



Mekong River Commission
For Sustainable Development

FLOOD AND DROUGHT MASTER PLAN FOR 9C-9T SUB-BASIN

Mekong River Commission - Joint Project
on Flood and Drought Management

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This Master Plan, including maps and figures appearing herein, shall be without prejudice to Cambodia and Thailand's rights with regard to land boundary under international law.

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EXECUTIVE SUMMARY

This 9C-9T Flood and Drought Master Plan is a dynamic framework setting out the joint investment and action by Cambodia and Thailand 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 9C-9T sub-basin is a shared river network flowing down to the Tonle Sap comprising both the Cambodian area called the Mongkol Borey river basin and the Thai area named as the Tonle Sap river basin. Both parts of the sub-basin, and hence the two countries, are bound together in their shared management challenges and solutions. Mitigating flood and drought is the overarching objective because of their far-reaching impacts on every aspect of life in the 9C-9T sub-basin, with the threat to become more severe as climate changes take hold. In response, this Master Plan comprises a 20 year strategic vision, a 15 year action plan and a five year schedule and indicative budget running from 2022 to 2026.

Scope

This Flood and Drought Master Plan promotes a strategic framework and accompanying investments within an integrated river basin planning approach. The strategic priority areas, outcomes and outputs of the action plan have been designed in response to the current condition of the 9C-9T sub-basin. The focus is on basin-wide rehabilitation of the watershed through nature based and hybrid solutions that reinforce and leverage existing and planned investments in hard infrastructure. Hard infrastructure itself is not included within this first phase of the Master Plan. That may change as the plan is reviewed and revised in the next planning cycle, but there would need to be a transparent and evident commitment to assessment of infrastructure projects within an integrated planning approach including adequate assessment of potential environmental, social and transboundary impacts. The Master Plan does include expanding hydromet infrastructure to improve the understanding of water resources within the 9C-9T sub-basin.

Vision in common

The shared basin vision is that:

The 9C-9T is a sub-basin that is a healthy, clean and productive system that sustains ecosystems, reduces risks from floods and drought, and provides valuable services for all, now and in the future.

The mission statement for this master plan is to combat flood and drought in the 9C-9T sub-basin by healing and rejuvenating the basin through strengthened joint mechanisms and institutions, with information and early warning to support human wellbeing and water-sensitive livelihoods and through coordinated actions to invest in a linked network of ecosystem-based adaptation with nature based and hybrid solutions across the sub-basin such that flood and drought risks and overall water security are managed within an integrated transboundary watershed approach.

This plan addresses the vulnerability of Cambodian and Thai communities within the shared 9C-9T transboundary sub-basin to the increasing frequency, intensity and impacts of flood and drought under the pressure of a growing population, climate change and watershed degradation.

Policy alignment

This Master Plan is 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 also supports achievement of international agreements as signed by both countries, including the United Nations Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), and the United Nations Framework Convention on Climate Change (UNFCCC), the Sendai Framework 2015-2030, the RAMSAR convention on wetlands, and the 2030

Agenda for Sustainable Development. Most importantly, it is 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**
6. **Building effective management, administration and information systems**

These signify a shift from focusing only on infrastructure project planning and investment to proactive basin wide planning, rehabilitation and application of IWRM approaches through cross sectoral action for solving flood and drought challenges shared by both countries. The contribution of the Master Plan outputs is mapped to these six common areas in Annex 1.

Strategic priorities

The strategic framework of this Master Plan scales up investment for flood and drought resilience in five strategic areas – 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 listed in Table 1.

Table 1 Strategic priorities for action on flood and drought resilience in the 9C-9T sub-basin

Strategic Priorities 2022-2026	
Strategic Priority 1: Review, update and implement a river basin master plan	Outcome 1.1: Aligned legal frameworks and practice for transboundary water resource management to support resilience to flood and drought.
	Outcome 1.2: Strengthened mechanisms to improve IWRM planning and integrated basin management for flood and drought.
	Outcome 1.3: Sustainable financing of ecosystem-based adaptation measures for flood and drought resilience.
Strategic Priority 2: Manage urban and rural flood and drought to reduce risk	Outcome 2.1: Strengthened urban flood and drought resilience through application of innovative climate-sensitive and ecosystem-based planning tools and adaptation interventions.
	Outcome 2.2: Strengthened rural flood and drought resilience through ecosystem-based planning tools and adaptation interventions.
	Outcome 2.3: Rehabilitated basin headwaters and wetlands, to improve water security and climate resilience through ecosystem-based adaptation interventions.
Strategic Priorities 3: Exchange information and knowledge	Outcome 3.1: Flood and drought resilience and climate sensitive IWRM through knowledge sharing.
	Outcome 3.2: Replicate best practices and share lessons learnt from the 9C-9T Joint Project within the Lower Mekong Basin.

<p>Strategic Priorities 4: Strengthen hydromet network and flood and drought warning</p>	<p>Outcome 4.1: Strengthened joint hydrological monitoring and warning protocols to reduce impacts from flood and drought.</p>
<p>Strategic Priority 5: Build regional capacity</p>	<p>Outcome 5.1: Enhanced capacity for rehabilitation and maintenance of the basin through nature based and hybrid measures.</p>
	<p>Outcome 5.2: Enhanced capacity river basin planning and transboundary management.</p>
	<p>Outcome 5.3: Enhanced capacity in flood and drought modelling, interpretation, and communication of results.</p>

Basin-wide needs

The 9C-9T sub-basin has been divided into 18 catchments so that hotspot areas for flood and drought management can be identified. Most of those sub-catchments are defined as flood or drought hotspots but it is particularly those upstream and head water areas where degraded forest conditions are creating downstream flood and drought problems. Their effective management has a critical role in moderating flood and drought extent and severity across the 9C-9T sub-basin. A network of twelve locations recommended for resilience-building measures has been mapped as a spatial starting point for future investment and implementation.

Implementation

Cross-sectoral and multi-level cooperation nationally and bilaterally is essential for successful implementation of Integrated Water Resources Management, river basin planning and transboundary resilience to flood and drought. Relevant government agencies and levels of stakeholders on both sides of the border will need to contribute to revising and implementing the action plan across the 20-year strategy. Institutional arrangements for implementation of the Master Plan will therefore retain and expand the existing governance structure established for the 9C-9T sub-basin, with bilateral cooperation between Cambodia and Thailand as facilitated by the Mekong River Commission.

Implementation of the Master Plan will be accompanied by regular Monitoring and Evaluation (M&E) against the strategic framework, overseen by the governance structure. Associated indicators will be detailed in the first stages of Master Plan implementation, with consideration to the common strategic priorities of both countries and other global best practice indicators as relevant to evaluate success.

Most outputs will require an initial phase of detailing as project-based actions through consultation and engagement with a broad range of stakeholders as implementation of the Master Plan begins. Significant stakeholder engagement will be continued to inform detailed design and as partners for implementation. These stakeholders are identified to include the public of the targeted area, community leaders and civil society, academic and research institute, NGOs and private stakeholders. In particular, prior to implementing each action, the local community in the vicinity and particularly in downstream area should be consulted to request their free, prior, and informed consent.

The funding strategy for this Master Plan is founded in national funding contributions via sectoral and agency budget of the Royal Government of Cambodia and the Royal Government of Thailand. This commitment is essential to sustainability of project activities. This national funding will be supplemented by bilateral and global funding to add momentum and scale for implementation of the identified action plan across the short-to-medium term. External funding opportunities are identified to include the Global Environment Facility, the Mekong River Commission, German Federal Ministry for Economic Cooperation and Development (BMZ) and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) via the International Climate Initiative (IKI), the Global Ecosystem based Adaptation Fund and the NAMA facility.

Risks to implementation have been reviewed with four key areas identified for proactive management by Cambodia and Thailand:

1. Shortfalls or delays in commitment of national budget contributions by the two countries;
2. Shortfall or delay in commitment of international funding support;
3. Data sharing protocols are not fulfilled in a timely manner to facilitate joint integrated assessment, planning and hazard warning; and
4. Cross-sectoral engagement in integrated, basin-wide implementation of the Master Plan is not achieved in a timely manner.

An adaptive approach will be taken to pursue progressive implementation with the support of the MRCS and within available resources.

1 Introduction

This master plan for flood and drought management in the 9C-9T sub-basin presents a 20 year strategic vision, a 15 year action plan and a five year schedule and indicative budget running from 2022 to 2026. The plan provides the framework for resource mobilisation and implementation of activities by Cambodia and Thailand to strengthen resilience to flood and drought within their shared sub-basin. This master plan is to be reviewed and revised every five years during its implementation to ensure it remains responsive to the priorities and needs of the two countries. The 9C-9T sub-basin planning cycle needs to be locked into the national, sector and local development planning and budgetary cycles of Cambodia and Thailand. Relevant government agencies and levels of stakeholders on both sides of the border will need to contribute to revising and implementing the action plan across the 20 year strategy.

9C-9T sub-basin is an unusual name for a shared river network flowing down to the Tonle Sap. It is a major river basin in its own right – but the name comes from its place in the hierarchy of the Mekong River’s hydrological system with its many tributaries. The Cambodian area of the 9C-9T is called the Mongkol Borey river basin and in Thailand it is the Tonle Sap river basin. Both parts of the sub-basin, and hence the two countries, are bound together in their shared management challenges and solutions. Mitigating flood and drought is the overarching objective because of their far reaching impacts on every aspect of life in the 9C-9T sub-basin, with the threat to become more severe as climate changes take hold. Key drivers of flood and drought (Section 2.3) have been identified as population growth and associated pressures, largely uncoordinated hard infrastructure development altering hydrological function, and climate change exacerbating watershed degradation. Responding to this challenge requires both countries to work together in breathing ecological health back into this shared sub-basin which has degraded to such an extent that it is impeding economic development and social well-being.

Cambodia and Thailand initiated a collaborative governance structure for the 9C-9T sub-basin in 2018 under the auspices of the Mekong River Commission, with cross sectoral national working groups established in both countries and a high-level Regional Steering Committee co-chaired by the Cambodian Ministry of Water Resources and Meteorology (MOWRAM) and the Thai Office of National Water Resources (ONWR). This Master Plan has been prepared by this collaborative structure to reflect and integrate the work of the two countries to date, with a clear plan for implementation starting from 2022. It provides the strategic framework to scale up investment for flood and drought resilience of the 9C-9T sub-basin in five strategic areas – river basin planning, regional capacity building, urban flood and drought resilience, hydrometeorological and early warning and binational data sharing.

The Master Plan is a dynamic framework for joint investment and action supported by the Mekong River Commission (MRC) and international partners. The Master Plan is 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. Yet, it is primarily a bilateral vehicle for collaboration, funding and joint action by Cambodia and Thailand. The aim is for the Master Plan to be approved by the Regional Steering Committee in December 2021 and then by national Cabinets - a necessary high level endorsement given its critical internal and national importance and the need to fully harness national resources for its implementation.

This Master Plan is structured as two major parts following this Section 1 Introduction and Section 2 Purpose and Scope. Section 3 is the first part and provides a situation assessment of the 9C-9T sub-basin status and characteristics. This includes a description of the key drivers of flood and drought and the current government response as the underlying basis and rationale for this Master Plan. Section 4 then sets out the strategic framework and action plans for building flood and drought resilience in alignment with the national strategic priorities for water resources that are common to both

countries, the BDS 2021-2030, and international commitments of relevance to flood and drought. The plan comprises the vision statement, strategic priorities and desired outcomes followed by a detailed action plan for the 9C-9T sub-basin. Also, guidance on implementation is provided for institutional arrangements, funding and monitoring and evaluation of the efforts by the two countries in meeting the objectives of the plan.

2 Purpose and scope

This Master Plan is the integration of the collaborative work on flood and drought resilience by Cambodia and Thailand since the beginning of the Joint Project in 2018. This Master Plan commits the two countries to strategic priority areas and the accompanying action plan, as identified through this joint planning process, to rehabilitate the watershed of the 9C-9T sub-basin as the foundation for flood and drought resilience. Detailing of the action plan's outputs, the delegation of responsibilities within the binational governance structure, and the preparation of associated feasibility studies are all tasks to be conducted within the implementation phase. This will include detailed studies of transboundary impacts and preparation of environmental impact assessment and approvals as required under the national legislation of each country.

