



INCEPTION REPORT

October 2023

**PREPARATION STUDY TO SUPPORT THE DESIGN
OF A COMPREHENSIVE JOINT PROJECT IN THE
SEKONG, SESAN AND SREPOK (3S) SUB-BASIN
OF THE MEKONG RIVER**

Prepared for: GIZ and MRC

Prepared by: ICEM



This document was prepared by the Mekong River Commission (MRC) with the support of German Development Cooperation, implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and the ICEM – International Centre for Environmental Management, for the project: *Preparation of a Joint Project in the Sekong, Sesan and Srepok (3S) Sub-Basin of the Mekong River*

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Suggested citation MRC. 2023. Inception Report. *Preparatory study to support the design of a comprehensive Joint Project in the Sekong, Sesan and Srepok (3S) Sub-Basin of the Mekong River*. Mekong River Commission. Vientiane, Lao PDR.

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ABBREVIATIONS

3S	Sekong, Sesan and Srepok river basin in Cambodia, Lao PDR and Viet Nam
9C-9T	Mongkol Borey and Tonle Sap River basins in Cambodia and Thailand
CNMC	Cambodia National Mekong Committee
COVID-19	Coronavirus disease 2019
DCCDM	District Committees for Disaster Management
DDPM	Department of Disaster Prevention and Mitigation
DOM	Department of Meteorology
DRR	Disaster Risk Reduction
DWR	Department of Water Resources
EWS	Early Warning System
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
IW	International Waters
IWRM	Integrated Water Resources Management
LMB	Lower Mekong Basin
LNMC	Lao PDR National Mekong Committee
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOE	Ministry of Environment
MOWRAM	Ministry of Water Resources and Meteorology
MRC	Mekong River Commission
NGO	Non-Governmental Organisation
NMCs	National Mekong Committees
NWFPC	National Water Resources and Flood Policy Committee
NWG	National Working Group
ONWR	Office of National Water Resources
PMU	Project Management Unit
UNEP	United Nations Environment Programme
VNMC	Viet Nam National Mekong Committee
WPs	Work Packages

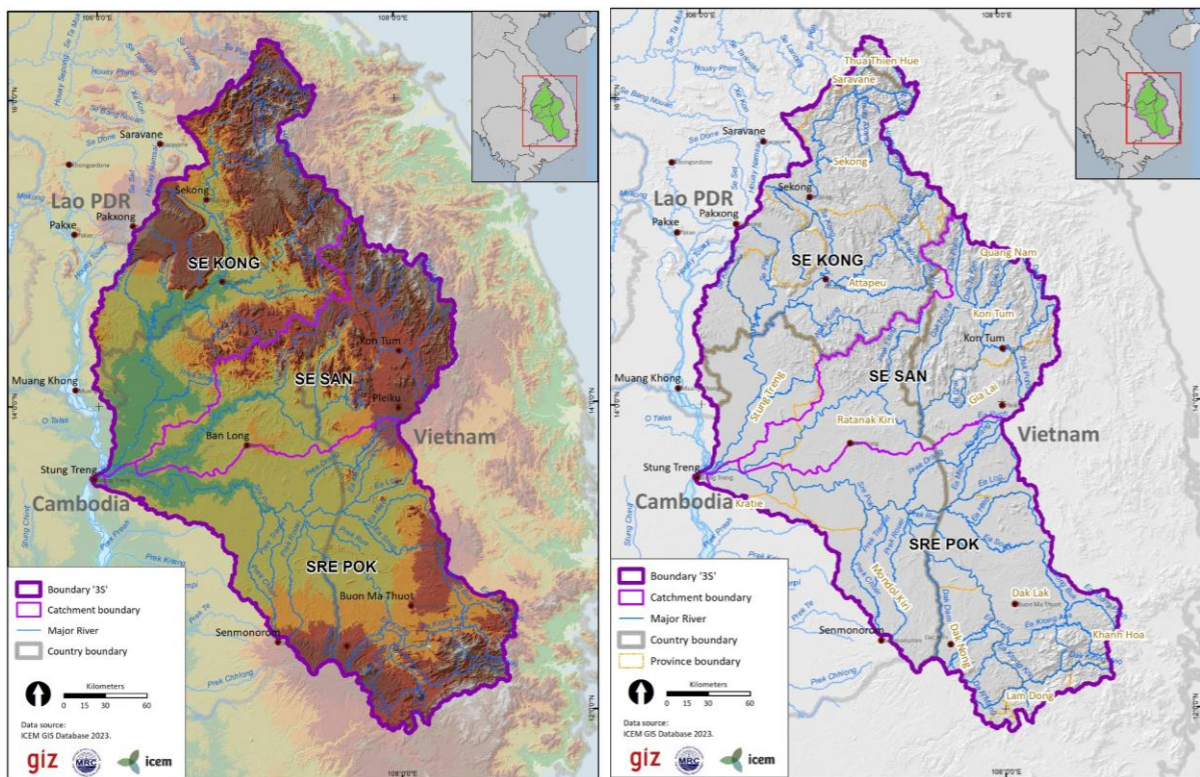
1 INTRODUCTION

1.1 Overview and characteristics of the 3S sub-basin

The Mekong River is one of the world’s great rivers. It flows through six countries: China, Myanmar, Thailand, Lao PDR, Cambodia and Viet Nam and covers a distance of about 5,000 km from source to sea – from the Tibetan Plateau in China to the Mekong Delta. The entire basin, including the Lower Mekong River Basin (LMB), is one of the most biodiverse regions on the planet, with 850 fish species and over 20,000 plant species. Of the 65 million people living in the LMB, some 80% depend on the river and its rich natural resources for their livelihoods.

The Sekong, Sesan and Srepok, rivers, referred to as the 3S river basin, are shared by three countries and constitute a significant part of the LMB. The basin – where all three rivers are transboundary – is one of the most important in the Mekong region for flood and drought resilience, sediment dynamics, fisheries, irrigation and aquaculture, natural resource-based livelihoods and biodiversity.

Figure 1: 3S Sub-Basin Map of Topography (L), and River Network (R)



The 3S river system comprises approximately 78,650 km² in Cambodia (33% of total sub-basin area), Lao PDR (29%), and Viet Nam (38%). Combined, it provides over 20% of mean annual flow of the Mekong and almost 15% of its suspended sediment (Brunner et al., 2019). The source of the three rivers rests in the Central Highlands of Viet Nam. The Sekong flows through Lao PDR before joining with the Sesan and Srepok. The Sesan and Srepok rivers flow through Viet Nam to Cambodia. The three rivers join before forming the confluence with the mainstream of the Mekong River at Stung Treng, in Cambodia.

The sediment in the 3S provides nutrients vital to fisheries in the Tonle Sap and rice production in the Mekong Delta. The 3S is the Mekong’s most important river basin for migratory fish and sustains productive downstream fisheries. However, over half of the LMB fish catch is from long-range migrant species that are particularly susceptible to dams, dikes, and other barriers. Many of the fish in the 3S are migratory (65, 54 and 82 species in the Sekong, Sesan and Srepok respectively (Ziv et al, 2012)), travelling long distances to reach spawning and nursery grounds (SWECO-Groner, 2006).

Agriculture and fisheries are the main sources of income for communities living in the 3S, with high value cash crops grown alongside subsistence rice paddies. The most poverty-stricken areas comprise indigenous ethnic groups, located on marginal lands in the high mountainous regions. The livelihoods of these ethnic groups are highly dependent on a mixture of traditional low productivity irrigated and rainfed agriculture, fisheries and forest products (ibid). In the 3S, it is the poorest ethnic minority groups and women who disproportionately pay the price for the negative effects of national economic development.

1.1.1 Sekong

The Sekong originates in central Viet Nam (comprising 3% of the basin) and flows into southeast Laos – where 78% of its watershed is located – and then into northeast Cambodia (with 19% of the basin). The Sekong River basin is fundamental in overall maintenance of the Mekong hydrological system, for nature-based livelihoods, for biodiversity and given the current and imminent threats, increasing flood and drought and land degradation.

The Sekong is the least developed of the 3S in terms of population, agriculture, and hydropower. It is home to over 3.5 million people highly dependent on the natural resources and ecosystem services. It has the largest proportion of ethnic minorities from at least 20 different ethnic groups, all relying on the surrounding forests, the fish and fertile lands for gathering and cultivating food. The river is renowned for a profound diversity of fish species, with over 300-350 species, many endemic and 64 migratory.

The basin has many globally important areas for biodiversity, including a large freshwater wetland, Beung Kiat Ngong Ramsar Site, found on the western border of the Sekong Basin, southeast of Pakse, Lao PDR. The wetland is an important natural system, with connected streams, forested areas and grasses, which create an extensive ecological network during the wet season. The area provides for flash flood retention and sediment trapping, and is an important carbon store, being the only peatland location in Lao PDR. It is also a spawning ground for indigenous fish and is home to several endangered species, including the fishing cat (*Prionailurus viverrinus*).

In addition, the Xe Sap National protected area extending across the Central Annamite Mountains in the north of Lao PDR is a moist forest ecoregion, which hosts some of the world's highest concentrations of endemic species. In Cambodia, the North-East Corridor and Siem Pang protected areas, comprise an important network for wetland protection, biodiversity connectivity and flood and drought resilience.

1.1.2 Sesan

The Sesan River originates in the Central Highlands before flowing into northeast Cambodia, fed by two major tributaries that join above the Plei Krong Dam, near the town of Kon Tum in Viet Nam. The Dak Bla River flows to the west and is joined by the Krong Poko, which flows south. The topography of the Sesan represents a transition between the steep and rugged upper Sekong, and the relatively flatter Srepok.

Protected areas in the Sesan include Virachey National Park – the largest protected area within the 3S – Chu Mom Ray National Park, Bac Plei Ku Nature Reserve, and small overlaps with Kon Ka Kinh National Park and Ngoc Linh (Kon Tum) Nature Reserve. Virachey within Cambodia is adjacent to Mom Ray Nature Reserve in Viet Nam and Dong Ampham protected area, in Lao PDR. Together these three form a contiguous protected area across all three countries. The portion of the Sesan River riparian corridor within Cambodia is also classified as an IBA.

The 720 MW Yali Falls dam commissioned in 1996, was the first large hydropower dam in the 3S, and is the second largest dam in Viet Nam. Viet Nam, particularly in the Sesan, has the greatest overall installed capacity of the 3S countries. The 400 MW Lower Sesan 2 (LS2) was completed in late 2017. Located just below the confluence of the Sesan and Srepok in Cambodia, the LS2 blocks fish migration up the entire length of these two rivers and is estimated to reduce total fish biomass in the Lower

Mekong by almost 10% (Ziv et al., 2012). Monitoring of fish catch in the Sesan indicates that at least 41 migratory fish species are commonly caught by fishermen and these migratory fish represent 60% of the fishermen’s total catch (Baran et al., 2014).

1.1.3 Srepok

The Srepok originates in the Central Highlands of Viet Nam before flowing into northeast Cambodia. The Srepok River is fed by several tributaries that travel from the highlands above Buon Ma Thuot in Viet Nam. These come together to form the Ea Krong River, joining with the Dak Dam River to form the Srepok. The Srepok eventually converges with the Sesan and Sekong Rivers before discharging into the Mekong River.

Much of the lower Srepok is relatively flat, with valleys that are extensively cultivated, particularly in Viet Nam. Forest cover in the Srepok is proportionally lower than the Sekong and Sesan. The Srepok has the greatest number of protected areas within the 3S. In Cambodia these include Mondulkiri and Nsok protected forests, as well as Lomphat, Phnom Prich and Phnom Namlear wildlife sanctuaries. In Viet Nam there are seven nature reserves in the upper basin, as well as a cultural/historic site at Yok Don and Ho Lak National Park (Constable, 2015).

1.2 3S Study context and background

1.2.1 MRC Joint Projects

In 2015/2016, the Mekong River Commission (MRC) and its Member Countries identified five joint projects (Table 1) under the MRC Basin Development Strategy (BDS) for the Lower Mekong Basin (LMB) (2016-2020), to help countries further promote the sustainable development of the Mekong Basin. Four of the projects are being rolled out under the current MRC BDS (2021-2030) and the MRC Strategic Plan (2021-2025) – a cooperative plan to address national, cross-border and regional needs. Supported by MRC, these joint projects involve two or more countries with the aim of tackling transboundary issues and supporting governments in achieving the Sustainable Development Goals (SDGs). The joint projects complement actions and targets at the national level and will further improve national water resources development plans to (i) ensure long-term water and environmental security, and (ii) achieve optimal and sustainable development, as envisioned in the 1995 Mekong Agreement.¹

As part of the "Transboundary Water Cooperation in the Lower Mekong Basin II" (TWC II) project, GIZ has been supporting the implementation of the MRC Joint Projects since 2018 which proactively promote regional integration and transboundary cooperation between the MRC member states.

Table 1: MRC Joint Transboundary Projects

No.	Joint Project	Description	KH	LA	TH	VN
1	Lao-Thai safety regulations for navigation	The project will establish and support the implementation of joint rules on anti-pollution, inspection of vessels, port safety, and emergency response, which will improve waterway, navigation and environmental activities		x	x	
2	Cross-border water resources development and management, including environmental	The Project aims to inform mitigation and adaptive management measures at the Don Sahong hydropower plant, develop a longer-term vision for the Khone Falls and	x	x		

¹ Joint Projects are is one cooperation within MRC’s overarching strategy to address water resource challenges within the lower Mekong Basin. Other major activities of relevance include the work on flood and drought forecasting and warning by the recently-renamed Regional Flood and Drought Management Center (RFDMC) and MRC’s work to upgrade its Data and Information Systems including integration of the database and data management, modelling tools, monitoring and communication of forecasts

No.	Joint Project	Description	KH	LA	TH	VN
	impact monitoring of the Don Sahong hydropower project	Cambodia's upper Mekong areas, and prepare and implement projects and activities that generate benefits in both countries				
3	Transboundary cooperation for flood and drought management in the Thai-Cambodian border area (9C-9T sub-basin)	The Project aims to increase the capacity for transboundary integrated water resources planning and the forecasting of floods and droughts and associated information services. It also aims to provide water security, including measures mitigating floods and droughts, to support economic and social development in the project areas	x		x	
4	Sustainable water resources development and management in the Sekong, Sesan and Srepok river basins (3S Basin)	The Project aims to enhance coordinated national investments and possibly joint investments in further improvement of hydro-meteorological systems, flood and drought forecasting and associated services, transboundary operational water management, and water resources development infrastructure	x	x		x
5	Integrated flood management in the border area of Cambodia and Viet Nam in the Mekong Delta for water security and sustainable development	The Project aims to prepare and implement investments and supporting measures in the border areas of Viet Nam and Cambodia for flood diversion and agricultural improvement, and develop an integrated flood management strategy for the Mekong Delta	x			x

Joint Projects should identify synergies with previous and ongoing studies and plans of project partners and use MRC's experience in the field of Integrated Water Resource Management (IWRM) and climate change adaptation.

With five years (2018-2023) of technical support from GIZ to the MRC Joint Project on Transboundary Flood and Drought Management between Cambodia and Thailand in the 9C-9T sub-basin, GIZ with funding from the German Federal Ministry for Economic Cooperation and Development (BMZ) is now working with MRC to replicate the collaborative experiences to the 3S river system through a joint project for transboundary cooperation for sustainable water resource management in the Sekong, Sesan and Srepok (3S) river basins of the Mekong.²

The project outlined in this report specifically comprises a preparatory study to support the design of a comprehensive Joint Project in the Sekong, Sesan and Srepok (3S) Sub-Basin of the Mekong River. The preparation of measures for implementation of the 3S Joint Project is in line with the National Indicative Plans (NIPs) of the three MRC Member Countries of Cambodia, Lao PDR and Viet Nam, which set a goal of establishing a Joint Project in the 3S region. The 3S Joint Project will build up on the good experience of the 9C-9T Joint Project. It will also build on the existing mechanisms and plans developed in the 3S in frame of the Mekong-Integrated Water Resources Management Project (M-IWRMP), including:

- Transboundary Fisheries Management on the Mekong and Sekong Rivers in Cambodia and Lao PDR – Transboundary Fisheries Management Plan (MRC, 2019); and
- Joint Transboundary Action Plan in the Sesan and Srepok River Basin and the Mekong Delta of Cambodia and Viet Nam (MRC, 2019).

² In 2002, the MRC delineated sub-areas for the LMB to help with development planning and reporting. Numbers increase from upstream to downstream, while the letter denotes the country in which the sub-area falls. The 3S Basins are covered by sub-areas 7C (Cambodia), 7L (Lao PDR), and 7V (Viet Nam)

More widely, this upscaling transfers to a larger, strategically important sub-basin of the Mekong in the 3S, including other MRC member states, emphasising the regional importance of the Joint Projects and demonstrating the possibility to extend to the entire Mekong Basin. The 3S Joint Project identifies synergies with previous and ongoing studies and projects of the project partners in the 3S region and uses MRC's experience in the field of IWRM.

1.2.2 The need for transboundary collaboration in the 3S

The transboundary 3S sub-basin – where all three rivers are transboundary across Cambodia, Lao PDR and Viet Nam – is one of the most important basins in the Mekong region for flood and drought resilience, sediment dynamics, fisheries, irrigation and aquaculture, natural resource-based livelihoods and biodiversity. The sub-basin is the focus of existing and planned major projects with potential to reduce water quality and security, reduce fisheries and livelihoods, and is facing increasing severity and duration of drought and flooding. The rivers are expected to play a significant role in the economic growth of the wider region. The 3S river basin is remote and located far from provincial and national capitals making coordination among the three countries difficult.

All parts of the sub-basin, and hence the three countries, are bound together in their shared management challenges and solutions. Mitigating ecosystem degradation, a loss of livelihoods, floods and droughts is the overarching objective because of their far-reaching impacts on every aspect of life in the sub-basin, with the threat to become more severe as climate changes take hold. These factors create an urgency for collaborative restoration action and strategic opportunity to intervene, share knowledge between the four project countries and implement appropriate nature-based interventions through a river basin and ecosystem approach.

1.3 3S Study objectives

The core objective of this preparatory study is to support the design of a comprehensive Joint Project in the Sekong, Sesan and Srepok (3S) sub-basin of the Mekong River, comprising Cambodia, Lao PDR and Viet Nam. This includes the preparation of measures for the implementation of a Joint Project for transboundary cooperation on sustainable water resource management in the 3S sub-basin. It is important to note that the study is introductory – it will provide the information base, decision support tools, needed capacities and an initial framework of actions, which would be picked up for future phases to set out the design of a comprehensive and longer-term Joint Project.

To meet this objective, a review of the setting, trends and policy and institutional arrangements in the 3S sub-basin will be undertaken. This will inform future priorities and opportunities for building transboundary sustainable water resource management and climate resilience.

The Joint Project will be facilitated through cross-border and cross-sectoral engagement, collaboration and validation, supported by GIZ and the Mekong River Commission Secretariat (MRCS), in coordination with the National Mekong Committees (NMCs) and relevant sectoral agencies in each country.

Specifically, this assignment aims to:

1. Identify and analyse relevant data and information on the 3S sub-basins, and present findings via a Basin Diagnostic Analysis and georeferenced data catalogue and explorer tool (3S Basin Atlas);
2. Establish transboundary steering mechanisms (RSC and NWGs) and facilitate national and regional meetings;
3. Design a capacity building programme and provide training to relevant national stakeholders; and
4. Define joint priorities for the 3S sub-basins and identify possible measures for future project design.

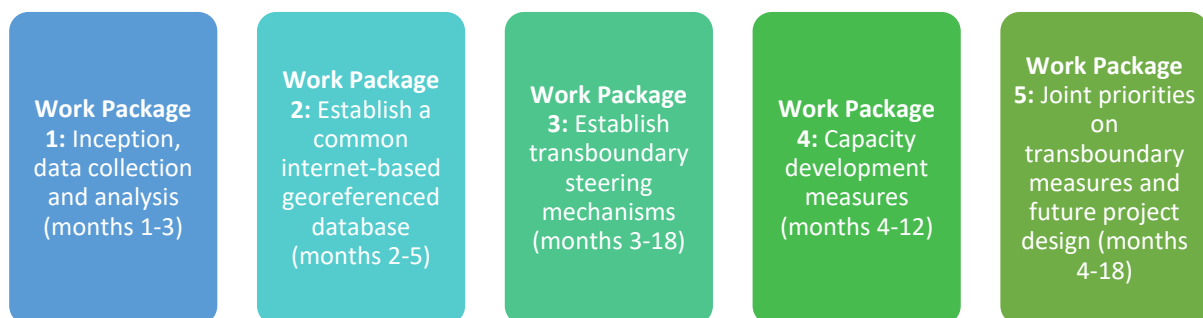
The project will be completed over a period of 17-months and involving a core team of experts. The project will target critical ecosystem and natural resource hotspots and existing assets at risk, including their catchments and downstream areas of influence.

The regional importance of upscaling sustainable water resource management to all countries and sub-basins in the LMB is essential. Therefore, synergies will be integrated with previous and ongoing studies and projects in the 3S sub-basin and in the Mekong region more widely, including transboundary mechanisms such as those developed in the 9C-9T, which provides a model for application in this project.

1.4 Overview of the 3S Joint Project work packages and key outputs

The schedule of the Joint Project will be divided into five work package (WP) phases, as presented in Figure 2. The phasing of the work packages is presented in Section 10.1.

Figure 2: 3S Joint Project Work Packages



WP1– the basis of this report – focuses on scoping, data collection and analysis, with the core output being a Basin Diagnostic Analysis (BDA), reviewing the characteristics, trends and setting of the 3S sub-basin and its countries. WP2 will build on the data collected in WP1 to establish a project database and a web based, interactive and dynamic decision support tool for stakeholders in the 3S sub-basin, termed the 3S Basin Atlas. WP3 concerned with collaborative arrangements, will be implemented throughout the project development process, with the establishment of NWGs in Cambodia, Lao PDR and Viet Nam and a joint RSC, and facilitation of NWG and RSC meetings. Building on WP3, WP4 will provide capacity building events in each country for key NWG and RSC participants. WP5 will define joint priorities for the 3S sub-basin for future transboundary cooperation and identify proposed measures for future project design.

