly flooding, worsening pollution, and competition among sectors for water in the dry season. If nothing is done to reduce these threats, they could combine to cut GDP by about 6 percent annually by 2035, against a scenario without these threats (see figure ES.1). These threats will need to be addressed to ensure sufficient and safe water to support economic growth.

## Too dirty—pollution

**Pollution is emerging as the greatest water-related threat to the economy**. The economic model developed for this study suggests that the main threat is the impact of water pollution on human health, which could reduce GDP by 3.5 percent by 2035 (see figure ES.1). A much smaller impact (0.8 percent) could come from the effects of declining water quality on paddy yields. The model did not quantify the economic consequences of other forms of water pollution, including the salinization of surface water and groundwater supplies.

**Rapid urban development has led to rising water pollution.** Urban and industrial wastewater is the largest contributor to water pollution. Only 46% of urban households have connections to drainage systems and only 12.5% of municipal wastewater is treated (MOC, 2019). Over the next 15 years, urban wastewater is expected to account for the largest share of effluents (about 60 percent). Industrial wastewater will account for 25–28 percent and rural wastewater for 12–15 percent.

**Much industrial wastewater is discharged without pretreatment.** It is estimated that at the end of 2018, centralized wastewater treatment plants were treating only about 71% of industrial wastewater (Thoi Bao Tai Chinh 2018).

**Agriculture produces vast quantities of waste from fertilizers, pathogens, and pharmaceuticals fed to animals**. About 80 million of the estimated 84 million tons of livestock waste generated each year enter the environment untreated, carrying nutrients, pathogens, and volatile compounds that compromise water and air quality and damage soils (Nguyen The Hinh 2017). With crop farming intensifying, pollution from fertilizers and pesticides has also surged. There is scant monitoring but strong global evidence of the harmful effects of pollution on health and productivity. Aquaculture, a key export industry, is also highly polluting. Neither regulation nor food safety concerns seem able to halt the toxic waste flowing from aquaculture farms.

**The costs of this water pollution are high**. Due to economic activities, in no river basin does surface water meet the organic pollution standards for drinking water established by the World Health Organization. Waterways flowing past major cities, such as the To Lich, Set and Kim Nguu Rivers passing through Hanoi, are seriously polluted—a wasted resource and a risk to human health and natural ecosystems. High pollution levels also constrain urban development and the sustainability and future growth of industry and agriculture. It will cost Vietnam around US$12.4–US$18.6 million a day by 2030 if treatment measures are not put in place by then. In Vietnam's southern key economic zones, the cost estimate for 2010 was US$867 million.

## Too little—investment and enforcement

**Much of the problem results from underinvestment in collection and treatment of wastewater.** At the end of 2018, out of 326 industrial zones planned countrywide, 251 were in operation. Of these zones, 220 (88%) had wastewater treatment plants (MPI, 2019). However, as mentioned above, it is estimated that these facilities were treating less than three quarters (71%) of the wastewater produced in the zones (Thoi Bao Tai Chinh 2018). Most of the remaining wastewater is not treated and is discharged directly to the environment. Of the total of 587 operating industrial clusters, only 55 industrial clusters have centralized wastewater treatment facilities, accounting for 9.4% of the operating industrial clusters (Thoi Bao Tai Chinh 2018). Most of the wastewater discharged from the 5,000 craft villages and traditional craft villages goes without treatment. In addition, some big industrial factories located outside industrial zones as well as the majority of local hospitals and private clinics do not have wastewater treatment facilities (MoNRE 2016)

**The regulatory framework is basically sound, but enforcement is uneven.** The legal framework includes a large set of regulations that deal with wastewater management, but enforcement remains a challenge. As per Circular No. 35/2015/TT-BTNMT, all businesses and service establishments have to be connected to the centralized wastewater treatment plant operating in their industrial zone. However, some businesses and service establishments are exempted from this requirement, i.e. if they (a) treat their wastewater in compliance with environmental, technical regulations and the connection to the centralized treatment plant would cause unreasonable costs; (b) generate wastewater volumes exceeding the treatment capacity of the receiving centralized wastewater treatment plant and concurrently apply wastewater treatment measures in compliance with environmental technical regulations and (c) treat their wastewater in compliance with environmental technical regulations and the industrial zone has no centralized wastewater treatment system (Article 9, para 4). These exemptions, however, significantly increase the difficulty of controlling and supervising wastewater generated and discharged from these exempted businesses and service establishments (MPI, 2019).

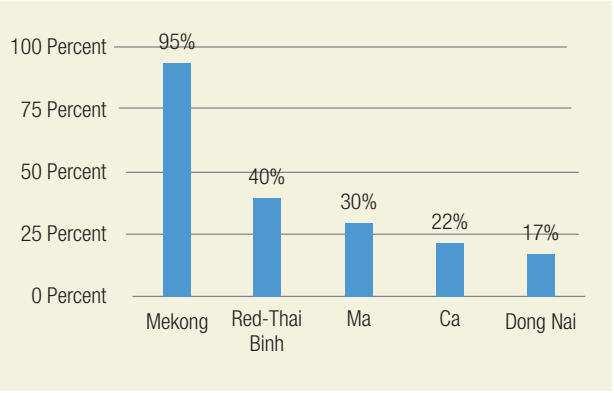
For industrial wastewater, there has been a new decree issued in 2016 (154/2016/ND-CP), which introduced an environmental protection fee for

wastewater discharges. The environmental protection fee is based on a fixed component of Dong 1.5 million and a variable component. The variable component applies when discharge is above 20 cubic meters per day. Although to date there has been no assessment on the actual effectiveness of the environmental protection fee, current pollution levels suggest that its impact on untreated wastewater discharges has so far been limited.

### Too much—managing for flows originating outside the country

**Because most of Vietnam's rivers originate in other countries, water supply remains vulnerable to what happens upstream.** Vietnam depends on international rivers, with more than 60 percent of the total average yearly surface water discharge generated outside the country (see figure ES.5). Two of the most economically important rivers depend on water that flows through international neighbors. Nearly 90 percent of the Mekong River originates outside the country, arriving in Vietnam through Cambodia, and 40 percent of the Red River originates in China (ADB, 2009). Vietnam is an upstream riparian for the Sesan and Srepok Rivers flowing into Cambodia. As riparian countries continue to develop their water resources, there is need to cooperate on matters of common interest, including increased water extraction, pollution, and dam development. The existing agreement on the Mekong has already brought benefits in terms of information, consultation requirements, and identification of beneficial and negative impacts of proposed development and management.

**FIGURE ES.5: The proportion of each river originating in other countries is high, 2017**




*Source:* 2030 WRG 2017.

### Climate change–related risks and environmental flows

**Vietnam is one of the most hazard-prone countries in the East Asia and Pacific region.** More that 70 percent of the population is exposed to one or more types of water-related natural hazards. Models suggest that climate change will lead to increased severity and frequency of floods, typhoons, sea-level rise, and associated storm surges. Across climate change scenarios, by the 2040s, dry season runoff nationwide will likely be reduced while wet season peak runoff will increase. At the front line of impacts are the agriculture and aquaculture sectors, though economic damages from flooding in cities could turn out higher.

**Economic losses, currently estimated at 1.5 percent per year, are predicted to rise sharply.** Losses due to water-related natural disasters averaged 1–1.5 percent of GDP over the last two decades. They are predicted to rise to 3 percent by 2050 and to as much as 7 percent by 2100—among the highest in the world. Recent events have exposed both an infrastructure design deficit and low levels of resilience. Current infrastructure is often not adequate to cope with the new hazards of floods and droughts, a problem compounded by poor maintenance.

**Prudent water management and basin planning can be key to building resilience to natural hazards and protecting lives and assets.** The emphasis on flood control systems to protect agriculture has often transferred the flood risks to adjoining urban areas, where higher-value assets are located and much of the country's GDP is produced. The lesson is to integrate water risk into policy making and investment planning in a basin context, because this is the geographic scale from which risks emanate, have impacts, and can be addressed.

**Environmental flows are dwindling.** In some locations, minimum dry season environmental flows, i.e. as defined by MONRE as a value ranging between the level of flow rate of the lowest months to the average value of the three lowest months, have fallen below the levels needed to preserve the ecology and amenity of the river, and also below the levels needed to ensure that downstream users have access to the water they need. These shortfalls have exacerbated the impact of recent droughts.

## Improving governance: Framework, initiatives, and financing

### Integrated water resources management at the basin scale

**Policy and the legal framework provide for integrated management of water resources.** The institutional and governance framework for water resources management has been established and evolved over

time in response to the growing challenges of sector management. Two decades ago, the government adopted integrated water resource management (IWRM) as the basis for water resources planning, development, and management. For example, the 2012 Law on Water Resources mandates this approach. The National Strategy on Water Resources to 2020 confirms that "water resource management must be implemented in an integrated manner on a river basin basis."

**However, Vietnam has long tried to establish planning and management at the basin level, but with limited success.** While river basin organizations are mandated in the 2012 Law on Water Resources, existing river basin organizations have not been fully empowered as they are not state management agencies. As a consequence, many organizations have overlapping tasks and accountabilities; and they lack the legal authority, institutional capacity, and financial and physical resources to plan and ensure that the plans are implemented. MONRE is currently proposing to the Prime Minister to establish four river basin organizations for the Hong-Thai Binh, North Central, South Central and Dong Nai basins.

**While the legal and regulatory framework has been established and is gradually being improved, it is not fully implemented.** In September 2015, MONRE issued Circular 42 *Regulations on Water Resources Planning Techniques* to spell out implementation of the ministry's planning functions under the law. However, there is still little comprehensive planning, as the overall Master Plan on Water Resources has not yet been approved. In the absence of this Master Plan, provinces have started to develop and approve their own water resources master plans. As these are not coordinated, this may lead to conflicts between the master plan of upstream and downstream provinces in the same river basin and to conflicts with the overall national planning. In general, legal and regulatory provisions for water are sound—the problem is implementation capacity and accountability, with monitoring and enforcement functions often fragmented across agencies. Some legal documents to implement the 2012 Law on Water Resources are yet to be issued by MONRE, MOST, MARD and MOF.

**Data on water resources management is a basic building block for water resources planning and monitoring, yet information remains limited and fragmented.** While an initial database for water resources planning has been established, limited budgets prevent required updates, and the database does not yet meet all the requirements of management agencies and society. Further, information sharing is a particular problem. There is a lack of a united database on water resources to be used consistently from the national to the local level. Water data are scattered among ministries and localities, posing difficulties in management. Apart from database sharing between MONRE and reservoir operators subject to inter-reservoir procedures, there has been little information sharing on water extraction, use, permit granting, planning and projects in and around rivers among different stakeholders.

**The ministries' mandates are clear, but imbalances in resources and capacity are evident**. MONRE has responsibility for management of the legal and regulatory framework, information and resource assessment, water resources strategy and planning, water allocation and resource management, and pollution control. However, it lacks the human and financial resources to take on this massive task. In addition, it is noted that a high degree of delegation of responsibilities, financing, and human resources to subnational governments can create difficulties in integrating management of water resources at the central level. The provincial departments – DONREs – have to follow two lines of reporting - to MONRE and to the PPCs. While a DONRE has to follow MONRE in respect to technical guidance, it must also follow the instructions of the PPC which allocates resources and appoints DONRE staff. More effective coordination between provincial governments and national ministries, including DONRE and MONRE in particular, should be promoted.

**Getting a multi-sectoral approach to water resource management has proved challenging**. With so complex an institutional structure, getting a multi-sectoral, cross-institutional approach to planning, development, and management presents a particular challenge for water management, which straddles sectors and internal jurisdictions. Its scale can be judged from the recent assessment by the 2030 WRG study, which found that to reduce water stress in one basin, 24 demand side measures were required from a host of different actors, including seven ministries, six provincial councils, multiple municipalities, numerous irrigation companies and private firms, and millions of farmers and city dwellers. Getting all the sectoral and local interests to work together presents a massive challenge of horizontal and vertical coordination (2030 WRG 2017).

**While Vietnam is an upstream and downstream riparian country, the Mekong River is the only transboundary river in Vietnam with an agreement among riparian states.** For all but one of Vietnam's transboundary watercourses, there is little or no joint

planning or management to optimize water resources at the basin scale and little consultation among riparian countries on proposals or their impacts. Only for the Mekong is there a transboundary agreement among Cambodia, Laos, Thailand and Vietnam on cooperative water use and an organization—the Mekong River Commission (MRC) and the associated National Mekong Committees. Implementation of the Mekong agreement has brought tangible benefits to riparian countries in terms of information and risk management. However, despite these arrangements in the Mekong, challenges persist. For example, the two upper riparian states, China and Myanmar, participate in the MRC as "Dialogue Partners" but are not formal members and the construction of mainstream dams has been a contentious issue within the MRC. However, additional cooperation mechanisms among Mekong riparian states, such as the Lancang-Mekong Cooperation Mechanism, also have the potential to address water-related challenges.

## The incentive structures

**The current incentive structure drives many of the negative trends in the sector** Public agencies lack cooperation with one another, either horizontally or vertically. Farmers' behavior is driven by an investment policy skewed toward rice and by perverse economic incentives, particularly the absence of water charges, which militates against water use efficiency. Investment in water utilities may be driven more by the prospect of capital gain from land speculation than by planning for profitable, consumer-responsive service delivery. Many regulatory incentives are negative, and moral hazard is inherent—it is often easier to pay a pollution fine than to invest in a cleaner environment.

**Some economic instruments have been introduced but implementation and incentive mechanisms remain limited.** Economic instruments include water supply tariffs, environmental protection fees for wastewater and solid waste, water abstraction fees, irrigation service fees and incentives for water efficient technologies in industrial production and for small-scale irrigation systems. However, the implementation process shows that these economic policy instruments remain inadequate, and far from incentivizing and regulating the sustainable exploitation and usage of water as well as effective prevention and control of water pollution.

**Revenue policy needs to be aligned with water resource management objectives**. Regulated by Decree 82/2017/ND-CP in 2017, revenues from water abstraction charges have resulted in 7,144 billion VND after one year of implementation (28 Dec 2018). To date, however, the revenue generated is received in the general state budget and is not earmarked for water-related improvements. It is necessary to review obstacles and shortcomings of this decree and to issue relevant correcting and guiding circulars to improve effectiveness of this policy. In addition, other revenue policy measures in the water sector can be studied and issued to promote efficiency and to protect natural resources and enhance their value in use, as well as to generate fiscal resources, as provided for in the 2012 Law on Water Resources. This approach could apply to water charges; for example, raising the price of irrigation water will at the same time cause water to be more valued and better conserved and key O&M functions such as dam operation and safety and irrigation water service to be secured. The policy could also apply to pollution charges, with higher charges and strengthened compliance and enforcement. This would also raise resources for environmental protection. Overall, an incentive framework is needed that is aligned with policy and fiscal objectives and that can drive behavioral changes.

## Declining public investment and the scope for private finance

**There is a shortfall in water sector investment and its financing.** Investment in the water sector, largely by the public sector, has been high in the past, with more than US$6.4 billion invested in 2006–15 in 140 water programs and projects. Yet investment requirements remain high, estimated at as much as US$2.7 billion annually for the water and sanitation sector alone. Actual financing for that sector falls well short of these amounts, at about US$1 billion annually, or about 4 percent of total investment in the economy.

**In the current fiscally constrained climate, there are opportunities for more "value-for-public-money."** After decades of state-led investment and intervention in the economy, government policy now promotes progressive withdrawal of the state from direct economic activity and assumption of a more facilitating and regulatory role. This approach is being accelerated by the emergence of severe fiscal constraints, which limit the government's ability to invest and which have led to a cap on borrowing. These constraints will potentially have the beneficial effects of encouraging increased effectiveness of public investment and of promoting more innovative financing. Within a tightening budget, the water sector can still improve the quality and efficiency of public spending, for example, by concentrating capital investment and rebalancing

budgets between capital and recurrent expenditures to get the most out of existing assets.

**Opportunities are there to bring in more private financing.** The scope for private financing in the water sector is widening, particularly in urban and rural water and sanitation, but also in irrigation. The recent rapid "equitization" of water supply utilities has demonstrated the feasibility of public–private partnerships in the sector. Realizing the full potential by attracting new sources of financing would require tackling multiple obstacles, both economy wide constraints and risks specific to water— for example, the need for assured revenue streams in urban water and sanitation.

**Mobilizing private finance for water would require a major, coordinated policy effort.** It could be modeled on the framework recently proposed for the energy sector, which comprises a multiyear program to prepare and launch projects for public–private partnerships, work with the enterprises to prepare them to access commercial finance, and actions to boost capital mobilization in local currency. A similar program could be designed for the water and sanitation utilities and ultimately, perhaps, for the irrigation management companies.

## The way forward

**Vietnam is confronted by a host of water challenges that risk jeopardizing future growth.** Having achieved middle-income status, Vietnam now aspires to modernity, industrialization, and a higher quality of life (WB and MPI, 2016). The sustainable growth needed to achieve these goals will require a different approach to managing water resources. Past policies were shaped by assumptions of almost limitless growth in public investment and an endless supply of water. Now, the rapid investment of earlier decades is fiscally unaffordable. Risks from floods and droughts are rising, poor water quality is an economic burden, and the clean and safe water required for economic growth can no longer be taken for granted. A business-as-usual approach to escalating water demand and degrading water supplies will inevitably impede economic progress.

**Meeting these challenges will call for a greater focus on policies and incentives, and for increased fiscal discipline.** Vietnam has sound water policies, but in practice they do not function as intended. Policy implementation is uneven, the incentives required to ensure better policy compliance are inadequate, and the institutional foundations needed to address the new generation of challenges are insufficiently developed. Likewise, while there is an acknowledged need to adopt integrated basin-wide approaches that manage water across sectors and protect the environment, implementation has been lacking. Going forward, greater emphasis will have to be given to policy enforcement and to the incentives needed to assure greater compliance.

**The solutions suggested by this analysis are clustered around sets of seven recommendations.**

1. Improve water resources management institutions.
2. Manage Vietnam's water at the basin scale through inclusive governance arrangements.
3. Increase the value produced by water in agriculture.
4. Give the highest policy priority to reducing the devastating levels of pollution.
5. Improve risk management and disaster response and strengthen resilience.
6. Develop and scale up market-based financing and incentives.
7. Strengthen water security for settlements.

### Recommendation 1. Improve water resource management institutions

**Further improve the legal framework to allow for efficient and effective water resources management.** It is recommended to revise the 2012 Law on Water Resources and 2014 Law on Environmental Protection in order to improve coordination of state management of water resources, particularly for the division of tasks among ministries and provinces as well as to address overlaps with other regulations and to legalize key issues such as river basin organizations. Policies set out in the 2012 Law on Water Resources and in related decrees need to be implemented, notably incentives to encourage water saving, recycling, wastewater reuse and water use efficiency. Financial regulations need to be amended to allow for ring-fencing of revenues from economic instruments to allocate them to water resource management activities. Economic instruments should be further refined to incentivize behavioral changes in water users towards sustainable water resources management, and they should be strictly enforced. Market-based mechanisms which allow the consumer to 'vote' for sustainably produced products through their purchases should be further developed and promoted. Certification schemes and consumer education can be key pillars of this initiative.

**Enforcement of regulations, particularly related to discharge of wastewater, needs to be strengthened, to ensure strict compliance with environmental**

**regulations.** Monitoring and inspection – particularly random inspection - activities need to be increased and penalties firmly imposed. State management from central to local level needs to be strengthened, and active participation of stakeholders, particularly civil society, should be enabled and encouraged through policies and regulations, in order to support water resources management activities, including monitoring activities.

**Human and financial capacities and resources need to be enhanced to allow for implementation of important policy measures.** These tasks include the development of the overall master plan for water resource basic survey, water resources master plan, river basin planning, establishing and operation of river basin organizations, and inter-reservoir operations. In support of these tasks, basic surveys need to be strengthened, monitoring stations expanded, information collected, and databases managed as well as increasing information sharing among ministries and localities.

**Increasing engagement with civil society.** On the one hand, educational and communication campaigns could increase the awareness of Vietnam's citizens of water resource challenges and could offer guidance on how to support sustainable water resources management. On the other hand, given the scarce resources, civil society could be more actively involved in water resource management activities, such as monitoring water quality and untreated wastewater discharges.

## Recommendation 2. Manage Vietnam's water at the basin scale through inclusive governance arrangements

**Move forward on integrated management within basins and across sectors.** The 2012 Law on Water Resources sets out the requirements of integrated management and basin planning. However, at present, many central, provincial, and local authorities and agencies take decisions on water development and management without adequate coordination or regard for spatial externalities at the scale where it matters—the basin. An integrated approach is essential to provide a framework to address inter-sectoral and interjurisdictional issues like infrastructure planning, water allocation, flow management, pollution, flooding, and drought resilience. However, integrated approaches are challenging to achieve when mandates are spread across jurisdictions and agencies. The focus in integration should not necessarily be on *administrative architecture* but on *integrating functions*. What is needed is a specific timeline and action steps for implementing the 2012 Law on Water Resources, adapted to each basin situation. In this, Vietnam can learn much from its own ongoing experiences in integrated planning: at the largest scale, in the Mekong Delta; at the meso scale, in the Sesan and Srepok Rivers; and at the intra-provincial scale, on the Dinh River in Ninh Thuan. Based on these local test beds and on international experience, lessons may be drawn on how to carry out effective integrated basin planning in all main basins.

**Build a national water information system to meet the intensifying water management challenges:** *You cannot manage what you cannot measure*. Water resources management is a knowledge-based activity that at present is constrained by lack of information and of access to information. There is little reliable information or monitoring of the economically most significant problem—water pollution. High quality and timely water data are needed to support planning and decision taking. That will require expanding and completing investments in data gathering. A national water information system also needs to be built, based on modernized water monitoring and enhanced analytical tools, with all water data collected into a robust and transparent system easily accessible to all as the building block for good water management.

## Recommendation 3. Increase the value produced by water in agriculture

**Speed up implementation of the Agricultural Restructuring Plan and of the new irrigation strategy**. Growth of incomes and value in Vietnam's agriculture and aquaculture, which use 92 percent of the nation's water, will depend on using less water more productively through innovation, climate-smart agriculture, and environmentally sustainable measures. Experience throughout Vietnam shows that higher-value cash crops have higher water productivity, and improved irrigation can boost output and incomes and proof farming against drought. Up to 25 times more value and farmer income can be obtained if farmers switch part of their production to higher-value crops that return more value per cubic meter. This calls for a bundle of complementary policies to reduce agricultural water usage, boost agricultural water productivity and promote diversification to higher value crops. It will require adopting new production systems, such as 1 Must–Do 5 Reductions and System of Rice Intensification (SRI), including Alternative Wet and Dry (AWD) techniques, which form an important component of both systems. In addition, it will require investments in irrigation systems and in market linkages and value chain development, with

farmers and the private sector as leading partners. It will also require incentives to align farmers' behavior with policy and fiscal objectives and other goals such as environmental sustainability, pollution control, and resilience to shocks. Most of these actions are articulated in the 2014 Agricultural Restructuring Plan and in the new irrigation strategy but remain only partially implemented.

**Integrate agricultural water management within a basin planning and management framework.** As the major water users, agriculture and aquaculture must actively participate in developing and implementing integrated basin planning, to ensure efficient allocation and good water service and to mitigate climate change and pollution risks. Basin-wide planning and implementation need to be collaborative between MARD and MONRE horizontally and with the PPCs vertically.

**Align public resource allocation in irrigated agriculture with policy objectives within a basin framework.** Aligning public spending on agriculture and water with basin plans could help resolve the challenge of coordinating among sectors and between the center and the provinces. More broadly, improving the allocation and efficiency of public resources would help boost agricultural growth and farmer incomes. There is scope to rebalance budget allocations away from new irrigation systems toward upgrading of the existing irrigation systems and toward O&M and to strengthen agricultural services. New resource planning and allocation instruments could help this rebalancing. The Medium-Term Investment Plan and the Medium-Term Financial and Budgetary Plan could allow multiyear programming at the basin scale, integrating sectoral and subnational priorities with national priorities within basin plans, improving the fit of investment with needs, and facilitating long-term provision of O&M. In addition, there is scope to replace 'paddy land' by 'agricultural land' in the budget allocation formula to promote diversification and consequent higher water productivity and higher incomes for farmers.[4] An irrigation water public expenditure review could help define both process and priorities for action.

## Recommendation 4. Give the highest policy priority to reducing the devastating levels of pollution

Risks from water pollution are becoming extreme, with impacts on human health, the economy, and the environment posing a massive threat that could cost nearly 6 percent of GDP by 2035, if nothing changes. Infrastructure, incentives, and regulation must be top priorities and the focus of a massive national effort and investment push.

**Make domestic wastewater collection, treatment, and reuse an investment priority—and a business opportunity.** Vietnam's performance on domestic wastewater collection, treatment, and reuse is comparatively low in the region. Investments in wastewater have sizable public good characteristics—generating large public health benefits—but it is hard to attract private investors without improved revenue streams or subsidies. This calls for public investment and regulatory efforts to expand wastewater treatment and collection and for a collaborative effort with the private sector to develop financing options to make domestic wastewater attractive for investors, either alone or as public–private partnerships (PPPs).

**Sharpen incentives to reduce industrial and agricultural pollution.** For industry, there is a need to address the ineffectual effluent tariff regime. A review of the regulatory and incentive structures for industrial pollution would reveal why they are not working and what actions would have the most impact. A priority would be to strengthen water quality monitoring, regulatory and enforcement systems. The construction and operation of central wastewater treatment plants in industrial zones has to be closely monitored by the authorities to prevent any risks and errors during the design, construction and operation phases. Steps should be taken to encourage the expansion of Eco-Industrial Parks (as per Decree 82/2018/ND-CP) and particularly to encourage water efficiency measures and re-use of wastewater as part of the Industrial Symbiosis concept. In agriculture, there is a need to implement the measures in MARD's Agricultural Restructuring Plan (2014) to induce a shift in cultivation methods, including a package of rules and incentives that reduce fertilizer and pesticide use. Smart fertilizer and pesticide use could produce greater efficiency, reduced pollution, and higher incomes.

**Test innovative approaches to water pollution control that have been developed in other countries.** Vietnam can learn from innovative approaches to water pollution control globally, including innovative approaches to monitoring and accountability such as monitoring pollution in real time, developing a water health index, and strengthening local accountability for pollution control. Possible innovative approaches to financing and incentives include water funds to help finance natural capital alternatives to conventional water treatment technologies; environmental quality contracts, which help enterprises and local

governments meet water quality targets and target incentives to specific pollution reduction outcomes; payment for ecosystem services approaches; and the piloting of a market in trading pollution discharge permits.

### Recommendation 5. Improve risk management and disaster response and strengthen resilience

**Adopt a phased approach to address both urgent needs for managing risks and longer-term needs to build resilience to all types of risks across key sectors.**

Global experience is that disasters have long-term macroeconomic impacts and can affect development outcomes and that provident preparation is the best approach. Given the high level of risks that Vietnam is facing, there is a strong need to continue proactively investing in risk reduction, preparedness, and long-term resilience. In the short term, this would require resolving the multisector coordination and implementation challenges, improving effectiveness, and coordinating horizontally across sectors as well as vertically at national, regional, and provincial levels. In the medium term, the Central Committee for Natural Disaster Prevention and Control needs to be empowered to drive inter-ministerial coordination and serve in an advisory role for integrated disaster risk management. In the long term, multi-hazard disaster risk management and climate change adaptation need to be factored into planning for managing natural resources and land use across all climate-sensitive sectors.

**Implement an integrated approach to disaster risk management and resilience building**. A recent report (World Bank 2017h) highlights four musts for disaster risk management in Vietnam: (1) an integrated drought and flood monitoring and warning system; (2) a financial protection strategy; (3) strengthened social assistance systems; and (4) locally specific risk and vulnerability analyses. The report also highlights four musts for building resilience through both structural and nonstructural measures across key sectors: (1) integrating water resource management with climate-sensitive land-use planning; (2) adopting climate-smart good agricultural practices; (3) employing inclusive, community-based approaches; and (4) empowering vulnerable populations to access risk reduction opportunities.

**Develop a comprehensive disaster risk finance strategy**. Led by the Ministry of Finance, this would require coordinating and combining existing instruments to ensure quick access and disbursement for immediate response and recovery needs, mobilizing additional private funding from the capital and insurance markets, and trying innovative instruments such as the Catastrophe Deferred Drawdown Option used in the Philippines or Mexico's Fund for Natural Disasters.

### Recommendation 6. Develop and scale up market-based financing and incentives

**Develop a new water sector financing strategy.** Against the backdrop of declining public finance, investment and operational needs in urban and rural water and sanitation must increasingly be met by the private sector. A new sector financing strategy should aim at maximizing private finance for development and at introducing financially autonomous operations. The recent proposals for developing a financing strategy for the energy sector could help frame this investigation (World Bank 2018f). The new decree (Decree 63/2018/ND-CP) on Public–Private Partnerships, which came into effect on 19 June 2018, seeks to improve and clarify the enabling environment for such partnerships. However, some outstanding issues, including complicated and lengthy procedures for appraisal and approval for PPP projects, and risk allocation between the State bodies and private investors, remain unclear and unaddressed. It is expected and of importance that these will be addressed by the Law on Investment, which is currently being drafted and will likely be debated by the National Assembly in 2020 or 2021 (KPMG, 2018). Likewise, there is a need for the government to become a facilitator rather than an investor in agriculture. Given the neglect of O&M for publicly funded irrigation schemes, bringing in farmers and professional partners to operate and maintain facilities may also increase the reliability and extend the useful life of these assets.

**Scale up PPPs across all branches of the water sector.** The recent trend in equitization of the water utilities and development of private sector–financed bulk water schemes has demonstrated the potential to draw domestic and international private financing and expertise into the water sector. Despite current constraints, there could be scope for PPPs throughout the water sector if the right packages (with risk allocation and incentives) could be tailored. In irrigation, the new Law on Hydraulic Works (Articles 50–52) provides for broader participation of farmers and the private sector. As in other countries such as China, a PPP strategy could be developed for each branch of the sector—water infrastructure, water pollution control, urban and rural water supply, wastewater, and irrigation.

**Assess the overall incentive structure in water to identify the most important and practical ways to align behavior with policy goals and to meet fiscal objectives.** The government's policy to reduce the role of the state in most policy areas, including water resources management, points to a much greater role for market-based policy instruments. These instruments send pricing signals concerning the importance of conservation, efficient use, and the externalities entailed in different water uses. A range of economic policy instruments can promote efficient water allocation, development, and sustainable use, including water pricing reforms to promote conservation, and water rights assignment and trading to facilitate the re-allocation of water to its highest-value uses. Incentives for cooperation of both public and private actors within comprehensive plans are critical. An assessment of the overall incentive structure in water would help identify the most important and practical ways to align behavior with policy and fiscal objectives.

### Recommendation 7. Strengthen water security for settlements

**Integrate water security for settlements within broader spatial planning.** The rate of urbanization and industrialization in Vietnam has outpaced the planning, infrastructure, and regulation needed to support this rapid growth. Water security for settlements requires risk management, including resilience to climate-related risks such as floods and saline intrusion, and resilience to threats to water quantity and quality; development and protection of water sources; and provision of good quality water supply and sanitation services. Ongoing planning for the Mekong Delta should show how to integrate urban planning for water management, hazard mitigation, water supply, and drainage and wastewater into broader spatial planning at local and basin wide levels. This can be replicated for settlements throughout the country

**Complete urban water reforms and improve service delivery for all.** Strategy and planning for urban water supply services need to focus on 100 percent access, and on the quality and efficiency of services, with an emphasis on improving governance and strengthening autonomous utilities and on developing services in smaller towns. The reform program needs to be carried through to improve governance by accompanying completion of the privatization process with "contractualization," institutional development, and establishment of an independent regulator. Service delivery and utility autonomy need to be sustained by improving the financial situation of the utilities, particularly by boosting the collection rate, reducing non-revenue water and improving energy efficiency. For rural water, attention is needed to ensure sustainability, close provision gaps between rich and poor, and include women and marginalized groups.

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**Policy shifts need to ensure that water is used sustainably and more productively for multiple sectors.** Water management policies need to shift water allocation to higher-value uses and increase the value of water use within sectors. Agriculture needs to be reoriented from its traditional food security focus to a modern production system resilient to climate change. Policy enforcement, as well as the incentives needed to ensure accountability and compliance across tiers of government, will require greater emphasis. Underlying most of these moves will be a shift in focus to make water and the natural ecology it supports the concern of all, seeing water as a precious resource that sustains life, drives prosperity, and enhances an amenity for recreation today and for future generations.

# Acronyms

| | |
|---|---|
| 1M-5R | 1 Must—5 Reductions |
| ADB | Asian Development Bank |
| AWD | Alternate Wet and Dry Method |
| CAT DDO | Catastrophe Deferred Drawdown Option |
| CCA | Climate Change Adaptation |
| CEM | Center for Environmental Monitoring |
| CGE | Computable General Equilibrium |
| DoNRE | Department of Natural Resources and Environment |
| DRM | Disaster Risk Management |
| EBRD | European Bank for Reconstruction and Development |
| FAO | Food and Agriculture Organization of the United Nations |
| FONDEN | Fund for Natural Disasters |
| GDP | Gross Domestic Product |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| HCMC | Ho Chi Minh City |
| IFC | International Finance Corporation |
| IPP | Independent Power Producer |
| IWRM | Integrated Water Resources Management |
| MARD | Ministry of Agriculture and Rural Development |
| MICS | Multiple Indicator Cluster Survey |
| MoC | Ministry of Construction |
| MoF | Ministry of Finance |
| MoH | Ministry of Health |
| MoIT | Ministry of Industry and Trade |
| MoT | Ministry of Transport |
| MoNRE | Ministry of Natural Resources and Environment |
| MPI | Ministry of Planning and Investment |

| | |
|---|---|
| MRC | Mekong River Commission |
| MTFP | Medium-Term Financial and Budgetary Plan |
| MTIP | Medium-Term Investment Plan |
| NAWAPI | National Center for Water Resources Planning and Investigation |
| NGO | Nongovernmental Organization |
| NTP | National Target Program |
| NWIS | National Water Information System |
| O&M | Operation and Maintenance |
| OEPIW | Order on Exploiting and Protecting Irrigation Work |
| PER | Public Expenditure Review |
| PCERWASS | Provincial Centers for Rural Water Supply and Sanitation |
| PES | Payment for Ecosystem Services |
| PIM | Participation in Irrigation Management |
| PPC | Provincial People's Committee |
| PPP | Public–Private Partnership |
| RBO | River Basin Organization |
| SERC | South East River Cluster |
| SOE | State-Owned Enterprise |
| SRI | System of Rice Intensification |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| UNICEF | United Nations Children's Fund |
| USGS | United States Geological Survey |
| VEA | Vietnam Environment Administration |
| WRG | 2030 Water Resources Group |
| WRM | Water Resources Management |
| WSS | Water Supply and Sanitation |
| WUO | Water User Organization |

# 1

# Water Resources Assessment: How Secure are Vietnam's Water Resources?

*How secure are Vietnam's water resources—now and in the future?*

- Despite an abundant natural endowment, Vietnam's water resources are already coming under stress, and the country is also vulnerable to water's great destructive power.
- There are big and growing risks to the quantity and quality of water.
- As levels of water development rise, competition between needs is emerging, and tradeoffs have to be made.
- Under a "business as usual" approach, problems will only grow worse, with the costs of inaction as much as 6 percent of gross domestic product (GDP) by 2035.

## 1.1 The greatest pressures on water resources come from the speed of economic development and the changing structure of the economy

**Liberalized economic policies have driven rapid growth.** In response to slow growth in the 1980s, Vietnam embarked after 1986 on a program of economic liberalization and integration—Doi Moi, or Renovation. Although progression to a market economy is still in transition, with some 40 percent of GDP coming from the state, liberalization has contributed to remarkable levels of growth in recent years, sometimes exceeding 10 percent a year, and has transformed Vietnam into a middle-income country. GDP is around US$160 billion (2015), or US$1,735 for each of the 92 million citizens. Marking this transition, Vietnam graduated from the International Development Association to the International Bank for Reconstruction and Development in 2017.

**Poverty has dropped, although risks remain.** Economic growth and social transformation have lifted large portions of society out of poverty. Nonetheless, risks are pervasive. Gains against poverty remain fragile, and a considerable portion of the population is vulnerable (World Bank 2017b, c).

**Rapid growth has come at the expense of pressure on natural resources.**[1] Rapid growth has put pressure on sustainable resource use and environmental protection. The greatest pressures on water resources come from the speed of economic development and the changing structure of the economy. Essentially, the development of water infrastructure, the rapid rise in water use, and the emergence of growing risks to the resource such as pollution and climate change have outpaced the ability of water institutions to manage and regulate water resource development and use and to manage risks. Resource degradation and rising risk are likely to put limits on future economic growth unless there are changes in water governance.

Box 1.1, drawn from the preliminary results of a computable general equilibrium modeling, indicates the potential magnitude of the impacts on the Vietnamese economy if nothing is done to alter current trends (World Bank 2018g; Blake and Robbins 2016).

## BOX 1.1: The potential economic impacts of inaction

To provide insight into the consequences and economic costs of inaction today, the study *Water-related Threats to Vietnam's Economy* quantifies the economywide effects of selected future threats and of the impacts of inaction by 2035 (World Bank 2018g). The study uses computable general equilibrium modeling of the overall GDP impact of the threats by 2035 compared with the scenario in 2035 without the threats. The overall GDP impacts range from 0.2 percent to 3.5 percent, which conservatively applied to Vietnam's 2016 GDP is between US$400 million and US$7 billion per threat/impact. For all threats combined (except for increased climate change–induced flooding of Red River), **the total impact on GDP amounts to 5.96 percent annually** (see table).

**Summary of sectoral and GDP impacts by 2035 of threats in case of inaction**

| Threat | Impact in case of inaction | Change (%) | | | |
|---|---|---|---|---|---|
| | | Agriculture | Industry | Services | Total |
| **Combined Threat** | **Includes all cumulative threats/ impacts except for climate change–induced flooding of Red River** | **19.34** | **2.67** | **5.55** | **5.96** |
| Increased climate change–induced flooding of Red River | Infrastructure damage and loss in crop yields → Loss of capital and land, reduced transport efficiency, cost of reconstruction | 0.64 | 0.23 | 0.37 | **0.34** |
| Sea-level rise and land subsidence due to overabstraction of groundwater in Mekong and Red River Deltas | Impact on paddy rice production → Reduced paddy yields, loss of agricultural land | 1.67 | 0.06 | 0.29 | **0.36** |
| Intensifying seasonal and regional water shortages | Impact on agriculture and hydropower → Reduced yields in paddy and other crops, reduced efficiency in hydro-electricity | 5.37 | 0.33 | 1.01 | **1.25** |
| Climate change–induced rising temperatures | Impact on paddy production → Reduced paddy yields | 0.90 | 0.00 | 0.20 | **0.20** |
| Increased discharge of untreated industrial wastewater to surface water bodies—impact on paddy yields | Impact on irrigated agriculture → Reduced paddy yields | 3.60 | 0.10 | 0.60 | **0.80** |
| Increased discharge of untreated municipal and industrial wastewater—impact on human health | Impact on human health/childhood development → Reduced labor productivity; increased expenditure on health | 5.80 | 2.80 | 3.60 | **3.50** |
| Increased damming for hydropower upstream of Mekong River | Impact on wild fish productivity → Reduced yield in fishing | 3.28 | –0.18 | 0.27 | **0.45** |

*Source:* World Bank 2018g.

**Water governance and water security are essential components of policy in coming years when institutional development will be important for Vietnam's economic growth.** Governance of environmental sustainability and water security (see box 1.2) are essential to the consolidation of the institutional underpinnings of development in coming years. Aware of the risks of too rapid economic growth and societal change, the government formulated a vision for the next stage of the country's development. The Socio-Economic Development Strategy 2011–2020 calls for "break-throughs" in structural reforms, environmental sustainability, social equity, and macroeconomic stability to allow Vietnam to lay the foundations for a modern economy and society. Water governance and water security are important components.

## BOX 1.2: What is water security?

The goal of water security is to balance risks and opportunities to deliver three positive water-related social, economic, and environmental *outcomes*: (1) water resources managed efficiently and sustainably; (2) water-related risks mitigated; and (3) water services delivered efficiently, sustainably and equitably. These three outcomes roughly correspond to the three parts of this Report.

Delivering these outcomes depends on the water *sector architecture*, that is, on water governance, water institutions, and water infrastructure.

In addition, the available *water endowment* is fundamental for framing the water security challenge.

When water resources are managed efficiently and sustainably, water-related risks are appropriately recognized and mitigated, and water services are delivered reliably, affordably, and inclusively, a country can be considered *water secure*.

However, the acceptable levels of many of these characteristics of sector performance will change with economic and social development, meaning that water security is a dynamic goal reflecting changing societal expectations.

*Source:* World Bank 2018h.

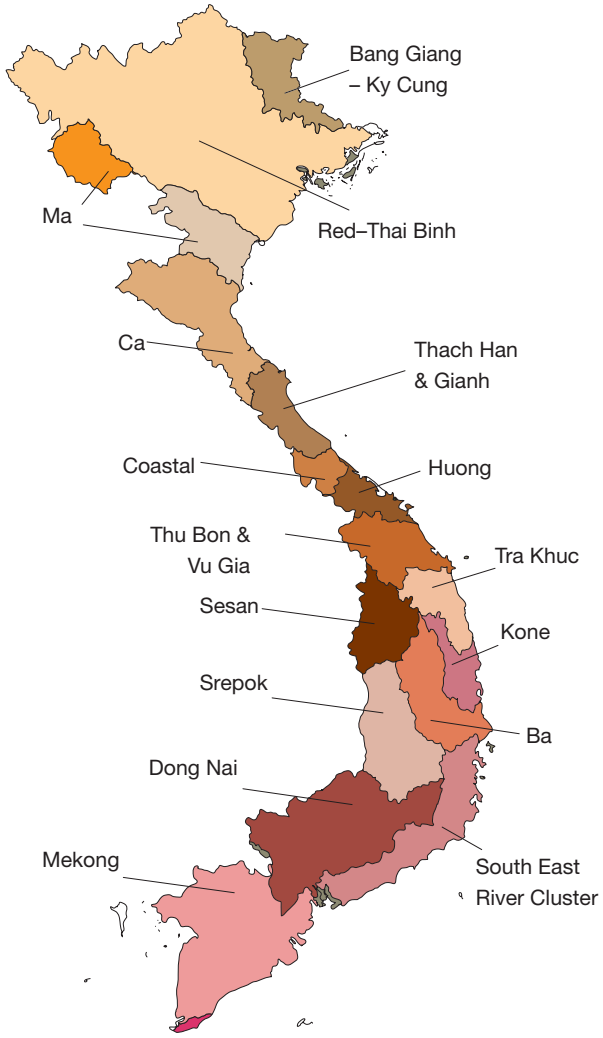
## 1.2 Vietnam's water resources are relatively abundant, but stress and competition are growing

### 1.2.1 Water resources are already coming under stress

**Water is Vietnam's most precious natural resource, but it is not limitless.** Vietnam has 16 major river basins and nearly 3,500 rivers in a dense and complex river network (MONRE, 2016b; see map 1.1). With ample average rainfall of almost 2,000 millimeters (mm) a year Vietnam appears to be rich in water. Surface water and reserves of groundwater provide considerable water resources, and a high proportion of these resources can be developed. The Mekong, Red–Thai Binh, and Dong Nai rivers account for 80 percent of the country's water resources. The Mekong has a catchment area of 800,000 square kilometers ($km^2$)—the size of France—spread across six countries. Only 8 percent of the basin's area lies within Vietnam. The total water available to Vietnam from this river is more than 500 billion cubic meters ($m^3$), 57 percent of Vietnam's water resource and exceeding the entire water availability of the Philippines or Australia. The Red–Thai Binh River has a catchment of 155,000 $km^2$ and delivers to Vietnam 137 billion $m^3$, more than the entire water resources of the United Kingdom. Overall water availability—9,434 $m^3$ per capita[2]—is high by regional and global standards.

**However, much of Vietnam's water lies beyond its direct management.** Two-thirds of water resources flow in from neighboring countries upstream (see table 1.1). As a consequence, Vietnam ranks low in the region for internal renewable water resources—4,200 $m^3$ per person against an average of 4,900 $m^3$ for Southeast Asia. Water resources are also highly seasonal, with precipitation and runoff concentrated in a short rainy season followed by a long, hot, dry season (see figure 1.1). Thus, rivers are in flood during the rainy season, but flows are low in the dry season. In addition, rainfall and water resources are unevenly distributed across the country.

**MAP 1.1: The 16 main river basins in Vietnam**



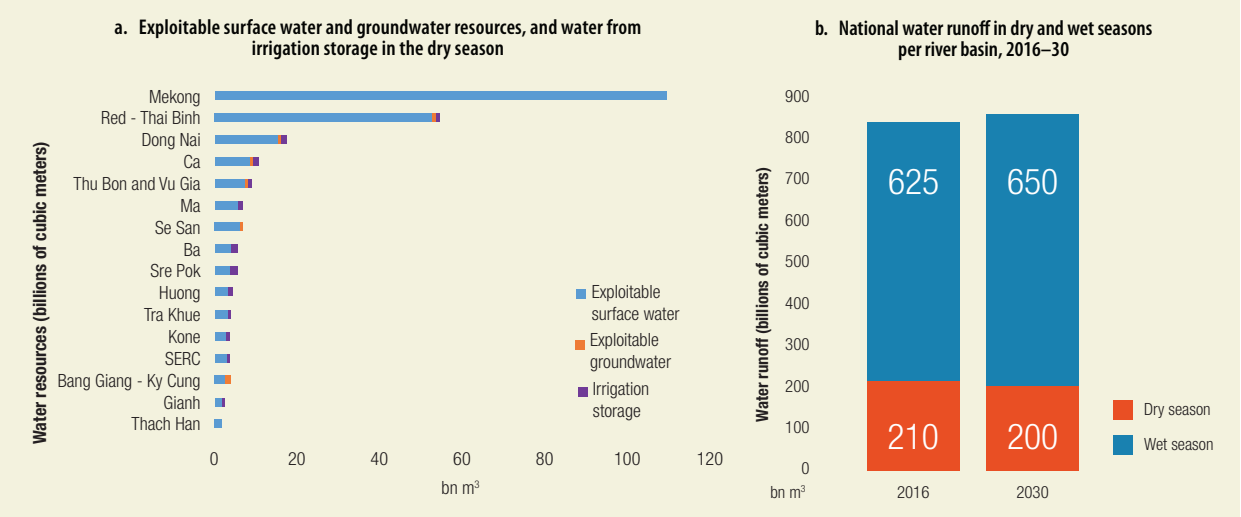

*Source:* 2030 WRG 2017.

**TABLE 1.1: Water resources in major rivers**

| River basin | Catchment area | | Total volume (billions of cubic meters) | | |
|---|---|---|---|---|---|
| | Total area (square kilometers) | Percent in Vietnam | Total | Total generated in Vietnam | Percent generated in Vietnam |
| Mekong | 795,000 | 8 | 508 | 55.0 | 11 |
| Red–Thai Binh | 155,000 | 55 | 137 | 80.3 | 59 |
| Dong Nai | 44,100 | 85 | 36.6 | 32.6 | 89 |
| Ma | 28, 400 | 62 | 20.2 | 16.5 | 82 |
| Ca | 27,200 | 65 | 27.5 | 24.5 | 89 |
| Ba | 13,900 | 100 | 13.8 | 13.8 | 100 |
| Bang Giang – Ky Cung | 11,220 | 94 | 8.9 | 7.3 | 82 |
| Thu Bon and Vu Gia | 10,350 | 100 | 17.9 | 17.9 | 100 |

*Source:* WEPA 2018.

**FIGURE 1.1: Exploitable water resources and irrigation storage, and national water runoff**




*Source:* 2030 WRG 2017 (left); Vietnam Institute of Water Resource Planning (right).

**Vietnam has developed and used this precious resource of water for the good of its people.** With over 7,500 dams and reservoirs and 4 million hectares (ha) of irrigated area, irrigation brings livelihoods to about half the workforce and their families, contributing nearly one-fifth of the nation's income (World Bank 2016b; World Bank 2017b). Hydropower generates 37 percent of the country's electricity (see box 1.3). Huge investments have brought clean drinking water to the vast majority of households. Vietnam has a strong cultural tradition of respect for its precious water resource, and rivers, streams, and lakes enhance a beautiful countryside for people and nature.

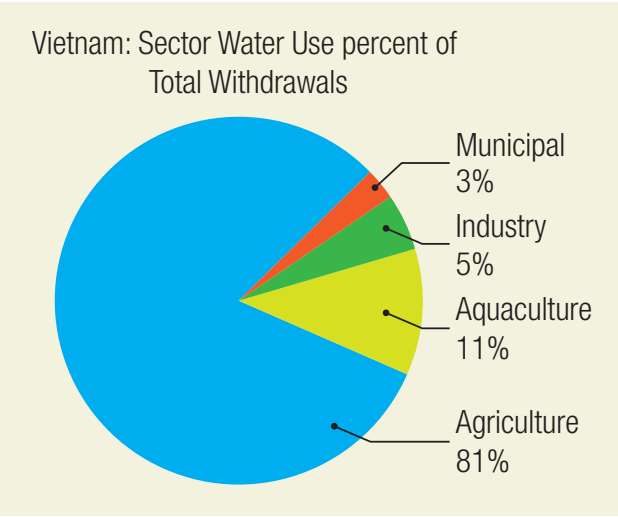
## BOX 1.3: Hydropower in Vietnam

Vietnam has 3,450 rivers of more than 10 kilometers in length, presenting a high potential for hydropower development of about 35,000 megawatts (MW), of which some 26,000 MW can be economically developed. By 2017, installed capacity was 17,000 MW, with 54 percent in the northern region, 35 percent in the center, and just over 11 percent in the southern region. Hydropower accounted for 37 percent of the electricity mix of Vietnam in 2018. The update of the Power Master Plan VII gives high priority to further hydropower development but focuses on multipurpose projects (flood control water supply, and power generation) and on pumped storage power stations to increase network efficiency. Total projected capacity, including small and medium hydropower plants and pumped storage stations, is planned to reach 21,600 MW in 2020, rising to 23,400 MW in 2025 and 25,400 MW in 2030. Because of fast rising demand, other generation capacity will also grow fast and the share of hydropower (including small hydropower plants) in the overall national power supply is expected to decline—to 29 percent in 2020, 20 percent in 2025, and 15 percent in 2030.

*Source:* GoV 2016; Vietnam National Assembly Committee for Science, Technology and Environment 2013; MoIT 2018. Government's report at the 6th session, XIV National Assembly Meeting, October 2018.

**Economic growth is a thirsty business.** With growing cities, rapid industrialization, and an expanding agriculture sector, the demand for water will continue to climb. Water resources are abundant but not limitless, and water availability varies across regions, years and seasons, with variability exacerbated by climate change. By use, 81 percent of water goes to agriculture, with a further 11 percent to aquaculture, 5 percent to industry, and only 3 percent to municipal uses (see figure 1.2). In addition to direct water uses, inland waterway transport is estimated to convey approximately 48% of the total national tonnage being transported. Thus, inland waterway transport makes a significant contribution to Vietnam's economy (World Bank, 2013b).

**FIGURE 1.2: Water withdrawals by sector in Vietnam**

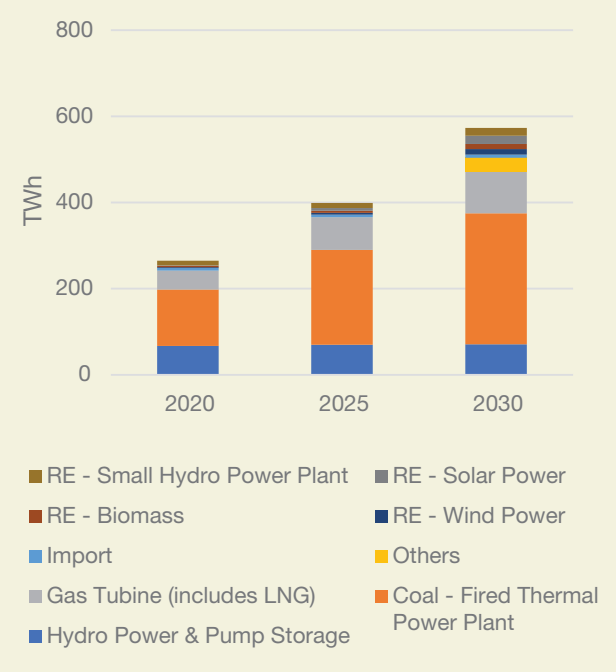



*Source:* 2030 WRG (2017).

*Note:* Energy water withdrawals are not included.

**Energy demand is rising exponentially, but little is known about its impact on water resources.** The energy sector plays a significant role in Vietnam's economic growth. The National Energy Development Plan for the period 2016-2025 with the vision to 2035, developed by MOIT, has forecast that by 2035 the total final energy demand under a business as usual scenario will be nearly 2.5 times higher than in 2015. It is expected to increase from 265 TWH in 2020 to 573 TWh by 2030. The highest growth in energy consumption up to 2035 is attributed to the transportation and industrial sectors, with an annual growth of 5.7% and 5% respectively. While the share of renewable energies contributed to 53% of total primary energy supply in 2000, the share of domestic supply of hydropower and biomass seems unable to meet increasing demand. Thus, the expected share of renewable energy is expected to be 32% in 2020, 24% in 2025 and 23% in 2030. The balance is planned to be met mostly with increased coal fired power plants and gas turbines. Coal fired power plants will contribute 40%, 55% and 53% to the total energy mix by 2020, 2025 and 2030, respectively (Revised PDP VII). Most thermal coal fired power plants, require large volumes of water for cooling processes and powering turbines with steam (World Resources Institute, 2018). While most of this water is not consumed by the process and is discharged back into the water body, it needs to be considered that the high level of water withdrawals may pose a potential systematic or network risk, particularly in basins with already competing water uses. This situation can be aggravated during times of water shortage and drought. In India, for example, drought related water shortages in 2016 forced 18 thermal power plants to shut down between a few days to months. As a result, 14 TWh of thermal energy generation was lost, impacting India's economy and society. The energy loss was the equivalent of Sri Lanka's entire energy demand for one year (World Resources Institute, 2017). Thermal water pollution is a further challenge which needs to be addressed. Further, Vietnam will use between 45–56 million tons of domestic coal a year, with the balance of 100 million tones/ year of coal demand by 2030 being imported. Coal mining also requires water and in addition can have implications for water pollution. However, to date there seems to be little investigation on the impact on water resources of coal fired thermal power production, nor on the impact of water resources on coal fired thermal power production and its potential risks to the economy.

**FIGURE 1.3: System generated power in 2020-2030 as per revised PDP VII**

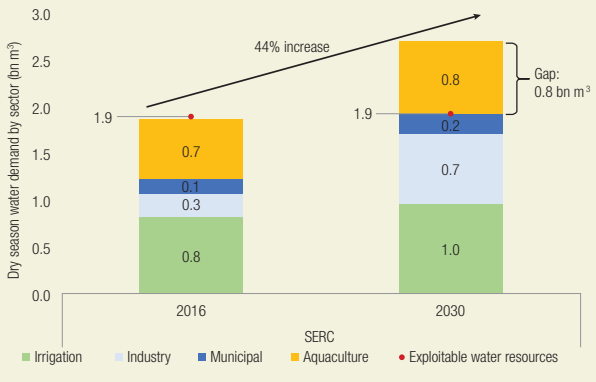



*Source:* Decision 428/QĐ-TTg dated 18th March 2016.

**Rapid development is beginning to stress the water resource.** Although the resource remains abundant in most locations, rapid development and growth in demand have produced stresses. Two major basins are already experiencing unsustainably high levels of extraction, and other economically important basins will become stressed if action does not start now. The 2030 Water Resources Group (WRG) study found that the economically important South East River Cluster (SERC) and Ma basins are already registering unsustainably high rates of extraction in the dry season (2030 WRG 2017).

Figure 1.4 shows that dry-season demand in the SERC basin of nearly 2 billion $m^3$ is already equal to the entire available resource of 1.9 BCM

**FIGURE 1.4: Water demand by sector in 2016 and 2030 in the dry season in the South East River Cluster basin**




*Source:* 2030 WRG 2017.

**In coming years, water stress will have considerable impact on Vietnam's socioeconomic development and natural capital unless action is taken now.** Section 1.2.6 below describes how rising demand will bring 11 of Vietnam's 16 basins into stress by 2030 and how this stress will have a considerable impact on the economy if nothing is done—and this is without considering the effect of pollution on water systems. Reducing water stress will be critical, particularly in the four major river basins in which about 80 percent of Vietnam's GDP is generated—the Red–Thai Binh, Mekong, Dong Nai, and SERC river basins. Action now is already a pressing need (GoV 2018).

### 1.2.2 Water has great destructive power

**With more than 70 percent of the population at high risk from water-related natural disasters, Vietnam is one of the most hazard-prone countries in the East Asia and Pacific region.** The costs of these disasters have been high—13,000 deaths, property damage of over US$6 billion in two decades, and losses of 1–1.5 percent of GDP each year. These disasters have also revealed low levels of resilience. Flash floods kill an average of 50 people each year (see box 1.4). Cities and farms in the Mekong Delta are flooded up to 3 meters every year. In addition, more than 30 dam failures in the last five years have led to devastating regional flooding, loss of human life, and substantial economic losses.

**BOX 1.4: Flooding is a growing danger**

The narrow and steep topography of the Sesan-Srepok River Basin (and the effect of its development for hydropower generation—see box 1.8) results in frequent floods and makes forecasting and early warning difficult. Flooding has a heavy human and economic cost. The historical Ketsana storm in 2009 affected 11 provinces in the Central region and Central Highlands, killed 172 people and caused an estimated US$70 million in damage (WHO, 2018). A 2017 flood in the northern and central regions of Vietnam has killed at least 54 people. The picture at right is from Hanoi City in 2008.

The floods have killed 17 people in Hanoi and 44 across northern and central Vietnam
*Picture:* GETTY

*Source:* Telegraph 2008; Telegraph 2017.

**Drought events are increasing in frequency and severity, at a high cost to livelihoods and the economy.** Between 2014 and 2016, an El Niño event caused Vietnam's most severe drought in over 90 years, affecting 18 provinces (see box 1.5). The drought affected mostly the Central Highlands, the southern coast, and the Mekong Delta (2030 WRG 2017). A recent World Bank global report found that the impacts of "wet shocks," such as floods, are more visible but that the impact of "dry shocks," such as drought events, can have higher economic costs: "for firms and cities the cost of dry shocks is four times greater than wet shocks" (World Bank 2017n).

**Some of these disasters stem from land-use changes and poor management, aggravated by climate change.** Vietnam is one of the most vulnerable countries to climate change. Climate change is expected to increase total annual runoff slightly, but more rain in the wet season and less in the dry will result in more variability and more extreme events. The likely impacts are grim: sea-level rise of up to 30 centimeters by 2050, declining river flows, increasing reliance on cross-border flows,[3] rising number and intensity of storms and floods, more frequent drought conditions, and increased saltwater intrusion.

### BOX 1.5: The economic effects of the 2016 drought

The total direct economic losses from the 2016 drought came to VND15 trillion (US$675 million), representing 0.35 percent of GDP and resulting in negative agricultural growth for the first time in decades.

By early April 2016, discharges of the main rivers in the Central Highlands were reduced by up to 90 percent, and water volumes in most reservoirs declined to as little as 10 percent of the design capacity. Seventy percent of the cultivated area experienced severe drought. Freshwater was lacking for about 2 million people, and 1.1 million people were obliged to seek food aid. Impacts continued after the drought was over as perennial crops like coffee were affected.

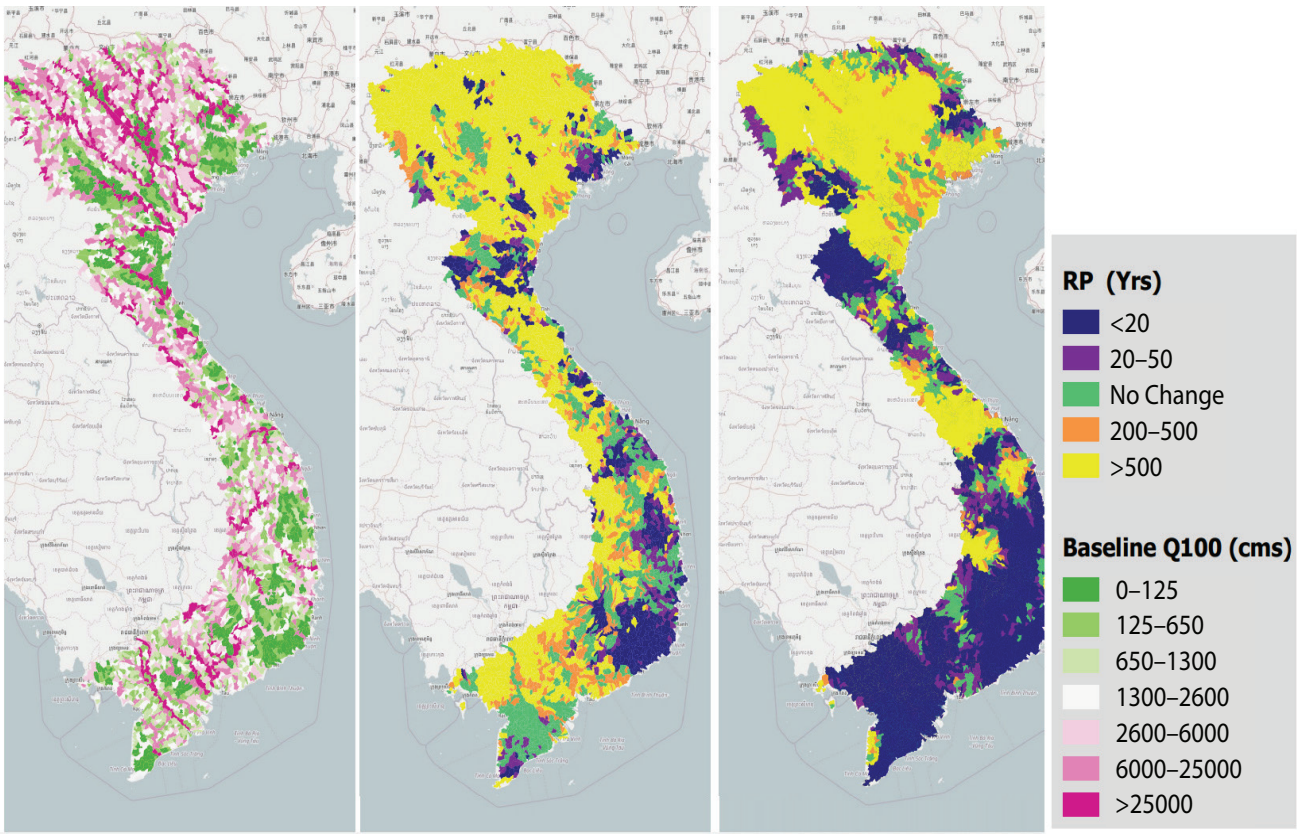
The drought hit the Mekong Delta in the critical growing season for rice, requiring farmers to supplement irrigation with groundwater to save their crops. The reduced surface water flows allowed saltwater to intrude up to 70–90 kilometers (km) upstream, 20–30 km further than usual, making the water unfit even for irrigation. Thirteen provinces with some 180,000 hectares of irrigated area in the Mekong Delta (10 percent of the total irrigated area) were seriously affected by the drought and salinization. Rice production fell by 1.1 million tons (2.2 percent of national production). Effects from salinization will be felt into the longer term.

*Source:* WPP 2017; World Bank 2016c; World Bank 2017h.

## 1.2.3 Risks are large and growing

**Flood risks are rising, particularly in the Mekong Delta and in the south and centre of the country.** A recent assessment of flood risk shows that historical peak flood flows that used to occur once every- one to five centuries are now expected across half the country in as little as every 20 years or less by 2026–45 (World Bank 2018i). The half of the country south of Danang will be particularly affected (see map 1.2). In Ho Chi Minh City, the area exposed to the risk of a 100- year flood is projected to increase from 29 percent to 46 percent by 2026–45.

**MAP 1.2: Regional overview of annual peak flows and their return period in 2000–17 and with climate change in 2026–45**




*Source:* World Bank 2018i.

