

PROJECT PERFORMANCE ASSESSMENT REPORT

LAO PEOPLE'S DEMOCRATIC REPUBLIC

Mekong Integrated Water Resources Management Project

Report No. 192745

FEBRUARY 11, 2025



IEG
INDEPENDENT
EVALUATION GROUP

WORLD BANK GROUP

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Lao People's Democratic Republic

Mekong Integrated Water Resources Management Project

(IDA-61180, IDA-H6750, IDA-H7620, TF-93258, TF-94553, TF-98965)

February 11, 2025

Finance, Private Sector, Infrastructure, and Sustainable Development

Independent Evaluation Group

Abbreviations

DMH	Department of Hydrology and Meteorology
IEG	Independent Evaluation Group
IWRM	integrated water resources management
LMB	Lower Mekong Basin
MONRE	Ministry of Natural Resources and Environment
MRB	Mekong River Basin
MRC	Mekong River Commission
NRERI	Natural Resource and Environment Research Institute
O&M	operation and maintenance
PAFO	Provincial Agriculture and Forestry Office
PDO	project development objective
PONRE	Provincial Office of Natural Resources and Environment
PPAR	Project Performance Assessment Report
RBMP	river basin management plan
WRM	water resources management
WUA	water user association

All dollar amounts are US dollars unless otherwise indicated.

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Note: IEG = Independent Evaluation Group; PPAR = Project Performance Assessment Report.

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Data

This is a Project Performance Assessment Report by the Independent Evaluation Group of the World Bank Group on the Mekong Integrated Water Resources Management Project phase 1, P104806. This instrument and the methodology for this evaluation are discussed in appendix C.

Following standard Independent Evaluation Group procedure, copies of the draft Project Performance Assessment Report were shared with relevant government officials for their review and comment.

Mekong Integrated Water Resources Management Project (P104806)

Basic Data

Country:	Lao People's Democratic Republic	World Bank financing commitment	US\$52,132,700
Global Practice	Water	Actual project cost	US\$49,040,873
Project name	Mekong Integrated Water Resources Management Project Phase 1	Expected project total cost	US\$52,717,900
Project ID	P104806	Actual amount disbursed	US\$49,040,873
Financing instrument	Investment project financing	Environmental assessment category	B
Financing source	International Development Association		

Dates

Event	Original Date	Actual Date
Approval		March 8, 2012
Effectiveness	April 15, 2012	May 5, 2012
Restructuring		July 6, 2017
Mid-Term Review		January 29, 2016
Closing	March 31, 2018	February 28, 2022

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Summary

Background and Description

In 2012, the Lower Mekong Basin countries—the Lao People’s Democratic Republic, Cambodia, and Viet Nam—faced the need to balance ecosystem protection with infrastructure development, particularly in hydropower. They depended on fisheries but faced competition for water resources, seasonal discharge variations, upstream development, climate events, and climate change, all of which affected rural communities and highlighted the need for better weather and climate forecasting. The Mekong River Commission (MRC), established in 1995, aimed to foster regional cooperation but was limited by inadequate data systems in member countries. The Lower Mekong Basin countries aimed to improve hydrometeorological networks for better flood and drought management and to establish an effective regional framework for integrated water resources management (IWRM), including regional water use procedures and hydrological models.

In Lao PDR, urbanization and economic growth put pressure on water resources. The 1996 Law on Water and Water Resources provided a management foundation, and in 2013, the Ministry of Natural Resources and Environment centralized natural resources management. Despite initial plans and committees, the expected outcomes were not achieved, leading to the recognition of the need for updated legal frameworks and infrastructure improvements.

The World Bank and the Australian Aid Agency had previously supported MRC capacity building. The Mekong Integrated Water Resources Management Program shifted focus to strengthen member countries’ water resources management (WRM) capacity. This program, structured as an adaptable program loan, was planned in phases across Lao PDR, Viet Nam, and Cambodia. It integrated regional efforts to finalize water use procedures and improve stakeholder communication and national support for IWRM implementation and capacity building and addressed emerging issues in border areas through the MRC and bilateral dialogue.

The Mekong Integrated Water Resources Development Project was the program’s first phase implemented in Lao PDR. Its objective was to improve water resource and fisheries management in selected areas of the Lower Mekong Basin. The project design included interventions at regional, national, and basin levels, such as creating joint action plans, enhancing legal and regulatory frameworks, building institutional capacity, and operationalizing infrastructure for irrigation and flood management. The expected outcomes were better regional and national IWRM and improved river basin

and fisheries management in Lao PDR, leading to sustainable development that would provide long-term social and economic benefits.¹

Results

An overview of project results according to priority areas of investigation undertaken by the field evaluation for this Project Performance Assessment Report includes policies and institutions, information and decision systems, infrastructure, and incentives:

- **Policies and institutions.** Transboundary action plans were successfully developed at a technical level but not implemented because of political challenges and ongoing data-sharing issues among MRC countries. The project aided in revising Lao PDR's water law, but budgetary constraints hamper enforcement. Eight river basin management plans and one groundwater management plan were developed for Lao PDR, but these were not robust because of data deficiencies and were unimplemented because of financial limitations.
- **Information decision systems.** The project supported the establishment and renovation of 89 hydrometeorological stations and an early-warning center but faced significant challenges with data availability, quality, and maintenance, primarily because of budgetary constraints and internet connectivity complications. Water quality monitoring and laboratory accreditation were also hindered by budget limitations, and water resource models suffered from data inaccuracy and lack of climate change integration.
- **Infrastructure.** The project notably improved irrigation infrastructure on 7,993 hectares, leading to reported rice yield increases. However, water user associations managing the infrastructure need further support for operation and maintenance costs. The rehabilitation of 15 floodgates improved flood management, but these were less effective during severe floods, and better fish migration solutions were recommended.
- **Incentives.** The project fostered sustainable fisheries through the development of a fisheries law and regulations and the establishment of 12 fisheries management

¹ The project was approved on March 3, 2012, and closed on February 28, 2022, with an original closing date extended by about four years. Initially financed by two International Development Association grants totaling \$26 million, the funding was increased in July 2017 by an additional International Development Association grant of \$25 million and three trust fund grants totaling \$1.132 million. At closing, \$47.95 million was disbursed under International Development Association grants and \$1.087 million under trust fund grants.

committees, which were supported by livelihood interventions and helped reduce overfishing, as confirmed by stakeholders.

What Worked and Why?

The project's objective was relevant to addressing the development challenges and aligning with the MRC's decentralization policy. The project supported an integrated approach to water resources and fisheries management in Lao PDR, in line with the MRC's policy shift toward decentralizing its core river basin management functions and encouraging member countries to take on more responsibility for managing and monitoring their water resources. The project also recognized the need for capacity building in ministries responsible for Mekong River tributaries; sustainable management of the Mekong River and its tributaries is crucial, as highlighted in the World Bank's Country Partnership Framework for 2017–21 and Lao PDR's National Socio-Economic Development Plan for 2016–20 (World Bank 2017a).

The project design was sound in its aim to strengthen community participation in WRM at the local level. It facilitated the creation of water user associations and fisheries management committees, which empowered communities to formulate local management plans, operate infrastructure, and engage citizens to foster ownership and long-term sustainability of the project-supported infrastructure and fisheries management. The fisheries management committees were specifically responsible for participatory fisheries management plans, while the water user associations received capacity-building support to extend agricultural techniques, including intensification of rice production.

What Didn't Work and Why?

The project's successful development of transboundary action plans for water and fisheries resources was hindered by a lack of political will for implementation. While Mekong riparian countries agreed to MRC's principles of transboundary coordination, effective implementation depends on willingness at the political level, which can be strengthened through stakeholder analysis, consultation, trusted negotiations and trust building, and conflict resolution mechanisms.

The project's support for the Ministry of Natural Resources and Environment in Lao PDR was focused but could have been further strengthened with a comprehensive institutional capacity-building program for IWRM. The project design could have included a thorough capacity-building program that would start with an institutional capacity assessment and would include data management, regulation enforcement, public awareness, and financial mechanisms for sustainable WRM.

The lack of budget support for the operation and maintenance of hydrometeorological stations after the project led to a nonfunctional hydrometeorological system. The project could have preemptively addressed this issue.

Lessons

This assessment offers the following lessons:

Given the scale of geopolitical barriers among MRC member countries, conducting stakeholder analysis, holding consultations at the political level, and adopting dispute-resolution mechanisms to alleviate political differences among countries on transboundary issues could facilitate enhanced collaboration and coordination.

Although the project supported the development of key outputs—including procedures for data and information exchange, a transboundary environmental impact assessment, and various training and awareness workshops—implementation of the supported transboundary action plans for WRM was impeded by a lack of political will among MRC member countries, despite their technical-level endorsement. Pending agreement on issues among MRC member countries regarding data sharing and prior consultations for development projects on the Mekong River underscores the need for improved dispute-resolution and trust-building mechanisms. Careful stakeholder mapping and analysis to anticipate potential disputes or political challenges and consultations at the political level to build consensus among key stakeholders could be quite important. Member countries can reinforce such mechanisms implemented by transboundary organizations (such as the MRC Secretariat) by acknowledging the collective benefits of collaboration and thereby counteracting political tendencies to appease specific interest groups such as those involved in hydropower development.

Projects aimed at building institutional capacity on IWRM benefit from a comprehensive prior assessment of institutional capacity at the central and local levels so that a well-rounded and long-term capacity-building program can be designed. The project benefited from a joint study undertaken by the MRC with the support of Australia and the World Bank on data management and modeling capacities of the MRC countries. The project provided support to the Ministry of Environment and Forestry on various fronts, including regulations, information and monitoring systems, and river basin management plans. While building capacity for WRM is a long-term process that requires more than one project cycle, the project support could have benefited from a comprehensive suite of interlinked interventions to consider all gaps and financial sustainability. These would alleviate some of the issues on data quality, access, and dissemination; implementation and monitoring of river basin management plans; and enforcement of regulations.

Long-term procurement arrangements that ensure adequate financial resources for the operation and maintenance of hydrometeorological infrastructure will enhance data accuracy for decision-making on WRM. Various solutions in project design to finance the operation and maintenance of hydrometeorological stations after project closure could be procurement arrangements to cover spare parts for longer durations as well as longer-term agreements with the telecom companies to cover internet connection fees. Such arrangements during project implementation would compensate, to a certain extent, for the lack of budgetary provisions for operations and maintenance after project closure.