1.4.1 Spatial focus and approach

The Joint Project will focus on the Sekong, Sesan and Srepok basins in Cambodia, Lao PDR and Viet Nam. The NWGs will determine specific geographic areas and issues of concern in their discussions and transboundary collaboration within the 3S. For example, whether NWGs should operate by basin or by country, and whether collaborative management should proceed for individual basins, for the 2S and Sekong, or for the entire 3S.

A review of the characteristics, trends and setting will be undertaken for the 3S sub-basin as a whole. Priority areas will be identified based on a watershed assessment via the application of a landscape hotspot framework, like that applied for the 9C-9T sub-basin. This analytical approach will be described in the BDA (see Section 0).

The spatial focus and interface of the 3S Basin Atlas will be determined as data is progressively collected and analysed. It is proposed that the Atlas will present information for the entire 3S, with information, layers and user access also divided by basin for the Sekong, Sesan and Srepok.

1.5 Joint Project principles

1.5.1 Ensuring participation and project ownership

The project team will work to ensure all activities produce beneficial outcomes in terms of mainstreaming, capacity building, knowledge product development and dissemination and the promotion of learning and innovation. The consultative and communications processes embraced by MRC and the project team will ensure national stakeholders shape and have a strong sense of ownership over the Joint Project process and outputs.

The project will emphasise and practice open communication and participatory approaches. Consultation with national and local level stakeholders will take place through: (i) National Working Groups (NWGs) of technical officers representing relevant sectors and agencies; (ii) an overarching Regional Steering Committee (RSC); (iii) capacity building and training events and; (iv) intensive outreach during field missions with technical staff, decision-makers and local communities, to ensure that findings are rooted within and reflecting views of affected local communities.

Stakeholder participation is a vital part of river basin management planning and management. Consultation and communication must recognise the role of multi-stakeholder groups, including river basin committees, line agencies, other national agencies, local governments, planners, the private sector, water user groups, NGOs and local communities in the management of water resources. These stakeholders will be involved as far as possible throughout the study process.

1.5.2 Transboundary sustainable water resource management

Integrated water resources management (IWRM) provides an approach for the protection and use of water that accounts for the entire hydrologic cycle, including the relationship of surface water to groundwater, and the ecology of the water environment.³ The IWRM approach integrates:

- Water quality and water quantity concerns;
- Surface water planning with ground water planning;
- All water uses including ecosystem uses;
- Various distinct measures into the range of solutions considered; and
- Stakeholders into the planning process including national agencies, local governments, private industry, non-profit groups, water user groups and the general public.

River basin master planning and management facilitates IWRM according to the communities, local environmental context and development goals within a specific river basin. Ultimately, this process should enable protection and sustainable use of all waters of the target basin. Planning and management based on IWRM principles includes considering the needs of agricultural practices, transportation, industry, urbanization, flood control and other activities that interact with water resources and the aquatic and terrestrial environment.

1.5.3 Climate change adaptation for water management

Climate change affects water management in a range of ways – for example, changes in seasonal and annual precipitation affects water availability or patterns of floods and droughts. Blending IWRM and climate change adaptation can assist communities to adapt to changing climatic conditions that affect water availability or flood and drought, and in turn ecosystems, human health, livelihoods, economic growth and international relations.

To advance climate-resilient IWRM there is a need for (i) improved water and climate data-sharing mechanisms, (ii) context and decision-relevant data for water management and climate adaptation, and (iii) cross-sectoral collaboration in long-term programme planning and budgeting. Climate change

³ Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment.

adaptation mechanisms associated with IWRM may include investing in built and natural water infrastructure (such as wetland restoration), developing water regulation frameworks, establishing web-based decision support systems and designing early warning systems for flood and drought.⁴

1.5.4 Taking an ecosystem and landscape-based approach

The introduction of IWRM and climate change adaptation interventions needs to go beyond site level, to take a landscape or watershed perspective so that upstream/downstream processes and influences are considered. Where the scale of the needed innovations extends beyond jurisdictional boundaries, suitable mechanisms must be in place to enable joint decision-making by stakeholders.

Any water resource management drivers, impacts and interventions upstream have knock-on effects downstream. For example, the effects of upstream dams, floods and drought are particularly severe in the downstream areas. Those conditions are exacerbated by curtailed land and water connectivity, forest loss and degrading land uses in upstream areas. Their effective management has a critical role in avoiding and moderating the extent and severity of impacts across the 3S sub-basin.

Interventions need to be applied taking an ecosystem approach, with the aim of rehabilitating and conserving ecosystem structure and function, so that ecosystem services and biodiversity are enhanced, along with additional co-benefits (Figure 3). The concept of water-based ecosystem services is well suited to supporting IWRM. Water-based ecosystem services includes water provisioning (for human and non-human use), water purification, disease control, erosion prevention, flood protection, fisheries, aquatic habitat provision, recreation, and other cultural services (Nagabhatla and Metcalfe 2018; Grizzetti et al., 2019; Vollmer et al., 2022). These services are often integrated within landscapes, whereby a well-functioning ecosystem can provide multiple water (and other) ecosystem services (Vollmer et al., 2022).

Figure 3: Watershed scale interactions and benefits of an ecosystem approach. Source: Infrastructure Pathways⁵



Such nature-based interventions need to be applied as networks at a basin, watershed or landscape scale, because it is the cumulative impact of many connected measures across a landscape that makes the difference. Individual measures need to be designed to suit the needs of a site but in appreciation of their overall contribution to the broader spatial scale. Nature-based actions are best applied in an integrated manner with hard solutions as part of a hybrid approach, although they can be effective alone as in the case of forest restoration in degraded headwaters.

⁴ https://wedocs.unep.org/bitstream/handle/20.500.11822/41138/water_management_climate_change.pdf

⁵ <https://infrastructure-pathways.org/use-case/nbs/>

2 PROJECT GOVERNANCE AND KEY STAKEHOLDERS

2.1 3S Governance structure and Arrangements

The Mekong River Commission (MRC) is an inter-governmental organisation that works directly with the governments of Cambodia, Laos, Thailand, and Viet Nam to jointly manage the shared water resources and the sustainable development of the Mekong River. National Mekong Committees (NMCs) in each member state coordinate MRC programmes at the national level and provide links between the MRC Secretariat and the national ministries and line agencies. The three countries, led by the NMCs, will support implementation of the Joint Project and the project management unit (PMU) in the coordination, preparation and implementation of project work packages and activities at the national and transboundary level and facilitating transboundary collaboration and decisions.

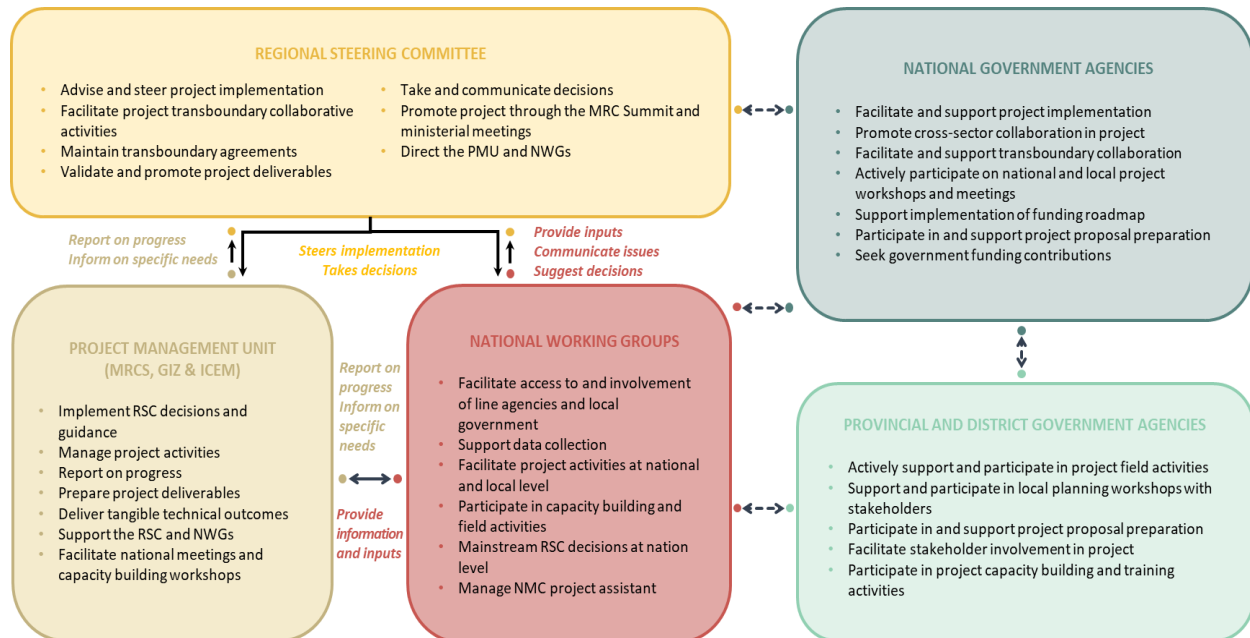
The proposed implementation arrangements for the 3S Joint Project are illustrated in Figure 4. A transboundary Regional Steering Committee (RSC) and three National Working Groups (NWGs) (one in each country) are proposed to guide and support the project implementation by the PMU, led by MRCS and comprising MRCS and GIZ technical staff. Implementation arrangements are set up at the national level and link to the regional level:

- The **PMU and technical team's** focus is to manage and deliver on project work packages and outputs. *Key roles will be to:* undertake technical assessments; seek input and report to the NMCs, RSC and NWGs; organise and facilitate meetings; and define the work program. The PMU members will comprise MRCS and GIZ with technical support from the service provider, ICEM.
- The **NMCs** focus is to provide coordination and facilitate engagement with national line agencies under the Joint Project. *Key roles will be to:* agree on the NWG scope and roles; ensure active involvement of line agencies in the Joint Project; engage line agencies and distribute relevant technical documentation for review and comment; facilitate meeting arrangements; chair meetings; represent national perspectives and communicate decisions to all members⁶.
- The **RSC's** focus is to monitor, guide and validate Joint Project outputs. *Key roles will be to:* advise and steer the study; ensure transboundary engagement and consensus at each step; validate deliverables; endorse work plans and commitments; take and communicate decisions; and facilitate uptake and replication of study methods and results. The RSC members will comprise senior officials (at least at the Deputy Director General level) who can understand and oversee the technical, institutional and international dimensions of the joint project (RSC ToR in Annex 2).
- The **NWG's** focus is on data gathering, providing technical advice and input, and supporting capacity building. *Key roles will be to:* support data collection via respective agencies; provide access to relevant stakeholders, especially at local levels; provide technical recommendations; and support mainstreaming tools and outputs at national level. The NWG members will comprise senior officials and general experts from a broad range of line agencies who can understand and oversee the technical and institutional dimensions of the Joint Project (NWG ToR in Annex 2).
- The **3S national consultants** focus is on data gathering and providing technical review on behalf of the national NMCs and line agencies. *Key roles will be to:* support data collection; contribute to meetings and presentations; undertake technical reviews; provide technical recommendations to the PMU; and coordinate inputs from the national level. The consultants will work under the strategic guidance the MRCS Planning Division and will work in close collaboration and coordination with the NMCs's (national consultant ToR in Annex 2).

⁶ It should be noted that the individual arrangements of the NWGs and more specifically their interactions and alignment with existing NMC-led, working groups, meetings and practices, will be decided on by the countries NMCs's.

Through the Joint Project, MRC-GIZ and ICEM will provide technical and operational support to the RSC and NWGs. The PMU and NMCs will identify relevant national implementing and cooperating agencies to prepare the Joint Project. Senior NWG members in each country will also be members of the RSC, to facilitate coordination and joint decision making. There will be scope for modification of the implementation arrangements during the implementation of the Joint Project. Proposed changes by the NMCs or the MRCS will be discussed and agreed on by the NMCs.

Figure 4: Project Governance Structure and Interactions



2.2 Joint Project interactions

The Joint Project will be facilitated through cross-border and cross-sectoral engagement, collaboration, and validation, supported by the MRCS and GIZ, working through the NMCs and relevant sectoral line agencies in each country.

Based on MRC-GIZ guidance and using proposed cooperation and communications mechanisms, a regular dialogue process between Joint Project actors will be established to ensure that results are well embedded in local institutions and development planning processes. Effective cooperation and coordination between relevant government agencies on an intersectoral basis is required to ensure harmonised planning and management across the three basins of the 3S system to maximise the Joint project benefits. That principle applies in working relationships within each country as well as between them. Joint Project actors will need to operate at the line agency, national, and transboundary levels:

- **At the line agency level**, the implementation of the required project work packages and activities will be coordinated by the NWG representatives of the implementing and cooperating agencies and organizations (where the representatives act as focal points). The NWGs include membership from national and provincial agencies. The results (inputs, perspectives, information, recommendations) regarding the Joint Project themes, issues and proposed measures will be brought up by the representatives to national meetings of the NWGs. The success of the Joint Project will depend on the effective and consistent involvement of a broad range of line agencies and provincial governments in the NWG and in actively supporting agreed Joint Project activities.
- **At the national level**, the members of the NWGs, supported by their national consultants, will review and discuss the inputs, perspectives, information and recommendations of the various national agencies and organizations that are represented in the working group, and prepare for discussion of the consolidated national inputs, perspectives, information and recommendations at the transboundary level with representatives of the other riparian countries involved.

- **At the transboundary level** (regional or bilateral) the consolidated national inputs, perspectives, information and recommendations regarding the project themes, issues and proposed measures will be discussed at the RSC by senior representatives of Cambodia, Lao PDR and Viet Nam. The achieved consensus on the themes, issues and proposed measures will be brought back to the national level for action by the implementing and cooperating agencies and organizations of the Joint Project, with members of the NWGs acting as line agency focal points.

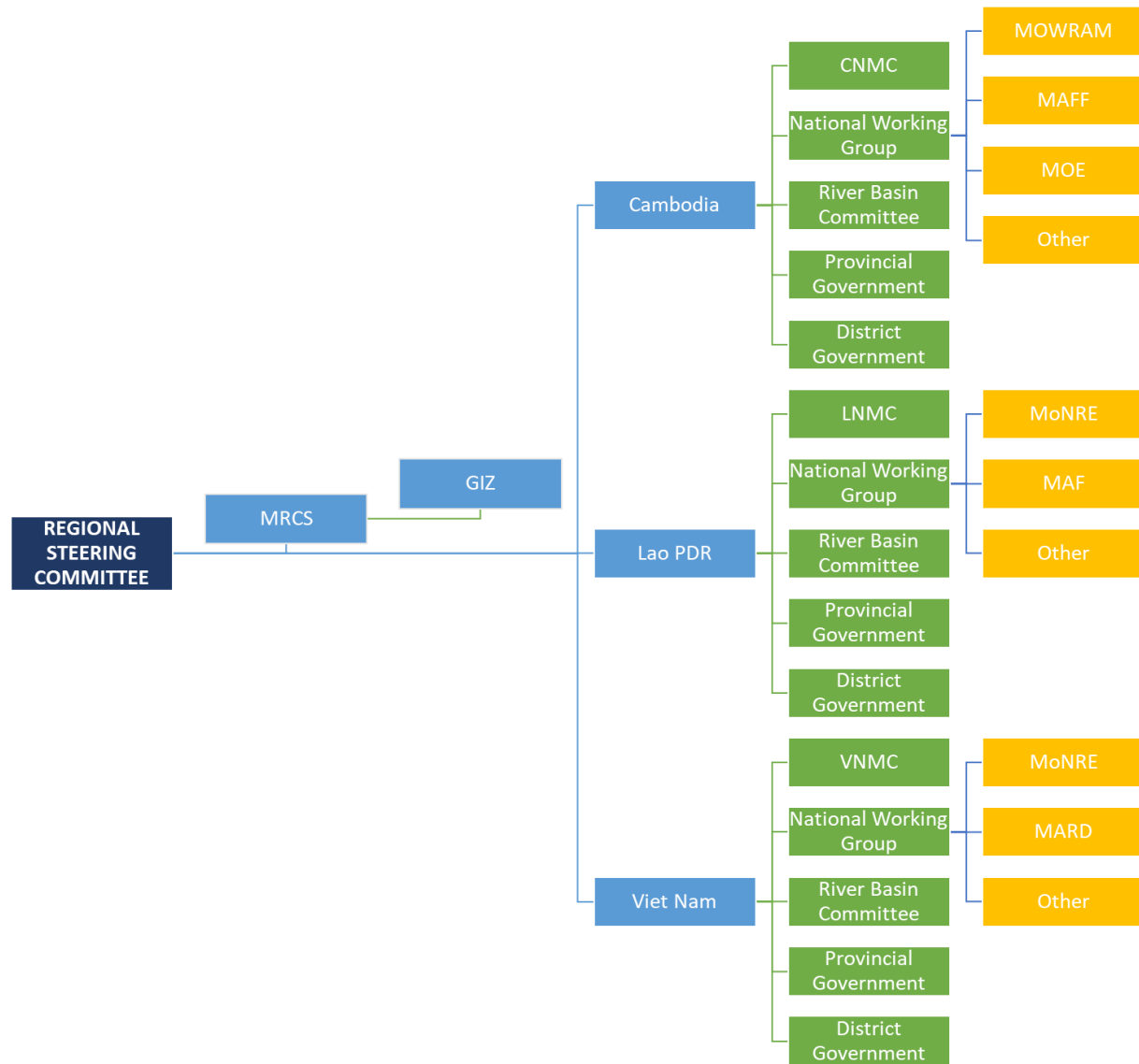
2.3 3S key stakeholders

Based on MRC-GIZ guidance and using proposed cooperation and communications mechanisms, a regular dialogue process between Joint Project actors will be established to ensure that results are well embedded in local institutions and development planning processes. The following core actors will be involved to varying degrees during the Joint Project (

Figure 5):

- **MRCS:** Planning Division, Environmental Management Division and Technical Support Division;
- **GIZ:** technical cooperation and contractual management team;
- **Regional Steering Committee (RSC):** comprised of MRCS, and Cambodia, Lao PDR and Viet Nam NMCs and line agencies and jointly chaired by MOWRAM (Cambodia), MoNRE (Lao PDR) and MoNRE (Viet Nam);
- **National Working Groups (NWG):** comprised of line agency officials (national and provincial level), and NGO members from Cambodia, Lao PDR and Viet Nam and Chaired by MOWRAM (Cambodia), MoNRE (Lao PDR) and MoNRE (Viet Nam);
- **National Mekong Committees:** CNMC (MOWRAM), LNMC (MoNRE) and VNMC (MoNRE);
- **National and provincial line agencies:** relevant national and provincial lines agencies in each country, engaged through the NWGs, training and field engagement;
- **Regional collaborators:** technical organisations such as IUCN, with experience in the 3S, which will support ICEM with data collection, information transfer, stakeholder consultations and interactions with local communities;
- **Local communities:** the communities living in the sub-basins that impact and are impacted by the management of catchments;
- **Local universities and research institutes:** relevant national universities and research institutions working on projects and/or possessing relevant data on the 3S sub-basin; and
- **ICEM team:** the expert project team and backstopping experts based in the 3S countries.

Figure 5: Key 3S Actors



An initial stakeholder mapping exercise has been undertaken to identify relevant line agencies and other stakeholders in each country to form the NWGs and RSC. These stakeholders comprise key representatives for a range of topics relevant for the 3S Joint Project, including water resources management, flood and drought management (including early warning and data sharing systems), climate change, fisheries, agriculture, environmental management, spatial planning, protected area management, ecosystem services and livelihoods, and tourism.

Through the RSC, NWGs and NMCs and project activities, it is anticipated the following national and provincial agencies will play a key role in implementing the work packages (Table 2). Relevant sub-national stakeholders and target groups within identified landscapes in each 3S country will be explored as the project progresses and target landscape are identified.

Table 2: 3S national and provincial stakeholders

Country	Agency/organisation
Cambodia	Ministry of Water Resources and Meteorology (MOWRAM) <ul style="list-style-type: none"> • Department of Meteorology • Department of Hydrology and River Works Ministry of Environment <ul style="list-style-type: none"> • General Department of Administration for Nature Conservation and Protection • Tonle Sap Authority Ministry of Planning Ministry of Rural Development Ministry of Agriculture, Forestry and Fisheries Department of Agriculture <ul style="list-style-type: none"> • Department of Forests Ministry of Tourism Provincial Departments from Kratie, Mondul Kiri, Ratanak Kiri and Stung Treng provinces 3S Rivers Protection Network (3SPN)
Lao PDR	Ministry of Natural Resources and Environment (MoNRE) Ministry of Agriculture and Forestry Ministry of Foreign Affairs Ministry of Public Work and Transport Ministry of Planning and Investment Provincial Departments from Salavan, Sekong, Champasak and Attapeu provinces
Viet Nam	Ministry of Natural Resources and Environment (MoNRE) Ministry of Agriculture and Rural Development Ministry of Construction Ministry of Planning and Investment Provincial Departments from Dak Lak, Gia Lai, Khanh Hoa, Thua Thien Hue, Quang Nam, Dak Nong, Lam Dong and Kon Tum provinces

3 JOINT PROJECT APPROACH AND METHODOLOGY

The Joint Project methodology aims to assess the current state of water resources and climate change in the 3S, and opportunities for ecosystem scale interventions for transboundary cooperation on sustainable water resource management and climate change adaptation. This will focus on the identification of at-risk watersheds, infrastructure and livelihoods in need of improved resilience and hotspots for ecosystem degradation, flood and drought. As part of the characterisation and prioritisation process under the 3S sub-basin assessment, there are four parallel processes that will be followed (also presented in Figure 10):

1. A **basin-wide analysis** to provide all the spatial information and layers for the characterisation and trends of the three basins, leading to basin profiles. This also includes the identification and delineation of the 3S sub-basin and catchment boundaries, trend analysis, gender and vulnerability analysis hydrological modelling and climate change analysis (all high-level);
2. A **3S wide analysis** to identify terrestrial and freshwater **corridor opportunities** to enhance the connectivity between and within aquatic and terrestrial ecosystems;
3. A **catchment assessment** based multicriteria analysis leading to the definition of sets of maps with identification of (i) hot spots of degradation and human pressure, (ii) remaining ecosystem assets requiring protection and (iii) strategic infrastructure assets at risk from development scenarios, ecosystem degradation, climate change and extreme events; and
4. A **landscape assessment** using secondary data, satellite images, key environmental and socio-economic parameters and consultations to identify five degraded landscapes in each of the three basins which are high priority for restoration and maintenance.⁷

A summary of each of those processes is presented in the following sections. The cross-cutting issues of IWRM, climate change adaptation, ecosystems services, poverty, livelihoods and gender are integrated throughout all four processes.