*Note:* This figure shows the extent of areas with more frequent exposure to extremes: (a) 1 in 100 stream flow (Q100) in cubic meters per second based on data from dataset Climate Forecast System Reanalysis for 1979–1999; (b) the return period of the Q100 in the recent period of 2000–2017; (c) the return period associated with Q100 in 2026–2045 (that is, using Representative Concentration Path 4.5 Community Climate System Model).

**Alternating cycles of flood and drought are highlighting infrastructure gaps in some areas.** Despite the extensive development of dams, reservoirs, and other water control structures, a changing climate and changing patterns of runoff and river flow are revealing problems of inadequate infrastructure. A recent study of Ninh Thuan Province found that fluctuating climate patterns were contributing to alternating cycles of drought and flood. Reservoirs in the province hold only 8 percent of the average annual flow and are thus unable either to prevent damaging flooding in a wet year or to carry over adequate water to the dry season to mitigate the impacts of drought in a dry year (World Bank, 2018e).

**Pollution is fouling surface water.** Only 12.5 percent of municipal wastewater is treated, and countrywide most sewage, industrial effluent, and solid waste find their way into watercourses (MOC, 2019). While water quality remains fair upstream, the downstream and estuary zones are routinely fouled, especially rivers in and around major cities.

**Environmental flows are dwindling.** The requirements for environmental flows (termed "minimum flows" in Vietnam) are set out in the 2012 Law on Water Resources and in a recent circular (64/2017) issued by MONRE. These instruments require flows to be maintained at least at the level in the lowest month or the average value of the three lowest months. MONRE and its decentralized departments are responsible for setting the levels, subject to the approval of the concerned provincial people's committees. Levels are announced each year, and hydropower operators, irrigation districts, municipalities, and others withdrawing water are responsible for ensuring that minimum flows are maintained. In many locations, minimum dry season environmental flows, as defined by the MONRE circular, have fallen below the levels needed to preserve the ecology and amenity of the river and also below the levels needed to ensure that downstream users have access to the water they need.

**Risks to the quantity and quality of groundwater are also on the increase.** Unregulated abstraction of groundwater is "mining" the resource to the detriment of future generations. This abstraction and use are an unregulated free-for-all that is fast depleting aquifers. Water tables are dropping in areas of unsustainable over-abstraction, resulting in dwindling quality and quantity of the resource, and in rising costs, and are also one of the causes of land subsidence (see box 1.6). Further, salt water is flowing into surface water and groundwater. In 2016, salt water flowed almost 100 km up the Mekong—200,000 ha of crops were ruined, and rice and shrimp production plummeted.

### BOX 1.6: Overexploitation of groundwater and land subsidence in the Mekong Delta

In the rural areas of the Mekong Delta, almost every household owns at least one groundwater well, and wells are still proliferating. In Ca Mau alone, there are more than 138,000 wells producing 400,000 cubic meters ($m^3$) of water daily. Soc Trang has a further 80,000 wells. Groundwater is used not only for domestic purposes but also for agriculture, animal production, and aquaculture.

Development and pumping are largely unregulated, and water tables are plummeting, leading to land subsidence and saline intrusion. According to the Ministry of Natural Resources and Environment, the water table across the whole delta is dropping by 0.2–0.4 m per year. The worst depletion occurring is in Long An, Ca Mau, and Tra Vinh Provinces, ranging from 0.5 m to 0.9 m per year. In Hau Giang, Can Tho Bac Lieu, Dong Thap, and Vinh Long Provinces, water tables are falling by 0.3–0.5 m a year.

The upshot is that land subsidence is now accelerating all across the Mekong Delta. Analysis from spatial data (InSAR) and remote sensing from 2007 to 2010 confirms land subsidence of 1–3 centimeters (cm) a year deltawide. In Ca Mau, for example, the land is sinking at 1.9–2.8 cm each year and roads are sinking in many spots. According to the World Bank (2018g), land subsidence caused by groundwater extraction in the Mekong Delta is estimated to reach 0.24–0.90 m by 2035. Groundwater subsidence is expected to have 10 times more impact to GDP in 2035 from lost paddy land than sea level rise alone (WB, 2018g).

*Source:* National Center for Water Resources Planning and Investigation 2016; Viet Nam News 2017; Erban and others 2013; Erban et al 2014.

**Dependence on transboundary resources creates vulnerability.** With two-thirds of water resources coming from outside the country, Vietnam's high dependency creates risks. Upstream riparian countries are developing infrastructure that affects flows, and upstream hydropower dam construction presents risks (see boxes 1.7 and 5.4). On the Mekong, the highly seasonal discharge patterns create flood risks that are exacerbated by unplanned development. However, Vietnam is also an upstream country, for example in the Sesan Srepok River Basin, and thus also needs to consider downstream concerns in its planning.

### 1.2.4 Tradeoffs are intensifying

**As water development intensifies, competition among needs is emerging, creating conflicting demands for water resource management.** More than 90 percent of the water used nationwide is allocated to irrigation and aquaculture. Today, increased demand from hydropower and other fast-growing and higher-value uses is beginning to create conflicting demands, which current water resource management institutions cannot easily resolve (see box 1.7). For example, some small and medium sized hydropower investors pay more attention to power generation without sufficient consideration for reservoir operations. This creates risks for downstream areas of flooding in the wet season and of water scarcity in the dry season (MONRE, 2016b). As an example, in 2013 the Central Coast, including Da Nang City, faced a severe water shortage affecting 1.7 million people and 10,000 hectares of agricultural land. A bilateral solution had to be found with the dam operator of Dak Mi 4 Hydropower Joint Stock Co. to release additional water downstream.

**Vietnam still has ambitious hydropower development plans (see box 1.3), and risks will increase—including to inland fisheries and to nutrient-rich sediment flows—unless planning and management improve.** The government is well aware of the challenges, and since 2014 the Prime Minister has issued inter-reservoir operation procedures for the 61 biggest hydropower and irrigation reservoirs. The total capacity of these reservoirs amounts to 33.3 billion $m^3$, accounting for over 98% of the total capacity of reservoirs nationwide. Priority objectives of the inter reservoir operation procedures in the flooding season are ensuring engineering work safety, controlling flooding and protecting downstream and ensuring power generation efficiency. In the dry season, engineering work safety remains the first priority, followed by the requirement of maintaining minimum flow, meeting downstream water demand and reservoir water level, and lastly the power generating efficiency. The efficiency of these procedures, however, still needs to be formally evaluated.

#### BOX 1.7: Downstream hazards of dams

One downstream hazard concerns fish stocks. A 2016 assessment estimated that by 2030 the wild fish catch on the mainstream of the Mekong River would be reduced by 26–42 percent if a potential cascade of 11 large dams is constructed (ICEM,2010). Analysis using a computable general equilibrium (CGE) modeling approach to assess the overall economic effects of the upstream Mekong development on fish catches estimated that—when considering only the impact on fish catches—agricultural GDP would decline by more than 3 percent by 2035. This translates into an overall GDP reduction of about a half percentage point (see table and World Bank 2018g).

**Impact on GDP from reduced fish production caused by additional hydropower development on Mekong River**

| Sector | Percent deviation |
|---|---|
| Agriculture | –3.28 |
| Industry | 0.18 |
| Services | –0.27 |
| **GDP** | **–0.45** |

Further negative economic impacts include the interruption of nutrient-rich silt flows downstream on which Vietnamese flood irrigation has historically depended (but which were not quantified in the CGE model). The problem is that reservoirs trap all "bedload," and the supply of sediment downstream is reduced. In the Thu Bon–Vu Gia Basin, for example, 42 hydropower reservoirs upstream trap silt and sand, reducing the dam sediment reaching the mouth of the Cua Dai River by about 40 percent and eroding 100 m of riverbank in the two decades 1997–2017. The Mekong River Commission found that existing and proposed dams in the Mekong Basin are likely to reduce current sediment by 67 percent by 2020 and by 97 percent by 2040 (Piman et al, 2017). Mitigation measures should be considered for each dam and for the entire cascade to ensure that sediment can reach further down the delta to provide floodplain fertility.

*Source:* World Bank 2013; World Bank 2018g; MoIT 2018.

### 1.2.5 Water conservation is an emerging priority, but this does not mean loss of economic value

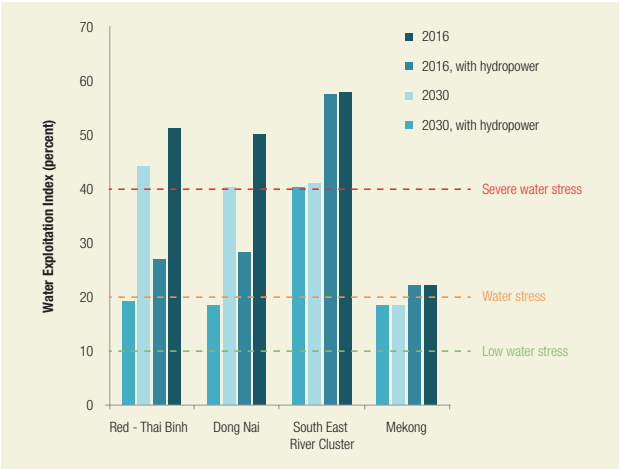
**Agriculture and aquaculture jointly use 92 percent of the nation's water, but much more value could be obtained.** At present, two-thirds of the arable area is planted in rice. Many farmers—and the nation—could earn more from their water by switching to higher-value products like vegetables, fruits, fish, and live-stock. New technology such as drip irrigation and higher-yielding varieties can give farmers much more income per unit of water consumed—more "dong per drop."

**In addition, current resource management arrangements do not optimize the value derived from water.** Water infrastructure—for irrigation, water supply, and hydropower—is developed and managed by thousands of operators without optimization at the level of the basin or stream flow. The government has begun to address this problem for major rivers and infrastructure, but implementation of the 2014 operating principles has been slow (see box 1.7). In addition, the problem persists for smaller infrastructure and watercourses. This leads to loss of value—for example, optimizing hydropower cascades on a river as a system could yield significantly higher power production and higher revenues. Managing flow variance on rivers—adapting the sequence and timing of high and low flows on rivers—could optimize value and minimize tradeoffs among hydropower, fisheries, agriculture, and transportation.

### 1.2.6 Under business as usual, problems will only grow worse

**Even today, the four river basins where 80 percent of Vietnam's GDP is produced are facing water stress in the dry season.** Applying the Water Exploitation Index—the ratio of mean annual total abstraction of freshwater divided by long-term average "renewable" freshwater resource availability—to Vietnam's river basins, reveals that the Red–Thai Binh, Mekong, and Dong Nai basins already face water stress, while SERC even faces "severe" water stress (see figure 1.5).[4] Even where rivers are not currently stressed in quantity, problems of water quality or groundwater overabstraction may spell shortages of water for supply to settlements. Box 1.8 illustrates how there is plenty of water in the seven provinces south of the Hau River but the declining quality of water from local sources is obliging government to transport water over long distances for potable supply to settlements throughout the region.

**FIGURE 1.5: Water Exploitation Index for key basins—with and without hydropower storage—in the dry season, 2016–2030**




*Source:* 2030 WRG 2017.

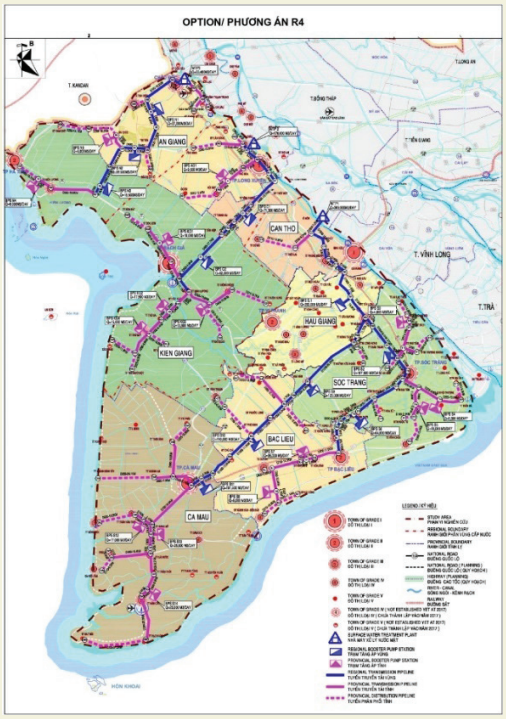
**If business continues as usual, problems will intensify.**[5] Economic growth, changing patterns of consumption, and demographic pressures will continue to boost demand. The 2030 WRG study (2017) projected an approximate 30 percent increase in total water demand between 2016 and 2030,[6] with significant regional consequences in the dry season. If demand is unchecked and there is no change in policies or practices, all but five river basins are expected to face water stress in the dry season by 2030, with the SERC and Ma River Basins facing severe water stress (see figure 1.6). 2030 WRG further projected that SERC—under business as usual—would be unable to meet 28 percent of its water demand in the dry season.

**BOX 1.8: Scarcity amid plenty: Regional water supply to settlements in the seven provinces south of the Hau River**

There is no shortage of water south of the Hau River. However, the reliability of sources of drinking water supply are deteriorating due to declining groundwater resources, saline intrusion to both surface and groundwater, and pollution. The Mekong Regional Water Supply Master Plan to 2030 and a pre-feasibility study commissioned by the Ministry of Construction in 2015/16 concluded that the most viable future water supply to settlements in the seven provinces south of the Hau River is through regional/interprovincial bulk water supply, with water sourced from the Hau River sufficiently upstream to be safe from salinity intrusion problems for the foreseeable future (see map). The total capital cost was estimated at about US$1.7 billion. The initiative is to be developed in a multiphased manner. The government is exploring additional options that consider a combination of surface water, groundwater, and desalination to supply various parts of the region, taking into account least-cost sustainable solutions and source diversification to increase the security of supply.

*(Box continues next page)*

**BOX 1.8: (Continued)**



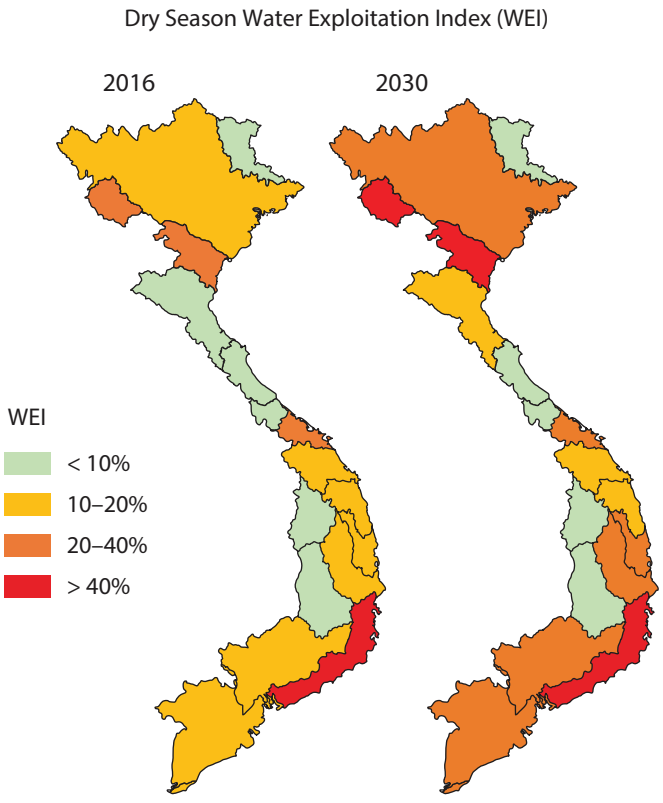

*Source:* (GoV, 2016, Decision 1240/QD-Ttg).

**Water allocation conflicts between hydropower and other users could further increase water stress.** Water allocation conflicts can arise in the dry season due to hydropower storage, making water temporarily unavailable for other users. Attention needs to be given to the management of hydropower storage and trade-offs between water users, particularly in the Red–Thai Binh, SERC and Dong Nai River Basins, where around three quarter of Vietnam's GDP is generated (see figure 1.5).

**The impact on the economy of sticking to business as usual is expected to be great.** The CGE modeling shows that the overall impact of water shortages by 2035 if nothing is done would be equivalent to a reduction of GDP below trend of 1.25 percent versus a future without water shortages (see table 1.2)—and this is a lower-bound estimate (WB 2018g). The agricultural and hydropower sectors would be particularly affected, with up to 30 percent of water demand unmet. Hydropower production could be reduced by 3 percent in 2035 compared with 2012. Nationwide, rice production could be cut by 22 percent, with up to half of production lost in key rice production areas (see table 1.3). These projections are conservative as the modeling framework assumes that there are close substitutes for water. In more realistic modeling scenarios, the consequences of water scarcity are much higher.

**FIGURE 1.6: Water stress levels in the dry season in 2016 and 2030, excluding hydropower storage**

| Basin | 2016 | 2030 |
|---|---|---|
| Bang Giang - Ky Cung | 1% | 2% |
| Red - Thai Binh | 19% | 27% |
| Ma | 35% | 44% |
| Ca | 9% | 12% |
| Gianh | 2% | 3% |
| Thach Han | 5% | 6% |
| Huong | 23% | 28% |
| Thu Bon & Vu Gia | 11% | 15% |
| Tra Khuc | 13% | 16% |
| Kone | 19% | 23% |
| Ba | 19% | 24% |
| Dong Nai | 19% | 28% |
| SERC | 41% | 58% |
| Sesan | <1% | 1% |
| SrePok | 5% | 6% |
| Mekong | 19% | 22% |




*Source:* 2030 WRG 2017.
*Note:* green = no stress, amber = low stress, brown = stressed, and red = severely stressed.

**TABLE 1.2: Impact of water shortage on GDP, 2035 (%)**

| | Combined* | Paddy rice | Other crops | Electricity |
|---|---|---|---|---|
| Agriculture | –5.37 | –4.70 | –0.67 | –0.07 |
| Industry | –0.33 | –0.18 | –0.01 | –0.14 |
| Services | –1.01 | –0.83 | –0.09 | –0.09 |
| **GDP** | **–1.25** | **–1.02** | **–0.13** | **–0.11** |

*Source:* WB (2018g).
*Note:* The percentage change is that from the reference path, that is, no additional future water shortages.
**Combined* column is the reduction in GDP from all impacts (paddy, other crops, and electricity). These estimates include substitution of goods and sector interactions, so the sum of the three categories may not total to the "combined" values.

**TABLE 1.3: Impacts of water shortage on key crops for the most water-stressed regions**

| Basin | Dry season lost rice (%) |
|---|---|
| Red River | 39 |
| Dong Nai and South East River Cluster | 52 |
| North Central Coast | 53 |

*Source:* WB (2018g).

## Notes

1. This chapter is based on several reports, including 2030 WRG (2017), World Bank (2017a) and World Bank (2018g). The chapter also uses material from the recent World Bank (2018i) assessment of climate change and flood risk, the ADB Water Sector Review (ADB 2009), the Mekong Delta Integrated Climate Resilience Project (World Bank 2016f), and numerous other studies. Specific references are indicated where appropriate. For more detailed information on the water resources and water demand situation, as well as on water-related challenges, see 2030 WRG (2017).
2. Based on 884 billon $m^3$ renewable water resources (FAO Aquastat database) and 93.7 million people in 2017 (estimation of Vietnam General Department—Ministry of Planning and Investment).
3. Cross-border inflows to Vietnam are expected to increase by 5–10 percent by 2045.
4. The WEI marks the following levels of water stress: no stress, less than 10 percent; low stress, 10 percent to less than 20 percent; stressed, 20 percent to less than 40 per-cent; and severe water stress, more than 40 percent.
5. Business as usual refers to expected water demand and supply if no significant changes are made to policy or practice. Assumptions for water demand growth rates per sector and water supply considering climate change can be found in 2030 WRG (2017).
6. Water demand projections consider changes in water demand for agriculture, aquaculture, industry, municipalities, and hydropower. Water resources projections include climate change impacts. Details on the assumptions for these projections can be found in 2030 WRG (2017).

# Part I

# Boosting Efficiency—Rising Demand and the Need to Increase "Dong per Drop"

With growing cities, rapid industrialization, and an expanding agriculture sector, the demand for water will continue to climb. Water resources are abundant but not limitless, and water availability varies across regions, years, and seasons, exacerbated by climate change. Vietnam could generate far greater economic benefit from its water than it does. Agricultural productivity typically lags that in many comparator countries. Despite heavy investment in a vast irrigation infrastructure, underinvestment in operation and maintenance has contributed to deteriorating water service and a loss of productivity. And while basic water supply coverage has been achieved in urban areas, second-generation challenges related to the reliability and quality of water supply services are emerging.

2

# Increasing Water Productivity in Irrigated Agriculture

*Agriculture depends on irrigation, but constraints and risks are emerging*

- Vietnam's successful agriculture sector is the main user of water (81 percent), but the government has overemphasized expansion of the vast irrigation infrastructure to the comparative neglect of operation and maintenance (O&M), leading to deterioration in performance.
- There are also emerging constraints and risks to the supply of irrigation water, particularly from seasonal shortages and competition from other sectors and from pollution and salinization. The agriculture sector is increasingly vulnerable to climate variability and extreme events.

*Improving agricultural water productivity would boost incomes and value added*

- Rice is the predominant irrigated crop, and there is scope to improve value added, particularly through improving quality, and to strengthen resilience against increased water variability and shocks.
- The sector has been diversifying to higher-productivity, less water-intensive crops. Continuing this trend would increase value from water and incomes further and would help boost farmer incomes and value added even as dry season water availability becomes a growing constraint.

*Planning, resource allocation, and incentives in irrigated agriculture need to be aligned with policy objectives and integrated in a basin framework*

- Improving the allocation and efficiency of public resources in agriculture and sharpening the incentive structure for farmers would boost agricultural growth and farmers' incomes.
- Agricultural investment and water management also need to be better integrated in the basin planning and management framework. New resource planning and allocation instruments such as the Medium-Term Investment Plan (MTIP) and the Medium-Term Financial and Budgetary Plans (MTFP) could help.
- There could also be scope for public–private partnerships (PPP) in irrigation.

*The government's strategy for irrigated agriculture is sound: the challenge is to accelerate implementation*

- The government has devised the 2017 Law on Hydraulic Works to improve the efficiency and productivity of irrigated agriculture and to introduce a participatory governance model and more efficient asset management. The 2014 Agricultural Restructuring Plan and the new irrigation strategy support this approach.

*Priorities for action*

- Implementing the 2014 Agricultural Restructuring Plan and the new irrigation strategy.
- Factoring irrigation and irrigation infrastructure management into integrated basin planning.
- Accelerating adoption of improved rice-husbandry systems.

*(Box continues next page)*

- Promoting water efficiency and water productivity and strengthening drought resilience.
- Improving resource allocation and revenue raising in irrigation, with better asset management, less emphasis on new infrastructure, and a review of the budget formula prioritizing paddy.
- Looking at possible innovations in private financing for irrigated agriculture.
- Reassessing the overall incentive structure for farmers to align their behavior more closely with policy goals—and to articulate options for charging irrigation service fees not only as a fiscal measure but as incentives for optimal farming practices

## 2.1 Agricultural water use has to be managed within an overall integrated framework

**Agriculture is the dominant user of water, and its performance determines the availability of water to other users, with consequences throughout the economy.**

Agriculture accounts for 81 percent of water withdrawals, contributes about 17–18 percent of GDP and employs 45 percent of the workforce. As the largest user of water, agriculture determines much else in the water sector, and so agricultural diversions need to be coordinated with other priority demands, not only hydropower, industrial and human use but also ecosystem, amenity, and navigational uses. Agriculture is also particularly vulnerable to climate-related risks that are largely channeled through uncertain changes in water availability, suggesting the need for "no-regrets" water management approaches that build resilience to possible future threats. Water pollution is another threat that has emerged as perhaps the overarching problem in the water sector. Agriculture is affected by poor water quality from cities while also being the major contributor to nonpoint source pollution, which is responsible for much of the eutrophication of Vietnam's rivers. Finally, as demand for other, higher-value uses for water grows, there will be a need for mechanisms for intersectoral transfers of water that protect the interests of all stakeholders.

**Scarce water resources could be used and allocated more efficiently during periods of seasonal water shortages.** Agricultural water use during the dry season could be reduced by diversifying away from rice toward higher-value, less water-intensive crops and by adopting more efficient irrigation methods. The current low levels of agricultural water productivity in Vietnam show that there is considerable scope for both increasing revenues and reducing water use in the dry season. Agricultural water savings could then help meet growing urban and industrial demands through a well-functioning water allocation system.

**Vietnam is ideally positioned to grow rice in the wet season, when water is abundant and not a constraining factor—but attention is needed to downstream impacts.** Wet season rice production typically requires flood-control structures that in some cases transfer flood risk to urban areas. Rice production also generates water quality impacts due to the application of fertilizers, pesticides, and herbicides (see chapter 4).

## 2.2 Agriculture depends on irrigation and water control, but performance is deteriorating

**Vietnam's agriculture sector has made enormous strides but at an environmental cost that is growing more visible and with impacts that cascade through the economy.** Vietnam is the top global producer of pepper, the second-largest of coffee (after Brazil), the third-largest of aquaculture products, and the fifth-largest of tea (see figures 2.1–2.3). Performance on agricultural yields, output, and exports, however, has been more impressive than gains in efficiency, farmers' welfare, and product quality. Some of the gains have been won at an increasing environmental cost, with a growing pollution footprint and increasing levels of water consumption. Agricultural water use is largely traditional and is overwhelmingly dedicated to water-intensive, low-value crops, notably rice, of which Vietnam is the world's second-largest exporter (World Bank 2016b).

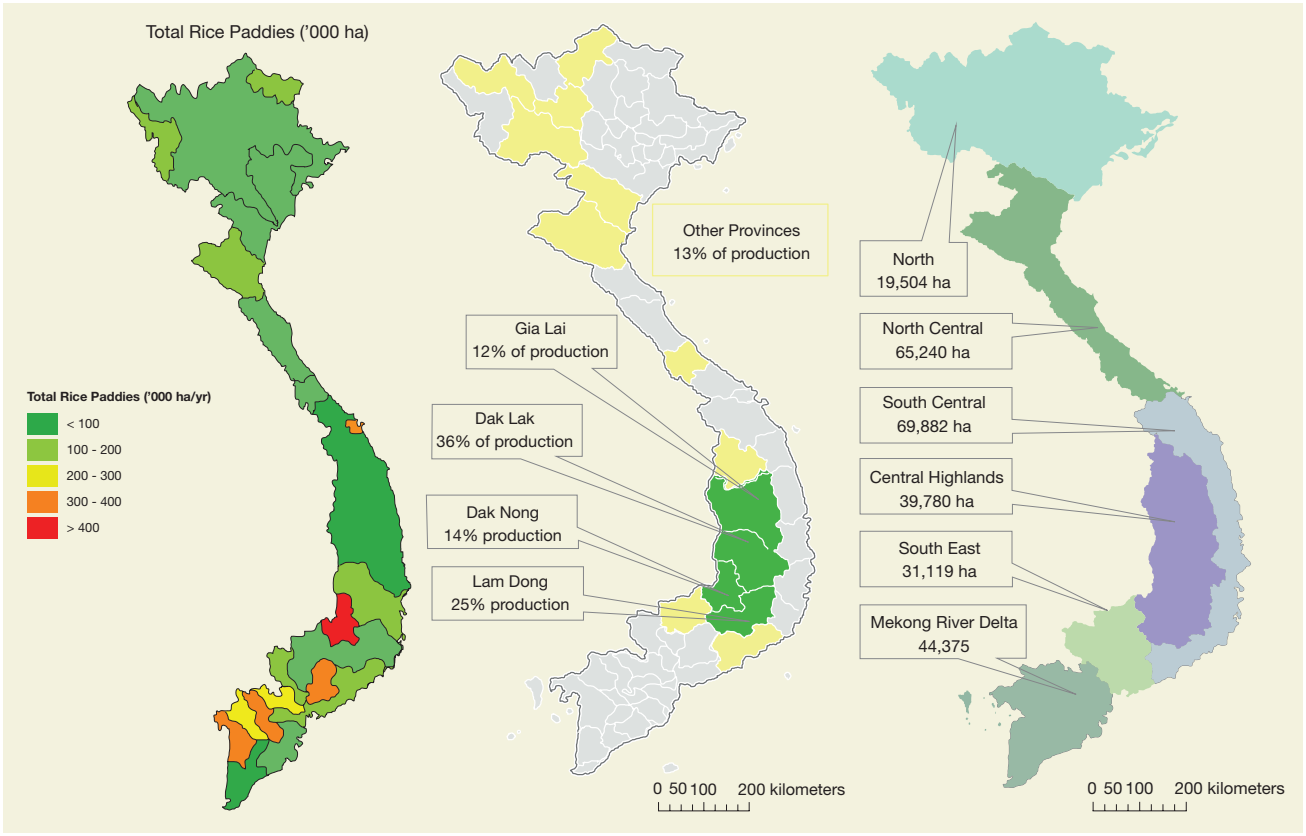
**Although rice is the dominant irrigated crop and yields are high, value added lags behind that of major competitors.**[1] Although Vietnam has high rice yields—around 6 tons per hectare—the quality and price reduce the value farmers and the country get from rice production. Vietnam has the second lowest rice price in the world, at $0.36/kilogram (kg) while China and the Philippines achieve almost US$ 1.00/kg. Largely as a result of these quality issues, the value of rice output per unit of irrigation water in Vietnam is only half that in China and one-third that in India (see table 2.1). While Vietnam has a global comparative advantage in the production of rice, especially when compared to arid countries, more efficient rice production could boost output and incomes, and save water (GoV, 2014c).

**About 58 percent of the area under irrigation is used for rice production, and 96 percent of the rice area is irrigated.** Rice is produced mainly in three regions: The Southern Delta, which includes the Mekong Delta and accounts for about 50 percent of total rice production; the Northern Delta; and the Northern Highlands (see figure 2.1). With irrigation, rice can be produced in any of four growing seasons. Almost 45 percent of Vietnam's irrigation water is used in the Mekong River Basin, almost exclusively for paddy rice. In the Mekong delta, one plot can produce up to three rice harvests a year. In 2014, total rice production was 45 million tons (GoV, 2014c). Recognizing the need to diversify production and risks, the government has proposed a cap on the expansion of rice cultivation. The target is to produce 41–43 million tons in 2020 and 44 million tons in 2030 (GoV, 2009, Resolution 63/NQ-CP). This would continue to meet expected domestic demand and leave a large although declining surplus for export. The challenge then would be to increase revenues from lower exports through attention to quality and through diversification.

**FIGURE 2.1: Distribution of rice-growing area in Vietnam**

**FIGURE 2.2: Distribution of coffee-growing area in Vietnam**

**FIGURE 2.3: Distribution of sugarcane-growing areas in Vietnam**




*Source:* 2030 WRG 2017.

**TABLE 2.1: Water productivity in Vietnam, China, and India**

| Country | Cropping pattern | Output per service area (US$/ha) | Output Per Unit of Irrigation Water (US$/ cubic meter) |
|---|---|---|---|
| Vietnam | Rice | 654 | 0.03 |
| | Rice and vegetables | 1,051 | 0.11 |
| | Rice and sugar | 3,603 | 0.34 |
| | Vegetables | 4,862 | 0.49 |
| China | Rice | 1,541 | 0.06 |
| | Rice and rapessed | 1,546 | 0.38 |
| | Wheat/Corn | 2,491 | 1.46 |
| | Apples | 4,163 | 1.20 |
| India | Rice | 988 | 0.09 |
| | Rice/Chilli/Cotton | 1,206 | 0.12 |
| | Sugarcane | 1,844 | 0.17 |
| | Coconut and sugarcane | 2,165 | 0.12 |

*Source:* Burke and others 2015.
*Note:* Sample of irrigation schemes larger than 5,000 hectares.

### 2.2.1 The performance of the large stock of irrigation infrastructure is deteriorating

Even though Vietnam is endowed with a vast irrigation network and supplies of easily diverted water, it faces the dual

**problem of deteriorating dams and more variable water flows.** Rainfall is limited to a wet season lasting only a few months, and irrigation is essential during the long, dry months. An immense network of about 7,500 dams and reservoirs store and divert water to several thousand irrigation schemes, increasing the amount of water available during the dry season and helping smooth flow variability (see box 2.1). However, many dams have deteriorated due to neglect and lack of maintenance, with the result that storage has decreased. About 1,500 small and medium-size dams and reservoirs need to be rehabilitated and modernized, including restored and increased storage and outflow capacities. Siltation of reservoirs is a further problem. Increased precipitation and inflows—reflecting changes in climate—create risks of flooding. Even if the dams were in perfect condition, the increased flows from upstream would be difficult to store.

In addition, impacts from upstream development and changed flow regimes due to climate change require changes and replacements in existing irrigation works, which lead to increased investment and production costs

### BOX 2.1: Vietnam's huge irrigation infrastructure

Vietnam has developed a vast infrastructure network for irrigation, hydropower, water supply, and hydraulic water management, including drainage, flood control, and prevention of salinity intrusion. It includes:

- 904 diversion structures serving more than 200 hectares (ha) of irrigated area (110 of which can serve more than 2,000 ha).
- 6,336 irrigation reservoirs (in operation) with a volume of >50,000$m^3$ and the height of dam >5m, with a total storage capacity of 14.5 billion $m^3$. These include 851 big reservoirs, 1,532 medium reservoirs and 3,950 small reservoirs, distributed across 45 cities and 63 provinces.
- 238 hydropower reservoirs.
- 13,400 large electrical pumping stations.
- 5,500 large drains, 235,000 kilometers (km) of canals, and 26,000 km of dikes.

The country has 97 water resource works exploitation companies, three of which are directly under the Ministry of Agriculture and Rural Development and 94 under provincial control. There are also 21,000 local water resource organizations. Together, these organizations manage 7.48 million ha of paddy land; 1.64 million ha for higher-value crops (fruit, vegetables, industrial crops); water supply for 1.3 million ha; salinity control on 870,000 ha; alum treatment for rehabilitation on 1.6 million ha; drainage on 1.72 million ha of agricultural land; and water supply to aquaculture on 400,000 ha.

*Source:* Ministry of Agriculture and Rural Development (2018).

**Multiple, new water management pressures have emerged that need to be addressed if agriculture is to improve or even sustain its past performance.** Three key challenges stand out: (1) poorly maintained infrastructure that operates below design capacity; (2) growing and multiple threats to the rivers and watersheds that underpin the irrigation infrastructure, and (3) increasing competition for water resources from other users, especially cities.

**With a government focus on infrastructure growth and expansion of irrigation, public spending on operation and maintenance (O&M) has often received lower priority.** A Public Expenditure Review conducted in 2017 found that between 2009 and 2012 public expenditure on new irrigation investment shot up, but the allocation to O&M declined. More generally, the bulk of public spending on agriculture has supported a "food security strategy" aimed at generating ever-increasing quantities of rice. However, this policy has resulted in low value addition and an overemphasis on building large irrigation schemes for rice cultivation (see box 2.2; World Bank 2017a; World Bank 2017b).

**Irrigation systems often perform well below their design capacity.** Despite the high levels of public capital investment over the last four decades, the irrigation system is seriously degraded and meets only about 50–60 percent of its design capacity (World Bank 2013). As a consequence, costs of irrigation in Vietnam are among the highest in Southeast Asia (HCMUAF, 2013). Countrywide, only 26 percent of canals (by length) are fully functional—slightly more for main and tertiary canals and slightly less for secondary canals.

### BOX 2.2: Changing flood dynamics in An Gian and Dong Thap are attributed to high dike construction.

The Mekong River Delta is Vietnam's most important rice growing region, contributing 50 percent of total national rice production. The vast network of dike and irrigation systems makes year-round rice cultivation possible. There are 30,000–40,000 kilometers of interconnected canals within the delta alone. Farmers cultivate three crops of rice each year (winter, spring, and autumn). The spring crop accounts for

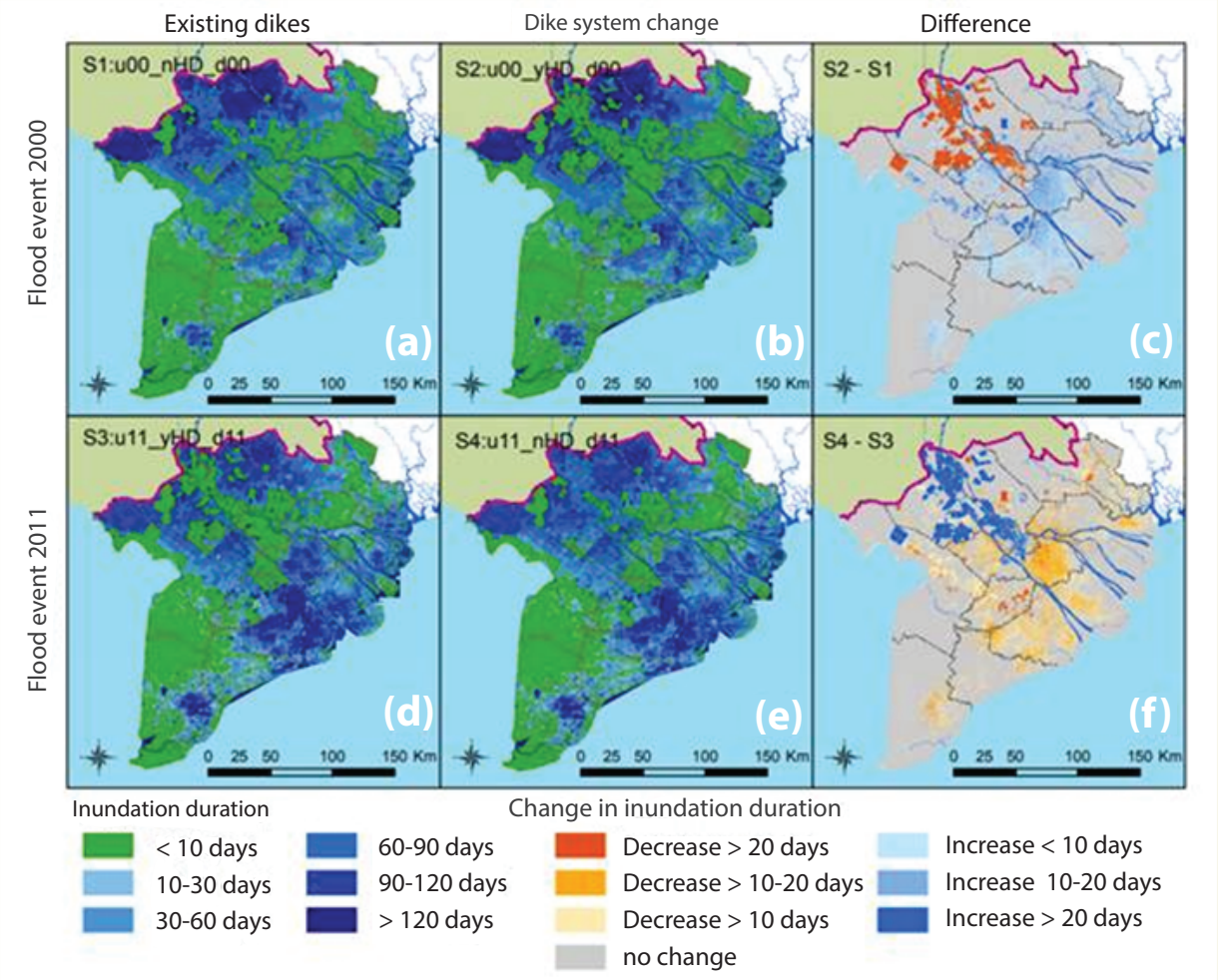
*(Box continues next page)*

**BOX 2.2: (Continued)**

more than 50 percent, autumn accounts for 45 percent, while winter accounts for 5 percent of the total rice production of the delta. Spring and autumn rice contribute 53–79 percent of national output.

Half of all available rice lands in the Mekong Delta are submerged by floodwaters during the period in which the late autumn crop is sown (July/August). Due to trends associated with subsidence, sea level rise, and rainfall variability, low lying areas are hard to cultivate for part of the year. Satellite images show the highest area expansion in provinces close to the Cambodian border (An Gian, Dong Thap, Long An, and Ben Tre). Vietnam's program to increase rice acreage by protecting larger land areas from seasonal flooding is delivering results in terms of rice production. The adverse impact is that more areas are losing their flood deterrence capacity, further increasing the vulnerability of urban areas to floods.

For two recent large flood events (2000 and 2011), simulations reveal that for the central delta an increase of 9–13 centimeters in flood peak and 15 days in duration can be attributed to the development of high dikes. The study confirms the claims that dike development has raised the flood hazard downstream. The study notes that changes in tidal levels caused by sea level rise in combination with the widely observed land subsidence and the temporal coincidence of high water levels and spring tides have even larger impacts.




*Source:* Triet and others 2017.

**Declining storage capacity, coupled with deteriorating irrigation infrastructure, has reduced the volume of water for farmers while increasing irrigation costs.** Degrading watersheds and deferred canal and dam maintenance have reduced the storage capacity of most dams. Box 2.3 illustrates the example of the massive 125,000 ha Bac Hung Hai irrigation system, where irrigation service and water quality are getting worse, due in part to inadequate budgets. Compounding the problem is that farmers pay little or nothing for their water, reducing the accountability of service providers and making services dependent on government transfers.

**BOX 2.3: The Bac Hung Hai irrigation system faces major challenges, including deteriorating system performance, rising competition for water, increasing pollution, and underfunding**

Drawing its water directly from the Red River, the Bac Hung Hai irrigation system is the largest irrigation and drainage system in northern Vietnam. Constructed in the 1950s, it includes 11 head works, 231 kilometers of main canals, 400 large pumping stations, and thousands of small pumping stations.

The system irrigates almost 125,000 hectares (ha), provides drainage for over 190,000 hectares, supplies water for 3 million people, and serves as an inland waterway. The system has been the motor of development and source of livelihood for the area. The predominant crop is rice, with annual production of up to 6–6.5 tons per hectare and total production of 1.23 million tons a year. The system also supports cash and industrial crops, livestock, and aquaculture.

This massive and productive system is facing considerable challenges, however. After 60 years of operation, structures are degraded, canals and drains are filled with sediment, and water service has deteriorated. Water quality is declining, with 300,000 cubic meters of largely untreated wastewater flowing into the system every day from urban areas, craft villages, and industrial parks, as well as inflows from upstream agricultural fertilizers, pesticides, and animal waste. Development in the area is leading to illegal encroachment and increasing competition for water, with growing demand from urban areas, industry, and aquaculture. At the same time, irrigation fees have not been collected from farmers since 2008, and no move has been made to reintroduce them, despite a recent policy change to that effect and fee provisions in the new Law on Hydraulic Works. The state has to provide a subsidy, but this barely covers regular operation and maintenance and provides no funds for major repairs or system improvement.

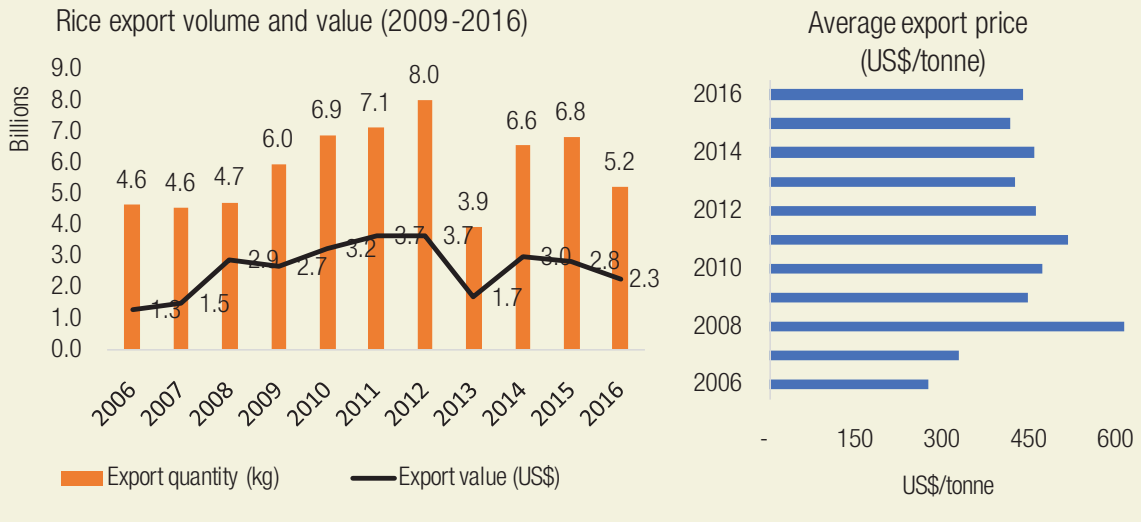
What is needed is investment in the system to adapt to current challenges and changing demand. The main requirements are modernization to restore system functionality, provide improved water control, and allow transition of some paddy land, where appropriate, to pressurized irrigation and higher-value cash crop production; drainage improvement and dredging of all rivers in the system; separation of wastewater from rainwater drainage systems and collection, treatment, and reuse of wastewater; and investment in human resources to improve irrigation water service and increase value added by upgrading farming systems and water productivity.

*Source:* MARD 2017; Information provided by Mr. Dang Duy Hien, Director General of the Bac Hung Hai Irrigation system; and working note compiled by Dr. Dao Trong Tu, February 22, 2018.

### 2.2.2 Constraints are emerging to water supplies for irrigation

**Problems of poorly maintained infrastructure are compounded by multiple threats to degrading river ecosystems.** Climate change remains the overarching risk to agriculture, channeled primarily through changes in the hydrological cycle (through droughts, floods, and erratic rains). The El Niño climate event of 2016 affected rice production significantly (see figure 2.4). Modeling shows that under the hottest

**FIGURE 2.4: Rice export volume and value through years.**




*Source:* Food and Agriculture Organization database and United Nations Commodity Trade Statistics Database.

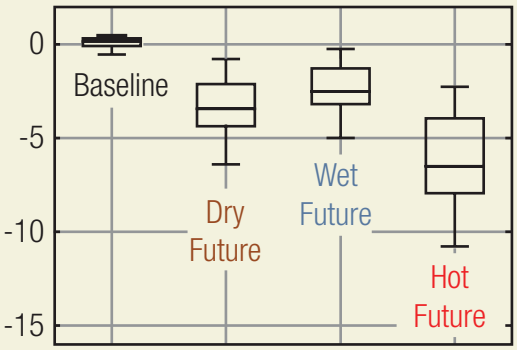
climate change scenario, paddy yields could decline by as much as 11 percent, with significant impact on the agricultural economy (see box 2.4; World Bank 2016b; World Bank 2018g).[2] The poor condition of water infrastructure has increased vulnerability to these climate risks, which are projected to become more frequent and intense. Management of flood and drought risks may require better storage—and better management of storage—integrated in planning at the basin level (see chapters 6 and 7). Irrigators are also affected by increasingly polluted water that compromises yields, particularly downstream of major settlements. Near the coast, seawater inflows reaching further up estuaries are a growing problem, leading to a loss of productive land along the country's 3,000 km coast. Agricultural pollution in irrigation drainage water is also a hazard to downstream water quality (see chapter 4). With no effective regulation or incentive framework, agricultural chemicals are polluting both surface water and groundwater.

### BOX 2.4: The impact of climate change–induced higher temperature on paddy yields

Rising temperatures under climate change are projected to reduce agriculture yields. Rice, for example, has been shown to be sensitive to high temperatures. By building on the relationship between temperatures and paddy rice yields (Oh-e and others 2007), a statistical approach was used to estimate the decrease of rice production for the historical climate and for three future climate scenarios—dry, wet, and hot. The hot future climate scenario is based on the General Circulation Model that produces the highest temperature in Vietnam by 2035. Rice yields are expected to decrease in all three scenarios, with a maximum decrease of some 11 percent in the hot scenario (see figure 1).

The computable general equilibrium modeling was used to assess the overall economic impacts of rising temperatures on paddy rice yields by 2035 against the historical climate baseline. Not surprisingly, the impact on agricultural GDP is the largest among all sectors across all scenarios. The overall impact amounts to a 0.1–0.3 percent reduction of GDP, with the hot future scenario having the largest impact (see table 1).

**FIGURE 1: Impact of temperature on rice production for the historical climate (baseline) and three climate scenarios (percent of baseline mean production) in 2035**




*Source:* World Bank 2018g.

**TABLE 1: Impact on GDP of reduced rice yields due to rising temperature effects in 2035 (%)**

| | Scenario | | |
|---|---|---|---|
| **Sector** | **Dry** | **Wet** | **Hot** |
| Agriculture | −0.9 | −0.6 | −1.6 |
| Industry | −0.0 | −0.0 | −0.1 |
| Services | −0.2 | −0.1 | −0.3 |
| **GDP** | **−0.2** | **−0.1** | **−0.3** |

*Note:* The values show the deviation from historical climate, the reference path.

## 2.2.3 Returns to water are low, and the agriculture sector needs to be restructured to boost productivity

**As the economy grows, the demand for water from multiple sectors outside agriculture has surged** (see chapter 1). In some basins, surface water supply for irrigation will be heavily constrained in coming years. For example, in the South-East River Cluster (SERC) basin, demand from aquaculture is increasingly competing with irrigation demand, and the amount of water available to agriculture may dwindle—water saving and demand management measures may therefore have to be introduced. Groundwater development and abstraction are largely unregulated, and the incentive framework encourages a "race to the bottom." In some coffee areas, over-abstraction of groundwater is depleting the resource and reducing the scope for supplementary and dry season groundwater irrigation.

**With the fixed supplies of land and water now under greater stress, future expansion of agriculture will need to be based on improvements in efficiency that generate "more for less."** Agriculture growth has slowed, and diversification remains low. There is considerable scope to increase the productivity of water use (see table 2.1), especially for rice. Rice now faces growing domestic competition—from cities, industry, and services—for labor, land, and water. Downstream

value-added creation remains low, and food safety concerns are rising. Going forward, Vietnam's agriculture sector needs to generate more value and jobs in a broader agri-food industry. The priority is to boost farmer incomes and agricultural value added within the growing constraints. This requires investment in more productive agriculture that will give farmers more income from the same quantities of land and water. The measures required are well-known and form part of Vietnam's agricultural strategy of improving value added from rice cultivation and promoting diversification and investment in improved technology.

## 2.3 The way forward

### 2.3.1 Rebalance public spending toward operation and maintenance

**There is wide scope for rationalizing public service delivery in agriculture without jeopardizing service quality.** Rebalancing the composition of public spending within the sector would give an opportunity to bring spending into line with policy objectives for boosting incomes and growth. This "public expenditure for incomes and growth" approach would reduce investment in new irrigation and shift resources to measures that: increase the efficiency of water service on existing schemes; improve on-farm water management to increase water productivity; and strengthen other functions, such as agricultural services, to promote higher productivity. As part of this strategy, the regional allocation of resources could also be reviewed to focus more spending on, for example, high-potential farming areas like the Mekong Delta, which could substantially increase production of higher value-added products, such as marine products and fruit (World Bank 2017a).

**To improve efficiency and accountability, farmers should be encouraged to pay a larger share of O&M costs.** This would reduce the cost burden on the state budget and sharpen incentives to increase water productivity. Higher cost recovery would also gradually increase the budgets of irrigation management companies, which would lead to better service. The legal framework for a revival of farmer contributions is in place (see box 2.5). As irrigation fees come into practice, impacts on households should be gauged and the possibility of conditional fee exemptions considered—for example, to promote technology and husbandry practices that improve water efficiency.

**BOX 2.5: Paying for water in Vietnam: The special case of irrigation service fees**

According to Decree No. 143/2003/ND-CP, which implements the Ordinance on Exploitation and Protection of Irrigation Works, agricultural and aquaculture users of water provided by irrigation management companies are to be charged fees. For food crops, fees are area based and differ per region and irrigation equipment. For nonfood crops, they are volumetric. However, Decree No. 115/2008/ND-CP abolished the irrigation service fee payments on management and exploitation of irrigation systems. Decree 67/2012/ND-CP further amended Decree No. 143/2003/ND-CP and replaced Decree No. 115/2008/ND-CP – it exempts individuals and households from the irrigation fee, if they use surface water for agricultural purposes. Decision No 1580/QD-TTg and Circular No. 41/2013/TT-BTC further guide the implementation of Decree 67/2012/ND-CP. Many observers have commented on the inefficiency of this policy, as farmers have no incentive to conserve water or to maximize water productivity, and the irrigation management companies depend on government subsidies.

Exemption from the surface irrigation fee to support irrigation programs and household exemptions resulted in an estimated reduction in production costs of 5–10 percent. This cost is borne by the state (VND3,000 billion annually) and provinces (VND3,400 billion) (FFTC, 2013).

In 2017, the Law on Hydraulic Works (see box 6.3 in chapter 6) provided for the reintroduction of irrigation service fees for users. Irrigation prices will comply with the provisions in the Law of Price and will include management costs, operations and maintenance expenses, depreciation charges, and other reasonable expenses, allowing for profits deemed suitable to the marketplace. Affordability will be considered when setting the price level. The state will determine the price of irrigation services and products; the road map for adjusting these has already been approved by the relevant state agencies (Article 34). Decree 96/2018/ND-CP provides the guidelines for prices of irrigation products and services and financial support for use of public irrigation products and services, but still has to be implemented.

*Source:* GoV 2017a; Thang and Linh 2015; 2030 WRG 2017.

**With constraints on public finances, there is further scope to "crowd in" private sector financing through targeted public–private partnership investments in irrigation.** The four major river basins in Vietnam will need nearly US$6.3 billion in new investment between now and 2030 (2030 WRG 2017). Much of this investment will

be in irrigated agriculture—dam and canal rehabilitation and modernization; improved management of water services; and on-farm investment in pressurized irrigation, crop and variety choice, crop husbandry, and so on. Current fiscal constraints and general government policy to encourage more private sector involvement point to greater private investment. Around the world, various forms of public–private partnerships in irrigation have been tried, with mixed results. The two most successful models are enhanced management contracts, such as the Megech-Seraba irrigation scheme in Ethiopia, which combines a fixed management fee with incentive rewards and penalties, and build-own-operate arrangements, such as one that proved successful with commercial farmers in Morocco (see box 2.6). These encouraging examples show that, where projects are well structured with clear revenue streams, public-private partnerships can be an effective option for irrigation.

**BOX 2.6: Contrasting experiences with irrigation public–private partnerships in Morocco: Guerdane and the Gharb**

A public–private partnerships (PPP) project in Guerdane, Morocco, was designed to overcome the challenge of decreasing water availability and its effects on livelihoods in the Souss Massa Draa region, Morocco's second most important economic province. Climate change, water scarcity, and groundwater depletion were threatening the survival of farmers' livelihoods and incomes.

The project brought water 60 miles from a reservoir to an irrigated command area of 10,000 hectares (ha) farmed by about 2,000 commercial citrus farmers, who produce about 50 percent of Morocco's citrus output. It brought water to farmgate hydrants, where farmers then bought volumetrically metered water. It was the world's first PPP irrigation project investment of any considerable size.

The transaction process for the build-own-operate arrangement was well designed (with the help of the International Finance Corporation [IFC]) and had a successful outcome. The transparent and competitive bid process resulted in a lower than expected unit water price. A 30-year concession was awarded to a Moroccan-French conglomerate for the construction, cofinancing, and operations and maintenance of the irrigation network. Implementation went smoothly and farmer commitment was total: all farmers connected to the supply.

Second-round benefits were in technology transfer financed by the private sector and in the successful testing of a model that could be replicated in similar PPP irrigation projects in the region.

The conditions of success were strong government commitment and subsidies (about 60 percent in total); government assumption of most downside risks, including that water would not be available; and good profitability of the production operation.

A PPP proposal in the Gharb was very different and had a very different outcome. The Gharb was a large undeveloped public area of 55,000 ha in the command area of a new dam. The government declared a willingness to share development costs 50:50 with the potential beneficiaries or other investors. IFC was asked to develop a formula for private participation for development and operations. However, there was no interest from investors, and in the end the government developed the scheme.

*Source:* IFC 2010; World Bank 2006.

### 2.3.2 Integrate agriculture and water management

**Mechanisms are needed to integrate agricultural water use within an overall planning framework at the basin level.** Given agriculture's dominance in water use, irrigation needs to be central in integrated basin planning. Climate change impacts need to be factored into integrated planning. To mitigate such impacts, flood and drought risk management may require better storage and better management of storage. These impacts are likely to require increases in water storage capacity of as much as to 40–50 percent according to one estimate. This will require a combination of restoring existing reservoir capacity (through silt removal or physical rehabilitation) with constructing new reservoirs.

**Vietnam has a strong national disaster network (see chapter 5), but it could be reinforced by an integrated approach to hazard risk management.** Local protection and response plans could be developed for each geographic area. Integrated planning requires cross-institutional collaboration between MARD and MONRE horizontally and the provincial people's committees (PPCs) vertically. It also requires integrating hydro-meteorological monitoring, river basin planning, and operational management of structures and diversions along the river within a practical planning and management framework and with the allocation of the financial resources that underpin joint planning, investment, and management.

**New resource planning and allocation instruments will allow multiyear programming, improving the fit of**

**investment with needs, and facilitating long-term provision of O&M.** The 2017 Public Expenditure Review (PER) identified new resource allocation instruments—the Medium-Term Investment Plan (MTIP) introduced in 2014 and the Medium-Term Financial and Budgetary Plan (MTFP) introduced in 2015—as key instruments for improving resource allocation. They allow the allocation of capital investment to be linked to the MTIPs agreed to on the basis of development and infrastructure gaps. They also allow the multiyear programming and the gradual increases in O&M expenditure that are essential to preservation and efficient use of assets. These planning improvements could eventually be accompanied by improvements in the budget process, particularly a move toward results-based budgeting. Finally, the PER underlines the need for sound sector strategy to underpin both long-term fiscal planning and shorter-term budget requests. These new approaches may create an opportunity for joint work between MONRE and MARD on irrigation development and management within basin plans, along the lines suggested above. Decree 84/2015/ND-CP aims at improving monitoring and evaluation in investments. While it still has to be made fully operational, the introduction of results-based management has the potential to significantly improve the effectiveness of public interventions (World Bank 2017a).

### 2.3.3 Improving agricultural water use under both water plenty and water scarcity can drive growth

**The goal in agriculture is not so much water saving per se—although this may become important in the future —but improving incomes and value added under conditions of both plenty and scarcity, particularly seasonal scarcity.** The challenge for agricultural water is twofold. For the wet season the challenge is to improve water control and husbandry for rice in order to optimize yields and to invest in adding value through crop and post-harvest management to increase value from rice for farmers. Investment in improved water control to irrigate higher-value fresh fruit and vegetables and industrial crops is also a priority. For the dry season, where water stress and drought are growing problems and where there may ultimately be a need for agriculture to transfer water to other higher value uses, the challenge is to maximize returns to the scarce factor by increasing returns per cubic meter of water consumed while ensuring that less water is used, not more.[3]

**The priority in water-short or drought-prone areas in the dry season will be to manage scarcity and risk at the basin level and to manage the fact of less water at the irrigation scheme and farm level by producing less dry season rice and by diversifying into crops that deliver higher value per cubic meter of water.** Measures to accompany dry season water management will likely include not only extension and support to investment but also measures to reduce uncertainty and risk for farmers—for example, by allocating fixed quantities of dry season water based on expected minimum dry season availability (see box 2.7). The reintroduction of water charges also opens possibilities of allocating water in the dry season on a pay-per-use basis, possibly supported by metering water at hydrants or by monitoring evapotranspiration. Abundant experience with these approaches is available, for example from neighboring China.

**BOX 2.7: Coping with less water and drought risk in the dry season in Ninh Thuan's irrigated agriculture**

A recent study in Ninh Thuan suggested two means of coping with reduced and uncertain dry season water availability for irrigated agriculture. The first is simply to reduce irrigation water demand in the dry season at the farm level, relying on the water saving and income boost from switching to a system of rice intensification and alternate wet and dry production and switching part of the area from rice cultivation to higher value crops.

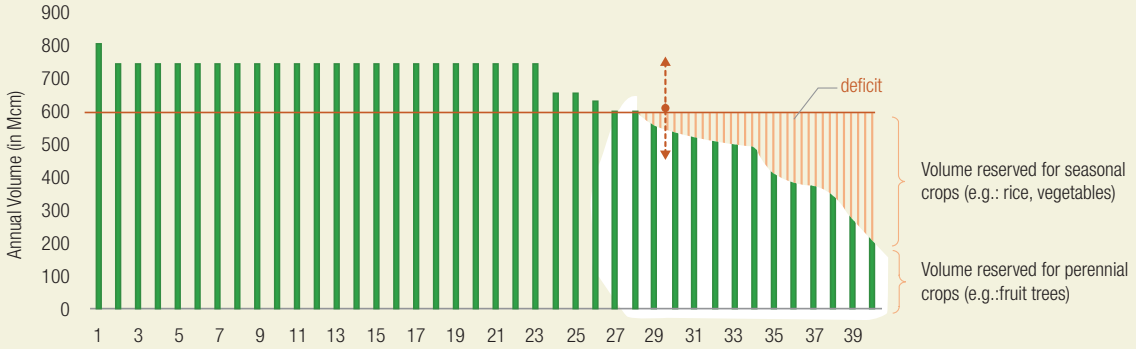
The second, complementary, approach is to manage scarcity at the basin and irrigation district level through firm dry season allocations to each district along the river, with each district making firm allocations to perennial crops, and annually variable allocations for seasonal crops, depending on water availability.

With water allocation managed at the basin level, forecasts of water availability in the dry season would allow water to be allocated annually. Records show that in a certain number of years—say 28 of 40—it can be assumed that reservoirs will be full and normal levels of dry season irrigation can be ensured, but in 12 years of the 40 years (30 percent of the time) there will be a supply deficit. Based on these assumptions, a guaranteed volume of water could be assigned in the dry season to perennial tree crops, with the maximum allocation determined by the lowest level of supply anticipated (year 39 in the figure). Second, a balance—to be determined based on forecasts and actual reservoir levels each year—could be assigned to seasonal crops like rice or vegetables. Based on good water information, this kind of planning could be conducted for each of Ninh Thuan's irrigation districts.

*(Box continues next page)*

## BOX 2.7: (Continued)

**FIGURE: Ordered sequence of optimal annual irrigation volumes**




*Source:* World Bank 2018e.

**Irrigated agriculture will need to up its game by raising efficiency and productivity.** The priority is to drive up the efficiency of water delivery and water productivity ("dong per drop"), particularly in the dry season, by improving O&M, shifting cropping and husbandry techniques, and boosting value added and farmers' incomes. These steps will raise agricultural productivity and growth and make agriculture more sustainable. The incentives and potential gains for farmers are strong, with higher-value cash crops yielding gross margins ten times or more that of rice (see table 2.2). Much of the benefits will come from increased efficiency in irrigation water service—getting water in a more efficient and timely fashion to the plant roots—and from agronomic choices and water management practices that can bring farmers higher incomes and increase agricultural value added (World Bank 2017b).

**TABLE 2.2: Gross revenue and margins of rice and alternative crops in the Chau Phu, Mekong Delta, 2012 (millions of dong)**

| Crop | Gross revenue | Gross Margin |
|---|---|---|
| Bean | 300.97 | 173.3 |
| Chili | 341.69 | 202.66 |
| Gourd | 159.94 | 133.84 |
| Lotus | 631.07 | 461.2 |
| Flower | 170 | 118.15 |
| Rice | | |
| Winter/Spring season | 36.61 | 17.26 |
| Spring/Autumn season | 33.38 | 13.39 |
| "Autumn/Winter season | 39.63 | 20.2 |

*Source:* Le Canh Dung 2012.

**Technology, too, can be important.** Much more value and higher incomes could be obtained if more rice farmers adopted improved husbandry systems, such as the 1 Must-5 Reductions (1M-5R) Program for rice production in the south and the system of rice intensification (SRI) program in the north[4]. The alternate wet and dry (AWD) method is an integral part of both programs, which can save 30–40 percent of water on paddy land. To scale up adoption, the government would need to modify irrigation and water control systems and on-farm irrigation, facilitate field leveling, bring information technology solutions to reduce additional labor costs associated with AWD (smart sensor technologies already exist in Vietnam), and strengthen water user groups (as AWD adoption requires collective action). The cost need not be exorbitant: the estimate for conversion of 30,000 ha in Ninh Thuan was VND300 billion (US$13.6 million) over five years, and economic rates of return were very high, exceeding 35 percent (see box 2.8).