The participation of local communities in irrigation, flood, and fisheries management can serve as a catalyst for their contribution to IWRM, and inclusion of such project components can encourage government counterparts to tackle complex reforms in the sector. The project's support of community-led initiatives on irrigation, flood, and fisheries management fostered beneficiary involvement, which generated income and yielded sustainable and innovative approaches to fisheries management, enhanced flood control, and more efficient irrigation water management. These positive effects also prompted government counterparts to engage in more challenging institutional reforms related to IWRM.

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1. Background, Context, and Design

Background and Context

1.1 In 2012, when the Mekong Integrated Water Resources Management [IWRM] Project was designed, the countries of the Lower Mekong Basin (LMB)—the Lao People’s Democratic Republic, Cambodia, and Viet Nam—were facing competition for water resources, the challenge of balancing ecosystem protection with infrastructure development, and seasonal discharge variations, climate events, and climate change. The Mekong River originates on the Tibetan Plateau and discharges into the sea after traveling 4,350 kilometers. The river drains a 795,000-square-kilometer catchment area and has the world’s eighth-largest annual discharge volume (475 cubic kilometers). The river and its delta influence regional socioeconomic development, particularly in Cambodia, Lao PDR, Thailand, and Viet Nam. The Mekong River Basin (MRB) is host to some of the richest biodiversity in the world; the Mekong holds three times more fish species per unit area than the Amazon River. The MRB wetlands are also important biodiversity hotspots that play an essential role in the region’s economy, society, and culture. The pressure exerted by population growth and socioeconomic development has posed considerable challenges to communities’ access to safe water. Between 2018 and 2060, the basin’s population is projected to rise from about 65 million to about 83 million (OECD et al. 2020). Rapid industrialization and urbanization lead to reduced land for agriculture, increased demand for clean water, and more wastewater and pollution. These demands place an enormous burden on the Mekong’s water resources). Climate change has intensified the challenges via extreme weather events such as floods and droughts, particularly affecting the rural communities that depend on the Mekong River for livelihoods and basic food security. This also underscores the need for better weather and climate forecasting.

1.2 Lao PDR is intrinsically connected with the welfare and the flow of the Mekong River. The country depends on the Mekong for hydropower, to which the entire country’s economic development trajectory is linked. This power is already a major revenue generator for Lao PDR and is set to increase; 90 percent of the hydropower production will be exported to Thailand and Viet Nam. The expansion of hydropower has contributed to much of the country’s recent GDP growth (World Wildlife Fund 2016). The 1996 Law on Water and Water Resources in Lao PDR was foundational for management, and in 2013, the Ministry of Natural Resources and Environment (MONRE) centralized natural resources management. Despite initial river basin plans and committees, outcomes were not as expected, leading to recognition of the need for updated legal frameworks and improved infrastructure.

1.3 The Mekong River Commission (MRC) was established in 1995 for regional cooperation but faced issues due to inadequate data systems. LMB countries aimed to enhance hydrometeorological networks for improved flood and drought management and to establish an effective regional framework for IWRM to establish uniform regional water use procedures and hydrological models to inform and manage water resources investments.

1.4 The World Bank and the Australian Aid Agency (Department of Foreign Affairs and Trade) had supported MRC capacity building, shifting focus to strengthening member countries' water resources management (WRM) capacity through the Mekong Integrated Water Resources Management Project.¹ This project, structured as an adaptable program loan, was planned in phases across Lao PDR, Viet Nam, and Cambodia. It coordinated regional efforts to agree on water use procedures and improve stakeholder communication, national support for IWRM implementation, and capacity building. A third pillar addressed emerging IWRM issues in border areas through the MRC and bilateral dialogue (World Bank 2012a).

Objective, Design, and Financing

1.5 According to the Financing Agreement dated April 4, 2012, the project development objective (PDO) was to “establish key examples of IWRM practices in the LMB at the regional, national, and subnational levels, thus contributing to more sustainable river basin development in the LMB.” The additional financing approved on July 6, 2017, revised the PDO and indicators. The PDO was revised to “improve water resource and fisheries management in selected areas of the LMB.” This Project Performance Assessment Report (PPAR) uses the revised PDO and revised PDO indicators since they were relevant to the final project objectives, maintained the project's ambition, and clarified the assessment of the project's achievements.

1.6 The project had three components:

- **Regional WRM (actual cost at closing \$7.5 million).** This component supported transboundary dialogue on critical water resources and fisheries management issues among the LMB countries to promote regionally harmonized solutions and provide technical assistance for the preparation of phase II (Cambodia and Viet Nam) of the Mekong project.
- **National WRM (actual cost at closing \$17.9 million).** This component supported legal, institutional, and human resources strengthening to implement IWRM and improve water resources planning in Lao PDR. Although implemented at the national level, this component would benefit all the LMB countries, given that Lao PDR accounts for more than one-third of the flow of the Mekong River.

- **Improved Floodplain and Aquatic Resources (Fisheries) Management (actual cost at closing \$23.1 million).** This component supported floodplain management, balancing livelihood support for local communities and sustainable comanagement of fisheries in key spawning and feeding habitats of regional significance.

1.7 The theory of change for the project was clear but lacked some key elements (presented in more detail in appendix C). Effective IWRM necessitated intercountry cooperation on joint action plans, which were essential for planning, implementing, and monitoring IWRM activities. At the regional level, this involved creating joint action plans to frame IWRM and establishing arrangements for IWRM planning, data collection, monitoring, and information sharing among member countries. However, capacity building for dispute resolution at the regional level was also needed. Countries needed to manage IWRM within their territories; therefore, the project included support for enhancing legal and regulatory frameworks, building institutional capacity, creating information infrastructure, and developing river basin plans. However, a needs assessment for this institutional capacity building was lacking. The basin-level interventions also included operationalizing irrigation and flood management infrastructure and improving community fisheries management. The expected outcomes were better regional and national IWRM and improved river basin and fisheries management in the LMB, leading to sustainable river basin development with long-term social and economic benefits.

1.8 **Dates and financing.** The project was approved on March 3, 2012, and became effective on May 15, 2012. The original closing date was March 31, 2018. The closing date was extended twice, and the actual closing date was February 28, 2022.² At appraisal, the project was financed by two International Development Association grants totaling \$26 million. This was increased in July 2017 by additional financing of \$26.13 million through an additional International Development Association grant of \$25 million and three trust fund grants totaling \$1.132 million. At closing, \$47.95 million had been disbursed from International Development Association grants and \$1.087 million had been disbursed by trust fund grants. The remaining amounts were canceled.

1.9 This PPAR assesses the project's overall achievements and includes a section focusing on its contribution to IWRM followed by conclusions and lessons learned.

2. What Worked, What Didn't Work, and Why?

Results

2.1 An overview of project results is aligned to priority areas of investigation undertaken by the field evaluation, which included policies and institutions, information and decision systems, infrastructure, and incentives.

2.2 **Policies and institutions—transboundary collaboration.** The project effectively developed three transboundary action plans and a transboundary environmental impact assessment, procedures for data and information exchange, and training and awareness workshops, and supported the revision of the MRB strategy and the MRC strategy for 2021–25 (Mekong River Commission 2021). While stakeholders technically agreed to the action plans, these had not been implemented by the project's closing because of relevant governments' budget constraints. These initiatives were important steps toward the execution of joint plans, enhanced cooperation, and better data and information sharing on WRM. As of the Independent Evaluation Group (IEG) mission in February 2024, interviews with various key informants revealed that the transboundary action plans had still not been implemented because of a lack of political will among the member countries. Also, challenges persisted in data and information sharing among member countries. IEG found that the new MRC strategy thoroughly analyzed transboundary issues for the Mekong River. However, conflict resolution mechanisms to foster better collaboration between countries are needed.

2.3 **Policies and institutions—revised water law.** The project supported the revision of the water law in Lao PDR, which the National Assembly ratified in May 2017. After ratification, the MONRE crafted five legislative pieces: the River Basin Management Decree, the National Water Resource Management Strategy, the Agreement on Water Use Management, the Decree on Wetland Management, and the Agreement on Water Quality. IEG assessed the revised water law as comprehensive but noted the absence of clauses on climate change impacts.

2.4 IEG's discussions with central and local authorities uncovered that budgetary constraints at both levels impede MONRE, Provincial Offices of Natural Resources and Environment (PONREs), and District Offices of Natural Resources and Environment from effectively disseminating and enforcing water-related legal documents and regulations. This financial shortfall also affects the promotion of WRM awareness among other sectors and users and the coordination of WRM among various stakeholders. Additionally, there are bottlenecks in the exchange of information concerning water use permits from the local to the central level. Without a mandated procedure for reporting across these levels, some PONREs do not report the water use

permits they issue. MONRE authorities estimate that local authorities report only about 70 percent of permits granted.

2.5 Policies and institutions – river basin plans. The project supported the development of eight river basin management plans (RBMPs) for priority basins, a groundwater management plan for Savannakhet province, and guidelines on RBMPs. At the time of the IEG mission in February 2024, the prime minister had approved all RBMPs assisted by the project. IEG discussed implementation of the RBMPs supported by the project with MONRE’s Water Resources Department and with the PONRE in Khammuan province. Using the Xe Bang Fai Basin Management Plan as a case study, IEG assessed the adequacy and robustness of the RBMPs supported by the project. The plan was developed through a participatory approach, incorporating economic, environmental, and social considerations. Several shortcomings were identified: (i) the government’s lack of funds to implement the river basin plans, which is a significant obstacle to the implementation of the activities outlined in the plans; (ii) the data informing the plans are insufficient for them to be considered fully developed RBMPs; weaknesses include reliance on estimated water use figures, omission of climate change analysis, and the absence of a detailed water resource inventory; (iii) there is no monitoring framework to verify the implementation of the plans and the sustainable management of the river basin; and (iv) there has been no assessment of the capacity and skills in human resources required at the institutional level to implement river basin management. However, the planning process was still deemed valuable as it helped elicit priorities from stakeholders, identified gaps that need to be filled in the future, and documented the understanding of the river and the needs of the people at the time of the writing.

2.6 Information and decision systems: hydrometeorological stations. The project supported MONRE’s Department of Hydrology and Meteorology (DMH) in establishing or renovating 89 hydrometeorological stations and the early-warning center building in Vientiane and training technical staff in using and managing the stations. DMH is responsible for the operation and maintenance (O&M) of all hydrometeorological observation networks and for providing weather and flood forecasts and severe weather warnings throughout the country. IEG interviewed DMH authorities, visited one meteorological station in Sanamxay District in Attapeu province, and interviewed the district officer responsible for the station. In addition, IEG interviewed the World Bank project team of the Lao PDR Southeast Asia Disaster Risk Management Project (P160930), which also supported hydrometeorological stations.