The approach will support the achievement of the outcomes of WP1, WP2 and WP5 via a BDA, presented in the 3S Basin Atlas and informing the joint priorities and proposed transboundary measures for the comprehensive Joint Project.

3.1 Basin wide analysis

3.1.1 3S sub-basin boundary identification and delineation

To support the basin wide analysis, the project team conducted a 3S catchment boundary identification and delineation process. The purpose of this process was to ensure that the 3S catchments selected for the analysis (i) align with the national basin plans; (ii) represent similar catchment sizes (i.e. to avoid significant differences in sizes) (iii) consider upstream (low slope, high population density) and downstream (high slope, low population density) catchment characteristics.

As a first step, 79 catchments were identified, based on existing datasets from MOWRAM Cambodia 3S4P DSS (for Cambodia and Laos) and Viet Nam national river basin planning documents (Sesan river basin plan and Srepok river basin plan):

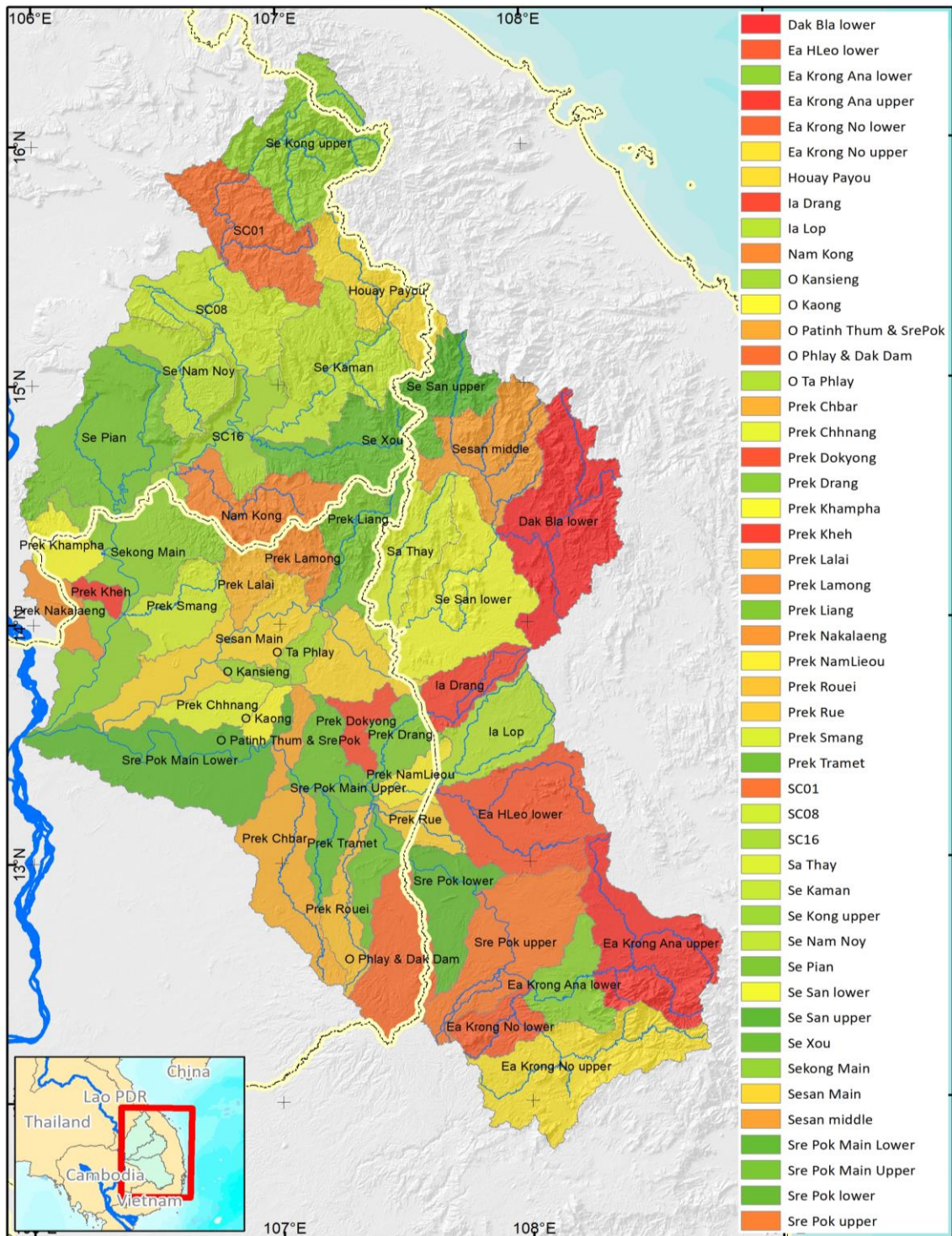
- 32 catchments in the Sekong with a total area of 28,453 km² and average size of 889 km² (median = 643);
- 21 catchments in the Sesan with a total area of 18,465 km² and average of 879 km² (median = 774); and
- 26 catchments in Srepok with a total area of 30,666 km² and average size of 1,179 km² (median = 644).

⁷ The combined catchment and landscape assessment process is presented in Figure 10.

Under a parallel process, catchments were aggregated from 2,354 SWAT delineated catchments to adjust the boundary for areas crossing/between different countries. The number of catchments were also reduced to between 230-350 km², by merging a number of smaller catchments, and redefining certain catchment boundaries to align with defined assets or control points (e.g. reservoirs and hydromet stations). Catchments of less than 100 km² were merged with adjacent catchments, along with 11 catchments under 200 km².

Ultimately, these two parallel processes were combined/overlain and resulted in the identification and mapping of 48 catchments (Figure 6), which provide the foundation units for data gathering and analysis in this study.

Figure 6: The 48 3S catchments proposed for the study



3.1.2 3S Sub-Basin situation and trend analysis

Data will be collected and analysed on areas such as hydrology, natural resources, biodiversity, land use, flood and drought, climate change projections and socio-economic status and trends as part of the BDA. Existing (and as feasible, planned) infrastructure, water bodies, protected areas (and other areas of value for biodiversity and ecosystem services), will be mapped.

Secondary information will also be collected on spatial, sectoral and provincial plans, as well as existing and planned development projects (including on hard, hybrid and nature-based interventions), relevant to the 3S Joint Project. Information and datasets to assemble baseline status and trends assessment of the focus areas to be targeted will include:

- **Climate, climate hazards, and climate change:** meteorological data, climate change projections for temperature and precipitation, climate-related hazards;
- **Land use and land cover:** agricultural areas, forest lands, forest production areas;
- **Natural systems:** ecozones, protected areas, biodiversity areas and wetlands; and
- **Existing and planned Infrastructure:** irrigation systems, dams, constructed reservoirs for agriculture and water supply; and
- **Other critical green infrastructure assets:** existing flood, landslide and coastal protection, existing nature-based solutions.

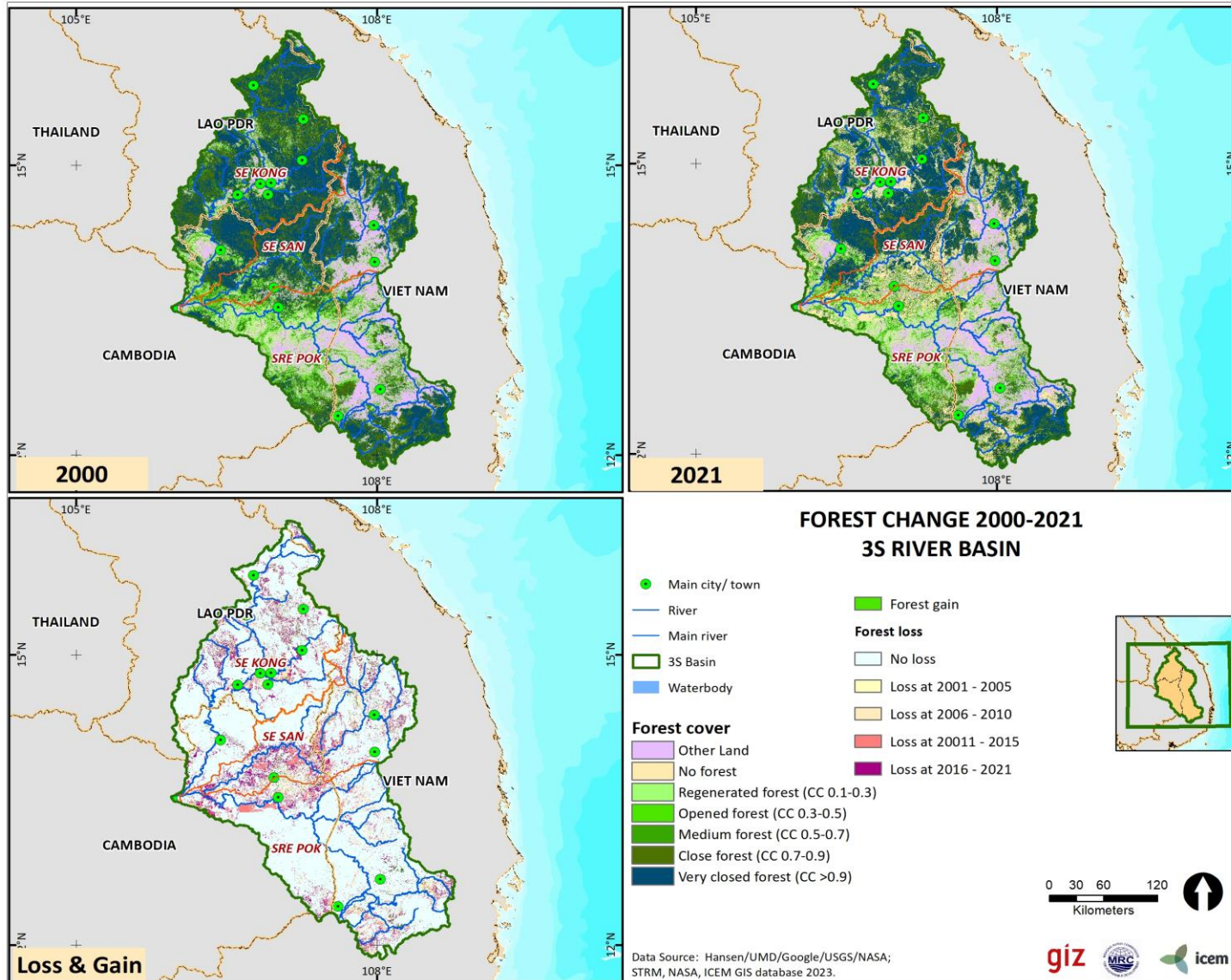
Remote sensing technology, which provides comprehensive, continuous, synoptic and multi-temporal earth observation satellite coverage of large areas, will be applied for a number of important baseline assessments. This analysis will compare passed temporal periods (e.g. over 30+ years) to identify key trends and characteristics for different parameters and identify catchments and landscapes that have undergone gradual or rapid change. Key parameters for the trend analysis will include:

Forest dynamics across space and time – a spatial and temporal analysis of forest change (forest health and disturbance) in the 3S sub-basin will be conducted using advanced remote sensing methods (example presented in

- Figure 7);
- **Land use land cover (LULC) change** – Landsat data and Land Use Land Cover (LULC) maps will be developed for 10-year intervals from 1990-2020 (1990, 2000, 2010 and 2020), along with the most recent LULC map of 2022; and
- **Flood and drought trends analysis** – a remote sensing-based approach for mapping flood and drought hotspots and trends in the 3S sub-basin.

For the socio-economic status and trends assessment, desk-based spatial mapping and analysis will be complemented by secondary data collection. The 3S Basin Atlas will present the datasets and related maps and analysis as part of study outputs.

Figure 7: Forest cover change in the 3S sub-basin from 2000-2021



3.1.3 Hydrological modelling and catchment characteristics

Stakeholders in the 3S sub-basin require improved access to up-to-date information to improve short-term flood response and long-term water management for the Sekong, Sesan and Srepok river basins. Establishing hydrological modelling outputs for these areas is a fundamental component to support real-time monitoring, flood forecasting and reservoir operations.

For this preparation phase of the 3S Joint Project, hydrological modelling for the basins will be identified and acquired from existing secondary sources – no project-based hydrological modelling will be undertaken for this phase. Hydrological models for the 3S have already been established by Cambodia and Viet Nam, and are integrated under the 3S4P (Sekong, Sesan and Srepok) and VNMC 2S (Sesan-Srepok) DSS's (see Section 5.1 for further details).

Hydrological modeling data acquired from CNMC will include:

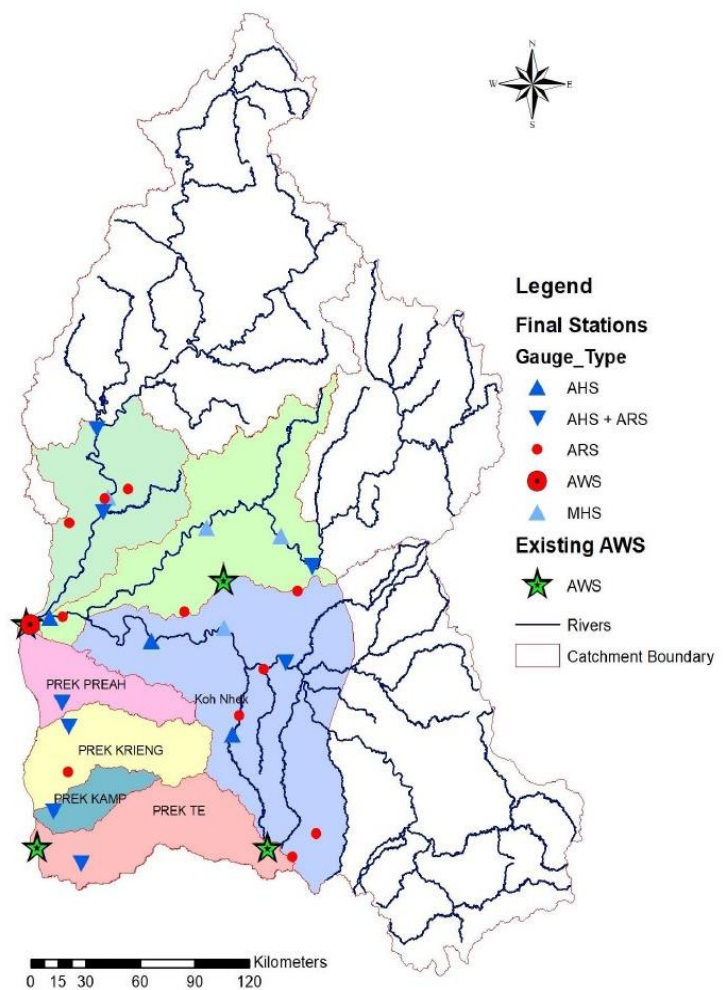
- The eWater Source model set up for 3S sub-basin;
- Modeling results for baseline and future scenarios (climate change, infrastructure and development planning).

Hydrological modeling data acquired from VNMC will include river basin planning outputs for the Sesan and Srepok river basin:

- SWAT and MHB (MIKE Hydro Basin) model set up for the Sesan and Srepok river basins: 74 sub-catchment delineation and tributaries, 6 meteorological stations, location of monitoring stations (reservoirs, discharge and sources);
- SWAT and MHB modeling results for baseline and future scenarios (climate change, land use-land cover change, water quality, infrastructure, and others);
- Flood modeling: NAM and MHR (MIKE Hydro River) model setup and modeling results for baseline and future scenarios.

The acquired hydrological modeling data will ultimately be incorporated into the 3S Basin Atlas to provide public access to data from the different models and scenarios.

Figure 8: Gauging stations and automatic weather stations for the 3S (and 4P). Source: CNMC 3S4P DSS

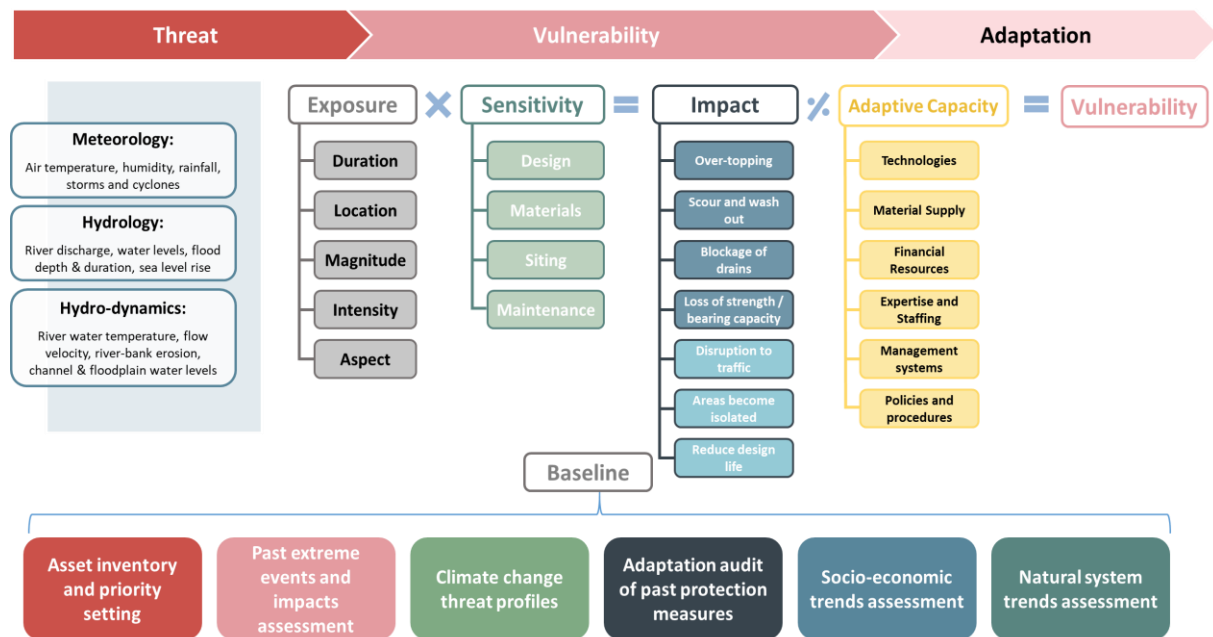


Note: AHS = Automatic Hydrological Stations, ARS = Automated Rainfall Stations (ARS), AWS = Automatic Weather Stations, MHS = Manual Hydrological Stations

3.1.4 Climate change vulnerability and adaptation framework

The methodology for the climate change analysis will be broadly based on tools and processes from ICEM’s Climate Change and Adaptation Methodology (CAM), which will be tailored to the objectives of this project (Figure 9). The straightforward, step-by-step approach used in CAM is flexible enough to allow it to be applied in a highly stakeholder inclusive manner. Stakeholders of widely varying backgrounds may be involved, from government officials, technical specialists to academics and local community groups, regardless of their level of technical proficiency in risk or vulnerability assessments.

Figure 9: ICEM Climate Change and Adaptation Methodology (CAM) and Associated Phases



This methodology will be adapted to the project scope during the inception phase, and sets out a process to analyse the results of multi-criteria vulnerability assessments, collaboratively developing appropriate adaptation options, and set priorities based on cost-benefit and cost-effectiveness analyses. The key steps comprise:

- i. **Step 1 – scope:** Determine the scope, by identifying the focal areas of the assessment and the systems (natural, social, economic, institutional and built) of interest;
- ii. **Step 2 – baseline:** Conduct a baseline assessment and hazard and exposure mapping to describe the past and existing situation, trends and drivers across each of the identified systems, as well as projecting likely future changes in these systems;
- iii. **Step 3 – vulnerability:** Conduct an impact and vulnerability assessment, combining *exposure* levels of communities, areas and key assets, as well as their relative *sensitivity* to the threats and their *capacity* to cope with or adapt to the threats; and
- iv. **Step – response:** Defining adaptation and resilience building responses. This step includes developing and comparing a range of climate change adaptation interventions and integrated planning options, and then determining priorities (see Section 3.3).

The hazard analysis and mapping will identify and map key hazards, including climatic hazards, erosion, landslides, forest fires, floods and droughts. The project team will identify and evaluate existing hazard data and will develop comparable maps for the focus areas that incorporate the impacts of climate change and recent disaster events in the coastal zone.

Data collection and analysis will also include relevant data and trends on climate change. Climate projection data for precipitation and temperature for difference RCP scenarios (RCP 4.5 and 8.5) will be analysed, comparing baseline data (1960-1990) with projections to 2050. This will be mapped for both wet and dry seasons. Key climate data requests are presented in Table 3.