## BOX 2.8: Introducing the system of rice intensification including alternate wet and dry rice production in Ninh Thuan Province would cost little and would have big economic benefits

Ninh Thuan Province is experiencing water stress, with not enough water in the basin to meet growing demand and with more frequent and severe drought events. Still, a modeling study showed that the province could live within its water budget and cope with risks while farmers increased their income. This outcome depends on improved water allocation and management and on the massive adoption of the system of rice intensification (SRI), which includes the alternate wet and dry method for rice production.

Vietnam has encouraged farmers to apply advanced techniques through SRI and 1M-5R programs. These techniques reduce the use of fertilizer and pesticides by 30 percent, increase yields by 10–20 percent, and reduce greenhouse gas emissions by 30 percent. 1M–5R has been successfully introduced as a sustainable and yield-increasing farming method in northern and parts of central Vietnam. SRI increases economic returns and has the potential to enable farmers to adapt to climate

*(Box continues next page)*

**BOX 2.8: (Continued)**

change. Researchers and farmers need to work together to explore this potential.

In Ninh Thuan Province, 62 percent of water use is for irrigating rice. The modeling study found that SRI including the alternate wet and dry method could be adopted on about three-quarters of the rice area in the province, that the value of output would go up by 10 percent, and that farmers' income would increase by 30 percent. Irrigation time and water use would decrease by 20 percent, and the water productivity of rice would rise by 50 percent. This would save around 45 million cubic meters of water in the province.

The study concluded that what was needed was largely a matter of knowledge and behavioral change and that the measures could be put in place incrementally and without massive structural changes. Over five years the total cost—largely for extension services—would be only about VND300 billion (US$13.6 million). The resulting economic rate of return of this program was estimated at 35 percent and the net present value at VND1.2 trillion (US$52 million), using a 10 percent discount rate. These results, although highly positive, are still conservative since the benefits of saving water were not quantified.

*Source:* WPP 2017.

### 2.3.4 The new irrigation strategy seeks to maximize water productivity, farmers' incomes, and value added

**The government, with World Bank assistance, devised a new irrigation strategy in 2017 to address many of these challenges** (see box 2.9). The strategy seeks to improve the efficiency and productivity of irrigated agriculture and proposes a participatory governance model and asset management model. The underlying philosophy is that more efficient and sustainable irrigation and drainage services can support a more diversified agricultural economy that increases value and boosts both farmers' incomes and national growth. The key change recommended is in line with the budget changes proposed in the Public Expenditure Review —a move toward a less subsidized model and a more autonomous and participatory approach to service provision, with greater emphasis on efficient asset management and less on expanding irrigation networks.

**BOX 2.9: Vietnam's new irrigation strategy**

The new irrigation strategy proposes a paradigm shift from water infrastructure to a demand-responsive approach. It includes:

- Devolving power and responsibility to farmer organizations to operate and maintain larger sections of the irrigation network and to pay the full costs of water service provision.
- Shifting the planning, financial, and management focus from infrastructure construction to rehabilitation, maintenance, and modernization of existing schemes.
- Increasing farmers' incomes by increasing on-farm water productivity and boosting downstream value added.

To implement this strategy, four sets of actions are proposed:

**Institutional reforms and capacity building at three levels**

- Building the capacity of the Ministry of Agriculture and Rural Development at all levels to plan and guide a demand-responsive approach that emphasizes decentralization, user participation, and asset management rather than construction.
- Reforming irrigation management companies to become independent, pay-for-service providers, financed by service payments from water user organizations and other water users and building their capacity to provide efficient water service.
- Building participatory irrigation management with legal and effective water user organizations.

**Rehabilitating, modernizing, and developing irrigation and drainage systems**

- Prioritizing rehabilitation and modernization of main and secondary canals and water control structures, as well as completing the on-farm systems, with user participation, to improve the functioning and sustainability of irrigation and drainage systems.
- Increasing storage by removing silt and minimizing future siltation of reservoirs; building new multipurpose reservoirs (irrigation, flood control, water supply, hydro, and so on); and improving dam safety.

*(Box continues next page)*

**BOX 2.9: (Continued)**

**Improving irrigation water service on a fully participatory basis**

- Launching performance-based asset management and irrigation service plans and budgets.
- Moving to full financing by users, with payment of fees only for services received.
- Increasing local investment (including farmers' investment), with "smart" subsidies.
- Gradually empowering water user organizations to operate and maintain larger sections of the irrigation network.

**Increasing water productivity and farm incomes**

- Switching 10–12 percent of the current rice area to higher-value production (vegetables, fruits, fishponds, livestock).
- Increasing water productivity by adopting the system of rice intensification and alternate wet and dry technologies for rice production.
- Promoting higher on-farm value added through farm consolidation, technology transfer services, modern irrigation (including drip or sprinkler irrigation), and demand-responsive water service.
- Increasing value added downstream through rural small-scale industry and marketing services run by cooperatives and the private sector.

*Source:* World Bank 2017b.

## Notes

1. Productivity in terms of yield per hectare is above average when compared to peer countries.
2. Note that the computable general equilibrium modeling results do not take account of impacts on crops other than paddy. In addition, there may be some shifts from paddy to higher value aquaculture, for example, where there is sea-level rise and increasing salinity in the Mekong Delta. For the possible impacts of groundwater depletion, land subsidence, and sea-level rise on agricultural output and on the economy, see box 5.3 in chapter 5.
3. Some attempts across the world to reduce agricultural water use by investing in "more $ per drop" husbandry and technology have resulted in *more* water use, not less, bearing out the "Jevons paradox"— that increasing returns to a factor of production will result in more use not less, as it is more profitable.
4. A management practice developed to adapt rice production to climate change. The "1 must" refers to the use of certified seeds, and the "5 reductions" refer to the reductions in seed rate, nitrogen application, pesticide use, water use, and post-harvest losses.

3

# Water Security and Water Services for Settlements

*Water security for urban settlements is at risk*

- Water security for urban settlements requires risk management, development and protection of water sources, and provision of quality water supply and sanitation (WSS) services. Climate change and natural disasters, particularly floods, now pose increasing risks to built-up areas.
- Pollution from untreated wastewater is a massive problem and a huge cost to the economy.
- The pace of urbanization and industrialization has been rapid, creating the risk that development could outpace the planning, infrastructure, and regulation required.
- Urban development needs to reflect basin plans and to apply the principles of integrated and risk-informed urban planning.

*There is room to improve WSS services, including for women and marginalized groups*

- Urban water network access and services have improved vastly, but there is still some way to go in access, cost recovery, affordability, and financial sustainability.
- Sourcing water for settlements is becoming a problem in some locations.
- Corporatization and partial privatization of utilities have accelerated, bringing new risks. The accompanying program to strengthen governance of urban water has stalled.
- Sanitation and wastewater have been neglected compared with water supply, and pollution and health risks are growing.
- Progress on rural WSS has been good, but there are questions of sustainability.
- Gaps in access and quality of service persist between the rich and the poor and between town and country, with women and marginalized groups the most vulnerable.

*Priorities for action*

- Integrating risk-informed urban planning—for water management, hazard mitigation, water supply, and drainage and wastewater—into broader spatial planning.
- Completing sector reforms for efficient and sustainable urban water services.
- Maximizing finance for WSS services and for a new business model for wastewater.

## 3.1 Water security for urban settlements

**Achieving water security in urban settlements requires risk management, the development and protection of water sources, and the provision of quality WSS services.**

Water security for urban settlements requires three things: (1) management of water-related risks, including resilience to climate-related risks such as floods and saline intrusion; (2) adequate and sustainable quantity and quality of water resources for domestic, commercial, and industrial needs; and (3) access to equitable, sustainable, and affordable WSS services through viable, regulated institutions.

### 3.1.1 Climate change and natural disasters pose particular risks to built-up areas

**Unplanned development and poorly connected infrastructure have left urban centers highly vulnerable to risks from river flooding, poor drainage, sea-level rise, and sudden-onset coastal flooding.**

Combined drainage systems are the most common systems in residential areas in big cities, i.e. domestic wastewater and runoff are discharged into the same sewers, canals and ditches, and are then discharged – with or without treatment - into the main water bodies. As most drainage systems were developed locally and lack proper maintenance, the drainage systems lack synchronization and operate below their design capacity. While some new urban areas have invested in separate systems in runoff and domestic wastewater, these are mostly localized and not connected to the overall network of the urban area. The construction of the drainage systems in Ho Chi Minh City and Hanoi are ongoing. To date, about 69% (4,176km out of a planned 6,000km) of drainage canals and sewers have been constructed, following the Master Plan of Ho Chi Minh City's drainage system until 2020 (approved by the Prime Minister in Decision No. 752/QD-TTg dated 16 June 2001). In Hanoi, 60% (2,285 km) out of a planned 3,800 km of sewers have been constructed, following the Hanoi Capital Drainage Plan until 2030 and Vision towards 2050 (approved by the Prime Minister in Decision No. 725/QD-TTg dated 10 May 2013) (MOC, 2019). Ho Chi Minh City and Hanoi – among other urban areas – experience flooding in heavy rainfall events. The main causes are found to include: (1) the current status of the drainage system; (2) effects of climate change leading to an increase in rainfall and fluctuations in tidal waves; (3) effects of urbanization resulting in increased concrete surfaces reducing permeability and reduced water storage areas; (4) effects of encroached canals and garbage dumping into the urban sewer system causing localized flooding and (5) land subsidence caused partially by over-exploitation of groundwater (MOC 2019).

In the Mekong Delta, climate change and rapid urbanization have created an existential challenge to the region, and poorly planned urban development has aggravated flooding in cities (see box 3.1). City plans rarely reflect climate risks or boost disaster risk resilience, and poor people are most at risk. There are institutional challenges of mandates and interagency coordination, with several government

**BOX 3.1: Seasonal flooding now inundates half the city of Can Tho every year**

Can Tho City faces the same hazards as the larger Mekong Delta. The city is susceptible to flooding caused by Mekong alluvial overflow, high tides, and extreme rainfall. With almost the entire city less than one meter above sea level, seasonal flooding typically covers 30 percent of the city area, and this has recently increased to 50 percent (World Bank 2016c).

**The causes of flooding are many and complex**

Multiple factors contribute to the flooding, including heavy rainfall, tidal increase, poor drainage in built-up urban areas, and land subsidence. The core urban area is affected by high tides and heavy rains during the flood season. Increased flooding is made worse by morphological changes of the Hau River and probable land subsidence. In addition, sewer systems in the city are generally old and of insufficient capacity to deal with high rainfall levels, while many parts of the city do not yet have drainage systems. Rapid and uncontrolled urbanization has encroached on many natural canals, significantly reducing capacity of the city drainage system. Urban flooding from rainfall and high tides is therefore now a regular occurrence and is expected to worsen from projected climate change.

**The economic and human costs are high**

Recent flooding in Can Tho has affected more than two-thirds of the area and more than 200,000 people a year. Direct economic damages are estimated to be US$130 million–US$190 million annually. Direct and indirect losses are put at almost US$650 per household each year, or 11 percent of average household income. Yet the city does not have a strategy or specific instruments to manage these costs or reduce the negative development impacts from flooding.

*Source:* World Bank 2016c.

agencies involved in flood risk management and urban development, often with overlapping mandates and authority.

### 3.1.2 Water quality for settlements is a growing problem due to pollution in some locations

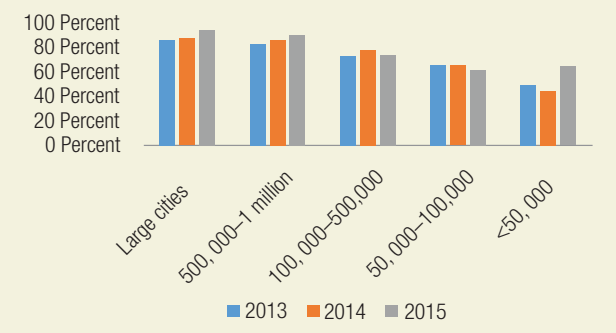
**Though water is available to most cities in abundance, the quality is often unfit for safe consumption.** There are threats to both surface water and groundwater sources. Salinity intrusion is already making it hard to secure freshwater supplies for cities in the Mekong Delta. Two-fifths of urban water is sourced from groundwater, typically a higher-quality source of potable water. However, rapid extraction for water supply and other uses is depleting groundwater in some areas, leading to declining quantity and quality and contributing to land subsidence. Groundwater in the shallow aquifers in Hanoi, Ho Chi Minh City (HCMC), and some other urban areas is showing signs of contamination by organic compounds. In some areas—the delta, for example—dwindling groundwater and deteriorating quality are dramatically raising the costs of supply, as needs for transport and treatment increase (2030 WRG, 2017).

### 3.1.3 The urban water network and services have improved greatly, so the focus is now on the more complex challenges

**Expansion of piped water to urban households has been rapid, and piped water reached 86 percent of the population, with a total design water supply capacity of 9.8 million $m^3$/day in 2018** (MOC, 2019). Most of the remaining urban population not now connected is likely to be connected by 2025. Average per capita consumption of just over 100 liters a day is comparable to that in other countries in the region.

**Most utilities ensure water supply for 14–20 hours a day, and water quality is generally good.** At present, many people who are not connected in urban areas resort to buying tanker water. In Ho Chi Minh City, 2 million people depend on tanker water as their primary source. In smaller cities and towns, access to piped water is often available to up to 70 percent of the population (see figure 3.1). Though the ambitious government targets for 2020 of 95% percent coverage urban areas categorized as grade IV or above and 120 liters a day average residential consumption will be missed, they could largely be met by 2025 (GoV, 2016b; Prime Minister in the Decision No. 2502/QD-TTg dated December 22, 2016).

**FIGURE 3.1: Water coverage by city size**



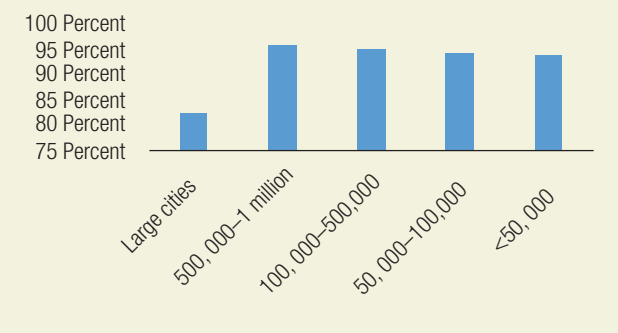

*Source:* Ministry of Construction Management Board of Technical Infrastructure Development Projects of Vietnam.

**Although tariffs cover operating costs, this adequacy may conceal underspending on operations and maintenance (O&M).** On average, generally affordable tariffs cover operating costs with a 50 percent margin. However, this coverage rate has fallen over the last decade, threatening financial sustainability. In addition, relatively low operating costs may suggest underfinancing of O&M as much as they suggest efficiency. Consumers would probably be prepared to pay more, but there is political reticence to raise tariffs. Given that in many parts of the country, quality of raw water is deteriorating, water utilities will likely need to move to more expensive sources or treatment processes, driving up the costs of production and transportation of water. This could further strain cost recovery and keep utilities from expanding water access.

**Levels of nonrevenue water have fallen sharply, but a declining tariff collection rate could threaten financial sustainability.** Nonrevenue water, previously high, is being progressively reduced and is now 21.5 percent, comparable to levels in other countries in the region, although well above levels in developed countries (MoC 2019). The Central Highlands is the region with the highest non-revenue water, amounting to 29.2%, while the North Central and Central Coast region is the best performing region with 20.9% . The percentage of nonrevenue water differs widely among provinces within each region, with the province of Gia Lai in the Central Highlands performing worst (43.8%) and the province of Binh Duong in the South East region performing best (6.2%) (MOC, 2019). A declining rate of collecting tariffs could, however, spell cash-flow and liquidity problems, particularly for the larger cities where rates are lowest (see figure 3.2). The Vietnamese government recognizes the importance and potential benefits of reducing NRW and has set

a target of reducing NRW to 18% by 2020 (Prime Minister Decision 2147/2010/QD-TTg). However, due to low tariffs and consequent budgetary constraints and a lack of technical capacity in water utilities, achieving the targets for NRW is challenging (World Bank, 2018l).

**FIGURE 3.2: Tariff collection rate by city size, 2015**



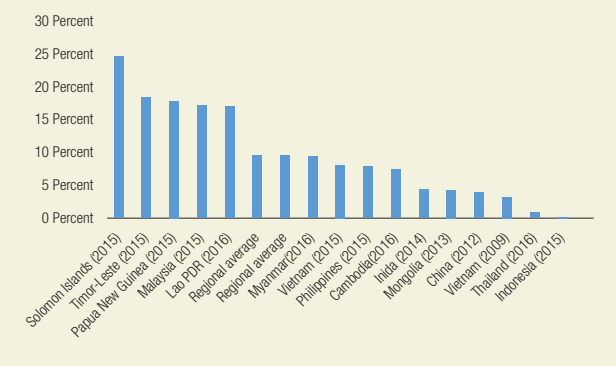

*Source:* Ministry of Construction Management Board of Technical Infrastructure Development Projects of Vietnam.

**Improving energy efficiency can be an important tool for utilities to reduce operational expenditures and thus move towards achieving full cost recovery.** However, governance, technical knowledge, and financing constraints remain barriers to the active pursuit of energy opportunities by utilities. There is a lack of capacity for utilities to identify and develop energy improvement projects, and limited financing resources are available for the up-front capital expenditure. In addition, significant gaps in information and data remain in the sector. With the exception of nonrevenue water, other measures for energy efficiency in the water sector are not yet included in the benchmarking of system performance. Even for nonrevenue water, the reliability of the data may be questioned (World Bank, 2019).

### 3.1.4 The quality of water service provision for businesses has declined in recent years, potentially hampering economic growth.

**While water is typically thought of as important for health, hygiene, and agriculture, it is also vital for businesses, especially in manufacturing.** Water disruptions can have heavy impacts on revenues, with a daily water shock reducing revenues of formal firms by 8.7 percent and those of informal firms by 34.8 percent (World Bank 2017n). According to the 2015 World Bank Enterprise Survey for Vietnam, about 8 percent of manufacturing firms reported experiencing at least one incident of insufficient water supply in the preceding year, a rate slightly below the average for countries in the region (see figure 3.3; World Bank, 2015c).

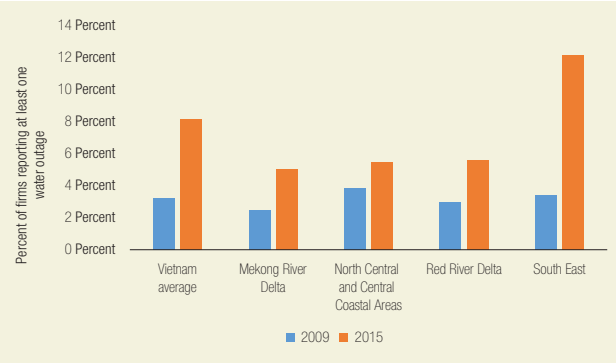
**FIGURE 3.3: Share of manufacturing firms reporting at least one water outage in the previous year**




*Source:* World Bank Enterprise Surveys and authors' calculations.

**Reliability of the water supply has declined in recent years, increasing business costs.** In 2009, only 3.2 percent of firms in Vietnam reported experiencing water outages in a similar Enterprise Survey. The nearly threefold increase by 2015 occurred throughout the country, but was most dramatic in the South East, a region encompassing HCMC, the largest economic center in Vietnam (see figure 3.4)

**FIGURE 3.4: Share of manufacturing firms reporting at least one water outage in the previous year, by region, 2009 and 2015**




*Source:* World Bank (2015c) Enterprise Surveys and authors' calculations.

**Corruption in the sector is low, and firms are generally able to obtain water connections quickly.** In 2015, about 5 percent of firms reported the need to give an informal gift or payment to receive a water connection. This is considerably lower than in other East Asia and Pacific countries, where the average is 32 percent. It is also lower than in India, where 52.5 percent of firms report the need to make informal payments. Receiving a water connection is relatively quick in Vietnam, taking on average less than 13 days, compared with 23 days in the region (World Bank, 2015c).

### 3.1.5 Low rates of sanitation services and of domestic wastewater recovery and treatment are major factors in water resource degradation

**Infrastructure for urban sewerage and drainage is limited and, coupled with rapid industrial and urban growth, has generated a serious pollution problem.**

Vietnam's performance on wastewater collection, treatment, and reuse is the worst in the region. Only 46% of urban households have connections to drainage systems and only 12.5% of municipal wastewater is treated (MOC, 2019). In 2018, there were 45 centralized wastewater treatment plants in operation, with a total capacity of 960,000 $m^3$/day. Currently the construction of an additional 50 wastewater treatment plants, with a total capacity of about 2,200,000 $m^3$/day is planned (MOC, 2019). With the low rate of collection and treatment and the prevalence of leaky septic tanks, contamination of water resources—surface water and groundwater—is widespread.[1]

**Cost recovery and fee collection could be part of the problem.** The domestic wastewater tariff is set at a maximum of 10 percent of the water supply tariff, whereas in practice the costs of collecting, treating, and disposing of wastewater can be several times the cost of supplying water. This low level of cost recovery has created disincentives to invest in sewerage networks and treatment; at least one wastewater treatment plant has gone out of business (ADB 2009). But more generally, there is a public good imperative to collect and treat wastewater, which is hazardous to human health. Hence, there remains the need for appropriate policies and regulations to align private incentives with public health and environmental objectives.

## 3.2 Urban development has outpaced the governance needed to support it

### 3.2.1 Urban growth has often outstripped planning, infrastructure, and regulation

**The pace of urbanization and industrialization has been rapid, creating the risk that development could outpace the planning, infrastructure, and regulation needed to support it.** By June 2017, there were 805 cities, and the urbanization rate was approximately 35.7 percent. In particular, land and water spatial planning to guide the spread of settlements has often lagged. The infrastructure and institutions to provide flood protection; supply of water services; water resources protection and management; and wastewater collection, treatment, and disposal have struggled to catch up with urbanization in many locations.

### 3.2.2 Utilities have corporatized and equitized rapidly, bringing benefits and risks[2]

**A reform to allow private shareholders to hold equity shares in utilities, under way since 2002, proceeded slowly until recently.** Urban water services are corporatized, and a reform is under way to strengthen their autonomy and open them to private investors, with the objectives of relieving the fiscal burden and improving access and service quality. Since 2005, urban water supply companies have been in the process of equitization. There are now only 10 companies out of a total 111 companies not yet equitized (9%), including companies in Hanoi and Ho Chi Minh City (VWSA, 2018). Further, about 100 private enterprises have been mobilized in 63 provinces and cities to invest in urban water supply works, while several hundred private enterprises invested in rural water supply works (MOC 2019).

**The early phase was hampered by perceived risks that slowed the process of equitization.** Constraints to equitization included perceived high financial risks due to insufficient tariffs and inadequate revenues. Lack of transparency in the asset valuation system led to the perception that assets were overvalued and that utility management and staff were not committed to the reforms. Private sector reluctance also reflected the absence of a clear contractual relationship between provincial governments and the utilities. And corporate risk was raised by the requirement that private equity always be the minority partner because water supply was perceived as a partially "public" rather than "commercial" good. Further, utilities are expected to be brought to the market via auction. Limited transparency, accountability, and advertisement of opportunities reduce the credibility of the process. Since expertise in water operations is not required for potential investors, investors without any knowledge of water utilities may become shareholders, potentially hindering operations and the credibility of the process (World Bank n.d.b).

**Recent changes in policy and practice have accelerated progress in equitization but with attendant risks.** In 2017, the government eliminated the state shareholding requirement and opened the utilities to 100 percent private ownership. Provincial water service companies were listed in the 2017 budget among the state-owned enterprises slated for full privatization. As a result, most utilities are now equitized, with a trend toward majority or full private ownership. However, this process faces some challenges. Some deals involved

significant inducements to private sector investors by the provinces, such as grants of permission to develop land, rather than commitments to increase tariffs to support revenue. There has been limited focus on professional commitment to quality service provision. In addition, although equitization has provided a much-needed injection of private capital, it is not clear that efficiency gains have followed.

**Privately owned utilities are largely unregulated, while those that are majority province-owned remain under the regulatory umbrella of the Ministry of Construction (MoC) and are subject to oversight by provincial people's committees (PPCs).** This works to the detriment of consumers, who are not assured of service standards, and of the utilities, whose tariffs are still set by the PPCs. In the case of one major utility, for example (in Ho Chi Minh City), services and performance are reported to have deteriorated since privatization. This finding matches earlier studies, which had found scant efficiency gains from equitization.

**The difficulties of privatization are unsurprising because water supply services are a natural monopoly.** Water distribution services are characterized by high capital costs and relatively high barriers to entry due to the capital-intensity of operations. Capital costs are high enough to make duplication of infrastructure economically unviable in virtually any circumstances. The resulting lack of competition means that the operator, whether publicly or privately owned, has no incentive to invest in improving efficiency or service quality, especially if that detracts from earning higher profits. The role of the government in these circumstances is to recognize these disincentives and to design regulations and service contracts to ensure that affordability and quality services go hand in hand with a fair and normal rate of return to the service provider. Missing this balance renders a city vulnerable to poor service quality, whether by a private or a public operator.

### 3.2.3 The program to strengthen governance of urban water has stalled

**In recent years, Vietnam has accelerated the implementation of the policy of "equitization" of water supply; however, the enforcement of the regulations binding the roles and responsibilities of local authorities and the obligations of the water supply units (Decree No. 117/2007/ND-CP) has not been adequately implemented yet.**

To protect all stakeholders, Decree 117 mandates contracts between local governments and the utilities setting out the functions and obligations of each. The intention of this contractualization requirement is to specify performance standards and monitorable indicators, service and investment obligations and financial commitments, and mechanisms for dispute resolution. Specifically, Decree 117 stipulates that agreement on the implementation of water supply services should be signed between the People's Committee or an authorized agency and the water supply unit (Article 31, Clause 1). Further, the water supply service area shall be subject to adjustment, if required (Article 32, Clause 4). In addition, water supply units are obliged to prepare and submit an annual and long-term water supply development plan in the service areas to the People's Committee for approval. The existence of a clear contractual relationship was expected to provide incentives and safeguards to investors, assurance to PPCs that quality services would be provided, and protection to consumers. However, the reform has not yet been implemented. As a result, all parties—consumers, PPCs, and privatized utilities—are exposed to risks, and many parties seem dissatisfied (World Bank 2014b).

**The government's reforms also call for establishment of an independent regulator and for independent public regulation in line with global good practice for a natural monopoly, but this has not yet occurred.** Regulation is intended to cover five interrelated factors that are crucial to performance: sustainable tariffs and funding structures, business planning, asset management and development, financial planning, and capital investment (World Bank 2014b). However, the proposed independent regulator has not yet been set up.

## 3.3 To ensure cities' water security, planning and governance need to catch up

### 3.3.1 Integrated and risk-informed urban planning is essential

**Urban development needs to reflect basin plans and to apply the principles of integrated and risk-informed urban planning.** What are needed are holistic solutions, with planning done in an integrated manner and not in sectoral silos. Urban infrastructure planning needs to integrate resilience measures within basin plans by promoting the connectivity of networked infrastructure as a means to plan for and mitigate disaster risks, especially flooding. This will require moving from the current sector-specific, uncoordinated model of

urban planning to an integrated and risk-informed approach, integrating water resources management (WRM) at the wider, basin scale as well as incorporating responses to climate change and disaster risks. For example, flood prevention solutions at the tertiary infrastructure level (such as in low-income areas) need to be combined with broader measures to systematically reduce flood risks, such as prevention from tidal inundation, maximization of storm water storage, and provision of drainage capacity in the larger catchment area (World Bank 2015a).

**Recent initiatives indicate ways forward.** The government has recognized these problems, and recent extreme events, especially flooding disasters in several basins, have raised national awareness of the risks. The Mekong Delta has been particularly affected, which has driven activities to strengthen urban resilience (see box 3.2). The Mekong Delta Plan under preparation (see chapter 7) will address land and water spatial planning, institutional organization, and infrastructure needs from a basin-wide perspective.

**BOX 3.2: Building urban resilience: The Mainstreaming Disaster Resilience in Vietnam Project**

A component of this World Bank–supported project is identifying ways to build resilience for cities in the Mekong Delta. City-specific analysis reports are being prepared for seven Mekong Delta secondary cities, incorporating sector-specific analysis of urban planning, land use planning, urban transportation, water management, disaster risk management, climate change, institutional capacity, and geospatial data infrastructure, with economic and financial analysis.

An overarching synthesis study has also been initiated to look at ways of scaling up urban resilience across the delta—*Enhancing Resilience of Mekong Delta Region Secondary Cities*. The synthesis study will draw on the analysis carried out in the seven city-level studies to provide cross-cutting lessons on urban transformation and risk-informed planning in secondary cities of the Mekong Delta. Given the growing importance of secondary cities in Vietnam, the study has the potential to provide valuable lessons for resilience planning in secondary cities more broadly throughout the country.

*Source:* World Bank 2018b.

### 3.3.2 Efficient and sustainable urban water services require completion of sector reforms

**Sector performance would improve if completion of equitization were accompanied by contractualization, institutional development, and targeted investment.** Priority activities for the reform agenda and improved sector performance include completing the equitization of the remaining state-owned utilities; professionalizing the sector by strengthening commercial, operational, and financial management and planning; establishing contractual relationships between PPCs and water utilities, complete with monitorable key performance indicators; prioritizing investment in the utilities that offer the highest improvements in operating or financial effectiveness and can deliver improved service to customers; and tapping new and larger sources of finance for infrastructure from private sources and public–private partnerships (PPPs) (World Bank 2014b).

**Reducing leaks and improving cost recovery are the key operational requirements for most utilities.** Aware that reducing water losses is the cheapest way to increase supply, the government launched a nationwide leak reduction program. This needs to be pursued with greater vigor. In addition, attention needs to be paid to improving cost-recovery rates, particularly in the larger utilities, where financial viability is threatened by recovery rates falling as low as 80 percent of amounts billed (World Bank 2014b).

**Independent regulation is a key requirement where utilities are autonomous and partly or fully privatized.** Independent regulation is needed to protect stakeholder interests and to promote improved performance, while establishing a clear methodology and process for setting tariffs. Based on international best practice and on lessons from Vietnam's electricity sector, regulation by contract with a national regulator is the most appropriate approach for Vietnam (World Bank 2014b).

### 3.3.3 Applying integrated and risk-informed planning to water

**Integrated planning methods—at the local and basin-wide scale—should be developed and applied across all key basins.** The key lessons for urban planning are that an integrated and risk-informed approach to water needs to be applied and that, beyond local water issues, city planning needs to be set in the context of integrated land and water resource planning and management, taking account of basin-wide infrastructure

and management connectivity. The ongoing comprehensive planning for the Mekong Delta should indicate methodologies for accomplishing this.

### 3.3.4 Planning for urban water supply and sanitation services

**Strategy and planning for urban water supply services need to focus on universal access and service quality and efficiency.** Planning for urban water services needs to identify, manage, and protect sustainable water sources. On the service delivery side, investment and financing need to keep up with urbanization and reach 100 percent coverage. A particular focus is required on smaller towns and on poorer parts of larger towns to identify the constraints to extending services there. Where funding is an obstacle to investment, consideration will need to be given to increasing customer tariffs to recover operational and investment costs (World Bank 2014b). The Government has recognized these challenges and has initiated a National Program to ensure safe water supply with the duration of 2016-2025 (Decision No. 2502/QD-TTg dated December 22, 2016). WHO has supported the Ministry of Construction in designing and implementing the safe water supply plan, and has supported training of water supply units. To date, the plans have been deployed in 43 provinces and cities; including the management of water source risks, water supply plants and pipeline networks.

**Strategy and planning also need to focus on improved governance and strengthened autonomous utilities.** The reform program needs to carry through to improve governance, with a focus on the components that will protect stakeholders and ensure efficient and affordable services—contractualization and regulation. The constraints to implementing these two reforms need to be identified. Service delivery and utility autonomy need to be sustained by improving the financial situation for the utilities, particularly through customer tariff levels, the collection rate, and reduced nonrevenue water (World Bank 2014b).

**Resolving the major environmental issues will require a new business model for wastewater.** The new model should incentivize municipalities, households, industries, and the private sector to invest in wastewater collection, treatment, and reuse. Actions are needed to strengthen the legal framework and its application and to better incentivize private investment in the sector under PPP arrangements. One possible win–win solution, particularly in water-stress hot spots, would be to invest in wastewater reuse as well as treatment, so that there is a secondary revenue stream to partially cover costs.

## 3.4 Rural water supply and sanitation

**Coverage of WSS services has improved sharply in rural areas.**[3] Access to safe water supplies and hygienic sanitation facilities in rural areas of Vietnam was historically among the lowest in East Asia. In 2000, only 10 percent of rural households had access to improved water. By 2016, the Vietnam Household and Living Standards Survey found that 70 percent of rural residents had access to improved water (20 percent to piped water) and 77 percent of rural households had access to improved toilets. This was achieved through a dedicated sector program for rural Vietnam, the National Target Program for Rural Water Supply and Sanitation. Focused on developing water infrastructure, the National Target Program was launched in 2000 and closed in 2016 after three funding rounds (the last allocated more than US$1.5 billion to rural water supply, channeled through the PPCs). Since 2000, an estimated 16,200 piped water schemes have been constructed. In 2016, the government launched a New Rural Development National Target Program, which encompasses 19 sectors, including rural water.

**The water supply and sanitation sector has made much progress in setting up the legal and institutional framework for rural water service delivery.** Several central government institutions have responsibility for formulating policies. The Ministry of Finance sets and approves the policies for tariffs and for incentivizing private sector participation in water infrastructure development and management. In practice, though, PPCs have the final say in tariffs effectively applied. The Ministry of Construction sets construction standards and also participates in the approval of tariffs submitted by PPCs and service providers. Responsibility for formulating and implementing the strategy for rural water falls to the Ministry of Agriculture and Rural Development. At a lower level, Provincial Centers for Rural Water Supply and Sanitation (PCERWASS) are usually formed to implement government strategy, and they have been the lead institutions implementing the rural water interventions under the National Target Program.

**Sustainability, however, has lagged.** The National Target Program and the New Rural Development National Target Program are robust structures to deliver infrastructure and increase access to water supply. However, arrangements for the provision of quality water services and sustainable O&M are undeveloped. As of June 2016, the Ministry of Agriculture

and Rural Development reported that 10 percent of piped water schemes were not functional, while 15 percent functioned below their design capacity. In mountainous and ethnic-minority areas, an estimated 33–48 percent of piped water schemes are entirely out of use or operating poorly. Six main factors explain these shortcomings:

- Little to no attention to building the capacity of service providers, particularly if they are local communities, to manage water schemes.
- Limited participation of users in the design, implementation, and O&M of the schemes.
- Poor application of tariff policies (which call for full cost recovery), so that water is highly affordable but many schemes need subsidies.
- Limited funds allocated to promoting the value of safe drinking water and so increasing consumers' willingness to pay.
- Absence of financial mechanisms to ensure that funds are earmarked for asset maintenance, particularly in schemes managed by local governments and communities.
- A weak regulatory framework that inhibits participation of professional operators, including private ones.

**Community-based management is the predominant model for rural water services.** It accounts for 77 percent of total piped water schemes, generally at the village level. PCERWASS and private operators usually manage multi-commune schemes covering large rural areas. PCERWASS face two main challenges: (1) too few human resources (often decentralized) to assist all villages and (2) limited revenue from tariffs, which are not ring-fenced and can be reallocated to any other provincial activity. Private sector participation in rural water services remains slight (less than 4 percent of schemes) and comes in various forms. Nonetheless, the World Bank–financed Program for Results Rural Water Supply and Sanitation Project under the National Target Program in eight Red River Delta provinces shows promising private participation in infrastructure investments and in the O&M of larger rural water schemes. From 2013 to 2017, about 133,000 connections (40 percent) were financed or co-financed by private investors and about 650,000 people (26 percent) were served with sustainable services managed by private entities.[4] However, the enabling environment, particularly regulation, remains unattractive for scaling up and diversifying private sector partnership arrangements, especially for smaller schemes in remote areas.[5]

**For comprehensive and sustained improvements in rural water (to serve remote and ethnic-minority areas), the following policy recommendations are suggested:**

- Formulate new responsibilities for PCERWASS related to promotion, oversight, and sustainability of water service delivery, including support for professionalizing community-based management.
- Introduce regulatory mechanisms to incentivize adequate asset management and overall operational and financial performance, which could increase private sector participation.
- Ensure that future schemes are demand-responsive to increase the population's ownership and participation in water systems management (including paying tariffs to move towards covering at least O&M costs).
- Explore alternative support structures for community-based organizations, such as bringing in the private sector to provide routine or ad hoc support or forming associations of community organizations to offer technical assistance and services.
- Design and pilot PPP contracts for rural water supply. The government, increasingly seeing the private sector leading in the water sector, should provide further guidance to PPCs, including a menu of potential PPP arrangements.

## 3.5 Access to water supply and sanitation services among poor and rural people

**Despite appreciable progress in nationwide access to basic WSS services, gaps between rich and poor persist.** Access by the poorest 40 percent has increased considerably, but a large and widening gap between the poor and non-poor remains. Only 7 percent of the poor have piped water against 40 percent of the non-poor, only 40 percent of the poor have access to improved water against 81 percent of the non-poor, and only 30 percent of the poor have access to improved toilets against 88 percent of the non-poor.

**The picture is similar for urban and rural households** (see table 3.1). Only 20 percent of rural residents have piped water against 86 percent of urban residents, 70 percent of rural residents have access to improved water against 96 percent for urban residents; and 77 percent of rural residents have improved toilets against 96 percent of urban residents.

**TABLE 3.1: Access to drinking water, sanitation, and hygiene as of 2015 (percent)**

| | Drinking water | | | Sanitation | | | Hygiene | | |
|---|---|---|---|---|---|---|---|---|---|
| Quality of service | National | Rural | Urban | National | Rural | Urban | National | Rural | Urban |
| Basic service | 91 | 91 | 92 | 78 | 72 | 91 | 86 | 82 | 93 |
| Limited service | 3 | 1 | 6 | 4 | 4 | 4 | 13 | 16 | 7 |
| Unimproved | 5 | 7 | 2 | 14 | 19 | 3 | — | — | — |
| No service | 0 | 1 | 0 | 4 | 5 | 2 | 2 | 2 | 1 |

*Source:* WHO and UNICEF (2018).

**Differences particularly affect women and ethnic groups.** Women—especially in poor and ethnic house-holds—still suffer the drudgery of collecting water and the problem of lack of adequate sanitation (see box 3.3). There are also wide differences across regions and ethnic groups.

### BOX 3.3: Gender equality in water supply and sanitation needs further improvement, particularly in the poorest households and in ethnic communities

By Vietnamese social norms, the gender division of labor typically assigns women the tasks of securing water for household needs such as drinking and washing; cooking and overall household food security; and caring for children, the elderly, and the ill. Poor water supply and sanitation (WSS) services severely affect poor women's time, physical security, nutritional status, overall productivity, income-generating capacity, opportunities for adult education, and overall health and well-being.

The government is strongly committed to gender equality—see, for example, the Law on Gender Equality adopted in 2006. The National Rural Clean Water Supply and Sanitation Strategy to 2020, developed in 2000 and updated 2010, emphasizes the need for special attention to gender issues. The strategy requires that both men and women participate in decision making and in water user groups.

Nonetheless, statistics on household access to basic infrastructure from the Multiple Indicator Cluster Survey (MICS) of 2014 suggest that, while 68 per cent of households in the richest quintile enjoyed piped water at home, only 6 per cent of households in the poorest quintile did. Thus, particularly in poorer households, women are still enduring the drudgery of collecting water, and their families are at risk from unsafe water.

The burden of water collection falls disproportionately on ethnic-minority women and girls. Water collection is a daily, time-consuming activity (at times requiring more than 30 minutes a trip) in 20 percent of ethnic-minority households compared with a national average of less than 4 percent (MICS 2014, table WS.3). Ethnic-minority households also lag on access to improved sanitation, with only 24 percent using a septic tank against 71 percent of households among Kinh and Chinese groups (MICS 2014, table WS.4). These inequalities have not declined.

In addition, poor sanitation and water supply have wide effects on girls at school. Lack of privacy in sanitation leads to menstruating girls missing school (for example, in India, one in four girls do not attend school while menstruating because of the lack of adequate toilets). Lack of sanitation can also expose women and girls to physical violence (for example, one in four girls say they never feel comfortable using school latrines).

Women's involvement in WSS-related decision making leads to benefits in better procurement, O&M, cost recovery, and hygiene awareness, as well as in improved WSS project performance. It also includes economic benefits, such as more time for income-generating activities. Quality of life benefits include freedom from the drudgery of water collection and management, which enables children, especially girls, to go to school; increased convenience, comfort, and privacy for women from proper sanitation facilities; and women's empowerment.

There are three methods for integrating gender into WSS programs in Vietnam: context-specific information and data; consultation, advocacy, and decision making; and actions to promote gender-sensitive organizations. All these have been detailed in a September 2017 Guidance Note on Gender Inclusion.

*Source:* World Bank 2017g.

## 3.6 Priority actions for water in urban development

Among the many issues affecting water in urban development and the provision of WSS services, the following are priorities for further investigation and action:

- **Integrating urban planning for water management, hazard mitigation, water supply, and drainage and wastewater into broader spatial planning.** The initiative led by the Ministry of Planning and Investment (MPI) for integrated

cross-sectoral and multi-institutional planning in the Mekong Delta may indicate pathways for city planners to work within a comprehensive spatial and socioeconomic context basin-wide. In smaller basins, the question will be how to fit urban water-related planning within broader basin plans—for example, in urban settlements in Ninh Thuan Province within a basin plan for the Cai River (see box 7.2 in chapter 7).

- **Maximizing finance for development of urban WSS services, and for broader urban development.** Equitization of urban water supply utilities essentially transfers the onus for mobilizing new investment finance to the private sector. Well-run utilities in Vietnam can access bank finance, but this often requires them to use their assets as collateral, because banks are concerned that revenue streams are unstable. There are many constraints to expanding access to investment finance (see chapter 8) and tapping private finance would require a major coordinated policy effort. A strategy could be developed along the lines of that proposed for Vietnam's energy sector (see box 8.2). The private using new technologies. Beyond WSS services, experience from other countries shows that sector could be incentivized to propose cheaper, innovative sustainable solutions for water and wastewater treatment
- **Developing a new business model for wastewater.** Given the high cost of retrofitting sewerage networks and treating wastewater, and given likely consumer unwillingness to pay, a new business model is required. There may be opportunities for new technology or for off-grid solutions for wastewater collection and treatment that are cheaper to implement and easier to operate and maintain than those currently used. There is an opportunity to learn from the experiences of other countries that have successfully met this challenge. Developing a new business model calls for a detailed assessment of the economic prospects of reuse, especially where supply deficits are driven by deteriorating water quality. One approach in India is to require power plants in water-stressed areas within a specified radius of a water reuse plant to take reused water. In Singapore, industry is required to use reused water rather than potable water for their processing requirements. For such policies to work, there would need to be stringent reused water quality rules and strict enforcement.

### BOX 3.4: A public–private partnership for complex urban development challenges in China

Rapid urbanization and poor water management and drainage are large issues in China. In 2013, more than 230 cities were affected by flooding. With cities getting bigger and climate change threatening to bring more extreme weather, China has embarked on the "sponge city" initiative to construct cities that soak up almost every raindrop and capture that water for reuse. Instead of funneling rainwater away, a sponge city retains it for use within its own boundaries. The recycled water can be used to recharge depleted aquifers and irrigate gardens and urban farms. When properly treated, the recycled water can replace drinking water, flush toilets, or clean homes.

A public–private partnership (PPP) project was launched in Chizhou City in Anhui Province for a sponge city pilot program to improve resilience to extreme weather and simultaneously improve the Qingxi River Basin environment. This very successful PPP is often referred to as the "Chizhou model."

The PPP started in 2014, when the Chizhou municipal government signed a cooperation agreement with Shenzhen Water (Group) Co. Ltd., a Shenzhen city government–owned company, for urban sewage treatment and municipal drainage facility operations.

Because the city's financial resources were insufficient to cover the costs of the project, the government set up a PPP, splitting the project into three components: sewage and municipal drainage, restoration of the Qingxi River, and sponge city construction measures including public parks and natural recreation areas. The three components together leveraged CNY 2.28 billion, split among contributions from the central government, municipal government, and the private partners. The project was so successful that in 2016 the city announced the expansion of the PPP.

*Source:* DRCSC 2017.

## Notes

1. The consequences for pollution of the poor performance on municipal wastewater are discussed in chapter 4.
2. Although the urban utilities are performing relatively well, there is wide variation among them. Management and governance improvements needed for many include defined and agreed service standards, asset management plans, investment planning, O&M planning, business planning, and standardized and consistent tariff methodologies
3. This section is based partly on World Bank 2017c, World Bank 2017k, and the Vietnam Household and Living Standards Survey, 2016
4. Sustainable water services are defined within this Program for Results as providing clean water (as per Ministry of Health standards), and continued supply of at least 22 hours a day, 7 days a week, having O&M costs covered by operating revenue from tariffs, nonrevenue water below 25 percent, and operated under a recognized management model.
5. PPCs are not always implementing the Circular 54 with regard to tariffs subsidies, creating uncertainties as to the responsibility for financing full cost-recovery.

# Part 2

# Reducing Threats—Too Little, Too Much, Too Dirty

Water is a vital factor of production, so it is no surprise that too little water, too much water, or water that is too dirty translates into slower growth and darkened economic prospects. Both the quality and the quantity of Vietnam's water resources face growing threats. The country's rapid development, combined with climate change, threaten costly flooding, worsening pollution, and increasing competition among sectors for water in the dry season. The greatest economic impact is from the health effects of water pollution. If nothing is done to avert these threats, they could combine to reduce GDP by about 6 percent annually by 2035.

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4

# Water Pollution: The Hidden Threat to Development and Growth

*Water pollution and environmental damage are massive problems*

- Risks from water pollution are becoming extreme. Industry is generating huge amounts of highly polluting wastewater, and the toxicity and complexity of pollution are increasing.
- The impact of untreated wastewater on human health and on the economy is a massive threat, potentially costing nearly 4 percent of GDP by 2035.
- Water pollution from agriculture is getting worse, and water-related development and activities are harming Vietnam's environment.

*Solving the pollution problems requires regulation, incentives, and investment*

Pollution presents considerable challenges. The nation needs to make regulation, incentives, and investment a top priority and the focus of a mammoth national effort. Needed measures include:

- Assessing and adjusting the regulatory and incentive structures.
- Trying innovative approaches to water pollution control used in other countries.
- Assessing the scope for commercializing wastewater collection, treatment, and reuse.
- Reducing agricultural pollution through education and incentives, as well as the regulatory framework.
- Using innovative financial mechanisms to support investments in natural capital and reduce nonpoint source pollution.

## 4.1 Water pollution is a growing menace and development hazard

### 4.1.1 Risks from water pollution are becoming extreme

**Water pollution has emerged as the greatest water-related economic threat to Vietnam.** Experience has consistently shown that few other interventions bring as great and immediate development benefits as the provision of clean water. For example, child mortality increased in Great Britain for most of the second half of the 19th century, despite a doubling of average income and better nutrition and housing. It was not until major reforms improved the quality of water supply and sanitation (WSS) that life expectancy and child survival increased (Cutler and Miller 2005). A similar trend has been observed across the world (see, for instance, Cutler and Miller 2005, Watson 2006).

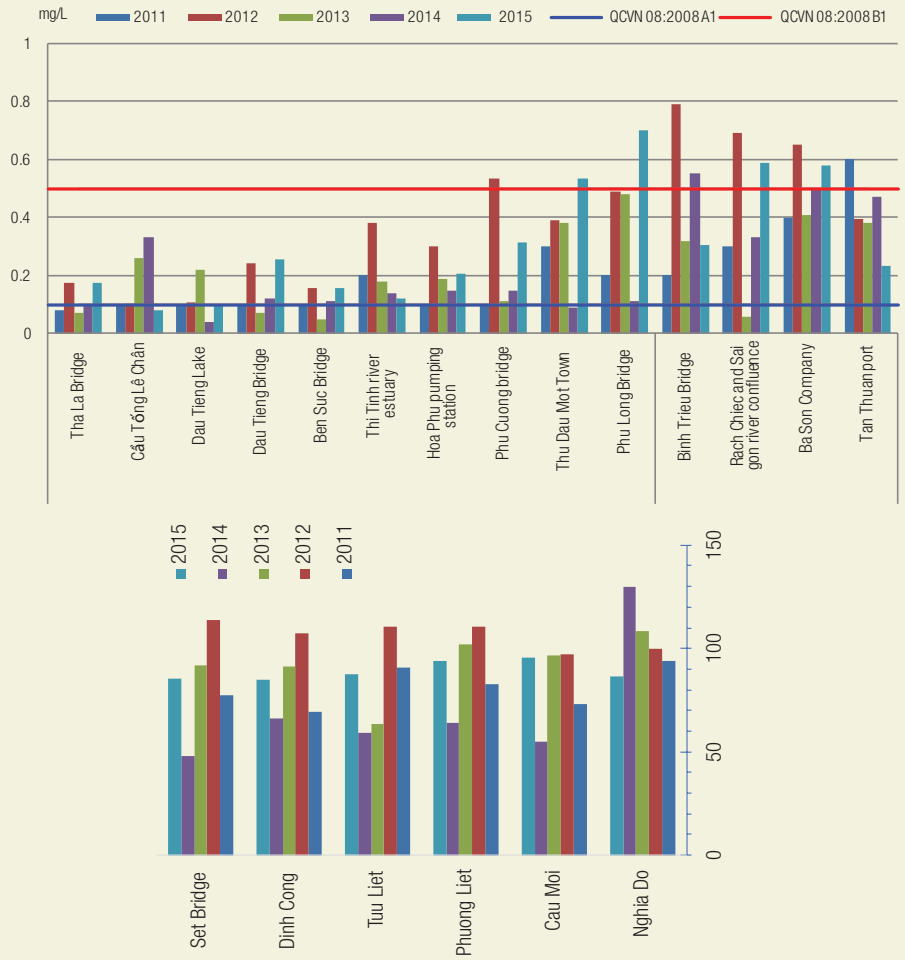
**Vietnam today confronts a dual development burden from its water quality problems.** The pollutants generated by rapid industrialization have introduced new diseases and risks to productivity and growth, before the country could fully address problems related to underdevelopment, such as diarrhea

and undernutrition caused by poor sanitation. In the past, poor water was thought to affect primarily human health, through diarrhea and other infectious diseases. More recent research indicates a host of new contaminants with multiple pathways affecting economic outcomes as well, ranging from labor productivity (the intensive margin), to labor supply (the extensive margin) and agricultural productivity (Humphrey 2009).

**Water quality in Vietnam has deteriorated worryingly, with a trail of toxicity generated by cities, industry, and agriculture.** Waterways flowing past major cities are seriously polluted. Groundwater in many regions has been contaminated with a range of surface pollutants, while over-abstraction has increased concentrations of pollutants and of salt (see figure 4.1). In the Mekong and Red Rivers, these problems are compounded by seawater intrusion.

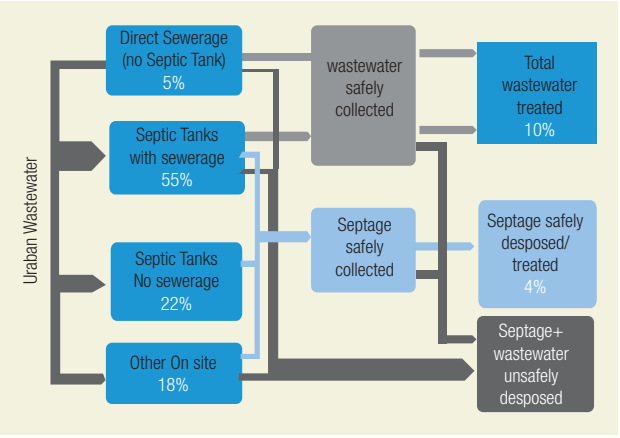
**Urban wastewater is the largest contributor to water pollution, with only 12.5 percent of municipal wastewater treated before discharge into water bodies.** This is a consequence of a long history of neglect of sewerage and wastewater treatment by municipalities (see figure 4.2). Due to the prevalence of combined sewer systems (carrying both wastewater and storm water), domestic wastewater accounts for 30 percent of the discharge to lakes, canals, and rivers. Cities like Hanoi and Ho Chi Minh City (HCMC) discharge to the ecosystem some 700,000–900,000 cubic meters of sewage a day. All this is the upshot of the low rate of connection to sewerage networks; widespread underinvestment in effluent collection, treatment, and disposal; neglect of wastewater reuse potential; low tariffs that do not cover costs; and a dysfunctional regulatory system.

**FIGURE 4.1: Water quality of rivers, 2011–15: left, chloride levels in Mekong; top, chemicaloxygen demand levels in rivers going through Hanoi city; bottom**




*Source:* (Data provided by Centre for Environmental Monitoring (CEM), MONRE, 2011-2015).

**FIGURE 4.2: Urban wastewater management in Vietnam**




*Source:* World Bank 2014b.

**Solid waste from municipalities poses another threat to surface waters.** Illegal dumping, unsanitary and badly managed dump sites near waterways, and a lack of solid waste collection allow solid waste to reach waterways. Though Vietnam has 660 operating landfills, only 203 are sanitary (MONRE 2017). The remainder do not collect and treat leachate—the liquid that drains from landfills and pollutes soil and water. Reliable municipal solid waste collection rates are difficult to track down, but they were estimated to be 86 percent in urban areas in 2018 (MOC, 2019) while 2004 figures suggest rates below 20 percent in rural areas and among the urban poor. About 70% of the solid waste collected was landfilled in 2018 (MOC, 2019). A recent report suggests that the volumes of waste from Vietnam are disproportionately large for its size: 60 percent of the plastic that enters the world's seas originates in just five countries, one of which is Vietnam (Ocean Conservancy and McKinsey, 2015). This highlights the gravity of Vietnam's solid waste situation (Möller-Gulland, 2017).

**Industry generates huge amounts of potentially highly polluting wastewater, much of it from chemicals, which is difficult to treat.** With rapid industrial growth, the demand for water is increasing. Industrial production is already highly polluting, and the toxicity and complexity of pollution are rising as industry expands. The state sector, which still accounts for about 40 percent of GDP, bears much responsibility, as many state enterprises are among the most polluting industries in the country. Water pollution from craft villages is also a serious and growing problem (2030 WRG 2017). The more than 5,000 craft villages are distributed mainly in the Red River Delta, and the North Central Coast and Central Coast regions. The 1,300 craft villages of Hanoi alone discharge an average of 156,000 cubic meters a day of untreated wastewater (Thanh Hien, 2017).

**Much industrial wastewater is discharged without pre-treatment, damaging the environment.** It is estimated that at the end of 2018, centralized wastewater treatment plants were treating only about 71% of industrial wastewater (Thoi Bao Tai Chinh 2018).

**Water pollution from agriculture is growing.** Annually, Vietnam consumes approximately 11 million tons of fertilizer, of which inorganic fertilizers account for 90% and organic fertilizers for 10% (World Bank 2017m). The average amount of fertilizer application amounts to 195-200 NPK kg/ha, while it varies greatly depending on crop type, variety, location, soil types and forms of application. Rice uses 65% of total fertilizer consumed in Vietnam and it is found that most rice farmers apply fertilizers well above recommended rates (World Bank 2017m, Doan 2015). Only about 45–50 percent of fertilizer is used effectively; the rest is washed out in runoff.

**As with fertilizers, Vietnam saw a strong increase in pesticide consumption in the past decades, owing to the intensification of the agricultural sector.** In 1981-86 Vietnam imported around 6,500-9,000 tones of pesticide active ingredients (ai), which amounts to an average of 0.3 kg ai/ha. Between 2001-2010 33,000–75,000 tons/year were imported, which amount to an average of 2.54 kg ai/ha – a dramatic sevenfold increase. In 2015, the pesticide import amounted to around 100,000 tons, indicating a further increase (see figure 4.3). Over the past ten years (2000-2011) the number of pesticides registered and used in Vietnam has increased tenfold. The current mix of pesticides is also found to be highly toxic, with 31% of the pesticides used by farmers in the Red River Delta being categorized within the WHO classification as 'highly hazardous', while 54% were categorized as 'moderately hazardous (World Bank 2017m). These high numbers can be explained by several factors:

- A removal of import restrictions in 1991 allowed prices of chemical fertilizers, pesticides, and other inputs to drop by 50 percent in the following few years, resulting in farmers moving from traditional organic and farm manure fertilizers to imported chemical fertilizers in order to increase yields (World Bank 2004);
- Farmers tend to use older, less expensive and non-patented pesticides that can be manufactured or blended domestically – these are found to be more toxic and persistent than others (World Bank 2017m, Pham et al. 2012);
- Low and unreliable quality of many pesticides and fertilizers leads farmers to apply more to

ensure that they take effect. A study in 2013 found that 54 percent of NPK fertilizers in the market were of low quality (World Bank 2017m, Phạm and Nguyễn 2013).

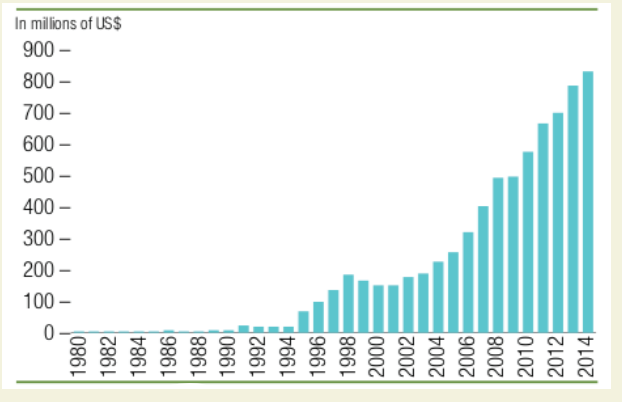
- The availability of cheap fertilizers and pesticides in local markets and their advertisement in local mass media are encouraging farmers to use more of these (World Bank 2017m).

**Water pollution from pesticides and fertilizers was found to be mainly due to discharge of agrochemicals and pesticides into canals and rivers.** A study in 2010 found that 69,238 kg and 43,574 liters of pesticides and 69,640 kg of chemical packages (including paper and nylon bags) are released into the surrounding environment without proper treatment annually (World Bank 2017m, Khanh and Thanh 2010). Besides causing an environmental risk, pesticide residues on agricultural products are still common and high, thus causing a risk to public health. A study from MARD's Department of Plant Protection found that pesticide residues on cash crops were more than 10–26 percent higher than the maximum allowable level in Hanoi and 10–30 percent in Ho Chi Minh City (cited by Trương 2015 in WB 2017 m).

**Overall, with the intensification of crop farming, agricultural pollution has soared.** Fertilizer overuse is the major contributor, particularly in the Mekong Delta (see figure 4.4) and in the Central Highlands. Chlorophyll concentration, a proxy for nitrogen and phosphorous pollution, has risen rapidly (see figure 4.5). Pesticide overuse and related pollution are now rampant in certain parts of Vietnam, resulting in expensive and ineffective pest control and hazards to wildlife and people. Crop farming is the second largest source of greenhouse gas emissions in Vietnam. Correction of fertilizer and pesticide use would produce greater efficiency, reduced pollution, and higher incomes.

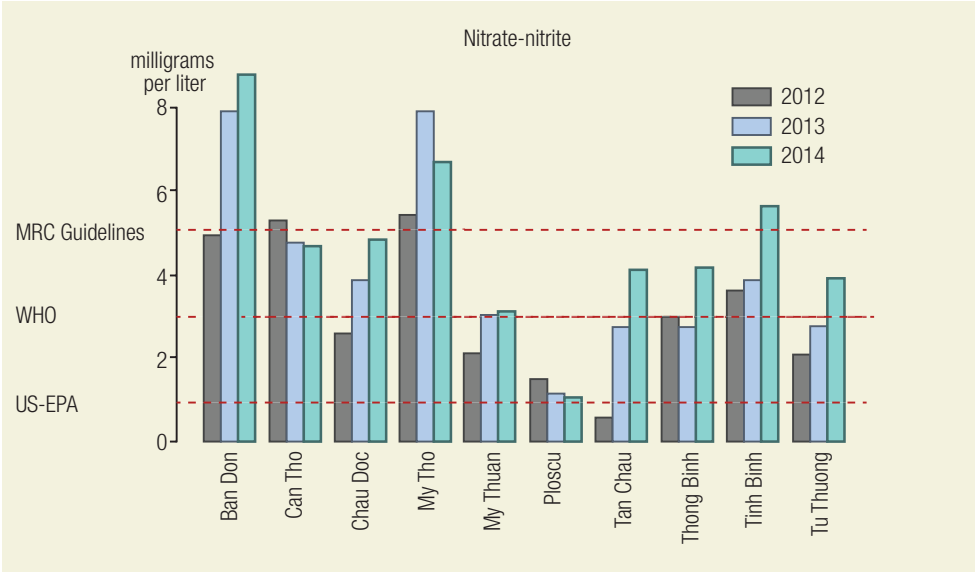
**Livestock, particularly pigs and poultry, produce 84.5 million tons of waste a year charged with nutrients, pathogens, and pharmaceuticals, and two-thirds of this waste enters the environment untreated** (Nguyen The Hinh, 2017). Despite rising productivity, the pressure of livestock production on the environment has not diminished. Pigs and poultry are the most polluting, with the Red River Delta, the South East, and the Mekong Delta generating the most animal waste. There is scant monitoring but strong evidence of pollution and of its harmful effects on water and health in rural areas. Livestock production is also a major contributor to greenhouse gas emissions from the agriculture sector. (MONRE, INDC 2015).

**FIGURE 4.3: Value of pesticide imports into Vietnam 1980-2014**




*Source:* Based on FAOSTAT data.

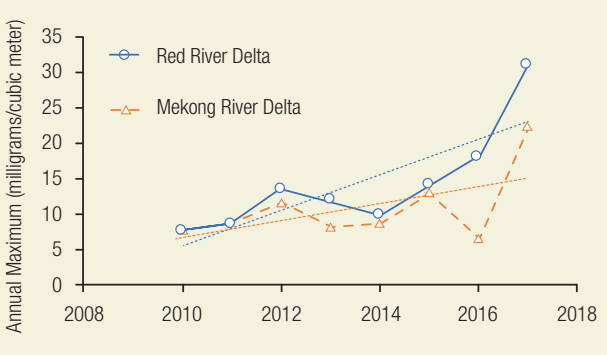
**FIGURE 4.4: Pollution levels in the Mekong River Basin relative to the standards of the Mekong River Commission, World Health Organization, and US Environmental Protection Agency**




*Source:* MRC.

**Aquaculture, too, is highly polluting.** This sector has developed rapidly, especially in the Mekong Delta. Regulation has failed to stem the high levels of pollution due mainly to discharge of untreated wastewater into local water bodies. Food safety concerns have affected sales but are also beginning to drive improvements in standards (World Bank 2017m).

**FIGURE 4.5: Annual maximum chlorophyll concentration in Red and Mekong Rivers**



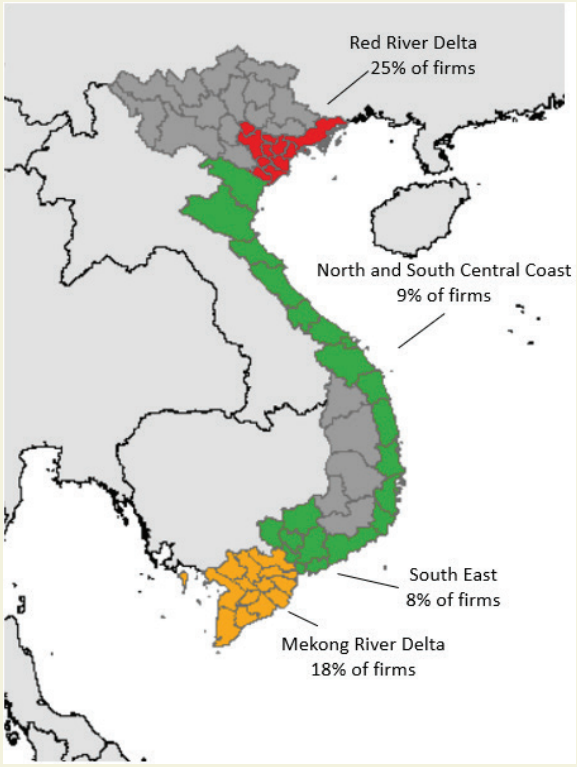

*Source:* Moderate Resolution Imaging Spectroradiometer (MODIS) satellite.