2.7 IEG discovered that there are still issues with hydrometeorological data availability, quality, and access. First, the operation of the hydrometeorological system is insufficient because of insufficient funding for O&M after project closing. IEG also

learned that because of a limited budget, the internet service fees for many automatic stations are not paid, meaning they are often unable to provide data; thus, the department still relies on manual stations for data collection. Furthermore, remote hydrometeorological stations cannot be repaired because of difficulty accessing them and a lack of compatible spare parts. Second, local staff in district and provincial offices often make mistakes in manually collecting and reporting the hydrometeorological data. Third, there is an inadequate system for hydrometeorological data sharing; a coordinated mechanism at the central level to share and publish periodic and real-time hydrometeorological data is not yet available (the website created to publish hydrometeorological data is not working). Finally, there is a need to integrate all the hydrometeorological stations financed by various development partners (more than 200 stations). A stocktaking analysis is required to identify which stations are working and the optimum number and locations of stations. The government authorities informed IEG that the ongoing World Bank financed Lao PDR—Southeast Asia Disaster Risk Management project is supporting DMH in developing a unified system that will integrate near real-time data from hydromet stations managed by different development partners.

2.8 Information and decision systems—water quality data. The project supported MONRE’s Natural Resource and Environment Research Institute (NRERI) to improve water quality monitoring. The project supported the expansion of water quality monitoring measurement sites and parameters and a water quality monitoring laboratory. During the IEG mission, water quality was measured only twice yearly (rather than the planned four times a year) because of budgetary constraints. International Organization for Standardization accreditation for the laboratory, which serves external clients for a fee, was pending.

2.9 Information and decision systems—water models. The project supported NRERI’s crucial role in water resource modeling for tributaries of the Mekong River, but IEG learned that the models face data accuracy issues and lack updates, which undermined the models’ effectiveness for informing water management decisions. This is primarily due to relying on estimated water use data rather than actual surveys, inaccurate hydrometeorological data fed into the models (as mentioned in paragraph 2.7), and lack of climate change information embedded into the models.

2.10 Infrastructure—irrigation and floodgates. The project’s achievements in irrigation infrastructure rehabilitation were notable, with an area of 7,993 hectares being improved, which surpassed the PDO indicator target. IEG interviews with various stakeholders, including the Department of Irrigation at both central and provincial levels and members of a selected water user association (WUA) in Khammuan province, confirmed the effectiveness of the irrigation component. The stakeholders generally

viewed the irrigation component as successful. Improved irrigation infrastructure, along with the introduction of improved rice varieties, led to substantial increases in paddy rice yields (estimated by the local authorities at 80–90 percent during the project period) and vegetable production. The project supported lining main canals with brick, which reduced leakage, thus contributing to increased irrigation efficiency. However, increased production meant that pump capacity was sometimes insufficient to meet the demand for irrigation.

2.11 Additionally, the project focused on capacity building for 65 WUAs, which are groups formed by farmers to manage tertiary irrigation networks. This capacity building included training and support for improved infrastructure management and the development of regulations for the WUAs. Notably, the membership of these associations included women farmers, which was an important step toward inclusivity. Despite the successes, challenges remained. Many WUAs were still considered weak and required additional support to cover their O&M costs. For example, WUAs made numerous requests for exemptions on electricity fees for agricultural production, since they could not pay the bills.

2.12 The project's rehabilitation of 15 floodgates, which protect 17,097 hectares, has somewhat improved flood management. However, their effectiveness is limited during severe floods because there are no pumps to keep the water out. A study found that gates with fish passages were beneficial for fish populations (110 species of fish could ascend the modified floodgate aprons), but the study also recommended building fishways for better fish migration throughout the wet season since they do not require manual operation like the gates supported by the project (Department of Irrigation 2019), but this solution comes with the trade-off of higher costs. It should also be noted that the study's findings aimed to inform future investments and provide guidance for the participatory management and operation of floodgates to maximize their net benefits for flood protection, irrigated agriculture, and fisheries. This approach reflects the iterative process of development, whereby solutions are implemented based on current knowledge and refined over time.

2.13 **Incentives—fisheries and livelihoods interventions.** The project contributed to sustainable fisheries by developing fisheries law and regulations, establishing 12 fisheries management committees, and providing training. The project supported the creation of fish conservation zones monitored by these committees and supported community livelihoods with agricultural inputs to discourage overfishing. The project also enhanced hatchery capabilities for fish species conservation, which authorities and committee members deemed successful in increasing fish populations and improving livelihoods, despite difficulties attributing specific outcomes to the project interventions. In a perception survey conducted by the Department of Irrigation in 2019, only

30 percent of fishers reported higher fish catch rates, attributed to improved fisheries management and fish-friendly floodgates. However, it should be noted that these positive outcomes for a subset of beneficiaries also show the need for a more comprehensive analysis to measure the long-term impact of these interventions.

What Worked and Why?

2.14 The project's objective was relevant to the development problem in general, including MRC's decentralization policy. The project supported building an integrated approach to water resources and fisheries management for Lao PDR, which aligned with the MRC's recent policy of decentralization of core river basin management functions. This included a shift toward MRC countries taking responsibility for managing and monitoring their water resources and carrying out water assessments previously undertaken by the MRC Secretariat. Furthermore, MRC's work had previously focused on the mainstream, whereas tributaries remained largely the responsibility of the line ministries in the respective countries; however, the ministries needed to improve capacities to adequately perform the required functions. Sustainable management of Lao PDR's key asset, the Mekong River and its tributaries, was also deemed critical by the World Bank's Country Partnership Framework 2017–21 and the country's strategies (the National Socio-Economic Development Plan 2016–20; World Bank 2017a).

2.15 The project design to strengthen community participation toward achieving improved WRM at the local level was sound. The creation of WUAs and fisheries management committees strengthened communities by allowing the formulation of local management plans, O&M of infrastructure, and citizen engagement to foster ownership and long-term sustainability of project-supported infrastructure and fisheries management and improved WRM. The fisheries management committees were directly responsible for the participatory fisheries management plans. The WUAs received capacity-building support to extend agriculture techniques, including the system of rice intensification, and to promote the pest management plan.

What Didn't Work and Why?

2.16 Insufficient support for dispute-resolution mechanisms for transboundary coordination possibly contributed to the lack of political will to implement transboundary action plans. Although the project supported the development of transboundary action plans on water and fisheries resources, no plans were implemented because of a lack of political will in member countries. Political backing in member countries for transboundary coordination requires strong dispute-resolution mechanisms endorsed by all the participating countries and processes and strategies to build trust. Although the Mekong's riparian countries have accepted MRC's principles

of transboundary coordination on the use of the basin's water resources through multicounty agreements, exactly how this will be implemented depends on achieving a trusted negotiation and effective conflict resolution among the parties.

2.17 The project faced ongoing challenges in strengthening institutional capacity for IWRM partly due to the absence of a comprehensive capacity-building program on IWRM at both central and local levels for MONRE from the outset. While capacity building programs for IWRM is a long-term process and effort, which is hard to complete in one project cycle, the start of such a program would benefit from a comprehensive needs assessment. The project's support for MONRE as the organization in charge of IWRM focused on specific tasks related to monitoring systems, such as establishing hydrometeorological stations, developing water models, and enhancing water quality measurements. While institutional assessments were conducted, a more comprehensive institutional capacity assessment at an earlier stage could have informed more robust and structured support to MONRE. A well-rounded capacity-building program would have encompassed all facets of WRM, including (i) data collection, analysis, and dissemination (for example, stocktaking of existing hydrometeorological stations and integrating them into a common system, conducting water resource surveys and inventories, assessing climate impacts, and sharing data through various platforms); (ii) monitoring and enforcing water use regulations; (iii) promoting public awareness of water resources, and (iv) exploring financial mechanisms for sustainable water management, such as cost recovery, user fees, and funding for developing and maintaining water infrastructure (Salman and Bradlow 2006).

2.18 Lack of attention to O&M arrangements for hydrometeorological stations led to ineffective use of the hydrometeorological system after project closing. The project design did not include solutions for the continued operation of the hydrometeorological system after project closing. Thus, because of the lack of funding for O&M, the hydrometeorological infrastructure supported by the project became mostly idle. This led to shortcomings in data availability, quality, and access. Although a diagnostic of Lao PDR's hydrometeorological system is planned under the Lao PDR—Southeast Asia Disaster Risk Management Project, this could have been addressed earlier.

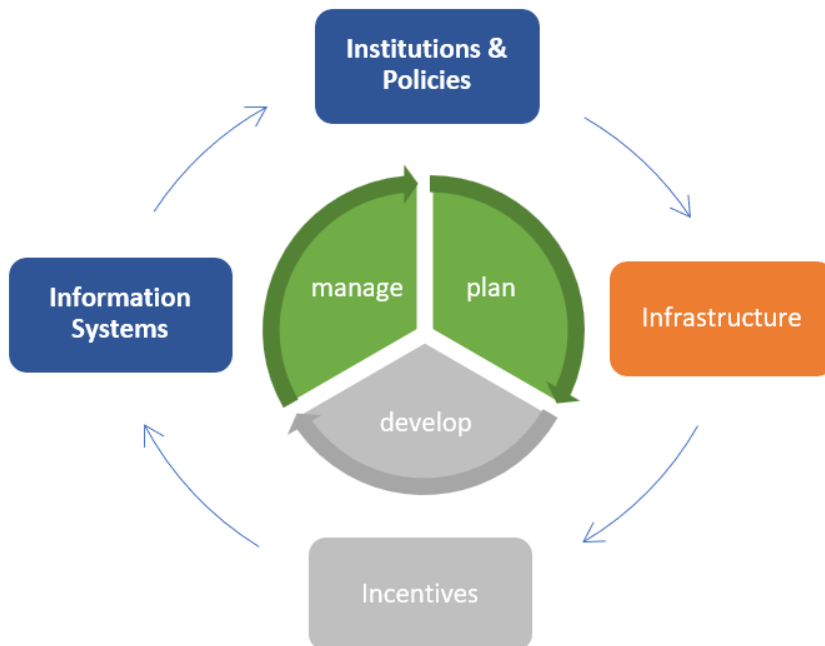
2.19 An insufficient results framework and lack of outcome-based indicators hinder the ability to assess the project's contribution toward sustainable water resources management and policy effectiveness. The project's PDO indicators were mainly at the output or intermediate results level (for example, the number of action plans, river basin plans, and fisheries management plans prepared and implemented, and area covered by infrastructure). Expected long-term outcomes would include sufficient water availability for different uses and improved flood management and water quality. However, realizing these outcomes would extend well beyond the project's completion date.