Table 3: Climate data requests

Category	Data types	Description
Hydrology and climate	Climate Change data for 3S	Monthly Temperature and Precipitation for baseline and future projections, 3 GCMs: GFDL-CM3, GISS-E2-R-CC, IPSL-CM5A-MR, Scenario: RCP2.6, RCP4.5, RCP6.0, RCP8.5
	Hydro-meteorological station data for 3S	Daily Temperature; Precipitation, Water Level and Flow for last 20 years
	Dams and Reservoirs (Irrigation and Hydropower)	Name, Location, Dam height and elevation, reservoir capacity, installed capacity (for HP) and/or service area (for irrigation)
Flood and Drought	Weekly drought monitoring data for 3S	Weekly Standardized Precipitation Index (SPI1), Soil Moisture Deficit Index (SMDI) , Combined Drought Index (CDI)

The project team will use and apply a mixture of Coupled Model Intercomparison Project Phase 5 (CMIP5) – generated and applied by the MRC – and CMIP6 datasets – developed by ICEM as part of this project.

3 GCMs were selected by the MRC in 2014 under CMIP5, which are the most suitable for the Mekong region. These are GFDL-CM3 (wetter overall), GISS-E2-R-CC (drier overall) and IPSL-CM5A-MR (wetter wet seasons and drier dry seasons). The 3S Joint Project will adopt MRC geospatial climate datasets for the 3S sub-basin, which will be presented on the 3S Basin Atlas, including: 3 GCMs; 2 climate Variables (Tmax, Prec); 4 scenarios (RCP 2.6, 4.5, 6.0, 8.5); Average 12 months changes for 2050s. The raster data resolution is 30 arc-second (~1km).

There is no detailed study for the Mekong region under CMIP6. ICEM will adopt an ensemble approach for future climate projections in the 3S sub-basins, following these steps:

- Determine the 10th and 90th percentile thresholds for changes in precipitation and temperature to isolate GCMs falling within these percentile ranges;
- Identify GCM models that demonstrate minimal biases in simulating temperature and precipitation for the 3S sub-basin; and
- GCMs ensemble average change will be calculated for the 3S sub-basin from NASA-NEX-GDDP-CMIP6 daily dataset for 2 Variables (Tmax, Prec); 4 scenarios (SSP126, SSP245, SSP370, SSP585); Average 12 months changes for 2050s.

3.2 Connectivity analysis for identify corridor opportunities

Connectivity will be assessed by terrestrial and freshwater ecosystems. A 3S sub-basin wide analysis will be undertaken to identify terrestrial corridor opportunities to enhance the connectivity between ecosystems – for example between remaining forest patches and protected areas – and along disrupted drainage corridors – the aim being to enhance ecosystem services and lead to biodiversity net gain.

Terrestrial connectivity may be assessed by measuring land use and distances between recognised forest ecosystems, or the fragmentation within Protected Areas and along drainage corridors, by the construction of dams, reservoirs, roads and transmission lines.

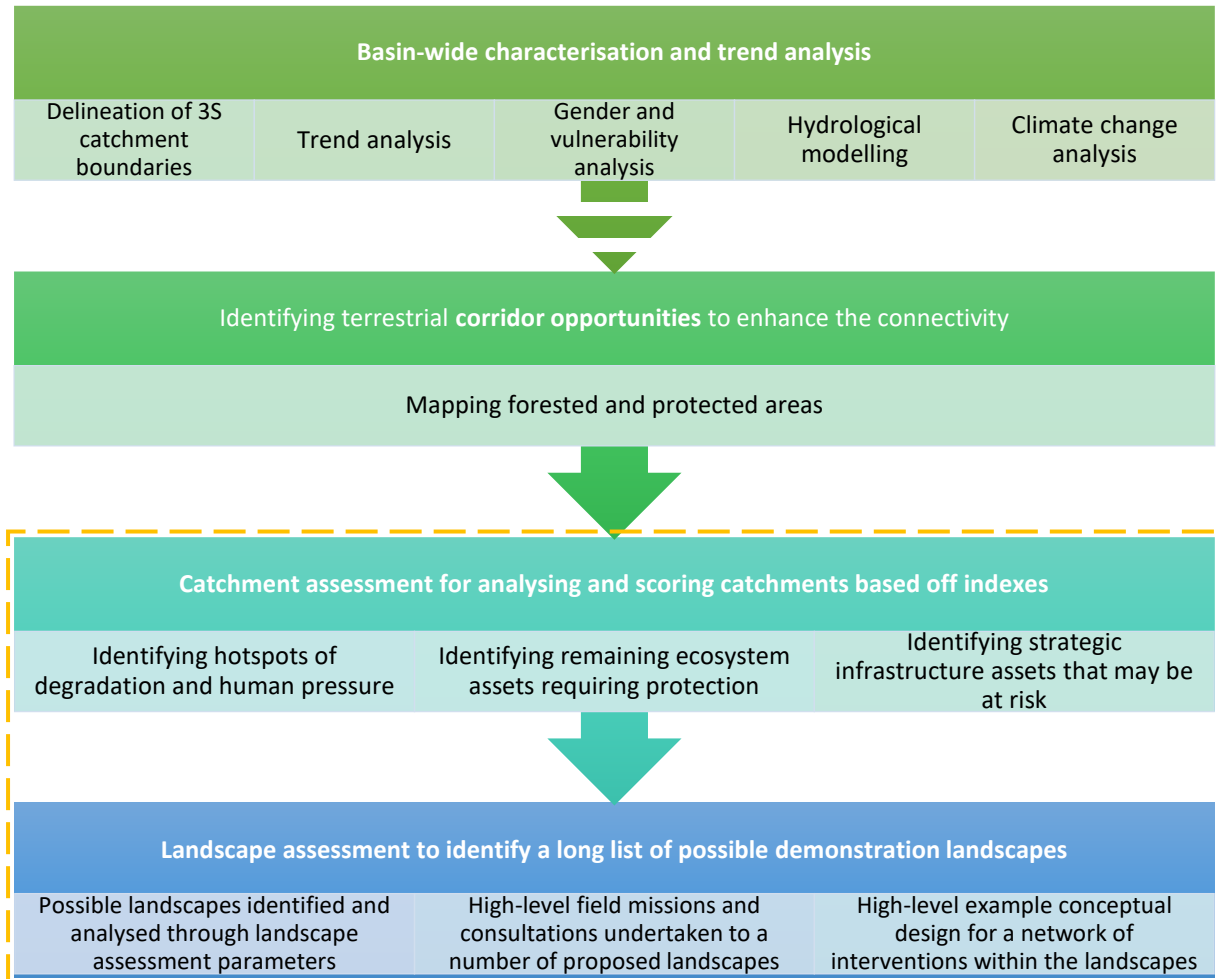
Freshwater connectivity would use and adapt the methodology developed for assessing the free-flowing rivers of the World, considering the degree of fragmentation of the river ecosystems, degree of regulation in the flows and sediment trapping.⁸ This will need to be updated to include new hydropower dams and other infrastructure development.

⁸ <https://www.worldwildlife.org/pages/free-flowing-rivers>

3.3 Application of a catchment assessment and landscape hotspot framework for the 3S sub-basin

The catchment and landscape assessment forms a core part of the 3S Joint Project methodology, as highlighted in Figure 10.

Figure 10: Steps for Assessing 3S Catchments and Identifying Possible Demonstration Landscapes



3.3.1 Catchment Assessment

A comprehensive catchment assessment will be conducted to identify hotspot areas within the 3S sub-basin for ecosystem degradation and flood and drought risk, to inform river basin planning and management, including addressing transboundary issues. Priorities will be identified based on spatial analysis, remote sensing, and ground truthing.

Catchments that are significantly degraded or that contain valuable natural and human assets will be identified by assessing and ranking sub-catchments according to rehabilitation needs.

Seven composite indexes are proposed for the **hotspot analysis**, comprising several parameters, defined as follows:

1. **Flood risk:** A composite score based on average flood depth, flood area, and evidence of historical flash floods;
2. **Drought risk:** A composite score based on sub-catchment soil and water characteristic (Total Available Water, Interception, Exfiltration, Evapotranspiration, soil moisture), evidence of historical drought events and trends, and projected dry season precipitation;
3. **Soil erosion risk:** A composite score based on historical soil loss and local knowledge on soil erosion;

4. **Biodiversity risk:** A composite score based on biodiversity importance and loss over time (i.e., Protected Areas, Key Biodiversity Areas (KBAs), Alliance for Zero Extinction (AZE) sites, Multiple Use Areas);
5. **Forest loss risk:** A composite score based on forest coverage and recent forest loss;
6. **Climate risk:** a composite score based on extreme hazards and events; and
7. **Human pressure:** A composite score based on population density, infrastructure, agriculture.

In addition to the hotspot parameters, four key composite indexes are proposed for the **asset analysis**, comprising several relevant parameters, defined as follows:

1. **Areas of high biodiversity value:** A composite score based on biodiversity importance;
2. **River reaches of high biodiversity value:** A composite score of fish species and diversity;
3. **Socio-cultural diversity:** A composite score based on ethnic diversity, rural/urban density (measure of dependence on natural resources), population within 5 km buffer of rivers (i.e. those using the river) by sub-basin; and
4. **Strategic infrastructure value:** key infrastructure locations (reservoirs, canals, dams, bridges, roads and settlements).

To support the development of the indexes, the following spatial data will be explored to provide the GIS layers for these processes. These include (i) biophysical parameters; (ii) strategic infrastructure; and (iii) social parameters.

Biophysical parameters

Table 4: Biophysical parameters for the catchment assessment

Parameter	Data approach
Floods	Historical and projected to 2050
Droughts	Historical and projected to 2050
Climate change	Temperature, rainfall, extreme events to 2050
Risk of soil erosion	Analysis of soil type, slope and landcover to highlight areas of greatest risk of soil erosion
Forest cover	Historical and trends using global datasets (including natural forests and plantations)
Land use/land cover	Historical and trends (using datasets for example from MRC and Servir Mekong). Changes in landuse e.g. increase in agricultural areas, growth of urban areas, and the identification of remaining areas with a high degree of naturalness
Areas of high biodiversity value	KBAs, AZEs, protected areas, protected forests, biodiversity corridors
River reaches of high biodiversity value	River reaches with high geomorphic diversity and associated wetlands, fish conservation zones, Freshwater KBAs, fish species diversity, threatened fish species presence, migratory species recorded and likely presence of endemic fish species
Connectivity	Terrestrial and freshwater ecosystems

Strategic infrastructure

The purpose of the strategic infrastructure layer is to identify the locations of those infrastructure assets and to assess the levels of risk, e.g. from flooding, drought, extreme events and soil erosion and sedimentation. The strategic infrastructure to be considered include:

- Dams/reservoirs;
- Transmission lines;
- Roads and bridges;
- Airports;
- Water supply and sanitation;
- Irrigation systems; and
- Industrial and mining areas.

The presence of these infrastructure will also be used to identify areas of high human pressure, such as land degradation, water pollution, increased access to natural resources.

Social parameters

Various social datasets will be used to assess the vulnerability of the populations of the 3S sub-basin. For example, maps will be developed to show population density, urban settlements and ethnic diversity of the different sub-basins. The distribution of poverty and rural populations in these sub-basins will be indicative of level of dependence on ecosystem services and natural resources from the rivers and forests. Cultural heritage and natural tourism assets will be mapped drawing from heritage and local government tourism web-sites – and additional input by relevant line agencies through the NWG process.

Table 5: Social parameters for the catchment assessment

Parameter	Data approach
Population density	-
ethnic diversity	Ethnic groups across basins
% rural/urban density	Measure of dependence on natural resources
Population using river	Population within 5 km buffer of rivers
Cultural heritage sites	Locations on religious sites, temples, ruins, tourist sites, cultural sites

The processes will depend on the direct application of spatial datasets to locate assets and infrastructure, and the development of indices of relevant parameters. The identification and ranking of sub-basins with higher degradation or values and assets to be protected facilitates the landscape analysis described in the next sub-section.

3.3.2 Landscape hotspot assessment

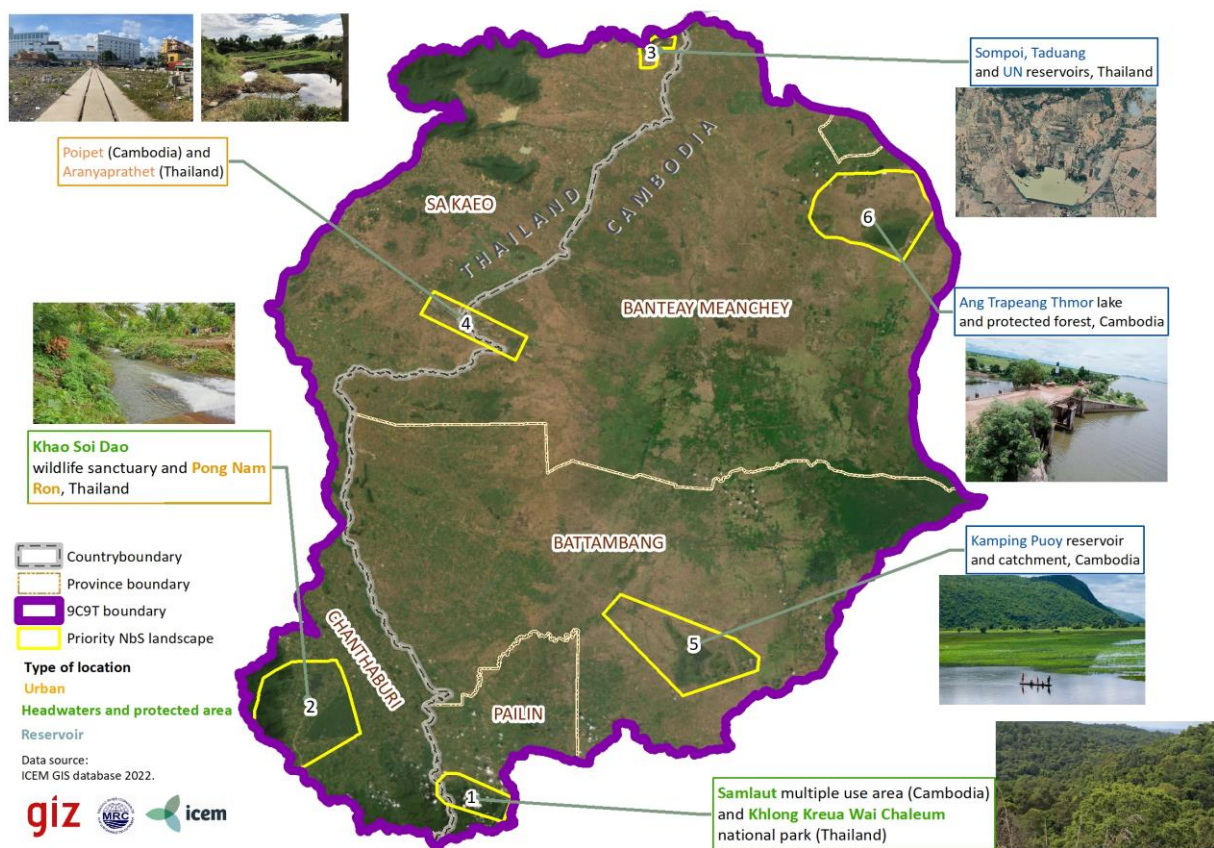
Based on the catchment assessment, priority landscapes targeted for resilience-building measures will be mapped as a spatial starting point for future implementation. These landscapes will be potential high priorities for investment in ecosystem, livelihoods, and flood and drought management. The landscapes will be identified based on several overarching factors:

- Areas in need of landscape rehabilitation;
- Strategic infrastructure under stress and in need of improved resilience;
- Strategic urban areas under stress and in need of improved resilience;
- Hotspots for ecosystem degradation,
- Hotspots for flood and drought;
- Critical ecosystem corridors which need to be restored and maintained; and
- Core transboundary river zones which require collaborative joint management.

Five degraded landscapes will be identified in each basin – 15 in all. The landscapes will represent a diversity of ecosystems, infrastructure assets, and flood and drought challenges within Cambodia, Lao PDR and Viet Nam. Some may be transboundary in nature – and all will aim to demonstrate restoration across headwaters, rural landscapes, and peri-urban and urban areas. The network of demonstration adaptation and resilience building measures to be identified in each landscape will contribute to and bring multiple benefits – strengthening hard infrastructure resilience and ecological integrity and connectivity, the management and improvement of water quality, reducing flood and drought risk, the conservation of water resources, and the restoration of watersheds and degraded forests.

Based on their experience and understanding in the region, the NWGs will have a key role in supporting the identification of key landscapes in the 3S sub-basin. Examples of the landscapes identified for the 9C-9T Joint Project are presented in Figure 11. All have critical infrastructure and rural and urban development areas which are under acute pressure aggravated by climate change as the targets for resilience building.

Figure 11: Selected Priority Landscapes in the 9C-9T



3.4 Methodological considerations and caveats

As presented above, the Joint Project approach and methodology will focus on four parallel processes. It is important to note the following considerations regarding the methodological scope for this initial preparatory phase of the 3S Joint Project:

- The Joint Project will rely heavily on open-source and accessible secondary desk-based data and information. This will also rely on effective collaboration between the PMU and national stakeholders to provide data in a timely and responsive manner;
- No primary field-based data collection will be undertaken for the 3S sub-basin as a whole. Primary data collection will only occur at selected priority landscapes as part of the one field mission, which will inform the landscape assessment;
- No hydrological modelling will be undertaken as part of the assessment. All hydrological and sedimentological information for the 3S will be derived from existing sources, such as relevant online decision support systems (see Section 5.1 for details). This will largely rely on access to the hydrological modelling data and outputs being provided to the consultants (ICEM) by the NMC's;
- No detailed climate change modelling will be undertaken to inform the climate change assessment. In addition, no real-time data (e.g., climate, flood, drought or hydrological data) will be integrated or presented as real-time on the 3S Basin Atlas; and
- The landscape assessment will identify a list of priority landscapes and suggest general adaptation options for different landscape types (e.g., rivers, wetlands, reservoirs, forests, agricultural landscapes, protected areas and urban areas). No detailed project concepts, such as designing a network of NbS measures at each priority landscape, will be developed as part of the landscape assessment.

4 DATA COLLECTION AND BASIN DIAGNOSTIC ANALYSIS (WP1)

This section presents an overview of data and information that will be collected, reviewed and analysed as part of the BDA, presented in report format and via an interactive online tool as the 3S Basin Atlas.

4.1 3S characteristics and trends data collection and acquisition

Data will be collected and analysed on areas such as hydrology, natural resources, biodiversity, land use, flood and drought, climate change projections and socio-economic status and trends. Secondary information will also be collected on spatial, sectoral and provincial plans, as well as existing and planned development projects (including on hard, hybrid and nature-based interventions), relevant to the Joint Project.

The data scoping, selection and acquisition phase of the project will review existing global, regional, national and provincial datasets relevant to ecologically sustainable development of the 3S sub-basin. The process will build on the extensive in-house dataset developed by ICEM. Key datasets may include land cover, forest/vegetation cover, protected areas and biodiversity values, agriculture, irrigated areas, wetlands, climate change (historical and projected, including risks and vulnerabilities), flood and drought prone areas, water resources, erosion and landslides, sedimentation, water quality, fisheries and a broad range of water, power, transport and other infrastructure.

4.1.1 Data collection and acquisition

Data requests from the PMU will be distributed to national line agencies via the NMCs, supported by the national consultants. Subject to their national laws, regulations and policies and the rights of the holders of intellectual property, NMCs and line agencies will promptly exchange all information necessary for the activities, outputs and effective functioning of the Joint Project under this arrangement.

Data availability, acquisition, quality and usage constraints within the 3S sub-basin will affect the datasets that can be collected under the Joint Project and the extent of analysis which is possible. Constraints on data acquisition are anticipated, and therefore in-house and open-source datasets will be prioritised. ICEM has developed an extensive database of global and regional datasets that are relevant and can be used for the 3S Joint Project. This database includes some national data for Cambodia and Viet Nam in particular, but also for Lao PDR.

Applicable and accessible data sets for each county in the 3S sub-basin are being identified through consultations with regional and national data custodian agencies and MRC. This data will be supplemented by available online open-source datasets.

A detailed data collection and acquisition plan is provided in Annex 3, which provides an overview of the data requirements, a description and rationale for each dataset and the relevant agency responsible for providing the data. The plan covers data for the following categories:

- Base layers;
- Natural resources and biodiversity;
- Land use and land cover;
- Demographics and socio-economics;
- Infrastructure and transport;
- Hydrology and climate change; and
- Flood and drought.

This plan will be further discussed with relevant stakeholders after the first NWG meetings.

4.2 Policy and institutional review

As part of the BDA, a review of relevant policies and institutions (past, present and future) in Cambodia, Lao PDR and Viet Nam, and their relevance for sustainable water resource management and climate change adaptation in the 3S sub-basin, will be presented.

Secondary information will also be collected on spatial, sectoral and provincial plans, protocols, as well as existing and planned development projects (including on hard, hybrid and nature-based interventions), relevant to the Joint Project. Access to information on planned projects, including their specific locations and dimensions will depend on its ready provision by NWG members and their respective line agencies. The Joint Project needs to build on past consultations and negotiations among 3S countries and seek to help implement and maintain the momentum of the resulting plans of action which have been formally adopted.

Review activities will include:

1. Review of existing institutional structures and collaborations;
2. Review of existing policy and planning documents for 3S;
3. Review of existing joint master plans/ action plans; and
4. Review national and regional gender and vulnerability policies and data.

A number of significant recent and existing national and bi-lateral projects have been established for the 3S, which will be further aligned and explored under this WP, including:

- Mekong Integrated Water Resources Management Project (IWRM) – Phase III (2016-2022);
- Enhancing Integrated Water Management and Climate Resilience in Vulnerable Urban Areas of the Mekong River Basin project (2021-2025).

Several existing protocols and plans developed for the 3S sub-basin through MRC consultative mechanisms (Mekong IWRM Project) will be further aligned and explored under this WP, including:

- Transboundary Fisheries Management on the Mekong and Sekong Rivers in Cambodia and Lao PDR – Transboundary Fisheries Management Plan (MRC, 2019); and
- Joint Transboundary Action Plan in the Sesan and Srepok River Basin and the Mekong Delta of Cambodia and Viet Nam (MRC, 2019).