The identified strategic priority areas, outcomes and outputs of the action plan have been designed in response to the current condition of the 9C-9T sub-basin. The focus is on basin-wide rehabilitation of the watershed through nature based and hybrid solutions that reinforce and leverage existing and planned investments in hard infrastructure. Further detail on existing and planned infrastructure will be added to the 9C-9T Basin Atlas, the shared database underlying preparation of this Master Plan, on a progressive basis as the necessary data is provided by both countries.

This Flood and Drought Master Plan promotes a strategic framework and accompanying investments as identified within an integrated river basin planning approach. While a basin master plan could usefully include all infrastructure currently under consideration, this first five year planning cycle is focused on basin rehabilitation through nature and ecosystem based actions in headwaters, and in urban and rural landscapes. The Master Plan does not include hard infrastructure development. In the next five year planning cycle, the detail of pipeline plans from both countries would need to be shared, discussed and fully assessed for environmental, social and transboundary impacts within an integrated basin wide approach. Such environmental assessments are included as outputs in this current Master Plan. Then, planned hard infrastructure could be progressively included in future planning cycles. This Master Plan does include hydromet infrastructure as required to improve foundational hydrological information for the 9C-9T sub-basin.

3 Situation assessment

3.1 The joint project cooperation

In 2018, the Cambodian and Thai governments initiated a bilateral cooperation under the *Joint Project for Transboundary Cooperation for Flood and Drought Management in the Cambodian and Thai Border Area*¹ (the Joint Project). This joint project is the first bilateral cooperation for management of flood and droughts in a transboundary sub-basin within the Mekong region. The cooperation is facilitated by the Mekong River Commission with support from Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) on behalf of the German Ministry for Economic Cooperation and Development (BMZ) until 2024. Each country established a National Working Group for the 9C-9T sub-basin to provide technical advice to a Regional Steering Committee involving a broad range of line

¹MRC, 2018. Media Release: Mekong River Commission launches two joint projects to better manage the Mekong Basin resources and address flood and drought issues. News, 17 Jan 2018. MRC, Vientiane. URL: <http://www.mrcmekong.org/news-and-events/news/launches-two-joint-projects-to-better-manage-the-mekong-basin-resources-and-address-flood-and-drought-issues/>

agencies and chaired jointly by MOWRAM and ONWR under the auspices of the MRC. The Joint Project is reflected in the National Indicative Plan (NIP) 2021-2025 for each country for implementation of the MRC Strategic Plan 2021-2025 and the Basin Development Strategy for the Mekong River Basin 2021-2030.

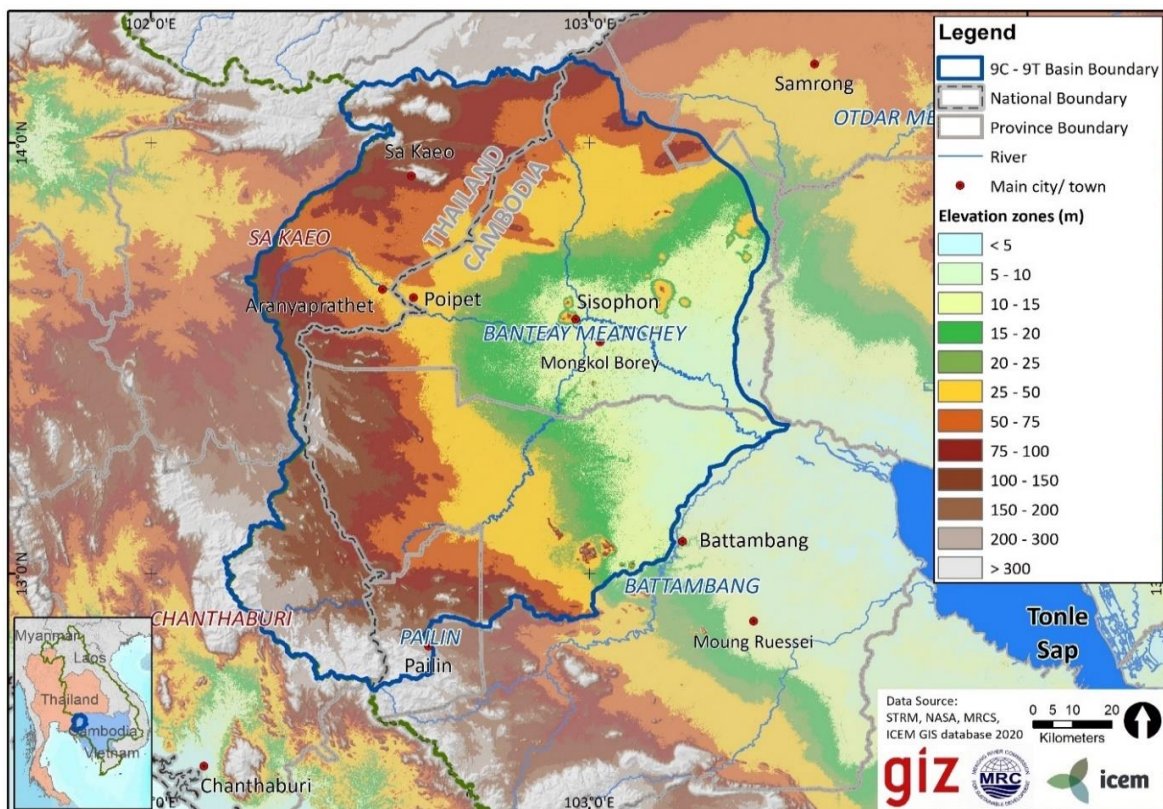
Phase I of the Joint Project ran from 2018 to 2019 and established the joint governance mechanism while preparing an assessment of the sub-basin. Three technical reports were produced to identify the current state of flood and drought risks, and five priority areas for action and propose a set of mitigation project concepts requiring either full integration between the two countries, coordination of activity, or local implementation. These priority areas and classifications are reflected in the Master Plan.

In October 2019, Cambodia and Thailand launched a second phase of the Joint Project which runs until December 2021. This cooperation has progressed with flood, drought and climate change modelling, ecosystem health assessments, and the definition of hot spot areas and projects on a spatial basis. This Phase II cooperation has already begun implementation of the five priority areas through development of a web-based shared platform for information and data, the 9C-9T Basin Atlas, by conceptualization of a network of nature based measures to build flood and drought resilience within the watershed, and through preparation of a joint roadmap for preparation of a river basin master plan.

3.2 Status of the basin

The project focuses on the 9C-9T sub-basin shared by Cambodia and Thailand (Figure 1). The 9C-9T sub-basin covers 14,952 km² with about 27.3% of the area located in Thailand (called the Tonle Sap basin). The larger part of the sub-basin to the south-east, named the Stung Mongkol Borey basin of Cambodia, covers an area of 10,866 km² or 72.7% of the total stretching across the ‘rice bowl’ of Battambang province, neighbouring Banteay Meanchey province and Pailin province.

Figure 1. 9C-9T sub-basin boundary and elevation zones



A comprehensive baseline of the basin status can be found on the *9C-9T Sub-basin Atlas*. The following sub-sections provide summaries of the basin’s social, economic, environmental and climate change status and trends extracted from the 9C-9T Sub-basin Atlas if otherwise the sources will be indicated.

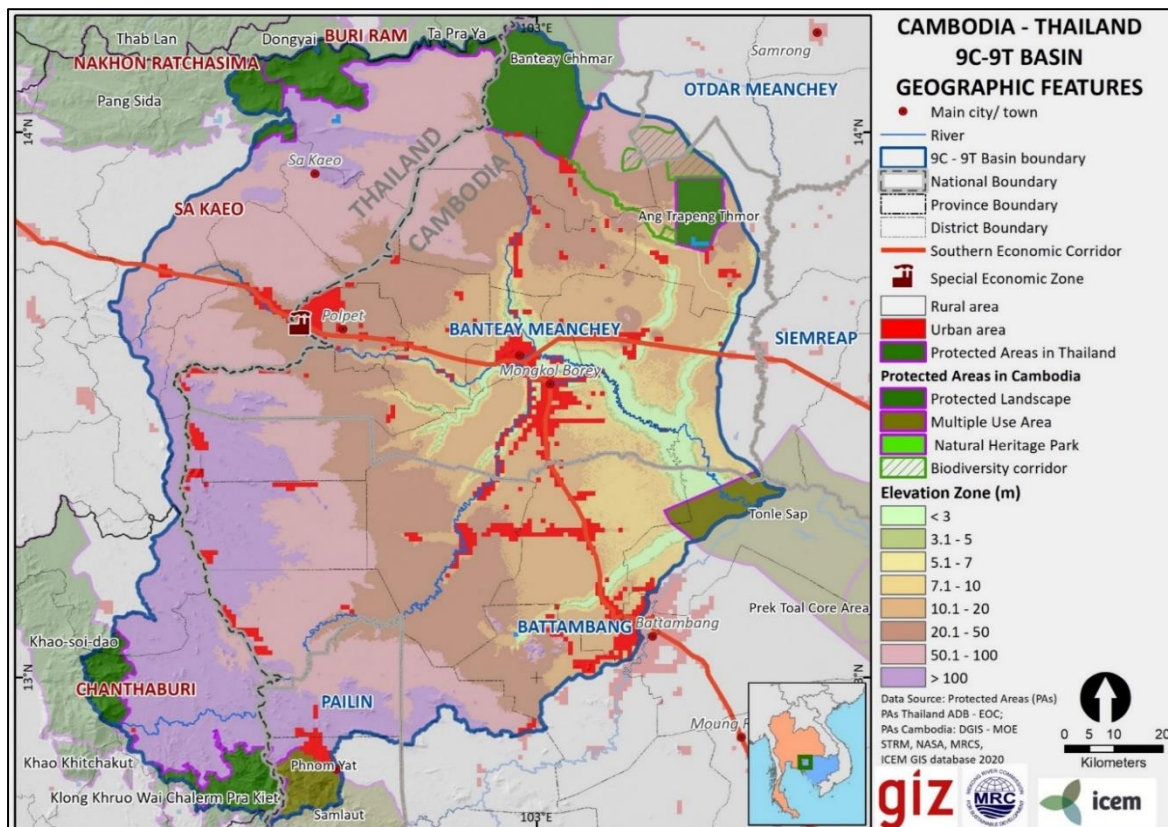
3.2.1 Environment

The sub-basin is an important contributor to sustaining ecosystem services and aquatic biodiversity in the Tonle Sap Lake. National parks (Ta Phraya and Pang Sida) and other designated protected areas are in the headwaters of the various sub-basin tributaries mainly located in the Thai provinces (Figure 2). Their effective rehabilitation and maintenance is of critical concern to Thailand and for Cambodia downstream. Protected areas within upper elevations of the Cambodian area include the Samlaut Multiple Use Area, Ang Trapeng Thmor and Banteay Chhmar Protected Landscapes. The first is an important watering site for the endangered Eastern Sarus Crane.

These areas feed multiple rivers that flow from the upper watershed areas in Cambodia and Thailand down across the 9C-9T sub-basin to the Tonle Sap Multiple Use area near its the outlet before continuing into the Tonle Sap Lake. This combined biodiversity landscape is of global importance and an essential facet of effective flood and drought management in the sub-basin. Land use alteration and degradation of ecosystems has occurred throughout the 9C-9T with significant loss of forests and wetlands in the past 30 years. Land use within the sub-basin is dominated by cropping, particularly within Sa Kaeo province in Thailand and throughout the Cambodian area. There is a large rice-growing region surrounding Battambang. Agriculture is a major consumer of water within the sub-basin and is acutely vulnerable to drought.

Water quality across the 9C-9T sub-basin is variable due to uncontrolled development and pollution in urban areas, use of agricultural chemicals, loss of most vegetative cover that would provide some natural filtration and inadequate infrastructure for wastewater and waste management. Flooding spreads contaminated waters into agricultural areas and during drought pollution is concentrated in creeks, rivers and reservoirs.