Similar future projects could monitor intermediate outcomes attainable during the project’s lifetime. These might measure, for example, whether transboundary action plans are being implemented, water organizations are sufficiently and sustainably performing their roles, water laws and regulations are being enforced, river basin plans are being implemented, and information systems are sustainably used to provide sufficient and accurate data for decision-making. The omission of these outcomes during early interventions limits the potential for building a better long-term data set.

3. Was Water Resources Management Improved?

3.1 WRM is defined by the World Bank’s Water Global Practice as “the process of planning, developing, and managing water resources, in terms of both water quantity and quality, across all water uses. It includes the institutions, infrastructure, incentives, and information systems that support and guide water management” (World Bank 2022b). The Lao PDR project comprised all four aspects under this definition; thus, this PPAR focuses on all the four elements in this section, but the first two elements (policies and information systems) are covered in more detail (see figure 3.1 for the conceptual framework for this section).

Figure 3.1. Aspects of Water Resources Management



Source: Independent Evaluation Group using Water Global Practice definition.

Institutions and Policy Regulatory Framework

3.2 The project design benefited from the long-standing regional technical assistance program provided by the MRC, which supported development transboundary action plans and communication products. Notably, the revised MRC strategy covering 2021–25 enabled the project to support both of these at the regional country levels, including coordinated actions by LMB countries and development of a new water resources law and RBMPs specific to Lao PDR.

Transboundary Action Plans and Other Transboundary Interventions

3.3 The project supported the development of guidelines for transboundary environmental impact assessment, data procedures, information exchange, water use monitoring, maintenance of flows, and water quality, as well as action plans at the transboundary level; the action plans were agreed at the technical level but not implemented because of a lack of support from political leadership in the MRB countries. This project successfully supported the development of three joint action plans to facilitate actions by LMB countries on critical transboundary communication activities and products, including a transboundary environmental impact assessment and procedures for data and information exchange. The project also supported the development of a revised MRC Strategic Plan (see appendix C for details). The Implementation Completion and Results Report reported that the member countries endorsed the transboundary actions but that they were not implemented because of a lack of funds at the time of project closing (World Bank 2022a). However, the PPAR mission learned from key stakeholder discussions that the primary factor behind the lack of implementation of the transboundary actions was a lack of political will at the higher levels of the government. Consideration and endorsement at the technical level were insufficient to achieve concrete results for transboundary cooperation. Therefore, obtaining political support for implementing transboundary actions requires attention to the political dynamics in each country.

3.4 Analyzing the political dynamics among riparian nations is crucial for devising sustainable solutions to transboundary issues (see box 3.1 for key issues), and the project-supported Mekong Basin Strategy incorporates valuable diagnostics. The Basin Development Strategy, which later became the MRC Strategic Plan for 2021–25, includes a comprehensive diagnostic to assess competing political interests among riparian countries and to define strategic environmental, social, economic, climate change, and cooperation priorities for the MRB's future (Mekong River Commission 2021).

Box 3.1. Political Dynamics for the Mekong River

Population growth and socioeconomic development exert significant pressure, presenting substantial challenges for water allocation for domestic, industrial, and agricultural uses in Mekong River Basin (MRB) countries. These demands impose a heavy burden on the Mekong's water resources (OECD et al. 2020). Hydropower sources in the MRB are vital, supplying 10 percent of the electricity demand for MRB countries. The Lao People's Democratic Republic relies almost entirely on MRB hydropower for its energy needs. Over 120 dams are planned for the Mekong's tributaries, and 11 large-scale hydropower dams are proposed for the main course of the river. Cambodia, Lao PDR, and Myanmar hold the most significant potential for hydropower development. With ambitions to become the "battery of Asia," Lao PDR plans to export electricity to neighboring countries and other Association of Southeast Asian Nations member states. Nonetheless, there is concern over the potential environmental, fishery, and livelihood impacts of hydropower infrastructure and operations in the MRB (OECD et al. 2020). In addition, China and Myanmar, not members of the Mekong River Commission but situated upstream, affect downstream flows. China has invested heavily in dam construction on the Lancang (upper Mekong River) and in development projects across all Mekong River Commission member countries. As a dialogue partner, the Mekong River Commission must demonstrate its capacity for constructive cooperation with the Lancang Mekong Commission. These intricate issues warrant thorough analysis and strategic approaches to mitigate political tensions among nations over water resources.

Source: Independent Evaluation Group.

3.5 Although the MRC has established procedures and defined roles for member countries, adherence to these procedures is often inconsistent. The MRC's Procedure for Notification, Prior Consultation and Agreement mandates that member countries engage in feedback and consultation with riparian nations regarding hydropower dam projects. The independent mid-term review of the MRC Strategic Plan 2016–20 acknowledges some progress (Bird et al. 2019), such as in the case of the Pak Beng dam, but also highlights ongoing issues, including a lack of member feedback and insufficient advance notice of consultations by member countries. Regarding the Procedure for Maintaining Flows on the Mainstream, the report recognizes that China is upholding minimum flow levels on the Lancang River (the Upper Mekong River), yet concerns persist about lower-than-average flows downstream at Kratie in Cambodia. Despite extensive modeling and scenario planning, the challenge of low flows during the dry season in the LMB countries remains contentious. Furthermore, the report indicates minimal advancement in implementing the Procedure for Water Use Monitoring. It points out a need for clarity on the required data and their application and recommends exploring alternative methods for data collection, such as remote sensing and water accounting tools.

3.6 Resolving transboundary issues would benefit from effective dispute-resolution mechanisms to manage conflicts among member countries and to foster trust. The MRC

Secretariat needs to enhance its dispute-resolution capacity, and the project design could have included activities to build this capacity. The World Bank report *Promoting Development in Shared River Basins: Tools for Enhancing Transboundary Basin Management* highlights the importance of both formal agreements and informal arrangements in implementing effective cooperation mechanisms (Leb et al. 2018). Successful cooperation is built on strong personal relationships and mutual respect. An independent oversight body could ensure compliance with agreed terms and help resolve misunderstandings. While the MRC assumes the role of an independent third party, it needs to strengthen its capabilities to build trust and enhance collaboration among all riparian states. A study by Mallick (2022) points out that building institutions alone is insufficient to resolve issues; these institutions need clear rules and regulations for conflict resolution and authorities with decision-making and enforcement powers to maintain cooperative arrangements. Equitable benefit sharing among stakeholders is also crucial. The World Bank paper on the role of the MRC notes that the MRC's dispute-resolution mechanisms are weak (Schmeier 2011). Since changes in the basin could lead to conflict, strengthening these mechanisms is essential for building resilience.

Revised Water Law in Lao PDR

3.7 The project supported the development of the revised water resources law in Lao PDR, which was approved by the National Assembly in May 2017. According to the Implementation Completion and Results Report, the revised water resources law aligns with international agreements relating to natural resources protection and climate change, including the Ramsar Convention, the Paris Agreement on climate change, and the Vientiane Declaration on International Cooperation. MONRE representatives informed IEG that after the law's adoption, MONRE developed the following five legislations: the River Basin Management Decree, the National Water Resources Management Strategy, the Agreement on Water Use Management, the Decree on Wetland Management, and the Agreement on Water Quality.

3.8 This PPAR assesses the adequacy of the water resources law by using several key elements identified in the literature (see the Key Required Elements of a Water Resources Law section in appendix C). The law complied with all the key aspects including water rights (protection of the traditional users' rights), water licensing, IWRM, identification of different sectors' roles and responsibilities, quality and maintenance flows, protection of water supply areas, and Lao PDR's international and regional obligations as a member of the MRC. However, specific clauses on climate change were missing; it did not directly address possible climate change impacts on water availability and quality.

3.9 Discussions between the PPAR mission team and MONRE, which is in charge of the overall WRM, and PONRE revealed that lack of funding at the central and local government levels makes it difficult to disseminate and enforce legal documents and regulations, create awareness of WRM in other sectors and users, and coordinate WRM among various stakeholders. Government staff also face capacity limitations particularly in monitoring water resources.

3.10 Information exchange between the central and local government levels on water use permits is still insufficient. MONRE issues permits for surface water, underground water, and wastewater release for large-scale projects (for example, dam development and industry such as manufacturing soft drinks). Provincial directorates of the ministry issue permits for smaller-scale projects. By law, PONREs must report water use permits to MONRE periodically, but not all PONREs do this because there is no procedure to enforce it. MONRE authorities estimate that only about 70 percent of permits are reported. IEG learned that since 2019, MONRE has issued 71 permits.

River Basin Plans in Lao PDR

3.11 The project supported development of eight RBMPs in Lao PDR identified as priority basins (Nam Tha, Nam Khan, Nam Ngiep, Xe Done, Xe Kong, Xe Bang Fai, Xe Bang Hieng, and Nam Ngum),³ one groundwater management plan (Savannakhet province), and RBMP guidelines. The PPAR mission visited the Division of Water Resources Department under PONRE in Khammuan province. There, MONRE facilitated the development of two RBMPs for Xe Bang Fai and Hinboun Rivers. Because these are large river basins, MONRE is responsible for them at the central level. PONRE participated in the plan development process and coordination with relevant stakeholders at the provincial level to obtain required data.