4.2.1 Relevant work by NMCs

A Regional Inception Workshop was held in Hanoi on 17 August 2023, between the three project countries NMC's and the PMU. The NMC's presented an overview of their current work areas and relevant projects in the 3S. The presentations are summarised below and appended in Annex 4.

Cambodia

CNMC reported on the *Mekong Integrated Water Resources Management Project (Phase III)* (2016-2022), which was funded by the World Bank (IDA Credit Number: 5777-KH). The aim of the project was to establish the foundation for effective water resource and fisheries management in project areas in the northeast of Cambodia. The project comprises of two components. The second component focused on water resources management (WRM) in north-eastern Cambodia and aimed to improve water resources management in the 3S sub-basin and the Prek Preah, Prek Krieng, Prek Kampi and Prek Te (4P) sub-basin. A key element of this was to support transboundary dialogue with Vietnam, under the framework of the Mekong IWRM Program. Specific sub-components of this project included:

- Improvement of the hydrometeorological monitoring network;
- Development of a 3S4P DSS decision support system (DSS) managed by CNMC (Section 5.1.2);
- Water resources planning, development and management; and
- Strengthening the organizational capacity for water resource management, planning and development.

In addition, CNMC reported on the *Enhancing Integrated Water Management and Climate Resilience in Vulnerable Urban Areas of the Mekong River Basin* project (2021-2025) is a joint initiative between the Ministry of Environment of the Republic of Korea and the United Nations Development Programme (UNDP). It aims to strengthen the resilience of the people and communities in these climate and disaster vulnerable regions of Cambodia and Lao PDR. As part of this project, flood forecast modelling will be developed to inform climate vulnerability assessments, disaster risk reduction and climate risk-informed basin development in 3S and 4P basins.

Lao PDR

LNMC reported that the Sekong river basin plan has been approved by the Government of Lao PDR. This includes a review of the state of basin, a scenario assessment and the five-year work plan. The Sekong river basin plan and its IWRM principles will be the blueprint/reference for the Department of Water Resource’s work in the Sekong. Past studies for the Sekong are presented in Figure 12.

Figure 12: previous studies in Sekong River Basin (reported by LNMC)

Author	Study overview
EWater (2018)	SWAT and Source models developed to undertake a surface water resource assessment for the Xekong River Basin. HEC-RAS model used to develop initial flood simulation at a basin scale.
Piman (2016)	Assess the magnitude of potential changes, daily flows in Sekong, Sesan and Sre Pok Rivers of the Mekong Basin that were simulated over 20 years using the HEC ResSim and SWAT models for range of dam operation and development scenario.
Piman et al (2015)	Projected climate change scenarios affect flow regimes in the 3S basin compared to flow alterations induced by hydropower development using SWAT and HEC-ResSim
Piman (2012)	SWAT and the HEC ResSim models to assess the impact of hydropower development and operation on river flows in the 3S basin was studied through simulations over a period of 20 years from 1987 to 2006.
Phongpachith (2009)	Water Resource Study in the Xekong River Basin A national case study to build capacity of Lao National Mekong Committee modelers (using SWAT, IQQM and ISIS).
Energy-Water Nexus (EWN) study (ongoing)	The Energy-Water Nexus in Lao PDR: Demonstrating Integrated Water Resources Management in the Hydropower Sector - integrating water resources management into hydropower management in order to maximize the value of Lao PDR’s water endowment and provide security of water rights in the hydropower sector, using HEC-HMS and HEC-ResSim.
IFC Cumulative Impact Assessment (ongoing)	Cumulative impact assessment (CIA) of hydropower development in the Xekong River Basin.

SWAT: Soil Water Assessment Tool
IQQM: Integrated Quantity and Quality Model
ISIS: Suite of Modelling Software
HEC-ResSim: Hydraulic Engineering Centre Reservoir System Simulation

Viet Nam

VNMC outlined a number of important projects for the Central Highlands, including:

- Procedure for Water Use Monitoring (PWUM) Pilot study (2015) – *objective*: to calculate water balance under different development scenarios in the Srepok river Basin;
- Sediment Case study (2017) – *objective*: to assess fluctuation of sediment concentration under different development scenarios in the Sesan-Srepok River Basins;
- Distribution of inter-regional and inter-river basins in the 2S region (2018) – *objective*: Calculate the water demand and water balance under different Development Scenarios in Sesan-Srepok River Basins;
- Mekong IWRM Project in the 2S basins (2019) – *objective*: to develop a fully functional, user-friendly DSS for the 2S River Basin that is conceptualized and documented with a package of well-verified models, a knowledge base, including interfaces for information services designed to meet the needs or various stakeholder groups;
- Water management Pilot study (2021) – *objective*: to develop the capacity of VNMC in decision making for managing water resources at river basin scale, especially at the transboundary basin scale, such as 2S; and
- Contradictions in the Exploitation and Use of Water Resources in the Central Highlands (2022) – *objective*: Defining the current status and main contradictions in the exploitation and use of water resources and analysing, evaluating and forecasting the impacts of this exploitation on river basins in the Central Highlands.

4.3 High level gender sensitive and vulnerability analysis

Promoting gender equity and social inclusion within project activities and outputs is crucial to IWRM and mitigation activities. Gender and social vulnerability are key considerations of the Joint Project. Vulnerable groups are most likely to be most impacted by, and least resilient to, ecosystem and water degradation, flood and drought and loss of fisheries and other natural resources.

Gender is a social term, linked to societal expectations, including roles and responsibilities, activities and actions, access and control and decision-making. It refers to both female (women and girls) and male (men and boys). Furthermore, it can also refer those that comfortably self-identify themselves as “male” or as “female” and/or also in the general “non-binary” category and/or identify as (lesbian, gay, bisexual, transgender, and queer (LGBTQ)). **Vulnerability** refers to marginalized populations and those that are potentially at risk of negative impacts due to minor changes in their development situation. More specifically, it is the characteristics and situation influencing their capacity to anticipate, cope with, mitigate and recover from the impacts of flood and drought risks. Vulnerability may also have differing definitions in Cambodia, Lao PDR and Viet Nam.

As part of the BDA, a high-level gender and vulnerability analysis will be undertaken for the 3S sub-basin. This will include:

- Defining gender and vulnerability, including identifying their sub-groups and sub-components, relevant to the 3S;
- High-level review of best practice gender mainstreaming policies and frameworks;
- High-level review of gender and vulnerability legal framework in Cambodia, Lao PDR and Viet Nam;
- Outlining the relevant international and national policy frameworks applicable for the 3S Joint Project, including relevant international agencies;
- Identifying several key gender and vulnerability guiding principles for the 3S sub-basins; and
- Identifying key gaps and recommendations.

4.4 Basin Diagnostic Analysis report

The BDA report aims to present an overview of the situation in the 3S sub-basin. The **scope** of the BDA will comprise a review of the setting, characteristics, and trends in the 3S across Cambodia, Lao PDR and Viet Nam; specifically, the 48 catchments that have been identified in the 3S sub-basin (Figure 6). This will include relevant assessments, based on the methodological approach and considerations presented in Section 3. The information provided by countries (Section 4.2.1) will be used as a framework for follow up to inform the BDA. The BDA report will include the following sections:

Table 6: Basin Diagnostic Analysis report contents

Chapter no.	Chapter title
1	Introduction and background
2	Availability of data and information (and data sources)
3	Policy and institutional setting
4	Basin characteristics and trends (for each basin): <ul style="list-style-type: none"> 4.1 <i>Environment</i> (Geology and soils, Hydrology, Forests, Land use and land cover, Biodiversity and ecosystems) 4.2 <i>Social</i> (Socio-economics and Gender and vulnerable groups) 4.3 <i>Economics</i> (Agriculture and fisheries, Infrastructure and assets) 4.4 <i>Climate change</i> (Climate, hazards and vulnerability) 4.5 <i>Cooperation</i> (Policy and institutional setting)
5	Climate change assessment
6	Basin connectivity and transboundary
7	Catchment assessment
8	Landscape assessment
9	Priority landscapes
10	Summary

5 DEVELOPMENT OF THE 3S BASIN ATLAS (WP2)

The most significant output of the 3S Joint Project study is the development of an online, geo-referenced decision support tool to support the Governments of Cambodia, Lao PDR and Viet Nam in managing transboundary water resource management challenges and climate change risks and the implementation of a comprehensive Joint Project. It provides for the open sharing of information and data to inform transboundary, national, and sub-national planning, management, and investment in resilience building measure.

The **scope** of the 3S Basin Atlas is listed below. Section 5.4 provides further details on the contents of the proposed 3S Atlas (Figure 17) and Section 5.5 provides an overview of the configuration process for the different components.

- Development of a ‘geoserver’ database (Data Catalogue component), containing relevant collected and analysed datasets for the 3S;
- Development of a foundational, high-level digital reference map for the 3S sub-basin via the integration of datasets as a common internet-based georeferenced system (Data Explorer component), including;
 - An introductory home page;
 - A map viewer tool;
 - A map gallery page;
 - A documents page;
- Integration of the 3S internet-based georeferenced database to the existing MRC Interactive Publications platform⁹.

The Joint Project will build on and update existing datasets and spatial information for the 3S sub-basin, including drawing from MRC’s ‘Data and Information Services’ portal and the different DSS developed by various institutions over recent years.

5.1 Review of existing 3S decision support tools

5.1.1 IUCN 3S Basin Atlas

IUCN – through the Building River Dialogue and Governance (BRIDGE) initiative – previously developed an Atlas of the 3S Basins (the Sekong, Sesan and Srepok transboundary basins), published in 2015.¹⁰ A 3S Atlas report is accessible online, however the interactive DSS is no longer active.

The atlas provides a brief overview of the basins to illustrate their importance, complexity, and transboundary setting. At the time, the range of maps provided essential spatial information where there had been a general lack of easily accessible thematic maps for the 3S sub-basin. The atlas was targeted at policy makers, natural resource managers and practitioners, and interested parties to better understand the 3S sub-basin.

5.1.2 CNMC 3S4P DSS

The CNMC 3S4P DSS¹¹ is a dynamic open access portal developed by DHI. It provides the most extensive and up-to-date existing database for river basin planning in the 3S sub-basin. The tool applies near-real time monitoring data on a range of parameters. Its core components are presented in Figure 13 and 14. A comprehensive review of the CNMC 3S4P DSS will be undertaken to identify linkages and opportunities for integrated, and gaps that can be filled by the 3S Basin Atlas. Discussions will be held with CNMC to that end – including a critical assessment of the current application and values of the DSS by MOWRAM and other line agencies.

⁹ MRC Interactive Publications: <https://www.mrcmekong.org/news-and-events/multimedia/interactive-publications>

¹⁰ Constable, D. (2015). Atlas of the 3S Basins. Bangkok, Thailand: IUCN.
<https://portals.iucn.org/library/sites/library/files/documents/2015-064.pdf>

¹¹ <https://cnmc.waterdss.com/portal/workspaces/decision+support+system+for+3s+and+4p+river+basins>

Figure 13: CNMC 3S4P DSS platform categories and components

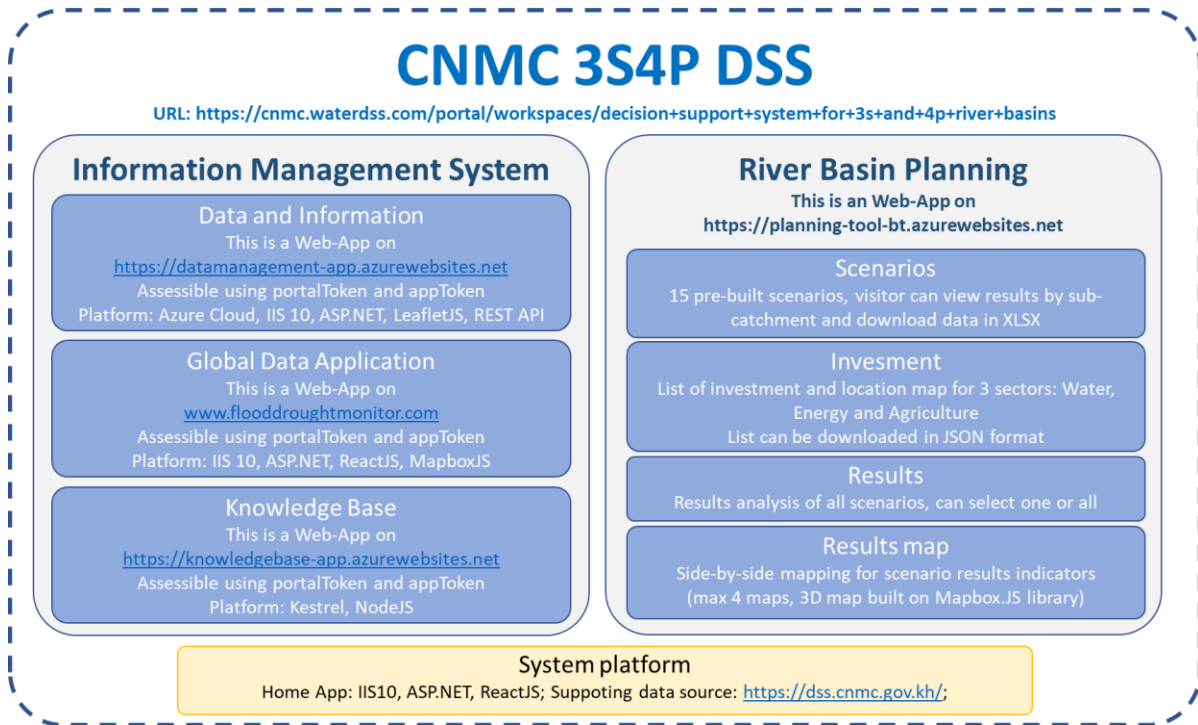
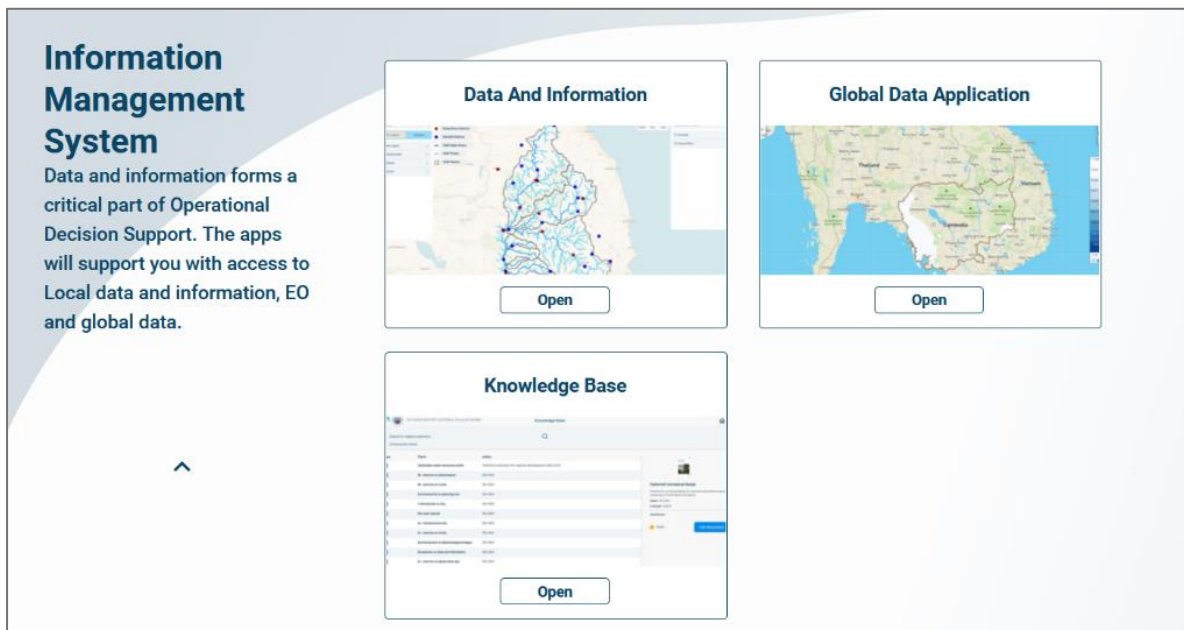
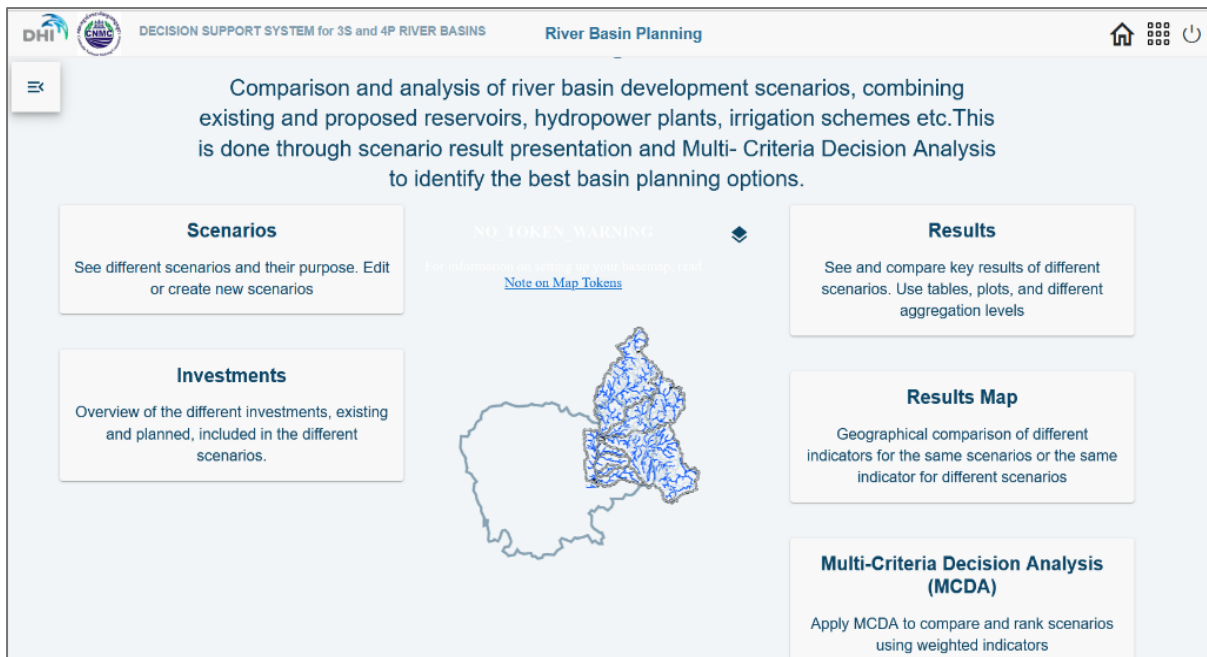


Figure 14: Information management system interface (top); river basin planning interface (bottom)



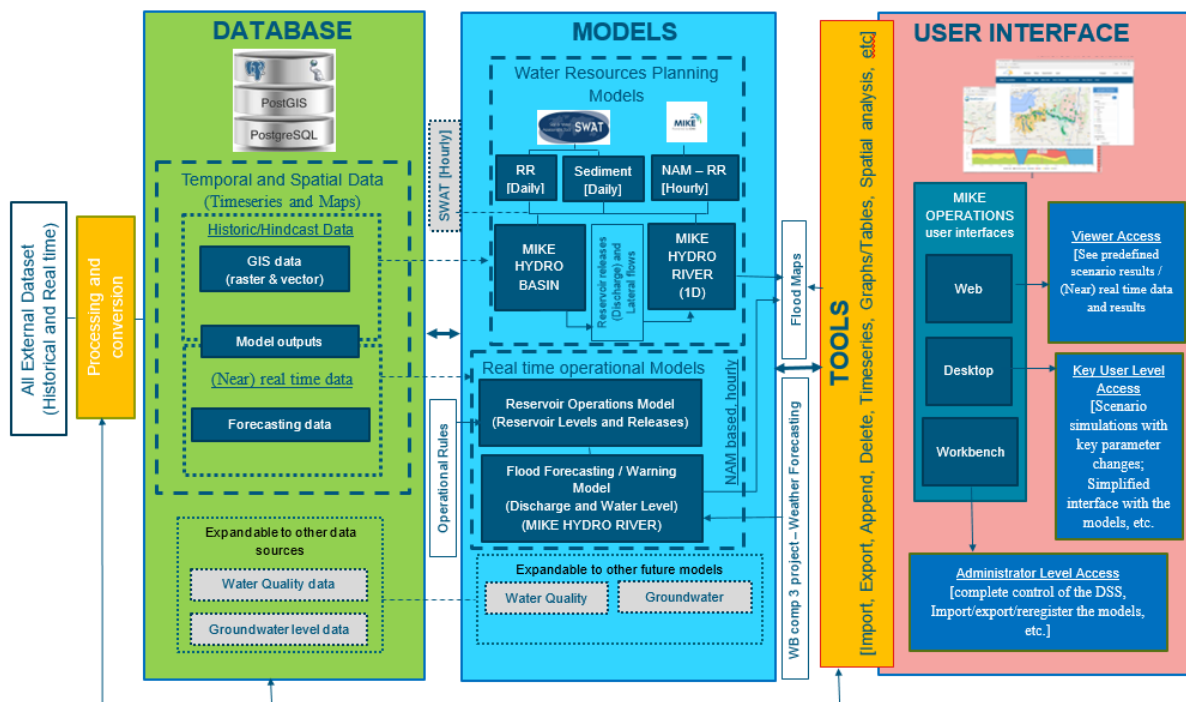


5.1.3 VNMC 2S DSS

Limited information is available on the 2S DSS being an offline system. It is managed by VNMC, who provided a briefing on the DSS during the regional inception meeting in Hanoi (17 August 2023). Funded by World Bank, the system was developed by DHI, with several model components including SWAT, MIKE NAM, MIKE Hydro, MIKE Basin, with MIKE Operation at the centre. It is understood that the DSS has been introduced and transferred as an offline system to several line agencies. The web-based interface is included as part of the DSS, but is for internal use only, not accessible online.