Figure 2 Key geographic feature within the 9C-9T sub-basin



3.2.2 Economic

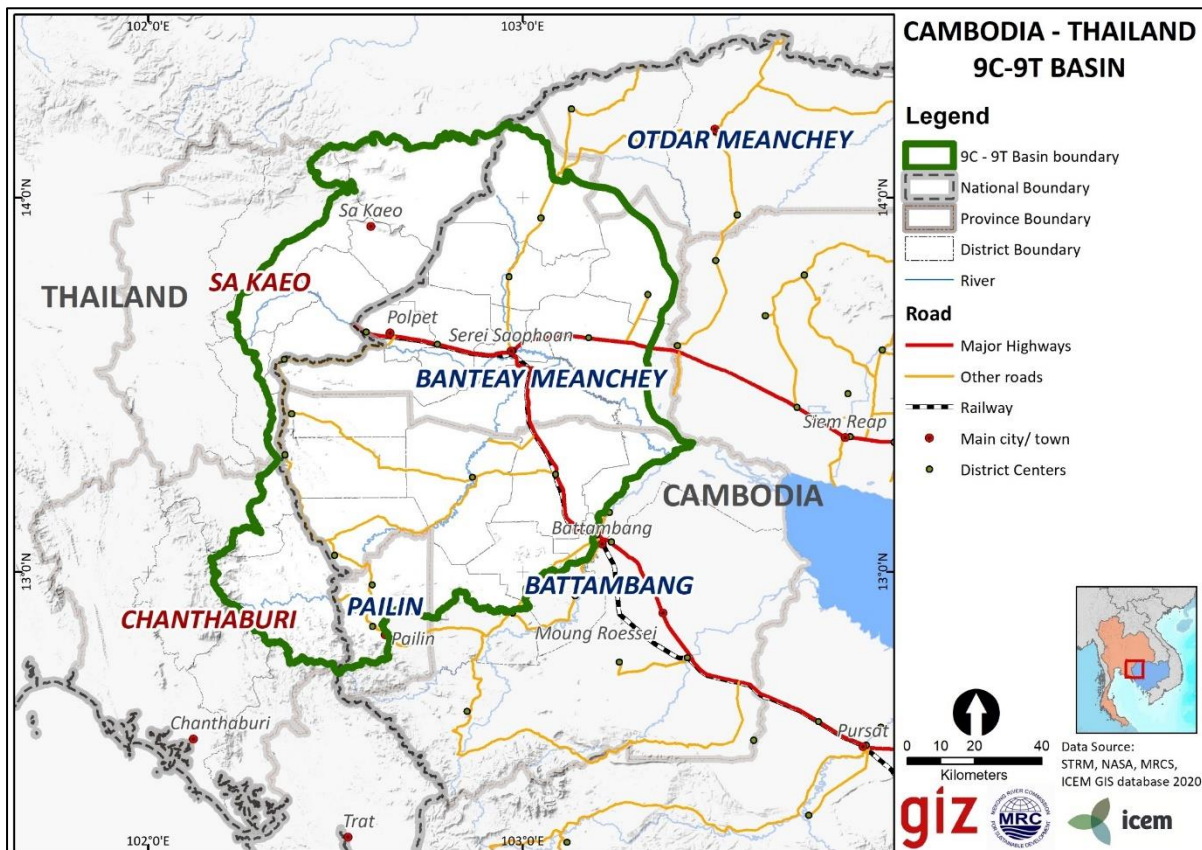
GDP Annual Growth Rate in Thailand averaged 3.68 percent from 1994 to 2019. In 2011, the nation gained upper middle income status. Cambodia graduated to lower middle income status in 2015 and between 1998 and 2018 sustained an average growth rate of 8%, making it one of the fastest-growing economies in the world. In 2019, growth remained at 7.1%.

Most residents within the 9C-9T sub-basin are engaged in livelihoods linked to agricultural production. In Cambodia, Battambang and Banteay Meanchey provinces are among the top agricultural producers of rice, and Battambang is the leading province for maize and cassava. Tourism including the attraction of natural areas, natural parks and cultural heritage is another important foundation of the economy in both countries.

The 9C-9T sub-basin has economic importance with two Special Economic Zones (SEZs) located at the Cambodia-Thai border - Cambodia's Poipet and Thailand's Aranyaprathet. The border between these two zones is the busiest crossing between Cambodia and Thailand, connecting the cities of Siem Reap and Battambang with Bangkok. The highway from Siem Reap is part of the Greater Mekong Subregion Southern Economic Corridor which meets the major highway from Battambang at the urban centre of Sisophon. Poipet and Aranyaprathet SEZs are fast-expanding areas for development and major hubs within their provinces. Another urban centre on the Thai side with a similar population to Aranyaprathet city is the provincial capital city of Sa Kaeo.

Figure 3 shows the economic and transport corridor crossing the border of the two countries.

Figure 3 Administrative boundaries of the 9C-9T sub-basin



3.2.3 Social issues

The 9C-9T sub-basin is home to 1.4 million people. 0.35 million residents live in the Thai area within Sa Kaeo Province to the north and Chanthaburi Province to the south. The Cambodian portion is home to 1.05 million residents. Population density is focused along major transport corridors, major urban areas and along the border between the two countries.

The districts along with international border in Thailand have a relatively high number of migrant workers. There is significant migration of Cambodian citizens – mostly men – seeking work in Thailand. Environmental shocks have a role in driving this migration, particularly following droughts and crop losses although better wage conditions and lack of land ownership are also drivers.

Rural women are important players in the rural economy and are responsible for 80% of food production. They make up 51% of the primary workforce in subsistence agriculture, and 54% of the workforce in market-oriented agriculture.

Despite rapid economic development in Cambodia and Thailand in the past 10 years, poverty rates within the 9C-9T sub-basin are still significant. Mapping of commune poverty rates in the Cambodia as of 2015 shows a rate of at least 15% of households within the 9C area, with the exceptions of Battambang and Serei Sisophon communes. Thailand has a national reported poverty rate of approximately 9% in 2017² but provincial-level mapping indicates that Sa Kaeo and Chanthaburi provinces have higher poverty rates than surrounding provinces, at 15-20% of households.

3.2.4 Climate change

Climate change is changing the frequency and severity of flooding and drought events and creating new challenges for water security. The MRC climate change projections used three Global Circulation Models (GCMs) and a range of scenarios for the Lower Mekong Basin. The IPSL-CM5A-MR model gives the greatest seasonal variability in results and is described here using the RCP 8.5 scenario to 2050. The climate changes in the 9C-9T sub-basin are most likely to fall within this the broad range of projections.

Climate change-induced impacts on precipitation will likely vary spatially across the 9C-9T sub-basin and seasonally. Dry season precipitation by 2050 (Figure 4) is projected to decrease across most of the central and western regions of the sub-basin with most extreme reductions of around 11% in the north. At the same time, average maximum temperatures during the dry season are projected to increase significantly across the sub-basin by around 2.4°C.

In the wet season, precipitation in the Cambodian area is projected to increase especially towards the east up to around 5% (Figure 5). Yet, in the Thai upper watersheds of the sub-basin, precipitation will remain the same or even decrease slightly. Rainfall is expected to be distributed less evenly and arrive in more intense events by 2050. These trends indicate an increased severity of flood and drought events with climate change.

² NESDC in <https://blogs.worldbank.org/eastasiapacific/reducing-poverty-and-improving-equity-thailand-why-it-still-matters>

Figure 4 Change in precipitation during the dry season by 2050 in the 9C-9T sub-basin

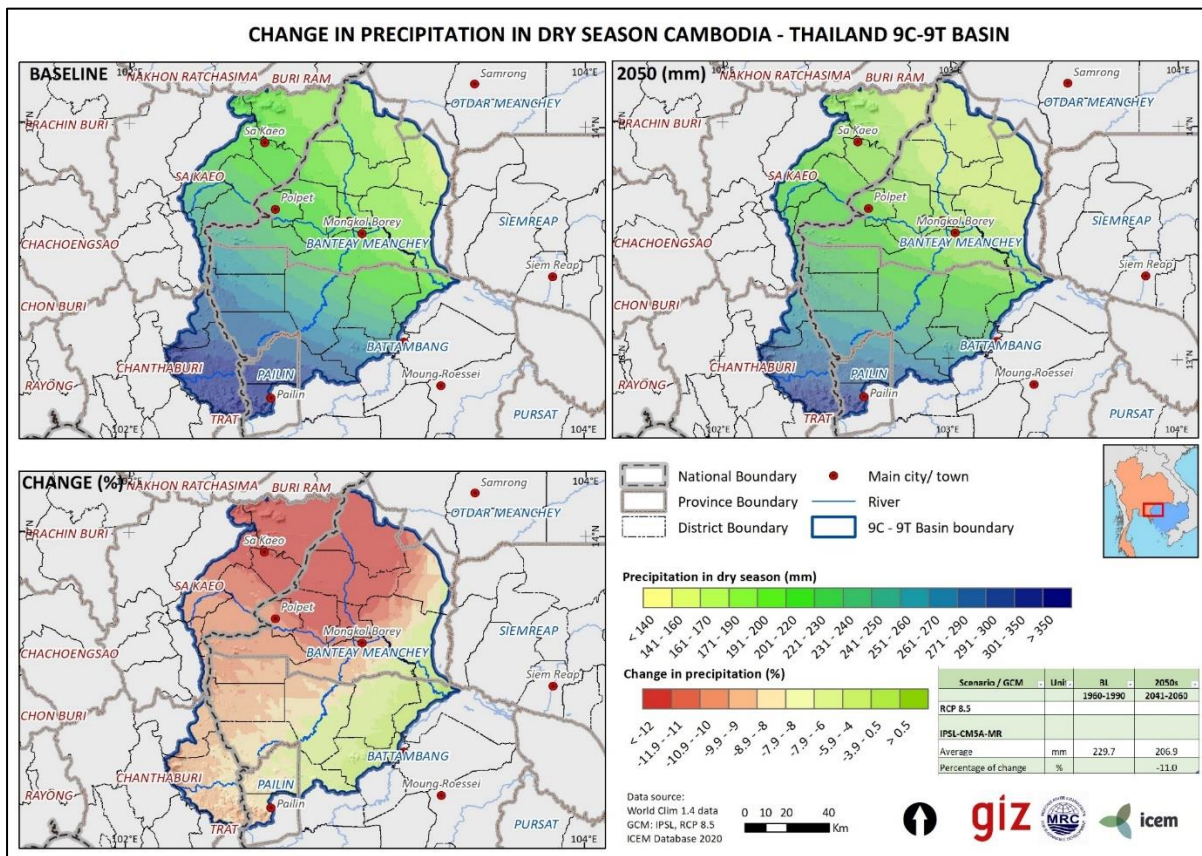
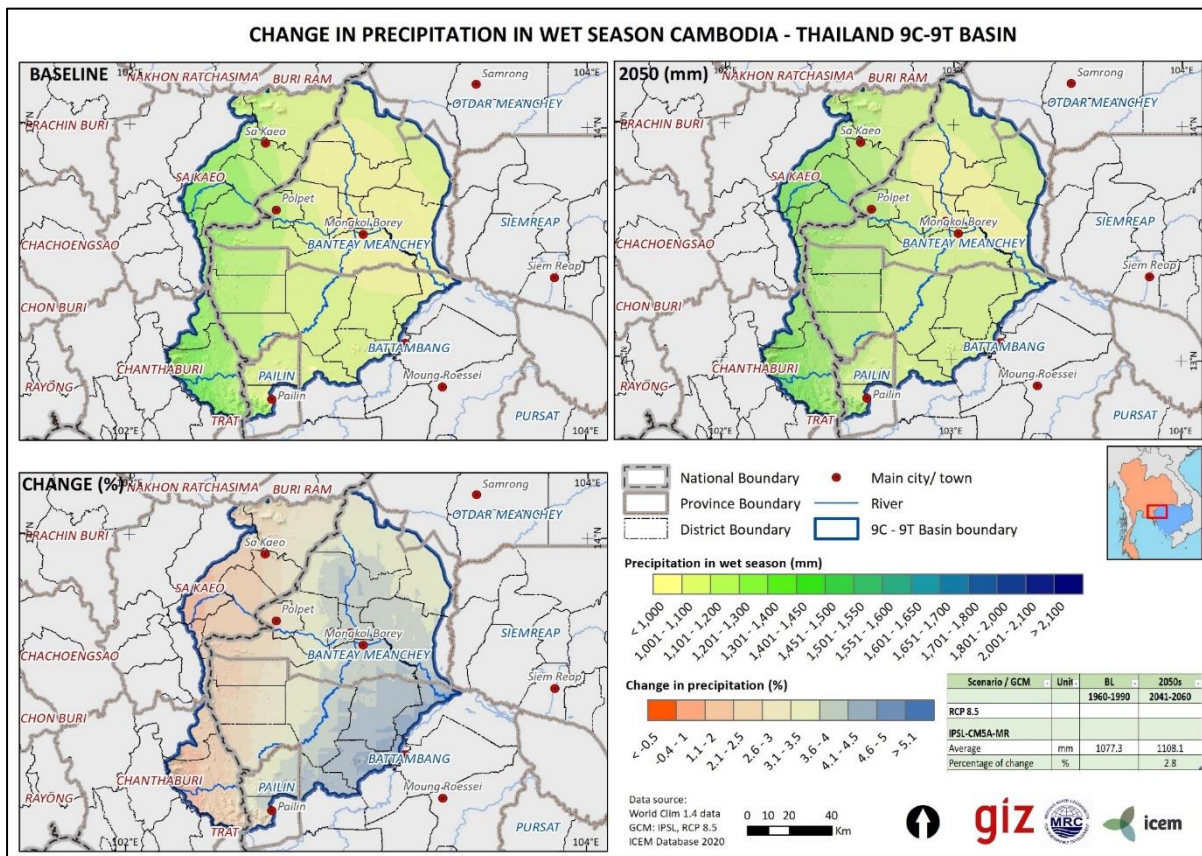