3.12 IEG assessed the Xe Bang Fai River basin development plan supported by the project by using literature on the principles of river basin management and information obtained during the PPAR mission (see the Elements of a Robust River Basin Management Plan section in appendix C and tables C.1 through C.5 for selected tables from the Xe Bang Fai RBMP). The river basin plans were generally participatory, involving all relevant stakeholders. Economic, environmental, and social considerations were also integrated into the plans. PONRE representatives stated that the process to develop the RBMP included setting up a committee with members from relevant departments in MONRE and other relevant ministries and consulting with relevant stakeholders, including district governors and representatives from ministries, the private sector (cement factory, Nam Thuen dam), and the Lao Women Union. There were, however, several issues raised as concerns:

- a. **Preparing plans at the central level makes it difficult to implement and follow up on the plans at the river basin level.** Furthermore, the plans did not include developing any human resources or skills assessment for river basin planning and management for either MONRE or PONRE.
- b. **The government lacks funding to implement the river basin plans, although several projects support some of the basins (see paragraph below).** This is one of the main challenges preventing the achievement of the plans' activities. The prime minister approved the earliest plan in 2022, but MONRE has not yet been able to develop a work plan and a monitoring framework for it. The plans included an indicative budget, but funding from the private sector, development partners or donors, and the government is still needed to implement the plans' activities.⁴
- c. **Data feeding into the plans are insufficient to make them comprehensive RBMPs.** The main issues are (i) outdated data or estimates for water use (for example, for water supply), (ii) insufficient data from hydrometeorological stations because of O&M issues (see next section), (iii) no data on water resources inventory or environmental inventory of the basin, and (iv) no analysis of climate change data that feed into the RBMPs. Regarding this last point, the United Nations Development Programme informed IEG that the water model developed under the project for one river basin had to be updated by incorporating climate change impacts.
- d. **There is no monitoring framework to assess whether the plans are being implemented and the river basin is managed sustainably.**

3.13 The government authorities also informed IEG that some activities were being carried out with the support of other development partners. For example, Korea supports IWRM and climate resilience in the Xe Bangfai and Xe Don basins, China supports the Nam Por IWRM project in the Nam Ngum basin, and United Nations Development Programme supports the IWRM in the Xe Banghieng and Luang Prabang basins. Furthermore, these plans are being considered in the budgetary processes of MONRE and PONRE to support and implement some priority activities

Water Resources Management Information, Monitoring, and Decision-Support Systems in Lao PDR

3.14 In terms of information technologies, the project supported the establishment and rehabilitation of hydrometeorological infrastructure, improved water quality measurement, and supported the development of water resources models to be used for decision-making in Lao PDR. The project also provided capacity building to relevant departments of MONRE at the central and local levels.

Hydrometeorological Infrastructure

3.15 The hydrometeorological services assessment report for Lao PDR carried out by the World Bank and other development partners in 2012 cited the very basic requirements for the National Meteorological and Hydrological Services to function effectively (World Bank 2012b; see figure C.1 for a schematic presentation of the system). The report pointed to the importance of modernizing DMH facilities and observation networks to collect and disseminate reliable, timely, and accurate forecasts and warnings, which has become particularly critical because of climate change.

3.16 MONRE's DMH provides weather and climate-related services for Lao PDR. It is responsible for O&M of all hydrometeorological observation networks and for providing weather and flood forecasts and severe weather warnings throughout the country. The country assessment report stated that DMH has limited technical, human, and financial resources to carry out its mission (World Bank 2012b). Its office premises, observation network (particularly the limited hydrological and meteorological stations), production systems, and current funding are inadequate to ensure the delivery of better products and services to all sectors.

3.17 IEG interviewed DMH authorities, visited one meteorological station in Sanamxay District, Attapeu province, and interviewed the district officer responsible for the station. In addition, IEG interviewed the World Bank project team for the Lao PDR Southeast Asia Disaster Risk Management Project (P160930). The Mekong Integrated Water Resources Management Project supported 89 hydrometeorological stations, including 24 hydrometeorological stations in five provinces and the early-warning center building in Vientiane during the first phase. In addition, the project financed 38 rainfall stations and 26 hydrometeorological stations and 2 meteorological stations in the additional finance phase. All stations renovated or established are automatic and provide information online. The project also supported training technical staff on how to use and manage the stations.

3.18 The IEG mission found shortcomings in the availability, access, and quality of hydrometeorological data. Since the 2012 assessment of the hydrometeorological system,

there has not been significant progress. Interviews revealed weaknesses in the operation of the hydrometeorological system due to the lack of funding for O&M after project closing. Reportedly, the department uses only 28 manual stations for meteorological data and 8 stations for hydrological data covering 30 tributaries (data include water level and temperature). In addition, some hydrometeorological stations in remote areas are not functioning because the department lacks the funds to access these stations to repair them.

3.19 Local staff in district and provincial offices often lack the capacity to collect and share hydrometeorological data, which impairs data quality. Staff turnover is frequent, and continuous training cannot be provided. The department also contracts individuals in remote villages to collect data, but these data often contain mistakes. These mistakes are corrected by comparing the data with similar meteorological data from neighboring countries.⁵

3.20 IEG's interviews revealed issues with the system integration of hydrometeorological stations financed by various development partners. The World Bank Disaster Risk Management Project financed 70 stations in three provinces. Other donors financed various other stations, but these stations do not share information or provide data in standard formats. It is estimated that more than 200 stations will need to be integrated into a joint system. Stocktaking and analysis are required to identify the optimum number of stations. The World Bank will soon prepare a diagnostic report to analyze these key issues. One problem is the high cost of internet connectivity; a possible solution is a long-term agreement with the telecom company for lower fees.

3.21 The system for hydrometeorological data sharing is inadequate; a coordinated mechanism at the central level to share and publish periodic and real-time hydrometeorological and climate data is not yet available. A website was created to publish the hydrometeorological data at project closing, but the authorities during the IEG mission reported that it is still under development. DMH authorities noted that the data collected manually are shared with various selected ministries via a WhatsApp group. However, hydrometeorological data should be open access and available in real time. Interviews with key informants revealed that obtaining data is very difficult; it takes a long time to obtain specific data, and this is reportedly challenging for other departments in MONRE and for other ministries.

3.22 While the project supported the national early-warning center, weaknesses in the system persist; these will be dealt with in a follow-up disaster risk management project. The World Bank Disaster Risk Management Project team clarified that a set of interventions is still needed for climate risk and early-warning systems in Lao PDR. The Mekong Integrated Water Resources Management Project and the current disaster risk

management project worked on establishing the infrastructure systems (which are not yet working effectively, as noted earlier in this section). The planned follow-up disaster project will reportedly work on such components as early-warning systems, communications, and information dissemination and services.

Other Water Data

3.23 **Water quality.** NRERI is responsible for water quality monitoring in Lao PDR, which was supported under this project. The project helped expand the water quality parameters and measurement sites (five stations). At project closing, water quality was measured four times a year, but because of budget limitations, it is currently measured only twice a year—enough to cover both wet and dry seasons. Reportedly, water quality is generally good during the dry season, but high levels of sediment due to riverbank erosion cause a decrease in quality during the rainy season. The project also supported the establishment of a water quality monitoring laboratory. During the IEG mission, the International Organization for Standardization laboratory accreditation was pending; the NRERI representatives stated that because of the COVID-19 pandemic, the accreditation committee had not been able to come to Lao PDR. Official confirmation of accreditation was expected in 2024. IEG learned that the water quality laboratory also provides services for a fee. A business plan was developed in 2023 for this purpose; its main clients are mining companies, and so far, there have been about 200 fee transactions. However, the collected fees go toward the national budget and cannot be used for the O&M of the laboratory, which has a limited budget.

Water Models

3.24 NRERI in Lao PDR is responsible for water resource modeling, which has been implemented under the project. NRERI provides modeling information and data to the Department of Water Resources in MONRE to feed into the RBMPs and to the MRC Secretariat, particularly to its Decision-Support System. Whereas the MRC Secretariat assesses the broader impact on the mainstream Mekong River, NRERI works on its tributaries.

3.25 **Water modeling.** The project supported NRERI in developing flood modeling and water resource assessment for eight selected priority basins in Lao PDR, but there are concerns regarding the quality of the output. The models were completed in 2021; the models have not been updated. The data that feed into the models are inaccurate. For example, there are no detailed data on water use (for example, irrigation water use per hectare and water consumption for domestic use are not measured or surveyed); these numbers are estimated. As mentioned earlier, hydrometeorological data are inaccurate or do not cover all river basins; data are also lacking for soil and groundwater and from relevant sectors on planned development investments on irrigation, industry,

and hydropower. As mentioned in the previous section, climate change impacts are not incorporated in water models that feed into the RBMPs. Water balance models are assessed using the required parameters and based on information from NRERI (table 3.1). Thus, the water models developed by the project are insufficient to provide accurate estimates to inform decision-making for WRM.

3.26 However, IEG was also informed that the water models also included several positive aspects. For example, water allocations were simulated under different scenarios. Five of the eight basin models (Nam Ngum, Nam Ngiap, Xe Bangfai, Xe Banghiang, Xe Don, and Xe Kong) were developed with four future scenarios: 1. Current and planned development, 2. Population growth and projected domestic water consumption, 3. Land use change and projected irrigation extraction, 4. Climate change. These assessments are deemed valuable for river basin planning under these future conditions. Additionally, these models support other aspects of water resource management. For example, hydraulic models have been used to produce flood maps for the Nam Ngum, Xebangfai, and Xedon rivers. These maps were handed over to the Provincial Governor and PONRE for flood monitoring and management and to address water use conflicts in the upper Nam Ngiap basin.

Table 3.1. Water Balance Parameters for Water Resource Models

System Element Required	Estimation Source	PPAR's Assessment of Water Model Supported by the Project
Precipitation	Local or global data	Insufficient because of limited hydrometeorological data
Evapotranspiration	From remote sensing estimation	Missing
Stream flows	Local observations, satellite-derived estimates	Insufficient, because of limited hydrometeorological data
Groundwater	Groundwater models, local observations, Earth observation for large areas	Missing
Water quality	Local observations, Earth observation for large areas	Available
Water consumption	Measurement or records, estimates using specific water use, crop water models (for example, Aqua Stat)	Insufficient, because of lack of actual surveys and lack of information on investment plans
Climate change	Various IPCC models for scenario analysis	Missing

Sources: Independent Evaluation Group; World Bank 2021.

Note: IPCC = Intergovernmental Panel on Climate Change; PPAR = Project Performance Assessment Report.

Infrastructure: Community-Level Irrigation and Flood Management

3.27 **Irrigation.** The project supported the rehabilitation of irrigation infrastructure, covering 7,993 hectares (exceeding the PDO target) by upgrading or replacing pumps and delivery pipes and lining main canals with brick. The project also provided capacity building to 65 WUAs to help them manage the irrigation network. IEG interviewed

representatives of the Department of Irrigation, which oversees irrigation works at the central and provincial levels (Provincial Agriculture and Forestry Office [PAFO] Irrigation Department in Khammuan province). IEG also met with members of Nawang WUA in Nongbok District, Khammuan province. In general, the relevant stakeholders interviewed by IEG deemed the irrigation component effective. The Ministry of Agriculture and Forestry is eager to have follow-up projects on irrigation support.

3.28 The project established new WUAs or improved existing groups by providing training and support with improved infrastructure and developing regulations for WUAs. The revised WUA membership included women farmers. The improved irrigation infrastructure was handed over to the WUAs. Reportedly, farmers contributed labor to the project on irrigation rehabilitation works to increase farmer ownership. This also provided some savings that helped them to cover more areas. At project closing, 65 WUAs had improved their operations by collecting increased revenues from the users; these funds were used for O&M of the irrigation infrastructure.