The components of the DSS are presented in Figure 15.

Figure 15: VNMC 2S DSS components



It is understood that more than 1000 km of rivers have been simulated, including a number of reservoirs and their complex operations. The river model runs in real-time and provides accurate flood forecasting twice daily. A separate MIKE OPERATIONS model supports the river basin planning and management component based on IWRM principles, providing insight months in advance for the 50,000 km² catchment. The model supports real-time outputs, connecting to a range of data sources¹². The system appears to make use of data exchange capacity and mechanisms, whereby station data for the wider 2S (i.e., not just in-country) has been incorporated.

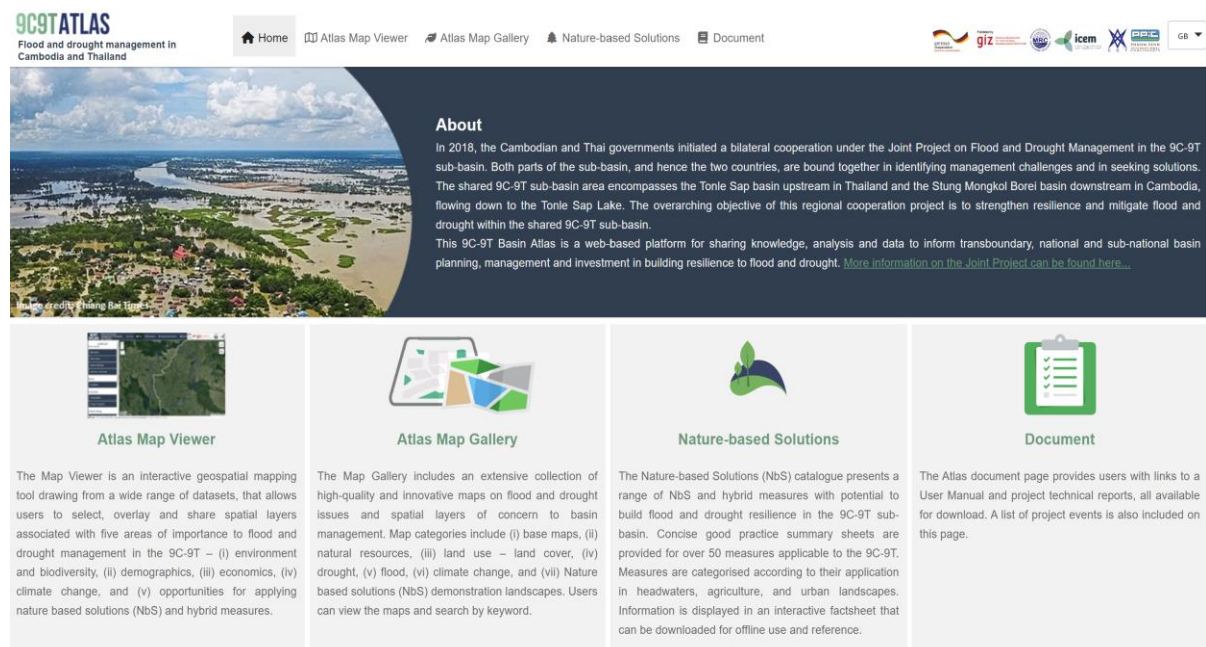
VNMC will be requested to provide a thorough briefing on the status and use of the 2S DSS during NWG meetings, and to provide the Joint Project will full access to its data, spatial analysis and modelling output. It is important that the 3S Atlas is well integrated with the 2S DSS so that data sharing and user accessibility is provided and consistent for all countries.

5.2 9C-9T Basin Atlas as basis for development

The 9C-9T Sub-basin Atlas was a core output from the 9C-9T Joint Project. The Atlas is hosted by the MRCS for use by Member Countries and partners to support the planning and implementation of the 9C-9T Master Plan.¹³ The Basin Atlas is now an operational tool for use by countries and is available in English, Khmer and Thai.

The objective of the 9C-9T Basin Atlas is to support the Governments of Cambodia and Thailand in managing transboundary flood and drought risk through a web-based interactive platform to facilitate integrating, accessing, visualizing and exploring national flood and drought-related datasets and information. It is a central resource for open sharing of information and data to inform transboundary, national, and sub-national 9C-9T planning, management, and investment in building resilience to flood and drought. The 9C-9T Basin Atlas provides a model and demonstration for development of the 3S Atlas which will be available on the MRC server for ready access by all countries as an open planning and monitoring tool and resource.

Figure 16: 9C-9T Basin Atlas Home interface



¹² DHI Group. Development of a water management system for the Sesan-Srepok river basins. <https://www.dhigroup.com/projects/improving-transboundary-water-management-in-the-mekong-river>

¹³ The 9C-9T Basin Atlas is accessible to users on the MRC website: <https://9c9t.mrcmekong.org/>

The final 9C-9T Basin Atlas interface comprises four main components and two tools (illustrated in Figure 16):

1. **Atlas Map Viewer:** The Map Viewer is an interactive geospatial mapping tool drawing from a wide range of datasets, that allows users to select, overlay and share spatial layers associated with five areas of importance to flood and drought management in the 9C-9T – (i) environment and biodiversity, (ii) demographics, (iii) economics, (iv) climate change, and (v) opportunities for applying nature-based solutions (NbS) and hybrid measures. The Map Viewer forms the frontend of the Basin Atlas and enables users to interrogate data resources relevant to the flood and drought management. The primary function of the viewer is to overlay and visualize selected data layers, to provide valuable insights for integrated development planning in the shared 9C-9T river basin. The users can also download some of the datasets. The Map Viewer can be viewed in English, Khmer or Thai.
2. **Atlas Map Gallery:** The Map Gallery includes an extensive collection of high-quality and innovative maps on flood and drought issues and spatial layers of concern to basin management. Map categories include (i) base maps, (ii) natural resources, (iii) land use – land cover, (iv) drought, (v) flood, (vi) climate change, and (vii) Nature based solutions (NbS) demonstration landscapes. Users can view the maps and search by keyword.
3. **Nature-based Solutions Catalogue:** The Nature-based Solutions (NbS) catalogue presents a range of NbS and hybrid measures with potential to build flood and drought resilience in the 9C-9T sub-basin. Concise good practice summary sheets are provided for over 50 measures applicable to the 9C-9T. Measures are categorized according to their application in headwaters, agriculture, and urban landscapes. Information is displayed in an interactive factsheet that can be downloaded for offline use and reference.
4. **Document:** The Atlas document page provides users with links to a User Manual and project technical reports, all available for download. A list of project events is also included on this page.
5. **Tools:** (1) Urban surface runoff model which is a practical tool for modelling urban surface runoff developed on MS Excel and (2) 9C-9T sub-basin drought vulnerability ranking – a practical tool for drought vulnerability assessment developed on MS Excel.

5.3 Rationale for 3S Basin Atlas

The existing 3S/4P DSS provides the most extensive existing support for river basin planning in the 3S sub-basin, through the provision of basin-wide real-time hydrometeorological data, and various global datasets, such as land use, DEMs, hydropower infrastructure, population, socioeconomics, future projections of climate variables (IPCC AR5 and AR6), rainfall (CHIRPS), and those pertinent to agriculture and other economic sectors. Yet, there are gaps in certain data layers for Lao PDR and Viet Nam.

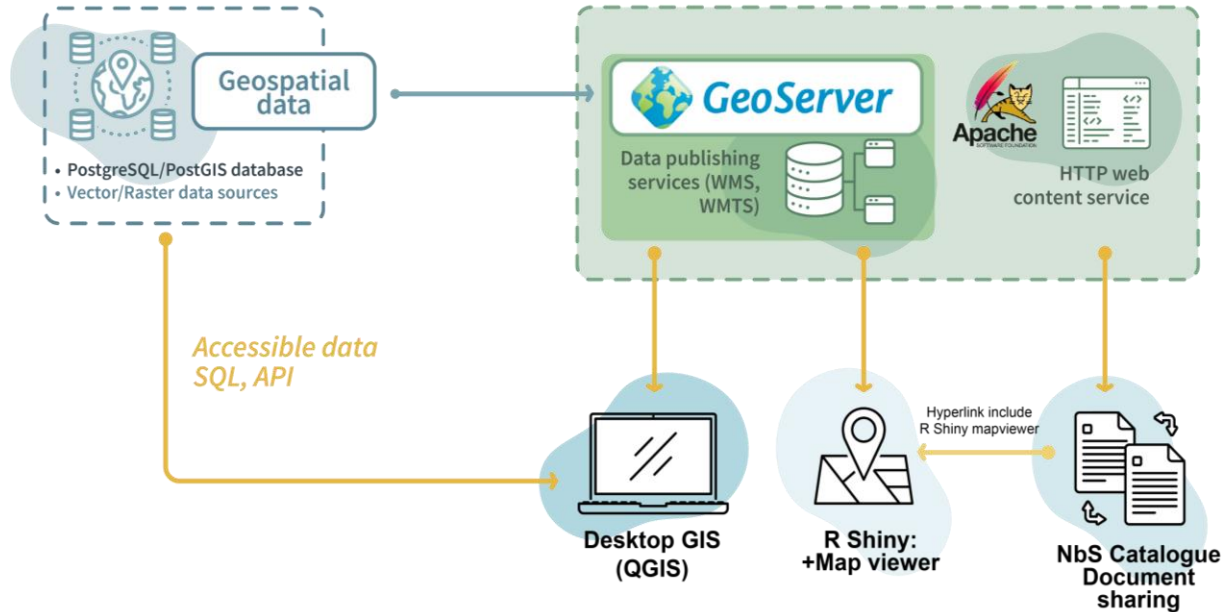
The current system does not provide users with guidance in addressing climate change adaptation, including planning and management. The successful development of the MRC 9C-9T Basin Atlas has emphasised the use and importance for LMB countries of transboundary IWRM and climate change adaptation planning tools.

The 3S DSS will supplement and add value to the existing 3S DSS system through the generation and sharing of data and information products that support climate change adaptation. For instance, as with the 9C-9T Joint Project, ICEM can generate climate change hotspot maps showing areas of greatest risk to future projections of precipitation and temperature. The flood data in the 3S/4P DSS might support identifying areas of greatest risk to flooding. As integrated in the 9C-9T Basin Atlas, a catalogue of NbS measure factsheets would inform planners as to the range of practical measures that could be undertaken to address potential impacts at the identified climate change hotspot locations.

5.4 3S Basin Atlas content

As outlined in Section 5.2, the 3S Basin Atlas will typically follow the design approach and contents of the 9C-9T Basin Atlas. An overview of the key components proposed for the 3S Atlas is outlined in Figure 17. They include:

Figure 17: Proposed 3S geospatial database



- Basin Atlas geospatial database – a store of all vector and raster data collected for the 3S;
- GeoServer – an open-source web server for storing and publishing geospatial data and maps;
- HTTP web content service – web server;
- Frontend visualisation – published spatial data services viewable as web-based application (via R Shiny); and
- Desktop GIS programs – to download and view geospatial and geoserver data.

5.5 3S Basin Atlas configuration

The technical configuration of the 3S Basin Atlas will comprise a number of steps, as outlined below.

5.5.1 3S data catalogue and configuration of GeoServer

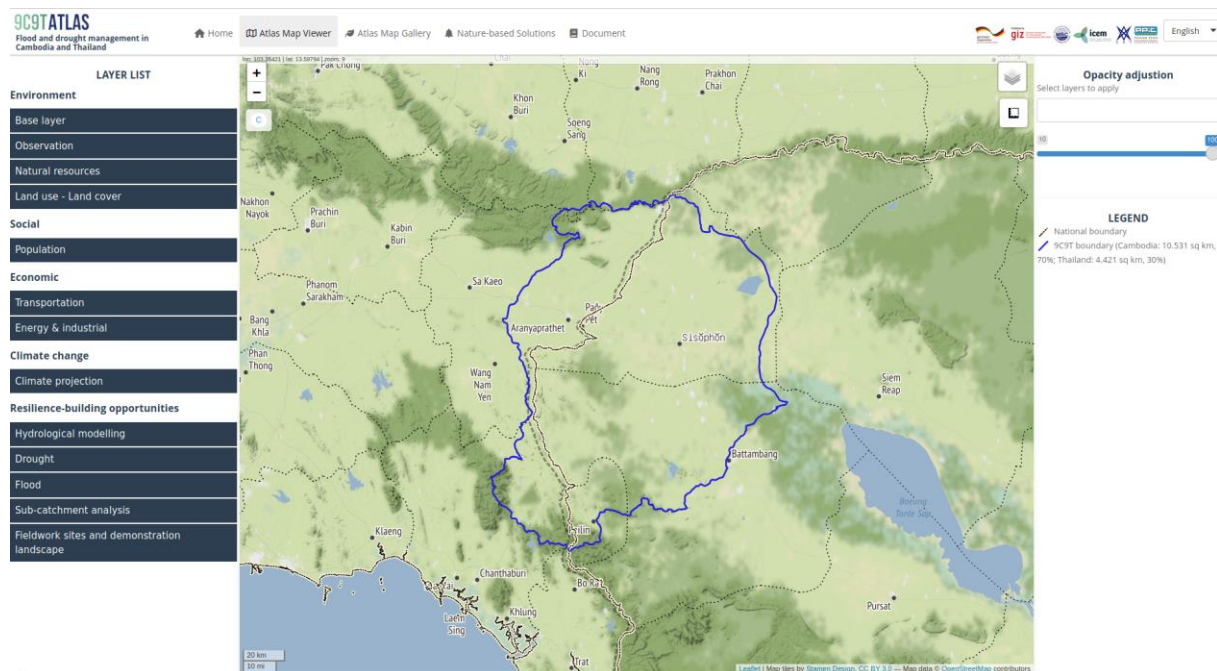
A Data Catalogue will comprise establishment of an online GeoServer, populated with geospatial data publicly available as a standard Open Geospatial Consortium (OGC) compliant data service. This will display key datasets and map elements, using the open source GeoServer application. As part of the Data Catalogue, a bibliography of resources will be developed, containing core descriptions (metadata) of datasets from the GeoServer application as well as existing data services from third party sources.

5.5.2 3S design and development of frontend data explorer and integration of datasets

This task will support the design and development of an online web-based platform – the 3S sub-basin Data and Scenario Explorer tool. This online platform will visualise the data services generated under the GeoServer /Data Catalogue. The Data Explorer will form the frontend of the catalogue and enable users to explore parameters related to datasets/indicators identified. The core feature of the Data Explorer will be an interactive map viewer with primary functionality to overlay and visualize selected data and information layers. The frontend Data Explorer will be based on the ‘R’ software and the ‘Shiny R’ package¹⁴.

The design of the 3S Atlas graphical user interface (GUI) will build on the overall framework as developed for the 9C-9T Atlas. However, rather than focusing on a single river basin, the 3S Atlas will categorise and display data for each of three 3S subbasins (Sekong, Sesan and Srepok) and the entire 3S sub-basin. The navigation tree as developed for the 9C-9T Atlas will be modified to facilitate access to data across the entire basin and at subbasin level. The 3S Atlas will also present the 48 catchments identified as part of the catchment boundary identification and delineation process (Figure 6), as well as the priority landscapes identified during the landscape assessment (Figure 10).

Figure 18: Map Viewer of 9C-9T Atlas with navigation tree on left side of window



¹⁴ R is a software used worldwide, built for statistical analysis and visualization of data. Its functionality can be extended via installation of software ‘packages’, of which ‘Shiny’ is a well-known package for R. R and Shiny are both open-source; the source code can be viewed and edited, with no licensing restrictions on its use or sharing and no acquisition costs.

In the 3S Atlas navigation tree, a simple dropdown menu will be placed at its top and will provide menu options to select and display data for the entire 3S (default view) or each sub-basin. On selecting the 3S basin/subbasin menu item, a navigation tree specific to the basin/sub-basin will be dynamically displayed. The anticipated design of the navigation tree is shown in Figures 19 to 22.

Figure 19: Dropdown menu for selection of 3S basin/sub-basins

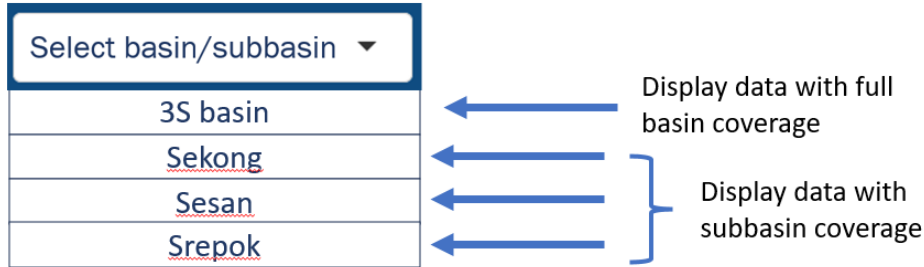
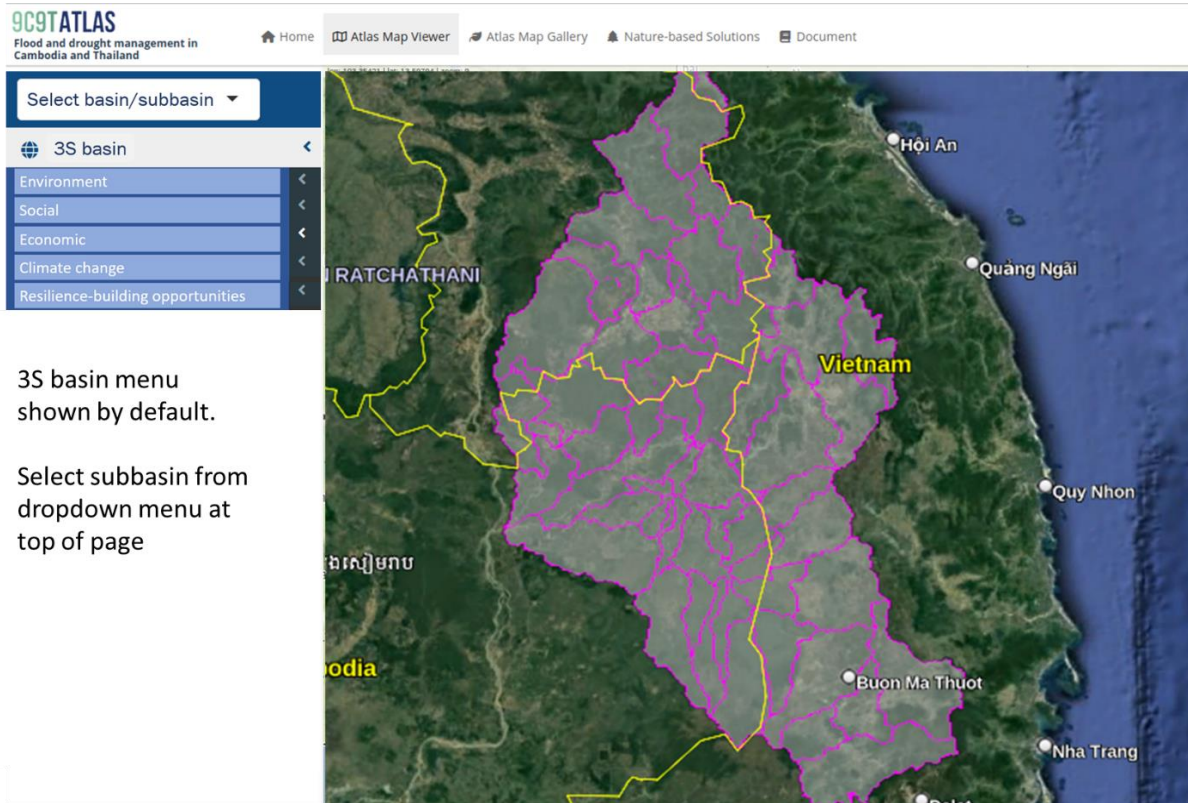


Figure 20: Proposed default view of map and navigation tree with 3S Basin-wide data



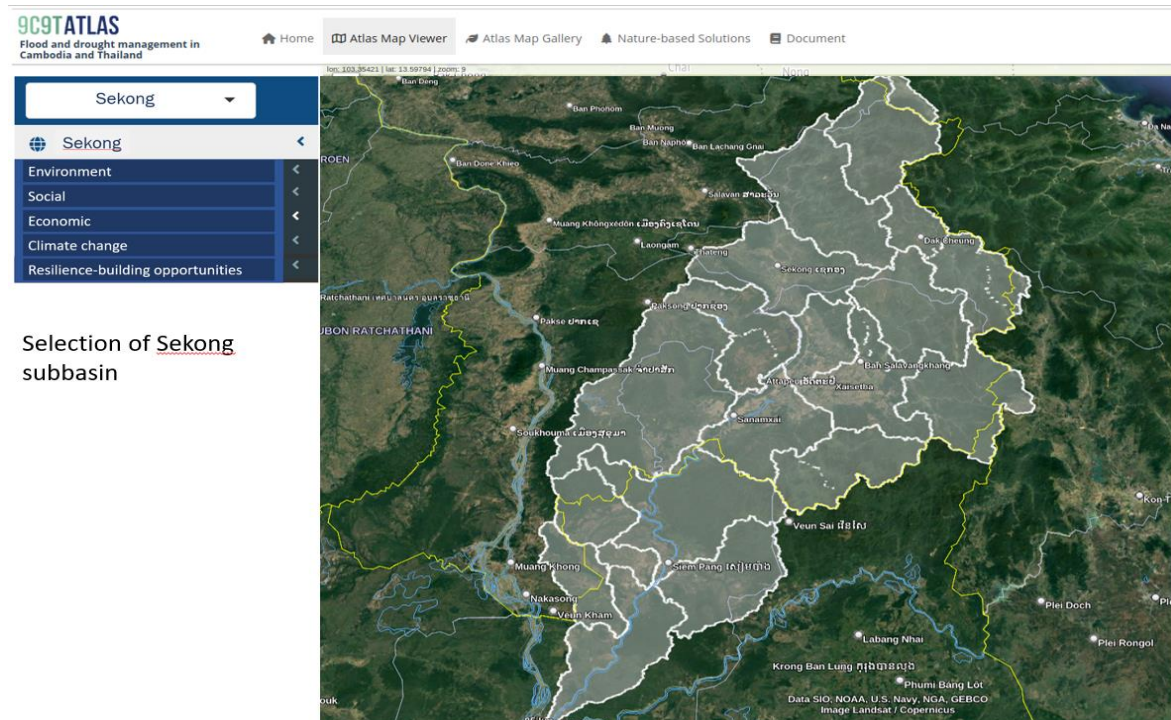
3S basin menu shown by default.