**More broadly, water-related development and activities are harming Vietnam's economy and environment.** Natural ecosystems and biodiversity are under threat from water-related activities, while deforestation and land use changes are affecting the water cycle. Vietnam's environment is reported to be at the threshold of tolerance. The government's "green growth" strategy focuses on more efficient and sustainable use of natural resources and on climate adaptation, low carbon policies, and disaster risk management. However, environmental regulations are not well enforced, in particular in some local governments (World Bank 2016d; Audinet et al, 2008; GoV 2012b, Decision 1393/QD-TTg).

### 4.1.2 Water pollution is now one of Vietnam's greatest development challenges and constitutes a massive cost to the economy

**Poor water quality poses one of the biggest water-related challenges to businesses.** A recent World Bank (2019b) survey, covering 1,032 formally registered firms in Vietnam, found that 14% of questioned companies stated poor water quality as a 'major' or 'very severe' obstacle to their performance. Firms that reported water quality to be a 'major' or 'very severe' obstacle, had 48% lower sales than similar firms reporting water quality as being a 'moderate', 'minor' or 'no' obstacle. Firms in the Mekong Delta and Red River Delta were found to be substantially more impacted by poor water quality (see figure 4.6).

**FIGURE 4.6: Percentage of firms reporting poor water quality as a 'major' or 'very severe' obstacle to their performance in 2018**




*Source:* World Bank (2019b).

**The cost to the economy of untreated wastewater is high and rising.** Untreated industrial wastewater can have significant impacts on the downstream economy. For example, one study estimates that paddy yields downstream of industrial parks in the Mekong River Delta in Can Tho Province are reduced by 12 percent due to discharge of untreated industrial wastewater (Kai and Yabe 2012). Based on a pollution index, Can Tho was the tenth most polluted province in Vietnam (ICEM 2007). To estimate the impact on the economy of reduced paddy yields due to industrial pollution, a study assessed the 10 most polluted provinces and the provinces downstream from them using a computable general equilibrium (CGE) model (World Bank 2018g). These provinces jointly account for 30 percent of Vietnam's rice production. GDP is expected to be reduced by 0.8 percent annually from reduced rice yields alone if untreated industrial wastewater continues to be discharged (see table 4.1). Agricultural GDP is hit the hardest, with an estimated 3.6 percent decline. Even this is a very conservative estimate, as only the 10 most polluted provinces and the provinces downstream of them were considered. Further, the impacts on the quality of rice (and thus its market price) or on farmers' health, such as skin diseases, were not included in the analysis.

**TABLE 4.1: Impacts on sectoral GDP from a decline in rice productivity due to discharge of untreated industrial wastewater**

| Sector | Shares (%) | | | Deviation from base in 2035 (%) |
|---|---|---|---|---|
| | 2012 | 2035 | 2035 | |
| | Base | Base | SIM D01 | |
| Agriculture | 15.2 | 12.4 | 12.1 | –3.6 |
| Industry | 44.8 | 44.8 | 45.1 | –0.1 |
| Services | 39.9 | 42.8 | 42.9 | –0.6 |
| **GDP** | **100.0** | **100.0** | **100.0** | **–0.8** |

*Source:* World Bank 2018g.

*Note:* The values show the deviation from the reference path, that is, no additional discharge of untreated industrial effluent from the baseline of 2012.

**There are broader impacts beyond agriculture.** Untreated wastewater can harm human health, which in turn affects the economy through reduced worker productivity and increased health costs. This can be manifested as lower effort on the job or days lost to sickness and higher mortality affecting the size of the workforce. In addition, reduced health places a higher burden on the health system. Thus, there is a double shock: workers can be off work (reducing output) and drawing on health services.

**Action on wastewater treatment could boost GDP by 2.3 percent, but inaction could lower GDP by 3.5 percent.** The CGE modeling shows that the impact of decreased or increased productivity has huge consequences for the economy: the difference between action and inaction is 5.8 percent of GDP (see box 4.1). Vietnam's water governance should therefore be improved—and enforced—to enable full treatment of wastewater.

## BOX 4.1: The huge gains—or losses—to GDP from wastewater treatment

Untreated domestic and industrial wastewater contributes significantly to disease occurrence, especially diarrhoea, through secondary exposure, i.e. exposure other than through ingestion of primary drinking water (Ferrer and others 2012). The impact on health reduces workers' productivity, and thus that of the economy at large. WHO (2004) estimates that Southeast Asia loses 5.4 billion productive days a year (which equates to about 3.5 days per worker a year in Vietnam) due to diarrhoea caused by untreated wastewater, all of which can be avoided by full treatment of wastewater. In addition, poorer health can place a higher burden on the health system. In Vietnam, hospitals are already overcrowded, average length of stay and rate of hospital admissions are higher than the regional average, and out-of-pocket health expenses push many Vietnamese into poverty (World Bank 2008, 2016).

The economic impacts of lower labor productivity and increased health costs due to the discharge of untreated wastewater were assessed in a computable general equilibrium model. The analysis differentiates between the economic impacts of inaction by 2035, that is, business as usual where only 12.5 percent of municipal wastewater is treated, and action, that is, 100 percent of municipal wastewater is treated.

By 2035, labor productivity is expected to be reduced by an additional 7 percent if current rates of municipal wastewater treatment continue (see table 1). However, if municipal wastewater were 100 percent treated, labor productivity would increase by 4.7 percent by that year.

In the case of inaction, additional health expenditures amount to 0.7 percent of government expenditures.

**TABLE 1: Change in labor productivity by 2035 resulting from inaction or action on wastewater**

| Scenario | Change in labor productivity, 2035 (%) |
|---|---|
| **Inaction** (10% municipal wastewater treated) | (–7) |
| **Action** (100% municipal wastewater treated) | 4.7 |

Under the inaction scenario, GDP in 2035 is 3.5 percent below what it would otherwise have been (see table 2). In contrast, under the action scenario, GDP is 2.3 percent higher than what it would have been. Agriculture is the most affected sector in both scenarios.

**TABLE 2: Impacts on GDP of labor productivity by 2035 and health cost changes resulting from inaction or action on wastewater**

| | GDP (percentage change) | |
|---|---|---|
| Sector | **Inaction** (10% of municipal wastewater treated) | **Action** (100% of municipal wastewater treated) |
| Agriculture | –5.8% | 3.7% |
| Industry | –2.8% | 1.8% |
| Services | –3.6% | 2.4% |
| **GDP at factor cost** | **–3.5%** | **2.3%** |

*Note:* The values show the deviation from the reference path of current municipal wastewater treatment levels.

This analysis shows that even when the full costs for wastewater treatment are taken into account, the overall positive economic impact is substantial—that is, a difference of 5.8 percent of GDP when comparing the inaction and action scenarios.

This assessment is conservative, as only the impact of untreated municipal wastewater was considered, not the impact from untreated industrial wastewater or diffuse agricultural pollution, which also have significant effects on human well-being.

*Source:* World Bank 2018g.

## 4.2 Reducing pollution requires investment, regulation, and incentives

### 4.2.1 Underinvestment in treating wastewater is considerable

**Much of the pollution problem results from underinvestment in industrial wastewater treatment.** This underinvestment is leading to widespread pollution and contamination. At the end of 2018, out of 326 industrial zones planned countrywide, 251 were in operation. Of these zones, 220 (88%) had wastewater treatment plants (MPI, 2019). However, as mentioned above, it is estimated that these facilities were treating less than three quarters (71%) of the wastewater produced in the zones (Thoi Bao Tai Chinh 2018). Most of the remaining wastewater is not treated and is discharged directly to the environment. Of the total of 587 operating industrial clusters, only 55 industrial clusters have centralized wastewater treatment facilities, accounting for 9.4% of the operating industrial clusters (Thoi Bao Tai Chinh 2018). Most of the wastewater discharged from the 5,000 craft villages and traditional craft villages goes without treatment. In addition, some big industrial factories located outside industrial zones as well as the majority of local hospitals and private clinics do not have wastewater treatment facilities (MONRE 2016)

### 4.2.2 The regulatory and incentive frameworks are in principle sound, but implementation and enforcement are weak

**The legal framework is basically sound, but implementation and enforcement of regulations lag.** Vietnam has many regulations on wastewater management, such as for treatment and disposal of wastewater (see box 4.2), and these regulations were rationalized and strengthened by the 2012 Law on Water Resources and by the 2014 Law on Environmental Protection (LEP). In fact, water environmental protection has been an essential part of the environmental legal framework. The LEP in all three versions - 1993, 2005 and 2014 - has specific sections and articles on addressing water pollution. Vietnam has applied all key policy instruments as internationally recommended to address water pollution in Vietnam such as environmental impact assessment, water ambient environment standards, effluent standards, effluent charge, inspection and penalties, monitoring, incentives for environmental protection via soft loans and tax and land preferential conditions, certificates of completion of environmental protection works, and education and awareness raising campaigns. Some 38 laws and Government decrees related to water pollution have been issued since 1993. In addition, since the Party Central Committee's Resolution on strengthening environmental protection in the period of industrialization and modernization of the country dated 15/11/2004, considerable financial resources of one per cent of the state budget for environmental expenditure have been allocated annually for state management of the water environment.

**However, despite over 20 years of implementing environmental enforcement, non-compliance rate remains high.** Illegal discharge of untreated is widespread, as is discharge of treated wastewater that is not compliant with regulations and standard for wastewater. Up to 31% of inspected facilities in 2017 were found to be non-compliant (VEA 2018). Up to 60% of discharge from FDI enterprises exceeds permitted effluent standards (Thien Nhien 2016). The underlying cause for this low compliance rate is insufficient incentive to comply and limited institutional capacity to enforce (2030 WRG 2017, CECR 2018).

**Law enforcement is uneven, and pollution is worsening**. Monitoring, inspection, and enforcement are inadequate, and the environmental protection fee is often not assessed. More monitoring and public disclosure are required to understand the full extent of urban and rural water pollution. Further, only certain pollutants are currently regulated and monitored - COD, TSS, mercury, lead, arsenic and cadmium. However, new pollutants are emerging, such as chemicals found in pharmaceuticals, personal care products, pesticides, industrial and household products, metals, surfactants, industrial additives and solvents. In addition, there is the increasing challenge of solid waste in waterways. Further action needs to be taken to meet these emerging challenges.

**Human resources for environmental enforcement remain inadequate.** The total number of environmental officers at the end of 2017 was 5,728, of which 613 were at the national level, 2,901 at the provincial level and 2,214 at the district level (GOV 2018). There are no environmental officers at the commune level. Of these staff, only 650 are inspectors (140 at the national and 510 at the local level) and these inspectors need to cover not only environmental protection but also mineral resource mining and land administration. On average, each province has only eight inspectors, too few to cover the wide range and number of regulatory tasks.

**The penalty structure is not conducive to compliance.** For industrial wastewater, as regulated in Decree 154/ND-CP, the tariff has a fixed component of VND 1.5 million and a variable component

that applies for discharge volumes above 20 cubic meter/day and the concentration of key pollutants (see chapter 6). Moreover, the tariffs[1] are too low to achieve cost recovery and do not provide financial incentives for industrial companies to invest in common effluent treatment plants. Provinces hesitate to increase fees for fear of losing investors. Industries are often reluctant to pay even these low tariffs. (ADB 2009; Nguyen 2013). Although no study on the effectiveness of the wastewater fee has been carried out, the increasing pollution levels suggest that the current fee is either too low or fee collection is inadequate. The penalties for violation regarding water resources are set out in Decree 33/2017/ND-CP, and those relating to environmental protection are set out in in Decree 155. Penalties for violation are high (a maximum VND 250 million for one violation as per Decree 33 and VND 1 billion as per Decree 155), and there are other mandatory measures such as restoring the initial condition of the environment or cancellation of permits. However, these stiff penalties have not deterred violations, posing the question whether penalty levels are high enough or enforcement adequate.

### BOX 4.2: The regulatory framework for pollution control and the protection of water resources

The discharge of wastewater is regulated by the 2012 Law on Water Resources, the Law on Environmental Protection of 2014, the 2014 decree on wastewater drainage and treatment; and the 2015 decree on waste and materials management.

The decrees state that "wastewater must be collected, treated, reused, or transferred to functional units suitable for reuse or treatment up to environmental technical standards before being discharged into the environment." Further, industrial zones are obliged to have wastewater treatment systems to treat the entire wastewater generated from operations, except for operations which are exempted from discharging their effluent to the central wastewater treatment plant. As per Circular No. 35/2015/TT-BTNMT, all businesses and service establishments have to be connected to the centralized wastewater treatment plant operating in the industrial zone. However, some businesses and service establishments are exempted from this requirement, i.e. if they (a) treat their wastewater in compliance with environmental and technical regulations, and the connection to the centralized treatment plant would cause unreasonable costs; (b) generate wastewater volumes exceeding the treatment capacity of the receiving centralized wastewater treatment plant and concurrently apply wastewater treatment measures in compliance with environmental technical regulations and (c) treat their wastewater in compliance with environmental technical regulations and the industrial zone has no centralized wastewater treatment system (Article 9, para 4). Companies outside of industrial zones must also have wastewater collection and treatment systems (Article 37, 2012 Law on Water Resources).

**Permits for wastewater discharge:** All wastewater discharges must be licensed by an authorized government office (Article 37 Water Resources Law and Article 26 OEPIW). Provincial people's committees (PPCs) are responsible for licensing and issuing permits for wastewater discharges. PPCs are also responsible for dispute settlement on environmental issues (Decree 149/2004/ND-CP). One objective of discharge permits is to control the pollution of water sources and to regulate and reduce the use of toxic chemicals in industrial and agricultural production.

**Assessment of the receiving capacity for wastewater discharge and nutrient loading limits of water bodies:** Circular 76/2017/TT-BTNMT, which took effect on March 1, 2018, provides guidelines for the assessment of the capacity of water sources to receive wastewater discharge and the load-bearing capacity of water sources. The guidelines include direct, indirect, and modeling-based methods to estimate the capacity of receiving waters for wastewater discharge based on maximum loading of surface water quality parameters, flow rate, and quality of river water. The Ministry of Natural Resources and the Environment (MONRE) is responsible for approving the assessed capacity of receiving water bodies and subsequent discharged water of international and interprovincial rivers and lakes. The People's Committees of central-affiliated cities and provinces are responsible for the approval for the same of intra-provincial rivers and lakes. Carrying capacity of receiving waters is one of the bases for issuing discharge permits. However, limited water quality monitoring makes it difficult to implement this circular.

**Payment for wastewater treatment:** Organizations and individuals, aside from those identified as exempt, pay for the treatment of discharged wastewater. The payment is based on an annual fixed amount plus the volume of water used (for domestic consumption) and the pollution content of discharge due to industrial, agricultural, and service activities. Water supply and drainage companies, with provincial, district, and commune people's committees, are responsible for collecting the charges and transfering them to the state treasury, which uses them for environmental protection activities (Decree 154/2016/ND-CP).

*(Box continues next page)*

**BOX 4.2: (Continued)**

**Monitoring water quality and applying sanctions:** In theory, MoNRE and the Department of Natural Resources and Environment (DoNRE), in cooperation with the Environmental Police (under the Ministry of Public Security), are responsible for monitoring water quality and identifying violations. Once a violation is identified, the PPC is informed and assesses fines and, depending on the violation, may issue a warning, demand compensation, request restoration, strip licenses/permits, or a combination of those measures (Decree 155/2016/ND-CP). Implementation of these procedures remains uneven.

**Protection of water sources from pollution:** MoNRE has a shared responsibility (with PPCs and other stakeholders) for protecting water resources, identifying areas being polluted or depleted, assessing the status of water quality, and monitoring and supervising water resource quality and discharge of sewage into water sources. The 2012 Law on Water Resources controls abstraction of groundwater that affects the quantity or the quality of the source.

*Source:* 2030 WRG 2017; Nguyen 2013.

### 4.2.3 The root of the agricultural pollution problem

**Shortcomings in regulation and the incentive structure are at the root of agricultural pollution.** Agricultural pollution remains rampant due to these failings coupled with insufficient capacity and will to enforce regulations. Government policies such as cheap fertilizer and pesticides may even be driving some polluting activities. Structural changes are also needed in sector development policies, to move to less-polluting technologies (World Bank 2017m).

## 4.3 Options for reducing water pollution

### 4.3.1 Focusing on wastewater investment and regulation and on pollution reduction

Despite the adoption in 2007 of a program for comprehensive reform of water pollution (Decree 88/2007), it is only getting worse. The major issues are:

- Pollution from domestic and industrial wastewater, as well as from craft villages.
- Agricultural diffuse pollution, as well as discharge of agrochemicals and pesticides into canals and rivers.
- The dysfunctional regulatory system.
- The low rate of connection to sewerage networks.
- Underinvestment in collection, treatment, and effluent and sludge disposal.
- Neglect of the potential for wastewater reuse.
- Low tariffs that do not come close to covering costs.

One key area of investigation is why the regulatory and incentive structures are so ineffectual. This would determine which actions would have the most impact on the devastating pollution of Vietnam's environment.

**There is a need to better incentivize investment in wastewater services, but it is not clear that the benefits can be monetized.** In Vietnam at present wastewater services are treated as a public good. They are provided and paid for largely by municipal bodies, either by the water utility or by a separate wastewater company or a municipal department. Since 2013, 18 dedicated wastewater service companies have been set up. The challenge is that there are few investors willing to risk capital in a market that offers limited returns.

**The scope for commercializing industrial wastewater collection, treatment, and reuse needs to be assessed.** This assessment could identify possible business models, regulatory reforms needed to underpin such models, and ways to bring in private investors, either alone or in public–private partnership (PPP) arrangements.

**Reusing treated wastewater could provide some income.** Government policy aims to reuse 20–30 percent of treated wastewater from domestic properties (Decision 1930/QD-TTg, November 20, 2009; Prime Minister in the Decision No. 2502/QD-TTg dated December 22, 2016). The Government also issued Decree 54/2015/ND-CP to provide incentives for water conservation improvements. According to this decree, activities related to reuse of treated wastewater, which has been treated to meet national technical regulations for the purpose of reuse, can benefit from concessional loans and reduced or exempted business income taxes. However, as specific guidance documents have not been issued yet by relevant line ministries, there has been no update yet on these incentives (see section 6.5.3). The 2030 Water Resources Group report identified wastewater treatment and reuse as a priority for investment (2030 WRG 2017), and this could be attractive if the benefits— for example,

of reusing treated wastewater—could be monetized. The report argues that reusing treated municipal wastewater has the potential to reduce Ho Chi Minh City's water stress to "low stress" status by 2030. This has certainly a value, but it is yet unclear how this can be monetized and the regulatory framework needs to be amended. Similarly, treating wastewater from industrial clusters along the Nhue-Day River close to Hanoi can considerably improve surface water quality, but again the benefits would have to be paid for (2030 WRG 2017). The 2030 WRG (2017) report argues that reuse in industry could make treatment a commercial proposition (see box 4.3) and suggests three avenues: leveraging wastewater investments from public and private organizations under PPP arrangements; working with infrastructure development companies on commercializing treatment plants and industrial water reuse systems; and requiring (in certain circumstances) industry to use treated wastewater for their processes. One possible win–win solution, particularly in water-stress hot spots, could be to invest in wastewater treatment *and* reuse (2030 WRG 2017).

**BOX 4.3: Wastewater treatment and reuse are priority areas for investment**

- **Reusing treated municipal wastewater** has the potential to reduce water stress in Ho Chi Minch City to "low" by 2030. The potential for reuse as nonpotable water is up to 3.7 million cubic meters daily. The additional cost of upgrading the planned wastewater treatment works to meet suitable nonpotable water standards is estimated at US$0.25 per cubic meter. This could be an area for private investment under public–private partnership arrangements.
- **Treating wastewater from industrial clusters** along the Nhue-Day River close to Hanoi could considerably improve surface water quality. This would involve the treatment of 22 million cubic meters of industrial wastewater annually; the associated cost of the treatment plants has been estimated at US$97 million in 2010. Infrastructure development companies may be interested in commercializing treatment plants and investing in industrial water reuse systems.

*Sources:* 2030 WRG 2017.

**Considering the direct impact on water quality and ecosystem health, it is crucial to consider solid waste management as part of sustainable water resources management.** For example, leakage points in the collection system, such as illegal dumping or unsanitary dump sites near waterways, need to be closed; waste collection rates need to be increased; technologies to treat waste, such as waste-to-fuel and waste-to-energy, need to be introduced; and low-value plastic waste needs to be converted into refuse-derived fuel.

**Recognizing the importance of this challenge the Government has started to take action.** The Prime Minister has approved three Drainage and Wastewater Treatment Plans for three key polluted rivers systems, namely (1) Dong Nai River Basin; (2) Nhue-Day River and (3) Cau River. According to these plans, the following improvements are required:

- Dong Nai River Basin: 51 projects, increasing total wastewater treatment capacity to 2,500,000 $m^3$/day by 2020 and to 4,000,000 $m^3$/day by 2030 (at a cost of 168,000 billion VND).
- Nhue-Day River: 23 projects, increasing total wastewater treatment capacity to 900,000 $m^3$/day by 2020 and to 1,100,000 $m^3$/day by 2030 (at a cost of 190,000 billion VND).
- Cau River: 28 projects, increasing total wastewater treatment capacity to 500,000 $m^3$/day by 2020 and to 970,000 $m^3$/day by 2030 (at a cost of 60,000 billion VND).

Further, the Ministry of Construction has submitted "*The National Program on Investment in Wastewater Treatment for the Immediate Future for Big Cities and River Basins following a reasonable schedule*" to the Prime Minister for approval in 2018 (No. 51/TTr-BXD dated 5 November 2018).

### 4.3.2 Enforcing regulations and improving education and incentives

**To counter agricultural pollution, the regulatory framework has to be enforced, and education and revised incentives brought in.** The government is well aware of the issues of agricultural pollution and, through the Ministry of Agriculture and Rural Development's Agricultural Restructuring Plan of 2014, has embraced the need to reduce the sector's environmental impacts. A recent World Bank report on agricultural pollution recommended that farmers be offered better technical options and that the incentive structure—positive and negative—be revised to encourage non-polluting behaviors (World Bank 2017m). Government programs promote good practice, but monitoring and enforcement are needed, supported by interagency cooperation. Good agricultural practices that have

already been developed need to be scaled up. With the right packages and their dissemination, correction in fertilizer and pesticide use could produce win–win results—greater efficiency, reduced pollution, and higher incomes. International experience, for example, in China (see box 4.4), shows the value of these approaches.

**BOX 4.4: China acts to reduce agricultural pollution**

In China's major river basins, nonpoint source pollution is estimated to account for over 70 percent of total pollutant loads, with 50 percent of the total arising from agricultural pollution alone, especially pesticides and fertilizers. During 1991–2008, use of synthetic nitrogen fertilizers increased by over 50 percent and pesticide use by 120 percent. Much of this rapid growth was due to a combination of subsidies and policies encouraging farmers to boost yields, which had the unwanted effect of dramatically increasing organic pollution.

The Chinese government has addressed these issues in recent regulatory reforms. In 2015, the Ministry of Agriculture announced that it would encourage farmers to use fertilizers more precisely, which typically require smaller applications, and set a target to effectively cap national fertilizer and pesticide use by 2020.

The Water Pollution Prevention and Control Action Plan—a landmark State Council directive formulated with input from 12 ministries—singled out pesticide production and nitrogen fertilizers for more stringent enforcement and technological improvements to reduce pollutant emissions. The plan also included other steps related to agricultural pollution, including the relocation of livestock industries outside urban source water regions.

*Sources:* Xu 2015; Guowuyuan 2015.

### 4.3.3 Learning from other countries

**Vietnam may be able to learn from innovative approaches to water pollution control in countries that face the same pollution challenges.** These approaches cover monitoring and accountability, financing and incentives, and financial mechanisms to support natural capital investments and reduce nonpoint source pollution.

*Innovative approaches to monitoring and accountability*

**Developing a water health index.** A target such as a water health index measuring the quality of water in specific water bodies would allow easy monitoring of levels and changes in water quality. It could also incorporate the wider range of ecological water requirements and could be used to monitor whether water quality and other environmental water requirements are being met.

**Strengthening local accountability for pollution control.** At present, PPCs and lower-level councils are responsible for regulating pollution and administering sanctions, but the responsibility is spread among several agencies, including the Department of Agriculture and Rural Development and the Department of Natural Resources and Environment. One possibility would be to strengthen local accountability by designating one office as responsible for regulation and for ensuring specific outcomes against targets. Box 4.5 describes how local "river chiefs" are accountable in China in this way.

**BOX 4.5: China's experiment with making local river chiefs accountable for pollution control**

In December 2016, the government created a new system of river chiefs (*hezhang*) for the country's waterways. A revision of the 2008 Water Pollution Prevention and Control Law, scheduled to take effect in 2018, codifies the responsibility of river chiefs to supervise water quality, enforce pollution regulations, and oversee ecological restoration efforts.

This system names a single person—typically a senior official at the local, county, or provincial level—to be responsible for each stretch or section of every major lake and waterway. These officials are responsible for meeting environmental protection and water-quality targets in their jurisdictions. River chiefs at the provincial level are also responsible for dealing with interjurisdictional issues.

The river and lake chief system effectively makes the leaders of each province, city, county, and township responsible for core water management functions, supported by a dedicated office at the county level and above.

The creation of these positions reflects the fact that these policy priorities have often been hindered by interjurisdictional and intergovernmental coordination problems. The river and lake chiefs are expected to ensure that officials of various departments under their control work together to achieve key water policy objectives.

*Source:* China Water Risk 2017; Xu 2017.

**Allowing civil society to litigate.** At present, all the burden of regulation and enforcement falls on the Vietnamese government. The experience of the United States and of China (see box 4.6) indicates that giving civil society and even individual citizens standing to sue can be important for promoting environmental enforcement. As in the US model, specific provisions allowing for such civil society suits could be included in legislation to encourage appropriate entities to enforce water pollution regulations. However, this approach can only be a complement to regulatory approaches.[2]

### BOX 4.6: Examples of civil suits for water pollution in China

In China, civil society action has helped enforce water pollution regulations. In 2014, for example, the courts in Taizhou—one of the first cities to establish a dedicated environmental court—ordered six local enterprises to pay some US$26 million in damages because of their illegal discharge of acid into the city's waterways. This award, one of the largest ever issued against a Chinese company, was widely viewed as a landmark for citizen lawsuits to prevent water pollution, as the case was brought by a nongovernmental organization formed explicitly to bring it to trial.

The same year, PetroChina—a large state enterprise—was ordered by a court to pay the inland city of Lanzhou about CNY 100 million in damages as a result of a benzene spill, which interrupted water supplies to the city's residents.

*Source:* Stern 2014; Wilson 2015; Zhang 2014, 2017.

*Innovative approaches to finance and incentives*

**Piloting markets in trading pollution discharge permits.** International experience in trading permits is promising in many cases, although transaction costs are high. In the United States, localized water quality trading programs have achieved reductions in pollutant loads at lower cost than command-and-control approaches. In Long Island Sound, for example, a water-quality trading program achieved a 65 percent reduction in nitrogen loading from 79 sewage treatment plants, saving US$300 million (see table 4.2). Trading pollution-discharge permits has been practiced in China since the mid-2000s (see box 4.7) and is now regulated. However, transaction costs for many water quality trading programs remain high, and administrative and regulatory capacity is needed to ensure functioning markets. Considerable investments would be needed in capacity if Vietnam were to set up a water quality trading platform. Ideally, this would start with multiple pilot programs that can offer lessons for full-scale trading platforms, as needed.

**TABLE 4.2: Examples of water-quality market initiatives, outcomes, and status**

| Example | Outcome | Issues |
|---|---|---|
| Long Island Sound, United States | Achieved 65 percent reduction in nitrogen loading from 79 sewer treatment plants between 2002 and 2014. Saved US$300 million. | Transaction costs are high. |
| Lake Taupo, New Zealand | Achieved 16 percent nitrogen reduction goal from farmers as of 2012 from 32 trades. Farmers became increasingly supportive of management interventions. | Transaction costs are high. |
| Hunter River, Australia | Reduced salinity pollution from farms well below target of 900 microseimens per centimeter. | Occasional overshooting of salinity targets have occurred; however, these are largely attributed to natural or diffuse sources. |
| South Nation, Canada | Phosphorus reduction targets are being achieved. While water quality trends show a reduction of instream phosphorus, it is not possible to attribute this solely to the Total Phosphorus Management program. | Ongoing monitoring and assessment is needed to verify phosphorus reductions. |

### BOX 4.7: Trading pollution-discharge permits in China

China has experimented with water-quality trading, which promises to achieve pollution control limits at lower compliance costs in much the same way as water rights trading attempts to achieve water consumption limits, namely by establishing a cap and allocating rights under it.

For several decades, a major element of China's water quality control regime has been the issuance of pollution-discharge permits. According to implementation guidance issued by the State Council in 2000, China's Water Pollution Prevention and Control Law requires all entities discharging certain categories of pollutants into waterways, including total phosphorous and organic nitrogen, to obtain a permit from local environmental protection authorities.

*(Box continues next page)*

**BOX 4.7: (Continued)**

Because total pollutant loads are capped in any given jurisdiction and waterway, a market for buying and selling pollutant permits has existed for some time. Trading pollutant permits has been allowed in China since the late 1980s, and a pilot program was initiated in the Tai Lake Basin in the mid-2000s. Growing enthusiasm for market-oriented policy tools has led to the promulgation of new regulations intended to provide a stronger basis for compensated transfers of pollutants.

Most notably, in 2014, the State Council issued its Guiding Opinions on Further Piloting the Paid Use of Trading Emission Permits, followed in 2016 by the Implementation Scheme for Pollutant Emission Permit Control, which explicitly allows the creation of markets in tradable pollutant emissions permits.

As of 2013, total covered allowances in water quality markets were 175,600 tons of chemical oxygen demand (of which 15,000 tons were via trades), 10,000 tons of total phosphorous (of which 1 ton was via trade), and 160,000 tons in ammonia nitrogen (of which 200 tons were via trades). Relative to the scale of such pollution nationwide, however, these trading volumes are small.

*Source:* DRCSC 2017a.

**Controlling nonpoint source pollution through water quality trading.** In several countries, including New Zealand and the United States (see box 4.8), water quality trading has demonstrated some success in reducing nonpoint source pollution while lowering compliance costs. The logic of using water quality trading is that it establishes a cap on pollutants from both point and nonpoint sources within a given region. Because it is often easier to reduce point source pollutants, compliance with an overall pollution cap can be achieved more cheaply and efficiently by allowing point source polluters to buy and sell water quality credits from nonpoint source polluters, who may be able to reduce pollution more cheaply, for example, by changing farming practices. Alternatively, nonpoint source polluters can take measures, such as stream bank restoration, that reduce runoff from fields or into waterways, thereby creating water quality credits that can likewise be bought or sold.

**BOX 4.8: Nonpoint source pollution control through water quality trading in New Zealand**

New Zealand's Lake Taupo water quality trading program, launched in 2011, set up the Lake Taupo Preservation Trust as the party responsible for reducing nitrogen emissions below a cap. This could be done either by buying farmland and converting it to forest to reduce nitrogen runoff into the lake or by purchasing water quality credits directly from farmers. Since 2009 when the Trust operated to June 2014, 37 trades had occurred involving some 147 tons of NDAs (Nitrogen Discharge Allowances) purchased. The total land area converted from pastoral land into forestry (less Nitrogen used) increased rapidly to 7,000 ha in 2013.

*Source:* DRCSC 2017a; Sandra Barns and Justine Young, 2012.

**Designating water pollution control as a priority for PPP investment.** Domestic wastewater collection and treatment is still mainly funded through the GoV budget and ODA loans. Private investment in this subsector is limited to date. One example of PPP is under the World Bank-financed *Da Nang Sustainable City Development Project*. However, China, for example, has sought extensive private investment in pollution control (see box 4.9).

**BOX 4.9: Water pollution control is a priority for public–private partnership investment in China**

In September 2016, the National Development and Reform Commission issued a list of 17 water quality enhancement projects worth CNY 20 billion. The emphasis on pollution control has been strengthened by a July 2017 joint directive from the ministries of housing and urban–rural development, environmental protection, and agriculture designating water pollution control as a priority area for public–private partnerships and proposing measures to accelerate private investment.

*Source:* China Public Private Partnerships Center 2017.

**Targeting incentives at specific pollution reduction outcomes.** Water pollution targets need not be the same everywhere but should be set on a zone basis. Targets should specify total pollutant loads for different waterways or water bodies, depending on whether they are zoned for source water protection, environmental protection, industrial use, or other water uses. Targets should be matched by investment in sewage and effluent treatment, strict control of pollution-discharge permits, and the imposition of differentiated fees depending on pollutant type. In principle, wastewater-discharge permits and treatment fees should be set at the level needed to support capital costs and O&M costs of wastewater collection and reuse. Preferential pricing could be introduced for users accepting treated wastewater.[3]

*Innovative financial mechanisms to support natural capital investments and reduce nonpoint source pollution*

**Nonpoint source pollution remains a major problem in many countries.** In the United States, for example, some estimates suggest that it accounts for 68–83 percent of total pollutant loads. Yet nonpoint source pollution is notoriously hard to control by regulatory mechanisms alone. Some countries have experience with innovative financing mechanisms to reduce nonpoint source pollution, particularly market-oriented approaches facilitating payments between ecosystem service providers and beneficiaries, which can work especially well when the links are clear. Market approaches include water quality trading, which can achieve higher quality standards and reduce the cost of compliance (discussed above), as well as payment for ecosystem services approaches; water funds to help finance natural capital alternatives to conventional water treatment technologies; environmental quality contracts, which help enterprises and local governments meet water quality targets; and revolving funds.

**Payment for ecosystem services.** Payment for ecosystem services can align incentives in natural resource management. The approach has already been tried in Vietnam (see box 4.10), and it could be applied to other cases in the water sector where there are externalities.

### BOX 4.10: Payment for ecosystem services in Vietnam

Payment for ecosystem services occurs when a beneficiary or user of an ecosystem service makes a direct or indirect payment to the provider of that service. A typical application in the water sector is when a downstream user of water pays upstream communities to manage the watershed and control pollution, to reduce siltation and maintain water quality.

Vietnam was the first country in Southeast Asia to introduce a national payment for ecosystem services law (2008), targeting forest protection. Water utilities, hydropower operators, and the tourism industry pay farmers and households for conserving and managing forests upstream.

Overall, results have been mixed (UNEP 2015). While successful in providing a source of revenue for the state for forest protection, challenges include high transaction costs, distribution of funds, and legal status of communities involved in the scheme (To and others 2012; Suhardiman and others 2013; de Silva 2014).

*Source:* UNEP 2018; 2030 WRG 2017.

**Water funds.** A water fund provides a vehicle to finance investments in environmentally sensitive areas so as to change farming practices in water source regions, or to promote reforestation or other measures that naturally abate nonpoint source pollution. Water funds can be structured around a variety of payment mechanisms, including fees or contributions paid by downstream water users who benefit from improved water quality. By putting the financial burden on beneficiaries of the desired ecosystem services, water funds can create a win–win situation for all investors. These schemes need to be supported by strong evidence-based research on how changes in land use and other interventions directly contribute to improving water quality and other ecosystem services. Box 4.11 illustrates an example from the United States, and box 4.12 describes four recent examples from China.

**Environmental quality contracts.** Under this model, major polluting enterprises or local governments enter into contracts with third-party environmental management companies that ensure compliance with water quality standards. Experience so far has been largely with point source pollution, but the model could be expanded to nonpoint sources. The approach has been used in China and was officially endorsed in a 2015 State Council directive encouraging "third-party environmental governance." Management contracts to ensure river basin environmental quality are

offered by several Chinese firms, with options to help enterprises comply with standards, including natural capital investments, land management, and agricultural pesticide and nutrient control. These contract mechanisms improve compliance with water quality standards while reducing the regulatory burdens for enterprises. The model needs to be paired with strong oversight and monitoring (Xia 2016).

### BOX 4.11: An example of a water fund in the United States

Effluent from wastewater treatment plants in the Chesapeake Bay catchment in Maryland is one of the top contributors of nutrient loads in the bay. To support improvements to water quality, the Bay Restoration Fund was established in 2004. The fund finances upgrades to wastewater treatment plants so that they can improve the quality of wastewater effluent. This program also supports upgrading of onsite septic systems and the planting of cover crops to further reduce nitrogen loading into the bay.

The fund is financed through fees collected from each domestic, commercial, and industrial user of the wastewater treatment plants and septic systems in the watershed. These funds are also used to back the issuance of bonds to generate financial resources to invest in these upgrades.

*Source:* Maryland Department of the Environment.

### BOX 4.12: Use of water fund approaches to improve water quality in China

**Water Fund for Longwu Reservoir.** Longwu Reservoir (Hangzhou, Zhejiang Province) is used primarily to supply domestic water to the villages of Qingshan and Cibi. The bamboo industry covers some 60 percent of the total catchment. Fertilizers and herbicides used in bamboo production are major contributors to nutrient pollution in the reservoir. In 2015, with the support of the Nature Conservancy, a water fund was established allowing local government, farmers, nongovernmental organizations, and a trust company to collaborate on environmental management of pollution around the reservoir.

**Beijing's Paddy Land–to–Dry Land program.** Miyun Reservoir is the main surface water source for Beijing. Over the years, nonpoint source pollution from agriculture in the catchment has degraded water quality. The program aims to reduce agricultural nutrient and chemical runoff and siltation by offering a subsidy to farmers to switch from water-intensive rice cultivation to corn. These subsidies are funded by Beijing urban residents.

**Payment for environmental services Laishihai Nature Reserve and Lijiang Old City.** This pilot program charges fees to tourists for visiting Lijiang Old City and the Laishihai Nature Reserve to be used to compensate upper watershed farmers adjacent to Laishi Lake for changing their land use practices. The Laishi Lake is a key part of the Lijiang Basin from which various rivers flow through and around Lijiang Old City.

**Beijing watershed management.** Under a five-year agreement between Beijing and the city of Chengde, Hebei Province, signed in 2005, the two cities agreed that Beijing would pay Chengde CNY 20 million per year to abate soil erosion in upstream watersheds. The agreement was extended in 2011.

*Sources:* Bennett 2009; World Bank 2017p.

**Revolving funds.** Financing of water quality improvements can also be directly addressed through a dedicated revolving fund. The US Environmental Protection Agency Clean Water State Revolving Fund offers a model that Vietnam could experiment with (see box 4.13).

### BOX 4.13: US Environmental Protection Agency Clean Water State Revolving Fund (CWSRF)

This federal fund was established in 1987 to provide financial assistance to a wide range of water infrastructure projects. Loans are provided to eligible recipients to construct municipal wastewater facilities, control nonpoint sources of pollution, build decentralized wastewater treatment systems, create green infrastructure projects, protect estuaries, and fund water quality projects. The Environmental Protection Agency provides grants to all 50 states to capitalize a state fund, with states contributing an additional 20 percent to match the federal grants.

The program functions like an infrastructure bank by providing low-interest loans. As money is paid back into the state's revolving loan fund, the state makes new loans to other recipients for high-priority water quality activities.

Under the federal fund, states may also purchase or refinance debt, provide guarantees and insurance, and provide additional subsidies. For example, a Green Project Reserve targets critical green infrastructure, water and energy efficiency improvements, and other environmentally innovative activities.

*(Box continues next page)*

**BOX 4.13: (Continued)**

Since 1988, US$ 126 billion have been cumulatively used for more than 38,441 assistance agreements, which cover a wide range of water quality infrastructure projects. In 2017, the CWSRF has provided over US$ 7.4 billion in funding. The weighted average interest rate for CWSRF loans is below the market interest rate and dropped to 1.4% in 2017 – a historic low.

*Source:* US EPA 2018.

## Notes

1. As established in Decree 154/2016/ND-CP comprise of a fixed amount of Dong 1.5 million and a floating amount. The floating amount applies when discharge is above 20 cubic meter/day. It is estimated based on concentration levels for six major pollutants.
2. There are free rider problems that deter litigants from bringing lawsuits. A loss may imply heavy financial penalties. Judges have been found to be uninformed about environmental issues, which is why some countries have set up environmental courts.
3. Some cities in China have introduced preferential pricing for reclaimed water to encourage its use. As of 2010, 37 cities and counties in 18 provinces had introduced a preferential price for reclaimed water (Moore 2015).

5

# Improving Management of Rising Risks

*Risks are high and rising from climate change and natural disasters and from vulnerable infrastructure*

- Risks from climate change and natural disasters are high and costly, revealing an infrastructure deficit and low resilience.
- Risks from vulnerable water infrastructure (dams, irrigation structures as well as dykes for river and sea, railroad, road etc.) are also high. The seasonal discharge patterns of Vietnam's transboundary rivers have both upsides and downsides.

*Institutional responses to rising water-related risks are struggling*

- If nothing is done, socioeconomic losses due to water-related natural disasters—currently 1.5 percent of GDP—are predicted to rise to 3 percent by 2050 and to 7 percent by 2100, which would be among the highest in the world.
- However, institutional problems, including gaps, overlaps, weak capacity, and low resources, hamper risk management.

*Vietnam needs to continue investing in risk reduction, preparedness, and long-term resilience*

- A phased approach that includes structural and nonstructural measures across key sectors is the way to address urgent needs for managing risks and longer-term needs for building resilience.
- Improved financial planning will also be critical to establishing a robust system for disaster preparedness and response.

*Water-related risks need to be tackled in a basin-wide planning framework*

- Managing risk is a key function of water resources management and is best coordinated with other natural disaster risk management functions at the basin level, including for transboundary water.
- Integrating the management of dams, reservoirs, and flows at the basin level could reduce risks and increase value from water; basin planning could also contribute to long-term solutions for dam safety.

## 5.1 Risks from climate change, natural disasters, and water infrastructure are high and rising

### 5.1.1 Risks from climate change and natural disasters are high and costly

**Disaster risk management and climate resilience are core development issues for Vietnam.** Vietnam is one of the most hazard-prone countries in the East Asia and Pacific region (see chapter 1). The country is regularly subjected to typhoons, floods, drought, and landslides, and its 3,260 kilometer (km) coastline is eroding. A recent climate risk index placed Vietnam in the top 10 countries most affected by extreme weather events over the past 20 years (Kreft, Eckstein, and Melchior, 2016). More than 70 percent of the

population and their livelihoods are exposed to risk from natural hazards. With climate change, the frequency and intensity of such events are expected to increase further. Climate change adaptation is crucial to prevent the impact from potentially more frequent and more severe natural disasters. A World Bank study of 84 coastal countries ranked Vietnam in the top tier of countries most at risk of sea-level rise for impacts on population, GDP, urban extent, and wetland area (World Bank, 2007).

**Extreme weather events and disasters have high socioeconomic impacts,** which translate into substantial costs to the country, estimated at 1.5 per-cent of GDP a year, excluding costs due to business interruptions (World Bank, 2013c). The recent post-disaster rapid assessment in Khanh Hoa Province estimated that the impact of Typhoon Damrey would reduce GDP growth in 2018 by 0.9 percent. A 2017 risk assessment carried out by the government with World Bank technical support estimated that US$1.3 trillion in assets are at risk, yet only about 5 percent of assets in the country are insured (World Bank 2017h). Based on a computable general equilibrium model, it was found that the likely increased incidence of damaging floods in the Red River basin alone could lower GDP by 0.34 percent from the baseline (see box 5.1; World Bank 2018g).

**Recent events have revealed an infrastructure deficit and little resilience.** These levels of damage and cost indicate a critical infrastructure challenge from the increased variability in the water cycle that most of the country's infrastructure is not equipped to handle. Inadequate and deteriorating infrastructure has increased risks from both floods and droughts, reducing capacity to deal with variability in rainfall and river flows. Floods, typhoons, and droughts have hurt people's livelihoods and assets, making it difficult for affected households to bounce back and recover, particularly poorer households, which are the least resilient (World Bank 2017h).

## BOX 5.1: Impact on GDP of increased flooding of the Red River

Flood events are expected to increase in the Red River Basin due to climate change. To understand the additional impact from intense future floods (once in 100-year floods) compared with the present impact, two scenarios were developed:

1. Baseline flood: identical to the historic flood of 1971 but with the current flood protection in place, which was designed to withstand the 1971 flood.
2. Climate change–induced flood: future flood event derived from the Representative Concentration Path run from the Geographical Fluid Dynamics Laboratory Global Climate Model Version 3 (GFDL-CM3) that was downscaled to a daily flow time series using the same 1971 flood, making both scenarios comparable.

The biophysical effects were analyzed with a Hydrologic Engineering Center–River Analysis System (HEC-RAS) flood model (from the US Army Corps of Engineers). River runoff from the Climate to Runoff (CLIRUN) rainfall-runoff model is used as input to the HEC-RAS model. The maximum inundated area under each climate scenario (baseline and climate change–induced) is overlaid on land use layers to determine inundated area (and depth), distinguishing between industrial, commercial, and residential areas and roads. Depth damage functions are applied to each inundated cell depending on the land use type (see table 1). These are then translated to changes in infrastructure depreciation rates, which are used in the economic modeling.

**TABLE 1: Total area of flood damages, by land use, for baseline and climate change–induced floods (%)**

| Land use | Baseline flood | | Climate change–induced flood | |
|---|---|---|---|---|
| | National | Red River only | National | Red River only |
| Agriculture | 1.3 | 10.5 | 1.8 | 14.5 |
| Hotels | 0.4 | 2.6 | 1.5 | 10.6 |
| Residential | 0.1 | 2.3 | 1.2 | 24.2 |
| Industry | 0.1 | 1.5 | 0.3 | 3.4 |
| Commerce | 0.1 | 0.4 | 0.8 | 4.6 |
| Education | 0.0 | 0.0 | 1.6 | 11.8 |

The modeling attempts to capture both the direct effects on the flooded areas and indirect effects on the rest of the economy. The direct effects include disruption and destruction of public infrastructure and private industrial capital, reduced production, and destruction of residential housing. Indirect consequences arise because activities in affected and unaffected areas are connected through their supply chains. Industries in non-flooded areas might lose production if they cannot source inputs from flooded areas, and they can lose demand if they have

*(Box continues next page)*

**BOX 5.1: (Continued)**

industrial and final customers in the flooded areas. Activities in unaffected areas can also be affected directly if, for example, their transport routes have been destroyed in the flooding.

The short-term costs depend on the extent and duration of flooding. However, the costs of recovery after the flooding might have longer-term repercussions. Investment in the affected infrastructure and capital will need to be higher than normal, and if the resources for such investment are constrained, reconstruction can divert investment from other sectors, affecting their growth and that of the economy.

The impacts on GDP from climate change–induced flooding by 2035 by sector are shown in table 2. Overall, the increased flooding reduces GDP by 0.34 percent compared with baseline flooding.

**TABLE 2: Impacts on GDP from climate change–induced flooding, 2035 (%)**

| Scenario | Full scenario | Capital loss | Land loss | Transport productivity | Housing reconstruction | Construction boom |
|---|---|---|---|---|---|---|
| Agriculture | −0.64 | −0.18 | −0.25 | −0.04 | −0.28 | 0.05 |
| Industry | −0.23 | −0.08 | −0.02 | −0.03 | −0.17 | 0.03 |
| Services | −0.37 | −0.13 | −0.06 | −0.05 | −0.23 | 0.04 |
| **GDP** | **−0.34** | **−0.12** | **−0.07** | **−0.04** | **−0.21** | **0.04** |

*Source:* World Bank 2018g.

### 5.1.2 Risks from vulnerable water infrastructure are high

**Until recent years, Vietnam's investment in water infrastructure—dams, irrigation structures and inland waterway transport—was effective for ensuring water security and meeting historical demands.** Today, however, infrastructure is subject to growing stresses. Many of the small and medium-size reservoirs built in the 1960s–1980s were constructed with little prior technical investigation, inadequate design, and poor quality, problems that have been compounded by neglect of operations and maintenance (O&M). Many dams have degraded, with structural and nonstructural safety often falling below acceptable international standards. These dams now pose a substantial risk to human safety and economic security. The dams' deterioration is exacerbating uncoordinated operational procedures. Coupled with increased risks and uncertainties arising from hydro-logical variability due to climate change and rapid upstream development, this deterioration has placed many reservoirs at risk (World Bank 2015a).

**Multiple costly dam failures have exposed high risks of dam safety.** Dam failures have caused considerable loss of life and have incurred high economic costs (see section 1.2.2 in chapter 1). Although a sound legal and regulatory framework is in place, budget and capacity problems mean that dam safety and O&M are often neglected. The technical risks are largely in small hydropower facilities and in the 1,500 small and medium-size irrigation dams that are in urgent need of rehabilitation or upgrading (see section 2.2.1 in chapter 2). The large hydropower dams are reported as comparatively safe (Tu, 2015).

**Public awareness of the risks and costs is high.** The loud public outcry over recurrent flooding and dam failure has been echoed by the media and has led to civil society campaigns, which have raised awareness of this problem in all spheres of government (World Bank 2015a).

**Dam operations have not been coordinated at the basin level, posing a risk of loss of value and heightened flood risk.** The impacts associated with natural flooding have been exacerbated by dam operations. Where there are cascades of dams in individual river basins, cooperation in their operation has remained a big challenge. There is limited capacity for timely monitoring and forecasting of high flows, particularly in the narrow and steep topography of the Central Highlands. To address this issue, MONRE has advised the government to issue 11 inter-reservoir operation procedures in the basin rivers of Hong, Ma, Ca, Huong, Ba, Tra Khu, Kon-Ha Thanh, Srepok, Sesan, Vu Gia- Thu Bon and Dong Nai (see Annex B). These regulations are regularly reviewed and revised to suit

practical conditions. However, as inter-reservoir operation involves numerous agencies and localities, close cooperation is a key to effective enforcement of these regulations.

**The development of civil works, infrastructure and transportation facilities does not always comply with the requirements on natural disaster prevention and control** (as specified in Article 19 of the Law on Natural Disaster Control and Prevention). This increases the risks caused by floods. The construction of houses and other constructions along the river bank and coast has increased in both quantity and scale. This leads to the destabilizing of the river bank and coast which causes landslides, especially in the Mekong river delta. Further, facilities for road and waterway transportation, as well as tourism infrastructure and resorts, and river dykes have been constructed along the river banks and coasts, but these often do not comply with the Master Plan. All this has an impact on the river and coastal flows, increasing the risk of river bank and coastal landslides.

**Inland waterway transport (IWT) accounts for shipping approximately 48% of the domestic transport tonnage in Vietnam, yet insufficient investments are posing challenges to future transport.** Vietnam's high economic growth over the past twenty years is closely linked to transport demand. As Vietnam targets further ambitious economic growth rates, it faces challenges in increasing the efficiency and reliability of multi-modal transportation, storage, handling and value-added services to remain competitive. Further, in Vietnam's effort to reduce carbon emission, rail and barge transport produce less. carbon dioxide (CO2) emissions per ton-kilometer (ton-km) than road transport. On average barge transport is 3.5-4 times more fuel efficient than truck transport. Yet IWT faces significant underinvestment in terms of both capital and maintenance expenditures to expand, improve and preserve Vietnam's waterborne transport networks. The Vietnam Inland Waterways Administration, Ministry of Transport, estimated that approximately US$2,000 per kilometer of fairway would be required to allow for proper maintenance especially for dredging and river bank protection (World Bank, 2013). However, only approximately US$ 1,000 per kilometer is allocated from the central budget, which is only 50% of the operation and maintenance requirement. In addition, there is a lack of up-to-date navigational charts, which define siltation levels. Legal and illegal sand mining pose additional challenges to maintaining siltation levels and river beds (MOT, 2019). Reliable logistic networks and competitive transport options are required to allow for further market development. The uncertainty of siltation levels of waterways also limits investments in larger vessels by companies, thus forgoing the opportunity to increase the economical ship size and so make IWT more cost-efficient. Currently, the road sector is the main recipient of public spending allocated to transport – 80% of budgets are devoted to expanding and maintaining the road network. (World Bank, 2013b).

## 5.2 Institutional responses to rising water-related risks are constrained

### 5.2.1 Institutional problems hamper risk management

**Fragmented sectoral approaches and institutional arrangements—gaps, overlaps, weak capacity, and low resources—are curtailing Vietnam's ability to manage risks.** Despite considerable investment in disaster risk management, there are gaps in the capacity of government and communities to manage risks and impacts. These gaps include institutional fragmentation and lack of coordination; underpowered agencies, with fragmented approaches; and weak integration of resilience needs in socioeconomic development planning (World Bank 2017h). For example, the management and licensing of sand mining in and close to a river involves various authorities, leading to overlapping and inconsistent functions. Further, a better understanding needs to be gained on the actual capacity and financial resources at province, district and commune level to prevent, alert and respond to natural disasters, such as floods and droughts.

**Despite large investments in better planning, the government still faces funding gaps after disasters.** The country's current financing capacity meets only about 21 percent of the estimated need just for emergency reconstruction and recovery. Vietnam could see losses of over 4 percent of GDP after a major disaster. In the next 50 years, Vietnam has a 40 percent chance of experiencing an event affecting more than 39 million people, with economic losses exceeding US$6.7 billion.

**Funding from the state budget is insufficient to manage areas prone to dangerous and very dangerous**

**river bank and coastal landslides and erosion.** The policy on supporting the resettlement of people affected by erosion can be further improved to reduce delays in project implementations. Some projects could not be implemented because of resettlement issues and had to be re-approved, which caused delays in construction and implementation, affecting overall investment efficiency.

**Currently, there is no national program on river bank protection and coastal erosion prevention.** Further, river training, coastal erosion prevention and natural disaster prevention need to be integrated into Sectoral Development Plans and the Socio-Economic Development Plan.

### 5.2.2 Socioeconomic losses will rise sharply if nothing is done

**Current economic losses of 1.5 percent a year are predicted to rise sharply.** Losses due to water-related natural disasters averaged 1–1.5 percent of GDP over the last two decades and are predicted to rise to 3 percent by 2050 and to as much as 7 percent by 2100—among the highest in the world.

**Agricultural losses due to a complex of climate-related and anthropogenic effects could be massive.** In predominantly agricultural areas, complex effects may combine to greatly reduce output, including a combination of sea-level rise and land subsidence driven by groundwater over abstraction (see box 5.2).

## BOX 5.2: Declining paddy yields and economic growth as a result of sea-level rise and land subsidence driven by groundwater over abstraction

Paddy production in Vietnam's key production areas—the Mekong and Red River Deltas—is expected to be hit by climate change-induced sea-level rise, and by land subsidence caused by groundwater over abstraction. Land subsidence in the Mekong Delta—assuming current rates of groundwater over-abstraction—is expected to be 0.24–0.9 meters by 2035 (World Bank, 2018g).

A computable general equilibrium model was used to understand the impacts of sea-level rise alone in the Red River and Mekong Deltas and of sea-level rise with land subsidence in the Mekong Delta (World Bank, 2018g). Projections for sea-level rise and inundation predictions are based on MoNRE's estimates (MoNRE 2016).

Three sea-level rise scenarios (low, median, and high) were analyzed. When only the impact of sea-level rise in the Red River and Mekong Deltas is considered, 0.5 percent of Vietnam's rice production is predicted to be lost in the low scenario, 0.8 percent in the median scenario, and 1.1 percent in the high scenario.

When the impact of land subsidence due to groundwater over abstraction in the Mekong Delta is also included, the lost rice production increases in all scenarios by a staggering 900 percent. Thus, the lost rice production in the Red River and Mekong Deltas is expected to amount to between 5.15 percent and 11.01 percent of Vietnam's rice production, depending on the scenario (see table 1).

**TABLE 1: Impacts of sea-level rise and land subsidence driven by groundwater over abstraction on rice production by 2035 compared with 2012 (tons per year)**

| Area | Sea-level rise only scenarios | | | Sea-level rise with subsidence scenarios | | |
|---|---|---|---|---|---|---|
| | Low (5th percentile) | Median | High (95th percentile) | Low (5th percentile) | Median | High (95th percentile) |
| Red River Delta | 63,837 | 102,138 | 140,440 | 63,837 | 102,138 | 140,440 |
| Mekong Delta | 151,950 | 243,119 | 334,289 | 2,181,561 | 2,813,440 | 4,660,238 |
| Total | 215,786 | 345,258 | 474,729 | 2,245,397 | 2,915,579 | 4,800,678 |
| Percent of Vietnam's total rice production | 0.49 | 0.79 | 1.09 | 5.15 | 6.69 | 11.01 |

*Source:* World Bank 2018g.

*Note:* The impact of land subsidence is analyzed for the Mekong Delta only because data are lacking for the Red River Delta. The values in the table show the deviation from the reference path, that is, without sea-level rise and land subsidence.

The sea-level rise scenario on its own does not have a major impact on GDP, with values ranging from –0.03 percent to –0.06 percent in 2035. However, the GDP impact is 10 times larger when sea-level rise and land subsidence are considered jointly. In this case, the reduction in GDP in 2035 ranges from –0.28 percent to –0.61 percent, depending on the sea-level rise scenario. Across all scenarios, all major sectors decline relative to the reference path without sea-level rise and land subsidence, with agriculture most affected and industry least (see table 2).

*(Box continues next page)*

**BOX 5.2: (Continued)**

These findings are of high policy relevance. Because sea-level rise is essentially outside Vietnam's control, this driver can be considered inevitable. However, the driver with far greater impacts than sea-level rise alone—land subsidence driven by groundwater overabstraction—can be reduced through changes in water governance and enforcement.

**TABLE 2: Impact on GDP of sea-level rise and sea-level rise in combination with land subsidence in 2035 (%)**

| Sector | Sea-level rise only scenarios | | | Sea-level rise with subsidence scenarios | | |
|---|---|---|---|---|---|---|
| | Low [5th percentile?] | Median | High [95th percentile?] | Low [5th percentile?] | Median | High [95th percentile?] |
| Agriculture | –0.12 | –0.19 | –0.26 | –1.28 | –1.67 | –2.83 |
| Industry | 0.00 | –0.01 | –0.01 | –0.05 | –0.06 | –0.11 |
| Services | –0.02 | –0.03 | –0.05 | –0.22 | –0.29 | –0.50 |
| Total | –0.03 | –0.04 | –0.06 | –0.28 | –0.36 | –0.61 |

*Source:* Adapted from World Bank 2018g.

*Note:* The impact of land subsidence is analyzed for the Mekong Delta only because data are lacking for the Red River Delta. The values in the table show the deviation from the reference path, that is, without additional sea-level rise and land subsidence from the baseline, 2012.

These are conservative estimates. For example, land subsidence due to over abstraction of groundwater may also be a challenge in the Red River Delta. But as no solid evidence on the rate of land subsidence was found, this was not included in the analysis. Further, only the impact on paddy yields was assessed; it is likely that other crops will also be negatively affected. However, in some areas, farmers might switch to aquaculture, which could have a positive effect on their household income.

### 5.2.3 Hydrological challenges are regional

**The highly seasonal discharge patterns of Vietnam's transboundary rivers create benefits and risks.** The regional hydrological challenges are best illustrated for the Mekong River. The Mekong and many of its tributaries have highly seasonal discharge patterns, creating rich wetlands and estuaries, supporting biodiversity and abundant capture fisheries, and enriching the soil for rice and other crop cultivation with silt. However, floods and droughts are also threats to livelihoods, particularly in poor rural communities. The Mekong Delta—Vietnam's rice bowl— is expected to receive less rainfall during the dry season and receive more rainfall in rainy seasons. Overall, total annual rainfall is set to increase 0.3% in 2020 and 0.7-0.8% in 2050 compared to the period 1980-1990 (MoNRE, 2010).

**The risks have been exacerbated by development.** Additional challenges are emerging, including upstream development, which will affect water and sediment flow patterns, and climate change, which is projected to increase the frequency of extreme weather events, change temperature patterns, and result in less predictable weather patterns. In the Mekong, for example, the impact of these changes in the 90 percent of the catchment that lies outside Vietnam will have major consequences on the downstream reaches within the country. Taken together, climate change and upstream development will affect the quantity and quality of water and sediment flowing to Vietnam, altering the flow regime, triggering salinity intrusion, and threatening current agriculture production and economic activities (World Bank 2013).[1]

## 5.3 Current institutions for managing risk need to be strengthened

### 5.3.1 An integrated response is needed for disaster risk management and climate change adaptation

**Much has already been done, but a more holistic approach is required that would institutionalize planning for resilience and address specific vulnerabilities and their causes.** A recent report found that, although Vietnam has invested considerably in disaster risk management and climate change adaptation, the country needs an integrated approach that not only addresses crises but also institutionalizes mechanisms to promote longer-term resilience and address the country's vulnerabilities to drought and floods and other hydrometeorological hazards (World Bank 2017h).

**An integrated approach has certain implications for water management in basin planning.** Disaster risk is a function of exposed assets and livelihoods and their vulnerability to hazard events. This risk can be managed instead of being treated as a shock over which the country has no control. The lesson is to be prepared. A comprehensive multidimensional approach is needed that integrates risk into policy making and investment planning and sets risk management within a basin context, combining structural measures with nonstructural measures like improved information and early warning. In fact, for most basins, new structural measures are only a small part of the response needed (World Bank 2017h).

**Long-term commitment to integrated water resources management and land-use planning within a basin framework is thus key to building climate resilience alongside economic growth.** The comprehensive planning process now beginning for the Mekong Delta is exemplary in this regard, as it incorporates risk management into planning in a basin context from the outset. This kind of planning, at both basin and local levels, should help "waterproof" settlements and their livelihoods, economies, and infrastructure and thereby reduce the socioeconomic impacts of extreme weather events, rainfall variability, and uncertainty (World Bank 2017h).

### 5.3.2 Integrating management of dams, reservoirs, and flows at basin level could reduce risks and increase value from water

**A river basin approach to managing dams and reservoirs can optimize value and ensure downstream protection.** The government has mandated a river basin approach to dam operations to optimize value and protect downstream areas from flooding by issuing inter-reservoir operation procedures. The 2012 Law on Water Resources (see box 6.1 in chapter 6) assigns responsibility to the Ministry of Natural Resources and the Environment for inter-reservoir operations in basins with cascades of dams, including responsibility for ensuring environmental flows. Dam safety is the responsibility of the operator.[2] The objective of the river basin approach is to achieve efficiency gains and safety improvements by enhancing inter-sectoral, inter-provincial, and inter-reservoir operations. The approach has been tested in the Ca, Thu Bon, and Vu Gia River Basins, and a multi-criteria framework has been developed to identify other basins where the approach could have substantial impacts. The approach has shown effectiveness and should be scaled up. (World Bank 2015a).

**Dam safety is a top priority, and dam operations need to be optimized at the basin scale.** Since 2003, the government has implemented a program for dam safety that includes structural and nonstructural measures. What is important is setting dam operation and safety in a basin context, resolving the technical problems, crafting effective regulation, improving data collection platforms and interinstitutional information management, and coordinating dam and reservoir operations at the basin scale (World Bank 2015a).

**Basin planning could also contribute to long-term solutions to dam safety.** Dam safety has become vulnerable because of inadequate regulation and the underfinancing of O&M, particularly for smaller irrigation dams and private hydropower dams. The government's program includes a multiyear investment program to improve dam safety, with a frame-work approach to identify risks and prioritize actions. However, long-term solutions lie in improving institutional mechanisms for regulation and putting in place measures to generate the needed revenues from users to finance optimal levels of O&M (World Bank 2015a). At present, MONRE is developing a national water resources master plan which includes dam safety.

### 5.3.3 Risk management is a key function of water resources management best coordinated at the basin scale, including for transboundary water management

**Multiple risks along a river need to be managed in an integrated way, with institutional mechanisms for coordination and implementation across sectors and agencies.** The government has attempted integrated management in a variety of ways but results have not met expectations (see chapter 6). MONRE is attempting to apply an integrated approach in the Sesan-Srepok River Basin that addresses internal as well as upstream and downstream transboundary risks (see box 5.3). In addition, MONRE is proposing to the Prime Minister to establish river basin commissions as well as operational protocols for the National Water Resource Council chaired by a Deputy Prime Minister.