3.29 During IEG's mission, the Department of Irrigation representatives stated that all 65 WUAs are still operating but noted that many groups are still weak and require more handholding. All WUAs collect irrigation service fees; 85 percent of fees go to the WUA's own fund, and 15 percent is allocated to the provincial budget. These funds are used to repair pumps (spare parts) and pay for electricity. The department has received numerous requests from WUAs for exemptions on electricity fees for agriculture production. About 60–70 percent of WUAs supported under the project still need support and requested exemption on electricity bills. The fees the WUAs collect are insufficient to pay for electricity expenditures (the fee ranges from 2 to 5 percent of revenue).⁶ But when a WUA does not pay its bill, the government does not cut the electricity. The government is trying to encourage more use of solar pumps, which are new within the past five years, and more suitable for southern rather than northern regions.

3.30 While yields have reportedly increased because of infrastructure support and improved water use efficiency, more irrigation water is needed for increased production. Improved rice varieties were also provided to farmers; reportedly this, together with improved irrigation infrastructure, increased rice yields significantly. According to Khammuan PAFO Irrigation department estimates, rice yields increased by 80–90 percent on average. The improved rice varieties require less water (because of a shorter production period), which also contributes to water use efficiency. There is also more vegetable production (5–7 percent increase). Irrigation efficiency increased because of less leakage in the brick-lined canals. However, with increased production, sometimes the pump capacity is insufficient to satisfy the demand for water.

3.31 Interviews and observations reveal that district authorities still provide close supervision and guidance to the WUAs. For example, when a pump part needs to be replaced, the District Agriculture and Forestry Office authorizes procurement of the spare part. Also, cleaning the canals is the responsibility of WUAs, and they reportedly handle this well. November and December are the production preparation months and are dedicated to cleaning; this is monitored by the District Agriculture and Forestry Offices. Thus, the WUAs are not left completely on their own; local authorities still monitor and supervise them.

3.32 **Flood management.** The project financed the rehabilitation of 15 floodgates that provide improved flood management for 17,097 hectares of land. Local villagers are responsible for opening and closing the gates. Interviews revealed that, although floodgates are useful in general, without pumps to move water out they provide limited protection in severe floods. Some gates have a fish passage (modified floodgate aprons), which the key informants deemed quite effective for fish to pass through. A study conducted by Department of Irrigation in 2019 found that these modified floodgates can provide fish passage if the gates and upstream water levels are managed to allow passage through the culverts and upstream past the gates, but only for a short and highly variable period at the onset of the wet season. The study concluded that fishways on the floodgates could provide fish passage throughout the wet season. Fishways are deemed more beneficial than fish-friendly regulators, since they do not require a human operator to manually open and close the gates, which is difficult (Department of Irrigation 2019). However, government counterparts also informed IEG that the floodgates financed by the project were more cost effective, which was why they were preferred under the project.

Incentives: Fisheries Management

3.33 The project supported the development of fisheries law and regulations, and supported establishment of 12 fisheries management committees, and provision of training to support sustainable fisheries. The project established fish conservation zones, where fishing is prohibited. Fishery management committees monitor these zones. The project also provided rice seed, peanuts, and small livestock to support livelihoods in the communities, as an incentive to protect the fisheries and not overfish. The project also rehabilitated three hatcheries and established one new hatchery to protect indigenous species and breed exotic species. The hatcheries sell fingerlings and release them to the river on fish release day each year.

3.34 IEG met with the Fisheries Department in the Ministry of Agriculture and Forestry and the Fisheries Division of PAFO in Attapeu province. IEG also visited one hatchery and met with Nong Due Fisheries Management Committee members in

Sanasoumboun District, Champassak province. The central and local authorities and fishery committee members assessed the project support as highly successful in terms of increasing fish population, preserving native fish species, and improving livelihoods and income. The Fisheries Department suggested integrating irrigation and fisheries interventions in selected areas to obtain even better results. IEG obtained fisheries monitoring reports from PAFO in Attapeu province, but results could not be attributed to project interventions, since specific project-area data were unavailable.

3.35 In summary, the project's relevance aligned with the MRC's decentralization policy and Lao PDR's development plans on capacity building on WRM at the central and local levels. However, during implementation, it faced challenges, including a lack of political will for transboundary plans and for the sustainable operation of hydrometeorological systems—and missed the opportunity to build a comprehensive institutional capacity-building program. The project successfully supported the development of transboundary action plans but faced implementation issues because of the lack of political will in LMB countries. The revised water law and RBMPs supported by the project in Lao PDR have not been acted on because of financial constraints. The project financed hydrometeorological stations and an early-warning center in Lao PDR yet struggled with data availability and quality because of budget limitations in maintaining these stations. Infrastructure improvements, particularly in irrigation and flood management, were notable, though WUAs required further support on O&M. The project also promoted sustainable fisheries through legal frameworks and management committees and incentives at the community level.

4. Lessons

4.1 This assessment offers the following lessons:

4.2 **Given the scale of geopolitical barriers among MRC member countries, conducting stakeholder analysis, holding consultations at the political level, and adopting dispute-resolution mechanisms to alleviate political differences among countries on transboundary issues could facilitate enhanced collaboration and coordination.** Although the project supported the development of key outputs—including procedures for data and information exchange, a transboundary environmental impact assessment, and various training and awareness workshops—implementation of the supported transboundary action plans for WRM was impeded by a lack of political will among MRC member countries, despite their technical-level endorsement. Pending agreement on issues among MRC member countries regarding data sharing and prior consultations for development projects on the Mekong River underscores the need for improved dispute-resolution and trust-building mechanisms.

Careful stakeholder mapping and analysis to anticipate potential disputes or political challenges and consultations at the political level to build consensus among key stakeholders could be quite important. Member countries can reinforce such mechanisms implemented by transboundary organizations (such as the MRC Secretariat) by acknowledging the collective benefits of collaboration and thereby counteracting political tendencies to appease specific interest groups such as those involved in hydropower development.

4.3 Projects aimed at building institutional capacity on IWRM benefit from a comprehensive prior assessment of institutional capacity at the central and local levels so that a well-rounded and long-term capacity-building program can be designed. The project benefited from a joint study undertaken by the MRC with the support of Australia and the World Bank on data management and modeling capacities of the MRC countries. The project provided support to the Ministry of Environment and Forestry on various fronts, including regulations, information and monitoring systems, and river basin management plans. While building capacity for WRM is a long-term process that requires more than one project cycle, the project support could have benefited from a comprehensive suite of interlinked interventions to consider all gaps and financial sustainability. These would alleviate some of the issues on data quality, access, and dissemination; implementation and monitoring of river basin management plans; and enforcement of regulations.

4.4 Long-term procurement arrangements that ensure adequate financial resources for the operation and maintenance of hydrometeorological infrastructure will enhance data accuracy for decision-making on WRM. Various solutions in project design to finance the operation and maintenance of hydrometeorological stations after project closure could be procurement arrangements to cover spare parts for longer durations as well as longer-term agreements with the telecom companies to cover internet connection fees. Such arrangements during project implementation would compensate, to a certain extent, for the lack of budgetary provisions for operations and maintenance after project closure.

4.5 The participation of local communities in irrigation, flood, and fisheries management can serve as a catalyst for their contribution to IWRM, and inclusion of such project components can encourage government counterparts to tackle complex reforms in the sector. The project's support of community-led initiatives on irrigation, flood, and fisheries management fostered beneficiary involvement, which not only generated income but also yielded sustainable and innovative approaches to fisheries management, enhanced flood control, and more efficient irrigation water management. These positive effects also prompted government counterparts to engage in more challenging institutional reforms related to IWRM.

Notes

¹ The World Bank has been engaged for several years in supporting the LMB countries in planning and institutional capacity creation for carrying out WRM-related activities in the MRB. In 2006, the World Bank, in cooperation with the Asian Development Bank, supported the preparation of a Mekong Water Resources Assistance Strategy for the LMB. In 2009, the World Bank, with Global Environment Facility financing, supported a Mekong Water Utilization Project, which provided technical assistance and financing for institutional capacity building, particularly in the MRC. The World Bank has also financed WRM projects in Viet Nam and Cambodia.

² The extensions of the closing date were to allow adequate time for completion of activities added under the additional financing in 2017 as well as delays during project implementation due to MONRE's internal restructuring by the Lao PDR government (along with the transfer of the Project Management Unit from the Department of Water Resources to Department of Planning and Cooperation in MONRE), as well as the impacts of the COVID-19 pandemic in 2020–21.

³ In total, 12 RBMP for large-scale basins have been prepared and approved. There are 62 river basins in Lao PDR, and 14 basins are large scale. PONRE prepared 4 RBMP plans for medium-size basins out of 19 medium-size basins. The District Offices of Natural Resources and Environment are responsible for small-scale basin plans and completed 1 plan out of 29 small-scale basin plans.

⁴ MONRE informed IEG that after project closing, only three RBMPs had been supported by donors for implementation: (i) Xe Bang Hieng River Basin and (ii) Nam Khan River Basin, supported by the United Nations Development Programme, and (iii) Xe Kong River Basin, supported by the Food and Agriculture Organization to develop a project concept note to access financial resources from the Green Climate Fund.

⁵ Lao PDR is part of the Global Telecommunication System under the World Meteorological Organization. DMH shares the hydrometeorological data with Thailand and Japan through this network.