Select subbasin from dropdown menu at top of page

Figure 21: Navigation tree dynamically generated on selection the basin/sub-basin menu option



Figure 22: Selection of Sekong sub-basin



5.5.3 3S Basin Atlas MRC server hosting and transfer

The Data Catalogue and Data Explorer applications (Shiny app and GeoServer frontend and backend) will be configured to facilitate upload and hosting on the MRCS server. This process will also ensure the app is suitable for use on both desktop and mobile applications. As outlined, this will largely be based on the software components applied for the 9C-9T Basin Atlas (Figure 23 and 24).

The technical configuration and preparation will be led by Expert 2, in coordination with the MRCS technical IT and spatial/GIS team. High-level guidance will be provided on the maintenance of the GeoServer application, Data Catalogue and the Data Explorer. All outputs (online platform and documents) will be presented in English.

It is proposed that physically, the 3S Basin Atlas will be a separate application to 9C-9T Basin Atlas. Each atlas can have a link on their homepage to the other. MRCS should establish an introductory webpage (with an index of apps) that links to selected basins – e.g. 9C-9T, 3S, CNMC 3S.

Figure 23: Overview of 9C-9T Basin Atlas software components

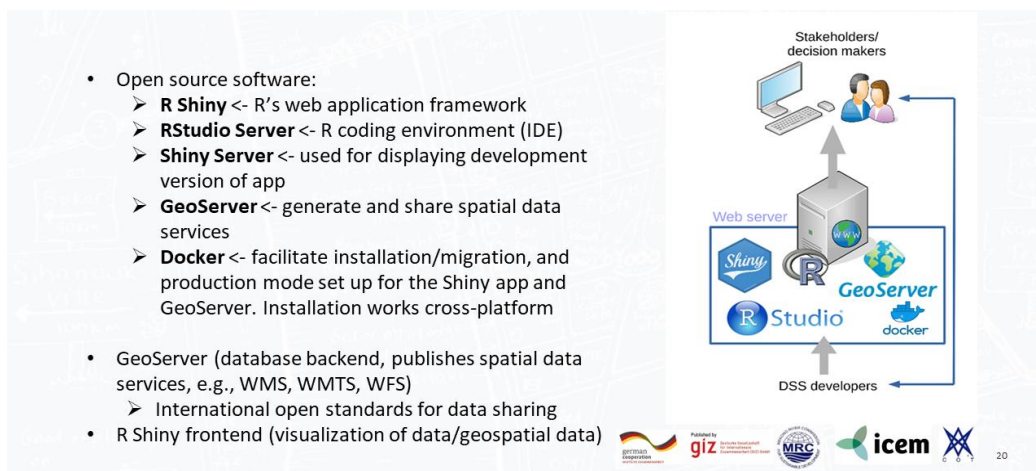
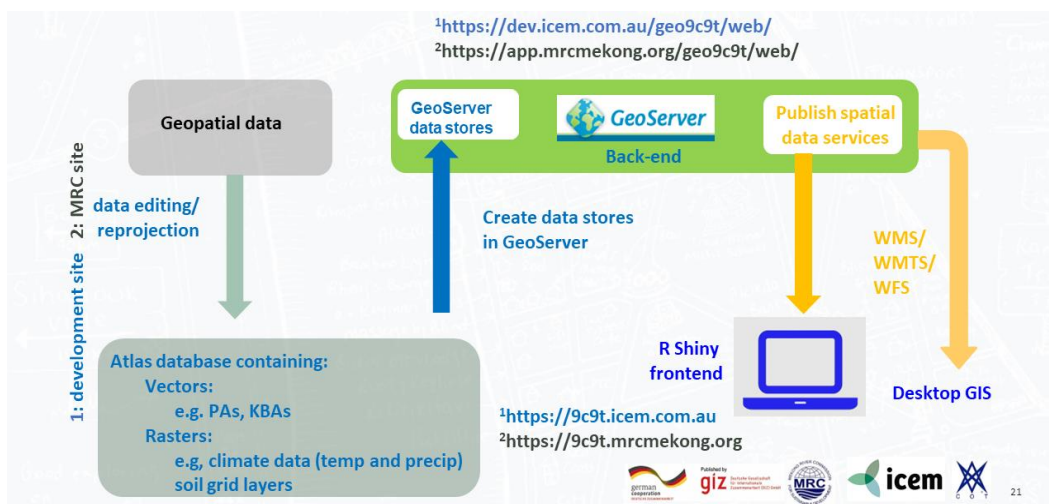


Figure 24: 9C-9T Basin Atlas software framework and spatial data flow



Hydrometeorological information for the 3S is a key dynamic dataset and its integration with the 3S Basin Atlas will be explored further under WP2. A simple hyperlink from the 3S Basin Atlas to other platforms or DSSs is proposed, rather than integrating hydromet data into the 3S Basin Atlas, which would likely require substantial input. It will be important to confirm if there is an existing database where hydromet data are being recorded, such as a central repository where data is archived (such as the CNMC 3S/4P server or another database). Opportunities to link the 3S Basin Atlas to that repository and download the data will be explored. Such data may then need to be further manipulated/modified for display in the 3S Basin Atlas frontend.

6 TRANSBOUNDARY STEERING MECHANISMS AND COLLABORATION (WP3)

6.1 Implementation agreements for steering mechanisms

6.1.1 Terms of Reference for the NWGs and RCSs

Based on MRCS guidelines and experiences from the 9C-9T Joint Project on Flood and Drought Management, Terms of Reference (ToR) documents have been developed for the RSC, three NWGs and national consultants (Annex 3). These define the objectives, scope of work, membership structure, operations and level of effort for the groups under the Joint Project and were discussed by the NMCs at the Regional Inception Workshop in Hanoi on 17 August 2023. These will be formally endorsed at the first NWG meeting planned for January 2024.

In addition to the RSC and NWG ToRs, a 3S Joint Project Implementation Arrangements document has been drafted (Annex 3). The objective of this arrangement is to facilitate cooperation and decision making in the 3S sub-basins, to support the effective implementation of the 3S Joint Project, during the preparation phase of the 3S Joint Project (May 2023 – September 2024).

6.2 National Working Group approach

6.2.1 Arrangements

The objective of the Cambodian, Lao PDR and Viet Nam National Working Groups are to support the effective implementation of the Joint Project in the 3S sub-basin of the Mekong River, by supporting the PMU in the coordination, preparation and implementation of project work packages and activities at the national level and, as required, at the transboundary level.

The NWG will be established to support data gathering, provide technical advice and input, facilitate coordination and collaboration, and support capacity building. The NWGs will be the main vehicle for stakeholder engagement, along with the field and training activities. The NWGs will be working at an operational level with a national and local level orientation. The project team will implement the activities, prepare deliverables, and report progress to the NWGs and RSC.

The NWGs would work under the supervision of the NMCs. It will be chaired by a Deputy Director General of the NMC. The NWGs will comprise of senior officials and general experts from a broad range of line agencies who can understand and oversee the technical and institutional dimensions of the 3S Joint Project. Membership should promote and ensure gender responsiveness. Further details are provided in Cambodia, Lao PDR and Viet Nam NWG TORs.

6.2.2 Events

Based on the implementation agreements and ToR developed for the NWGs, two NWG meetings will be held in each country, spread out across the 17-month study¹⁵. The meetings and workshops at the national level will be organized, led and chaired by the NMCs. The NMCs are responsible for preparing and circulating the meeting invitation letters and encouraging attendance from participating line agencies.

MRC-GIZ in collaboration with the NMCs will organize the NWG meetings. MRC-GIZ are responsible for the drafting the meeting plans, setting the meeting agenda, facilitating the meeting, and providing post-meeting reporting. MRC-GIZ, with support from the NMCs, will provide the required meeting documentation, such as technical documents, reports, and recommendations. Simultaneous interpretation in meetings is provided through GIZ.

¹⁵ Possible options for additional NWG meetings during this preparation phase of the Joint Project will be reviewed by MRC-GIZ and discussed with NMCs.

To work within the budget, it is proposed that each NWG will be held as hybrid format, with a mixture of in-person attendance for NWG members and virtual attendance or in-person for the project team (location dependent). ICEM notes that GIZ representation in Cambodia could provide in-person attendance (and presentation were appropriate) at Cambodia NWG meetings; MRC, being based in Vientiane, can provide in-person attendance (and presentation were appropriate) at Lao PDR NWG meetings; and ICEM, being based in Hanoi, can provide in-person attendance and presentation at Viet Nam NWG meetings.

6.3 Regional Steering Committee approach

6.3.1 Arrangements

The objective of the Regional Steering Committee is to support the effective implementation of the Joint Project in the 3S sub-basin of the Mekong River, by ensuring transboundary agreements and decisions.

The RSC will be established to monitor, guide and validate the assignment outputs. It is recommended that the RSC members should be senior officer level (at Deputy Director General level) who can understand and oversee the technical, institutional and international dimensions of the joint project. Membership should promote and ensure gender responsiveness. The RSC will be Jointly chaired by the representatives of the NMC's at Director General level. In total, the RSC will comprise 22 members.

6.3.2 Events

MRCS conducted a Regional Inception Workshop with relevant stakeholders, NMCs, GIZ and ICEM on 17 August 2023 in Hanoi to (i) officially announce GIZ support to the 3S Joint Project, (ii) present, discuss, and agree on the 3S implementation arrangement, including the TORs of the Steering Committee, the TORs of the National Working Groups, and the TORs of the National Consultants to support the 3S Joint Project at national level; and (iii) discuss the operational plan, the timing of deliverables, meetings, study trips, and the next steps.

Two RSC meetings will also be held at the midpoint and end of the Joint Project period. GIZ in collaboration with MRCS and the relevant NMCS's will organise and facilitate the RSC meetings. GIZ and MRCS is responsible for the drafting the meeting plans, setting the agenda, facilitating the meeting, and providing any post-meeting reporting.

The first RSC meeting is proposed to be held as a hybrid event, with each country based in a meeting venue in their respective capital city, with ICEM and MRC-GIZ joining virtually or at the respective meeting locations in the country where they are based. It is envisaged that the second RSC meeting could be held in Hanoi, Viet Nam, with in-person participation from all countries, as well as ICEM and MRC-GIZ.

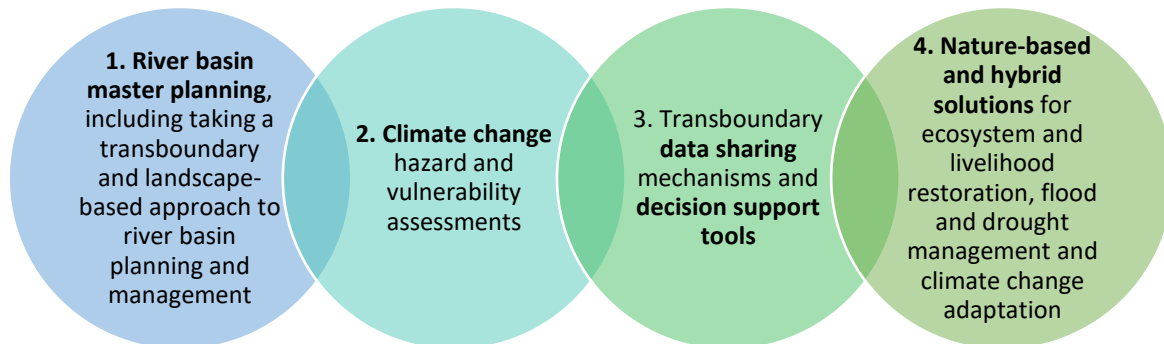
7 CAPACITY DEVELOPMENT MEASURES (WP4)

7.1 Designing training measures and themes

Engagement and capacity building activities are important for the guidance, successful implementation and sustainability of the work being prepared within this project.

NWGs in each country will be encouraged to consider their current practices and review proposed themes for training. Topics for training will include cross-cutting technical areas of relevance to the implementation of all work packages, as presented in Figure 25, and will be further detailed in a capacity building brief, that will be shared and discussed during the first NWG meetings.

Figure 25: Options for capacity building topics



The participants for the training events are expected to be nominated from the NWGs and provincial government within the 3S sub-basin. Stakeholders should feel comfortable to apply the methodologies and replicate the approaches demonstrated through the work packages so that they can be sustainably integrated within existing processes. To ensure that women in the core groups have the opportunity to speak and contribute within the group, the training facilitation will promote gender responsiveness in all training events.

The training events are in addition to the ongoing engagement planned via the NWG and RSC meetings. For example, NWG meetings will include some intensive orientation on the use of the 3S Basin Atlas. Overall, the recommended program is intended to build the capacity of key stakeholders to support the long-term implementation of Joint Project activities.

7.2 Approach to training events

The training activities will be conducted in national groupings so that participants can have in-depth opportunities to comfortably communicate with the international experts on the project team via simultaneous interpretation. Smaller group sizes also facilitate a more personalised training experience for participants. Training sessions will be designed to be participatory, inclusive and involve hands-on and on-the-job components, including during field missions.

The Team Leader, Expert 1 and National Experts from ICEM will support the planning and development of training schedules and materials. They will lead the facilitation of the training events on sustainable water resource management and climate risks in the 3S sub-basin. It is anticipated that the MRC-GIZ team would also provide input during the trainings.

One training event of one day is proposed for each country. Each training event will be held *virtually* over MS Teams, with up to 20 participants. The Project Team is experimenting with videoconference delivery mechanisms on other projects between now and the scheduled delivery of training for this project and so will be able to incorporate those lessons for these upcoming events. There is the potential for hybrid training if combined with the NWG meetings, including face-to-face involvement by ICEM and the MRC-GIZ team in their respective countries of residence.

Supporting materials for each event associated with the capacity building program will include PPT presentations and templates and guidance notes where relevant.

8 JOINT PRIORITIES ON TRANSBOUNDARY MANAGEMENT AND MEASURES FOR FUTURE PROJECT DESIGN (WP5)

8.1 Defining joint priorities for the 3S sub-basin

A common understanding and agreement is required to support transboundary and integrated sustainable water management in the 3S sub-basin. Joint priorities for the 3S sub-basin will therefore be defined for future transboundary cooperation on sustainable water resource management and climate change adaptation. A high-level document on joint priorities will be developed. The priorities will be presented, discussed and agreed on with the NWGs and RSC.

The priorities will align with and build on countries national strategic priorities, including the NIPs 2021-2025 and the MRC BDS 2021-2030. They will also build on the issues, recommendations and proposals made in the following pre-existing and endorsed transboundary plans (see Section 4.2).

The proposed actions should signify a shift from focusing only on infrastructure project planning and investment to a more proactive basin wide planning, rehabilitation and application of sustainable water resource management and adaptation planning approaches, through cross sectoral action for solving ecosystem, livelihoods and flood and drought challenges shared by the three countries.

8.2 Joint Project concept on proposed measures for future project design

As discussed during the regional inception meeting in Hanoi (August 2023), a concept note for the 3S Joint Project will be developed and submitted at the end of the study. The scope of the concept note will include:

- Overview of the 3S Joint Project and joint priorities;
- Overview of the key issues of concern and opportunities for the 3S sub-basin;
- List of possible international funding/donor options and associated funding timelines;
- Summary of proposed measures for future project design (that require additional funds); and
- Opportunities for upscaling to the LMB.

Proposed measures for future project design for the Joint Project will be identified, based on the strategic priorities for transboundary cooperation, sustainable water resources management and climate change adaptation in the 3S sub-basin. The proposed measures will be based on the set of priorities that could be supported in future 3S Joint Project phases and may include opportunities for:

- Developing a **3S sub-basin wide vision and master plan** for rollout at the basin and catchment scale;
- Establishing **transboundary plans, policies and technical collaboration**, including opportunities for a three-basin master plan approach, with an overarching mechanism for the 3S sub-basin;
- Strengthening **rural and urban flood and drought resilience** through ecosystem-based planning tools and adaptation interventions;
- Rehabilitating **headwaters, rivers and wetlands** to improve water security and climate resilience through ecosystem-based adaptation interventions;
- Establishing **transboundary operational water management**, developing technical concepts and guidelines on design floods for dams and coordination of reservoir operations for water security;
- Expanding the **baseline studies** for the 3S sub-basin, including for hydrological modelling, climate change assessments, gender and vulnerability assessments and ecological studies;
- Improving **data sharing and communication**, by developing protocols and mechanisms including early warning and progressing with shared databases and analytical tools, including the 3S Basin Atlas; and
- Improving **capacity building development**, identifying future needs and providing further training.

8.2.1 Alignment with 9C-9T priorities leading to a 3S Master Plan

Aligning with the general 9C-9T approaches and principles, and their replication in other shared river basins of the Mekong region will be attractive to donors in funding regional joint projects. A major activity of the 9C-9T Joint Project was the preparation and final endorsement of the 9C-9T Flood and Drought Master Plan; a dynamic framework setting out the joint investment and priority outputs to strengthen resilience to flood and drought within the shared 9C-9T sub-basin, with support from the Mekong River Commission (MRC) and international partners. The Master Plan comprises a 20-year strategic vision to mitigate flood and drought, a 15-year action plan and a five-year schedule and indicative budget running from 2022 to 2026. The Master plan was endorsed by the two countries in December 2021.

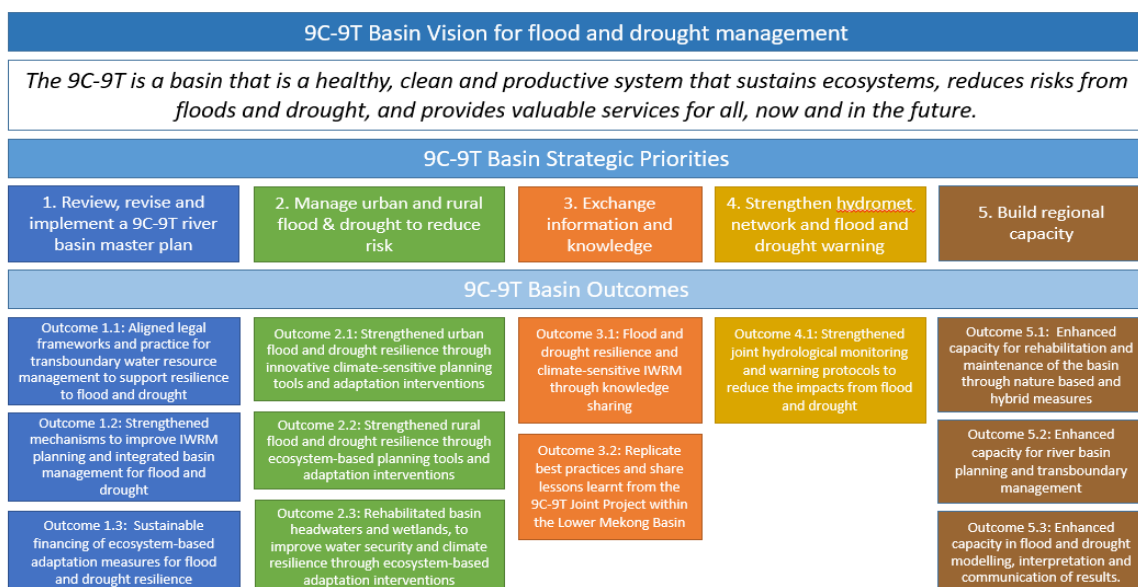
The Master Plan promotes a strategic framework and accompanying investments for basin restoration within an integrated river basin planning approach. The focus is on basin-wide rehabilitation of the watershed through nature based and hybrid solutions that build resilience in existing hard infrastructure assets such as reservoirs, canals, irrigation systems, roads and urban centres, as well as the design of planned infrastructure.

The Master Plan was developed in alignment with the National Indicative Plan (NIP) 2021-2025 prepared by each country to capture the benefits of regional cooperation according to Basin Development Strategy (BDS) for the Mekong River Basin 2021-2030 and the MRC Strategic Plan 2021-2025. It was designed to promote six areas of action common to both Cambodia’s and Thailand’s national strategic priorities contributing to integrated water resources management. These six common areas are:

1. Management of water for consumption;
2. Building water security in agriculture and industry, including irrigation systems;
3. Management of floods and drought;
4. Management of water quality and the conservation of water resources;
5. Restoring watersheds and degraded forests for sustainable water; and
6. Building effective management, administration and information systems.

The strategic framework of the Master Plan scales up investment for flood and drought resilience for five strategic priorities and associated outcomes from 2022-2026. The five strategic areas for the 9C-9T include river basin planning, regional capacity building, urban and rural flood and drought resilience, hydrometeorological and early warning and binational data sharing. These five strategic priorities and associated outputs for action from 2022-2026 are presented in Figure 26.

Figure 26: Structure of the 9C-9T Flood and Drought Master Plan to outcome level



The aim of the comprehensive 3S Joint Project in its future implementation would be to support the 3S countries in developing a Master Plan following the lessons, tools and approach taken in the 9C-9T Joint Project. The study will provide the necessary guidance for the design of the Joint Project next phases and for the development of a 3S Master Plan.

8.2.2 Opportunities for upscaling

This 3S Joint Project will be one of the first multilateral cooperation between three countries in the Mekong region to jointly plan and manage their shared sub-basins, building on the established institutional framework of the MRC and the 9C-9T experience. It is anticipated that the 3S Joint Project will engage with, learn from, and build on the successes and challenges of the 9C-9T Joint Project.