### BOX 5.3: Attempting risk management across borders in the Sesan-Srepok River Basin

The upper Sesan-Srepok River Basin is shared by Cambodia and Vietnam and is one of the most critical tributary basins of the Mekong River for water flow, sediment, and biodiversity. The major water resource-related issues in this basin are:

- Drought and flood risk management.
- Conflicts among water users.
- Major and small hydropower development, cascade operations, and impact mitigation.
- Benefit sharing among developers and local people.
- Water pollution control.
- Coordination with Cambodia, the downstream riparian, on issues of integrated water resources management, such as release of water from hydropower stations, water quality, disaster risk management, and sedimentation.

The Mekong River Commission has identified the following as priority transboundary water resource management issues:

- Monitoring and assessment of flow.
- Flood forecasting, flood control, and flood warning mechanisms.
- Communication and coordination mechanisms on information and data sharing.
- Mitigation measures to address social and environmental impacts.
- Institutional and technical capacity to improve transboundary coordination and cooperation.

To address these issues, the Ministry of Natural Resources and the Environment aims to set up a river basin organization, establish a water resources monitoring system, and develop modeling and management tools.

*Source:* World Bank 2013; MRC 2017c.

## 5.4 Priority actions

### 5.4.1 The government should better integrate responses to climate change and disaster risk management and improve resilience

**Vietnam needs to continue investing in risk reduction, preparedness, and long-term resilience.** Global experience shows that disasters have long-term macroeconomic impacts and can affect development outcomes; provident preparation is the best approach (see box 5.4). Given the high risks that Vietnam is facing, it needs to continue investing in risk reduction, preparedness, and long-term resilience. If it does not, opportunities for social, economic, and environmental progress will be diminished for years to come (World Bank, 2018j).

### BOX 5.4: Global experience and response to disasters worldwide and in Vietnam

**Disasters have long-term macroeconomic impacts and shape development outcomes.** Each year, disasters cost the global economy US$520 billion and push some 26 million people into poverty. They severely affect a household's earning potential through impacts on human capital (health, education, and nutrition). Investments in risk reduction and disaster preparation can help save lives and minimize impacts. Investments in disaster risk mitigation can significantly reduce damage and economic losses. Improved early warning systems and swift access to funds are essential. Ensuring that the government has access to sufficient resources for rapid emergency response is a key step to reducing the human impact of disasters (World Bank, 2017i).

**In response to disaster risks worldwide, the World Bank is partnering with many countries on disaster risk management.** Learning from global experience, it developed an integrated approach to disaster risk management, including a strong policy framework, investments in risk reduction, and disaster risk financing. In five years, the World Bank tripled its financing for disaster risk management, committing about US$6 billion each year to support resilience (World Bank 2017). The World Bank also supports countries with a package of wide-ranging technical and financial support, combined with global project experience, to enhance the capacity of implementing agencies.

**In Vietnam, the World Bank has contributed to disaster risk management and resilience.** Since 2008, the World Bank has contributed US$1.7 billion for hydro-meteorological modernization, disaster early warning systems, key disaster prevention infrastructures, and dam rehabilitation. Additionally, it mobilized US$10.0 million in trust funds through the Global Facility for Disaster Reduction and Recovery to strengthen government policies and legal frameworks on disaster risk management and to promote knowledge exchange between Vietnam and other countries. The next priority area will be to integrate resilience planning into investments in urban development, transport, agriculture, and water resources management (World Bank, 2018j).

**A phased approach is needed for managing urgent risks and longer-term risks by building resilience to all types of risks.** Vietnam needs strategic planning and coordinated implementation of critical measures and recovery efforts to tackle the impacts of drought, floods, and other climate-related risks and to work toward greater climate resilience. One goal is to ensure that current and future development activities are sustainable and climate resilient. Planning must be backed by sound knowledge and scientific understanding in order to target and prioritize investments in technology development and adoption, infrastructure, and capacity building.

**The phased approach would include actions for the short, medium, and long terms.** A first step in the short term would be to evaluate and try to resolve the multisector coordination and implementation challenges by improving effectiveness and coordination horizontally across sectors as well as vertically at national, regional, and provincial levels. In the medium term, the Central Committee for Natural Disaster Prevention and Control needs to be empowered to drive inter-ministerial coordination and serve in an advisory role for integrated disaster risk management. In the long term, multi-hazard disaster risk management and climate change adaptation measures need to be mainstreamed into planning for managing natural resources and land use across all climate-sensitive sectors.

**A better understanding of risks is required to allow for targeted responses.** Continued research on the causes and preventative measures for land subsidence is required. Further, continued research and baseline surveys are required to better understand soil conditions and to thus better predict, avoid or respond to river bank and coastal landslides and erosions.

### 5.4.2 A holistic and integrated approach for structural and nonstructural measures across key sectors is required based on eight "musts"

**The report *Toward Integrated Disaster Risk Management in Vietnam* highlights four "musts" for disaster preparedness, response, and recovery, and four for building resilience.** These are for the short, medium, and long terms (see table 5.1; World Bank 2017h).

**TABLE 5.1: Proofing against disasters and mainstreaming resilience**

| ***Short term:*** *Design, pilot, and standardize proven practices*<br>***Medium/long term:*** *Scale up and institutionalize practices* | |
|---|---|
| **Smarter disaster preparedness, response, and recovery** | **Tools for building resilience in development** |
| 1. **Integrated drought monitoring and warning systems** for linking hydrometeorological systems to preparedness and response procedures.<br>2. **Financial protection strategy** for effective financing of response and recovery.<br>3. Adaptive **social assistance systems** for supporting vulnerable households.<br>4. **Risk and vulnerability analysis** for providing location-specific and effective last-mile delivery of support target areas and populations. | 1. Systems to enable **integrated water resources management** (supply and demand sides) and climate-sensitive land-use planning at river basin, coastal zone, and watershed levels.<br>2. **Climate-smart good agricultural practices** for crops, livestock, aquaculture, and other productive assets.<br>3. **Inclusive, community-based approaches** for disaster risk management and climate change adaptation measures, and skilled human resources to implement them.<br>4. **Empowerment of vulnerable populations** to access risk reduction opportunities to enhance risk resilience and livelihoods. |

*Source:* World Bank 2017h.

### 5.4.3 Improved financial planning will be critical for establishing a robust system for disaster prevention, preparedness and response

**The Ministry of Finance could take the lead in financial planning for disasters by crafting a comprehensive disaster risk management finance strategy.** Although some financing instruments are available to the government, there is too much reliance on government budgets at all levels to finance disaster risk prevention, post-disaster response and recovery. Improved coordination of these instruments could help the government better manage the costs of disasters and ensure that funding will be channeled efficiently and at the right time. Further, the budget allocation between disaster risk prevention, response and recovery should be revisited, increasing the focus on disaster risk prevention. Combining financial instruments can allow the government and communities to mobilize, access, and disburse financing from public and private sources quickly. Given fiscal constraints, the government could also look to the capital and insurance markets to secure funding from the private sector, alleviating the burden on the state budget and/ or include mechanisms which allow for mobilization of private sector

and civil society support.[3] In addition, innovative instruments should be developed to help cope with the unpredictability of natural disasters and climate change (see box 5.5).

**BOX 5.5: Innovations in financial planning for disasters**

The **Catastrophe Deferred Drawdown Option (CAT DDO)** in the Philippines combines reforms in disaster risk management policies with innovative financial tools, allowing subnational governments to access financing in a timely manner. The country opened a CAT DDO contingent line of credit in 2017 that helped achieve fundamental disaster risk management reforms while providing quick-release financing for disaster recovery and reconstruction. In 2013, the CAT DDO enabled the Philippine government to mobilize US$600 million just days after the Haiyan tropical cyclone. Disaster risk management offices were set up in 80 provinces and in more than 90 percent of cities and municipalities, with budget and staffing allocations.

Another innovation was the establishment of a **Fund for Natural Disasters (FONDEN)** in Mexico to support disaster relief and reconstruction. FONDEN resources, leveraged with market-based instruments, allow for transfer of risks through insurance and other mechanisms such as catastrophe bonds. In 2011, FONDEN secured indemnity cover for government assets and low-income housing with a US$400 million excess-of-loss reinsurance treaty. FONDEN now provides one of the most sophisticated disaster financing vehicles in the world.

*Source:* World Bank 2018j.

### 5.4.4 Risk management—and dam operations and safety—need to be integrated in basin planning

**An integrated basin-wide approach could not only strengthen disaster response and resilience but also boost economic productivity.** The 2017 report *Toward Integrated Disaster Risk Management in Vietnam* recommends finding solutions to the multisector coordination and implementation challenge (see section 5.4.1), by "improving effectiveness and coordination horizontally across sectors as well as vertically at national, regional, and provincial levels" (World Bank 2017h). As this is also the challenge for integrated water resources management, the solution at the basin level could be found in the same approach, that is, in basin planning steered by a basin organization or by functional arrangements for interagency collaboration, perhaps with budget resource allocations aligned with basin plans. This same institutional setup could also provide for coordinated management of dam operation and safety within each basin. In addition, the hydro-meteorological and water resources information system being established across Vietnam (see chapter 6) could then serve a triple purpose, again in basin plans: flood and drought warning; basin planning; and river management, including oversight of dams. A recent study in Ninh Thuan Province shows how an integrated basin-wide approach, including coordinated planning of reservoirs and advanced technologies for water savings, could not only strengthen resilience to recurrent floods and droughts but also boost economic productivity and support better socioeconomic development planning (World Bank 2018a).

## Notes

1. In 2013, the government initiated a major study of impacts of upstream development on the Mekong Delta.
2. The 2012 Law on Water Resources Articles 53.2 and 60.5 assign to the Ministry of Natural Resources and the Environment responsibility for flow management and approval of inter-reservoir operations (GoV 2012). The 2017 Law on Hydraulic Works assigns to the Ministry of Agriculture and Rural Development and the provincial people's committees responsibility for dam safety: "Before the start of an annual rainy season, the Ministry of Agriculture and Rural Development and provincial-level people's committees shall organize the safety assessment of dams and reservoirs; and decide on water storage plans of reservoirs and solutions to ensuring safety for dams and reservoirs under their management."(GoV 2017a, Article 45).
3. A good example of this public–private partnership approach is the recent effort spearheaded by the Ministry of Finance to introduce insurance for public infrastructure through the revision of the Public Assets Management Law.

# Part 3

# Improving Governance—Framework, Initiatives, and Financing

Whether Vietnam can improve policy implementation and effectiveness will determine whether it can sustain its growth and protect its water resources, on which so much of its development depends. Addressing the newly emerging challenges—such as pollution, climate change, and service provision to agriculture and settlements—calls for complex policy reforms to tackle entrenched inefficiencies and diverging interests. This will require paying greater attention to the spatial dimension of policies through basin-level planning, raising adequate finance in a period of fiscal stringency, and emphasizing accountability and incentives to comply with regulations.

6

# Vietnam's Water Governance Framework

***Vietnam's water governance framework is sound, but institutions are facing difficulties in tackling rising stress levels***

- The legal framework for water management in Vietnam has been established and is gradually being improved
- The institutional set-up is mostly clearly defined by law. However, getting all the sectoral and local interests to work together constitutes a massive challenge of horizontal and vertical coordination. All agencies, including MoNRE which has lead responsibility for water resources management, are under-resourced.
- Planning for water resources is underway but encountering difficulties and delays. The nationwide assessment of Vietnam's water resources is still not complete. There is as yet no overall plan, and ministries and provinces are preparing their own, creating risks of an unintegrated or piecemeal approach.
- Vietnam's water governance framework aims to integrate planning and management at the basin level but organizations set up for planning and management at the basin level have so far met with limited success. Much remains to be done to empower these organizations, to give them adequate resources and to make them representative of stakeholder interests.
- Financing for water resources management is insufficient and fees and charges levied contribute little to covering costs or to incentivize good behavior.
- Incentives for water conservation and protection activities are provided for in law, but their effectiveness is yet to be assessed.
- Enforcement of water pollution prevention and control is low, with negative impacts on Vietnam's water bodies.
- Mechanisms for handling transboundary issues have brought tangible benefits but challenges persist. Because of Vietnam's high dependence on transboundary flows, cooperative arrangements should be negotiated on other rivers too.
- The basic building block for planning is information; the process has been started, but the data are still lacking and information sharing is a particular problem. Investments in data gathering need to be completed, and data need to be transformed into information.

## 6.1 The legal framework for water management in Vietnam has been established and is gradually being improved

### 6.1.1 The legal framework for water resources management has developed over the last two decades and is now comprehensive

**The institutional and governance framework for water resources management has evolved over time in response to the growing challenges of sector management.** In 1998, Vietnam's first water law – the Law on Water Resources – assigned responsibility for water resource management to MARD and then MoNRE when this ministry was established in 2002. The Law set out the basic policies to ensure an integrated approach. These policies were confirmed by a series of decrees and circulars (see Annex B). In 2012, the Law on Water Resources was updated to strengthen the integrated approach to water resource management and to allocate responsibilities for key functions under the overall direction of MoNRE (see box 6.1). The main provisions of the revised law were: (i) setting out the requirements for assessment, strategy and planning for water development; (ii) defining specific provisions for protection and sustainability of water quality and quantity; (iii) regulating water resources allocation and use, including protection of groundwater; and (iv) providing financing for water resources management (see Annex B)

**MoNRE has issued a number of decrees and circulars to apply key provisions of the 2012 Law on Water Resources.** These instruments (see Annex B) cover: water resources assessment, planning and management; water resources protection and conservation, including minimum flow requirements; encouraging investment in water and the environment; setting out water abstraction charges; regulating groundwater exploitation; and specifying penalties for violation of the law.

**According to MoNRE, a number of further legal instruments are under preparation to spell out further measures for applying the 2012 Law on Water Resources.** These concern (see Annex B): (a) the national water master plan and arrangements for water resources inventory and information; (b) arrangements for water resources planning between provinces and within provinces; (c) supplementary conservation measures for water resources, water bodies and river banks; and (d) further provisions for wastewater management and reuse.

**In addition, further instruments are required from other ministries:** from MoST on standards for water saving technology; from MARD on water saving practices and on reuse of drainage and wastewater; and from MoF on fiscal and financial supports to investment in water conservation (see Annex B).

**BOX 6.1: The Ministry of Natural Resources and Environment's statutory responsibilities and powers under the 2012 Law on Water Resources and 2017 Law on Planning**

**Legal and regulatory framework**

- Issuance of legal documents, regulations, and standards based on the Water Resources Law (70.2 (a))
- Secretariat of the National Council of Water Resources; host of the Vietnam Mekong River Commission, and river basin organizations (RBOs) (70.2 (k))
- Monitoring and advising on transboundary water issues (67.2)

**Information and resource assessment**

- Data gathering, database and information system management, and data dissemination (13.2, 70.2 (h))
- Water resources assessment (10.2–13.1)
- Water resources monitoring (28)
- Early warning on extreme and harmful events (70.2 (g))
- Public awareness and education (70.2 (d))

**Water resources strategy and planning**

- Water resources strategy (14.4)
- Preparation of Master Plans at national and inter-provincial basin levels for approval by the Prime Minister (15–24)
- Provisions for water conservation (39–53)
- Coordination of river basin organizations, provincial people's committees, ministries and agencies in water resources development and management (72.2 (c))

**Water allocation and resource management**

- Water allocation and licensing of uses (54–56)
- Flow management and preparing the development of inter-reservoir operations for approval by the Prime Minister (53.2, 60.5)
- Groundwater management and regulation (35–36, 52, 56)
- Protection zones and minimum flows (70.2 (c))
- Disputes and violations (70.2 (i))

**Pollution control**

- Pollution control and clean-up of major rivers (27.4)
- Discharge permits (37)

*Source:* GoV (2012); references are to sections of the 2012 Law on Water Resources.

### 6.1.2 The legal framework for environmental protection complements the water resources framework

**The 2012 Law on Water Resources is complemented by the 2014 Law on Environmental Protection.** The Government of Vietnam acknowledged the importance of environmental protection in the early days of the country's reform process (*Doi Moi*, see chapter 1). The first Law on Environmental Protection (LEP) was promulgated in 1993 and was revised in 2005 and 2014 to meet changing circumstances. Water environmental protection has been an essential element of this policy and legal framework.

**The Law on Environmental Protection in all three versions - 1993, 2005 and 2014 - has specific sections and articles addressing water pollution.** The laws and its implementing decrees and instruments (see Annex B) provide for the full range of policy instruments to address water pollution. These include: environmental impact assessment, water ambient environment standards, effluent standards, effluent charges, inspection and penalties, monitoring, certificates for completing environmental protection works, incentives for environmental protection via soft loans and tax and land preferential conditions, and education and awareness raising campaigns. Annually about one per cent of the state budget is allocated for environmental expenditure, including water environment expenditure.

### 6.1.3 Irrigation and other important water-related mandates are assigned under the legal framework to the Ministry of Agriculture and Rural Development (MARD)

**MARD's role in water is subject to a series of laws. In 2017, these instruments were completed by the Law on Hydraulic Works.** A series of laws and application decrees and circulars govern MARD's role in irrigation and related water management. The Law on Dykes (2006) spells out MARD's role in maintaining dykes and flood protection. The Law on Natural Disaster Prevention and Control (2013) provides for MARD's role in the coordination of disaster risk planning and disaster response. The 2017 Law on Hydraulic Works details MARD's role in planning, construction and management of hydraulic works and related water management tasks as well as provisions for cost recovery and financing (see box 6.2). The 2017 Law on Hydraulic Works also spells out how MARD will cooperate with MoNRE and with the PPCs. The Government subsequently issued five decrees and three circulars guiding the implementation of the 2017 Law on Hydraulic Works (see Annex B).

#### BOX 6.2: The Ministry of Agriculture and Rural Development (MARD): statutory responsibilities and powers under the 2017 Law on Hydraulic Works

**Water resources management (WRM): Cooperation between the Ministry of Natural Resources and Environment (MoNRE) and the Ministry of Agriculture and Rural Development (MARD)**

- Plans and works under this law must be within an integrated water resources management framework and conform to master plans for water resources (12).
- Structures must be efficient and promote water conservation and productivity (25).
- Water resources for hydraulic works are allocated and licensed by MoNRE and by provincial people's committees (PPCs) at their level (58).
- MoNRE (and PPCs) issue discharge permits, but discharge of wastewater into hydraulic structures must comply with the Law on Hydraulic Works (58).
- For hydraulic structures, MARD is the focal point for plans, standards, regulations, and issues with drought, water shortage, saline intrusion, flood, and so on, and for distribution of subsidies; and international cooperation (56).
- PPCs have the same responsibilities at the provincial level, and they must report annually to MARD (57).

**Planning for hydraulic works: MARD and PPC responsibilities**

- Baseline surveys for hydraulic works, including climate change forecasts, and so on (9.2).
- Hydraulic works strategy (30-year horizon, updated every decade) (10).
- Hydraulic works master plans for basins and regions (20-year horizon, updated every 5–10 years) (11).
- MARD responsible for master plans and works covering more than one province (PPCs at the intra-provincial level) (14.1).
- National hydraulic works master plan approved by the Prime Minister (14.2).
- MARD approves interprovincial and intra-provincial hydraulic works plans (14.2).

*(Box continues next page)*

**BOX 6.2: (Continued)**

**Management of hydraulic works: MARD and PPC responsibilities**

- MARD manages large and interprovincial works; PPCs manage smaller works (21).
- Farm irrigation units (registered as coops) and their unions can manage infrastructure and can receive state support (50–52).

**Cost recovery and financing**

- Cost recovery can include depreciation and profit within Ministry of Finance ceilings (34).
- Cost recovery for state structures is also based on socioeconomic conditions and payment capability (34).

*Source:* GoV (2017a); references are to sections of the 2017 Law on Hydraulic Works.

### 6.1.4 Other aspects of the legal framework also affect the water sector

**Twelve additional laws and their corresponding ordinances and decrees complement the 2012 Law on Water Resources and 2014 Law on Environmental Protection.** These legal instruments deal with flood protection, disaster risk management, dam safety and environmental protection. The relevant instruments and decrees are discussed in detail in Annex B.

## 6.2 The institutional set-up

In the early decades of the Vietnamese republic, water resources and irrigation were managed together. In 1962, a Ministry of Water Resources was established with both these responsibilities, and in 1995 this ministry was merged with agriculture and rural development in a single Ministry of Agriculture and Rural Development. In 2002, Vietnam recognized a key principle of integrated water resource management by separating water resources management from water users. Under this approach, MoNRE assumed the overall water resource management function while other ministries were responsible for the water using sectors. The set-up today is described in the following paragraphs.

### 6.2.1 Central ministries and their branches

In Vietnam, responsibility for water is divided horizontally among multiple sectoral ministries and their local branches. Four principal ministries are responsible for water (see figure 6.1):

**Ministry of Natural Resources and Environment (MoNRE)** is responsible for water resource management, water environment protection and pollution control. MoNRE sets and enforces environmental technical regulations. MoNRE is also national focal point for international treaties on water and environment. It is the standing agency of the Vietnam Mekong River Commission and of the National Water Resources Council, and oversees the river basin organizations. Within MoNRE, there are five units at central level: the Department of Water Resources Management; the Vietnam Environment Administration; the National Center for Water Resources Planning and Investigation; the Institute of Water Resources; and the Mekong River Commission (Vietnam). The Department of Water Resources Management under MONRE has established branches in three regions, namely North, Central and South. At the local level, there are Provincial Departments of Natural Resources and Environment (DoNRE).

**Ministry of Agriculture and Rural Development (MARD)** is responsible for irrigation, aquaculture and associated hydraulic infrastructure, river training, flood control, rural water supply and sanitation, and coordinating disaster response, including management of river bank and coastal landslide and the system of dikes for flood control.

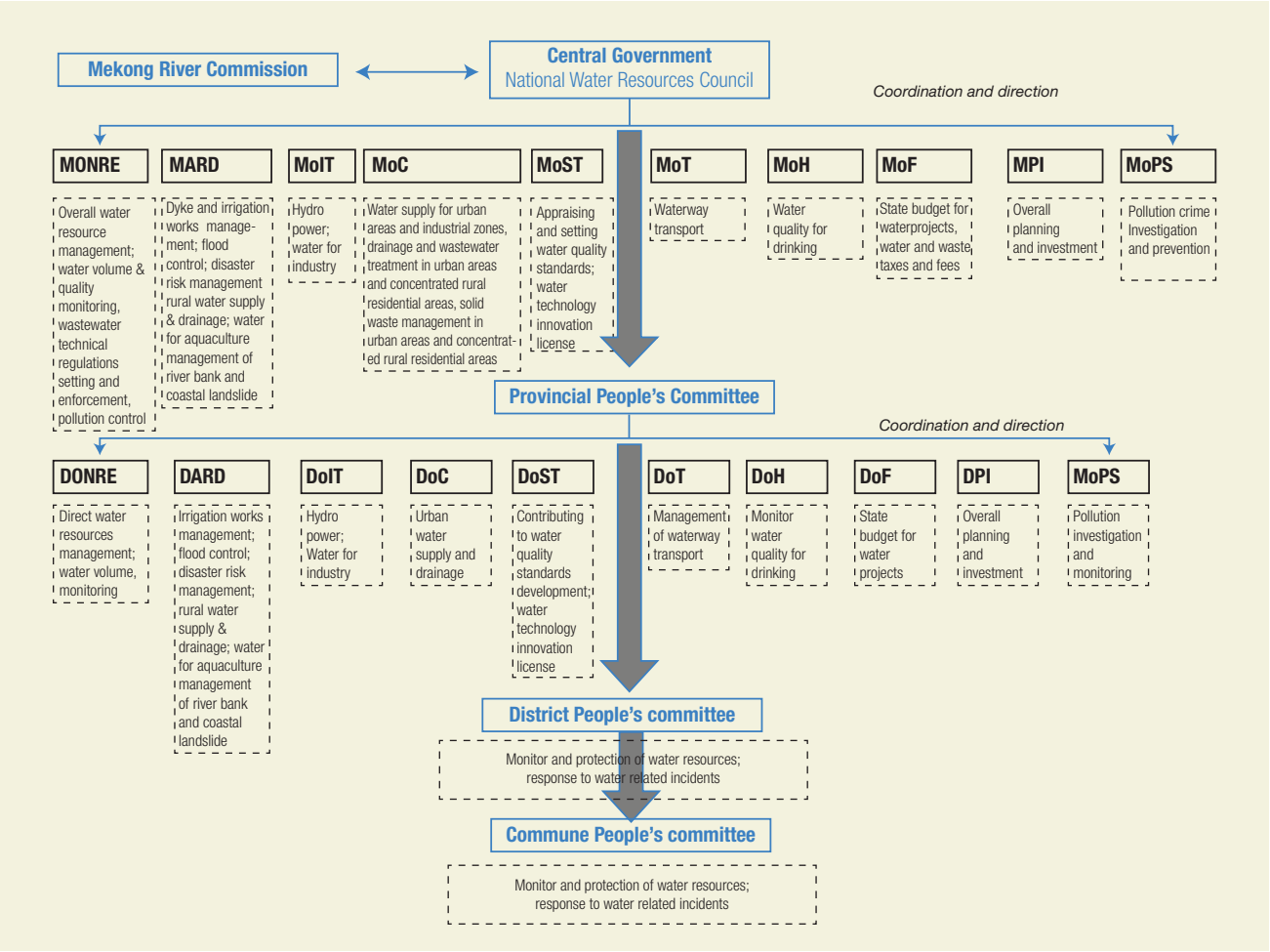
**Ministry of Industry and Trade (MoIT)** is responsible for hydropower and water for industry

**Ministry of Construction (MoC)** is responsible for water supply for urban areas and industrial zones, drainage and wastewater treatment in urban areas and concentrated rural residential areas, and solid waste management in urban areas and concentrated rural residential areas.

In addition, the **Ministry of Transport (MOT)** is responsible for managing and developing navigation, inland waterways and ports; the **Ministry of Science and Technology (MoST)** is responsible for setting water quality standards and for promoting technological innovation. The **Ministry of Health (MOH)** is responsible for providing technical guidance for urban and rural water supply and for inspections (including medical facilities); the **Ministry of Finance (MOF)** issues guidelines on taxes and fees related to water, wastewater and drainage; and the **Ministry of Planning and Investment (MPI)** synthesizes investment projects on water resources, provides the budget plans and submits these to the government for approval.

Each of these ministries has branches at provincial and district levels.

**FIGURE 6.1: Organizational and institutional structure of Vietnam's water and wastewater sector**




*Source:* 2030 WRG 2017.

### 6.2.2 Many responsibilities for water management are decentralized

**Responsibility for water resources and services within provinces is decentralized to local authorities.** Vietnam is notable for an exceptionally high degree of delegation of responsibilities, financing, and human resources to subnational governments. Subnational spending now accounts for over 70 percent of total public investment. This decentralization is reflected in responsibilities for water. At the subnational level, provincial people's committees (PPCs)—and under them the district councils—are responsible for developing and managing water resources, water services and irrigation within their jurisdiction. The ministries directly manage only responsibilities that cross provincial lines, such as larger projects. More than 70 percent of the irrigation budget, for example, is managed by the PPCs, not by MARD. Local authorities have varying capacity for planning and management. The local departments of the central ministries are in principle accountable to local authorities, but the reporting lines are confused as these units are also accountable to their parent ministries (World Bank 2017a).

### 6.2.3 Water resources management faces some institutional challenges

**Getting all the sectoral and local interests to work together requires horizontal and vertical coordination.** With so complex an institutional structure, ensuring a multi-sectoral, cross-institutional approach to water planning, development, and management is particularly difficult because water management straddles sectors and internal jurisdictions. The scale of the challenge can be judged from the 2030 WRG (2017) study that found that reducing water stress in one basin required 24 measures, which jointly required support from seven ministries, six provincial councils, multiple municipalities, numerous irrigation companies and private firms, and millions of farmers and city dwellers.

**Capacity for water resources management at the decentralized level is quite weak, particularly below the provincial level.** Some capacity in water resources planning and management exists at provincial level but most provinces have not issued detailed guidance for decentralization to district and commune

levels. Human resources for the management of water resources, particularly at local levels, are not yet sufficient and adequate in quantity and quality. Efforts to promote water resources management and environmental protection at the grassroots level need to be increased.

**Although MoNRE has lead responsibility for water resources management, it is relatively under-resourced for the task.** MoNRE's ambitious water resources mandate faces significant implementation challenges as the ministry lacks the human and financial resources to take on this massive task. Capacity in the key Department of Water Resources Management is limited. Staffing is restricted - about 157 staff at the central level (of whom only 60 are permanent) and only a half dozen staff in a typical provincial DONRE. Staff qualifications and training levels are relatively low. In some offices at the local level there are no staff in charge of water resources at all and tasks have to be accomplished by meteo-hydrology officers. Investment resources are also inadequate to meet needs related to water resource management at both central and local levels.

**The ministries' mandates are mostly clear, however there are some overlaps in tasks, and coordination between ministries within an integrated framework is weak.** The task division on water resources planning has resulted in each ministry developing their own planning without an overall integrated framework. For example, MARD develops irrigation planning, MOIT develops hydropower planning, and MOT develops inland water transport planning. A lack of cooperation among the ministries has led to water use conflicts, increasing water scarcity and pollution. Conflict of interest remains between power generation and flood control, water supply for downstream areas, domestic consumption and salinization prevention.

## 6.3 Planning for water resources is underway but encountering difficulties and delays

### 6.3.1 Water resources assessments are underway but face implementation problems

**Despite considerable progress since the 2012 Law on Water Resources, the nationwide assessment of Vietnam's water resources is still not complete.** The 2012 Law on Water Resources requires MoNRE to prepare a nationwide water resources assessment as the basis for water strategy, planning, allocation, licensing, management and coordination (see box 6.3).

**Implementation measures are being undertaken within the National Strategy for Water Resources for 2010 and the National Action Plan 2014-2020** (see Annex B). Under the 2014 National Action Plan, MoNRE has issued a number of circulars and much of the information has been collected at provincial level and consolidated. In 2018, MoNRE submitted to the Prime Minister's office a 'master plan' for surveying and monitoring water resources up to 2030, and a 2019 MoNRE ministerial decision spells out how the assessment is to be conducted and completed. However, budgets for surveys and monitoring are limited. As a result, there is a serious lack of data and information on water resources and on their exploitation and use on a nationwide scale. For the time being, the required annual and five-year water resources reports are not yet published, and ministries and PPCs continue to rely on their own surveys.

### BOX 6.3: Water resources assessment

**MONRE has implemented programs for the basic survey on water resources at the central level, and many provinces proactively invest in surveys.** On the central level, the programs for the basic survey include the survey for evaluation of surface and groundwater resources; the status of exploitation and use of water and discharge of wastewater into the water sources; and mapping of the river basins. Much of the information and data have been collected and updated, serving as the basis for management. Many provinces have proactively arranged a local budget to invest in projects on survey, study and evaluation of water resources, the status of exploitation, use and discharge of wastewater into the water sources, and local development of the master plan on water resources and database on water resources.

**However, the overall plan for a nationwide water resources survey has not yet been issued, causing coordination challenges across ministries and government levels.** The 2012 Law on Water Resources provides that MONRE is responsible for organizing the development of the overall plan for a nationwide survey of water resources and for submitting it to the Prime Minister for approval. However, to date, no overall plan has been approved by the Prime Minister. In 2017, MONRE approved the task to develop the overall plan on national level survey of water resources (Decision 2057/QĐ-BTNMTT). By the end of 2018, MONRE submitted the overall plan on the national level survey on water resources by 2030 and the vision for 2050 to the Prime Minister. MONRE's action plan on implementing the

*(Box continues next page)*

**BOX 6.3: (Continued)**

Government's Resolution 01/NQ-CP dated 1/1/2019 01/NQ-CP (MONRE's decision 12/QD-BTNMT) specifies major tasks for water resources management for the year 2019. These include finalizing the overall plan on national level survey of water resources and water resources planning.

Due to a lack of the overall plan on basic survey of water resources, concerned ministries and PPCs have conducted their own basic survey planning without overall coordination and planning.

The periodical five-year water resources reports and annual thematic water resources reports have not been disseminated. For the period of some years, there have been no inventory reports on water resources. Many agencies and provinces have not carried out the survey for reporting the status of water usage, which they should have submitted to MONRE.

Due to the absence of the overall plan for basic survey of water resources, budgets for water resources basic survey and monitoring remain limited at both the national and provincial levels. As a result, there is a serious lack of data and information on water resources, exploitation, and use of water resources on a nationwide scale.

Source: MoNRE.

### 6.3.2 Development of the master plan on water resources is delayed

**The 2012 Law on Water Resources specifies the need for three types of water resources master plans.** These are (1) the national level master plan, (2) the inter-provincial river basin management master plans, and (3) provincial master plans. The law specifies that the master plan should be updated every ten years and should include both surface water and groundwater. The law also outlines the principles for master planning, the obligations of each agency, and the contents of the master plan. The Law clearly specifies responsibilities - MONRE takes the main role and coordinates with MARD, MOIT, MOC and other related ministries to develop the national level overall master plan to submit to the Government for approval.

**However, it was not until 2017 that a start was made on the overall national master plan for water resources.** One reason for the deferred start is that water resources planning involves numerous sectors and localities, requiring agreements on data and methodologies while many major water works have been operating for many years. Another reason is a lack of human and financial resources for planning.

**As there is not yet an overall plan, some provinces have prepared their own, creating risks of an unintegrated or piecemeal approach.** The law requires that the provincial master plans have to be in line with the overall national master plan and with the inter-provincial river basin master plans. In principle, the PPCs have to obtain written opinions from MONRE when developing their plans. However, as there is as yet no national overall master plan, the provinces have developed and approved their own provincial plans. This may result in conflicts between the master plans of upstream provinces and those of downstream provinces in the same river basin.

**Similarly, the sectors have developed their own plans without overall coordination – particularly in irrigation.** The 2012 Law on Water Resources requires that water-related sectoral master plans such as master plans on irrigation, hydropower, water supply, inland waterway transportation and other related master plans developed by ministries, sectors and provinces must be in line with the overall national water resources master plan. Thus, in principle many plans related to the activities of exploitation and use of water resources depend on the national master plan. While the national plan is delayed, other ministries and agencies have gone ahead with their planning. For example, MARD has approved 22 irrigation master plans to meet the requirements for irrigation. As the Water Resources Master Plan is still under development, these irrigation master plans are not coordinated with it.

**The same risk of incoherence has arisen in river basin planning.** For example, MONRE is to develop the master plans for water resources of river basins but as these are not yet available, MARD has pressed on with developing river basin irrigation planning. (*Source: National Assembly's Economic Chair Vu Hong Thanh remarks on the Bill for Planning 2017).*

### 6.3.3 The sector is now integrating within GoV's recently adopted 'unified' planning approach

**A further challenge is the need to streamline planning and to integrate water resources planning with overall master planning.** To address the problem of having too many master plans – there were nearly 20,000 in existence (see box 6.4) – the National Assembly approved a

Law on Planning in 2017 to streamline and unify planning. This required amendment of a total of 37 planning-related laws to try to create a more unified legal framework for planning activities. Many of the laws amended are water-related, including the Law on Water Resources, Law on Hydro-meteorology, Law on Urban Planning, Law on Hydraulic Works, and the Law on Dikes. The Law on Amending and Supplementing a Number of Articles of 37 Laws related to the 2017 Law on Planning was passed in the sixth session of the 14th National Assembly in November 2018.

**The new law makes water resources planning an integral part of national sector planning.** Ministries are to develop sectoral master plans for the period 2021-2030, with a vision for 2050. Under this provision, MONRE is responsible for the Water Resources Plan, the Environmental Protection Plan, and the Biodiversity Conservation Plan. MARD is responsible for the Plan on the Prevention and Control of Natural Disasters and for the Irrigation Plan. In case of conflicting water uses between ministries, there is no formal process yet on how to settle issues. It is likely that MPI will provide guidance, while the cases will be brought to the Prime Minister for his decision. This 'unified' planning approach is essential – and requires dedication to implement.

### BOX 6.4: Streamlining a plethora of plans

**In 2017 and 2018, Vietnam adopted two laws designed to streamline a plethora of plans of one kind or another that had been developed in the past: the *Law on Planning* and the *Law on Amending and Supplementing a Number of Articles of 37 Laws related to the 2017 Law on Planning*.**

**The necessity for the 2017 Law on Planning**

Before the 2017 Law on Planning was passed, there were 19,285 master plans in all sectors - not even including product plans such as the cassava and tilapia plans. The number of plans increased six-fold between 2001 and 2011. For the period between 2001-2010 there were 3,114 plans, while these increased for the period between 2011-2020 to 19,285 plans. Among the 19,285 master plans, there were 2,326 urban plans and 9,864 construction plans. Over 8,000 billion VND were spent to develop these plans. (Source: Dai Doan Ket Newspaper, May 25, 2017).

The plans were found to be overlapping, at times even contradictory and they lacked cohesion. At times the plans were not connected to implementation resources. Thus, a high percentage of the completed plans had no practical value, and even contributed to overall low sector performance, actually hindering development.

**Key objectives of the 2017 Law on Planning**

- Put top priority on integration of state management and on efficiency of national resources utilization. Put an end to fragmented sectoral and local management.
- Establish a transparent mechanism in planning, enhance the role of communities and people, and improve the accountability of leadership.
- Reduce the total number of plans from 19,285 to 11,413. This includes a 97% reduction of plans at national, regional and provincial levels (from 4,362 plans to 110 plans). Sectoral, industrial and product plans will be reduced from 3,372 plans to 38 plans.
- Apply modern, consistent and efficient method of multidisciplinary integrated planning, following international trends. Create a unified information system and national planning database from central to local levels.

Source: MoNRE.

## 6.4 Vietnam has adopted 'integrated water resource management' (IWRM) but faces challenges to implement the approach

### 6.4.1 The framework provides for integrated water resource management but integrated planning is proving a challenge

**Vietnam has long recognized the importance of integrated water resources management (IWRM).** Two decades ago, the government adopted IWRM (see box 6.5) as the basis for water resources planning, development, and management. The 2012 Law on Water Resources emphasizes integrated water resources management and river basin-based management, stipulating that "water resources management shall be carried out using a river basin approach" and that "water resources shall be managed in an integrated manner, bringing together quality and quantity, surface and ground water, inland water and estuary and marine water, upstream and downstream, and integrated with other natural resources management". The National Strategy on Water Resources to 2020 and the Strategic Orientations for Vietnam's Irrigation Development to 2020 confirm that water resources management "must be implemented in an integrated manner on a river basin basis" (Decision 81/2006/ QĐ-TTg).

**BOX 6.5: What is integrated water resources management**

Integrated water resources management (IWRM) balances social, environmental, and economic concerns; upstream and downstream perspectives; and the interests of different sectors. It includes different stakeholders in transparent decision making. IWRM is accepted as global best practice in river basin management.

Source: Authors.

**The legal framework provides for basin planning between provinces sharing the same river basin.** Decree No. 120/2008/ND-CP on river basin management mandates the preparation of basin-level "framework plans" to identify key objectives and management issues and actions for a basin. It also called for preparation of specific "component plans" for a river or a groundwater area. Following the 2012 Law on Water Resources, MoNRE issued Circular No. 42/2015/TT-BTNMT on the regulations for Water Resources Planning Techniques to clarify MoNRE's planning functions (see box 6.6, MONRE 2015b).

**The development of intra-provincial river basin planning remains slow.** So far, many provinces have approved water resources master plans. However, they are struggling to develop intra-provincial river basin planning, due to a lack of capacity and resources. Some planning at basin level has begun, typically with external support. For example, for two river basins (Ky Cung River in the North and Srepok in the Central Highlands), basin plans are at the final stage of the approval process. MARD has prepared basin plans but only for irrigation development. MONRE is currently preparing water resource plans for the river basins of (1) Bang Giang – Ky Cung, (2) Red-Thai Binh, and (3) Sesan- Srepok.

**BOX 6.6: Circular 42 – a template for basin planning**

In September 2015, the Ministry of Natural Resources and Environment (MoNRE) issued Circular 42/2015/TT-BTNMT: Regulations on Water Resources Planning Techniques to spell out implementation of MoNRE's basin planning functions under the law. The circular covers:

- Water resources assessment and mapping.
- Current uses, projection of demand, and possible future water allocations.
- Identification of infrastructure development priorities.
- Protection requirements for quantity and quality of surface water and groundwater.
- Assessment of flood, drought, and saline intrusion risks and risk mitigation measures.
- A water resources monitoring framework.
- Preparation of plans and maps.

On this basis, MoNRE has started implementation of basin planning, delegating planning for the Sesan-Srepok basin (supported under the World Bank–financed Mekong Integrated WRM Project) to the National Center for Water Resources Planning and Investigation (NAWAPI). The work in the basin is coordinated with other ministries and local authorities.

Source: MoNRE 2015b.

### 6.4.2 Vietnam has long tried to establish organizations for planning and management at the basin level, but with limited success.

Beginning two decades ago, Vietnam has tried three approaches to establishing river basin management.

**During the period up to 2008 when MARD was responsible for water resources, it established eight river basin planning management boards (RBPMBs) which exist to this day.** The Law on Water Resources 1998 (Article 64) provided for 'river basin planning management boards' (RBPMB) as 'service providing entities' under MARD. Their essential role was to manage river basin planning. There was no provision for these organizations to coordinate and supervise water protection, extraction and use or to prevent and restore water related damage in the rivers. After the 1998 Law on Water Resources came into effect, MARD established eight RBPMBs for major river basins or sub basins: Red-Thai Binh basin; Ca river; Huong river; the Vu Gia - Thu Bon rivers; Srepok river; Dong Nai river; Cuu Long river; and two 'sub-RBPMBs' for the two basins of Nhue-Day and Cau rivers (within the Red-Thai Binh Basin).

**During the period 2008-2012, legal provision was made for setting up full-fledged river basin organizations.** After MoNRE assumed responsibility for river basin management, a decree was issued (Decree 120/2008/ND-CP on river basin management dated 01/12/2008) with a chapter on river basin organizations and a chapter on responsibilities of ministries and provinces in river basin management. According

to Decree 120, the Prime Minister was responsible for establishing major river basin organizations while MONRE was mandated to establish other interprovincial river basin organizations. The organizations were to be represented by a 'river basin office' established by MONRE.

**However, in practice, MoNRE focused on establishing river basin environmental protection commissions (RBEPCs) to combat the growing pollution menace.** In the period 2008-2013, due to increasing water pollution, master plans for environmental protection of the three river basins of Cau, Nhue-Day and Dong Nai were issued. Three river basin environmental protection commissions were established to assist the implementation of these master plans.[2]

**These environmental protection commissions have played an important role in implementing the master plans for environmental protection of the three river basins**, coordinating environmental protection and developing provincial-specific environmental protection plans. Through this means, over 200 environmental projects have been commissioned, including 31 projects for six provinces in Cau River Basin, 55 projects for five provinces in Nhue Day River Basin, and 120 projects for 11 provinces in Dong Nai River Basin. Under the work plans of the environmental protection commissions, the provinces in the three river basins have developed detailed environmental protection plans, monitoring plans and environmental protection rules for craft villages and industrial clusters, together with measures for seriously polluting entities. The provinces have also implemented pollution inventories, inspections and supervision and exchanged information among the provinces.

**Since 2013, river basin management and river basin organization, coordination and supervision have been regulated under the 2012 Law on Water Resources.** The revised Law on Water Resources spelled out the mandate of river basin organizations and the role of MoNRE, the PPCs and other ministries and agencies. According to this law, interprovincial river basin supervision and coordination are carried out by MONRE and river basin organizations with the cooperation of Provincial People's Committees.

Article 72 of the 2012 Law on Water Resources specifies the role of river basin organizations in water management in Vietnam: "River basin organizations recommend water allocation and balance, supervise water extraction, use and protection, and ensure the prevention and restoration of water damage in one or several interprovincial river basins."

With the effectiveness of the new law, Decree 120 was cancelled. A new 2013 decree (Decree 201/2013/NĐ-CP) gives some guidance on implementation of the law and provides that the Prime Minister shall establish river basin organizations for the Hong-Thai Binh and the Mekong, following the proposal of MONRE, while MONRE shall establish other interprovincial river basin organizations. The evolution of river basin organizations is illustrated in figure 6.2.

**The biggest challenge is that the existing organizations – the RBPMBs and the RBEPCs - have not been fully empowered as they are not state management agencies.** These organizations have evolved over time under varying legislation, mandates and authority. As a result, many of these organizations have overlapping tasks and accountabilities, and they lack the legal authority, institutional capacity, and financial and physical resources to plan and ensure that the plans are implemented. Coordination remains limited.

The River Basin Environmental Protection Commissions (RBEPCs) are chaired by the chairpersons of the PPCs involved on a rotating basis, so the chairpersons are constantly changing. Members of the Commissions are key officials of the ministries and provincial administrations working on a part-time basis, with limited time and incentives. MoNRE and the PPCs lack the time and resources to adequately supervise or assess the Commissions performance. In general, it appears that the Commissions have not so far identified concrete actions for interprovincial problems. Their discussions have been mainly on financial resources. Even on that point their conclusions are only advisory and hence do not lead to legal decisions on resource allocation. Participation of line ministries in the Commissions is insufficient.

**The organizations have no separate source of revenue and are dependent on annual budget allocations from different central agencies.** River Basin Planning Management Boards are dependent on MARD for their budget; River Basin Environment Protection Commissions are dependent on the Vietnamese Environment Agency within MoNRE; and River Basin Committees are dependent on the Department of Water Resources Management within MoNRE. Staff are seconded from different agencies.

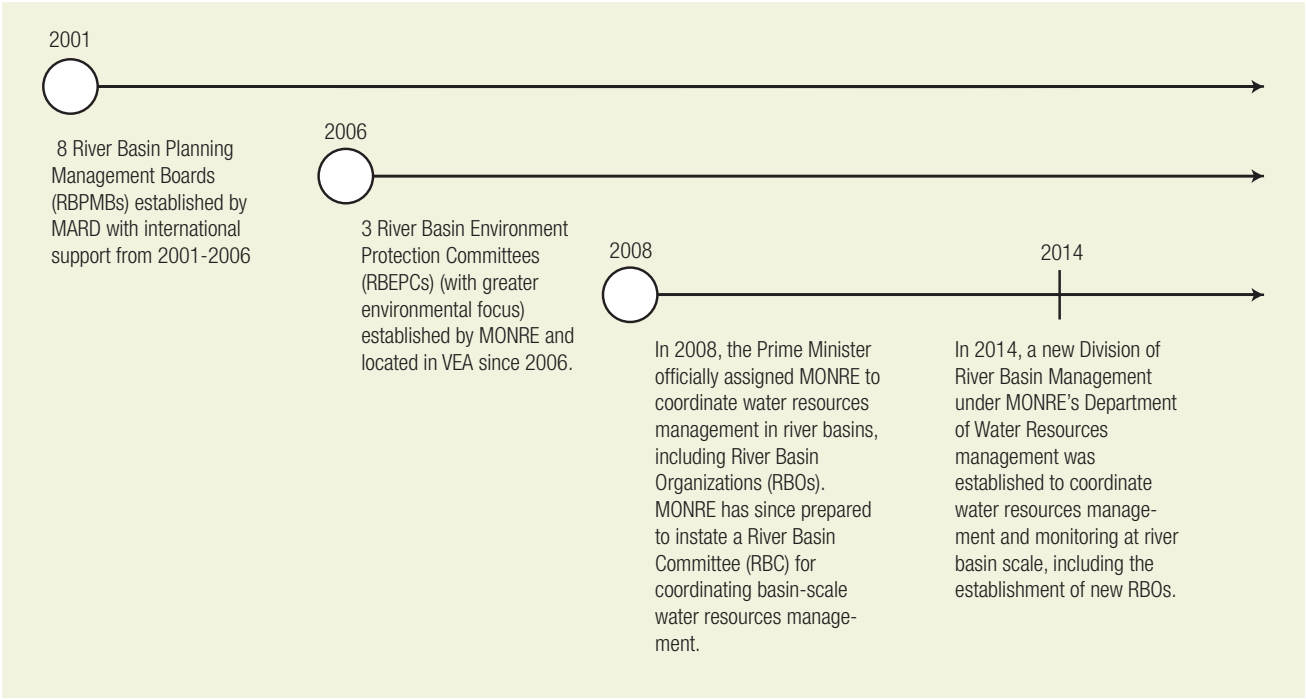
**The implementation of river basin measures faces challenges.** It has often proved difficult to establish a firm legal basis for environmental protection in a basin. Where there has been an attempt to issue regulations limiting or prohibiting some production or trade

activities in the river basin – for example, sand and gravel extraction – this may turn out to conflict with investment regulations. It has also proved difficult to strengthen the roles and status of the RBEPCs because there is no legal provision for giving administrative powers to interprovincial organizations of this kind.

**Overall, much remains to be done to empower these organizations, to give them adequate resources and to make them representative of stakeholder interests.** One assessment concluded: "these organizations are not independent entities in the form advocated by international models and do not have the state management functions to devise and implement basin plans or to resolve basin conflicts." In addition, not all stakeholders are represented. For example, local communities, nongovernmental organization (NGOs), and research bodies do not have a formal place at the table. Overall, these organizations have lacked the power, resources, and character for integrated river basin planning and management and have had little influence in driving an integrated approach to water resources management (Blake and Robbins 2016).

**In the light of these issues, MONRE is developing a program to establish a new generation of river basin organizations under the provisions of the 2012 Law on Water Resources.** MoNRE has submitted to the Prime Minister a proposal to establish four river basin organizations, covering Hong-Thai Binh, North Central, South Central and Dong Nai. The proposed functions of these organizations are to supervise water use and water use cooperation, identify water resources-related issues, and work out feasible solutions and recommendations for the government.

**FIGURE 6.2: Evolution of river basin organizations in Vietnam**




*Source:* Authors.

## 6.5 Financing water resources management

### 6.5.1 Budget for water resources management is insufficient

**Currently, finance for the management of water resources mostly comes from the public budget at both central and decentralized levels.** At the provincial level, there is a shortfall in budget allocations for water resources management in almost all provinces. Each year, PPCs decide on the allocation of budgets for the provincial DONRE but these budgets are typically small and have to cover the whole range of DoNRE tasks in water resources management and environmental protection.

**Budget constraints limit water resources assessments and regular monitoring activities.** The Government has approved a master plan for a system of monitoring of natural resources and the environment (Prime Minister's Decisions 16/2007 and 90/2017). This plan sets out the investment required for monitoring stations and equipment. However, the budget allocated to date is far from adequate to implement the plan. Many river basins lack automatic monitoring systems and often, due to a lack of budget

for maintenance, equipment breaks down after years of service. As a result, many activities such as basic surveys and routine monitoring are constrained and can only be conducted in a limited and fragmented fashion. This makes it impossible to provide the timely and comprehensive data needed to develop the various master plans required under the 2012 Law on Water Resources or to fulfill other water resource management tasks.

### 6.5.2 Some fees and charges are levied but they do not contribute enough to cover the costs of water resources management and environmental protection

**Vietnam has introduced some economic policy instruments - both charges and subsidies – for the management of water resources.** These include: water abstraction charges, water supply tariffs, wastewater tariffs, irrigation fees, environmental protection fees, and subsidy schemes for water saving technologies in industrial production and small-scale irrigation.

**However, the implementation process shows that these economic policy instruments do not yet generate adequate resources for sector management**. While the charges generate some revenue, it is inadequate – and insufficiently ring-fenced - to underwrite sustainable water resources management. According to the Law on Fees and Charges, these revenues are supposed to be returned to the sector to support the management, exploitation and use of water resources as well as protection of the environment. However currently, most of the revenues are simply absorbed by the central budget, without being returned to be used for water resources and protection of the environment. The specific economic instruments are discussed below.

**In addition, while the foundation for these economic instruments has been established, they are not yet designed to incentivize and direct water users' behavior to socially desirable outcomes.** The incentive structure is far from incentivizing and regulating the sustainable exploitation and usage of water as well as effective prevention and control of water pollution. On the role of economic incentives, see Chapter 8 (box 8.6).

**Those licensed to directly exploit water resources must pay water abstraction charges**. Once organizations and/ or individuals have received a license to exploit and use surface water and/ or groundwater, they must pay a charge to do so. The water abstraction charge is calculated based on water usage, water quality, type of water (surface or groundwater), location of abstraction for surface water and depth of aquifer for groundwater, abstraction volume and duration of abstraction. Abstraction charges apply for: hydropower; business activities and service provision; non-agricultural production, including water for cooling machinery and equipment, or for generating steam; and groundwater abstractions for perennial industrial crops, aquaculture and livestock. Other non-industrial agriculture, such as paddy rice farming, is excluded from the water abstraction charge.

At the end of 2018, 330 organizations and individuals had been granted water abstraction licenses by the Department of Water Resources (MONRE) at national level, with a total of annual receivables of over VND 7,144 billion. Of this amount, a little over 10% - approximately VND 877 billion – was collected for 2018. In the provinces, DONRE (for PPC) granted nearly 750 organizations and individuals water abstraction licenses, with a total of annual receivables of over VND106 billion. Of this, nearly VND 20 billion – about 20% - was collected in 2018 (MONRE, 2019).[2] The low collection rates in the first year suggest the need to monitor the collection rates over the coming years and take action in case they do not increase.

According to the Decree, a maximum of 15% of the total collected revenues from water abstraction charges are to be used to cover expenditures for water resources protection activities, for defining the boundaries of water source protection corridors, for supervising water exploitation activities, and for water pollution prevention and control. However, as there are no detailed guidelines on the usage of these revenues available yet, thus the collected revenues are allocated to the general State budget, despite the need for considerably larger budgets for water resources management.

**Water supply tariffs are based on full cost recovery.** The clean water selling price must be set such that all reasonable production costs and total costs arising in the production, distribution and consumption are covered (Article 3, Joint Circular 75/2012/TTLT-BTC-BXD-BNNPTNT). In case the PPC approves a water supply tariff lower than that suggested by the MOF/DOF to achieve cost recovery, the PPC needs to pay the price difference to the local water supplier. Charges are based on the volume of water used as measured by a water meter. The fee is determined by the PPC of central-affiliated cities and provinces and is paid directly to the water supply company. The fee has to be within the price brackets for urban and rural water supply[4]:

- Special urban areas, urban areas in Class 1: minimum VND 3,500/$m^3$ and maximum VND 18,000/$m^3$
- Urban areas in Class 2, Class 3, Class 4 and Class 5: minimum VND 3,000/$m^3$ and maximum VND 15,000/$m^3$
- Clean water in rural areas: minimum VND 2,000/$m^3$ and maximum VND 11,000/$m^3$

**Previously exempted, farmers must, from 2018, pay irrigation service fees.** Water from irrigation works is used for agricultural activities, including aquaculture, as well as for non-food production or industrial purposes. Fee related to this source of water includes a fee for water resources use and the costs for the operation and management of the irrigation works

In 2013 the Ministry of Finance issued Circular 41/2013/TT-BTC which basically exempted all users from the irrigation fee and made irrigation water free to use. Farmers only had to manage and pay for connecting their fields to the irrigation system. The companies responsible for the management, operation and maintenance of the irrigation works would be paid by the state budget through a contract for irrigation service provision. Thus, the management, administration, cleaning, dredging and repair of the irrigation network down to the lowest level of canal was paid by the state, and farmers only paid for any costs of transferring water to their fields.

However, it was found that the subsidy policy affected farmers' awareness of the value of water, while at the same time there was a lack of funds which resulted in irrigation works not being rehabilitated, managed and upgraded in a timely and efficient manner. This led to rapid deterioration of the irrigation system and to challenges around equality of distributing funds across irrigation schemes – in the same region and across regions. A further challenge was the timely distribution of these funds to allow for operation and maintenance works.

**The Law on Hydraulic Works introduced the basic principle that irrigation services now need to be paid for by the users.** Irrigation prices are to comply with the provisions stated in the Law of Price and should include management costs, operation and maintenance expenses, depreciation charges, and other reasonable actual expenses, and also allow for profit margins which are deemed suitable to the marketplace. Affordability for users is to be considered when setting the price level. The state determines the price of irrigation services and products.

Irrigation fees will be either charged by VND/ha/crop or by VND/ $m^3$. Drainage of water for agricultural production in rural and metropolitan areas (except in urban areas) is charged as VND/task/ year. If tasks cannot be specified, the fee will be charged as VND/ha of drainage basin, but will not exceed 5% of the public irrigation product (Decree 96/2018/ND-CP).

MARD is currently working on a roadmap to implement Decree 96/2018/ND-CP. However, there are significant challenges which need to be addressed in order to be able to charge irrigation fees, notably the predominance of smallholders and the lack of water measurement technologies to name but two. Further, the question needs to be asked whether the irrigation fee should only target cost recovery, or whether it should also take on an incentive function to promote water use efficiency and sustainability.

**Environmental protection fees are levied on wastewater discharges.** This fee aims to limit environmental pollution caused by industrial and domestic wastewater; to promote water conservation; and to create a funding source for the Environmental Protection Fund. The fee concerns the discharge of wastewater into water bodies and is regulated by Decree 154/2016/ND-CP[4]. Entities discharging wastewater into centralized treatment systems and which have paid for wastewater treatment services are exempted (Article 4). The fee rate for domestic wastewater amounts to 10% of the selling price of clean water per $m^3$, VAT excluded (Article 6). For industrial wastewater, the fee rate is composed of a fixed fee of VND 1,500,000/year and a variable fee that is calculated on the basis of the total volume of effluent, and on the basis of the concentration and type of pollutants discharged. The variable fee rate (VND/kg) applies to the following pollutants: COD, TSS, mercury, lead, arsenic and cadmium. Industries discharging on average less than 20$m^3$/ full day are exempted from the variable fee and only have to pay the fixed fee.

The Environmental Protection Fee for Domestic Wastewater is collected by the water supplier, and if water is self-extracted, by the PPC. DONRE collects the fees for industrial wastewater. The water supplier and/ or the PPC shall retain 10% and 25% of the collected fees for domestic wastewater respectively to cover the fee collection expenses. DONRE retains 25% of the total collected fee from industrial wastewater to cover expenses for the fee collection, as

well as for the measurement, sampling and analysis of wastewater samples to verify the fee declarations; and for periodic and ad hoc inspection of industrial wastewater. The remainder of the collected fees are remitted to the local state budget. The fees are to be used for environmental protection, financing of the local environmental protection fund for the purpose of prevention, mitigation and control of environmental pollution caused by wastewater; and implementation of wastewater treatment methods and technology (Article 9).

**In practice, fees are not always charged or allocated as prescribed in the Decree**. Taking Bến Tre in 2016 as an example, the distribution of the collected fees did not reflect the requirements of Article 9. The revenues from the environment protection fees for domestic wastewater amounted to VND 5.1 billion. Of this VND 4.6 billion (90%) was transferred to the state budget, while approximately VND 510 million (10%) was retained in the local environmental protection fund. The revenues for industrial wastewater amounted to VND 1.8 billion. Of this, approximately VND 1.47 billion (82%) was transferred to the state budget, while approximately VND 330 million (18%) was retained in the local environmental protection fund. Thus, there was insufficient local budget for the mandated activities (PPC Ben Tre, 2017).

**Fines are levied on discharge of untreated wastewater into the environment.** MONRE/ DONRE, in cooperation with the Environmental Police set up under the Ministry of Public Security, are responsible for monitoring water quality and identifying violations to regulations. Once a violation is identified, the Provincial People's Committee is informed and takes action. Depending on the nature of the violation, a fine and additional penalties may be imposed, including a requirement for restoration or a suspension of operating licenses or permits, or a combination of these measures. As per Decree 155/2016/ND-CP, Article 4, the maximum fine that can be imposed on an individual for a violation of regulations on environmental protection is VND 1 billion, and for an organization VND 2 billion. The maximum fines for a violation of regulations on water resources, as stipulated in Decree 33/ND/2017 is VND 250 million for an individual and VND 500 million for an organization.

**Environmental protection charges for solid wastes are low, resulting in low waste collection rates and unhygienic landfills and causing serious pollution of both surface and groundwater.** Waste generators are to pay for waste collection, transportation and treatment service as prescribed by law (Decree No. 38/2015/ND-CP). However, for solid waste from households and public places, expenses for collection, transportation and storage of household solid wastes are offset by local budgets (Article 25). Households are required to cover only the solid waste disposal service (Article 26). Based on the practical situation of the disposal and destruction of solid wastes in localities, PPCs decide on adequate environmental protection charges. The government sets a ceiling on fees for households or individuals to cover part of the costs for collection of waste and transport to the transfer points. The fees are limited to 3,000 VND/person or 20,000 VND/family per month. The remaining costs, i.e. the costs for transporting wastes from the transfer points to the waste treatment place/landfill and the waste treatment costs are borne by the government. Given the very low fees, the government essentially provides subsidy for all the transportation and treatment of wastes. Because the revenue base is so weak, only 85% of urban domestic waste and 40-55% rural domestic waste is collected and very little is treated properly. However, the application of environment-friendly waste treatment technologies is encouraged in the Decree (Article 4).

**Vietnam was the first country in Southeast Asia to introduce a national Payment for Ecosystem Services (PES) law and has applied PES schemes to hydropower and water supply** (UNEP 2015). Article 74 of the Biodiversity Law 2008 states that "organizations and individuals using ecosystem services related to biodiversity shall pay charges to service providers". Thus, water utilities, hydropower and the tourism industry pay farmers and households located on forested land for the ecosystem services provided. In 2016, the existing decree on payment for environmental service was adjusted to provide for an increased fee of PES for hydropower and water supply (2030 WRG 2017).

The implementation of the scheme needs clarity on operational procedures. UNEP (2015) found that while PES was successful in providing a source of revenue for the state for forest protection, there were challenges of high transaction costs, distribution of funds, and the legal status of communities involved in the scheme (To et al., 2012; Suhardiman et al., 2013; de Silva, 2014). In addition, as the companies pay PES fees directly to the government, benefit sharing

mechanisms with community and affected households need to be further clarified (To et al, 2012).

### 6.5.3 Incentives for water conservation and protection activities are provided for in law but still need to be fully enforced.

**Decree 54/2015-ND-CP provides for incentives for water conservation activities for state agencies, organizations, households and individuals.** Water conservation activities covered under the Decree include measures and technologies to recirculate or reuse water, to collect rainwater, to tum brackish water and saline water into freshwater for use, and to conserve water in production, business and residential activities. Actors who engage in these water conservation activities are eligible to receive benefits in the form of soft loans in accordance with the law on State investment credit, together with exemption or reduction in business income tax in accordance with the law on taxes (Article 7).

**To implement this decree, the Government assigned tasks for relevant line ministries to issue guidance documents but these have not yet been published.** For example, MOF is to issue guidance on concessional loans and tax reduction and exemption, MOST is to issue standards for water saving equipment and technology, and MARD is to issue technical indicators and measures for water saving in agriculture. However, although the Decree has been in effect for over three years, these detailed guidance documents have not yet been issued. Therefore, water saving activities have not been encouraged and promoted.

Furthermore, provisions regarding water reuse and recycling have not been consistent between regulations on water resources and those on environmental protection. Enterprises are hesitant to apply water reuse measures for fear of being fined for violating environmental regulations.

Similarly, enabling policies for municipal wastewater treatment, environmentally friendly products and recycling facilities as regulated in the 2014 Law on Environmental Protection have not been detailed. Therefore, there has been little incentive for enterprises to protect and reuse water.

In addition to Decree 54/2015-ND-CP, the Government also issued Decree No. 77/2018/ND-CP on water conservation in agriculture, providing for the development of small-scale irrigation, on-farm irrigation, and advanced and water-saving irrigation and advanced irrigation. However, to date it has not yet been operationalized.

## 6.6 Enforcement of water pollution prevention and control is low, with negative impacts on Vietnam's water bodies

**Self-monitoring of wastewater discharge is required but fewer than half of industrial parks have installed the relevant equipment.** Enterprises are required to self-monitor their discharges and report these to VEA/ DONRE. Industrial clusters and zones, and other industries which have access to centralized wastewater collection and treatment systems and which have discharge of at least 1,000 $m^3$/day and night, must be equipped with an automatic and continuous monitoring system (Article 5 and 18, Circular 31/2016/TT-BTNMT). While the installation of the automatic monitoring systems is mandatory, the installation is still ongoing, with industrial clusters being fined if found without. It is estimated that by 2018 about 42% of industrial parks had installed automatic monitoring systems (Thoi Bao Tai Chinh 2018). The data have to be shared with DONRE. However, not all DONREs have the physical infrastructure or human resources, to receive, evaluate and act upon the monitoring results.