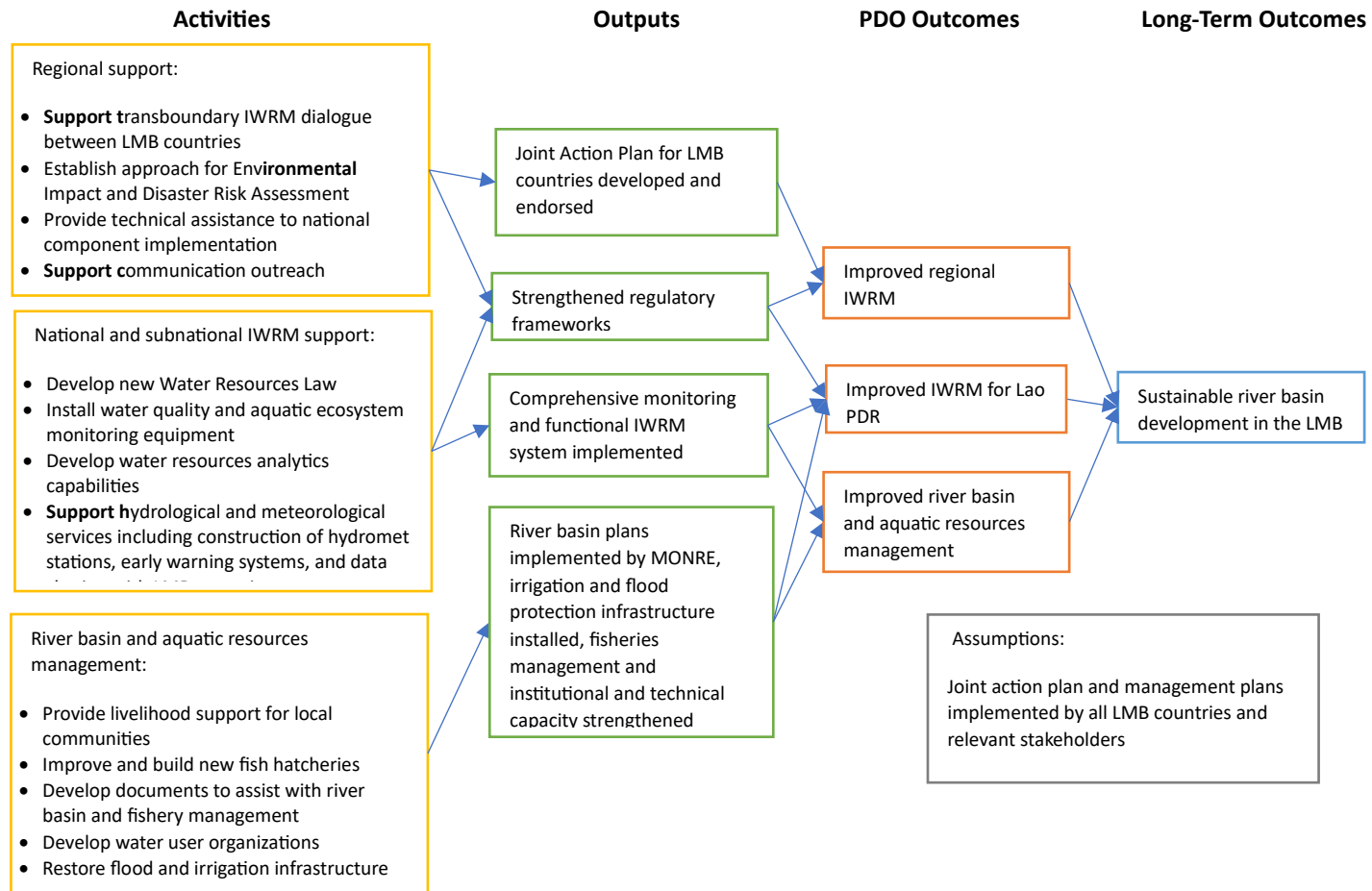
⁶ According to the WUA guidelines, the fee to be collected is 150 kilograms of rice per hectare of irrigated land. Total yield in dry season on average is 4.5 tons per hectare, and in rainy season 3 tons per hectare. Thus, the fee is about 3–5 percent of the revenue. However, many WUAs agreed to pay 80–100 kilograms of rice per hectare as fee, which is about 2 percent of the revenue.

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Appendix A. Theory of Change



Source: World Bank 2022a.

Note: IWRM = integrated water resources management; LMB = Lower Mekong Basin; MONRE = Ministry of Natural Resources and Environment; PDO = project development objective.

Appendix B. Methods and Evidence

This report is a Project Performance Assessment Report (PPAR). This instrument and its methodology are described at <https://ieg.worldbankgroup.org/methodology/PPAR>.

The PPAR employed a mix of methods to address the evaluation questions, comprising desk-based document reviews and semistructured interviews. The PPAR mission obtained the available reports and studies from the relevant ministries and the Mekong River Commission Secretariat. In addition, the PPAR consulted extensive relevant literature on water resources management (WRM).

- **Permission desk review of key documents and secondary data sets.** Desk review of documents by the World Bank, the client country government, other institutions, and relevant donors
- **Permission interviews.** Interviews with project task team leaders
- **Mission interviews.** Interviews with key stakeholders in Lao PDR
- **Site visits.** Visits to select sites to gain information from project beneficiaries and to observe the condition of the infrastructure supported by the project (hydrometeorological stations, irrigation, and floodgates)

Site Selection

The following criteria were applied in selecting sites to visit:

- There are WRM risks, particularly high flood risk.
- Irrigation or flood management investments affected a large population.
- There is an approved river basin management plan.
- Fisheries may have created economic benefits and livelihood improvement.

Based on these criteria, the team traveled to three provinces in the southern part of the country: Champassak, Attepaou, and Khammouane.

Evaluation Questions

Evaluation question 1: How effectively has the project supported the creation of or reforming institutions that sustainably coordinate WRM at the transboundary, national, and river basin–aquifer level?

- a. How clearly have the objectives, policies, and structures of WRM institutions been defined and developed (that is, revised Water Law, the National Water Resources Management Strategy)?
- e. Are river basin management plans made by WRM institutions participatory and inclusive?
- f. Are there adequate legal powers for WRM institutions to function effectively nationally and on transboundary issues, and at the provincial or district level?
- g. What is the evidence regarding the achievements and benefits of WRM institutions with respect to collaboration with other national and (where applicable) international institutions?
- h. What are the lessons learned by WRM institutions so far with respect to the planning, developing, and managing water resources?

Evaluation question 2: How successfully has the project created water and climate monitoring systems, decision support, and early-warning systems to make informed decisions on WRM?

- i. WRM packages (water modeling and water resource assessments) are they used in making decision? Were these incorporated into the river basin management plans? What are concrete examples on how these packages are being implemented?
- j. Is the water quality monitoring being carried out four times a year in seven priority areas as proposed? Are these results compliant with water quality monitoring standards? Are these results shared and applied for river basin management? What are successful examples that addressed water quality issues? Is the water quality in areas supported by the project improving or getting worse?
- k. Are hydrometeorological infrastructure and early-warning systems sustainably institutionally supported by the project and operational? Is there sufficient budget to sustain their operation and maintenance? Do they supply sufficient information for environment and disaster risk management early-warning systems?

Evaluation question 3: What is the evidence regarding the achievements and benefits of WRM institutions with respect to flood management, access to irrigation water, and to the efficient use of water for fisheries?

- l. What key benefits have the farming communities experienced from the irrigation and flood management infrastructure supported by the project?
- m. How has the formation of the water user associations benefited the water users? Have they noticed any improvements in water management or access to water resources?
- n. Has the project support on for community-based fisheries management been effective and sustainable?
- o. Are there changes (positively or negatively) in fish populations since the implementation of the project? What are the causes of these changes?

Appendix C. Additional Data

Transboundary Action Plans and Other Interventions on Integrated Water Resources Management

Cambodia and Viet Nam—integrated water resources management (IWRM) in Sesan and Srepok. The Cambodia National Mekong Committee and the Viet Nam National Mekong Committee endorsed the Joint Transboundary Action Plan for the Sesan-Srepok River Basins and Mekong Delta in May 2019. The Implementation Completion and Results Report noted that the transboundary activities under the Plan have not yet been implemented because of a lack of funds (World Bank 2022). The Independent Evaluation Group mission for this Project Performance Assessment Report in February 2024 found that the transboundary actions were not yet implemented.

Lao PDR and Cambodia—fisheries management. The Mekong-Sekong Transboundary Fisheries Management Plan between Cambodia and the Lao People’s Democratic Republic was developed to improve fisheries management in the bordering provinces of Stung Teng and Kratie in Cambodia and Champasak and Attapeu in Lao PDR. The Implementation Completion and Results Report noted that both parties endorsed the Transboundary Fisheries Management Plan in December 2019, with a five-year projected cost of \$1,520,500 between both parties. However, the funding source for this commitment has not been identified (World Bank 2022). The Independent Evaluation Group mission in February 2024 found that the transboundary actions were not yet implemented.

Viet Nam and Cambodia—IWRM in Mekong Delta. A joint issues paper was developed in the Mekong Delta subbasin, focusing on the provincial and basin levels. Both parties identified a framework for Joint Transboundary Cooperation through several joint workshops and the development of the Joint Cooperation Mechanism Paper for both Sesan-Srepok and IWRM in the Mekong Delta. The cooperation mechanisms are captured within the Joint Transboundary Action Plan but are yet to be implemented.

The Mekong River Commission produced and disseminated several communication products on water resources management, including guidelines on transboundary environmental impact assessment, procedures for data, information exchange, water use monitoring, maintenance of flows, and water quality.

The project contributed to the preparation of the IWRM based Basin Development Strategy, which later translated into the Mekong River Commission Strategic Plan and the respective national indicative plan.

Key Required Elements of a Water Resources Law

A robust water resources law should encompass several key elements to ensure effective management and sustainable use of water resources. These elements include the following:

- **Clear allocation and management of water rights.** Prioritizing different uses of water, such as domestic, agricultural, industrial, and environmental needs; a defined process for obtaining and transferring water rights; and mechanisms for monitoring and enforcing compliance with these rights (Jacoby 2017).
- **Protection of water quality and quantity.** Setting water quality standards, establishing pollution control measures, and implementing mechanisms for monitoring and enforcing compliance with these standards; addressing measures for sustainable groundwater management, including recharge and extraction regulations (Rodella et al. 2023).
- **Consideration of climate change and environmental sustainability.** Providing for adaptive water management strategies, promoting water conservation, and addressing the impacts of climate change on water availability and quality (Rodella et al. 2023).
- **Stakeholder participation and equity.** Ensuring the participation of relevant stakeholders, including local communities, Indigenous groups, and water user associations, in decision-making processes related to water management. It should also address equity in water allocation and access, particularly for marginalized and vulnerable populations (Rodella et al. 2023).
- **IWRM.** Promoting the principles of IWRM, which involves coordinated development and management of water, land, and related resources. This may include basin-level planning, coordination among different sectors, and mechanisms for resolving conflicts over water use (Baumann et al. 2006).
- **Legal and institutional framework.** Establishing a clear legal and institutional framework for water resources management, including the roles and responsibilities of relevant government agencies, regulatory bodies, and water user associations; addressing mechanisms for resolving disputes and conflicts related to water use (Baumann et al. 2006).

Elements of a Robust River Basin Management Plan

Drawn from the literature, the following elements are identified as key for robust river basin management plans.