Figure 5 Precipitation during the wet season in the 9C-9T sub-basin by 2050



3.3 Drivers of flood and drought risk

The rivers and freshwater resources of the 9C-9T sub-basin provide drinking water, ecosystem services, aquatic and terrestrial biodiversity that are central to ecological sustainability of the Tonle Sap Lake and sustain the livelihoods of 1.4 million residents from agriculture, industry, fisheries, tourism and expanding commercial and trade activities. Largely uncoordinated development activity has contributed to the major challenges of increasing intensity, frequency and severity of floods and droughts within this sub-basin. Both riverine flooding resulting from overtopping of waterways and lakes, and flash flooding caused by the high runoff of rainfall in the local vicinity are concerns in the basin. In terms of drought, low water levels in rivers and lakes resulting from hydrological drought and damagingly low soil moisture as experienced with agricultural drought are the key concerns to be addressed. The floods of 2011 and 2013 and major El Nino drought events of 2015-2016, and again in 2019-2020 resulted in loss of life and significant livelihood and economic damages in the sub-basin. Regular flooding is also experienced at the Special Economic Zones (SEZ) of Aranyaprathet and Poipet either side of the Cambodian-Thai border in the upper part of the sub-basin. These challenges highlight the importance of a transboundary approach to flood and drought management by the two countries and of equal commitment to integrated water resources management.

Phase II of the 9C-9T Joint Project has conducted an expanded situation analysis of flood and drought pressures, spatial characterization of the basin and high-resolution hydrological modelling. Building on the flood modelling conducted in Phase I, this analysis identifies three key drivers of flood and drought risk in the 9C-9T sub-basin:

- (i) population pressure including encroachment of land use and increasing demand;
- (ii) uncoordinated and poorly assessed hard infrastructure development; and
- (iii) impacts of climate change.

All three key drivers contribute to serious watershed degradation and associated risk for both flood and drought. A healthy, vegetated watershed acts like a sponge to retain water in the upper catchment and release it to the lower catchment over time. The pressures of population growth, hard infrastructure development and climate change are degrading this capability leading to a 9C-9T sub-basin with reduced natural infiltration and storage capabilities, increased runoff of rainfall into downstream areas, and hastened erosion and sedimentation. These trends worsen water quality, reduce water security, and increase flooding potential. They are aggravated by climate change.

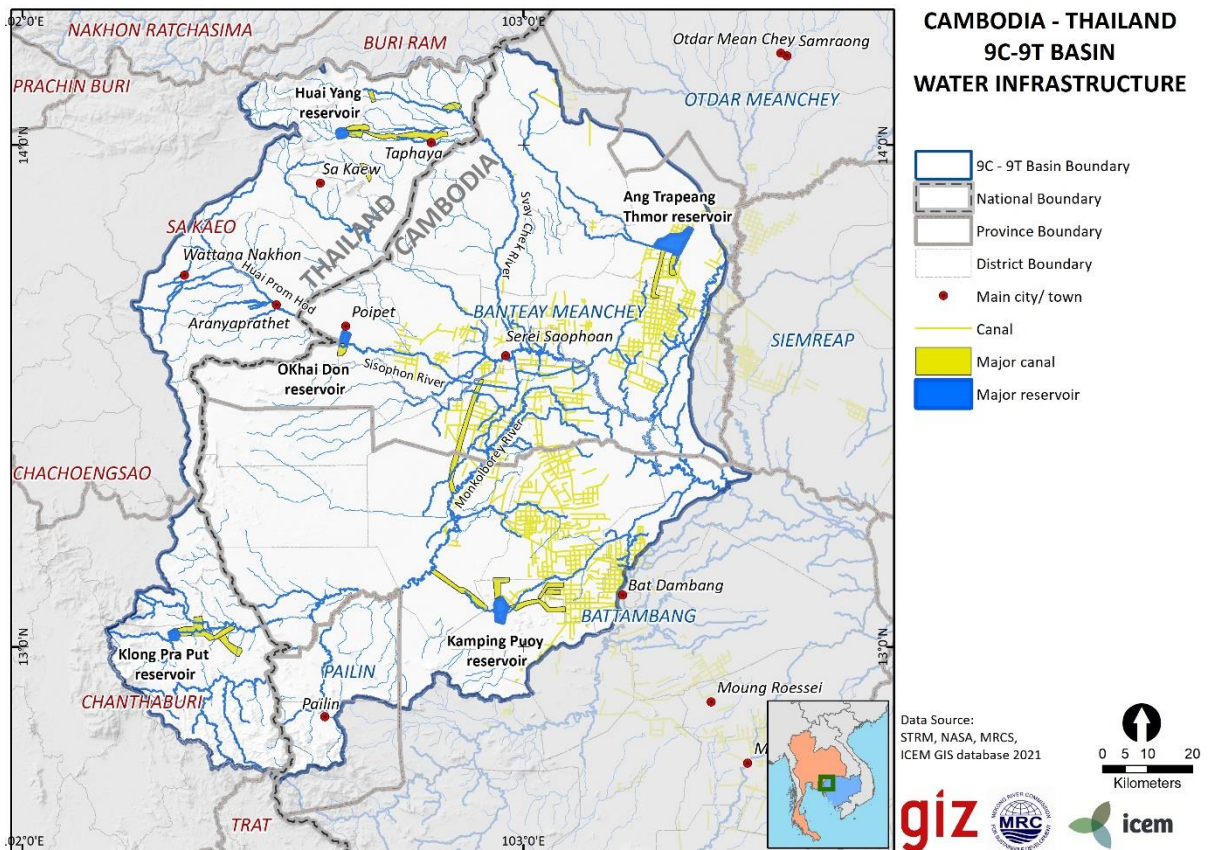
3.3.1 Population growth

Population growth is placing pressures on sub-basin land and water resources. Rapidly expanding urbanization and population growth within the sub-basin, particularly at Aranyaprathet in Thailand and Poipet in Cambodia, are increasing flash flooding and water demand. A lack of integrated spatial planning to accommodate this population growth is contributing to increasing encroachment on natural areas – forests, wetlands and waterways. In turn this reduces the capacity of those natural systems to buffer flood and drought impacts.

3.3.2 Hard infrastructure development

Hard infrastructure development throughout the basin has occurred in a largely uncoordinated manner, with projects moving forward on an ad hoc basis promoted by single agencies and without catchment wide cumulative assessment and planning. This piecemeal approach to development has fragmented the hydrological connectivity of the watershed leading to unexpected and unplanned impacts – and the steady degradation of the basin creating and exacerbating flooding and droughts. Existing water infrastructure within the 9C-9T sub-basin is shown in Figure 6.

Figure 6 Water infrastructure within the 9C-9T sub-basin



There is no effective assessment of upstream/downstream implications of these infrastructure projects or of their cumulative effects, especially for large scale dams and reservoirs, and the hundreds of small scale existing and planned projects which tend to fall under the radar for environmental impact assessment. The limited integrated planning and transboundary impact assessment of development fails to ensure benefits are derived for both countries upstream and downstream. The river basin committees that have been established for the 9T Tonle Sap in Thailand and for sub-basins neighbouring to Stung Mongkol Borey basin in Cambodia currently lack the cross-sectoral membership required to facilitate integrated water resources management. The lack of alignment between policy and process for river basin planning in the two countries means that opportunities to cooperate and consult are unclear in practice. As a result, flood and drought resilience is not mainstreamed across land use and development planning across the rural and urban landscape.

3.3.3 Climate change

Climate change is projected to change precipitation and temperature patterns and to increase the intensity of flood and drought events, hastening deterioration of land and natural resources under current management practices. Building resilience to climate change is critical to reducing the risks of flood and drought and ensuring the long-term health of ecosystem services, livelihoods and communities in this shared sub-basin.

Watershed protection and rehabilitation is essential in countering these forces. Particularly important is the rehabilitation and effective management of forest landscapes in the upper watersheds and of the drainage corridors within agricultural areas of the main basin with an emphasis on ecosystem based approaches. Similarly, the rapidly expanding urban areas require careful spatial planning, water-wise innovation and greening to reduce the risks of floods, droughts and worsening environmental conditions. A healthy watershed will improve the resilience and productivity of existing

and planned infrastructure by helping to moderate the flow of water and sediments and reducing the need for intensive maintenance.

There is little on the ground investment in ecosystem-based adaptation to climate change via restoration of watersheds and protected areas within the 9C-9T sub-basin or neighbouring areas. Most investment goes to reservoirs and irrigation systems and transport infrastructure which suffers the effects of increasing watershed degradation, erosion, sedimentation and flood damage. Investments in the Tonle Sap Lake just downstream of the 9C-9T sub-basin are also threatened by the degrading landscape and water resources of the 9C-9T sub-basin and associated floods and droughts.

There is an opportunity to implement nature-based solutions as essential measures for complementing and improving the longevity of hard infrastructure investments while restoring and rehabilitating the watershed, providing multi-benefits to livelihoods, urban livability, gender and social equality, biodiversity and climate change adaptation. Implementation of nature-based solutions is a priority investment to build the basin resilience to flood and drought.

3.4 Responses and opportunities

Both governments are responding to the challenges of flood and drought with increased commitment to integrated water resources management alongside the ongoing development of hard infrastructure at all scales. This action includes mandating and strengthening of river basin-scale planning, investments in climate change adaptation and attention to cross-sectoral and multi-level cooperation. In combination with action to offset the three key drivers of flood and drought, this baseline response underpins the rationale for the 9C-9T Flood and Drought Master Plan.

3.4.1 River basin planning

Both countries have updated their legislative commitment to integrated water resources management and river basin management planning. In Cambodia, this commitment is expressed through the 2015 Sub-decree on River Basin Management under the Law on Water Resources Management (2007) implemented by MoWRAM. In Thailand the approach is embraced in the Water Resources Act 2018 and associated regulations in 2019 to be coordinated and supported technically by ONWR. Implementation of the Thai Act is guided by the 20-year Master Plan on Water Resources Management (2018 – 2037), including a commitment under Strategy 5 for the “conservation and rehabilitation of degraded watershed forests and soil erosion protection”.

These legislations mandate the establishment of river basin committees and preparation of a plan for each river basin, supported by a national-level committee. A river basin plan has been prepared for the Thai portion of the 9C-9T sub-basin, and a 9T Tonle Sap River Basin Committee is operating. Thai river basin plans are reviewed and prepared for each river basin every five years with appropriate sectors contributing to their implementation and budgeting. Cambodia has a similar intention to establish river basin committees and prepare basin plans, however, there have been challenges in both countries to truly harness cross sector engagement in plan implementation and to move beyond a project list approach to one which is based on integrated planning.