**The level and quality of inspection needs to be improved to strengthen compliance with regulations on wastewater discharge.** Currently, routine inspections need to follow the guidelines of the Law of Inspection. These state that there can be a maximum of one inspection per enterprise per year. These inspections are planned in advance and the enterprises and local government must be informed of the impending inspection. Thus, even if these enterprises were to be non-compliant all year round, it is possible that they could pass the inspection simply by showing compliance on the inspection day. This can incentivize enterprises to leave their wastewater treatments plants dormant during the year to save O&M costs.

Besides routine inspections, *ad hoc* inspections are possible in case of specific directions by the authorized high-level officials. These unannounced inspections may be triggered by media reports of non-compliance or by complaints by the community. These inspections, however, need to be conducted sparingly in order to avoid duplication of onerous inspections by multiple agencies which would create an excessive burden on enterprises. As a result, these provisions have not proved very effective. In addition, while the public have the option to raise a complaint to the PPC, there is no clear mechanism to escalate the complaint to higher levels in case there is no action following the complaint.

**Environmental policing is largely reactive.** In addition to DONRE, the Environmental Police, a specialized People's Public Security force, have the function of preventing, detecting, stopping and combating environmental crimes and environment-related administrative violations; and of taking the initiative and coordinating with other forces in preventing and combating crimes and violations related to natural resources and environment-related food safety. The Environmental Police and DONRE are required to coordinate with each other. However, the Environmental Police may only take action when signs of crime or administrative violation are directly detected, or when they receive reports on crimes or administrative violations (Article 7, Ordinance No. 10/2014/UBTVQH13). Thus, for the Environmental Police to take action, either the monitoring of wastewater quality by DONRE has to show a violation (with the challenges discussed above) or the impact on the environment has to be so obvious that complaints can be made by the public in general or by officials.

**The current institutional structure may – in some provinces – make it difficult for DONRE to fully perform its tasks for control and prevention of water pollution.** DONRE has to follow two lines of reporting - to MONRE and to PPC. DONRE follows MONRE in respect to technical guidance, but must refer cases of non-compliance to the PPC for action. Increasingly the PPC is found to value environmental compliance and protection alongside economic development. This should be increasingly promoted and incentivized to avoid a conflict of interest in which a PPC may favor economic growth over environmental compliance.

As the PPC allocates the resources and appoints DONRE staff, DONRE may not be in the position to insist on enforcing environmental regulation. DONRE's role needs to be strengthened to be able to reinforce the implementation of the law, monitor compliance, and take swift action in case of any non-compliant behavior.

**Limited surface and groundwater quality monitoring stations and databases do not allow for systematic identification of non-compliant polluters.** The water quality monitoring network is under-resourced and suffers from considerable under-investment. To cut costs, water quality samples are only taken twice a year from existing monitoring stations – once in the dry season and once in the wet season. Lack of monitoring limits the assessment on compliance of wastewater discharges, as well as the ability to calculate the carrying capacity of water bodies and to optimize the issue and regulation of wastewater discharge permits based on this (MONRE, 2018).

**Some environmental mandates of line ministries are overlapping, which creates challenges in enforcement.** Permits for direct discharges to water bodies are granted by MONRE, while permits for discharge to irrigation systems are granted by DARD/MARD. Thus, while MONRE is mandated to regulate environmental pollution of water bodies, some discharges are beyond its control and coordination and data sharing on the regulation of discharges between MARD and MONRE is limited.

**Some legislative documents overlap or do not allow for effective and efficient implementation.** Decree 03/2015/ND-CP provides a formula to calculate the compensation for environmental damage caused. However, due to its complexity, no environmental damage compensation cases have been conducted. In another example, Article 101 of the Environmental Protection Law (2014) states that enterprises without connection to a centralized treatment system have to have their own wastewater treatment plant. Particularly for small and medium sized companies, the requirement to install their own wastewater treatment plant, rather than having the option to share a wastewater treatment plant or buying the services of a larger wastewater treatment plant, is often too costly. As a result, compliance is limited.

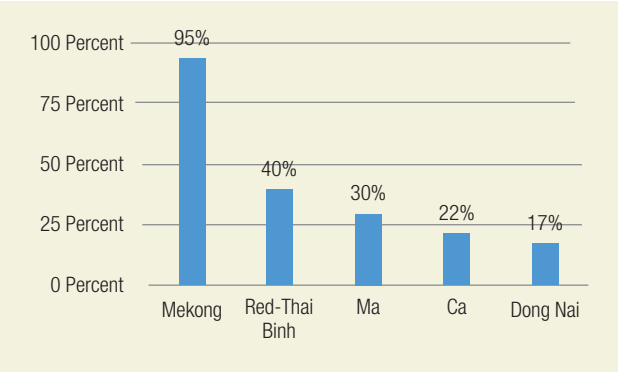
**The sources of finance for the Vietnam Environmental Protection Fund (VEPF) need to be strengthened.** Article 149 of the 2014 Law on Environmental Protection stipulates that funding sources for the VEPF include state budget, environmental protection fees and environmental damage compensation (see section 6.5). However, the Law on State Budget (2015) states that VEPF is a non-state budget financial fund. Therefore, VEPF is having difficulty in accessing resources. It is proposed that the 2014 Law on Environmental Protection should be revised by 2020, and strengthening of the VEPF could be included in this new legislation.

## 6.7 Are the mechanisms for handling transboundary issues working?

**While Vietnam is an upstream and downstream riparian country, the Mekong River is the only transboundary river in Vietnam with an agreement among riparian states.** Vietnam depends heavily on international rivers, with more than 60 percent of its total average yearly surface water discharge generated outside the country (see figure 6.3). For all but one of Vietnam's transboundary watercourses, there is little or no joint planning or management to optimize water resources at the basin scale and little consultation among riparians on proposals or their impacts. Only for the Mekong is there a transboundary agreement, signed in 1995 by Cambodia, Laos, Thailand and Vietnam on cooperative water use, together with an organization—the Mekong

River Commission (MRC) and the associated National Mekong Committees—to support implementation. The Mekong Agreement commits the countries to "cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin." The Agreement also contains important provisions for joint strategic planning, as well for notification and prior consultation on planned projects.

**FIGURE 6.3: Percentage of average annual surface water flows in river basins originating outside Vietnam**




*Source:* ADB 2009.

**Implementation of the Mekong agreement has brought tangible benefits to riparian countries in terms of information and risk management.** For example, in August 2000, discharge from the Yali Fall Dam on the Sesan River caused damaging floods in Cambodia. As a result, Vietnam agreed to change its release patterns, constructed the Sesan 4A regulating reservoir, and now shares planned releases with Cambodia during the flood season to prevent and mitigate potential impacts on Cambodia. There is also sharing of hydro-meteorological information for flood forecasting and for use in river basin planning through a shared basin model (MRC, 2017). Through the MRC, Vietnam and the other riparian countries have engaged in developing joint basin plans, as well as joint studies of impacts of proposed development of infrastructure along the Mekong. Cambodia and Vietnam are also engaged in identifying joint water management issues along their border areas in the Sesan, Srepok, and Mekong Delta areas and plan to agree on institutional mechanisms through which the issues can be further explored and resolved.

**However, despite these arrangements in the Mekong, challenges persist.** The two upper riparian states, China and Myanmar, participate in the MRC as "Dialogue Partners" but are not formal members. The construction of mainstream dams has been a contentious issue within the MRC. However, there has been formal consultation for the latest proposed mainstream dam with an agreed-upon approach to addressing potential adverse transboundary impacts (MRC, 1995). There is a risk that further development will affect water management in Vietnam (see box 6.7), particularly change and uncertainty over the timing of flows. In the longer term extensive development could have significant adverse impacts on the riverine ecology—the Mekong is the second most biodiverse river globally— and on ecosystem services more broadly. Strengthening mechanisms between the Mekong countries and finding new ways to broaden the dialogue among all riparian countries should be explored, as should ways to share benefits and minimize adverse impacts. This includes further bilateral work between Vietnam and Cambodia to find ways to address local water resources management issues in the Mekong, given Vietnam's unique role as an upstream and downstream neighbor to Cambodia. As development of the river increases, joint management and operation of the river will be increasingly important, and mechanisms for joint management should be investigated (MRC 2017a).

**Additional cooperation mechanisms among Mekong riparian states, also have the potential to address water-related challenges.** The Lancang-Mekong Cooperation Mechanism, covering China, Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, and Vietnam, was officially launched in 2016 and has established a "three + five" mechanism of cooperation, referring to the three cooperation pillars – political and security issues, economic and sustainable development, and cultural and people-to-people exchanges – and the five key priority areas of connectivity: production capacity, cross-border economic cooperation, water resources, agriculture, and poverty reduction. Based on the Lancang-Mekong river area, the Mechanism has also set up the Water Resources Cooperation Center, Lancang-Mekong Environmental Cooperation Center and the Global Mekong River Studies Center, to protect the water resources and environment in the region (CSIS 2018; Xinhua Net, 2018). In addition, in 2014 Vietnam ratified the Convention on the Law of the Non-Navigational Uses of International Watercourses.

**Because of Vietnam's high dependence on transboundary flows, cooperative arrangements should be negotiated on other rivers too.** For Vietnam, the risk of dependency on other countries is greatest in the Mekong and Red–Thai Binh Basins because such large proportions of river water are outside Vietnam's control. There is a need to establish transboundary mechanisms on the Red–Thai Binh and other shared river basins, looking at benefit-sharing arrangements that involve water availability (quantity) and benefits beyond the river (including hydropower and flood control).

## BOX 6.7: Plans for upstream hydropower dam construction on the Mekong River present risks

Upstream riparian countries on the Mekong River have invested in many infrastructure projects and are planning more, particularly hydropower projects that will change the flow regime and reduce quantities through evaporation. The 11 hydropower dams planned in Cambodia and Lao People's Democratic Republic, in addition to those planned in China, will have additional adverse impacts on river flows, sediment loads, and fish biomass.

Aside from evaporation from the reservoir pool, the risk from hydropower dams is not an overall reduction of river flows from the mainstream dams, as the dams are not for consumptive use. In fact, the production of hydropower actually gives an incentive to pass the water downstream rather than to consume it for irrigation. The issue is more the change in timing of water flows.

The Mekong River Commission (MRC) completed a cumulative impact study in 2017 on the consequences of current and planned water resources development projects in the Lower Mekong Basin (MRC, 2017a). It assessed three main water resource development scenarios over a 24-year period: 2007 early development scenario (baseline); 2020 definite future scenario, which includes all existing, under-construction, and firmly committed developments; and 2040 planned development scenario, which includes developments planned for implementation by 2040, in addition to the 2020 developments.

The study predicted that hydropower development plans will increase energy security and contribute to economic growth but that these benefits will also cause substantial losses in ecosystem services, many of which are transboundary. The highest sectoral GDP growth comes from hydropower development, driving 43–49 percent of the economic benefits. However, the negative effects on fisheries cuts the hydropower gains by about 26 percent in the 2020 scenario and by about 41 percent in the 2040 scenario. Potential mitigation measures for all planned dams could reduce the negative effects on fisheries to 11 percent.

A report from MoNRE prepared by Henningson, Durham and Richardson and the Danish Hydraulic Institute in 2015 quantified the impacts of the proposed 11 hydropower projects for the Mekong Mainstream in the Lower Mekong basin as follows (HDR&DHI, 2015):

- While low to moderate changes in the flow regime are expected in a normal hydrological year, high to very high short-term adverse impacts are expected in the dry season due to drawdowns for maximum power production and to dam hydropeaking operations.
- Sediment and nutrient deposition are predicted to decrease by up to 65 percent at Kratie and Tan Chau-Chau Doc - downstream of Sambor Dam - and by smaller amounts off the mainstream. This can potentially cause a substantial decline in biological productivity, a reduction in agricultural production, an increase in erosion, and a decrease in the build-up of riparian and coastal sites. As a result, salinity intrusion is expected to increase in some coastal areas.
- Mainstream and tributary routes for migratory fish are likely to be obstructed, leading either to their extinction or to a collapse such that they would no longer be considered an important catch by fisheries. These fish account for about 74 percent of the catch of the 10 most important commercial fish species. Cumulated with other impacts from the hydropower cascade, this would cause about a 50 percent loss in fish yields for Cambodia and Vietnam, with implications for food security and livelihoods of large segments of the population. In addition, several species would die out in the river, including the last of the 100 or so remaining Irrawaddy dolphins, a bellwether species that reflects the health of the river.
- Agricultural productivity is expected to be affected in areas along the mainstream branches of the Mekong due to retention of sediment and nutrients by the hydropower dams.
- Losses from agriculture and fisheries would amount to over US$760 million (VND15.8 trillion) annually in Vietnam alone. Households are expected to be affected either directly through reduced income (farmers, fishers) or indirectly through reduced protein (fish) availability. The impact on the incomes of affected producers is estimated at around 50 percent.

Close cooperation between the MRC member countries is key for reducing potential negative impacts of any given project. The MRC states that benefit-sharing agreements should be designed as cross-sectoral mechanisms and not as compensation schemes across countries because the winners (for example, energy companies) and losers (for example, fishing house-holds) are in all four countries.

Source: Mekong River Commission (MRC) 2017a; Mekong River Commission (MRC) 2017b; HDR and DHI 2015.

## 6.8 The basic building block for planning is information; the process has been started, but the data are still lacking

### 6.8.1 An initial database for water resources has been established

**In 2017, MONRE issued Circular 47/2017/TT-BTNMT on supervising extraction and use of water resources.** This circular specifies requirements for developing a database shared between the national and local levels and within river basins. The circular requires timely and continuous provision of integrated data between national and local levels, together with sharing of information and data between water extraction organizations, water users, and state management agencies.

**MONRE is responsible for investing and developing database management systems at the national level, and PPCs at the local level.** At present, MONRE is developing an online system to monitor and manage surface water and groundwater resources and their extraction and use. The system is also designed to monitor water discharge into auxiliary water courses in order to supervise compliance with water resources licenses and to support management and guidance relating to water resources. This system is estimated to commence its operation by the end of 2019. PPCs are responsible for the database at the local levels. Water extraction organizations are responsible for investing in and installing equipment for connecting and transmitting data to the monitoring database systems.

**A database on water quantity and quality is being constituted.** Between 2013 and 2018, water quality and quantity monitoring has been strengthened at both national and local level. At the national level, MONRE maintains regular surface water monitoring in 360 stations with a frequency of 4-5 times per year. These stations are located in nine river basins, namely Cau, Nhuệ - Đáy, Hồng – Thái Bình, Mã Chu, Cả - La, Vu Gia – Thu Bồn, Sesan – Srepok, Đồng Nai, and the Southwest region. There are seven cross-border water monitoring stations between China and Vietnam. In addition, MONRE maintains about 820 groundwater monitoring stations (MONRE 2019b). Other ministries conduct ambient environment quality monitoring with about 100 surface water monitoring stations in urban areas and industrial zones with a frequency of 3-6 times per year. At the local level, most provinces have approved environmental monitoring systems or provincial action plans for environment monitoring, including surface water and groundwater. In addition to regular monitoring systems, ongoing automatic monitoring networks have been upgraded at both national and provincial levels. There are 23 surface water real time automatic monitoring stations at the national level and 80 stations at the provincial level.

**A wastewater discharge database is in place for three inter-provincial basins and there are plans for its expansion.** The Vietnam Environmental Agency under MONRE has established wastewater discharge databases for the interprovincial river basins of Cầu, Nhuệ - Đáy, Đồng Nai. The databases are available in the VEA portal.[5] Although some data have been collected for other interprovincial river basins, a database has not been established comparable to those for the three river basins mentioned. In early 2018, the Prime Minister issued Decision 140/QD-TTg dated 26/1/2018 approving the project called 'Inventory, assessment, classification and development of national database of waste discharging sources', which is to be implemented between 2018 and 2020. Its objectives include establishing reliable, updated, sufficient, timely, united databases nationwide, connected to the environmental database for state management and scientific purposes.

**Databases on other water-related activities are also maintained.** In addition, databases on water extraction works, activities discharging into waterbodies, permits (water extraction permits, discharge permits) and projects on the rivers and riverbanks have been developed.

### 6.8.2 There is a pressing need to strengthen information to allow for informed decision-making

**Water resources management is a knowledge-based activity constrained by lack of information.** Vietnam lacks the data and modern modeling and management tools needed to manage its water resources. Virtually all water planning tasks have come up against the lack of reliable data and of the skills and tools needed to turn data into information to support planning and decision making. The 2012 Law on Water Resources assigns several data-related tasks to MONRE (see box 6.1).

**Even if data exist, information sharing faces challenges.** Two key bottlenecks have emerged: the widespread reluctance of organizations to share what data they have[3] and the requirement under the 2012 Law on Water Resources that users of information on water resources pay for it (see paragraph 8.3). There is a lack of a united database on water resources to be used consistently from the national to the local level.

Water data are scattered among ministries and localities, posing difficulties in management. Except from database sharing between MONRE and reservoir operators subject to inter-reservoir procedures, there has been little information sharing on water extraction, use, permit granting, planning and projects in and around rivers among different stakeholders. A strong knowledge base, sound management tools, and more open access need to be developed for water resources management up to the basin scale.

**Investments in data gathering need to be completed, and data need to be transformed into information and made available to everyone who needs it.** There has been external support for collecting data, including to MoNRE's hydro-meteorological network and centers (see box 6.8). However, the networks remain incomplete and do not cover the full range of hydro-meteorological, surface water, and groundwater monitoring requirements. Due to limited budgets, the database is not updated and lacks necessary data input, failing to meet demands from management agencies and the society. Chapter 7 (7.4.2) below makes recommendations on strengthening the national water information system.

### BOX 6.8: World Bank support for water resources information

Under the 2012 **Mekong IWRM Project** (US$26.59 million), significant investments are being made to construct the water resources monitoring network and water resources management database in the Sesan-Srepok basin, to measure water flow and quality. The investment is in the mainstream Mekong, Sesan, and Srepok as well as 10 other major tributaries shared with Cambodia. The project is also establishing a water resources information system for the Mekong Delta and supporting regional integration of forecasting and early warning in the Lower Mekong.

The 2012 **Managing Natural Hazards Project** (US$ 150 million) is supporting the national hydro-meteorological center and all nine of the regional hydro-meteorological centers. The architecture and design for an integrated hydro-meteorological system have been developed in 2016, and equipment is being acquired (meteo stations, rain and water gauges, flow and sediment monitors). A high-capacity computer system is being installed and a forecasting model and integrated forecast and early warning tools are being developed.

The **Dam Rehabilitation and Safety Project** is installing hydro-meteorological stations in the Vu Gia–Thu Bon and Ca basins.

The **Vinh Phuc Flood Risk and Water Management Project** will establish water monitoring and hydro-meteorological systems in the Pham basin.

The **Mekong Delta Integrated Climate Resilience Project** will support the Ministry of Natural Resources and Environment's surface water and groundwater monitoring as well as a water information function embedded in the proposed Mekong Delta Center.

*Source:* World Bank 2013; World Bank 2018c.

## Notes

1. See Prime Minister's Decisions 171/QD-TTg dated 14/11/2007 for Cau River Basin, 1404/QD-TTg dated 31/8/2009 for Nhue-Day River Basin, and 157/QD-TTg dated 1/12/2008 for Dong Nai River Basin.
2. Decree 201/2013/ND-CP, Article 28, specifies in what instances MONRE or PPC provide licenses and thus also charge the water abstraction charge.
3. Charges are based on Decree 117/2007/ND-CP on Clean Water Production, Supply and Consumption and Decree 124/2011/ND-CP which amends and supplements some articles of Decree 117/2007/ND-CP, as well as on Circular 88/2012/TT-BTC from the Ministry of Finance
4. It was previously regulated by Decree 67/2003/ND-CP and was replaced when Decree 154/2016/ND-CP came into effect in 2017.
5. The portal can be accessed via http://lvscau.cem.gov.vn

7

# Initiatives for Strengthening Water Resources Management

*Key issue*

- Under the business-as-usual approach, stresses will grow worse, with the costs of inaction climbing to as high as 6 percent of GDP by 2035.

*Actions, feasibility, and priorities*

- Integrated water resources management has been adopted to deal with solving the extreme water-related risks to which the Mekong Delta is vulnerable. Now, Vietnam needs to move forward on integrated management and the basin approach, adapting them to the challenges of each basin.
- Science, information, and institutional capacities need to be strengthened, with all stakeholders involved.
- The region-wide planning approach being pursued for the Mekong Delta may produce valuable lessons for other basins.
- Nationwide, multiple demand management measures could ease water stress and help balance supply and demand.
- Aligning public spending with basin planning could facilitate integrated approaches.

## 7.1 New initiatives in basin planning may show the way forward

**Vietnam has long recognized the importance of integrated water resources management (IWRM).**The institutional and governance framework for water resource management has evolved in response to growing challenges. Two decades ago, the government adopted IWRM as the basis for water resources planning, development, and management (see section 6.4.1 in chapter 6). The legal framework supports integrated management. The 2012 Law on Water Resources mandates integrated management of the resource. The National Strategy on Water Resources to 2020 confirms that "water resource management must be implemented in an integrated manner on a river basin basis without division by administrative boundaries". Recent initiatives in the Mekong Delta are testing pathways toward a multi-sectoral IWRM approach but are also revealing considerable remaining challenges (World Bank 2016a; GoV 2017b).

### 7.1.1 Prioritizing the Mekong Delta

**IWRM has been adopted as an approach to solving the extreme water-related risks to which the Mekong Delta is vulnerable.** The Mekong Delta—almost 40,000 square kilometers ($km^2$), the size of Switzerland or the Netherlands—is home to 17 million people. The delta produces most of the rice grown in Vietnam and is one of the largest rice production areas in the world. But it is highly vulnerable to water-related risks, including

droughts, water pollution, landslides, and river bank and coastal erosion, as well as to the impacts of climate change. It faces rising sea levels, a decrease in river discharge, saline intrusion, falling water tables, and periods of drought and water shortages (2030 WRG 2017). The government has determined that IWRM can offer a solution and is developing a more holistic and spatially integrated vision by trying to develop multi-sectoral long-term plans for managing water and land resources in the delta (World Bank 2016a; GoV 2017b).

**Planning has been under way since 2011.** Recognizing the scale of the challenges, the government began the Mekong Delta Plan in 2011 (GoV 2014). Over 2011–2013, a team of international and local consultants financed by the Dutch government worked under the guidance of the Mekong Delta Committee (MDC) and the Deputy Prime Minister, Mr. HE Hoang Trung Hai, to prepare the plan. At a total cost of €1.3 million, the Mekong Delta Plan describes the strategic vision for the delta until 2100 and calls for the industrialization of agriculture, the sustainable use of land and water, and planning based on a shared framework. The plan was adopted as a reference document, meaning that it is not legally binding.

### 7.1.2 Implementing the Mekong Delta Plan

**Given the major constraints of inadequate knowledge and the inherent difficulties of a multi-sectoral approach, the government negotiated the US$387 million Mekong Delta Climate Resilience and Sustainable Livelihoods Project with the World Bank in 2016 to support water sector planning and investments within a broader delta-wide planning process.** A significant challenge is the sheer complexity of the problems, which are very different in the three hydro-ecological zones in the delta:

- In the upper delta, the main challenge is managing floods. The primary objective is to reclaim and protect the benefits of controlled flooding while increasing rural incomes and protecting high-value assets.
- In the delta estuary, the current system of polders to control saline water intrusion has become unsustainable because of reduced dry-season water availability and sea-level rise. The main objective is to address salinity intrusion and coastal erosion while promoting sustainable aquaculture and climate-smart agriculture.
- In the delta peninsula, the priority is to protect coastal areas. The objective is to address the challenges of coastal erosion, groundwater management, sustainable aquaculture, and improved livelihoods.

**The Mekong Delta Climate Resilience and Sustainable Livelihoods Project takes a pragmatic approach.** Its water sector components take a good practice, multi-sectoral, participatory approach based on sound science to demonstrate how strategic, evidence-based multi-sectoral solutions can be planned and implemented from a basin perspective. The Ministry of Natural Resources and the Environment (MONRE) implements the knowledge component to enhance the information systems needed to support evidence-based planning and decision making. This includes monitoring systems and decision support tools. Building on this knowledge base, MoNRE will develop the institutional arrangements and road map for building provincial and district planning capacity for sustainable delta wide water resources management and development. The Ministry of Agriculture and Rural Development (MARD) will mount climate-resilient economic projects, seeking opportunities for "low-regret" investments and scaling-up of smaller, successful pilots. This approach is expected to scope out possible longer-term development options (to be financed under future phases) and to demonstrate how multi-sectoral solutions can be implemented.

**Implementation has begun.** MoNRE, with support of consultants, is preparing a decision support system and a comprehensive water resource inventory (Delta Atlas). MARD, with support from consultants, is identifying candidate pilot projects. However, progress is slowed by the budget constraints related to the national debt ceiling.

## 7.2 Scaling up the planning approach

**The government has put in place new arrangements for coordinating and incentivizing development across provincial lines.** In April 2014, to improve coordination of development of the Mekong Delta, the Prime Minster issued Decree 593 providing for region-wide planning and cross-provincial investments that are targeted to receive a supplementary 10 percent of the required investment budget as an incentive.

**Subsequently, the government designated the Ministry of Planning and Investment (MPI) to**

**coordinate development planning for the delta.** Resolution 120 of November 2017 (GoV 2017) spells out the policies for developing the delta: green growth and private financing for production and infrastructure projects, with public finance reserved for public good and interprovincial projects (see box 7.1). A new element is the assignment of specific roles to each sector ministry and a coordinating role to MPI.

**Under this coordinating role, MPI is launching a comprehensive multi-sectoral planning exercise for the delta.** At the request of MPI, World Bank financing of US$10 million was included under the Mekong Delta Climate Resilience and Sustainable Livelihoods Project to finance integrated master planning for the delta region across all sectors. MPI is the implementing agency for this component of the project. Consultation on the integrated master plan has begun with a workshop; terms of reference are under preparation.

**BOX 7.1: Resolution 120 spells out policies for developing the Mekong Delta**

**The Ministry of Planning and Investment (MPI)** is to develop the framework to encourage private investment and prioritize public investment. To support mobilization of private finance, MPI will develop mechanisms for mobilizing resources such as mechanisms of capital borrowing, issuance of bonds, and public–private partnerships, and will encourage participation of enterprises and people in infrastructure development. That requires prioritizing state capital sources for inter-regional and interprovincial projects, multipurpose projects, projects combining transportation and irrigation, and projects promoting smart use of water to mitigate the effects of climate change and tackle water-related natural disasters.

**The Ministry of Agriculture and Rural Development (MARD) is to support agricultural modernization and attract private investment.** MARD will develop "breakthrough" policies and mechanisms to develop large-scale, highly competitive agricultural production; encourage private investment; develop value chains; and promote on-farm and post-harvest value added.

**The Ministry of Industry and Trade (MoIT) will support green industries and low carbon and renewable energy.** MoIT will prioritize the development of green, low-emission industry; limit new coal-fired facilities in the delta; convert existing plants to cleaner technologies; and promote renewable sources of energy.

In addition, MARD will develop the following plans:

- Plan for Coastal Protection, which consolidates and upgrades the coastal dyke system and prevents and controls coastal erosion, with a focus on immediate handling of serious river bank landslide and coastal erosion.
- Master Plan on River Training, which is associated with the Master Plan on Land Use along the river, designed to save space for flood drainage and construction of traffic works associated with dykes.
- New rural area development plans to reduce exposure to flood and erosion near critical river stretches.

*Source:* GoV 2014b; GoV 2017b.

**This region wide approach holds considerable promise for integrated water planning and management.** Among the innovations:

- Inter-sectoral and inter-ministerial planning is being piloted by MPI that is also linked to the government's financial resource allocation nexus.
- Incentives are offered to the 13 provincial people's committees (PPCs) in the delta to buy into multi-provincial investments.
- Water sector planning is set within the larger framework of region-wide spatial and socio-economic planning.

## 7.3 Stepping up to the priorities

### 7.3.1 The integrated management and basin approaches need to be reinvigorated

**Despite lackluster past performance, there is a good case for setting up empowered river basin organizations (RBOs), starting with the Sesan-Srepok Basin.** Such initiatives in the past have had little success. Today, with the rapid increase in problems and risks, there is a good case for setting up empowered RBOs, and the government has plans for this on the table. The most advanced is the proposal for the Sesan-Srepok basin, in the pipeline since 2013 and supported under a World Bank-financed project. The design of

the proposed RBO is now complete, and a decree setting out the framework for RBOs has been prepared and is awaiting approval by the Prime Minister. The next step is implementation.

**Lessons from the Mekong Delta on integrated planning could be applied to other basins.** With World Bank support, the government is embracing the massive challenge of basin planning in the Mekong Delta. If this challenge is met, it should show the way to meeting other, lesser challenges. The Mekong Delta Initiative (along with that for the Sesan-Srepok) needs to be followed closely, with lessons applied elsewhere.

**The science needs to be strengthened—"you cannot manage what you cannot measure."** High-quality and timely water data need to be built up to support planning and decision making. Areas for consideration include strengthening the hydro-meteorological system and linking it to basin and national water information systems, with open access; building a data and information program for climate change (including regional cooperation); and developing a national water research plan. This knowledge base could be accompanied by developing or strengthening decision-support tools, including models and tools for integrated management of river flows. Much has been done. Still needed is completion of networks, at least in priority areas; real-time monitoring; and strengthening of national and regional hydro-meteorological centers, with information management and open access—for example a public portal.

**Institutional capacity building is needed, and all water stakeholders at the central and decentralized levels need to be involved.** RBOs, whatever their form, need to be adequately staffed and financed. Capacity of public organizations for basin planning needs to be built at central and decentralized levels. The capacity of stakeholders at the local level to participate, particularly local government and communities, also needs to be developed by providing means for their participation and mobilizing and empowering them to participate in sustainable water development and management.

### 7.3.2 Challenges are diverse, requiring adapted, integrated approaches

**Vietnam's four largest rivers—Mekong, Red–Thai Binh, SERC and Dong Nai—which account for 80 percent of the country's water resources, face challenges and risks of extraordinary complexity.** The high level of development, the large size of the population, and the socioeconomic importance of the Mekong raise complex issues of international cooperation; watershed management; spatial planning; complex hydropower cascades (there are more than 7,000 dams on the river); massive diversions to meet the demands of settlements, agriculture, and industry; contaminated return flows and pollution; and emerging environmental risks such as salinization, saline intrusion, and groundwater depletion.

**Institutional arrangements to manage this complexity are equally demanding.** There are a host of central and decentralized political and executive bodies, each with its own vision and powers. The challenge of developing an integrated approach to land and water management in a river like the Mekong which stretches across six countries and 13 Vietnamese provinces is formidable.

**Many of the challenges result not from exogenous factors like climate change but from past choices about development and management of natural resources.** In these vast basins, there is an impact from naturally occurring changes such as increased variability in the intensity and timing of precipitation. However, the challenges and risks are predominantly human-caused, resulting from choices about development and management of the resource and the institutional mechanisms established to implement them. As an illustration, the disastrous flooding in the Mekong Delta in 2008 occurred in a year when precipitation throughout the basin was no different from the long-term average. The floods resulted not from climate change but from patterns of development of land and water and the failure of institutional measures to manage the resulting risks (World Bank 2013).

**Smaller basins face less complex problems but have greater vulnerability to risks from scarcity and extreme events.** Many of Vietnam's rivers have much smaller catchment areas than the Mekong. While less complex, the challenges and risks of these smaller basins are equally pressing for the local population and their livelihoods. Box 7.2 illustrates the challenge of the relatively small Cai River Basin (4,000 $km^2$, about the size of Rhode Island). This is a steep-sided basin, descending from 1,600 meters right down to sea level over a short distance, rainfall is largely concentrated as relief rainfall in the upper part of the catchment, and downstream areas are highly sensitive to variations in precipitation and runoff. Variations in rainfall patterns have resulted in a series of droughts and floods that have had a severe impact on livelihoods and assets downstream (WPP 2017).

**Smaller basins also face different institutional challenges.** Almost the entire catchment of the Cai River lies within a single province (Ninh Thuan). Thus, public awareness of the problems is directly linked to their physical causes. The PPC responsible for water management is highly motivated but lacks the skills and resources to respond adequately. The local

departments of MONRE, MARD, and the Ministry of Construction (MoC) provide varying levels of support and interagency cooperation. Even in a basin as small as Cai, solutions are complex and the PPC will need considerable assistance to implement them.

**The lesson is that integrated management is the appropriate approach in all cases but that responses have to be adapted to the challenges.** At the scale of very large basins, the approach has to work across international and interprovincial jurisdictions to respond to extraordinarily complex challenges of land and water development and management. Within smaller basins, challenges, technical responses, and administrative delivery are less complex, but no less vital to socioeconomic development.

### BOX 7.2: Managing water and risks at the basin scale in Ninh Thuan Province

The principal river of Ninh Thuan Province is the Cai (or Dinh) River, with a drainage area of 3,958 square kilometers. The watershed, which lies almost entirely within the province, descends from 1,600 meters to sea level over a short distance. Development has been extensive, with six hydropower plants and 21 irrigation dams and reservoirs supplying 77,500 hectares of irrigated agriculture.

There is not enough water in the basin to meet growing demand. It is also vulnerable to two contrasting climate-related risks. High flows in the rainy season result in devastating flash floods in the lower section of the basin, causing heavy impacts on the fragile urban infrastructure and on risk-prone settlements along the coast. Since 2014, the province has also suffered cycles of severe drought, which adversely affect agricultural production, economic development, and the daily life of its inhabitants. In 2015, reservoirs dried up almost completely, with water levels falling below 10 percent of their design capacity. Farmers abandoned the summer-autumn rice crop on over 10,000 hectares, many livestock perished, and thousands of households experienced drinking water shortages.

With World Bank support, the province has been studying ways to improve the situation. The emerging (provisional) recommendations are:

- Strengthen water governance by better defining the roles and responsibilities of agencies and getting them to work together within an integrated plan.
- Improve water resources monitoring and develop a water resources information system and flood and drought forecasting and early warning system.
- Improve the operational capacity of reservoirs to ensure drought and flood preparedness and develop new storage capacity upstream to better manage drought and flood risk.
- Improve agricultural resilience and boost farmers' incomes by increasing water productivity and managing risks of water scarcity. This involves changing cropping patterns, with less water devoted to rice and more to higher-value crops, and adopting water-saving technology, notably drip irrigation.

*Source:* Water Partnership Program (WPP) 2017.

**In all cases, the right balance between institutional and infrastructural responses needs to be found.** Infrastructure responses may be only part of the solution, and dams and reservoirs do not necessarily require large, multiannual storage capability. In the case of Ninh Thuan, for example, the optimal patterns are relatively large inter-annual storage upstream and small, local inter-seasonal storage close to the irrigation perimeters in the lower reaches. In other areas, increased conjunctive use and recharge of aquifers may be the least-cost solution.

### 7.3.3 Multiple demand management measures could ease water stress and help balance supply and demand

**The 2030 Water Resources Group (2017) study found that an IWRM approach applying up to 24 demand management measures could close emerging supply– demand gaps and reduce water stress at the basin scale** (2030 WRG 2017). The study identified four major basins where demand was growing and likely to outstrip supply in the dry season by 2030: Red–Thai Binh, the South East River Cluster (SERC), Dong Nai, and Mekong. It examined the possible impact of 24 agricultural, municipal, and industrial measures to identify the most cost-effective solutions to close the identified water supply–demand gap in SERC and to move all four basins to a low water stress status. The study also made a rough estimate of possible costs (see figure 7.1). The study found that in three of the four basins, demand management measures could keep the basin resources in balance through to 2030 and that only in the SERC Basin would supply enhancement measures also be needed (see box 7.3). The study also described four technical options with potential high impact (see box 7.4).

## BOX 7.3: The emerging gap between supply and demand in the Red–Thai Binh basin through demand management measures in agriculture, municipal, and industrial water use

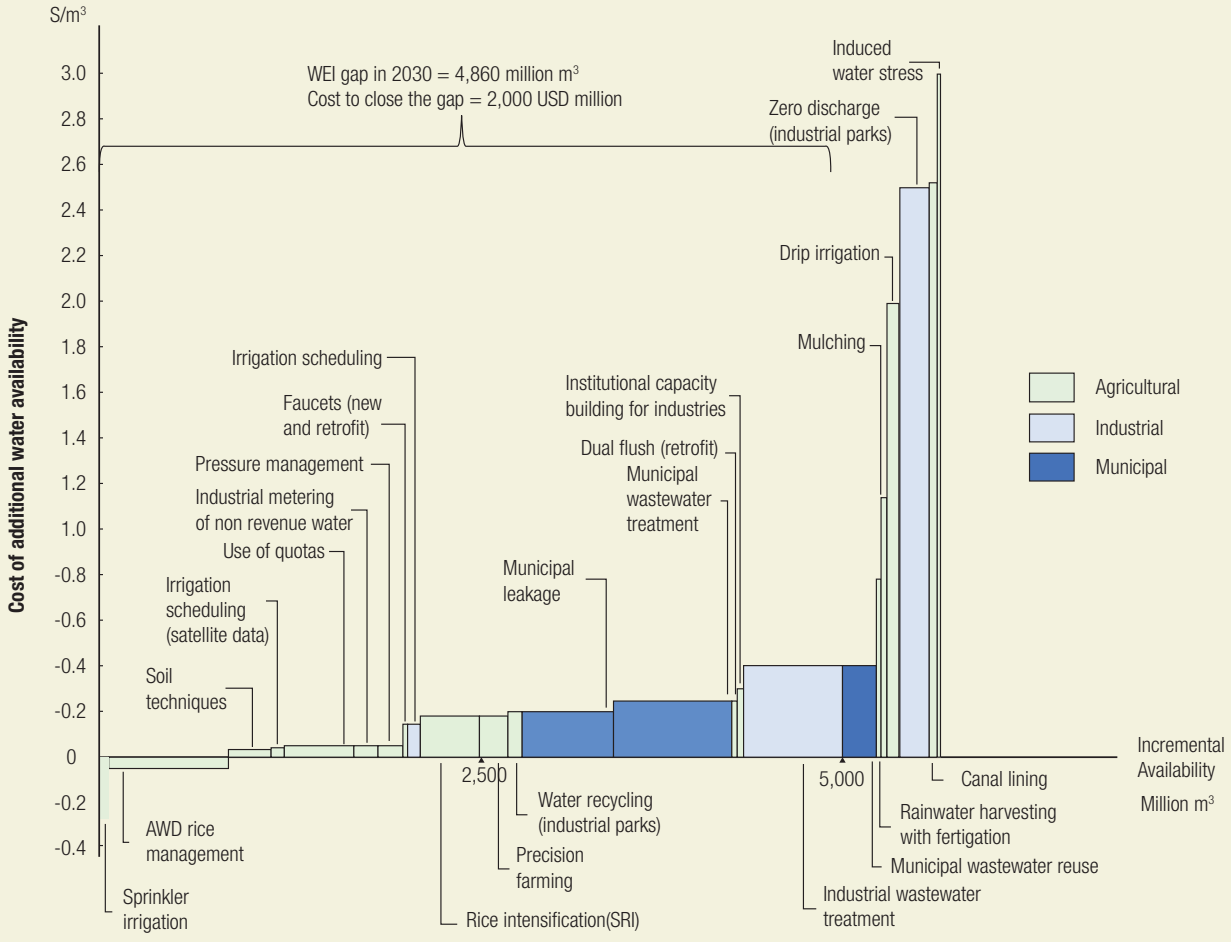
The Red–Thai Binh is a diverse river basin with 15 percent of Vietnam's rice irrigation. It is home to booming industrial areas, craft villages, and large urban conurbations such as the capital, Hanoi.

The 2030 Water Resource Group study forecast that under business as usual the Red–Thai Binh basin would be water stressed (Water Exploitation Index = 27 percent) during the dry season by 2030. The study forecast that a reduction in water demand of 4.9 billion cubic meters annually would be required to move to a low water stress status.

The study calculated a cost curve that ranked feasible measures to reduce demand in the basin. The least-cost measures are on the left in the figure below and the costliest are on the right. The width of each column measures how much water the measure would save, and the height of the column measures the cost for each cubic meter of water saved. The cost curve thus allows policy makers to prioritize the demand management measures that will save water most cheaply.

In the Red–Thai Binh Basin, agricultural measures are the most cost effective (with costs ranging from zero to less than US$0.1 per cubic meter), including sprinkler irrigation, alternate wet and dry (AWD) rice management practices, no-till agriculture and irrigation scheduling, management of evapotranspiration using quotas, and system of rice intensification practices. If all these measures were applied throughout the basin, the study estimates that around half the water gap could be closed. Less cost-effective municipal and industrial interventions, at an estimated US$0.2–US$0.4 per cubic meter, are required to fully close the annual water gap. Reducing the basin's water stress level to low would cost an estimated US$2 billion in all.

**Red–Thai Binh River basin cost curve of solutions to reduce water stress in the dry season in 2030**




*Source:* Adapted from 2030 WRG 2017.

*Note:* WEI is the Water Exploitation Index.

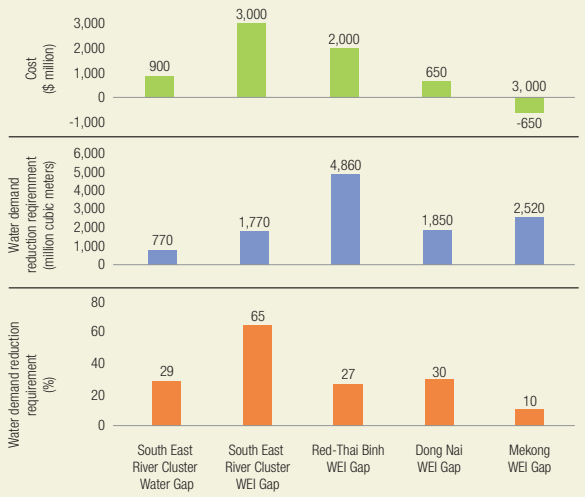
### BOX 7.4: High-impact technical options

The 2030 Water Resources Group study examined in depth four technical options that can be expected to have a high impact on reducing water stress:

- **Improved irrigation scheduling,** for example, "induced water stress" for coffee. This has the potential to reduce total water demand for coffee by up to 25 percent while sustaining or even increasing yields and farmers' incomes.
- **Alternate wet and dry (AWD) rice management practices,** which have been shown to reduce water demand for the country's most water-intensive crop by 30 percent (saving up to 20 billion cubic meters annually), while increasing farmers' profits. AWD could be applied on up to 4 million hectares.
- **Reuse of treated municipal wastewater,** which has the potential to increase urban water supply and reduce both pollution and water stress in some cities to low levels.
- **Treatment of wastewater from industrial clusters in specific "hot spots,"** which can considerably improve surface water quality and also create scope for public–private partnerships, for example, by commercializing central effluent treatment plants and industrial water reuse systems.

*Source:* Adapted from 2030 WRG 2017.

**FIGURE 7.1: Overview of water demand reduction requirements in key economic river basins and associated indicative cost**




*Source:* 2030 WRG 2017.
*Note:* WEI is the Water Exploitation Index.

#### 7.3.4 Aligning public spending with basin planning

**Aligning public spending on water with basin plans could ease coordination challenges among sectors and between the center and the provinces.** The use in the water sector of instruments recently adopted for planning public expenditures could facilitate a multisectoral approach in well-constructed basin plans. The government is adopting a more unified planning and budgeting process to make horizontal and vertical integration easier for planning and management. In particular, the new five-year Medium-Term Investment Plan could help integrate sectoral and subnational priorities with national priorities in basin plans. Experience with these instruments shows that they work best when there are clear sector strategies, a consolidated investment framework (also with clear sector priorities), and well-prioritized principles and guidelines.

**This approach could help in prioritizing investment planning.** Although improved water management will depend on the kinds of governance improvements discussed in this Report, strategic investment will also be needed. Even in the Ninh Thuan basin (see box 7.2), new storage capacity may be required alongside management measures. Streamlining public spending in basin plans could help prioritize the further infrastructure investments that will certainly be needed.

## 7.4 Priority actions for government consideration

The government may wish to consider the following priority actions in four key areas.

#### 7.4.1 Developing basin-level institutional approaches

**Experiences in several river basins could show the way to effective basin governance arrangements.** Vietnam is acquiring experiences of basin institutions and planning, at the largest scale in the Mekong Delta, at the meso scale in the Sesan-Srepok Delta, and at the intra-provincial scale in the Cai River in Ninh Thuan. An evaluation of these efforts could allow Vietnam to define the institutional and technical methodology for effective institutional arrangements and planning at basin level, perhaps starting with hot spots and priority basins.

**More effective basin-level governance institutions could be built up from these experiences.** Basin- and watershed-level governance institutions provide a forum and framework to address inter-sectoral and inter-jurisdictional issues like infrastructure planning, water allocation, flow management, pollution, and flooding. Vietnam's existing institutions already do some of this, but further institutional development could strengthen effectiveness in key areas.

**There are international good practices in developing a multi-stakeholder framework for horizontal and vertical collaboration in integrated planning.**

Essentially, an institutional structure is needed to serve as a forum to improve policy coordination and cooperative action—horizontally across sector agencies and vertically between central and local governments—to achieve common basin objectives and targets. Vietnam could consider six key points in developing this institutional structure:

- **Establishing or reconfiguring multi-stakeholder RBOs:** Existing structures (see chapter 6) could be strengthened or new ones created with expanded representation, for example, to include provincial and local government representatives, industry, commerce, irrigators, and civil society stakeholders such as environmental nongovernmental organizations (see box 7.5). The role of these organizations vis-a-vis territorial jurisdictions—provinces, districts, municipalities— would need to be defined, and their legal standing and powers in the basin defined and strengthened.
- **Defining the roles of the different ministries within RBOs:** Within the basin and the institutional structure, clarity on the roles and responsibilities of the ministries is needed, in particular for integrated management of water quantity and environmental health.
- **Providing technical support to the organizations:** An RBO needs professional technical support for planning, monitoring, policy making, and oversight and regulation (see box 7.5). For example, a technical function is needed to ensure that water quality improvement targets are met.
- **Setting up decision making structures at sub-basin or provincial level:** Many basins have sub-basins or straddle administrative jurisdictions. Whatever structure is established will need to have sub-basin structures—councils, committees, or other decision making structures—to reflect basin-wide policies, plans, and decisions at local level (see box 7.6).
- **Linking basin and sub-basin level structures to national policy:** Each basin-level institution needs to be linked to national policy and planning organizations so that basin-level policy and plans reflect national strategies. This will also encourage basin-level institutions to function in a more interagency manner and allow them to better arbitrate and navigate interagency or interjurisdictional issues.
- **Developing integrated plans for each basin:** MONRE, through the National Center for Water Resource Planning and Investigation, is initiating comprehensive and integrated planning for the Sesan-Srepok basin. This initiative could open pathways to basin planning across Vietnam within a multi-stakeholder basin governance framework.

**BOX 7.5: River basin institutions work best when they have representation from multiple sectors and levels of jurisdiction**

A key element of most river basin management institutions is that they feature mandated representation from multiple sectors and often leaders from different jurisdictions within a river basin.

For example, Australia's Murray-Darling Basin Authority is governed by a council consisting of representatives from six basin states as well as the federal government. These arrangements are stipulated in the Federal Water Act (2007). This structure ensures that political jurisdictions that share the basin are represented and that there is a platform for consensus building.

Similarly, the Brazil Water Law (1997) prescribes the river basin as the territorial unit for management. River basin committees include representatives of unions, states, districts, municipalities, water users, and civil society. Thus, the law provides for wide participation horizontally and vertically.

*Source:* Jaspers 2003.

### BOX 7.6: International experience with technical support units and sub-basin entities

Water management is often technical and local. Thus, many water management commissions are supported by strong technical units organized at sub-basin level. In France, for instance, the Seine-Normandy Basin Committee has four technical committees handling aquatic environments, coasts and the ocean, territorial policy, and land-use planning. Since 2004, the committee has also included a scientific council, an assembly of 21 external multidisciplinary technical experts, to advise on issues concerning long-term projects envisaged in the basin.

In the United States, the Upper Mississippi River Basin Association sub-basin entity (within the larger Mississippi River Commission) has been designed to provide greater local participation. It was formed in 1981 to facilitate dialogue and cooperation on water and related land resource issues specific to the upper portions of the Mississippi River Basin. It serves as a regional forum for the cooperative planning and management of river-related issues of common concern to the states of the upper Mississippi River basin. The association also provides a forum to develop regional positions on river resource issues and serves as an advocate of the basin states' collective interests before federal agencies.

*Source:* World Bank 2017p.

## 7.4.2 Building a national water information system

**Vietnam needs to modernize water monitoring, enhance analytical tools, and invest in water knowledge.** To underpin water resources planning and risk management, Vietnam needs to strengthen water resources information by reinforcing and broadening data gathering and building water information systems.[1] Box 7.7 shows one approach in India, which could provide a model.

### BOX 7.7: How the India National Hydrology Project invests in water information

Vietnam faces many of the same water challenges as India, pointing to lessons from the development of the India-wide hydrological monitoring network under the National Hydrology Project and its predecessors.

India took as its starting point that water knowledge would underpin integrated management of water resources at the river basin level. Investments have been in developing state-level hydrological information systems, with automatic real-time monitoring and data transmission; using data for river basin planning, infrastructure design, and operation of key reservoirs; and disseminating data through online real-time information systems.

The benefits have been clear. The hydrological information systems, with modern software tools, have supported river basin planning and development and improved structural design of infrastructure. Real-time information for reservoir operation and flood management has given much earlier warning and avoided loss of life and damage. Decision makers have become convinced of the need for a basinwide approach and of the key roles of accessible water information and institutional capacity.

The latest phase of investment—the National Hydrology Project (negotiated in 2017)—scales up the approach to the national level, supporting multistate coordination for river basin planning, flood management, and reservoir operation in large multistate basins, as well as for cross-boundary aquifer management. A four-pronged strategy has been adopted:

- **Modernizing monitoring** by establishing comprehensive, automated, real-time monitoring and data management systems nationwide for surface water and groundwater, for both quality and quantity.
- **Enhancing analytical tools** for water resources assessment, hydrological and flood inundation forecasting, water infrastructure operations, groundwater modeling, and river basin and investment planning.
- **Transforming knowledge access**, using the internet, mobile devices, social media, and other communication tools to support a web-enabled spatial water resources information system, with access to and visualization of customized water information by all stakeholders.
- **Modernizing institutions** through investments in people and institutional capacity.

*Source:* World Bank 2016f.

**A priority is to collect all water data into a robust, easily accessible, and transparent national water information system.** At present, data are not collected in a standardized way, often residing in several databases and not in a central location that is easy for provincial officials, agencies, and the public to see. A single national water information system with open real-time access via a data portal could be created, and government agencies collecting data on water could be obliged to share their data on this platform.

**An information system catalyzes good water management**, drawing on the adage "you cannot manage what you cannot measure." Boxes 7.8 and 7.9 (as well as 7.7) give examples from other countries of how information powers good water management. Creation of the system would facilitate the sharing of information across government agencies and enhance the integrated management of water resources, increasing the evidence base underpinning water policies and investment and management decisions; help agencies and stakeholders collaborate more effectively; give policy makers a more integrated view of the challenges and potential solutions in WRM; provide consistent information for benchmarking the performance of managed water systems over space and time; and support real-time drought and flood forecasting. All this will lead to greater certainty in water resources planning and improved community understanding of WRM.

### BOX 7.8: Improving water information in Australia

In 2004, the Council of Australian Governments incorporated a directive into the National Water Initiative (2004) to develop water resource accounting, requiring water data to be identified, quantified, reported, and published for the public.

Australia's Water Act (2007) gave statutory responsibility to the Bureau of Meteorology for collecting and disseminating water data across Australia. The same year, Australia launched the AUD 450 million 10-year Improving Water Information Program. This included issuing national water information standards, collecting and publishing water information, conducting regular national water resources assessments, publishing an annual National Water Account, providing regular water availability forecasts, advising on matters relating to water information, and enhancing understanding of Australia's water resources. The act also requires the bureau to "annually publish the National Water Account in a form readily accessible by the public."

*Source:* Australian Government Bureau of Meteorology n.d.

### BOX 7.9: The United States has a national water database accessible through a single website

The United States Geological Survey (USGS) maintains a distributed network of servers for the acquisition, processing, review, and long-term storage of water data, called the **National Water Information System** (NWIS). The NWIS is the principal repository of water resources data for the United States. It includes data from more than 1.5 million sites in all 50 states. Some of these sites have been in operation for more than 100 years.

NWIS integrates stream-flow information with many other types of water data, including historic water-quality data from rivers and aquifers, historic groundwater-level data, and real-time water quality, precipitation, and ground-water levels. Data are collected on gauge height (stage) and streamflow (discharge), temperature, specific conductance, pH, nutrients, pesticides, and volatile organic compounds.

**Water Data for the Nation** is the USGS public web interface to much of the data stored and managed within NWIS. The goal of the site is to provide USGS, USGS cooperators, and the general public with a geographically seamless and easy-to-use interface to most of the USGS water data maintained in the NWIS.

USGS also developed the web site WaterWatch, which displays maps, graphs, and tables describing real-time, recent, and past streamflow conditions for the United States. The real-time streamflow maps highlight flood and high flow conditions. The seven-day average streamflow maps highlight below-normal and drought conditions.

*Source:* USGS 2016, 2018.

## 7.4.3 Planning for demand management measures

**As demand grows and local scarcities increase, demand management measures will increasingly become necessary.** The recent report by 2030 WRG (2017) highlighted the fact that four major basins, which together generate 80% of Vietnam's GDP, are expected to face water stress, or even severe water

stress, by 2030. As discussed above (7.3.3), the report concluded that the high water stress levels in all but one river basin could be reduced to low or no water stress with cost-effective water demand management measures alone. The total cost of moving towards low or no water stress is expected to amount to about US$ 2 bn for the Red Thai Binh River Basin and to about US$ 650 mn for the Dong Nai River Basin. In the Mekong River Basin, water demand measures would – besides moving towards low water stress – even allow for savings of US$ 650 million. In the SERC River Basin, however, the report found that water demand measures would need to be complemented by investments to increase water supply in order to achieve low or no water stress levels. The cost curve methodology discussed in box 7.3 indicates entry points to a demand management strategy.

**Planning related to disaster risk control and prevention needs to be updated and streamlined into existing plans.** A Master Plan for river management and river bank protection of critical canals is required. This should be integrated with the planning of residential areas to ensure protection of resettlement areas against flood and erosion. Further, the planning for irrigation and for infrastructure to protect against natural disaster should take into account climate changes, sea level rise and land subsidence. Spatial planning, sand mining, coastal management, mangrove forests – all these aspects will need to be integral elements of the planning exercise and will need to be streamlined into Sectoral Development Plans and into the Socio-Economic Development Plan.

**Planning for the strategic orientation of irrigation development needs to be aligned with other water related plans to avoid future water sharing conflicts.** A draft on adjusting the strategic direction of the National Strategy of Irrigation is expected to be submitted by MARD for approval to the Government in the third quarter of 2019. It is crucial that this strategy is aligned and integrated with other water use strategies.

### 7.4.4 Assessing scope for more efficient budget resource allocation

**At a time when public resources are dwindling, increasing how efficiently they are used to meet investment needs and allowing for long-term provision of O&M is imperative.** The 2017 Public Expenditure Review (World Bank, 2017a) noted the need to make spending more efficient and identified some budgetary tools that could help.

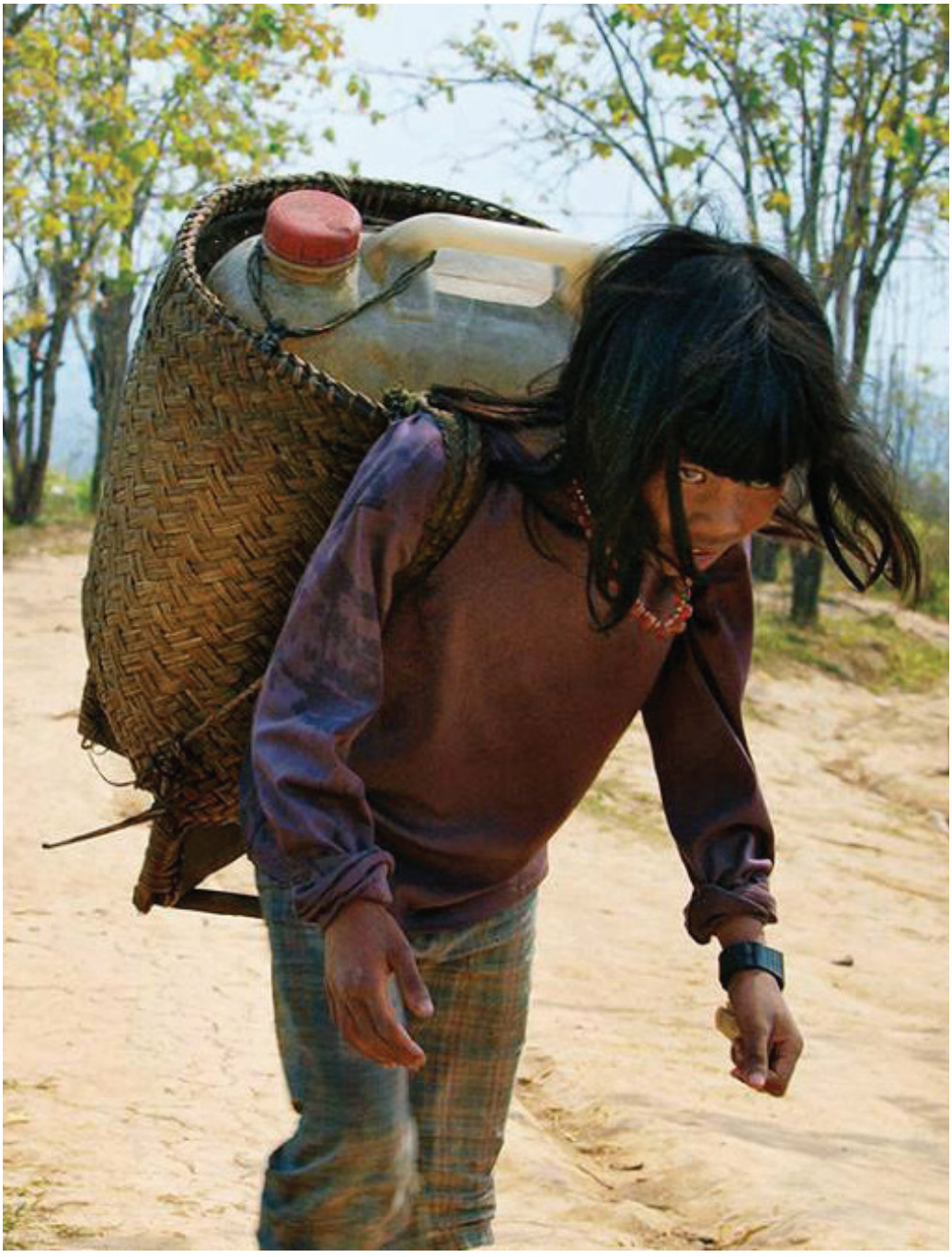
As discussed in section 2.3 in Chapter 2, the 2017 PER identified the MTIP introduced in 2014 and the MTFP introduced in 2015 as key instruments for improving resource allocation. They allow the allocation of capital investment to be linked to the MTIPs agreed to on the basis of development and infrastructure gaps. They also allow the multiyear programming and the gradual increases in O&M expenditure essential to preservation and efficient use of assets. These planning improvements could eventually be accompanied by improvements in the budget process, particularly a move toward results-based budgeting. Finally, the Public Expenditure Review underlines the need for sound sector strategy to underpin both long-term fiscal planning and shorter-term budget requests. Decree No.84/2015/ND-CP aims at improving monitoring and evaluation in investments. While it still has to be made fully operational, the introduction of results-based management has the potential to significantly improve the effectiveness of public interventions.

These new approaches may create an opportunity for joint work between MONRE and MARD on irrigation development and management to integrate the predominant agricultural water use within an overall planning framework at the basin level.

Further, the new Irrigation Strategy seeks to improve the efficiency and productivity of irrigated agriculture, maximizing farmers' incomes and value added, and proposes a participatory governance model and asset management model. The underlying philosophy is that more efficient and sustainable irrigation and drainage services can support a more diversified agricultural economy that increases value and thereby boosts both farmers' incomes and national growth. The key change proposed is in line with the budget changes proposed in the Public Expenditure Review —a move toward a less subsidized model and a more autonomous and participatory approach to service provision, with greater emphasis on efficient asset management and less on expanding networks.

## Notes

1. A global study identified that a US$1 billion investment in hydro-meteorological networks would yield total benefits of about US$4 billion–US$36 billion per year, with benefit–cost ratios between 4 and 36 (Hallegatte 2012).



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8

# Making Investment and Financing More Efficient, and Aligning Incentives with Objectives

*Investment in water falls short of needs, public financing is declining, yet more value needs to be obtained*

- A shortfall in water sector investment financing needs to be filled by more effective public investment and more innovative financing.

*New opportunities can bring in more private financing with a coordinated policy effort*

- Although limited in the past, the opportunities for private financing in the water sector are expanding.
- Even so, a major coordinated policy effort is required to address the multiple constraints and risks faced in mobilizing private finance for water and widening entry points for private finance in irrigation.

*To meet policy and fiscal objectives, incentives in the water sector need to motivate "good behavior"*

- Responses to growing stresses, conflicts, and risks require institutional and individual behavioral changes. Incentives—positive and negative—are needed to guide these changes and to align behavior with sectoral policy and fiscal objectives.
- Revenue policies need to be brought into line with these objectives.

*Priorities for action*

- In the nearer term, there is much that Ministries and Provincial People's Committees might do to improve the quality and efficiency of spending and to mobilize new sources of official development assistance.
- In the longer term, new resource planning and allocation instruments can improve multiyear programming, strengthen the fit of investment with needs, and facilitate long-term operations and management.
- Vietnam should investigate new water sector financing strategies, including scaling up public–private partnerships across all branches of the water sector.
- Greater private financing and more user involvement should be explored as part of the strategy to modernize irrigated agriculture.
- An assessment of the overall incentive structure in water would help identify the most important and practical ways to align behavior with policy and fiscal objectives.

## 8.1 Investment falls short of needs as public financing declines

**The water sector has received strong—mainly public—investment in the recent past.**[1] Between 2006 and 2015, Vietnam invested more than US$6.4 billion in 140 water programs and projects, largely in water supply and sanitation (WSS) (55 percent), irrigation (21 percent), and institutional development and capacity building (7 percent). These investments were predominantly publicly financed by the central budget, state development agencies, and international assistance. Some investment was made by the private sector, largely in WSS (ODI 2015).

**Investment requirements remain high, particularly for WSS, pollution control, inland waterway transport and multipurpose water control, but actual financing is well short of needs.** Vietnam's investment requirements are as much as US$2.7 billion annually for WSS alone. Expanding the sewerage network and wastewater treatment and disposal facilities—and improving onsite sanitation and septage removal and treatment would require higher levels of investment. However, there has been chronic underinvestment: actual investment in WSS (new infrastructure and maintenance) is estimated at less than half the "need"—about US$1 billion annually, about 4 percent of total investment in the Vietnamese economy. In line with the normal trajectory of middle-income countries and in response to the alarming levels of pollution, the next big infrastructure push should be control of water pollution, including municipal and industrial wastewater treatment (see chapter 4). Requirements are also steep for investment in hydropower, in inland waterway transport, and in multipurpose water control and storage which can both generate economic benefits (electricity, irrigation) and protect against risks of flood and drought.

**In the current financially constrained climate, increased investment effectiveness and more innovative financing could help.** The challenges on the investment side are to prioritize investments and implement them cost-effectively; to find innovative solutions and technologies that could reduce life-cycle costs; and to improve the productivity of existing investments. On the financing side, the challenges are to improve the quality of public spending; to ensure that there are revenues to service debt; and to mobilize private finance to the maximum possible.

## 8.2 Better planning and allocation can get more out of public financing

### 8.2.1 "More for less"—improving the efficiency of public financing in the water sector

**Given a tightening budget, the water sector can still improve the efficiency of public spending.** Public financing for the water sector is set in a context of shrinking public resources, with consistently high budget deficits, rising public debt, and falling official development assistance. At the same time, demand from other sectors for public resources has risen sharply. The challenge for the water sector is therefore to improve the efficiency and quality of spending, rather than the amount—to get more for less.