- **Data and analysis that are used to identify the condition and health of the basin’s resources.** Quality and comprehensiveness of the data collected, such as water quantity, water quality, environmental indicators, and social and economic data (World Bank 2006a).
- **Level of stakeholder participation in the planning process and management.** A comprehensive river basin management plan should include genuine participatory processes for the basin community to provide input and make contributions. It should also incorporate bottom-up planning to address the water-related problems and needs of local communities (World Bank 2006a).
- **Policy development.** Integrate economic, environmental, and social considerations (World Bank 2006a).
- **Sustainability assessment and performance monitoring.** Includes a system to assess whether the river basin is being managed sustainably. This may involve the introduction of a detailed, ongoing monitoring and auditing process to assess if the basin-wide institutional arrangements are achieving the goals and objectives set by governments (World Bank 2006b).
- **Organizational planning for the river basin.** Includes human resource capability assessment, training programs, and coordination and consultation levels. The plan should address any identified skill deficiencies and ensure access to expertise in all aspects of integrated natural resource planning and management (World Bank 2006c).

Table C.1. Water Balance Assessment in Xe Bang Fai River Basin

Components of Water Balance	Water Quantity (million cubic meters per year)		Percentage
	Before Construction of Nam Theun 2 Dam (2000–09)	After Construction of Nam Theun 2 Dam (2010–19)	
	Inflow of water to the river basin		
Rainfall	20,947	20,077	74.32
Discharge from Nam Theun 2 dam	—	6,938	25.57
Total water inflow	20,947	27,015	100
Outflow of water from the river basin			
Irrigation water use			
Water attracted into irrigation	320	368	1.36
Irrigation water flowing back to river	86	91	0.34
Net irrigation water use	234	277	1.03
Domestic consumption and industrial water use	6	6	0.02

Components of Water Balance	Water Quantity (million cubic meters per year)		Percentage
	Before Construction of Nam Theun 2 Dam (2000–09)	After Construction of Nam Theun 2 Dam (2010–19)	
	Water loss due to infiltration and evaporation	6,487	
Total water outflow	6,727	6,627	24.50
Quantity of outflow from Xe Bang Fai River Basin	14,221	20,389	75.47

Source: Xe Bang Fai River Basin Management Plan 2022.

Table C.2. Comparison of Average Monthly Flow (Xe Bang Fai River Mouth Point) in 2020 and Forecasted Flow in 2040 for Xe Bang Fai River Basin

Month	Flow in 2020 (m ³ /s)	Forecasted Flow in 2040		Notes
		Based on Sector Water Use Plan (m ³ /s)	Difference (m ³ /s)	
January	176	153	-23	The average monthly flow in January, February, March, April, June, October, November and December at Xe Bang Fai River mouth in 2040, compared with 2020, will decrease by 23, 20, 12, 6, 13, 22, 42 and 29 m ³ /s, respectively; whereas in May, August, September, the water quantity will increase by 4, 5, 4 m ³ /s, respectively. The average annual flow will decrease by 12 m ³ /s in 2040 compared with 2020. This means that the quantity of water exceeds demand, after deducting the demand of all types of water use in the river basin.
February	138	118	-20	
March	138	126	-12	
April	158	152	-6	
May	315	319	4	
June	814	801	-13	
July	1,342	1,342	0	
August	1,952	1,957	5	
September	1,565	1,569	4	
October	679	657	-22	
November	322	280	-42	
December	244	215	-29	
Average	653	641	-12	

Source: Xe Bang Fai River Basin Management Plan 2022 (extracted from Council Study 2018, Mekong River Commission Secretariat).

Note: m³/s = cubic meters per second.

Table C.3. Household Water Use in Xe Bang Fai River Basin in 2020

Data and Results from Modeling	Number or Quantity
Estimated population in Xe Bang Fai River Basin in 2020	363,268
Demand for household water use (average)	94 liters/person/day
Total household water use	12.46 million cubic meters per year

Source: Xe Bang Fai River Basin Management Plan 2022.

Table C.4. Hydropower Dam Construction in Xe Bang Fai River Basin up to 2040

Dam Name	Status	Maximum Managed Flood Level (m)	Maximum Managed Flood Level (m)	Dam Reservoir Area (km ²)	Maximum Volume of Water Supply (million m ³)	Installed Capacity (MW)	Annual Energy Supply
Kaengkeo Dam	Power development agreement (2019)	145	—	—	—	100**	
Xe-Neua Dam	MOU (2006)	370	330	16.4	624	53	230
Xe-Noy Dam	MOU (2011)	—	—	—	—	15	59.13
Kaeng-yaluan Dam	MOU (2015)	—	—	—	—	15	59.13
Saynamhai Dam	MOU (2016)	—	—	—	—	15	59.13
Xe Bang Fai Dam	MOU (2017)	—	—	—	—	15	65.7
Phapatae Dam	MOU (2017)	—	—	—	—	15	59.13
Kaeng Hat-huaxon Dam	MOU (2017)	—	—	—	—	15	65.7

Source: Xe Bang Fai River Basin Management Plan 2022.

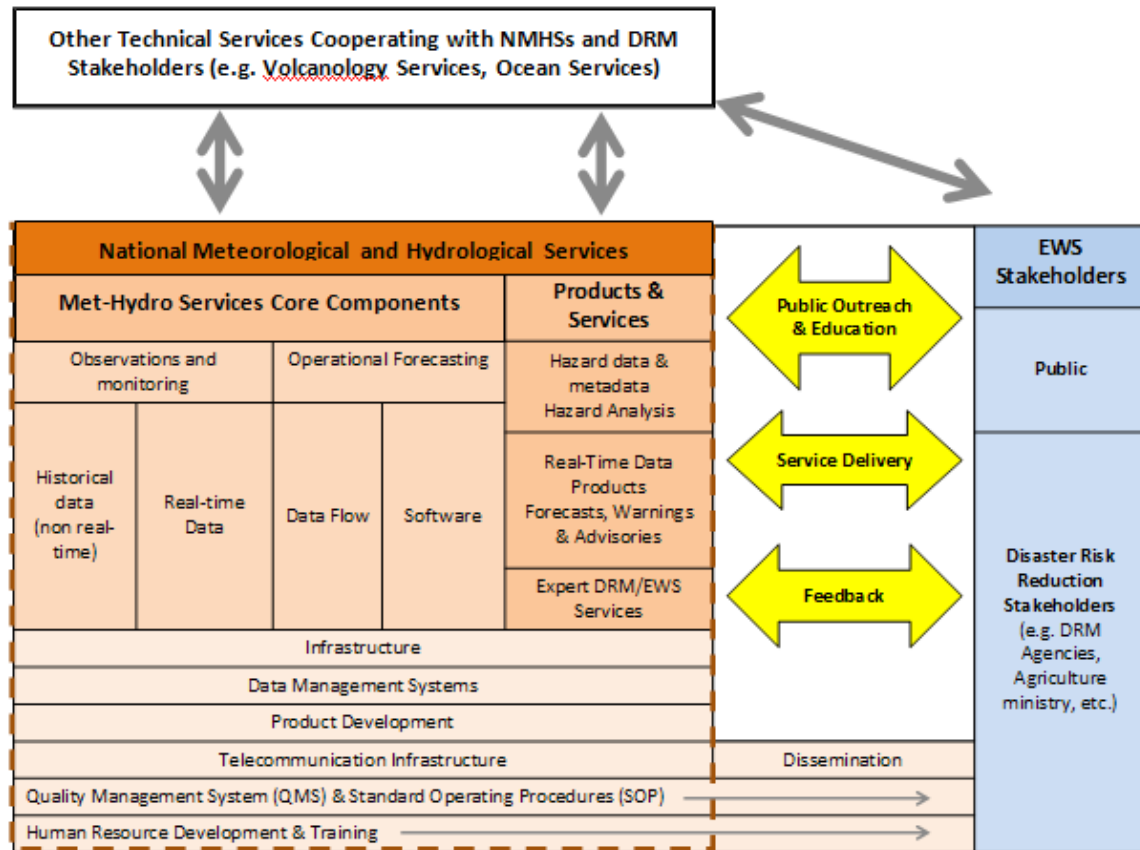
Note: km² = square kilometer; m = meter; m³ = cubic meter; MOU = memorandum of understanding; MW = megawatt.

Table C.5. Budget Plan for Implementation of Each Program Under Xe Bang Fai River Basin Management Plan

Program, Target, and Activity	Estimated Budget (kip)	Funding Source
Program 1: Develop the Mechanism of Management and Participation in the River Basin Management	810,000,000	Public and private sector projects, official development assistance, and others
Program 2: Manage the Use of Water and Water Resources	910,000,000	Public and private sector projects, official development assistance, and others
Program 3: Manage the Water and Water Resources Data and Information	830,000,000	Public and private sector projects, official development assistance, and others
Program 4: Protect and Rehabilitate the Water and Water Resources	710,000,000	Public and private sector projects, official development assistance, and others
Program 5: Mitigate the Impacts from Flood, Drought and Climate Change	930,000,000	Public and private sector projects, official development assistance, and others
Program 6: Management of Land, Forest and Environment	810,000,000	Public and private sector projects, official development assistance, and others
Total	5,000,000,000	

Source: Xe Bang Fai River Basin Management Plan 2022.

Figure C.1. Schematic of Links Among Hydrological and Meteorological Services



Source: World Bank 2012.

Note: DRM = disaster risk management; EWS = early-warning system; NMHS = National Meteorological and Hydrological Service.

Appendix D. Institutions Visited

- Australian Department of Foreign Affairs and Trade, Lao PDR
- Department of Irrigation, Ministry of Agriculture and Fisheries
- Department of Livestock and Fisheries, Ministry of Agriculture and Fisheries
- Department of Meteorology and Hydrology, Ministry of Environment and Forestry
- Department of Planning and Cooperation, Ministry of Environment and Forestry
- Department of Water Resources Management, Ministry of Environment and Forestry
- Lao PDR National Mekong Committee, Ministry of Environment and Forestry
- Mekong River Commission Secretariat
- Natural Resources and Environment Research Institute, Ministry of Environment and Forestry
- United Nations Development Program, Lao PDR
- World Bank, Mekong IWRM Project Task Team
- World Bank, South Asia Disaster Risk Management Project Task Team
- World Bank, Cambodia IWRM Project Task Team

Sites Visited

- PAFO, Fisheries Division, Attapeu province
- Hatchery, Sanamxay District, Attapeu province
- Nong Due Fishery Management Committee—Sanasoumboun District, Champasack province
- DONRE, Sanamxay Hydromet Station, Attapeu province
- PAFO, Division of Irrigation, Khammouan province
- PONRE, Division of Water Resources Department, Khammouan province
- Nawang Water User Associations—Nongbok District, Khammouan province

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