In Cambodia, one basin plan was approved in 2015 for a neighbouring sub-basin, yet no new plans have been prepared and approved since the 2015 Sub-decree. Cambodia intends to develop river basin master plans for all 39 river basins. Yet there is no river basin committee or plan for the Cambodian portion of the 9C-9T basin. For the Thai portion there is a draft Water Resources Management Master Plan (2020-2037) for the Tonle Sap River Basin released in September 2020 including an annual action plan for the 2020-2022 period.

The need to move beyond listing of infrastructure projects to IWRM plans is recognized by ONWR which has initiated strategic environmental assessments (SEA) for every river basin in Thailand to better-inform the planning process. The newer basin plans now include objectives and actions responding to each of the six strategic areas of the national 20-year Water Resources Master Plan. It

is intended that the next iteration of basin plans will be shaped by the SEA process. In Cambodia, the planning framework for river basins is not clearly articulated. A commitment to SEAs is included in the new draft Environment and Natural Resources Code that has been in development by the Ministry of Environment since 2015 but is not yet legally linked to river basin planning and management.

While gender sensitivity is increasingly mainstreamed within government agencies, consideration to other vulnerable groups can be strengthened. More emphasis is needed to express these principles within sectoral and basin planning. A further significant gap remains regarding the monitoring and evaluation for basin plans - particularly in Cambodia. Since its approval in 2015, there is no obvious progress on implementation of the one existing basin plan prepared in Cambodia for Strung Sreng. Community involvement in basin management and monitoring in both countries needs to be strengthened.

3.4.2 Investments in water sector hard infrastructure

Cambodia and Thailand are making significant infrastructure investments in irrigation, drainage and water supply infrastructure within the 9C-9T sub-basin. For the water sector, both countries have area-based development master plans that continue to emphasize a single sector approach to hard infrastructure investments primarily for increasing irrigated areas or drainage infrastructure without adequate environmental assessment and safeguards. As a result, current investments responding to flood and drought are heavy on hard infrastructure and lack cross-sectoral consideration and assessment of cumulative impacts as required for integrated water resource management.

In Cambodia, MoWRAM has ongoing and planned projects to rehabilitate existing irrigation infrastructure and build new large scale reservoirs within the 9C area. These include Korean-supported plans for Sisophon in Banteay Meanchey province, and ADB-supported infrastructure for Poipet SEZ including development of a wastewater treatment plant and upgrading stormwater drainage canals.

Thailand has prepared the 15-year Huai Phrom Hoad Basin Master Plan covering Aranyaprathet District in Sa Kaeo Province and identified 162 projects as responses to flood and droughts in the basin and SEZ within it. Measures include dredging and weeding programmes for various reservoirs, repair of irrigation systems, and strengthening drought-related water allocation plans. 'Soft' accompanying measures are also proposed to improve reservoir management and improve flood-related alerts, cooperation and information systems.

Major rivers through Aranyaprathet are being assessed by the Marine Department for dredging to improve drainage and reduce overbank flooding, with plans targeting implementation by 2030. Recommendations from a study of flood planning and flood mitigation for the Tonle Sap Basin by the Department of Public Works and Town and Country Planning in Thailand include preparation of land use guidelines.

3.4.3 Climate change adaptation for flood and drought

Both countries are investing in climate change adaptation with requirements for sector and provincial adaptation action plans. A recently completed Cambodia climate change adaptation project supported by ADB included capacity building of provincial staff in Battambang province. A key activity was preparation of adaptation guides for nature-based solutions of relevance for four sectors - agriculture, public works, water and environment. A follow up ADB Second Urban Environmental Management in the Tonle Sap Basin Project for improving urban services and enhancing climate resilience in three towns - Serei Saophoan (Banteay Meanchay Province), Battambang (Battambang Province) and Stueng Saen (Kampong Thom Province) – included a comprehensive climate change vulnerability assessment leading to design modifications by raising the level of roads and expanding the capacity for drainage.

Downstream of the 9C-9T sub-basin, the Tonle Sap Lake is receiving significant investment through the Cambodia Programme for Sustainable and Inclusive Growth in the Fisheries Sector (CAPFISH) with

aquaculture and capture fisheries components. KfW supported wetland rehabilitation and habitat management is being implemented specifically at the RAMSAR-listed Prek Toal site. The WB and GEF-supplemented Cambodia Sustainable Landscape and Ecotourism project also includes investments for the Tonle Sap Lake and buffer zone with a focus on Protected Area zoning and management and investments in tourism infrastructure development, including for Prek Toal, but no physical land or water restoration measures. These downstream investments are crucial and should be supported by equal investment in climate change adaptation for the catchments.

The Thai government's Office of Natural Resource and Environmental Policy and Planning (ONEP) formulated a Climate Change Master Plan in 2015 and a National Adaptation Plan (NAP) in 2019. ONEP is now actively working on NAP guidelines that include details for implementing adaptation measures by provincial, municipal and operational agencies. The NAP requires every government agency to establish and implement an adaptation policy for the period 2018–2021. The six sectors targeted by the NAP are: water management, agriculture and food security, tourism management, public-health management, natural-resource management, and human settlement and security. A collaborative GIZ and ONEP program is seeking to prepare climate change action plans for 17 provinces and 32 municipalities, eventually to cover Sa Kaeo and Chanthaburi provinces.

3.4.4 Hydromet and early warning for flood and drought

There are national warning systems in Cambodia and Thailand, with mobile app or text messaging established although coverage is not comprehensive. Both countries have multiple departments and centres with hydromet and remote sensing-based web tools and a hierarchy of disaster warning and management. The two countries do not have formal mechanisms in place for real-time exchange of data and information during flood and drought events within the 9C-9T sub-basin. Border communities are not connected in terms of flood warnings, meaning that the already existing Thai warning mechanism is not propagated to Cambodia. There is a lack of consistency in flood and drought information, and in symbology use for warnings. Given the deaths and high damages experienced in the 9C-9T sub-basin in 2012-2013, 2015-16 and in 2020, it is apparent that flood and drought information and warnings need to be improved - particularly at sub-national level.

The MRC has established a Mekong Flash Flood Guidance System that is available to both countries and covers the 9C-9T sub-basin but there are concerns that the resolution is not sufficient to guide residents at the local level, who become unresponsive in the face of multiple false alarms. One barrier to better local warning is a sparse hydromet network. In Cambodia the hydromet is not well-located to inform flood warning. In particular, flash flooding continues to be a challenge to forecast and monitor. Also, most stations are for water level only, not flow since representative cross-sections and rating curves are not developed.

In terms of transboundary flows, there are few stream gauging stations downstream of major reservoirs in Thailand prior to crossing the border into Cambodia since this zone is not a priority for Thai departments. This hinders flood warning and assessment of environmental flows, and planning and management of water resources. Government responses to improve the hydromet system involve ADB and AFD-supported projects specifically within Battambang province, and installation of additional flash flood warning stations in Sa Kaeo province, according to 2016-2030 plans of the Department of Water Resources.

3.4.5 Transboundary data sharing

Both governments have been investing in collection of new data but a mechanism for systematic data sharing between Cambodia and Thailand for the 9C-9T sub-basin has not been established. The Joint Project has begun addressing the need for shared information on flood and drought with development of flood maps for the 9C-9T sub-basin, development of a high-resolution hydrological model and preparation of climate change projections. A key output of this current phase (2019-2021) is the 9C-

9T Basin Atlas³ - a shared database of knowledge and information as a web-based geospatial Decision Support System for the sub-basin and accompanying catalogue of nature-based solution concepts for flood and drought resilience to support joint planning. Thailand has already expressed interest in replication of the 9C-9T Basin Atlas DSS planning support tool to other Thai basins.

Currently there is no protocol for maintenance and update of planning decision support data and information integrated within the new 9C-9T Basin Atlas. The hydromet network within the sub-basin is sparse and provides little information on transboundary flow. In times of flood and drought, limited effectiveness of sub-national warnings or transboundary Memorandums of Understanding for communication to downstream areas means that damages are likely to increase alongside the frequency of flood and drought due to climate change and watershed degradation.

4 Strategic framework and action plan

4.1 Rationale

The **problem** that the master plan seeks to address is the vulnerability of Cambodian and Thai communities within the shared 9C-9T sub-basin to the increasing frequency, intensity and impacts of flood and drought under the pressure of a growing population, climate change and watershed degradation.

The **proposed solution** is to strengthen joint mechanisms and institutions, action plans, monitoring and coordinated actions to invest in a linked network of ecosystem-based adaptation and nature based and hybrid solutions across the sub-basin, and to manage flood and drought risks and overall water security within an integrated transboundary watershed approach.

4.2 Overview of existing policy commitments

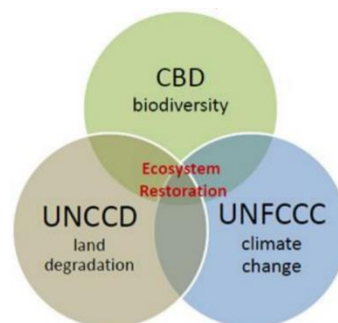
The Flood and Drought Master Plan for the 9C-9T Sub-basin takes its strategic policy guidance from a hierarchy of strategic orientations and commitments made by Cambodia and Thailand:

1. International agreements relating to flood and drought management
2. The Basin Development Strategy for the Mekong River Basin 2021 - 2030 & MRC Strategic Plan 2021 – 2025, and National Indicative Plans 2021-2025
3. The national strategic priorities for water resources management in Cambodia and Thailand
4. The 9C-9T Joint Project Phase I strategic orientations adopted by the Regional Steering Committee in 2018

4.2.1 International agreements on flood and drought

Cambodia and Thailand are parties to the three Rio Conventions (Figure 7) – the United Nations Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), and the United Nations Framework Convention on Climate Change (UNFCCC) – all key agreements in guiding national policies and action for addressing flood and drought in national and transboundary river basins. Both countries are also signatories to the overarching the Sustainable Development Goals (SDGs), the Sendai Framework for Disaster Risk Reduction and to the Ramsar Convention on Wetlands. National strategies, development plans and action programs in Cambodia and Thailand have sought to implement those international agreements in the field. The two

Figure 7 the three Rio Convention agreements for ecosystem restoration



³ The 9C-9T Atlas – Flood and Drought Management in Cambodia and Thailand. URL: [9C9TAtlas\(icem.com.au\)](http://9C9TAtlas(icem.com.au))

national governments regularly report on progress in meeting their commitments under these key international frameworks

Various subsidiary agreements and protocols linked to those international policies have provided further guidance to Cambodia and Thailand – and to the Mekong River Commission.

The Sendai Framework 2015-2030 is the most relevant international commitment towards Disaster Risk reduction. For example, it promotes “transboundary cooperation to enable policy and planning for the implementation of ecosystem-based approaches with regard to shared resources, such as within river basins” (para.28(d)) and strengthening “the sustainable use and management of ecosystems and implement integrated environmental and natural resource management approaches that incorporate disaster risk reduction’ (para.30(n)) with special reference to flood and droughts.

The Sendai Framework works hand in hand with the other 2030 Agenda agreements, including UNFCCC The Paris Agreement on Climate Change, and ultimately the SDGs both which include DRR as an integral part of sustainable development, addressing the relations between climate change mitigation and adaptation and DRR.

The 2030 Agenda for Sustainable Development, known as the Sustainable Development Goals, includes targets to implement IWRM at all levels including through transboundary cooperation (Target 6.5), to protect and restore water-related ecosystems including mountains, forests, wetlands, rivers, aquifers and lakes (Target 6.6), and to reverse land degradation, which is seen as a key driver for disasters (Goal 15).

The SDGs in Cambodia are being delivered through the establishment of institutions and mechanisms, creation of the Cambodian SDG Framework, integration with national planning and public budgets, as reflected in the RGC’s strategic planning priorities set out in the Rectangular Strategy Phase IV (RS-IV) and National Strategic Development Plan (NSDP) 2019-2023. Those commitments are expressed in greater detail in relevant sector development plans and policies such as those of MOWRAM, Ministry of Agriculture, Forestry and Fisheries and the Ministry of Environment promoting river basin planning, IWRM approaches and ecosystem restoration as strategies for reducing the risk of flood and drought.