**One way to do this is to focus capital investment and look to the private sector to propose whole-of-life output-based solutions to achieve operating efficiencies.** Current investment spending is probably spread too thinly across too many projects. The balance of spending needs to shift from new infrastructure to getting more out of existing assets, particularly by increasing operations and maintenance (O&M) expenditures and investing in higher productivity (see chapter 2).

**Another way is to rebalance budgets between capital and recurrent expenditures.** Proper maintenance of existing assets to maximize their value and enhance investment efficiency is one priority. In irrigation, a linked priority would be to rebalance spending from infrastructure development to improving asset and water productivity, including promoting agricultural services and revising the incentive structure to encourage crop diversification and to get more "dong per drop" (see chapter 2). For inland waterway transport, operation and maintenance costs are expected to be 50% short of required funds to maintain competitive waterway transport. Reliable waterways are essential to allow for further investment and thus increasing Vietnam's competitiveness in world markets (see chapter 5).

**Nonetheless, major public infrastructure investments in water will remain essential, and have to be managed under exceptionally high budget decentralization.** Protecting and developing a natural resource like water is a key public responsibility that requires major investment in large infrastructure and O&M. However, Vietnam faces a key budgetary challenge in aligning subnational spending with national priorities, because almost three-fourths of capital spending is now decentralized. For example, the Ministry of Agriculture and Rural Development (MARD) controls only a fifth of irrigation sector spending, with

four-fifths directly managed by subnational governments. This decentralization has resulted in a shift from major infrastructure projects to small, local ones and limited the scope for major water sector infrastructure investments (World Bank 2017a).

**Integrated investment planning is constrained by this decentralization and by the lack of an interagency coordinated approach.** This massive decentralization of investment resources—and more generally, the lack of an interagency approach—make it very hard to plan and invest in water infrastructure and management in an integrated way or at the basin scale.

### 8.2.2 Improving the quality of spending through innovations in resource planning and budgeting

**New resource planning and allocation instruments will, in the longer term, allow multiyear programming, improving the fit of investment with needs and facilitating long-term O&M.** Improved planning could, also in the longer term, receive support from improvements in the budget process. The government is gradually introducing output-based budgeting, and each sector could prepare a road map for this. However, currently there are more than 19,000 plans and master plans economy-wide. A plethora of targets and programs inevitably leads to overlap, unpredictability, and management inefficiency. The water sector should streamline plans and make them more realistic.

**In the nearer term, Ministries and Provincial People's Committees (PPCs) could improve the efficiency and quality of spending, including in integrated approaches.** Top-down improvements in the overall budget and planning process may offer some prospect of improved resource allocation and increased value for money, but the fruits are likely to appear only in the medium to longer term. In the near term, the best options for the water sector are bottom up:

- To work on integrated multi-sectoral plans at the local (PPC) and basin level.
- To prepare investment programs that implement local and basin plans in a prioritized and phased way.
- To adjust the balance between capital and O&M expenditure to get the best out of assets.
- To prepare quality investment projects and improve procurement and implementation.

**The quality of investments could be improved by returning some quality control and decision-making powers to the center.** Decentralization has placed responsibility for project preparation and decision-making on sectoral ministries and the PPCs, creating challenges of competence in project development and implementation and possible conflicts of interest. One suggestion is combining independent review of project appraisals with final project approval by the Ministry of Planning and Investment. This institutional arrangement has proven beneficial in many countries, including Canada and Chile (Jenkins and others 2017). It could also address the challenge of low capacity of appraising agencies within line ministries and local governments, as highlighted by the World Bank Public Expenditure Review (PER) report (2017a).

## 8.3 There are opportunities to bring in more private financing, but a coordinated policy effort is needed

### 8.3.1 Private financing in the water sector

**Financing in the water sector to date has been predominantly public.** Vietnam's traditional financing model has relied mostly on public investment, either directly by the government and the PPCs, or by state enterprise borrowing backed by government guarantees. The majority of investment needs are still covered by direct or indirect state transfers, often supported by official development assistance. Almost 90 percent of investment in the water sector is estimated to be publicly financed.

**Although public finance will remain important, there is scope for more private participation.** As a matter of national policy, Vietnam is aiming to progressively reduce public investment as a share of total investment while progressively increasing private participation in services, mobilizing user payments for public services, increasing private equity investment in water supply utilities through equitization, and reducing subsidies for public services. These policy orientations should not obscure the imperative that strategic, large-scale public investments are essential to protect Vietnam's precious natural capital and to put it to its best use for socioeconomic development. There is, nonetheless, a need to mobilize private finance in the water sector. The potential is principally in hydropower and water supply and sanitation (WSS), including in small-town and rural projects, and also in irrigated agriculture.

**Apart from the recent partial equitization of water supply utilities and some foreign direct investment in bulk water, private financing of water infrastructure and service has been limited.** Until recently, there was scant domestic and international private sector

participation. The most significant innovation over the past two decades has been the private injection of equity into water supply utilities. After a long drawn-out history (see chapter 3), equitization has recently accelerated, and major, largely domestic, private capital has now been invested in most utilities. But progress is slowed by relatively low tariffs, uncertainty in valuation of assets and about the equitization process, and a lack of oversight of utility performance, causing investors to think hard before investing in the sector. While government targets for equitization and private and PPC financing of water service companies are high, they have yet to be uniformly realized. Some of the urban utilities, including well-run non-equitized utilities, are already tapping commercial bank loans, and there is some private investment in bulk water and rural water schemes. However, banks typically require a lien on the utility's assets, because they are not confident that tariff levels will ensure adequate revenue (ODI 2015).

**Even so, the number of public–private partnership arrangements in water supply has been growing.** In the urban water sector, five "private participation in infrastructure" (PPI) investments have been made, all in water supply and mostly for bulk water supply treatment plants, where the state or the utility pays the investor/operator directly for water. Foreign commercial banks have provided debt finance for some build-operate-transfer projects under PPP arrangements. In the rural water sector, there are significant investments being made through privately financed and operated schemes, PPPs, and publicly funded schemes that are transferred to a private operator for O&M, with the debt service obligations passed to the operator.

**Wastewater, by contrast, is still seen more as a public good.** By law, wastewater services are classed as a public good and thus are eligible for subsidy. Most wastewater services are still financed by public investment or official development assistance, but there are some examples of finance by PPPs. For industrial wastewater, the polluting company is responsible for payment, and here examples of PPPs can be found.

### 8.3.2 The changing environment for private financing in the water sector

**The changing macroeconomic and sectoral context means that the traditional approach to financing the water sector is no longer sustainable and needs to be reconsidered.** Vietnam's public debt ceiling, set by the National Assembly in 2016, is approaching the 65 percent of GDP statutory limit (Resolution 25/2016/QH14). For some years to come there will be limited fiscal space either for direct public borrowing or for government-guaranteed borrowing that counts toward the statutory limit. At the same time, Vietnam's middle-income status is reducing the availability of concessional funding.

**However, water sector reform may be creating new opportunities.** The current equitization of urban water supply utilities is not just a one-time injection of capital. It essentially transfers to the private sector the responsibility for financing the development of water services, creating opportunities to explore new approaches to financing and to developing bulk water, water supply, sanitation solutions, and wastewater collection, treatment, and reuse. The government is looking to improve the enabling environment for private participation in the rural water sector. In the irrigation sector, the reintroduction of water charges could create an opportunity to build revenue streams that could attract private financing and management.

**The government has made provision for private sector participation in the WSS sector and for a framework for PPPs.** In addition to equitization of the utilities, investment incentives include income tax exemptions and access to concessional finance from the Vietnam Development Bank. In 2015, the government also issued Decree 15/2015/ND-CP and set up an ambitious PPP facility to co-finance major infrastructure projects. On 4 May 2018, Decree 15/2015/ND-CP was replaced by Decree 63/2018/ND-CP, which enhances the PPP framework. In addition, Decree 54/2015/NĐ-CP on encouraging and facilitating water saving and efficiency has been issued to promote private sector involvement in water resources management.

### 8.3.3 It is necessary to attract new sources of financing to the sector

**Some of these constraints are common to all sectors, including those affecting all PPPs** (World Bank 2018d):

- **An ambiguous legal framework.** Vietnam adopted an integrated legal framework for PPPs: Decree 63/2018/ND-CP. However, up to now, government agencies in other sectors (for example energy), have preferred to use Investment Law provisions that are less stringent for the preparation of feasibility studies and the application of competitive procurement.
- **Uncertain government support.** Although the legal framework allows for government co-financing and subsidies and does not count that support toward the country's statutory public

debt ceiling, the government may be unwilling to provide the level of support required by investors. There is currently no clear and transparent policy on the provision of government support and on the fiscal implications.

- **Questions over foreign exchange convertibility.** Despite Vietnam having removed controls on currency convertibility, foreign investors remain concerned about the availability of foreign exchange and usually require government commitment for future currency conversions.

**There also are economy wide constraints affecting local capital markets.** Despite sizable domestic savings of US$60 billion annually, deficiencies in the local banking sector and capital markets limit the extent to which these resources can be channeled into water projects, which require long-term and fixed-interest debt. A recent World Bank (2018d) report highlights the following:

- **Domestic commercial banks.** These have outstanding loans of US$250 billion, heavily skewed toward short- and medium-term lending (up to three years' maturity), reflecting the lack of long-term deposits and the flat yield curve by deposit duration. There is also a lack of technical capacity in the banking sector to evaluate water projects and lending against revenue streams. Where loans are provided, collateral is typically required, and for smaller borrowers, interest rates are high.
- **Stock exchange.** While there is a stock exchange in Vietnam, market liquidity is low, and the market is dominated by state-controlled companies.
- **Bond market.** The corporate bond sector remains in its infancy, with total issuances under 1 percent of GDP and a shortage of suitable large corporates that could issue bonds.
- **Institutional investors.** Resources controlled by longer-term investors, such as pension funds and insurance companies remain modest (US$25 billion), and their investments are mostly confined to government bonds.

**There are risks specific to investing in the water sector.**

These include:

- The risk that water is perceived as a human right or entitlement, which often makes tariff setting and collection a vexed affair.
- The risk that the quantity and quality of water required will not be available and that alternative sources will be more expensive to access and treat.
- The risk that utilities or irrigation management companies might not qualify for corporate finance. Some are large enough that they might, in principle, be able to raise their own corporate finance based on the strength of their balance sheet without recourse to government guarantees. However, few have a credit rating, and they might have problems obtaining finance in view of the high degree of risk.

**These sector-specific investment risks would need to be met through mitigation provisions.** To attract foreign expertise and potentially cheaper cross-border capital to Vietnam, the government would have to allocate risks in line with international best practice (World Bank 2018d).

**Added to these risks are constraints to investing in equitized utilities.** Although the equitized utilities present the most likely case to attract private investors, they feature significant disincentives:

- The financial risk of declining revenues stemming from low tariffs subject to political decisions and from a declining collection rate.
- Restrictions on the proportion of equity that private investors can hold.
- The absence of clear contractual relations between utilities and local authorities (or a clear licensing regime with an independent regulator).
- A lack of clarity in equitization.
- The absence of independent regulation or similar mechanisms for monitoring financial and service performance of utilities.

**There are also limited protections to ensure that the equitized companies deliver services, given that the performance regime is unclear and the monitoring of service delivery is limited.** Checks and balances are also few (unlike in England & Wales, and Chile, which have privatized water companies) that would ensure that the companies focus on their core business, do not invest in risky sectors, and do not sell off assets critical to water and wastewater service.

**The biggest and most pervasive risk is uncertainty over revenue streams.** Many investors are deterred by the low tariffs and the uncertain environment for enforcing collections. While national policy targets cost recovery, affordability concerns make it politically challenging for PPCs to increase tariffs. Private investors themselves have had the opportunity to express their views on the advantages and pitfalls of investing in Vietnam's water sector (see box 8.1).

### BOX 8.1: Potential investors' views of investing in Vietnam's water sector

**Investors are well aware of the pros and cons of investing in Vietnam's water sector**

In a workshop convened by AusAid during the VietWater 2016 exhibition, potential investors identified a range of positive and negative issues around the business environment in Vietnam. The positives included business opportunities, expected future market growth, low labor cost, strategic location, sociopolitical stability, and reform commitments. The negatives included inadequate infrastructure, corruption, low productivity, weak-nesses in legislation and policy, lack of transparency, and bureaucracy. The workshop also identified challenges for investing in the water sector that revolved around government intervention in economic activity, lack of information, human resources, and the pitfalls of investing in water in Vietnam, as learned from experience.

**The workshop also pinpointed areas where Vietnam could act to attract more private investment in the water sector**

Potential investors identified a range of needs around three themes: (1) efficient regulation, (2) clear institutional and market structures, and (3) scope for innovation and collaboration. A strong message was that limited information and transparency about the sector typically reduce investors' confidence. The conclusion was that action on these themes would enhance the attractiveness of the water sector for private investment.

*Source:* Austrade 2016.

### 8.3.4 Tapping new and larger sources of finance for water infrastructure

**To mobilize significant private finance for water would require a major coordinated policy effort.** It could be modeled along the multiyear program proposed for the energy sector to prepare and launch projects for PPPs, to work with companies to prepare them for accessing commercial finance, and to take steps to improve the mobilization of capital in local currency (see box 8.2).

### BOX 8.2: Maximizing finance for development of Vietnam's energy sector

The recent World Bank report *Maximizing Finance for Development of Vietnam's Energy Sector* proposed a three-part plan to tap new and larger sources of private finance for energy sector investment.

**A PPP/IPP (independent power producer) program to build investor confidence**

To scale up PPP/IPP, a well-designed programmatic approach is required, to be rolled out over the next few years. While Vietnam has recently made progress in harmonizing and integrating the legal framework for PPPs, the effort still falls short of what is needed to kick-start a new PPP/IPP program big enough to address energy sector investment. Many critical elements are missing from the enabling environment.

Moreover, to maximize interest, the government should consider crafting a multiyear PPP/IPP program for a substantial project pipeline with competitive bidding. This would establish a strong track record of speedily and competitively implemented PPP/IPP projects that will gradually reduce the need for government support as investor confidence increases.

**Prepare companies to access commercial finance**

Corporate finance will remain a central channel for funding investment into the sector, but this will increasingly need to be on the strength of the company's own balance sheet without recourse to the state.

Companies could work toward improving their financial performance. Having brought in private sector financing and expertise through full or partial privatization, they may subsequently obtain credit ratings with the objective of gradually being able to raise their own debt finance without state support.

Rationalizing pricing policies, as well as introducing the regulatory and governance frameworks, will be critical to achieving such creditworthiness. In the transition period, targeted concessional and development institution financing will continue to be required for funding critical infrastructure investments.

**Improve the availability of local currency finance**

There is a pressing need to strengthen the domestic commercial banking sector while deepening and broadening domestic capital markets. Both project finance and corporate finance structures could benefit from greater availability of longer-term lower-cost local currency financing through the domestic capital markets.

At present, however, these advantages are outweighed by high interest rates and constraints on the availability of capital in the banking sector. Addressing these obstacles will call for a concerted effort to deepen and broaden Vietnam's capital markets, particularly the domestic corporate bond market as an alternative channel of finance.

*Source:* World Bank 2018d.

**Using performance-based loans – in combination with institutional and regulatory support - to finance the construction and expansion of Central Effluent Treatment Plants (CETPs) to maximize the impact of scarce resources.** Traditional CETP financing (either concessional or commercial) has focused solely on CETP construction but paid little attention to actual performance of CETPs. A performance-based loan repayment schedule can be used to incentivize CETP investors to comply with environmental regulations during the operation phase. Failure to do so could result in reductions in the loan repayment term if discharge violations occur. Together with improved enforcement pressure and improved technical capacity of CETP investors, performance-based concessional financing is expected to improve compliance of Industrials Zones with wastewater effluent standards (see box 8.3).

### BOX 8.3: The World Bank-financed project Vietnam Industrial Pollution Management

The World Bank-financed project Vietnam Industrial Pollution Management aimed to help the country manage industrial pollution issues by improving compliance with industrial wastewater treatment regulations in four of the most industrialized provinces in Vietnam.

The project addressed the multifaceted issues of industrial wastewater pollution by piloting a holistic approach, focusing not only on institutional arrangements and the regulatory framework, but also: (i) providing concessional financing and technical assistance for CETP design, construction and operation, and environmental monitoring and enforcement; (ii) providing investments in the AMS network; (iii) supporting improved capacity for monitoring and enforcement; (iv) promoting information disclosure among agencies and the public; and (v) supporting the introduction of sizeable fines in case of non-compliance.

As a result, compliance with wastewater treatment regulations of the industrial zones of Dong Nai, Ba Ria Vung Tau, Ha Nam, and Nam Dinh provinces improved significantly between 2012 and 2018 when the project was completed (see table 1).

**TABLE 1: IZs compliance level in four project provinces at project start and at project end**

| Year | IZs in operation (#) | IZs with CETPs (%) | IZs in compliance (%) |
|---|---|---|---|
| 2012 | 34 | 60% | < 30% |
| 2018 | 43 | 98% | 72% |

The project helped change the culture away from an enforcement-driven approach where DONRE was tasked with detecting non-compliance, towards a self-monitoring approach in which the IZs were tasked with proving compliance. An enforcement-driven approach based on DONRE making regular visits to IZs to manually collect wastewater samples had proved problematic, especially given the ease with which wastewater discharge flow can be managed and since DONRE was required to announce their visits in advance. A self-monitoring approach underpinned by continuous 24-hour monitoring with online data transfer to provincial authorities and supported by independent analysis and verification of lab results turned out to provide the best conditions for improving compliance and protecting against wastewater contamination of the river basins.

The Industrial Zones have financed 5% of the investments in the CETPs, thus contributing to private sector financing.

*Source:* World Bank (2019) Implementation completion and results report for the Vietnam Industrial Pollution Management Project.

## 8.4 Private financing in irrigation offers entry points, despite challenges

**Although private finance accounts for at least half the irrigation investment globally, irrigation sectors like Vietnam's—predominantly large-scale irrigation for smallholders—have historically found it hard to attract private finance.** Irrigated farming throughout the world—and in Vietnam—is overwhelmingly a private sector activity, and globally more than half of irrigation investment is private (see box 8.4). However, large-scale irrigation investment for smallholders has always been dominated by the public sector, for four reasons (FAO/EBRD 2017).

- Large-scale irrigation has many public good aspects: water resource allocation; the multifunctional nature of many projects that often include hydropower, water supply, and flood management; and the multiple externalities that cannot easily be internalized, such as downstream effects, waterlogging, and pollution.
- Most large-scale irrigation has been developed for smallholders, often with very small farms. Tariffs have often been based on the capacity to pay rather than on the need to generate a revenue stream to pay for services and remunerate capital.

- Large-scale irrigation is typically a large, long-term, and relatively slow-return investment, beyond the terms typically of interest to private capital markets.
- Multiple risks are attached—of water scarcity, of environmental impacts, and so on.

The few private or PPP investments in large-scale irrigation have therefore been based on risk-sharing arrangements heavily dependent on government support. Box 2.6 in Chapter 2 illustrates a successful example from Morocco.

### BOX 8.4: Globally, private investment is important in irrigation and has driven water efficiency, incomes, and exports

Privately managed schemes account for more than half the irrigated area worldwide, and private investment accounts for at least half of total investment. Private investment has been the rule in small-scale irrigation, while farmers worldwide have invested in groundwater extraction, by far the fastest-growing irrigation activity in recent years. In the Arab world and in India and Mexico, more than two-thirds of groundwater development has been financed entirely by the private sector. In Mexico, around 40 percent of the irrigated area was privately owned even before reforms began to shift control of publicly funded irrigation districts to water user associations in the early 1990s. Following the reforms, private investment increased dramatically. In Chile, with one of the most privatized irrigation sectors in Latin America, farmers must by law contribute as much as 75 percent to new development, so only the most profitable schemes are built. Private investment in all aspects of irrigation in Chile has increased water efficiency and contributed to the boom in agricultural exports.

*Source:* FAO/EBRD 2017.

**Even so, there are multiple entry points for private finance in irrigation—and for PPPs in large-scale irrigation** (see table 8.1, and boxes 8.4 and 8.5). In fact, globally, the private sector has been attracted to irrigation development with diverse means of participation, ranging from individual farmers installing their own irrigation systems to the development of large-scale schemes. The main types of possible private involvement include (see figure 8.1, Global Water Partnership 2017):

- **Contracting out (outsourcing).** Specific functions are subcontracted to private firms, such as canal maintenance. This is the simplest, most often used, and least controversial form of private sector involvement.
- **Irrigation management transfer.** Responsibility and ultimately ownership of irrigation schemes is handed over to farmer groups (see box 8.5).
- **Leasing.** The water system remains in public ownership but is leased to private operators. Leasing is most common in French-speaking countries.
- **Concessions.** Assets remain in public ownership, but use of the system is transferred to private operators for a lengthy period, such as 20–25 years. The contract typically requires the private partner to invest in specified improvements and perhaps in expansion.
- **Build-own-operate-transfer and build-operate-transfer** are concessions, usually for new facilities. After a specified number of years, the facility is handed over to a public organization.
- **Divestiture or privatization,** in which full ownership of assets is transferred to private shareholders. Stringent public regulation is required.

### BOX 8.5: Turkey successfully transferred 2 million hectares of irrigated land to farmers

Turkey has emerged as a world leader in new approaches to irrigation and has conducted a largely successful program, transferring management of more than 2 million hectares of irrigated land to users since 1980. The results are largely positive: fiscal outlays on these schemes are zero, and irrigation efficiency on transferred schemes averages 59 percent, against 23 percent in non-transferred schemes (World Bank 2013).

For irrigation management transfers to succeed, they require strong political commitment from the government irrigation agency. A clear legal framework is essential, as are funds and resources to establish and support water user associations. Recent initiatives have sought to introduce more professional management approaches, sometimes through the private sector.

*Source:* FAO/EBRD 2017.

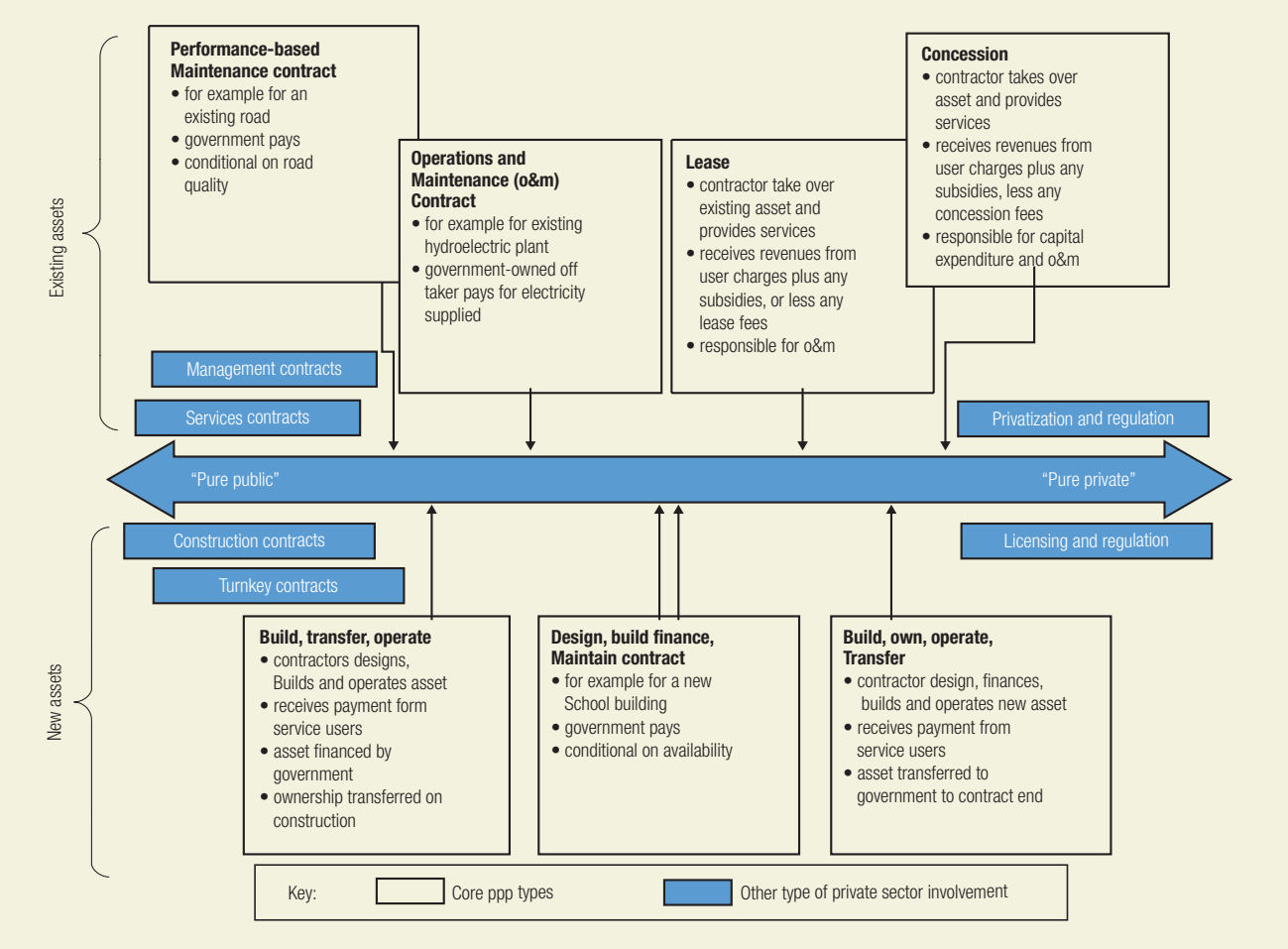
**Where irrigated agriculture is commercial, mobilizing private finance becomes easier.** As irrigation becomes increasingly commercial, this creates the revenue streams that can attract finance, both at scheme level for major works, paid for by increased water charges—and at farm level, where a multiplicity of sources of finance can be made available (see table 8.1).

**TABLE 8.1: Financing irrigation**

| Type of irrigation | Typical financing source | |
|---|---|---|
| | For working capital | For investment |
| **Larger-scale commercial irrigation** | • Local commercial banks<br>• Specialized agricultural credit agencies<br>• Supplier's credit<br>• Buyer's credit (for example, outgrower arrangements) | • Local commercial banks<br>• Specialized agricultural credit agencies<br>• Supplier's credit<br>• Buyer's credit (for example, outgrower arrangements) |
| **System development and modernization for large-scale irrigation** | • Irrigation service charges, public subsidies | • Subsidies<br>• Loans and guarantees from international financial institutions<br>• Grants<br>• Municipal bond issues<br>• Cost sharing<br>• PPP contracts |
| **Smallholder irrigation** | • Credit unions<br>• Cooperative savings and loan<br>• Nongovernmental organization schemes<br>• Money lenders and traders<br>• Project-specific credit<br>• Microfinance | • Same as for working capital<br>• Special government programs (for example, social funds) |

*Source:* FAO/EBRD 2017; Winpenny 2005; World Bank 2006.

**FIGURE 8.1: Forms of public–private partnership**




*Source:* World Bank Institute 2013.

## 8.5 Incentives need to motivate good behavior to meet policy and fiscal objectives

**Responding to growing stresses, conflicts, and risks requires institutional and individual behavioral changes, and incentives—positive and negative—are needed to guide these changes.** Incentives influence human behavior and are the prime instruments for encouraging citizen and corporate behavior to comply with government policies (see Box 8.6). For example, public and private agencies need to be incentivized to cooperate on integrated basin plans; farmers, to adopt sustainable water management measures; and dam operators, to manage their dams in a cascade.

**Economic incentives are the most efficient.** Incentives are of various types, with some more directly within the control of government than others. The most efficient are economic instruments, which send costless and easily grasped signals. Most economic incentives are market-determined—the prices of goods and services in a free market economy. Government can, nonetheless, have considerable influence over positive and negative economic incentives—by offering subsidies or tax holidays, or by increasing or reducing the fees and charges. One of the most common economic incentives in water is the application (or not) of water pricing, such as groundwater abstraction charges, irrigation service fees, and municipal water tariffs.

**Less efficient but also essential are regulatory incentives.** In the water sector, these include regulations on water abstraction, water quality, pollution, the environment, and service delivery standards. Regulatory incentives are almost entirely negative and moral hazard is inherent—that is, they oblige individuals and corporations to do what they would not otherwise have an incentive to do. So, they are much less efficient than economic incentives, and require a battery of regulatory authorities and sanctions.

**Vietnam's water sector illustrates the challenge of using incentives to align behavior with policy objectives.** Designing and applying incentives is challenging, as preventing industrial pollution in Vietnam shows, because enforcement is weak and the pollution fine may be less than the cost of treating the wastewater. Bringing about agricultural change definitely requires positive economic incentives, ideally through market signals, since negative incentives and regulation are largely impracticable. In municipal water supply, the water tariff can finance services and investment and promote water-saving investment and behavior, but there is generally political reticence to raise tariffs to the required level.

**An incentive framework is needed, aligned with policy and fiscal objectives and able to drive behavioral changes.** Revenue policies in the water sector can be designed to protect natural resources and enhance their value in use, and to generate fiscal resources. For example, raising the price of water for irrigation will raise the value and promote the conservation of water, and at the same time secure key O&M functions such as dam operation and safety and irrigation water service. The policy could also apply to pollution charges, where higher charges and efficient regulation would deter harmful behavior and raise resources for environmental protection.

### BOX 8.6: Economic and regulatory policy instruments

Broadly speaking, there are three policy instruments for changing individual and corporate behavior of water users: *regulatory instruments, economic instruments and education and influence.*

**Regulatory instruments** are often referred to as 'command and control' instruments as their purpose is to enforce the compliance of all parties with the goals and measures the regulation lays down, regardless of the parties' circumstances or compliance costs. Once goals are reached, there is no incentive to further improve performance. Regulatory instruments include, emission/ effluent limits, input specifications, technology requirements and location/ timing activities.

**Economic instruments** are incentive-based mechanisms, with the objective of changing behavior by providing positive or negative incentives to comply in pursuit of desired outcomes. Water-related economic instruments include, water tariffs, environmental taxes, subsidies on products and practices, tradable abstraction or pollution permits etc. These instruments can have the advantage of raising revenue, although they may also have a fiscal cost – e.g. in the case of subsidy programs like encouraging the adoption of drip irrigation or low-flush toilets by subsidizing their price. But the principal objective is to modify behavior rather than raise revenues. They are usually more efficient than regulatory instruments as they:

*(Box continues next page)*

**BOX 8.6: (Continued)**

- Can usually be introduced by government by a simple decision and can typically be implemented through conventional means– e.g. raising water supply tariffs, reducing import tariffs, or increasing the cost of energy for groundwater pumping. They do not require a detailed and expensive compliance-checking mechanism. The incentives reach the intended target effortlessly through the unseen hand of pricing.
- May promote dynamic efficiency by providing incentives for firms or individuals to modify their behavior (for example, to pollute less) to reduce costs or get benefits, and to continue to improve thereafter
- Should reduce compliance costs so that firms have a positive incentive to comply and fewer of the less efficient firms go out of business because of high compliance costs.

**Education and influence** includes tools targeted at changing behavior. Examples are: (1) education and public awareness campaigns; (2) behavior by opinion-formers as role models; (3) lobbying and advocacy by leaders or interest groups; (4) advertising, use of social media etc.. This approach can be highly effective, if properly designed.

## 8.6 Options and actions

**Vietnam should investigate the scope for a new water sector financing strategy.** A new strategy would aim at maximizing finance for development, including private investment, particularly in water supply services and in irrigation, but also in wastewater. The strategy would also aim at alternative sources of public finance such as green growth financing and increased grant aid for policy reform and institutional development (rather than borrowing in the capital markets). The proposals for developing a strategy for maximizing finance for development in the energy sector could help frame this investigation (see box 8.2). In addition, mechanisms for financing for smallholders—for example, for conversion to pressurized irrigation, greenhouse agriculture, and production of high-value cash crops—could be developed (see chapter 2).

**The scope for scaling up PPPs across all branches of the water sector should be investigated.** The recent rapid equitization of water supply utilities has demonstrated the feasibility of PPPs in the water sector. For water supply and wastewater projects, some of the impediments are being overcome by infrastructure subsidies and incentives from land development. Vietnam might learn from China's current program for scaling up PPPs across the water sector (see box 8.7).

**BOX 8.7: Building on success, China is scaling up PPPs for water infrastructure, water pollution control, urban water supply, and irrigation**

Several forms of PPP have been critical in China's water sector development over the past 20 years. Since China opened its water sector to private participation in 1995, international and domestic private companies, as well as state-owned enterprises (SOEs), have powered a dramatic expansion in water and wastewater provision, from serving less than 1 percent of the population in 1990 to about 40 percent in 2015.

These partnerships, which include O&M contracts, build-operate-transfer arrangements, and joint venture mechanisms, were initially dominated by multinational companies, but the market has become indigenized as local private companies and SOEs now are 9 of the 10 largest players.

In several cases, PPPs have helped introduce new technologies and practices and thus helped improve water supply and wastewater service delivery. Shanghai's Nanxiang Wastewater Treatment Plant, for example, financed in part through a PPP agreement with China Water Environment Group (a private investment company under China International Trust Investment Corporation's Industrial Foundation), uses an advanced anaerobic-anoxic-oxic treatment technology to purify water and meet discharge standards. The municipal government applied the PPP model to improve the government's managerial capacities and test new approaches, rather than for financial reasons.

A 2016 Asian Development Bank study surveyed some 300 state-run and PPP utilities in China and found that, overall, PPPs were significantly more efficient than state-run utilities. PPP-run utilities were more fiscally sustainable, featuring 5–16 percent higher total factor productivity, a 1 percent lower subsidy rate, and 6 percent lower labor costs.

PPP-run utilities also usually featured better outcome indicators, including larger service areas, lower leakage

*(Box continues next page)*

**BOX 8.7: (Continued)**

rates, better bill collection rates, and lower energy consumption. But while such performance indicators are compelling, tariff rates remained generally below cost-recovery rates, reducing the attractiveness of PPPs for private investors.

To signal the importance of PPPs in the water sector, the Chinese government has identified four priorities for investment:

- Dam and reservoirs. 12 large water infrastructure projects are in the pipeline.
- Water pollution control. In September 2016, the National Development and Reform Commission issued a list of 17 water quality enhancement projects, worth a total of CNY 20 billion. The emphasis on pollution control was strengthened by a July 2017 directive designating water pollution control as a priority area for PPPs and proposing measures to accelerate private sector investment.
- Urban water supply, which previously enjoyed high levels of private investment. In 2011, 309 urban water utilities featured some private investment, for a total of US$8.2 billion, and there is strong potential to increase this total further.
- Irrigation. Even though the lack of high water prices is an impediment to irrigation PPPs, China's first PPP in irrigation is in its pilot stage, sponsored by the Dayu Water Conservancy Group.

*Source:* DRCSC 2017.

**Greater private financing and more user involvement should be explored as part of the strategy to modernize irrigated agriculture.** The new policy orientations of the Vietnamese government and the text of the 2017 Law on Hydraulic Works suggest that there may be scope for building on current moves toward more water user involvement. The 2017 Law on Hydraulic Works provides for broader participation of farmers and the private sector in irrigation (articles 50–52). Irrigation management transfer could follow. In addition, there is scope to link smallholder irrigated farming to markets through innovative PPP approaches (see box 8.8).

**BOX 8.8: Modernizing agriculture through PPPs**

The World Bank has worldwide experience in supporting demand-driven productive alliances: investment programs that facilitate the formation of links between associations of farmers with aggregators (outgrower schemes, processors, exporters, financing institutions, and so on), where matching grants can leverage private funds for investments required to support planting high-value crops.

In Karnataka, India, the 2030 Water Resources Group helped create a "Drip-to-Market Agro Corridor," catalyzing adoption of drip irrigation in sugarcane. A multi-stakeholder platform consisting of the private and public sectors as well as civil society was formed under the leadership of Karnataka's chief secretary. The corridor is a large-scale initiative that connects farmers adopting drip irrigation with assured markets for high-value produce.

The initiative began with a pilot on 24,000 hectares in Ramthal, where 15,000 farmers were helped to convert to drip irrigation through a design-build-operate-transfer/hybrid annuity arrangement. The contract was awarded to two private companies at a cost of US$130 million. Around 70 percent of the contract was paid upon completion of civil works, while the balance is paid at 6 percent annually over a period of five years, during which the contractors provide O&M services. Under a memorandum of understanding, 14 private sector companies buy the high-value produce and build farmers' capacity in best practices. Ramthal is currently the world's largest community-driven drip irrigation system.

Following the successful pilot, this project is being scaled up. Private players are fully on board because they have been involved throughout, and both they and the farmers are enjoying substantially increased incomes at reduced risk.

*Source:* World Bank 2018e; 2030 WRG 2017; World Bank 2017l.

**An assessment of the overall incentive structure in water would help identify the most important and practical ways to align behavior with policy and fiscal objectives.** The government policy to reduce the role of the state in most policy areas, including water resource management, requires a much greater role for market-based policy instruments. These instruments help send pricing signals on the importance of conservation, efficient use, and the externalities entailed in different water uses. A range of economic policy instruments

can promote efficient water allocation, development, and sustainable use, including water pricing reforms (to promote conservation) and water rights assignment and trading (to facilitate the reallocation of water to its highest-value uses). Incentives for cooperation of public and private actors in comprehensive plans are critical (see sections 2.3, 4.2, 6.5 and 8.5). It would be useful to carry out a comprehensive assessment of the existing overall incentive structure and of options for better aligning incentives with policy goals. Box 8.9 illustrates how China is progressively making this alignment.

**BOX 8.9: Strengths and weaknesses of China's use of economic instruments to promote good water policies**

China has enjoyed considerable success in leveraging economic policy instruments to pursue water policy objectives. The reforms are broadly on the right track and should be expanded. Water prices, taxes, and fees could in some cases be better structured to promote conservation, especially in the agriculture sector, and to move toward greater cost recovery.

The overall incentive structure is aligned in policies for water conservation, environmental protection, pollution reduction, and fiscal sustainability. The price that users pay for water in China is designed to promote efficiency and conservation, in line with the vision of a water-saving society. In addition to pricing, various taxes and fees are also used to both encourage water conservation and finance water infrastructure.

- In general, water resource fees (*shuiziyuanfei*) are levied to cover capital and O&M costs associated with water supply and delivery.
- Water resource taxes (*shuiziyuanshui*) are intended to capture environmental externalities associated with particular water uses and are often levied on groundwater withdrawals.
- Wastewater treatment fees (*wushuichulifei*) support capital and O&M costs associated with wastewater treatment plants.

Prices vary by policy goal. Many localities in China have used economic instruments to promote sustainable water use, pollution control, and poverty reduction. Beijing, for example, has instituted a tiered pricing structure that charges users a progressively higher tariff, encouraging water conservation. Different prices have been set for different water uses, with special uses like golf courses charged a much higher tariff. This structure helps direct water to its highest-value uses.

Urban and rural water users are also charged at different rates, helping to ease the financial burden on poorer farmers and rural residents. To promote wastewater reuse, 37 cities and counties in 18 provinces had, by 2010, introduced a preferential price for reclaimed water.

The system needs further strengthening. Current signals are not yet strong enough to completely achieve the water use control, allocation, and efficiency objectives set out in the "Three Red Lines" (see annex A). In many cases, this entails further raising prices, fees, and taxes to send stronger signals, and to improve fiscal sustainability for water service providers and wastewater treatment operators.

The system strengthening aims particularly to control pollution better and further protect the environment. Recent moves to replace separate wastewater treatment fees with environmental protection taxes and water resource taxes with natural resource taxes to better capture environmental externalities represent a promising direction and should be expanded. Agricultural water prices, in particular, should be raised.

*Source:* Moore 2013; Moore 2015.

## Notes

1. This chapter is based the *Vietnam Public Expenditure Review* (World Bank 2017l); *The Status of Infrastructure Services in East Asia and the Pacific* (World Bank 2017f); the 2015 ODI paper on private finance (ODI 2015); and the energy sector financing publication *Vietnam: Maximizing Finance for Development* (World Bank 2018f). Other references are noted in the text.

# 9

# The Way Forward

To provide a sense of urgency for action, this chapter first summarizes the principal water-related threats and costs that Vietnam faces (see section 9.1). Then, section 9.2 summarizes seven main recommendations and some suggested actions for consideration of the government. Finally, section 9.3 sequences the suggested actions to understand when they can start and when they will have an impact.

## 9.1 The urgency for action

As previous chapters detail, Vietnam already faces myriad water-related challenges—all expected to become more severe under an inaction (business as usual) scenario and projected climate change trends. The key markers of the looming crisis are:

- Vietnam's four river basins in which 80 percent of GDP is generated—the Red–Thai Binh, Mekong, Dong Nai, and South East River Cluster (SERC) basins—are all expected to face water stress in the dry season by 2030. The severely stressed SERC River Basin is expected to be unable to meet even 28 percent of water demand in the dry season by 2030.
- Overexploitation of insufficiently monitored groundwater resources is one of the causes for lowering groundwater levels, contributing to land subsidence in Hanoi, Ho Chi Minh City (HCMC), and Da Nang, as well as localized water shortages in the dry season, for example along the Mekong (where 50 percent of Vietnam's rice is produced) and in the Central Highlands (where 88 percent of Vietnam's coffee is grown). Saline intrusion to aquifers further reduces agricultural productivity along the Mekong and Red rivers.
- Surface waters face serious pollution, with only 12.5 percent of municipal wastewater treated (MOC, 2019). Rivers in and around major cities are seriously polluted. Surface water pollution in turn increases groundwater dependence and over-abstraction. Untreated wastewater is used for irrigation downstream, threatening food safety and public health.
- Piped water supply and sanitation infrastructure and services reach only a fraction of the population.
- Rapid expansion of hydropower is risking the safety of small dams during flood season, can worsen downstream water stress in the dry season, and may lead to water-sharing conflicts. Further, reduced sediment loads in rivers endanger agricultural productivity.
- Droughts are increasing in frequency and severity, affecting livelihoods and agricultural production. The El Niño event between 2014 and 2016 caused the most severe drought Vietnam experienced in over 90 years, severely affecting livelihoods and the economy.
- A recent assessment of flood risk shows that historical peak flood flows that used to occur every one to five centuries are now expected to return across half the country every 20 years or less by 2026–45 (World Bank, 2018i).

To provide some insight into the economic cost of these water-related challenges, six selected threats were assessed for their economic impact using a CGE model

(see box 1.1). These six threats alone are expected to cause an approximate reduction of 6 percent of GDP annually by 2035. Given that only selected threats and impacts were assessed in selected areas, the expected GDP impact is expected to exceed 6 percent annually.

Taking decisive action now is therefore essential for Vietnam's sustainable socioeconomic development, especially as infrastructure and demand management solutions to avert the impending water crisis are at hand and feasible. 2030 Water Resources Group (2017) has assessed the most cost-effective demand-side solutions to reduce water stress levels in the four largest river basins (see table 9.1).[1] Demand-side interventions from the agricultural, industrial, and municipal sectors were prioritized based on their cost-effectiveness in US dollars per cubic meter. Implementing those solutions requires an enabling environment—governance and mobilization of finance.

**TABLE 9.1: Overview of estimated water gap and costs for interventions to achieve low water stress status, 2030**

| River basin | Estimated water gap (2030),a million cubic meters | Total estimated cost of interventions to close the gap (US$, millions) |
|---|---|---|
| Red–Thai Binh | 4,860 | 2,000 |
| Dong Nai | 1,850 | 650 |
| Mekong | 2,520 | (–650)[b] |
| SERC | 1,170 | 3,000 (+)[c] |

*Source:* 2030 WRG 2017.
*a.* The water gap is defined as the amount of water required to move from a severe or high level of water stress to a low level (as defined by the Water Exploitation Index).
*b.* As the most cost-effective interventions in the Mekong River Basin generate cost savings, required interventions result in overall savings.
*c.* Water demand management solutions assessed for this basin in the study were not sufficient to achieve a status of low water stress—further interventions at additional cost
are required.

## 9.2 Main recommendations and suggested actions

Based on the diagnostic in this report, seven main recommendations are made:

1. Improving water resources management institutions
2. Manage Vietnam's water at the basin scale through inclusive governance arrangements.
3. Increase value and incomes from water in agriculture.
4. Give top priority to reducing the high levels of pollution.
5. Improve risk management and disaster response, and strengthen resilience.
6. Develop market-based financing and incentives.
7. Strengthen water security for settlements.

### Recommendation 1. Improve water resources management institutions

#### 1.1 Further improve the legal framework to allow for efficient and effective water resources management

Revising the 2012 Law on Water Resources and 2014 Law on Environmental Protection would improve coordination of state management of water resources, particularly for the division of tasks among ministries and provinces. A revision could also help to address overlaps with other regulations and resolve key legal issues such as the status and powers of river basin organizations. In addition, the policies set out in the 2012 Law on Water Resources and in related decrees need to be implemented, notably incentives to encourage water saving, recycling, wastewater reuse and water use efficiency. Financial regulations need to be amended to allow for ring-fencing of revenues from economic instruments to allocate them to water resource management activities. Economic instruments should be further refined to incentivize behavioral changes in water users towards sustainable water resources management, and they should be strictly enforced. Market-based mechanisms which allow the consumer to 'vote' for sustainably produced products through their purchases should be further developed and promoted. Certification schemes and consumer education can be key pillars of this initiative.

> ***Suggested action:*** Revise the 2012 Law on Water Resources and 2014 Law on Environmental Protection to improve coordination and collaboration amongst institutions, to streamline synergies with other legislation, and to resolve issues outstanding from the 2012 provisions. Implement key provisions of the existing laws, with particular focus on water conservation and efficiency. Sharpen economic incentives to promote greater sustainability, and amend financial regulations to allow for ring-fencing of revenues to support water resource management activities.

#### 1.2 Enforcement of regulations, particularly related to discharge of wastewater, needs to be strengthened, to ensure strict compliance with environmental regulations

Monitoring and inspection – particularly random inspection - activities need to be increased and penalties firmly imposed. State management from central to local level needs to be strengthened, and active participation of stakeholders, particularly civil society,

should be enabled and encouraged through policies and regulations, in order to support water resources management activities, including monitoring activities.

*Suggested action:* Strengthen institutions, particularly for monitoring and inspection tasks, the use of incentives – both positive and negative, and participation of civil society to improve water resources management and reduce pollution.

### 1.3 Human and financial capacities and resources need to be enhanced to allow for implementation of important policy measures

Legislation and policy provides for a full range of instruments for integrated water resources management, but there has been delay in their development and use. In addition data collection and information sharing do not at present adequately support planning and management.

*Suggested action:* Develop and implement the overall master plan for water resource basic survey, water resources master plan, river basin planning. Establish river basin organizations and inter-reservoir operations. Strengthen basic surveys, expand monitoring stations, increase information collection, and database management, increase information sharing among ministries and localities.

### 1.4 Increasing engagement with civil society

Active participation of stakeholders, particularly civil society, should be enabled and encouraged. On the one hand, educational and communication campaigns could increase the awareness of Vietnam's citizens of water resource challenges and could offer guidance on how to support sustainable water resources management. On the other hand, given the scarcity of resources, civil society could be more actively involved in water resource management activities, such as monitoring water quality and untreated wastewater discharges.

*Suggested action:* Facilitate and encourage active participation of stakeholders, particularly civil society.

## Recommendation 2. Manage Vietnam's water at the basin scale through inclusive governance arrangements

### 2.1 Move forward on integrated management and the basin approach by establishing water governance at river basin level

The 2012 Law on Water Resources sets out the requirements of integrated management, basin planning, and the role of MoNRE. The 2017 Law on Hydraulic Works sets out the responsibilities of the Ministry of Agriculture and Rural Development (MARD). However, at present, many central, provincial, and local authorities and agencies take decisions on water development and management without adequate coordination at the scale where it matters—the basin. Building basin governance arrangements is essential for providing a forum and framework to address inter-sectoral and inter-jurisdictional issues such as infrastructure planning, water allocation, flow management, pollution, flooding, and drought resilience.

Preparation for establishing an inclusive organization in Sesan-Srepok and other basins has been moving to a conclusive stage. In addition, lessons on integrated planning emerging from the Mekong Delta could be applied to other basins.

*Suggested action:* Develop a timeline for specific steps to implement integrated management and the 2012 Law on Water Resources, adapted to the situation of each basin. Evaluate the evolving experiences: at the largest scale, the Mekong Delta; at the meso scale, the Sesan-Srepok; and at the intra-provincial scale, the Cai (or Dinh) River in Ninh Thuan. Prepare practical plans for effective basin governance arrangements in all main basins, building on local and international experience.

### 2.2 Build a national water information system to support good water management

Water resources management (WRM) is a knowledge-based activity currently constrained by lack of information. High-quality and timely water data need to be gathered to support planning and decision making. Based on these data, likely impacts of inaction should be assessed, and priority actions decided upon. Investments in data gathering need to be completed, and data need to be transformed into information and made available to all who need it.

*Suggested action*: Modernize water monitoring, enhance analytical tools, and invest in water knowledge. Collect all water data into a robust, easily accessible, and transparent water information system as the foundation of good water management.

### 2.3 Improve the efficiency of public expenditures on water in a basin framework

Aligning public spending on water with basin plans could help resolve coordination challenges among sectors and between the center and provinces. The approach could also rebalance public expenditures toward operations

and maintenance (O&M), away from the current overemphasis on capital spending. More infrastructure may not always be the answer, especially in times of public finance constraints. 2030 WRG (2017) found that in three of the four major basins, water stress could be reduced and resilience strengthened without any new infrastructure to increase supply.

*Suggested action*: Review the patterns and processes of public resource allocation in water through a water public expenditure review to help prioritize the use of scarce resources, better interconnect the use of budgets between the center and subnational levels, and rebalance budgets between capital and O&M expenditures. Use the new five-year medium-term investment plan to integrate sectoral and subnational priorities with national priorities within basin plans, encourage multiyear programming, improve the fit of investment with needs, and facilitate long-term O&M.

### 2.4 Strengthen arrangements for transboundary planning and operations

Implementation of the Mekong agreement has brought palpable benefits to the riparian countries in terms of information and risk management, but issues remain, and transboundary issues are emerging on other rivers, too.

*Suggested action*: Strengthen existing mechanisms among the Mekong riparian countries and find new ways to share benefits and minimize adverse impacts. Prioritize bilateral work between Vietnam and Cambodia, given Vietnam's unique position as both upstream and downstream riparian.

## Recommendation 3. Increase value and incomes from water in agriculture

### 3.1 Strengthen and accelerate implementation of the Agricultural Restructuring Plan and of the new irrigation strategy

Using 92 percent of the nation's water, Vietnam's successful agriculture and aquaculture depend on good water service but face increasing challenges. Expanding infrastructure has been overemphasized, and O&M comparatively neglected. Now performance is deteriorating, with emerging constraints and risks, particularly from seasonal shortages, climate variability, and extreme events. Agricultural growth has slowed, and diversification is still low, contributing to persistent rural poverty. Vietnamese agriculture is at a turning point where restructuring is needed to generate "more for less" through innovation, climate-smart agriculture, and environmental sustainability. To achieve this, it is essential to link agricultural policy and water policy at the national and river basin levels.

*Suggested action*: Strengthen and accelerate implementation of the government's Agricultural Restructuring Plan (2014) and the new demand-responsive irrigation strategy (2017), improving water service to maximize farmers' incomes and value added.

### 3.2 Factor irrigation and irrigation infrastructure management into integrated basin planning

Agricultural water management challenges—pollution, water stress, water service, and flood and drought mitigation—abound. Many farmers could obtain much more value from their water. Agricultural investment and water management need to be better integrated in the basin planning and management framework. Climate change risks need to be planned for. For example, flood and drought risk management may require more storage and better storage management, with national and local disaster risk planning for irrigated agriculture. As the major water user, irrigation needs to actively participate in integrated basin planning.

*Suggested action*: Incorporate agriculture and aquaculture into basin plans prepared and implemented collaboratively, factoring in MARD and the MONRE horizontally and Provincial People's Committees (PPCs) vertically. Integrate agricultural investment into plans to optimize value and water allocation and use at the basin scale, and factor in climate change impacts. Pilot the approach in Ninh Thuan, where planning for agriculture in a basin framework can boost farmers' incomes and increase drought resilience.

### 3.3 Accelerate adoption of improved rice husbandry systems

Much greater value and higher farmers' incomes can be obtained where farmers convert to alternate wet and dry (AWD) for rice production, as part of the 1 Must–5 Reductions (1M–5R) program or system of rice intensification (SRI). AWD can save 30–40 percent of water on paddy land. The investment required is not excessive, and rates of return and the boost to farmers' incomes are high. AWD and improved irrigation for coffee are part of Vietnam's Intended Nationally Determined Contributions (INDC) and thus provides a clear synergy to climate change related actions.

*Suggested action*: Scale up adoption of 1 M-5R and SRI programs, including AWD as a key component and support irrigation improvement, land leveling, and collective actions by farmers.

### 3.4 Promote water efficiency and water productivity, and strengthen drought resilience

Experience throughout Vietnam shows that higher-value cash crops have higher water productivity, and improved irrigation can boost output and incomes and proof farming against drought. Up to 25 times more crop value and farmers' income can be obtained if farmers switch part of their cropping to higher-value crops that return more value per cubic meter.

*Suggested action:* Support investment in irrigation systems, farms, and market links and value chain development, with farmers and the private sector as leading partners.

### 3.5 Align public resource allocation in irrigated agriculture with policy objectives, in a basin framework

Improving the allocation and efficiency of public resources in agriculture and sharpening the incentive structure for farmers would help boost agricultural growth and farmers' incomes. In particular, there is scope to rebalance budget allocations more toward rehabilitation, asset management, and operations. Also, asking farmers to pay a larger share of O&M costs would increase incentives and accountability and help finance operations. New resource planning and allocation instruments could help this rebalancing. The medium-term investment plan and medium-term financial and budgetary plan could allow multiyear programming at the basin scale, improving the fit of investment with needs and facilitating long-term O&M. In addition, there is scope to replace paddy land by agricultural land in the budget allocation formula to promote diversification and thus higher water productivity and higher incomes for farmers.

*Suggested action*: Progressively shift the balance of public financing from new irrigation systems toward upgrades of existing irrigation systems, O&M, and strengthened agricultural services. Pilot these innovations in preparation for the budget/medium-term investment plan for 2019, starting with the two provinces identified as pilots, namely Dong Thap and Lam Dong.

### 3.6 Develop private financing for irrigated agriculture and the value chain, and empower farmers to take more responsibility for their own development

As the government increasingly becomes a facilitator rather than an investor, there is enormous scope to increase private financing. Private capital or management could support large-scale irrigation through public–private partnership (PPP) arrangements, cofinance irrigation improvement and intensification for smallholders, and strengthen links and financing along the value chain.

*Suggested action*: Develop a strategy jointly with farmers and the private sector for increased PPP and for alliances and links between farmer associations and aggregators. Facilitate links between smallholder-irrigated farming and markets through innovative PPP approaches. Explore options for irrigation management transfer. To help commercialize agriculture, consider revisions to the current land law, for example, to lift the ceiling of maximum landholding size, allow transfer of paddy land to non-farmers, and remove the limit of 50 years for long-term agricultural land use.

### 3.7 Reassess the overall incentive structure for farmers

To align farmers' behavior with economic and fiscal objectives, and with other policy goals such as environmental sustainability, pollution control, and resilience to shocks requires a balance between nonmarket and market incentives.

*Suggested action*: Conduct a review to determine the optimal mix of positive and negative incentives to help farmers progress toward water-efficient and clean agriculture. Use this comprehensive incentive approach to articulate options for charging irrigation service fees not only as a fiscal measure, but as an incentive for optimal farming practices.

## Recommendation 4. Give top priority to reducing the devastating levels of pollution

### 4.1 Review the regulatory and incentive structure for industrial wastewater

Risks from water pollution are becoming extreme, and the impact on human health, the economy, and the environment is a massive threat that could cost nearly 6 percent of GDP by 2035 when comparing the inaction and action scenarios. The nation needs to

make infrastructure, incentives, and regulation priorities in a massive national effort and investment push.

*Suggested action*: Assess the regulatory and incentive structures for reducing industrial pollution to determine why they are currently ineffectual and what actions would have the most impact. As a priority, strengthen water quality monitoring and regulatory systems to control industrial pollution.

### 4.2 Test innovative approaches to water pollution control that have been developed in other countries

Vietnam can learn from innovative approaches to water pollution control in countries around the world that face the same challenges.

*Suggested action*: Study and test innovative approaches to monitoring and accountability, such as monitoring pollution in real time, developing a water health index, strengthening local accountability for pollution control, and allowing civil society to litigate. Also study and test innovative approaches to finance and incentives: piloting a market in pollution-discharge permits, designating water pollution control as a priority for PPP investment, and targeting incentives at specific pollution reduction outcomes.

### 4.3 Make domestic wastewater collection, treatment, and reuse an investment priority—and a business opportunity

Vietnam's performance on domestic wastewater collection, treatment, and reuse is the worst in the region. Only 46 percent of urban households are connected to a sewerage network, and only 12.5% of urban wastewater was treated in 2018 (MOC, 2019). However, investments in wastewater have sizable public good characteristics—large public health benefits—while attracting private sector investors poses challenges.

*Suggested action*: Redirect public investment and regulatory efforts toward this priority development challenge. Work with the private sector to develop financing models, assured revenue streams, and options to monetize treated wastewater that will make domestic wastewater attractive for investors, either alone or in PPP arrangements.

### 4.4 Cut agricultural pollution

MARD's 2014 Agricultural Restructuring Plan has embraced the need to reduce the sector's environmental impacts. With the right packages for farmers, corrections in fertilizer and pesticide use could lead to greater efficiency, reduced pollution, and higher incomes.

*Suggested action*: Implement the recommendations of the recent World Bank report on agricultural pollution to: promote and scale up good agricultural practices by offering farmers education and better technical options; implement the regulatory framework through monitoring and enforcement, supported by interagency cooperation; and revise the incentive structure to encourage nonpolluting behaviors (World Bank 2017m).

### 4.5 Use innovative financial mechanisms to support natural capital investments and reduce nonpoint source pollution

Although nonpoint source pollution is notoriously hard to control, some countries have introduced innovative financial mechanisms, particularly market-oriented approaches facilitating payments between ecosystem service providers and beneficiaries. These can work well, especially when the links are clear.

*Suggested action*: Study and test innovative market approaches including: water quality trading, which can achieve higher quality standards and reduce the cost of compliance; payment for ecosystem services (PES) approaches; revolving funds and water funds to help finance natural capital alternatives to conventional water treatment technologies; and environmental quality contracts, which help enterprises and local governments meet water quality targets.

## Recommendation 5. Improve risk management and disaster response, and strengthen resilience

### 5.1 Adopt a phased approach to address urgent needs for managing risks and longer-term needs to build resilience across key sectors

Disasters have long-term macroeconomic impacts and affect development outcomes. Provident preparation is the best approach. Given the high risks that Vietnam faces, it should continue investing in risk reduction, preparedness, and long-term resilience (World Bank 2018j).

*Suggested actions*: In the short term, resolve the multisector coordination and implementation challenge, improving effectiveness and coordination horizontally across sectors and vertically at national, regional, and provincial levels. In the medium term, empower the existing Central

Committee for Natural Disaster Prevention and Control to drive inter-ministerial coordination and advise on integrated disaster risk management (DRM). In the long term, mainstream multi-hazard DRM and climate change adaptation into planning for managing natural resources and land use across all climate-sensitive sectors.

### 5.2 Implement a holistic and integrated approach to disaster risk management

The report *Towards Integrated Disaster Risk Management in Vietnam* highlights four "musts" for DRM in Vietnam, incorporated here as suggested actions.

***Suggested actions***: Complete and operate an integrated drought and flood monitoring and warning system; develop a financial protection strategy; strengthen social assistance systems; and conduct locally-specific risk and vulnerability analyses.

### 5.3 Build resilience through structural and nonstructural measures across key sectors

The same report also highlights four "musts" for building resilience.

***Suggested actions***: Integrate water resources management and climate-sensitive land-use planning; adopt climate-smart good agricultural practices; work through inclusive, community-based approaches; and empower vulnerable populations to access available risk reduction opportunities to enhance risk resilience and livelihoods.

### 5.4 Develop a comprehensive disaster risk finance strategy

Improved financial planning will be critical to establishing a robust system for disaster preparedness and response. The Ministry of Finance could take the lead in financial planning for disasters by developing a comprehensive disaster risk finance strategy.

***Suggested actions***: Improve coordination of existing instruments and combine financial instruments to allow government and communities to mobilize, access, and disburse financing from public and private sources quickly for immediate response and recovery. Look to capital and insurance markets to secure additional sources of funding from the private sector, alleviating the burden on the state budget. Study and test innovative instruments such as the Catastrophe Deferred Drawdown Option used in the Philippines or the Fund for Natural Disasters in Mexico.

## Recommendation 6. Develop market-based financing and incentives

### 6.1 Develop a new water sector financing strategy

**Develop a new water sector financing strategy.** Against the backdrop of declining public finance, investment and operational needs in urban and rural water and sanitation must increasingly be met by the private sector. A new sector financing strategy should aim at maximizing private finance for development and at introducing financially autonomous operations. The recent proposals for developing a financing strategy for the energy sector could help frame this investigation (World Bank 2018f). The new decree (Decree 63/2018/ND-CP) on Public–Private Partnerships, which came into effect on 19 June 2018, seeks to improve and clarify the enabling environment for such partnerships. However, some outstanding issues, including complicated and lengthy procedures for appraisal and approval for PPP projects, and risk allocation between the State bodies and private investors, remain unclear and unaddressed. It is expected and of importance that these will be addressed by the Law on Investment, which is currently being drafted and will likely be debated by the National Assembly in 2020 or 2021 (KPMG, 2018). Likewise, there is a need for the government to become a facilitator rather than an investor in agriculture. Given the neglect of O&M for publicly funded irrigation schemes, bringing in farmers and professional partners to operate and maintain facilities may also increase the reliability and extend the useful life of these assets.

***Suggested action***: Develop a water sector financing strategy prioritizing: private investment and expertise; citizens' responsibility for payment for services; special financing mechanisms for smallholders, rural water supply and sanitation, and poor and marginalized populations; alternative sources of finance such as green growth financing; and a more strategic role for public finance, focused more on policy reform and institutional development than on capital investment.

### 6.2 Scale up PPPs across all branches of the water sector

The recent trend in equitization of the water utilities and development of private sector–financed bulk water schemes has demonstrated the potential to draw domestic and international private financing and expertise into the water sector. Despite current

constraints, there could be scope for PPPs throughout the water sector if the right packages (with risk allocation and incentives) could be tailored. In irrigation, the new Law on Hydraulic Works (Articles 50–52) provides for broader participation of farmers and the private sector.

> ***Suggested action***: Develop a PPP strategy for each branch of the water sector: water infrastructure, water pollution control, urban and rural water supply, wastewater, and irrigation. Learn from other countries' successful PPP strategies, such as China's.

### 6.3 Conduct a comprehensive assessment of the overall incentive structure in water

**Assess the overall incentive structure in water to identify the most important and practical ways to align behavior with policy goals and to meet fiscal objectives.** The government's policy to reduce the role of the state in most policy areas, including water resources management, points to a much greater role for market-based policy instruments. These instruments send pricing signals concerning the importance of conservation, efficient use, and the externalities entailed in different water uses. A range of economic policy instruments can promote efficient water allocation, development, and sustainable use, including water pricing reforms to promote conservation, and water rights assignment and trading to facilitate the reallocation of water to its highest-value uses. Incentives for cooperation of both public and private actors within comprehensive plans are critical.

> ***Suggested action***: Carry out a comprehensive assessment of the existing overall incentive structure and of options for better aligning incentives with policy objectives.

## Recommendation 7. Strengthen water security for settlements

### 7.1 Integrate water security for settlements within broader spatial planning

The rate of urbanization and industrialization in Vietnam has outpaced the planning, infrastructure, and regulation needed to support this rapid growth. Water security for settlements requires risk management, including resilience to climate-related risks such as floods and saline intrusion; resilience to threats to water quantity and quality; development and protection of water sources; and provision of quality WSS services.

> ***Suggested actions***: Based on ongoing planning for the Mekong Delta, integrate urban planning for water management, hazard mitigation, water supply, and drainage and wastewater into broader spatial planning both at local and basin-wide levels.