The project will promote scale-up of international good practice in joint sub-basin action planning and priority setting through integrated, inter-sectoral processes, involving a range of stakeholders (communities and the private sector where appropriate), to expand and identify opportunities for transboundary solutions to shared natural resource management and institutional challenges. Cross-sectoral and multi-level cooperation nationally and bilaterally is essential for successful implementation of IWRM, river basin planning and transboundary resilience to flood and drought.

Proposed interventions in these basins and their landscapes will provide transformative change for the entire LMB with replication of a new collaborative approach and institutional arrangements for managing transboundary rivers, which has been piloted and well demonstrated over the past five years in the 9C-9T basin with MRC facilitation and technical support.

Current ambitions by GIZ-MRC to attract international funding, through the Green Climate Fund (GCF), will support a longer-term vision and actions to ensure implementation of interventions on sustainable water resource management and climate change adaptation in the 3S sub-basin and wider LMB region.

9 FIELD MISSION PLAN

A major outcome of the Joint Project is the production of (i) a BDA, (ii) the 3S Basin Atlas and (iii) proposed measures and priority landscapes for future project design. Whilst secondary information will form most of the data and information used to inform these studies, a field mission is planned in Q4 2023 to provide more detailed primary data at selected locations within the 3S sub-basin. However, it would be advisable to organise the field mission after the landscape prioritisation process, to better inform the field mission locations with quantitative data. Also, based on the prioritisation process, field mission provinces and/or countries can be potentially revised.

It is anticipated that the field mission will be undertaken over eight days to Lao PDR (Champasak, Sekong and Attapeu provinces) – 4 days and Cambodia (Stung Treng, Rattanakiri and Monduliri provinces) – 4 days. No field visit in Viet Nam is resourced under this Joint Project but could be facilitated under other of ICEM's projects in the country and given ICEM has its headquarters in Hanoi and a significant portfolio.

The main objective of the mission will be to visit several priority landscapes to collect information on water resource management issues at the local level and check assumptions about conditions on the ground, based on advice from local authorities, communities and field inspections.

The field mission will be critical to defining the spatial scope, supporting the diagnostic and situational analysis of the sub-basin, recognising possible challenges, and helping to identify possible options for future project design. Visiting priority locations will support the initial identification of a network of possible demonstration landscapes and locations – a 'long list' (see Section 3.3) – where resilience building measures are needed, which would be built upon in future phases. It is anticipated that only a number of these possible landscapes will be visited as part of the mission.

Specific resilience building opportunities will be identified prior to the missions and will be dependent on the characteristics and setting of the selected landscapes. These may include flood and drought risk hotspots, fishery priority hotspots, at-risk biodiversity and conservation areas, water-related infrastructure, and/or areas with water quality concerns. Stakeholder engagement will ensure engagement with gender-sensitive and vulnerable groups, to understand distributional risks and impacts associated with the resilience building priorities.

During this phase of the project, data collection during the mission will focus on high-level information. This will inform requirements for further detailed investigation and conceptualisation at priority locations during future phases (i.e. when additional funding is received).

The main objectives of the mission will be to:

1. Consult with local authorities on the project and priority locations for sustainable water resource management and climate change adaptation;
2. Consult with local community representatives and groups on the project and priority locations for flood, drought and ecosystem management, which have upscaling potential;
3. Consolidate and gather further information for a network of restoration sites, the PAs and catchment area, to inform further detailing of initial concepts for hybrid and nature-based measures for flood and drought management in priority locations; and
4. Collect additional photographs and estimates of dimensions at potential target sites that could be suitable for future implementation of flood, drought and ecosystem resilience measures.

As appropriate, the field mission will include activities including:

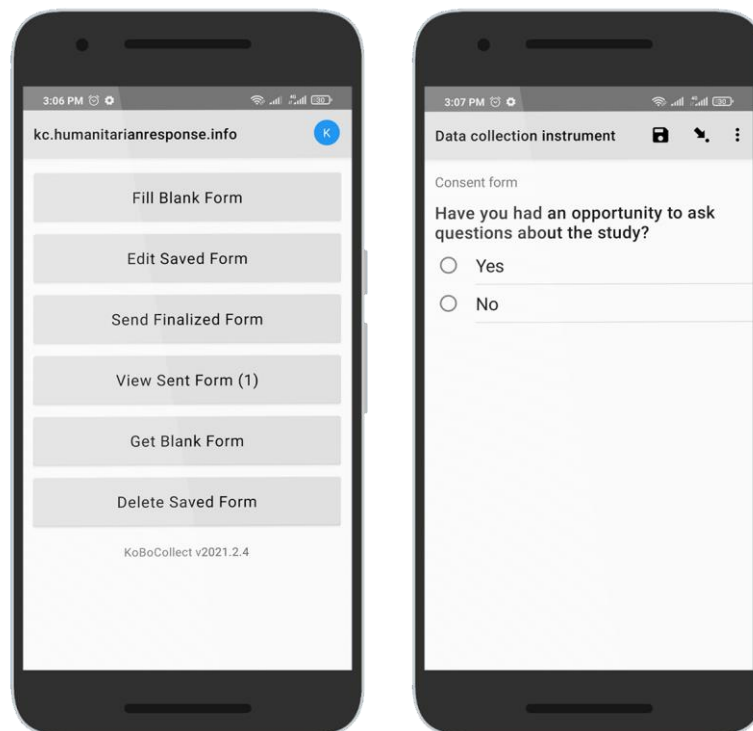
1. Round table discussion with relevant/identified provincial and local authorities;
2. Meetings and consultations with local authorities and local communities and other stakeholders at identified site locations; and
3. Field surveys of target locations (using web-based field survey forms – see below and Figure 23).

A detailed field guide will be developed before the mission outlining objectives, details of activities and outputs – and sets of survey questions. Field mission data collection will be conducted via four methods:

1. Collection of onsite observations, photos and survey information using the Kobo Toolbox Mobile Data Collection App;
2. Survey estimates of on-site dimensions using a laser distance measurer (where appropriate);
3. Onsite reporting based on field observations and discussions with local stakeholders; and
4. Roundtable meetings and discussions with provincial authorities.

A survey app will be created in KoboToolbox to complement the mission guides by providing a mobile data tool for the field team. Specific survey questions will be detailed for each location, reflecting the guiding questions of each field mission. For each of the priority locations identified, the app (sample of user interface shown in Figure 27) enables on-the-go mobile data collection, providing mobile base maps, survey forms, geotagging of photos taken at each site and quick syncing of data to cloud-based storage. Field mission results will be presented and discussed across several meetings with the NWG members.

Figure 27: User interface for KoboToolbox Mobile Data Collector App



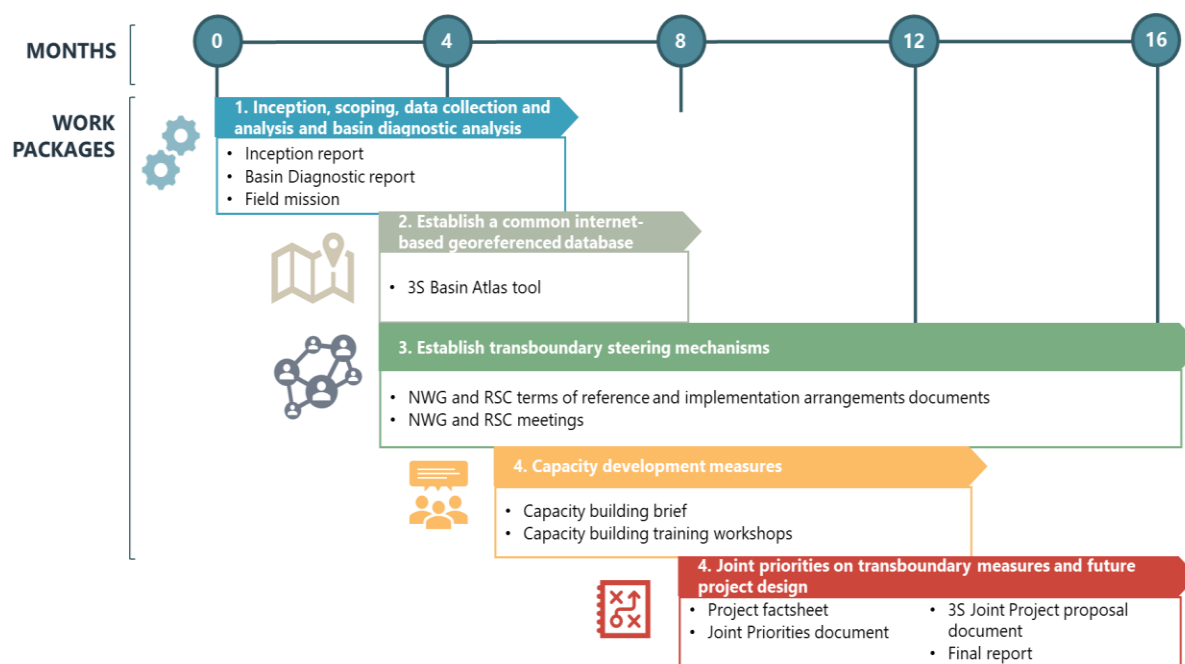
10 WORKPLAN AND SCHEDULING

The project schedule and work plan has been updated to match the updated approach recommended for each of the five work plans. The following sections describe the rationale to the project phasing, planned adaptations to achieve project outcomes, the resulting deployment of team members, and the expected milestones and reports.

10.1 Project phasing

The five WPs will be conducted as set out in Figure 28 over 17 months between May 2023 and September 2024. The initial inception phase has generated this Inception Report. The full work plan of activities, outputs and key events can be found in Annex 1.

Figure 28: Work package phasing and deliverables



MRC-GIZ's M&E system will monitor overall progress on the preparation and implementation of all Joint Project outputs over the 17-month Joint Project period (May 2023 – September 2024) and report to the RSC.

10.2 Deployment of team members

A work plan and personnel schedule showing inputs of all project team members are provided below. In addition to the core team comprising the Team Leader and five technical experts, three national coordinators (Cambodia, Lao PDR and Viet Nam) are proposed to be employed during the assignment. ICEM proposes to split the national technical and admin expert roles in each country into two separate roles. The national coordinators will take on the admin related tasks stipulated in the ToR for the national technical experts, including providing logistical, administrative and organisational support for key outputs and events. The specific tasks to be completed by each team member are detailed below.

- **Team leader, Harvey Rich (based in Viet Nam)** – Overall responsibility for the design, operation and implementation of the project; responsible for liaison and cooperation with MRC-GIZ; coordination of experts and work packages, including meetings, training, field missions, spatial outputs and technical reports; oversight of administrative processing and regular reporting to GIZ.
- **Expert 1, Jeremy Carew-Reid (based in Viet Nam)** – Lead the scoping, approach, design and conduct of technical reports, field design, training and national and regional meetings/

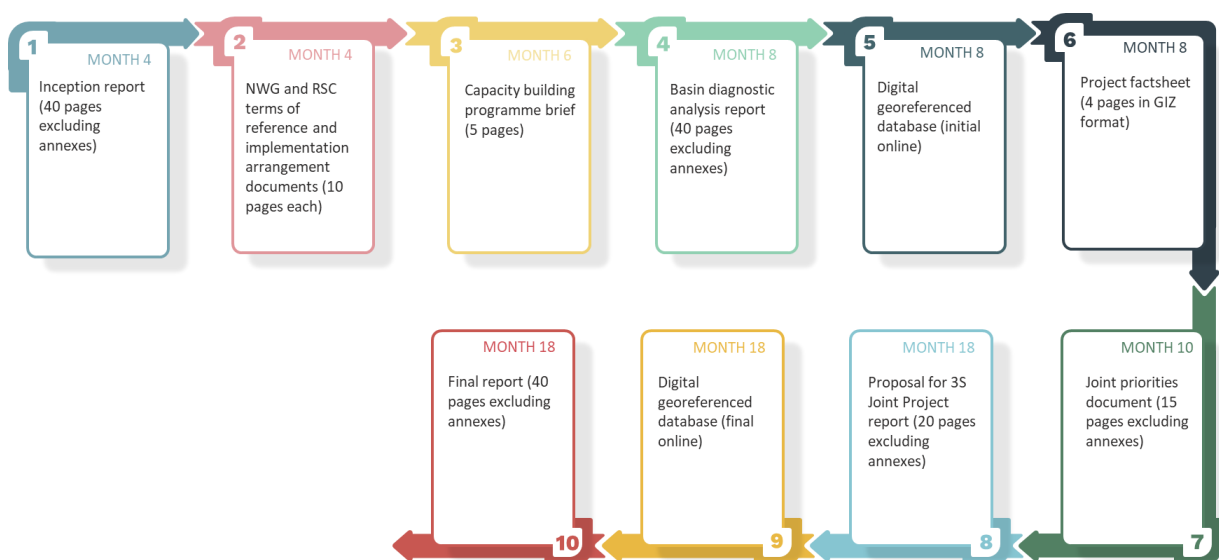
- consultations; give technical oversight, direction and support for the team on individual tasks, liaising with project management and overseeing technical aspects of project implementation.
- **Expert 2, Richard Cooper (based in Viet Nam)** – Provide technical and strategic inputs to the meetings, training, processes and reports; produce maps for the 3S and project sites and lead the spatial analysis of data; establish and develop the georeferenced data catalogue and data explorer tool.
 - **Cambodia Technical Expert 3 – Dr. Lun Sambo** – Support technical assessments; support, participate and present at national and regional events; coordinate and undertake activities at the project sites, including organizing field assessments (primary and secondary data and information collection), stakeholder consultations, meetings and workshops.
 - **Lao PDR Technical Expert 4 – Oulaphone Ongkeo** – Support technical assessments; support, participate and present at national and regional events; coordinate and undertake activities at the project sites, including organizing field assessments (primary and secondary data and information collection), stakeholder consultations, meetings and workshops.
 - **Viet Nam Technical Expert 5 – Pham Tran Minh** – Support technical assessments; support, participate and present at national and regional events; coordinate and undertake activities at the project sites, including organizing field assessments (primary and secondary data and information collection), stakeholder consultations, meetings and workshops.
 - **Cambodia National Coordinator 6 – Monireth Toy** – Provide logistical, administrative and organisational support for national and regional meetings, field missions, stakeholder consultations, trainings and reporting.
 - **Lao PDR National Coordinator 7 – Nilaphone Chanthachack** – Provide logistical, administrative and organisational support for national and regional meetings, field missions, stakeholder consultations, trainings and reporting.
 - **Viet Nam National Coordinator 8 – Nguyen Thi Phuong Thao** – Provide logistical, administrative and organisational support for national and regional meetings, field missions, stakeholder consultations, trainings and reporting.

10.3 Milestones, events and reports

Key outputs

The key outputs and their maximum page limit are outlined in Figure 29.

Figure 29: Key outputs and timeline

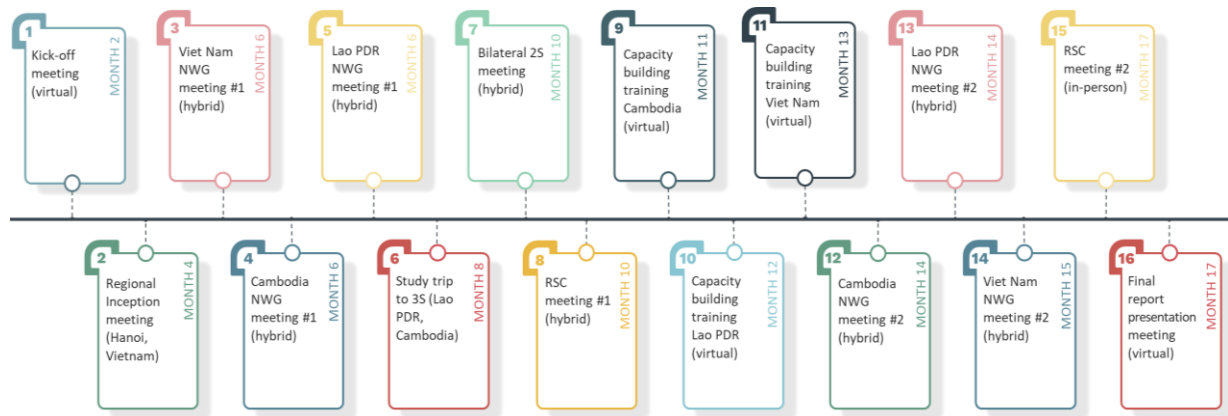


Joint Project reporting will be led by the MRC-GIZ, with feedback provided by the NMCs. All deliverables will follow MRC-GIZ style guidelines. All products will be circulated for review and comment by the NMCs and NWG at draft stages. All products will be circulated for review and comment by the Team Leader at draft stages. Comments received and actions taken in response, are documented in a ‘Comment Matrix’ and circulated to the client. Comments from MRC-GIZ on the draft outputs (and the RSC and NWG members), will be shared and outputs will be revised based on the comments received and submitted as final versions. Endorsement and approval will be provided by the RSC, wherever relevant.

Key events

The key events and timeline are outlined in Figure 30.

Figure 30: Key events and timeline



10.4 Future considerations

At the end of the study, the final report will present key outcomes and achievements, as well as lessons learnt. Key challenges will be identified throughout the 3S Joint Project development process. In most cases, it is anticipated that effective solutions can be found to overcome these problems. Lessons of implementation will inform future activities and phases of the 3S Joint Project and other joint projects established under MRC with member countries.

ANNEX 1: PROJECT WORK PLAN

		Project Period - 17 months																		
Work Package	No.	Activity	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	
Work package 1: Inception, scoping, data collection and analysis	1	Inception, scoping, data collection and analysis																		
	1.1	Data collection in the 3S in Sesan (Cambodia), Sekong (Lao PDR) and Srepok (Vietnam)																		
	1.2	Socio-economic trends, policy, planning and data analysis (including spatial mapping)																		
	1.3	Development of inception report																		
	1.4	Preparation of implementation agreements with terms of reference for NWGs and RSCs																		
	1.5	Study trip to 3S in Lao PDR (Champasak and Attapeu provinces) and Cambodia (Stung Treng)																		
	1.6	Conduct training needs assessment and design training measures for NWGs																		
	1.7	Development of Basin Diagnostic Analysis report																		
	1.8	Development of project factsheet																		
Work package 2: Establish a common internet-based georeferenced database	2	Establish a common internet-based georeferenced database																		
	2.1	Identification and selection of relevant data sets																		
	2.2	Collection and acquisition of data																		
	2.3	Data catalogue and installation and configuration of geoserver																		
	2.4	Design and development of data explorer and integration of datasets																		
	2.5	Initial handover of 3S Basin Atlas																		
	2.6	Handover/migration of final 3S Basin Atlas																		
Work package 3: Establish transboundary steering mechanisms	3	Establish transboundary steering mechanisms																		
	3.1	Prepare and organise NWG/RSC plans, logistics and materials																		
	3.2	Facilitate regional inception meeting																		
	3.3	Facilitate NWG meetings																		
	3.4	Facilitate RSC meetings																		
Work package 4: Capacity development measures	4	Capacity development measures																		
	4.1	Prepare and organise training plans, logistics and materials																		
	4.2	Facilitate training events																		
Work package 5: Joint priorities on transboundary measures and future project design	5	Joint priorities on transboundary measures and future project design																		
	5.1	Define joint priorities for the 3S sub-basin for future transboundary cooperation																		
	5.2	Discuss and agree on joint priorities at bi-lateral and RSC meetings																		
	5.3	Development of joint priorities document																		
	5.4	Identify proposed measures for future project design for the MRC Joint Project																		
	5.5	Discuss proposed measures in NWGs and RSC																		
	5.6	Development of proposal for 3S Joint Project report																		

ANNEX 2: PROJECT TERMS OF REFERENCE

ANNEX 3: DATA COLLECTION AND ACQUISITION PLAN

ANNEX 4: 3S JOINT PROJECT REGIONAL INCEPTION MEETING PPT PRESENTATIONS (AUGUST 2023, HANOI)

REFERENCES

- Constable, D. (2015). Atlas of the 3S Basins. Bangkok, Thailand: IUCN. <https://portals.iucn.org/library/sites/library/files/documents/2015-064.pdf>
- DHI Group (2023). Development of a water management system for the Sesan-Srepok river basins. <https://www.dhigroup.com/projects/improving-transboundary-water-management-in-the-mekong-river>
- Grizzetti, B., Liqueste, C., Pistocchi, A., Vigiak, O., Zulian, G., Bouraoui, F., De Roo, A. and Cardoso, A.C., 2019. Relationship between ecological condition and ecosystem services in European rivers, lakes and coastal waters. *Science of the Total Environment*, 671, pp.452-465.
- MRC. 2020. Inception Report. Joint Project on Flood and Drought Management. Mekong River Commission. Vientiane, Lao PDR.
- MRC. 2020. Mekong River Commission - Joint Project on Flood and Drought Management. Funding Roadmap. Vientiane, Lao PDR.
- MRC. 2021. A Network of Nature based Solutions for Flood and Drought Resilience of the 9C-9T Sub-basin. Initial Project Concepts. Mekong River Commission - Joint Project on Flood and Drought Management. Vientiane, Lao PDR (Draft).
- Nagabhatla, N. and Metcalfe, C.D. eds., 2018. Multifunctional wetlands: pollution abatement and other ecological services from natural and constructed wetlands. Springer.
- Pegram G., Y. Li, T. Le. Quesne, R. Speed, J. Li, and F. Shen. 2013. River basin planning: Principles, procedures and approaches for strategic basin planning. Paris, UNESCO.
- MRC (2023). The 9C-9T Basin Atlas: <https://9c9t.mrcmekong.org/>
- Vollmer, D., Burkhard, K., Adem Esmail, B., Guerrero, P. and Nagabhatla, N., 2022. Incorporating Ecosystem Services into Water Resources Management—Tools, Policies, Promising Pathways. *Environmental Management*, 69(4), pp.627-635.



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