Thailand’s 20-year National Strategy and 13th National Economic and Social Development Plan seeks to implement the SDGs including giving priority to disaster risk reduction, integrated water management and sustainable agriculture. Thailand is a strong advocate of the Sendai Framework for Disaster Risk Reduction (2015-2030), expressed through its Disaster Prevention and Mitigation Act of 2005, the National Disaster Prevention and Mitigation Plan of 2015 and the Water Resource Management Master Plan B.E. 2018-2037.

The Paris Agreement for Climate Change under the UNFCCC is legally binding on parties and acknowledges the Sendai Framework. It includes many provisions essential for IWRM and transboundary water resources management such as: strengthening the knowledge base, sharing of information, knowledge and experiences, monitoring and evaluation of plans, and achieving ecological resilience. Cambodia is implementing its Cambodia Climate Change Strategic Plan 2014-2023 (CCCS) and fifteen Climate Change Action Plans (CCAP) to promote climate resilience through, for example, improving food, water and energy security and ensuring climate resilience of critical ecosystems, biodiversity, protected areas and cultural heritage sites. The CCAPs target sectors with details of budget share allocated to each ministry to implement plans concerned with for example, agriculture, forestry and fisheries, disaster management, water resource and meteorology, rural infrastructure, transport, land management, urban planning and construction and the environment.

Thailand is implementing its Climate Change Master Plan (CCMP) 2015 – 2050 and linked National Adaptation Plan which builds on the six Master Plan priorities emphasizing water and natural system management and rehabilitation. The NAP and National Roadmap on Mitigation are expressed through sector action plans and local level development plans.

The Convention on Biological Diversity recognises the role of biodiversity and ecosystems in providing services that reduce flooding and drought hazards and the vulnerability of communities to them. Cambodia has strongly embraced the Biodiversity Convention and its 20 Aichi Biodiversity Targets. The National Biodiversity Strategy and Action Plan (NBSAP) (2016) is implemented through a range national strategies and plans such as the Cambodia Climate Change Strategic Plan 2014-2023, the Second National Communication to UNFCCC, the National Action Program to Combat Land Degradation 2018-2027 under the United Nations Convention to Combat Desertification, and the voluntary targets for Land Degradation Neutrality, the 2017 National Protected Area Strategic Management Plan, the National Environment Strategy and Action Plan 2016-2023, and the Environment and Natural Resources Code of Cambodia.

Thailand too has strongly supported implementation of the biodiversity convention and its Aichi targets. The Thai Constitution (2017) guarantees the right of citizens and communities to sustainably use and safeguard biodiversity and requires the state to regulate activities that may impact on natural systems. The commitment to biodiversity conservation and restoration is detailed in the Master Plan for Integrated Biodiversity Management (2015-2021). It is a key component of the National Strategy for Eco-Friendly Development and Growth (2018-2037), the National Environmental Management Plan (2017-2021) the other Master Plans for the National Strategy on Sustainable Development including the overarching 13th National Economic and Social Development Plan. Like Cambodia, Thailand has achieved the CBD's 2020 area target (Aichi target 11) of 17%. The Thai government aims to increase this to at least 25% of the country by 2025.

The Convention to Combat Desertification (UNCCD) has been expressed as targets to achieve land degradation neutrality by 2030 in both countries. Cambodia aims to increase forest cover to 47% of total land area; increase agricultural growth by 5% per annum as compared to 3% in 2016; increase the soil organic carbon stock in forest and cropland by 1.2% per year as compared to 2015, and maintain and enhance ecosystems and their services by establishing 23,500 sq. km of protected forest and 3,900 sq. km of production forest; and restoring at least 8% of degraded and depressed protected areas, conservation areas, agroecosystems and forest ecosystems including mangroves.

Thailand's targets have a similar intent but are less specific. They aim to increase the proportion of national forest cover through reforestation and rehabilitation degraded forest; restore and rehabilitate degraded land to be productive land, with an emphasis on sustainable agriculture; and reduce soil carbon loss and increase soil carbon sequestration by soil and water conservation and promote awareness raising and community participation in land management.

Next step for Cambodia and Thailand in supporting global action to reduce the threats of flood and drought: This year includes the attendance of both Cambodia and Thailand at the 15th meeting of the Conference of the Parties (COP 15) to the Convention on Biological Diversity (CBD) in Kunming, China in October 2021 - followed by a signing meeting in April 2022 - and the 26th session of the Conference of the Parties to United Nations Framework Convention on Climate Change (UNFCCC) in November 2021, UK.

The CBD COP 15 is taking a leading role in setting the future global agenda for ecological sustainability by adopting the ten-year Global Biodiversity Framework (GBF) to 2030 with vision to 2050. The Frameworks calls of parties to halt the collapse of natural systems, to meet the *Paris climate targets* and to achieve the *UN's Sustainable Development Goals* by conserving at least 30% of land and 30% sea areas through effective, equitably managed, ecologically representative and well-connected systems of protected areas. It also calls for a \$200 billion increase in international financial flows from all sources to developing countries for restoration and biodiversity conservation. The CBC COP 15 initiates the UN Decade on Ecosystem Restoration 2021 – 2030 which calls on all members to prevent, halt and reverse the degradation of ecosystems worldwide, to develop ecological networks and establish connectivity through ecological corridors, mitigating fragmentation and supporting

adaptation to climate change. The central idea behind the call is to move from mitigating biodiversity loss to achieving biodiversity gain through its restoration and effective management.

The UNFCCC COP 26 stressed the urgent need to increase funding to help developing countries promote adaptation to the impacts of climate change and the need to avert, minimize and address loss and damage. Over 120 countries committed to halt and reverse forest loss and land degradation by 2030 and to advance sustainable development and promote an inclusive rural transformation. Deforestation is one of four main subjects to be addressed as halting and reversing deforestation by 2030 will play a vital role in keeping 1.5 degrees within reach. It will also reduce the threat of flood and droughts and contribute to the effective management of water resources.

4.2.2 The Mekong BDS 2021-2030

At the regional level the Mekong Basin Development Strategy (BDS) 2021-2030, was approved by the Council of Ministers from Cambodia, Lao PDR, Thailand and Viet Nam. It focuses on five priority areas: improved ecological functions of the Mekong River Basin for a healthy environment and productive communities; improved access to and use of water and related resources for community well-being; development sustainability for inclusive economic growth; resilience against climate and disaster risks; and enhanced regional cooperation from a whole-of-basin perspective.

The new BDS is based on recent assessments of the significant impacts caused by water and related resources developments and infrastructure, including dams, that have changed flow regimes, affecting sediment transport and magnifying bank erosion. These impacts have in turn led to a decline in natural fish populations, the degradation of environmental assets and floodplains, and the reduction in replenishment of the Mekong Delta. Climate change has further added to the severity of the impacts, bringing more uncertainties and risks, including more frequent droughts and floods.

The BDS calls on member countries to move beyond the infrastructure project approach to planning to one based on more proactive regional cooperation to identify new joint and national actions of basin-wide significance that reduce vulnerabilities at both the basin and national levels and provide a comprehensive response to climate change and related flood and drought challenges.

The BDS adopts a vision for 2040 of an Economically Prosperous, Socially Just, Environmentally Sound and Climate Resilient Mekong River Basin. Of special relevance to the Flood and Drought Master Plan for the 9C-9T Sub-basin is the vision for an environmentally sound basin which states:

Environmentally Sound: *The Basin of 2040 is one where people live in harmony with nature, where the remaining environmental assets, especially the important wetlands and natural forests, are protected from further decline. Natural resources are managed sustainably within ecological limits so that ecosystem services including flood and drought protection are maintained for the benefit of the countries' economies and people. The basin remains one of the world's most biodiverse places with sufficient habitat and regulatory controls to arrest the decline in species. Watersheds serve an important role as refuge for plants and animals, regulating runoff and groundwater recharge and reducing soil erosion.*

Relevant BDS outcomes by 2030 include: 1.1: River flows support a healthy environment and productive riparian communities, 1.2: Sediment transport helps mitigate bank erosion and land subsidence, 1.3 River and wetland habitats and watersheds provide important ecosystem services, 4.1 There is sufficient flow in the dry season to support livelihood activities and reduced flood peaks in the wet season, and 4.2 Basin communities are better prepared for more frequent and severe floods and droughts as a result of climate change. Overall, the BDS Strategic Priorities and Outcomes for basin development and management are directed at contributing to the achievement of relevant SDGs.

The BDS vision, outcomes and their outputs provide a foundation framework for the Flood and Drought Master Plan for the 9C-9T Sub-basin, keeping in mind that the BDS is a comprehensive strategy whereas the 9C-9T Master Plan is focused on flood and drought management.

The BDS is shaped by the various international agreements to which Cambodia and Thailand are parties, in particular the SDGs and the three Rio Conventions with the various protocols and subsidiary agreements.

4.2.3 The national water resources management strategic priorities

Cambodia and Thailand have adopted a wide range of national strategies and plans to implement their obligations and commitments under international agreements including the MRC BDS to improve management of flood and droughts through IWRM measures.

In Cambodia, MoWRAM introduced the law on water resource management, a national water resource management policy and strategy, a master plan for water resource management and many guidelines and regulations for better climate change-adapted water resources management. The law on water resources management recognizes the critical role other agencies of government play in meeting its objectives and the importance of cross sector collaboration and coordination.

The pivotal role that the Ministry of Environment plays watershed rehabilitation and maintenance through implementing the various strategies and plans relating to climate change, biodiversity conservation and water quality were referred to earlier.

Also, the Ministry of Agriculture, Forestry and Fisheries (MAFF) is an essential partner in flood and drought management. For example, the Government's primary response to land degradation is encapsulated in the 2017-2026 National Action Plan to Combat Land Degradation. Land degradation is posing a direct threat to food and water security since it affects agricultural productivity and water retention capacity of watersheds. It is linked with forest degradation and the severity of floods and drought exacerbated by climate change. The Action Plan promotes on-farm soil conservation and agroforestry practices, community forest areas restoration and sustainable use, and watershed management and monitoring. The key instigating agency is the Department of Agricultural Land Resource Management (DALRM) within MAFF.

MAFF adopted the National REDD+ Strategy (NRS) 2017-2026 to reduce emissions from deforestation and forest degradation through conservation and sustainable management of forests and enhancement of forest carbon stocks – implemented through the NRS Action and Investment Plan (NRS-AIP). The NRS sets out three strategic objectives to address the drivers and underlying causes of deforestation and forest degradation – (i) improving the effectiveness of monitoring the utilization of forest resources and land management (ii) promoting sustainable forest management activities and (iii) enhancing stakeholder participation. These objectives support measures to address, mitigate and adapt to the impacts of climate change particularly to reducing the risks from flood and drought.

Thailand too is implementing a wide range of strategies and plans directly contributing to the better management of flood and drought through various sectors of government. In line with its commitments under the framework of UN Conventions on Climate Change (UNFCCC) and Biological Diversity (CBD), the Government's land degradation neutrality strategic commitments require collaborative action by many agencies including MONRE, ONWR, ONEP, the Royal Forest Department, the Royal Irrigation Department, the Ministry of Agriculture and Cooperatives, the Land Development Department, and the Department of National Parks, Wildlife and Plant Conservation to name a few. The creation of the Office of National Water Resources to oversee water sector coordination further emphasizes the commitment to cross-agency engagement for flood and drought resilience.