### 7.2 Complete sector reforms and improve service delivery for urban water supply

Urban water network access and services have improved vastly, but there is still some way to go in access, affordability, cost recovery, and financial sustainability. Corporatization and partial privatization of water supply utilities have accelerated, bringing new risks, and the accompanying program to strengthen governance of urban water has stalled.

> ***Suggested actions:*** Focus strategy and planning for urban water supply on 100 percent access, quality, and efficiency of services, including in smaller towns. Improve governance and strengthen utility autonomy and accountability through contractualization, institutional development, and targeted investment. Establish independent regulation.

## 9.3 Sequencing actions and timing impacts: the feasibility and political economy of change[2]

Table 9.2 categorizes the recommended actions according to whether they can practically be taken in the near or longer term. Practicality is a combination of readiness—*Can the action be taken within existing institutional and financial frameworks*?—and political economy—*Is there a solid constituency for change, and are there political, institutional, or public concerns that would impede change*? (see table 9.2)

The table also considers the timing of impacts, both as an indication of where action is needed right away to secure a better water future in five or fifty years' time, and as a guide to the lag between the moment of action and the flow of benefits, a key consideration in the eyes of both political decision makers and the public.

**TABLE 9.2: Moving to action: sequencing, timing, feasibility, political economy**

| Immediate actions with quick impacts | Immediate actions with longer-term impacts | Longer-term actions with quick impacts | Longer-term actions with longer-term impacts |
|---|---|---|---|
| ***1: Improving water resources management institutions*** | | | |
| Develop and implement the overall master plan for water resource basic survey, water resources master plan, river basin planning [1.3]<br><br>Increase monitoring and inspection – particularly random inspection [1.2]<br><br>Facilitate and encourage active participation of stakeholders, particularly civil society [1.4] | Establish river basin organizations and inter-reservoir operation [1.3]<br><br>Issue outstanding policies regulated in the Law on Water Resources and related decrees [1.1] | Amend financial regulations to allow for ring-fencing of revenues from economic instruments towards water resource management activities. [1.1]<br><br>Refine and further develop economic incentives Issue water efficient certification schemes and increase consumer education. [1.1]<br><br>Strengthen basic surveys, expand monitoring stations, increase information collection, and databases management, increase information sharing among ministries and localities. [1.3] | Revise the 2012 Law on Water Resources and 2014 Law on Environmental Protection in order to improve coordination of state management of water resources, particularly for the task divisions among ministries and provinces as well as to address overlaps with other regulations and to legalize key issues such as river basin organizations [1.1] |
| ***2: Manage Vietnam's water at the basin scale through inclusive governance arrangements*** | | | |
| Begin establishing water governance at the river basin level [1.1]<br><br>Build a national water information system [1.2] | | Improve the efficiency of public expenditures on water in a basin framework [1.3] | Strengthen arrangements for transboundary planning and operations [1.4] |
| ***3: Increase value and incomes from water in agriculture*** | | | |
| Factor irrigation and irrigation infrastructure management into integrated basin planning [2.2]<br><br>Promote water efficiency and productivity and strengthen drought resilience [2.4]<br><br>Align public resource allocation in irrigated agriculture with policy objectives in a basin framework [2.5] | Strengthen and accelerate implementation of the Agricultural Restructuring Plan and of the new irrigation strategy [2.1]<br><br>Accelerate adoption of improved rice husbandry systems [2.3]<br><br>Reassess the overall incentive structure facing farmers [2.7] | | Develop private financing for irrigated agriculture and the value chain, and empower farmers to take more responsibility for their own development [2.6] |
| ***4: Give top priority to reducing the high levels of pollution*** | | | |
| Test innovative approaches to water pollution control that have been developed in other countries [3.2]<br><br>Make domestic wastewater collection, treatment, and reuse a business opportunity [3.3]<br><br>Use innovative financial mechanisms to support natural capital investments and reduce nonpoint source pollution [3.5] | Review the regulatory and incentive structure for industrial wastewater [3.1]<br><br>Cut agricultural pollution [3.4] | | |
| ***5: Improve risk management and disaster response, and strengthen resilience*** | | | |
| Adopt a phased plan for managing risks and building resilience [4.1]<br><br>Develop a comprehensive disaster risk finance strategy [4.4] | Implement a holistic and integrated approach to DRM [4.2] | | Build resilience through both structural and nonstructural measures across key sectors [4.3] |
| ***6: Develop market-based financing and incentives*** | | | |
| Develop a new water sector financing strategy [5.1]<br><br>Conduct an assessment of the overall incentive structure in water [5.3] | | Scale up PPPs across all branches of the water sector [5.2] | |
| ***7: Strengthen water security for settlements*** | | | |
| Complete urban water sector reforms [6.2] | | | Integrate water security for settlements within broader spatial planning [6.1] |

## Notes

1. More information, as well as detailed cost curves, are available in the 2030 WRG (2017) report.
2. See annex A.2 for a discussion of the political economy of change in Vietnam's water sector.

# Annex A

# Reforming Water Governance in Vietnam: Lessons from Other Countries

**Although reform processes and governance reforms around the world have varied, change everywhere has been driven by a combination of growing need and rising awareness**

Experience from elsewhere in the world can show how a program of following best practices in the water sec-tor can be decided and implemented by consensus. In Australia, reform was driven by a fast-deteriorating water situation and followed an inclusive and evidence-based process of study and discussion. Based on sound science, the nation developed a comprehensive reform program through debate leading to consensus. The resulting program of change won acceptance because of its policy coherence and the improved water governance arrangements proposed.

In Israel, reform built on a water-respecting culture and a sense of national commitment and partnership between government and citizens, backed by a perception enshrined in law that water belonged to the nation. Reform was begun when extreme water short-ages loomed and was driven both by popular sup-port and by strong technocratic and scientific inputs. Information and planning were key to good water management, with a commitment to measuring and monitoring and to rolling 30-year plans. Public and private sectors were encouraged to work together to foster innovation and make it profitable.

A very different example of reform is China's Most Stringent System for Water Resource Management (known as the Three Red Lines). Mounting water shortages and pollution drove the top-down setting of targets that limit total national water use, specify minimum standards for water use efficiency, and establish clear limits on pollutant loads. Employing comprehensive monitoring and evaluation, the system has produced demonstrable results.

**One overall lesson is that reform is driven by a combination of mounting problems and growing under-standing in both government and society of the need for change, factors present in Vietnam today.** Water is a major preoccupation for all Vietnamese, making this a propitious time to press ahead with change. As issues and risks grow, there is considerable concern within government about water at the central, provincial, and local levels. Government is committed, with major programs and reform efforts already under way across the water sector and with growing concern about climate change and disaster risk challenges. In addition, water has been climbing the national agenda. Media coverage is extensive, awareness of problems is growing and an increasing number share participants in the debate. An inclusive, multi-stakeholder approach could work well, bringing in all levels of government and all branches of society, building on existing social capital, academic expertise, the media, and concerned advocates. Water reform is also an opportunity to give more voice to women, the poor, and minorities.

**A second lesson is the need for a structured evidence-based process.** Vietnam has an impressive array of institutional competences in government, universities, and civil society for analyzing needed reforms. This forms the foundation for a national debate leading to consensus on the shape of the reform program.

Creating momentum for reforming water governance requires, first, an understanding of the drivers of change and of the interests of different constituencies. Successful change programs respond to imperatives such as severe water shortages and disputes among sectors and may be catalyzed by decisive moments. Many such processes are evidence-based, systematically using data, science, and knowledge, and the practical application of economics. A process of this kind, founded on an inclusive process of study and debate, can lead to consensus on a national water reform agenda and coherent policies.

Section A.1 describes how momentum for change may be generated, looking first at typical drivers of change in water governance around the world and then at change processes in one country that has successfully completed a difficult water sector reform—Australia. The section also looks at the key factors that have made Israel a top performer in water development and management and have fostered its status as a world-leading technological innovator. And it examines the top-down approach used in China. Section A.2 then looks at the political economy of water governance reform in Vietnam, asking how decisions are taken, what actors might help move reform along, and what would be the right time and the right catalyst for reform.

## A.1 Drivers of change: Creating momentum for reforming water governance

### A.1.1 Typical drivers of change in water governance around the world

**Drivers of change have multiple origins.** Although each country context is different, it is possible to identify changes in attitudes, awareness of problems, and institutions and power relations that, in combination, have created momentum for change in water governance.

**The evolution of thinking and awareness about the need for change among the population and within governments is a common driver.** In many countries, demographics and economic growth have led to rapid urbanization and increased consumption of water and of water-intensive food products. As a result, urban constituencies are an important voice in the water debate. Accompanying this change are increasing education levels and broader social change, including change in the status of women, which have led to more emphasis on potable water and safe sanitation and less on water for agriculture. The thinking within governments has usually evolved in parallel. Policies that in the past favored supply increase and tended to skew demand through subsidies and protection have moved more toward concerns for efficiency, environmental protection, and a lighter fiscal burden.

**Across the globe, serious water problems have, little by little, become the subject of concern and open discussion.** The problems are everywhere, but they differ from place to place. For many countries, the problem is pressing scarcity. In others, it is extreme events like flooding and drought. Often the groundwater revolution has led to unmanageable overexploitation. In many countries, the rapid expansion of supply investments has created an inflexible pattern of rights and expectations, with over-allocation to agriculture giving rise to the challenge of water-short cities. Everywhere, climate change is introducing costs and risks that are hard to manage. There is awareness that management of environmental degradation has been neglected. Public and private investments in water infrastructure are altering water rights, in some cases increasing inequity. Almost everywhere there are deficiencies in water supply and sanitation services and worsening pollution.

**There is an awareness that water sector institutions have not always adapted to this changing context.** New technology and the development of water resources have outstripped the governance mechanisms that should have regulated them. More generally, there is a sense that governments have developed the resource and allocated water among sectors and to users but have not developed the flexible and participatory institutional mechanisms and accountability structures needed to respond to changing demand, create accountability, or resolve conflicts. There is an understanding, too, that access to water is not always equitable and that vulnerable and marginalized groups are most at risk since they lack the resources to man-age the systemic factors that contribute to poverty.

**All these developments create a context receptive to change, which may be sparked by some decisive moment.** Crisis can focus attention on lingering problems, and sudden, dramatic events can trigger beneficial change. For example, riots in Algeria in 2002–04 were a stimulus to water reforms. Conflict in Iran has demonstrated the need for a more consultative approach to relocation issues. Successive severe droughts in Morocco in the early 1980s stimulated water policy reform, including the passage of the 1995 Water Law. A long interruption in urban water supply in Ta'iz, Yemen, in 1995 triggered a national debate and the start of water sector reform.

### A.1.2 Introducing best practice water policies: Australia

**Australia developed a comprehensive reform program through science and debate leading to consensus.** At the end of the last century, Australia was experiencing serious water problems, particularly shortages, and stresses between sectors competing for water. Over a decade, Australia debated its water problems and developed a comprehensive reform program. Box A.1 shows the main elements in the Australian reform program and identifies the elements that contributed to its success in improving water management.

**BOX A.1: Australia's National Water Initiative: comprehensive reform of water management in an arid country**

Driven by growing water stresses and conflict, Australia conducted an inclusive study and debate to arrive at consensus on its National Water Initiative. This comprehensive reform plan incorporates the following principles:

**Resource management**

- Return all water systems to sustainable levels of extraction.
- Manage groundwater sustainably.
- Respect needs for environmental water.

**Water allocation**

- Provide secure water entitlements for irrigators.
- Provide secure water entitlements for the environment.
- Introduce water sharing plans with legal force.

**Demand management**

- Encourage open trading of water rights.
- Introduce water pricing based on economics.
- Ensure support for affected communities where irrigation supplies are reduced.

**Governance and institutions**

- Invest in knowledge about water and build capacity for good water management.
- Improve water data collection and water accounting.

**Water services**

- Improve the management and security of urban water supplies.
- The initiative has led to greatly improved water management by building:
- **Certainty** for water investors and communities.
- **Science and evidence** as foundations for water management.
- **Markets** in the water sector.
- The **environment** as central to water management.
- The **private sector** as a participant in the water sector.
- **Capacity** for good water management.
- The national **infrastructure** program as a contributor to water management.
- A national **narrative** for water reform.

*Source:* Adapted from Matthews 2011.

**What elements enabled Australia to bring about such sweeping reforms?** There are five key factors:

- **An imperative for reform.** Australia was experiencing severe water shortages and over-allocation to agriculture, and climate change was making the situation worse. These realities became drivers of change—the triggers that drove policy action and led to agreement that something had to be done.
- **An inclusive process of study and debate leading to consensus on a national water reform agenda.** A long process of study, national debate, and political discussion led to agreement on objectives and on a national water reform agenda, the National Water Initiative, which served as a blueprint for the changes.
- **Policy coherence.** The National Water Initiative contained the right suite of policies to achieve the policy objectives and the right measures to tackle the many water challenges within a coherent, integrated national plan.
- **Good water governance arrangements.** The reforms established the right institutions, with clear authority, the necessary resources, and stability (see box A.2).
- **An evidence-based process.** The National Water Initiative was based on the systematic use of data, science, and knowledge and on the practical application of economics, taking account of key concerns such as property rights and introducing the discipline of markets.

### BOX A.2: Governance and institutions matter: Australia's experience

Australia's National Water Initiative adopted the principle: "Governance and institutions are always critical to good water management and to the success of reform." As a result, institutional change and strengthening were at the heart of Australia's water sector reform.

**Reform of government agencies comprised:**

- A federal water department and legislation, both unprecedented.
- A new independent authority for the Murray Darling Basin.
- Intergovernmental coordination committees.
- Oversight by the Council of Australian Governments (prime minister and state premiers).
- An independent public assessor of progress (the National Water Commission).

**The National Water Commission, as independent assessor:**

- Is required by law to report on reform progress.
- Reports to the prime minister.
- Publishes assessments and reports.
- Can suggest new reform needs (for example, groundwater, water data, water science).
- Advocates reform and change.
- Invests in reform and better water management.

**Other specialist institutions, all administratively separate, were set up or strengthened:**

- Basin management authorities.
- Environmental water managers.
- Irrigation and urban supply utilities.
- Environmental regulators.
- Health regulators.
- Water market regulators.

**There was emphasis on institutions to build capacity for data, information, and knowledge:**

- A major new agency and funding for water data (the Bureau of Meteorology).
- Major investments in water science.
- National Water Commission inputs to public debate and understanding about water.

*Source:* Adapted from Matthews 2011.
*Note:* The National Water Commission is no longer active.

## A.1.3 Introducing best practice water policies: Israel

**A 2017 analysis of Israel's water governance concluded that a number of policy choices had driven what many observers consider excellent performance (Siegel 2017).**

**Good water management reflects Israel's political economy and public attitudes.** Israel has a water-respecting culture: there is a sense of national commitment and a partnership between government and citizens on water. From this has come a perception enshrined in law that water belongs to the nation: water resources In Israel are treated as public goods, not private property, allowing the nation to plan for water and to allocate it based on highest value best use. This national solidarity also drives a preference for regulators, not politicians: Israelis view issues of water planning as long-term issues and water tariffs as business issues, not political choices. Israel created a Water Authority as a technocratic decision maker and regulator and also set up an independent nonpolitical bulk water supplier and local water utilities. The notion of water as the concern of all, not just of the government, has created vocal and respected water advocates who persuade politicians to give water the focus and funding required. Finally, high levels of public awareness and commitment feed a sense of urgency: the need for water is growing, natural resources are under threat, and the time to act is now. Not taking action means opting for potentially terrible environmental consequences.

**The incentive structure is also conducive to good water management.** Most important is the paradox that **cheap water is expensive.** In the Israeli view, water has a real cost and users have to pay. Thus, the costs of supply are covered but, more important, Israel became a water-conserving nation, with scientists and entrepreneurs looking for ways to make water use ever more efficient. Reflecting this is the policy of using water charges for water—charging full cost but reserving the revenues to finance operations and to improve and extend water systems. In addition, public and private sectors work together to foster innovation and to make it profitable—with a government-financed incubator that has launched more than 200 water-based start-up companies and a billion-dollar export industry.

**Information and planning are seen as key to good water management.** There is a strong practice of measuring and monitoring: metering allows proper billing and rapid leak detection, and measurement is critical for basin planning, river flow management, flood control, and drought management. Finally, because Israel recognizes the imperative to plan today for long into the future, it works on rolling 30-year plans for water management.

### A.1.4 An administrative top-down approach: China's Three Red Lines

**China's Three Red Lines have been effective, but could they be adapted to Vietnam's very different political economy?**

**The single most important element of China's current water governance system is the Most Stringent System for Water Resource Management, also known as the Three Red Lines.** At the core of this system are targets that limit total national water use, specify minimum standards for water use efficiency, and establish clear limits on pollutant loads.

**The experience thus far with this system has been largely positive with demonstrable results.** Under China's hierarchical water management system, the targets are disaggregated by province and local jurisdiction in a detailed, formulaic process. The Ministry of Water Resources also sets targets for each of China's six major watersheds.

The target-setting process relies on a comprehensive monitoring and evaluation system established in 2014 that measures progress on several key indicators: total water quantity use, industrial water productivity, agricultural water use efficiency, and water quality. Two more indicators were added in 2016: domestic water use productivity and total pollutant loads (DRCSC 2017).

### A.1.5 How multi-stakeholder engagement can catalyze change

**Experience from around the world shows that inclusive approaches are also useful in moving from identifying problems to formulating and implementing solutions.**

One example is the development of a public–private partnership approach to solving one of the thorniest of development challenges—the pollution of a major waterway (see box A.3). The process followed an inclusive participatory model developed by 2030 WRG.

**BOX A.3: A multi-stakeholder process devises a public–private approach to rejuvenating India's Ganga River**

For years the government of India has attempted to rejuvenate the Ganga River. The basin covers more than a quarter of India's area and is home to more than one-third of its population—450 million people. The river is highly polluted and increasingly prone to seasonal water shortages.

In 2015, with support from the 2030 Water Resources Group, India started a multi-stakeholder collaboration among official agencies; central, state, and local governments; the private sector; and civil society. A multi-stakeholder platform was established to diagnose the problem and assess options. The process followed an inclusive participatory model developed by the 2030 WRG:

- **Analyze:** Stakeholders analyze the problem to be solved as the basis for subsequent discussions.
- **Convene:** Stakeholders from the public and private sector as well as from civil society come together on a common platform to create awareness, trigger action, and build momentum for change. Stakeholders identify and agree on priorities and forge partnerships based on trust and a shared commitment to transform the water sector.
- **Transform:** Through the common platform, stakeholders draft concrete proposals, develop new policies, and prioritize investments tailored to the problem and the country situation.

In India, after long debate, studies were launched to identify the scope of needed interventions and to develop partnership approaches. The best-evaluated option was for sewage treatment and reuse infrastructure based on a hybrid annuity-based public–private partnership (PPP). Under the proposed model, the government would pay 40 percent of the project cost based on construction milestones, with the remaining 60 percent to be paid over 15 years as annuities to the private concessionaire, along with operational and maintenance expenses. This balance between payment on delivery and the subsequent annuities aligned incentives as the project was profitable for the concessionaire, while the performance-linked payments ensure accountability and the sustainability of the investment.

With all stakeholders agreeing that this was the best model, the government adopted PPP solutions as the basis for a Clean Ganga Program, tendering the first three PPPs in Mathura, Varanasi, and Haridwar. The tender resulted in a strong market response with multiple bids. The first two concession agreements were signed with private companies in October 2017, providing wastewater treatment capacity of 132 million liters per day.

Key to the success of this initiative was the joint development of the program by multiple stakeholders, which allowed all interests to be balanced, resulting in an outcome-oriented model that takes into account both the market realities of the private sector and the concerns of civil society. This process created a feeling of ownership of the project and project outcomes for all stakeholders, which provides the base for a sustainable project.

*Source:* 2030 WRG 2017.

## A.2 In Vietnam, a combination of mounting problems and growing understanding means that the time is propitious for change

### A.2.1 How are decisions taken?

**The locus of decision making in Vietnam is broader and deeper than just the central government.** Since the start of Doi Moi, decision making has been increasingly delegated to the implementing agencies of government and away from the center toward the provincial and local levels. In particular, the transfer of budgetary control directly to the provinces together with state retreat from direct control have contributed to greater decentralization of decision making. In addition, citizens have considerable liberty of choice and action. Essentially, governance has shifted from a centralized to a more dispersed system of authority.

**This dispersion of decision making creates possibilities for community participation, but also poses challenges.** Dispersion of decision making creates space for socio-political organizations for change and creates numerous opportunities for advocates. Communities have, for example, assisted in detecting violations and creating pressure for compliance of polluting industrial enterprises (Vedan, Sonadezi). On the other hand, dispersion may also create obstacles and risks. It is, for example, not always clear who the main decision makers are or how to reach them.

### A.2.2 The increasing importance of civil society

**Vietnamese civil society includes organizations and individuals working cooperatively for change on issues of public concern.** Civil society in Vietnam includes not only nongovernmental organizations (NGOs) but also traditional village associations, religious groups, print and online media, intellectuals, and academics. Each of these has the potential to influence decisions on water, in cooperation with government officials and the private sector.

**The number of Vietnamese NGOs has grown considerably in the past decade.** There are now over 2,000 issue-based organizations in Hanoi and Ho Chi Minh City alone. Some NGOs have also formed in other provinces. Some have formed their own networks, with varying levels of effectiveness; some of the more established networks are reaching out to other parts of Vietnam. For example, the Vietnam Rivers Network is now coordinated by a group based at a university in Hue and includes a strong sub-network in the Mekong River Delta.

**Media are key to attracting public support.** Vietnamese media are state-owned, but the landscape is far from uniform and has been developing rapidly. There are now around 800 newspapers and magazines. Advocates can turn to sympathetic journalists and media outlets. Use of the internet and social media is opening up new spaces in the media. The internet, in particular, offers many opportunities, especially blogs.

**Academic institutions can be important partners.** The main universities, located in the major cities, are state-owned. Professors and other intellectuals are held in high esteem. Academics can be important partners in social organizations, since they have technical knowledge and links to authorities while still remaining separate from official structures.

**Public opinion is also a power.** Public opinion matters greatly in Vietnam, since authorities want to be seen as responsive to public concerns.

**Water reform is an opportunity to give more voice to women, the poor, and minorities.** Women are closely involved in water issues at household, farm, and community levels, yet they lack voice (see box A.4). Concerns are similar for the poor and for ethnic minorities. The water reform process is an opportunity to correct exclusions and to improve outcomes through more inclusive approaches at all levels, from households to the policy level.

**BOX A.4: Giving voice in water to women, the poor, and minorities**

Women have lead responsibility for nutrition, child rearing, sanitation, and much of the country's agricultural work. From these responsibilities flow women's keen interest in water, sanitation, environmental health, and agricultural water management. Poor people and ethnic minorities work predominantly in agriculture related sectors where their voice is poorly represented. Women and the poor are more vulnerable than men to water-related shocks such as flood losses and damages. Yet women, the poor, and minorities are largely absent from decision making.

Water sector reform is an opportunity to raise awareness among local community leaders, local government officers, extension workers, heath workers, and others about the implication of gender inequality. Public services and messages about water need to be directed explicitly to women. There is also a need for gender-sensitive mapping and vulnerable group targeting, to raise awareness of gender-sensitive issues, develop a gender-specific response plan, and mainstream gender concerns in service provision.

### A.2.3 Current opportunities for change

**Water is a major preoccupation for all Vietnamese.** Table A.1 sets out reasons why action on water issues could be a top prospect for reform advocacy.

**Now could be a good time to raise issues about water management.** There are significant openings (as well as challenges) for social organizations. Civil society is gaining strength, though there are countervailing limits. The dispersion of decision making among numerous institutions ensures the presence of coalition allies within at least some official structures. As government officials and National Assembly delegates gain more experience and comfort working with civil society groups and social organizations, cooperation is likely to increase.

**TABLE A.1: Is action on water issues a top prospect for reform advocacy?**

| | |
|---|---|
| *Does water governance reform have the potential for positive impact on a large number of people?* | Water is a basic necessity and critical to human, social, and economic development. |
| *Would water reform be likely to have a positive effect on social equity (including gender equality and benefits marginalized groups) and therefore fit with broad societal goals?* | Action on water and sanitation, irrigation, and pollution will benefit the poor and marginalized. Access by poor minority populations is well below the national average, while their exposure to pollution is often greater than average. |
| *Is water governance reform relevant to central or local government policy, concerns, and practice?* | Government has major programs and reform efforts already under way across the water sector and is deeply concerned about climate change and disaster risk challenges. Recent legislation demonstrates the government's proactive attitude to water issues. Locally and nationally, extreme events and emerging water scarcity have become major issues. |
| *Is an advocacy coalition likely to influence policy?* | Water has been climbing the national agenda, and advocacy could help trigger further important reforms. |
| *Is there a critical mass of civil society stakeholders interested and involved?* | A number of NGOs, including the influential Vietnam River Network, are involved in water issues. |
| *Is there diversity of stakeholders across government, the private sector, and the population at large interested and involved?* | Within government, there is considerable concern about water issues at the central, provincial, and local levels. In the private sector and the population at large there is strong interest, particularly in water supply and sanitation, pollution control, and irrigated agriculture. |
| *Is there potential for forging or strengthening a broad-based coalition?* | The potential is high, given the extent of media coverage, the awareness of problems, and the number of active participants in debate. |
| *Is there need for more donor resources, or for other types of donor aid?* | Donor involvement to date has been largely in infrastructure development. At this juncture, donor aid will be critical, particularly grant aid, to help reform and strengthen governance. |

# Annex B

# Vietnam's Water Governance Framework

## B.1 The legal framework for water resources management and usage

### B.1.1 Relevant water-related laws

| No. | Name | Code number | Date of issuance | Being effective from | Comments |
|---|---|---|---|---|---|
| 1 | The Law on Water Resources | 17/2012/QH13 | | 1/1/2013 | Replacing the Law on Water Resources 1998 |
| 2 | The Law on Inland Waterway Transport | 23/2004/QH11 | 15/6/2004 | 1/1/2005 | |
| 3 | The Law on Biodiversity | 20/2008/QH12 | 11/13/2008 | 7/1/2009 | |
| 4 | The Law on Environmental Protection | 55/2014/QH13 | 6/26/2014 | 1/1/2015 | Replacing the Law on Environmental Protection 2005 |
| 5 | The Law on Construction | 50/2014/QH13 | 6/18/2014 | 1/1/2015 | Replacing the Law on Construction 2003 |
| 7 | The Law on Hydrology and meteorology | 90/2015/QH13 | 1/23/2015 | 7/1/2016 | |
| 8 | The Law on amendment and supplementation of some articles of the Law on Inland Waterway Transport | 48/2014/QH13 | | 1/1/2015 | |
| 9 | The Law on Charges and Official Fees | 97/2015/QH13 | 11/25/2015 | 1/1/2017 | Replacing the Ordinance on Charges and Official Fees |
| 10 | The Law on Irrigation | 08/2017/QH12 | 6/19/2017 | 7/1/2018 | |
| 11 | The Law on Master Planning | 21/2017/QH12 | 11/24/2017 | 1/1/2019. | The provisions of this Law on development, appraisal of the national, regional and provincial master plans became effective from 01/3/2018 |
| 12 | The Law on amendment and supplementation of some articles of 37 Laws relating to master planning | 35/2018/QH12 | 11/20/2018 | 1/1/2019 | |

## B.1.2 Sub-laws Decrees

### B.1.2.1 The 2012 Law on Water Resources

**B.1.2.1.1 The decrees (Ministry of Environment and Natural Resources is responsible for taking lead in implementation)**

| No. | Name of decree | Code number | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | Provisions on some articles of the Law on Water Resources | 201/2013/ NĐ-CP | 27/11/2013 | 1/2/2014 | Provisions on details of some articles of the Law on Water Resources |
| 2 | Provisions on the development and management of corridors for protecting the water sources | 43/2015/NĐ-CP | 6/5/2015 | 1/7/2015 | Provisions on the development and management of corridors for protecting the water sources for water sources regulated under Article 31 of the Law on Water Resources |
| 3 | Provisions on incentives for the economical and effective use of water | 54/2015/NĐ-CP | 8/6/2015 | 1/8/2015 | Provisions on incentives for borrowings, tax reduction and exemption for the economical and effective use of water |
| 4 | Provisions on some conditions for investment and businesses in the area of natural resources and environment (Chapter II. Conditions for investment and businesses in the areas of water resources) | 60/2016/NĐ-CP | 1/7/2016 | 1/7/2016 | Provisions on some conditions for investment and businesses in the area of water resources, minerals and environmental protection, including:<br>a) Conditions to grant license for practicing ground water exploitation;<br>b) Conditions on capacity of the institution organizing the basic investigation of water resources, consulting on water resource master planning; conditions on the capacity of the consulting institutions and individuals making project proposal, reports in the dossier applying for water resource licenses; |
| 5 | Provisions on the calculation method, level of fees for granting WR exploitation right. | 82/2017/NĐ-CP | 17/7/2017 | 1/9/2017 | Provisions on the calculation method, level of fees for granting WR exploitation right with regards to state regulators and related institutions and individuals |
| 6 | Handling of administrative violations in water and mineral resources | 33/2017/NĐ-CP | 3/4/2017 | 20/5/2017 | Provisions on acts subject to punishment and levels of punishment in the area of water and mineral resources |
| 7 | Provisions on limited exploitation of ground water | 167/2018/ NĐ-CP | 26/12/2018 | 1/2/2019 | Provisions on limited exploitation of ground water in fresh water containing region within the territory of Socialist Republic of Vietnam. |
| 8 | Amendment of some articles of decrees relating to the conditions for investment and business in the area of natural resources and environment (which amend Article 4 and Article 6 of Decree 60/2016 relating to water resources) | 136/2018/ NĐ-CP | 5/10/2018 | 5/10/2018 | Amendment, annulment of some articles of Decree No.60/2016/NĐ-CP dated 01 /7 /2016 of the Government providing for some conditions on investments and business in the area of natural resources and environment: Conditions for granting licenses for practicing ground water drilling; conditions for the professional staff of the institutions taking part in implementation of the projects and plan on basic investigation, consultants for water resources master planning. |

**B.1.2.1.2 Decisions of the Prime Minister**

Between 2015 and 2018, MoNRE set out the legal requirements for inter-reservoir operations on main rivers. The National Assembly passed resolutions on strengthening planning, construction investment and operation of hydropower works. The objectives were to: reduce flooding in downstream areas; increase water use efficiency; and ensure sufficient water was available for production in downstream areas in the dry season. To implement these resolutions, MONRE submitted 11 draft decisions on inter-reservoir operation procedures and these were issued by the Government as Prime Ministerial Decisions.

The list of decisions of the Prime Minister for the inter-reservoir regulating process

| No. | Name of river | No. of Decision | Date of issuance | Being effective from | |
|---|---|---|---|---|---|
| 1 | Srepok river | Decision 1201/2014-TTg | 7/23/2014 | 15/8/2014 | |
| 2 | Vu Gia Thu Bồn river | Decision 1537/2015-TTg | 9/7/2015 | 7/9/2015 | |
| 3 | Red river | Decision 1622/2015-TTg | 9/7/2015 | 7/9/2015 | |
| 4 | Ca river | Decision 2125/2015-TTg | 12/1/2015 | 1/12/2015 | |
| 5 | Huong river | Decision 2482/2015-TTg | 12/30/2015 | 30/12/2015 | |
| 6 | Ma river | Decision 214/2018-TTg | 2/13/2018 | 1/3/2018 | |
| 7 | Sesan river | Decision 215/2018-TTg | 2/13/2018 | 13/2/2018 | |
| 8 | Dong Nai river | Decision 305/2017-TTg, Decision 471/2016-TTg | 3/24/2016 | 24/3/2016 | |
| 9 | Ba river | Decision 787/2018-TTg | 7/18/2018 | 1/9/2018 | |
| 10 | Tra Khuc river | Decision 911/2018-TTg | 7/25/2018 | 1/9/2018 | |
| 11 | Kon - Ha Thanh river | Decision 936/2018-TTg | | | |

### B.1.2.1.3 Circulars

| No. | Name of river | Code number | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | Regulation on techniques for investigation and assessment of surface water resources | 12/2014/ TT-BTNMT | 17/2/2014 | 7/4/2014 | providing for the contents of investigation, assessment of surface water resource and guiding the techniques for investigation and assessment of surface water resources |
| 2 | Regulation on conditions of capacity of institutions and individuals involving in basic investigation of water resources, consultants making water resources master planning, development of project, reports in the dossiers applying for water resources license | 56/2014/ TT-BTNMT | 24/9/2014 | 10/11/2014 | This Circular provides for conditions of capacity of institutions and individuals carrying out basic investigation of water resources pursuant to Clause 4 Article 13; conditions of capacity of consultants making water resources master plan pursuant to provisions in Article 23 of Water Resources Law and provisions on capacity of institutions and individuals making plans and reports in the dossiers applying for water resources licenses pursuant to Clause 2 Article 20 of Decree No. 201/2013/NĐ-CP |
| 3 | Regulation on WR master planning techniques | 42/2015/ TT-BTNMT | 29/9/2015 | 1/1/2016 | Providing for the details of techniques, products of the obligations of water resource master planning; development of master plan for water resources with regards to: Inter-provincial river basin; inter-provincial water source; water resources of the provinces and cities under central management |
| 4 | Master plan on identification and publication of sanitation protection area for domestic water sanitation. | 24/2016/ TT-BTNMT | 9/9/2016 | 25/10/2016 | providing for the identification and publication of sanitation protection area for domestic water, responsibilities of organizations and individuals in implementation |
| 5 | Regulation on supervising the exploitation and use of water resources | 47/2017/ TT-BTNMT | 7/11/2017 | 22/12/2017 | providing for the supervision of the exploitation and use of water resources: formality for supervision, system of supervision, responsibilities of stakeholders |
| 6 | Regulation on determination of minimum flows of rivers, streams and downstreams of reservoirs, weirs. | 64/2017/ TT-BTNMT | 22/12/2017 | 5/2/2018 | providing for methods for determination of minimum flows of rivers, streams, canals, ditches (hereafter referred to as rivers, streams) and downstreams of reservoirs, weirs (hereinafter referred to as reservoirs) |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Regulation on techniques for determination of minimum flows on the rivers, streams and development of inter-reservoir operational processes. | 65/2017/ TT-BTNMT | 22/12/2017 | 2/2/2018 | providing for techniques for determination, review and regulation of minimum flows on the rivers, streams where there has not any reservoirs and weirs; after reservoirs, weirs and development, review and modification of inter-reservoir operational processes. |
| 8 | Regulation on the evaluation of receptive capacity of waste water, loading capacity of river and pond water source. | 76/2017/ TT-BTNMT | 29/12/2017 | 1/3/2018 | providing for the evaluation of receptive capacity of waste water, loading capacity of water source of rivers, streams, canals, ditches and ponds ( commonly called receptive capacity of waste water, loading capacity of river and pond water source). |
| 9 | Regulation on contents, templates, reports in the area of water resources | 31/2018/ TT-BTNMT | 26/12/2018 | 10/2/2019 | providing for contents, templates, reports in the area of water resources, including: national water resources report, thematic report on water resources, report on the use of water resources and report on the exploitation and use of water resources, discharge of waste water to the water sources. |
| 10 | Promulgation of technical and economic norms for monitoring and forecast of water resources | 01/2015/ TT-BTNMT | 9/1/2015 | 24/2/2015 | |
| 11 | Promulgation of technical and economic norms for master planning and modification of water resources master plan | 15/2017/ TT-BTNMT | 21/7/2017 | 7/9/2017 | |
| 12 | Promulgation of the technical requirements and the economic and technical norms for surveying, evaluating the status of water resources exploitation and usage. | 16/2017/ TT-BTNMT | 25/7/2017 | 15/9/2017 | |
| 13 | Promulgating the economic and technical norms for surveying, evaluating water resources. | 30/2017/ TT-BTNMT | 11/9/2017 | 26/10/2017 | |
| 14 | Promulgating the technical requirements and the economic and technical norms for surveying, measuring the water resources, and evaluating and forecasting the water resources with river flow models. | 36/2017/ TT-BTNMT | 6/10/2017 | 21/11/2017 | |
| 15 | Promulgation of the technical requirements and the economic and technical norms for surveying, evaluating the status of discharge of waste water to the water source. | 37/2017/ TT-BTNMT | 6/10/2017 | 21/11/2017 | |
| 16 | Promulgation of economic and technical norms for determination of minimum flows on the rivers, streams and development of inter-reservoir operational processes. | 71/2017/ TT-BTNMT | 2/2/2017 | 12/2/2017 | |
| 17 | Regulation on techniques for mapping the ground water quality with scale of 1:25,000 | 08/2014/ TT-BTNMT | 7/4/2014 | 7/4/2014 | |
| 18 | Regulation on techniques for mapping the ground water quality with scale of 1:50,000 | 09/2014/ TT-BTNMT | 17/2/2014 | 17/4/2014 | |
| 19 | Regulation on techniques for mapping the ground water quality with scale of 1:100,000 | 10/2014/ TT-BTNMT | 17/2/2014 | 17/4/2014 | |
| 20 | Regulation on techniques for mapping the ground water quality with scale of 1:200,000 | 11/2014/ TT-BTNMT | 17/2/2014 | 17/4/2014 | |

| | | | | | |
|---|---|---|---|---|---|
| 21 | Techniques for investigation and assessment of ground water resources | 13/2014/ TT-BTNMT | 17/2/2014 | 7/4/2014 | |
| 22 | Regulation on registration of ground water exploitation, templates of dossiers for granting, extension, modification and re-granting of water resources licenses | 27/2014/ TT-BTNMT | 30/5/2014 | 15/7/2014 | |
| 23 | Regulation on practicing the ground water drilling | 40/2014/ TT-BTNMT | 11/72014 | 26/8/2014 | |
| 24 | Protection of ground water in exploitation and drilling | 25/2015/ TT-BTNMT | | | |
| 25 | Regulation on handling and filling of the unused wells | 72/2017/ TT-BTNMT | 29/12/2017 | 12/2/2018 | |
| 26 | Regulation on the protection of groundwater in drilling, excavation, exploration and exploitation of groundwater. | 75/2017/ TT-BTNMT | 29/12/2017 | 12/2/2018 | |
| 27 | Techniques for investigation and assessment of ground water resources | 34/2018/ TT-BTNMT | 26/12/2018 | 2/10/2018 | |
| 28 | Techniques for laboratory water pumping in groundwater investigation and assessment | 08/2015/ TT-BTNMT | 26/2/2015 | 15/4/2015 | |
| 29 | Techniques for drilling in groundwater investigation, assessment and exploration | 59/2015/ TT-BTNMT | 14/12/2015 | 05/02/2016 | |
| 30 | Issuing indicators for assessing quality of public services in operating inter-reservoirs in inter-provincial river basins | 19/2018/ TT-BTNMT | 5/11/2018 | 20/12/2018 | |

## B.1.2.2 The Law on Irrigation 2017

### B.1.2.2.1 Decrees on Irrigation (chaired by Ministry of Agriculture and Rural Development)

| | Name of decree | Code number | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | Regulation on management, use and exploitation of irrigation infrastructure asset | 129/2017/QH12 | 16/11/2017 | 1/1/2018 | providing for the management, use and exploitation of irrigation infrastructure assets invested and managed by the State. |
| 2 | Regulation on handling of administrative violations in the area of natural calamities prevention; exploitation and protection of irrigation works; dykes | 104/2017/QH12 | 14/9/2017 | 1/11/2017 | |
| 3 | Regulation on budget support in the use of products and services of irrigation public utilities | 62/2018/QH12 | 02/5/2018 | 2/5/2018. Deadline for providing budget support for the use of products and services of irrigation public utilities: from 01/ 01/2017 till the end of 30/ 6/ 2018 | |
| 4 | providing for details of some articles of the Law on Irrigation | 67/2018/QH12 | 14/5/2018 | 1/7/2018 | |
| 5 | Regulation on support to the development of small irrigation, internal field irrigation and water-saving and advanced irrigation | 77/2018/QH12 | 16/5/2018 | 1/7/2018 | Regulation on support to the development of small irrigation, internal field irrigation and water-saving and advanced irrigation, including: Investments in new construction of water storage works, system of advanced and water-saving irrigation, power pumping station, drainage and canal consolidation, meeting the requirements for agriculture restructuring, linking with new rural development. |

| | | | | | |
|---|---|---|---|---|---|
| 6 | On management of dam safety, reservoirs | 114/2018/ NĐ-CP | 4/9/2018 | 4/9/2018 | Provisions on management of dam safety, reservoirs for the dams having height from at least 5m or reservoirs having total volume of at least 50,000 m2 and safety for dam's lowlands . |

#### B.1.2.2.2 Circulars on Irrigation

| No. | Name | Code number | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| | Detailed provisions of some articles of the Law on Irrigation | 05/2018/QH12 | 15/5/2018 | 1/7/2018 | This Circular provides or the development, promulgation and implementation of the irrigation work operation process; points of hand-over of irrigation products and services; planting landmarks scoping the protection area of the irrigation works; management, exploitation of the small irrigation works, internal field irrigation. |

### B.1.2.3 Law on Environmental Protection 2014

#### B.1.2.3.1 Decrees (chaired by MONRE)

| No. | Name of decree | Code number | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | Regulations on conditions of the organizations operating in environment monitoring services | 127/2014/QH12 | 12/31/2014 | 15/2/2015 | This Decree provides for conditions for operating in environment monitoring services; dossiers and procedures for granting, extension, modification of contents, re-granting, temporary suspension of the validity, revocation and annulment of Certificate for eligibility for operation of the environment monitoring services, including monitoring and analysis of surface water, waste water |
| 2 | Regulation on environmental protection master planning, strategic environmental assessment, environmental impact assessment and environmental protection commitments | 18/2015/QH12 | 14/2/2015 | 1/4/2015 | |
| 3 | Detailed provisions of some articles of the Law on Environment Protection | 19/2015 | 14/2/2015 | 1/4/2015 | Detailed provisions on some articles of the Law on Environment Protection, including articles relating to protection of vocational village environment; incentives and support or protection of environment; community participation in environment protection |
| 4 | Waste and wasted material management; | 38/2015/QH12 | 24/4/2015 | 15/6/2015 | providing for management of types of wastes, including liquid wastes, waste water. |
| 5 | Regulation on handling of administrative violations in the area of environmental protection. | 155/2016/QH12 | 18/11/2016 | 2/1/2017 | Providing for acts of administrative violation, types of punishment, levels of punishment, measures of remedy for acts of administrative violations, power for making minutes of administrative violations, power for handling of administrative violations; responsibilities and coordination mechanisms in examination, inspection and handling of administrative violations in environmental protection, including waste water |

### B.1.2.3.2 Circulars on environment

| No. | Name of circular | Code | Date of issuance | Date of effectiveness | |
|---|---|---|---|---|---|
| 1 | Detailed regulation on appraisal of the conditions for operation in environmental monitoring and template of certificate | 19/2015/QH12 | 23/4/2015 | 9/6/2015 | |
| 2 | On strategic environmental assessment, environmental impact assessment and environmental protection plan | 27/2015/QH12 | 29/5/2015 | 15/7/2015 | Detailed regulation on contents, procedures and sequences of strategic environmental assessment, environment impact assessment and environmental protection plan, including requirements on water quality. |
| 3 | Protection of environment of economic zones, industrial zones, export processing zones, high-tech zone | 35/2015/QH12 | 30/6/2015 | 17/8/2015 | Provisions on protection of environment, including provisions on waste water of economic zones, industrial zones, export processing zones, high-tech zone |
| 4 | On hazardous waste management | 36/2015/QH12 | 30/6/2015 | 1/9/2015 | Regulations on hazardous waste management, including waste water |
| 5 | Reports on environment status, environmental indicator set and management of environmental monitoring data | 43/2015/QH12 | 23/9/2015 | 1/12/2015 | Regulations on structure and contents of environment status reports, environmental indicator set and management of environmental monitoring data, including water environment |
| 6 | On protection of environment of industrial clusters, central services and business areas, vocational villages and production, trading and services premises | 31/2016/QH12 | 4/10/2016 | 1/12/2016 | Detailed regulations on environmental protection, including waste water of industrial clusters; central business and services areas; 2. Protection of environment of vocational villages; protection of environment of production, trading and services premises |
| 7 | Promulgation of technical and economic norms for monitoring of environment | 20/2017/QH12 | 8/8/2017 | 1/10/2017 | Technical and economic norms for monitoring of environment, including monitoring of environment of continent surface water, groundwater, rain water, sea water |
| 8 | Technical regulation on Environmental Monitoring | 24/2017/QH12 | 1/9/2017 | 15/10/2017 | Technical regulation for monitoring of environment, including periodic monitoring of environment of continent surface water, groundwater, rain water, sea water, waste water Regulations on ensuring quality and controlling quality in periodic environment monitoring. Regulations on basic requirements and technical specifications of the automatic and continual waste water monitoring system. Requirements on receipt, transmission and management of data with regards to the automatic and continual environment monitoring. Regulations on management and use of environment monitoring equipment. |

### B.1.2.3.3 Environment standards

| No. | Name | Code number | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | National technical standards on waste water from natural rubber preliminary processing | 01/2015 | 31/3/2015 | 1/6/2015 | |
| 2 | The National Technical Standards on surface water quality | 08/2015 | 21/12/2015 | 1/3/2016 | |
| 3 | The National Technical Standards on groundwater quality | 09/2015 | 21/12/2015 | 1/3/2016 | |
| 4 | The National Technical Standards on sea water quality | 10/2015 | 21/12/2015 | 1/3/2016 | |

| | | | | | |
|---|---|---|---|---|---|
| 5 | National technical standards on waste water from fishery processing | 11/2015 | 21/12/2015 | 1/3/2016 | |
| 6 | National technical standards on waste water from paper and pulp industry | 12/2015 | 31/3/2015 | 1/6/2015 | |
| 7 | National technical standards on waste water from textile and dying industry | 13/2015 | 31/3/2015 | 1/6/2015 | |
| 8 | The National Technical Regulation on domestic waste water; | 14/2015 | | | |
| 9 | National technical standards on waste water from landfills | 25/2009 | 16/11/2009 | 1/1/2010 | |
| 10 | The National Technical Regulation on healthcare waste water; | 28/2010 | 16/12/2010 | 6/2/2011 | |
| 11 | National technical standards on waste water from petroleum and gas shop and storage. | 29/2010 | 16/12/2010 | 6/2/2011 | |
| 12 | The National Technical Regulation on industrial waste water; | 40/2011 | 26/12/2011 | 15/2/2012 | |
| 13 | National technical standards on waste water from steel manufacturing industry | 52/2013 | 25/10/2013 | 1/1/2013 | |
| 14 | The National Technical standards on waste water from animal husbandry; | 62/2016 | 29/4/2016 | 15/6/2016 | |

### B.1.2.4 The Law on Inland Waterway Transport 2004 and the Law on amendment and supplementation of some articles of the Law on Inland Waterway Transport

#### B.1.2.4.1 Decrees (chaired by Ministry of Transport)

| No. | Name of decree | Code | Date of promulgation | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | The decree provides for details and measures of enforcement of some articles of the Law on Inland Waterway Transport and the Law on amendment and supplementation of some articles of the Law on Inland Waterway Transport. | 24/2015 | 27/2/2015 | 1/5/2015 | Providing for details and measures of enforcement of some articles of the Law on Inland Waterway Transport and the Law on amendment and supplementation of some articles of the Law on Inland Waterway Transport, including: Scope of corridor for protection of inland waterway routes. |
| 2 | Regulation on handling of administrative violations in the area of inland waterway transport. | 132/2015 | 25/12/2015 | 1/7/2016 | |

#### B.1.2.4.2 Circulars

| No. | Name of circular | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| | Regulation on inland waterway management. | 15/2016/QH12 | 30/6/2016 | 15/9/2016 | Regulation on inland waterway management, including: classification, authority for deciding on the technical levels of the inland waterway; publication of opening, closing of routes and flow of special used inland waterway; landmarks for protection of the inland waterway transport infrastructure; projects for investments and construction of works relating to inland waterway transport and limit of inland waterway transport |

## B.1.2.5 The Law on Hydrology and Meteorology 2015

### B.1.2.5.1 Decrees (chaired by MONRE)

| No. | Name of decree | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | Detailed provisions of some articles of the Law on Hydrology and Meteorology | 38/2016 | 15/5/2106 | 1/7/2016 | Detailed provisions of some articles of the Law on Hydrology and Meteorology, including:<br>1. Monitoring of hydrology and meteorology of owners of facilities, and the supply of information and data of hydrology and meteorology monitoring.<br>2. Technical corridor of hydrology and meteorology facilities<br>3. Forecast and warning of hydrology and meteorology by organizations and individuals outside the national hydrology and meteorology forecast and warning system.<br>4. Exploitation and use of hydrology and meteorology information and data.<br>5. Exchange of information and data of hydrology and meteorology, supervision of climate changes with international organizations, foreign organizations and individuals who are not party to international treaty to which Vietnam is a member. |

### B.1.2.5.2 Circulars

| No. | Name of circular | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | Contents of hydrology and meteorology monitoring with regards to stations under the national hydrology and meteorology station network | 05/2016/QH12 | 13/5/2016 | 1/7/2016 | |
| 2 | Regulation on technical and economic norms for operation of the hydrology and meteorology network | 36/2016/QH12 | 8/12/2016 | 1/26/2017 | |
| 3 | Technical and economic norms for forecast and warning of hydrology and meteorology | 52/2017/QH12 | 30/11/2017 | 15/1/2018 | |
| 4 | Technical regulation on monitoring and supply of information and data of hydrology and meteorology with regards to special used hydrology and meteorology stations | 30/2018/QH12 | 26/12/2018 | 11/2/2019 | Technical regulation on monitoring and supply of information and data of hydrology and meteorology with regards to special used hydrology and meteorology stations |

## B.1.2.6 The Law on Construction

### B.1.2.6.1 Decrees

| No. | Name of decree | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | On production, supply and consumption of clean water | 117/2007/QH12 | 11/7/2007 | 1/8/2007 | Regulation on activities in production, supply and consumption of clean water under the central comprehensive water supply schemes in urban areas, rural areas and industrial zones, export processing zones, high-tech zones, economic zones (referred to as industrial zones); rights and obligations of organizations and individuals and households involving in production, supply and consumption of clean water in the territory of Vietnam. |
| 2 | Amendment, supplementation of some articles of Decree No.117/2007/NĐ-CP dated 11 /7 /2007 of the Government on production, supply and consumption of clean water | 124/2011/QH12 | 28/12/2011 | 20/2/2012 | |

### B.1.2.7 The Law on Charges and Official Fees

#### B.1.2.7.1 Decrees

| No. | Name of decree | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | On Environment protection charges for waste water | 154/2016 | 16/11/2016 | 1/1/2017 | Regulation on subjects of charges, cases of charge exemption, charge submission persons, level of charges, registration and declaration, submission, management and use of the environmental protection charges for waste water |
| 2 | Detailed regulation on prices of irrigation products and services, and support of fees for use of public utility irrigation products and services | 96/2018/QH12 | 30/6/2018 | 1/7/2018 | Detailed regulation on prices of irrigation products and services (including prices of public utility irrigation products and services and prices of other irrigation products and services); subjects, scopes, methods; level of supports of fees for use of public utility irrigation products and services. |

#### B.1.2.7.2 Circulars:

| | | | | | |
|---|---|---|---|---|---|
| | Guidelines on official fees and charges under the decision authority of People's Councils of provinces and cities under central management. | 02/2014/QH12 | 12/1/2014 | 17/2/2104 | Guidelines on official fees and charges under the decision authority of People's Councils of provinces and cities under central management (hereinafter called provincial level), including the List of fees under the authority of provincial People's Councils (including fees for appraisal of projects, reports on exploration, exploitation and use of ground water; exploitation and use of surface water; discharge of waste water to the water sources, irrigation works (for the appraisal conducted by local agencies); fees for appraisal of the reports on exploration and evaluation of ground water reserves (for the appraisal conducted by the local agencies); fees for appraisal of dossiers, conditions for practicing ground water drilling (for the appraisal conducted by the local agencies); |
| 1 | Guiding the use of financing sources in management and exploitation of irrigation works using state funds | 73/2018/QH12 | 15/8/2018 | 1/10/2018 | Guiding the use of financing sources, management and use of financial sources, accounting and mechanism of financial reporting, examination, supervision with regards to units involving in exploitation of irrigation works using state funds pursuant to Article 38 of the Law on Irrigation. |

### B.1.2.8 The Law on Biodiversity

#### B.1.2.8.1 Decrees: not yet in place

#### B.1.2.8.2 Circulars: not yet in place

### B.1.2.9 Healthcare: (Clean water)

#### B.1.2.9.1 Decrees: not yet in place

#### B.1.2.9.2 Circulars

| No. | Name of circular | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| | National technical standards and regulations on examination, supervision of clean water quality used for domestic purposes. | 41/2018/QH12 | 14/12/2018 | 15/6/2019 | Replacing Circular 50 |

### B.1.2.10 Industry and Trade (Hydropower)

#### B.1.2.10.1 Decrees: not yet in place

#### B.1.2.10.2 Circulars

| No. | Name of circular | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | regulations on management of hydropower project master planning, investments and construction, and operation and exploitation of hydropower works | 43/2012/QH12 | 27/12/2012 | 10/2/2013 | Regulations on some contents on management of hydropower master planning, management of hydropower project investments and construction, and operation and exploitation of hydropower works in the territory of Vietnam. |

#### B.1.2.10.3 Under preparation:

Ministry of Industry and Trade is drafting the circular regulating the management of dam safety, hydropower reservoirs having heights of at least 05m, hydropower reservoirs having total volume of at least 50,000m$^3$.

### B.1.2.11 Finance

#### B.1.2.11.1 Decrees

#### B.1.2.11.2 Circulars

| No. | Name of circular | Code | Date of issuance | Date of effectiveness | Main contents |
|---|---|---|---|---|---|
| 1 | Tariff for domestic clean water consumption | 88/2012/QH12 | 28/5/2012 | 11/7/2012 | Pursuant to the clean water tariff, People's Committees of the provinces and cities under central management decide on their specific domestic water prices in line with regulation |
| 2 | Regulation on management, use and exploitation of the central rural water supply schemes | 54/2013/QH12 | 4/5/2013 | 1/7/2013 | Regulation on management, use and exploitation of the central rural water supply schemes, including:<br>a) Clean water supply schemes for rural people are invested wholly or partly by state budget, or originating from state budget; state ownership is established over the schemes.<br>b) Clean water supply schemes for rural people and urban people are invested from the following funds:<br>- National Target Program for Rural Water Supply and Sanitation;<br>- Program providing supports of agricultural land, residential land, house, and water for domestic uses to poor/difficult ethnic minority households (referred to as Program 134);<br>- Program for socio-economic development in specially difficult communes in the ethnic minority and mountainous areas (referred to as Program 135);<br>- New Rural Development National Target Program;<br>- Water Resources National Strategy. |
| 3 | Amendment, supplementation of some articles of Circular No.54/2013/NĐ-CP dated 04 /5 /2013 of Ministry of Finance on regulating the management, use and exploitation of central rural water supply schemes | 76/2017/QH12 | 26/7/2017 | 10/9/2017 | |

| | | | | | |
|---|---|---|---|---|---|
| 4 | On maximum price of public utility irrigation products and services period 2018-2020 | 1050a/QĐ-BTC | 30/6/2018 | 1/7/2018 | Maximum price of public utility irrigation products and services period 2018-2020 during the state budget stabilization period 2017-2020 as follows:<br>1. Maximum tariff of public utility irrigation products and services for paddy cultivation land.<br>2. Maximum tariff for areas used for planting rice seed, vegetables, farm produce, short-period industrial plants including winter plants calculated as 40% of land areas for paddy cultivation.<br>3. Maximum tariff applicable to salt production is calculated as 2% of salt product value.<br>4. Maximum tariff for water supply for animal husbandry, fishery cultivation and supply of water to long term industrial plants, fruit trees, flowers and pharmaceutical trees. |

#### B.1.2.12 The Law on Master Planning

**B.1.2.12.1. Decrees (chaired by Ministry of Planning and Investment): not yet in place**

**B.1.2.12.2 Circulars: not yet in place**

**B.1.2.12.3 Under preparation: MPI is under drafting process of the decree**

## B.2 Legal documents that remain to be issued

Government has inventoried a number of legal documents that remain to be issued to implement outstanding provisions of the 2012 Law on Water Resources and related Decrees.

**MoNRE**

The following legal documents under MONRE's responsibility have not yet been issued:

Six items regulated by the 2012 Law on Water Resources:

- A **'master plan on the basic survey'** is required under Article 10. This is effectively **a national water resources assessment.** A draft has been prepared by MONRE and is being reviewed by other ministries. It is yet to be finalized and submitted to the Prime Minister for approval (as per Article 10). To date, a few separate water resources surveys were carried out, subject to budget constraints, but not yet the master plan.
- **A plan for the protection, exploitation and use of inter-country water sources.** This is currently being prepared by MONRE, and still needs to be submitted to the Prime Minister for approval (as per Article 21 (1a)).
- **Interprovincial integrated river basin planning:** MONRE has developed and approved this for two specific river basins, namely Hong-Thai Binh and Sesan-Srepok. The remaining ones still need to be developed and approved (as per Article 21 (1b)).
- **Water restoration plan:** The issuance by the Prime Minister is still pending (as per Article 7).
- **List of lakes, ponds and swamps not allowed to be filled up:** This list has not yet been issued.
- **Protection of interprovincial river banks:** This has not yet been issued.

Two items regulated by Decree 201/2013:

- **Water resources inventory.** Decree 201/2013 requires MONRE to carry out a water resources inventory every five years and prepare an inventory report based on forms issued by MONRE. Circular No. 31/2018 regulates the form of reports on water resources including a five year national water resources report. However, the inventory report still has to be completed.
- **Water resources database standards:** These have not yet been issued.

One item regulated by Decree 43/2015

- **Guidance on water protection corridors** has not yet been issued

One item regulated by Decree 54/2015

- **Determining freshwater scarcity zones and saline intrusion zones** has not yet been issued

**Other ministries**

The following legal documents under the responsibility of other line ministries also remain to be issued (regulated by Decree 54/2015- Annex 9):

- MOST: one item related to **water saving technology standards**
- MARD: two items related to: (i) agricultural water saving technology standards and (ii) methods for determining water recycling
- MOF: three items on (i) preferential conditions; (ii) concessional loans; and (iii) tax reductions and exemptions.

## B.3 National strategies for water and irrigation

In 2006, the ***National Strategy on Water Resources for 2020*** was approved.

This Strategy was adopted by a Decision of the Prime Minister (81/2006/QD-TTG). To achieve the goals outlined in this strategy, the Prime Minister subsequently approved the ***National Action Plan 2014-2020*** (Decision 182/2014). The Plan targets improvement of the effectiveness of integrated water resources management, protection, and use of water resources. It specifies seven priority programs, of which four were assigned to MONRE to lead:

- Developing water resources planning
- Grand inventory of national water resources (to be issued in 2015, with an update in 2020)
- Surveying, assessing and mapping water resources in river basins, water scarcity areas and key areas
- Developing water resources information, database and monitoring systems in river basins

In 2009 the strategic direction of the ***National Strategy for Irrigation*** was approved.

The Strategy was adopted by Decision No. 1590/QD-TTg, dated 9 October 2009. Under it, MARD was assigned the prime responsibility for ensuring implementation of the Strategy, with specific responsibilities for:

- guiding, inspecting and promoting implementation of the strategic orientation
- acting as a national coordinator for contact with international organizations in its domain
- drawing up specific action plans to define priorities, and assigning implementation tasks to sectors and localities
- overseeing implementation of the strategic orientation, reviewing the implementation every five years, and proposing adjustments of the strategic orientation to the Prime Minister to adapt to changing circumstances

A draft proposal for adjusting the strategic direction of the National Strategy of Irrigation is expected to be submitted by MARD for approval to the Government in the third quarter of 2019.

## B.4 Planning for water resources

**In 2017, Vietnam adopted two laws designed to clean up the mass of plans of one kind or another that had built up: the *Law on Planning* and the *Law on Amending and Supplementing a Number of Articles of 37 Laws related to the 2017 Law on Planning*.**

**The necessity for the 2017 Law on Planning**

Before the 2017 Law on Planning was passed, there were 19,285 master plans in all sectors - not even including product plans such as the cassava and tilapia plans. The number of plans increased sixfold between 2001 and 2011. For the period between 2001-2010 there were 3,114 plans, while these increased for the period between 2011-2020 to 19,285 plans. Among the 19,285 master plans, there were 2,326 urban plans and 9,864 construction plans. Over 8,000 billion VND were spent to develop these plans. (Source: Dai Doan Ket Newspaper, May 25, 2017).

The plans were found to be overlapping, at times even contradictory and lacked cohesion. At times the plans were not connected to implementation resources. Thus a high percentage of the completed plans had no practical value; and even contributed to overall low sector performance, actually hindering development.

**Key objectives of the 2017 Law on Planning**

- Put top priority on integration of state management and on efficiency of national resources utilization. Put an end to fragmented sectoral and local management.
- Establish a transparent mechanism in planning, enhance the role of communities and people, and improve the accountability of leadership.
- Reduce the total number of plans from 19,285 to 11,413. This includes a 97% reduction of plans at national, regional and provincial levels (from 4,362 plans to 110 plans). Sectoral, industrial and product plans will be reduced from 3,372 plans to 38 plans.
- Apply modern, consistent and efficient method of multidisciplinary integrated planning,

following international trends. Create a unified information system and national planning database from central to local levels.

**Overview of national planning under the 2017 Law on Planning**

- National Plans include the following: 1) National Master Plan, 2) National Marine Spatial Plan, 3) National Land-Use Plan, 4) National Sector Plan.
- The National Sector Plan must be in line with the National Master Plan, National Maritime Spatial Plan and National Land-Use Plan. In case the National Sector Plan contradicts the mentioned plans, it must be amended and implemented accordingly.
- Ministries and ministerial-level agencies develop the components of the National Sector Plan and submit these to the Prime Minister for approval.
    - MONRE is responsible for the Water Resources Plan, the Environmental Protection Plan, and the Biodiversity Conservation Plan.
    - MARD is responsible for Plan on the Prevention and Control of Natural Disasters and for the Irrigation Plan.

**Overview of technical and specialized planning under the 2017 Law on Planning**

- Technical and Specialized Plans concretize national plans, regional plans and provincial plans.
- The table provides an overview of the technical and specialized plans that contribute to the Water Resources Plan and to the Plan on Prevention and Control of Natural Disasters and Irrigation.

**TABLE B.1: Overview of Technical and Specialized Plans**

| Name of plans | Regulatory documents |
|---|---|
| Master plan on inter-provincial river basins and inter-provincial water resources | Law on amendments to some articles concerning 2017 Planning Law No. 35/2018/QH14 |
| Plan on protection, exploitation, utilization of international water resources | Law on amendments to some articles concerning 2017 Planning Law No. 35/2018/QH14 |
| Master plan on basic survey on water resources | Law on amendments to some articles concerning 2017 Planning Law No. 35/2018/QH14 |
| Irrigation plan | Law on Hydraulic Works No. 08/2017/QH14 |

**Law amending and supplementing a number of Articles of 37 Laws related to the 2017 Law on Planning**

To implement the **2017 Law on Planning**, a number of articles of 37 related laws had to be amended and supplemented. This is provided for in the Law amending and supplementing articles of 37 Laws related to the **2017 Law on Planning**.

- The amended articles of the 2012 Law on Water Resources include the following:
    - The Water Resources Plan is now defined as a National Sector Plan
    - The Master Plan on Fundamental Survey on Water Resources is now defined as a Specialized and Technical Plan
    - The Master Plan for inter-provincial river basins and inter-provincial water sources will be based on: Water Resource Strategy (submitted by MONRE for Prime Minister's approval); Water Resources Plan; natural and socio-economic characteristics, as well as specific conditions of each river basin and each region; actual potential of water resources; forecast impacts of climate change on water resources; water demand by sectors, localities and environmental protection; and on the results of the Fundamental Survey on Water Resources
- The amended articles of the 2017 Law on Hydraulic Works include the following:
    - The Irrigation Plan is defined as a Technical and Specialized Plan, concretizing the national plan and regional plan developed and submitted by MARD for Prime Minister's approval
    - The Irrigation Plans include the following: Irrigation Plan for Inter-provincial River Basins; Irrigation Plans on Irrigation Infrastructure involving two or more provinces

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