The overarching Thai 20-year Master Plan on Water Resources Management 2018-2037 similarly requires implementation by all arms of government. That Thai Master Plan sets out strategic priorities for water resources management in areas that the two countries hold in common – Cambodia

through its National Strategic Development Plan 2019-2023 and linked master plans of various sectors such as MOWRAM, MAFF and MOE. These six common strategic national priority areas are distilled as follows:

1. **Management of water for consumption:** Clean water supply and efficiency measures should be implemented to ensure water security for consumption for all communities.
2. **Building water security in agriculture and industry, including irrigation systems:** Develop new water sources and distribution systems alongside water conservation measures that boost productivity, achieved through integrated planning, including special consideration for flood and drought.
3. **Management of floods and drought:** through rehabilitation of natural rivers, removal of waterway obstacles, preparation of area-based management plans to decrease the risks and severity of flood and drought, and adoption of emergency response and improved distribution of information and warnings.
4. **Management of water quality and the conservation of water resources:** Protection and conservation of water quality, quantity and ecology within rivers, drainage corridors and wetlands, as well as for canals and reservoirs - combined with reduction and reuse of wastewater through efficiency, collection and treatment mechanisms.
5. **Restoring watersheds and degraded forests for sustainable water:** Preservation and rehabilitation of degraded watersheds and forests through suitable land use controls and conservation combined with tactical, protective revegetation to avoid loss of soil due to erosion.
6. **Building effective management, administration and information systems:** Integrated management of land and water as required for Integrated Water Resources Management requires greater cross-sectoral coordination for information sharing, planning, monitoring and evaluation across implementing agencies – particularly for flood and drought.

Those priorities reflect a shift from focusing only on infrastructure project planning and investment to proactive basin wide planning, rehabilitation and application of IWRM approaches through cross sectoral action for solving flood and drought challenges shared by both countries. It is a shift strongly advocated within the international agreements to which Cambodia and Thailand are parties, including the MRC BDS.

This objectives and outputs of this Master Plan contribute to all six of these common, national strategic priority areas as described within a matrix in Annex 1. Further detailing of indicators again each will be conducted on initiation of Master Plan implementation.

4.2.4 The 9C-9T Joint Project Phase I strategic orientations

It is also a shift which has been embraced within the 9C-9T Joint Project. That collaborative project itself has generated strategic orientations which provide a well targeted structure for the 9C-9T basin Flood and Drought Master Plan that seeks to implement global agreements, the Mekong BDS and national priorities related to effective flood and drought management. At its third meeting in May 2019, the Joint Project Regional Steering Committee defined five priorities areas for action on flood and drought within the 9C-9T sub-basin as:

1. **River Basin Master Planning:** A river basin master plan for 9C-9T provides the opportunity for integrated planning for land and water resources by the two countries towards their individual mandates for Integrated Water Resources Management. A river basin master plan seeks to improve the condition and function of the sub-basin with consideration to water resources and associated social and ecosystem services, with a key focus on resilience to flood and drought. This priority assumes the Joint Project will move from river basin master planning to implementation of action on the ground in its proceeding phases.
2. **Regional Capacity Building:** Knowledge sharing forms the basis for joint assessment and implementation of priority actions within the shared 9C-9T sub-basin. Through a regional approach,

agencies and local stakeholders in both countries can further exercise and develop their capabilities for integrated planning, transboundary water resources management and bilateral cooperation for flood and drought resilience.

3. Urban Flood & Drought Management: Review of urban flood and drought drivers and risks, and preparation of response strategies as valuable input to area-based planning and development of development safeguards. Water sensitive urban design and urban greening are multi-benefit opportunities to improve urban flood and drought resilience in the 9C-9T sub-basin.

4. Database of Knowledge and Information: A joint database to facilitate exchange of knowledge and information regarding flood, drought and water resources within the 9C-9T sub-basin.

5. Hydromet and Flood Warning Improvement: Expansion of the hydromet network within 9C-9T sub-basin will generate new data for improved understanding and management of water resources, including improvement of the hydrological model developed for the sub-basin. It also provides one way to strengthen flood and drought warning. Other opportunities such as flood zoning, disaster preparedness and response training, and improved distribution and communication of warnings should be pursued in parallel.

These five priorities for flood and drought action support implementation of strategic priorities for water resources management held in common by Cambodia and Thailand.

The strategic framework for the 9C-9T Flood and Drought Master Plan is structured around the five priority areas for action on flood and drought identified and agreed during Phase I of the Joint Project.

4.3 Vision and mission statement

The vision for the 9C-9T flood and drought master plan is to heal and rejuvenate the basin which has been severely degraded due to extensive loss of forest cover, large- and small-scale infrastructure development planned and delivered on an ad hoc basis without adequate catchment wide and cumulative assessment. The ongoing influence of climate change is further accentuating the degrading forces and aggravating the risks and impacts of flood and drought. That healing process will require a very significant redirection and balancing of investment toward nature-based solutions which involve protecting, restoring, and sustainably managing ecosystems in ways that increase their resiliency and ability to address the basin's flood and drought challenges, while also safeguarding biodiversity and improving human wellbeing. This vision and response as set out by this Master Plan are distilled as follows:

Basin vision: This master plan for combatting flood and drought in the 9C-9T basin is underpinned by the following basin vision:

The 9C-9T is a basin that is a healthy, clean and productive system that sustains ecosystems, reduces risks from floods and drought, and provides valuable services for all, now and in the future.

Mission statement: To achieve this basin vision, the responding mission statement for this Master Plan is to take action based on the following set of river basin planning and management values:

- Demonstrate the benefits of transboundary cooperation in flood and drought management, including information sharing and early warning to support wellbeing and water-sensitive livelihoods.
- Ensure that all strategic actions are just and equitable with a focus on flood and drought risk management measures that target areas and communities most in need.
- Recognise the interconnectedness of the river system, especially its upstream – downstream linkages.
- Seek ecological sustainability and maintenance of ecosystem services through basin-wide rehabilitation and maintenance.

- Apply hybrid green-grey development options and stand-alone nature-based solutions in watershed rehabilitation and maintenance and to enhance the health of existing and planned infrastructure.
- Promote gender equity and social inclusion.
- Build resilience to climate change by mainstreaming adaptation.

4.4 Flood and drought strategic priorities and outcomes

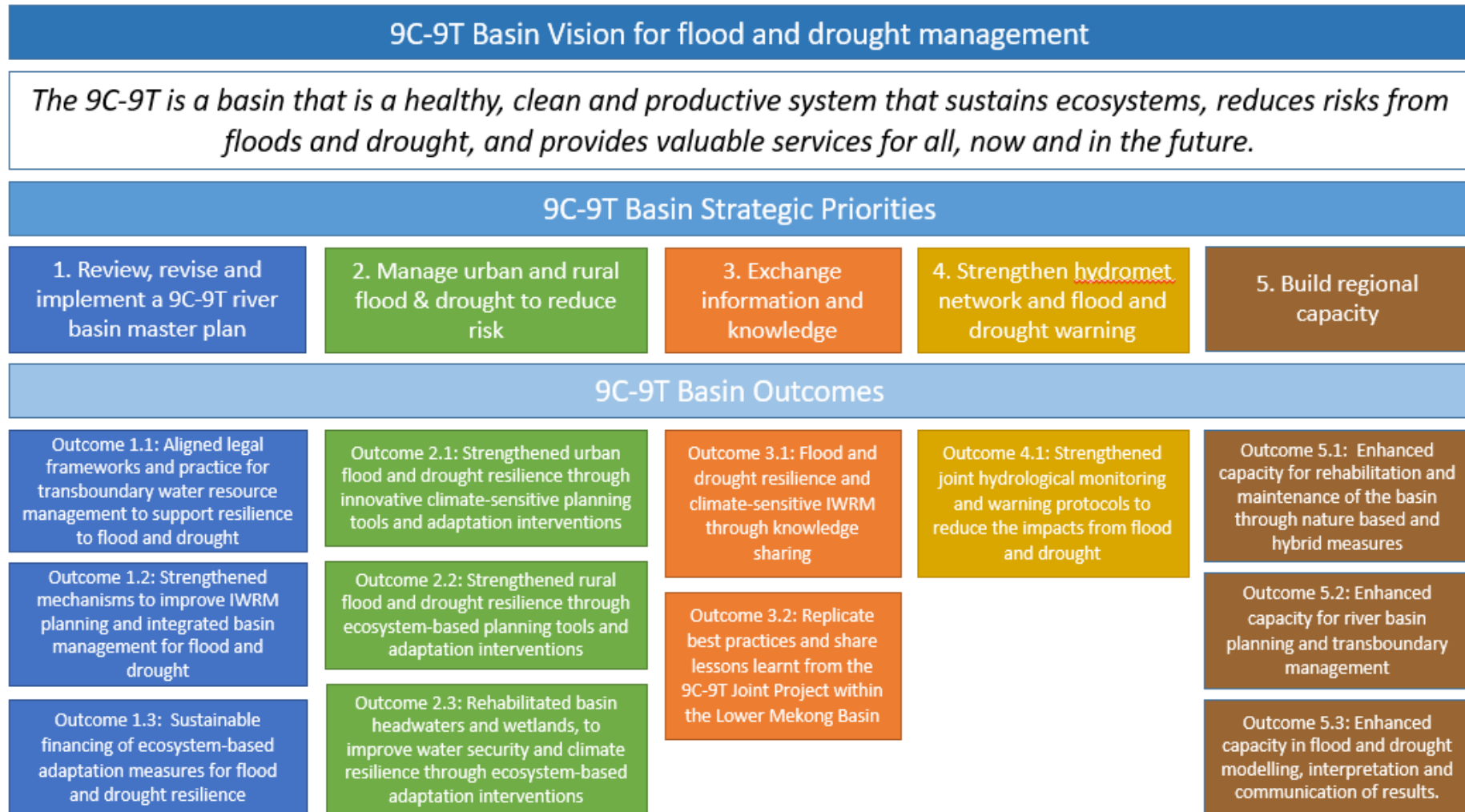
The master plan is structured to be consistent with the Mekong BDS format which identifies the basin vision, strategic priorities, the outcomes for each priority and then the outputs which seek to achieve the outcomes across a 15-year period. The strategic priorities are built on those adopted by the Joint Project Regional Steering Committee in Phase I as follows:

1. Implement a river basin master plan
2. Manage urban and rural flood and drought
3. Exchange information and knowledge
4. Strengthen hydromet network and flood and drought warning
5. Build regional capacity

Strategic priorities 3 and 4 are cross cutting in support of priorities 1 and 2 which focus on implementation of flood and drought interventions across the urban and rural landscapes and forest landscapes in the headwaters of catchments. Priority 5 aims to build capacity across all 4 priority fields.

Each of those priorities are given intended outcomes to form the Master Plan framework (Figure 8). Each outcome is then detailed to the level of output for the 15-year Action Plan as detailed in Section 4.6, with a schedule and indicative international and national budget given for the first five years from 2022-2026. Also indicated is the level of coordination at which each output will be implemented.

Figure 8 Structure of the 9C-9T Flood and Drought Master Plan to outcome level



4.5 Description of 9C-9T master plan strategic priorities and outcomes

4.5.1 Strategic Priority 1: Review, update and implement a 9C-9T river basin master plan

- **Outcome 1.1: Aligned legal frameworks and practice for transboundary water resource management to support resilience to flood and drought.**
- **Outcome 1.2: Strengthened mechanisms to improve IWRM planning and integrated basin management for flood and drought.**
- **Outcome 1.3: Sustainable financing of ecosystem-based adaptation measures for flood and drought resilience.**

Strategic priority 1 and its outcomes emphasize action areas to establish and implement consistent systems for river basin planning in Cambodia and Thailand. The aim is to have the flood and drought master plan evolve into a comprehensive river basin plan for 9C-9T sub-basin during the first five years of implementation. At this stage neither country conducts adequate cross sector and integrated river basin planning. It has proved challenging to bring all sectors on board to support and then embrace basin wide approaches to planning and investment – especially in strategies which restore and maintain natural systems as a priority in waters resources management. Planning, development, and budgeting proceeds very much on a sectoral basis.

To successfully prepare and implement an international river basin master plan with commitment from all relevant sectors on both sides of the border will require aligned legal frameworks and practice for transboundary water resource management, strengthened mechanisms to improve IWRM application and integrated basin wide approaches, and sustainable financing mechanisms which give priority to ecosystem-based adaptation measures.

Strategic priority 1 and its outcomes will scale-up international best practice in joint sub-basin action planning and investment. The alignment of policy and legal frameworks includes strategic environmental assessment within the sub-basin and strengthening institutional mechanisms for IWRM as the foundation for building resilience to flood and drought. For the water sector, both countries have development master plans that continue to emphasize a single sector approach to hard infrastructure investments primarily for increasing irrigated areas or drainage infrastructure without adequate environmental assessment or safeguards. River basin committees that have been established lack the cross-sectoral membership required to facilitate integrated water resources management. As a result, river basin plans are unlikely to receive the cross-sectoral, cross-agency support required for the success of integrated management. While gender sensitivity is mainstreamed into the project planning process for many development partners, more emphasis is needed within institutional development and sectoral and basin planning.

The limited integrated planning and transboundary impact assessment of development fails to ensure benefits are derived for both countries upstream and downstream. The lack of alignment between policy and process for river basin planning in the two countries means that opportunities to cooperate and consult are unclear in practice. As a result, flood and drought resilience is not mainstreamed across land use and development planning, including in urban areas.

The two countries are working to address these challenges within the current phase of the MRC-GIZ supported cooperation by developing this cyclical transboundary river basin master plan for flood and drought. The master plan initiates a process that can be endorsed and implemented by both countries to ensure regular review and update of the agreed strategic actions and five priorities. However, such a binational process requires further momentum to establish and embed joint protocols, action planning and capacity in national planning and budgeting cycles of the two countries.

Strategic Priority 1 of the master plan requires that a transboundary 9C-9T sub-basin strategic vision and joint action plan will be implemented and regularly reviewed in keeping with the national five-

year development planning cycles. To facilitate plan implementation, a river basin committee for the 9C area including Stung Mongkol Borey and Stung Sisophon needs to be established with cross sectoral membership similar to the “Tonle Sap” committee in Thailand. Further institutional strengthening will be needed to ensure those two basin committees can work closely together and with the national working groups and regional steering committee to implement the joint strategic action plan at basin level.

Policy harmonization is required to sustainably embed the priorities of the 9C-9T sub-basin strategic action plan within the cyclical planning and budgeting processes of the two countries, with a joint commitment to SEA to guide policy and planning in a sustainable way. The current Thai master plan for the Tonle Sap River Basin must similarly be reviewed and strengthened against the priorities and objectives of the 9C-9T sub-basin strategic action plan. There is a clear need to mainstream the agreed joint strategic actions as well as gender sensitivity within sectoral and local action and management plans, and a need for economic valuation to support this process and garner broader support. Opportunities for private sector investment in the joint strategic actions for flood and drought resilience, particularly in urban areas, should be pursued to ensure priorities on paper can be fully resourced and maintained in practice.

4.5.2 *Strategic Priority 2: Manage urban and rural flood and drought to reduce risk*

- **Outcome 2.1: Strengthened urban flood and drought resilience through innovative climate-sensitive and ecosystem-based planning tools and adaptation interventions.**
- **Outcome 2.2: Strengthened rural flood and drought resilience through ecosystem-based planning tools and adaptation interventions.**
- **Outcome 2.3: Rehabilitated basin headwaters and wetlands, to improve water security and climate resilience through ecosystem-based adaptation interventions.**

Strategic Priority 2 and its outcomes emphasize national priorities for watershed rehabilitation and the joint priority of building urban and rural flood and drought resilience. This involves the development and implementation of zoning and area-based flood management plans and safeguards, followed by design and implementation of nature based and hybrid measures across the sub-basin including headwater forests, rural landscapes, peri-urban and urban centres. This network of investments will contribute to the resilience of watersheds and communities to flood, drought and climate change whilst providing demonstration and learning for replication and upscaling.

Current investments for flood and drought resilience within the 9C-9T sub-basin are heavy on hard infrastructure and lack cross-sectoral consideration and assessment of cumulative impacts. Limited thought to transboundary impacts also raises concerns regarding upstream improvements to drainage that may hasten peak flows downstream. While much effort is being made in the fields of urban development, tourism development and protected area management there is little evidence of consideration to flood and drought within these programs and projects. There is also surprisingly little on the ground investment in restoration of watersheds and protected areas within the 9C-9t sub-basin or neighbouring areas. As a result, there remains a missed opportunity for multi-benefits to livelihoods, urban livability, vulnerable communities, gender equality, biodiversity and climate change adaptation through nature-based adaptation measures.

Meanwhile, ongoing investments in reservoirs and irrigation infrastructure suffer the effects of watershed degradation, erosion, sedimentation and flood damage. Investments in the Tonle Sap Lake just downstream of the 9C-9T sub-basin are also threatened by the degrading landscape and water resources of the 9C-9T sub-basin and associated floods and droughts.

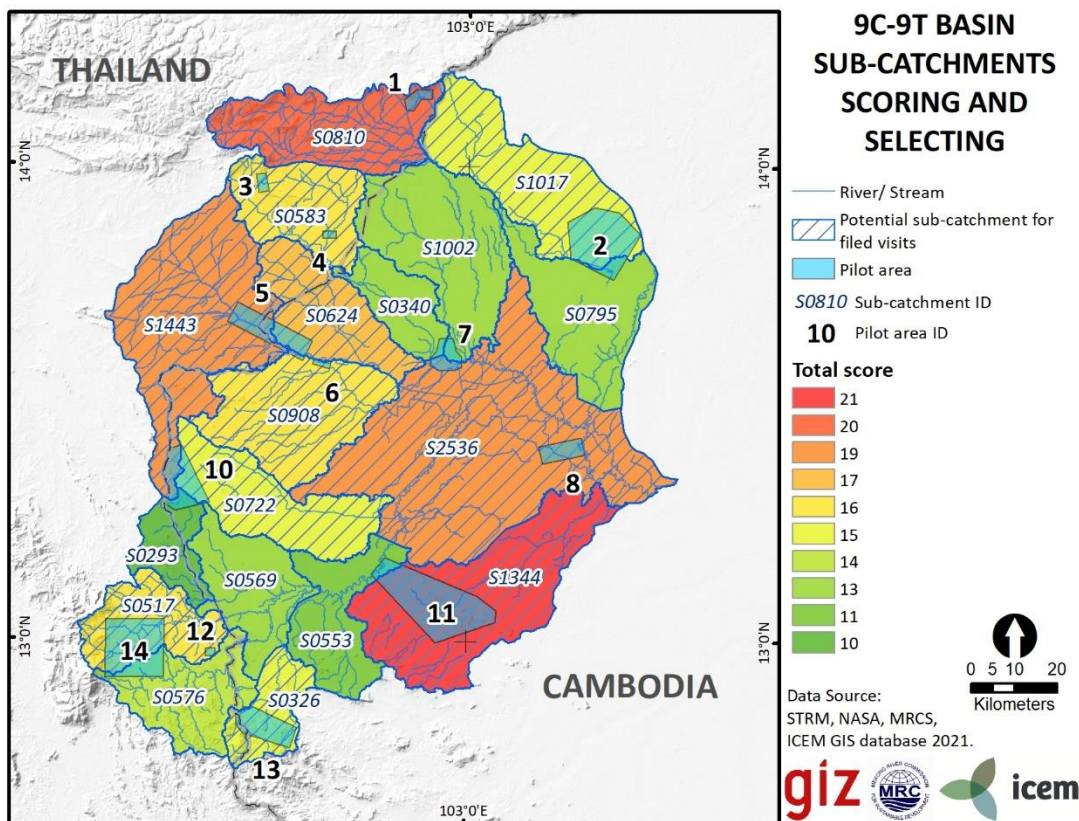
While both countries focus on hard infrastructure development, the transboundary cooperation of the Joint Project provides an important opportunity to establish frameworks for cooperation in managing upstream-downstream impacts of these investments through sectoral and local area management plans and associated scaling of ecosystem-based adaptation for flood and drought

resilience. The current phase (2019-2021) of the MRC-GIZ Joint Project is conducting field missions to document degraded areas and hotspots for flood and drought, and conceptualizing location-appropriate flood and drought mitigation measures to build resilience in the basin.

Strategic Priority 2 of the master plan will provide significant investment to implement landscape rehabilitation as a network of ‘sister’ demonstrations of nature-based solutions for flood and drought resilience in rural, peri-urban, urban and protected areas (PA) on both sides of the border in Cambodia and Thailand⁴. Example measures include rehabilitation of degraded upper catchments and drainage corridors; in-channel/floodplain/wetland and pond rehabilitation and construction in combination with bank stabilization to reduce erosion and sedimentation; rehabilitation and resilience building in agricultural landscapes linked with climate smart livelihoods and greening of expanding urban areas.

When so much needs to be done to rehabilitate the 9C-9T basin to reduce the risks of flood and drought, guidance is needed on specific locations for prioritization of investment for Strategic Priority 2. As a first step, the basin was divided into 18 sub-catchments for ranking according to rehabilitation need (see Annex 2 for details of this watershed assessment). Specific pilot areas within high priority catchments are then identified as pilot areas for immediate investment with measures to build resilience to flood and drought (Figure 9).

Figure 9. Sub-catchments scoring and selecting



Further development of this network will be linked to existing infrastructure and protected areas to facilitate private sector involvement and engagement through community conservation agreements

⁴ Sister projects would be of two kinds – (i) those on the border requiring actions from Thailand and Cambodia to meet shared objectives – such as the joint Poipet and Aranyaprathet sister city project involving separate but similar actions within each town and joint actions along the shared river corridor; and (ii) projects conducted separately but addressing similar issues such as application of nature based solutions to protect and enhance functions of heavily sedimented reservoirs, and involve sharing and close require coordination from each country. Both categories would be part of the funding proposals to support implementation of the master plan.

and committees. In rural areas and PA buffer zones, these measures will work with communities to promote water-saving livelihood opportunities and the productive benefits of ecosystem-based adaptation. Through this approach, the ecosystem-based adaptation investments will not only build flood and drought resilience but also contribute clear economic benefits, improved living standards and food security through hybrid, grey-green approaches.

4.5.3 *Strategic Priorities 3 and 4: Exchange information and knowledge and strengthen hydromet network and flood and drought warning*

- **Outcome 3.1: Flood and drought resilience and climate sensitive IWRM through knowledge sharing.**
- **Outcome 3.2: Replicate best practices and share lessons learnt from the 9C-9T Joint Project within the Lower Mekong Basin.**
- **Outcome 4.1: Strengthened joint hydrological monitoring and warning protocols to reduce impacts from flood and drought.**

Strategic Priorities 3 and 4 and their outcomes emphasize the improvement of the hydromet network and early warnings, as well as sharing of knowledge and information. Through these priorities, joint protocols for monitoring, warnings and data sharing will be established for flood and drought hazards specifically as well as for tracking of progress against the objectives of this Master Plan. Also planned is establishment of transboundary collaborations to share lessons learnt for best practice transboundary river basin planning by Cambodia and Thailand with other Mekong tributary sub-basins.

Currently there is no systematic data exchange mechanism established between the two countries, including during flood and drought events, and no protocol for maintenance and update of planning decision support data and information integrated within the new 9C-9T Basin Atlas. The hydromet network within the sub-basin is sparse and provides little information on transboundary flow. In times of flood and drought, limited effectiveness of sub-national warnings or transboundary communication means that damages are likely to increase alongside the frequency of flood and drought due to climate change and watershed degradation. A further significant gap remains regarding the monitoring and evaluation for basin plans – particularly in Cambodia. As result there is no obvious progress on implementation of the one existing basin plan prepared in Cambodia (for neighbouring Strung Sreng) since its approval in 2015. Lack of community involvement in basin management and monitoring in either country is also a missed opportunity.

Strategic Priority 4 activities will review and expand the hydromet network and establish protocols for real-time exchange of data between the two countries. It will also develop capacities in flood and drought modelling and communication of results to build on the models developed under the MRC-GIZ Joint Project, in partnership with the MRC Regional Flood and Drought Management Centre. A community system for monitoring and reporting on watershed health will be established as input to the evaluation and basin planning cycle for 9C-9T, with linkages to the new 9C-9T Basin Atlas DSS.

The master plan activities include documenting lessons learnt as input to future iterations and mainstreaming into the many river basin plans to be developed across both countries under their recently refreshed policy, and in similar transboundary sub-basins within the Mekong region. They will also be disseminated through establishment of a major knowledge sharing network to support mainstreaming of nature-based solutions within river basin action planning in Cambodia and Thailand, and replication of joint transboundary planning and monitoring mechanisms and protocols to similar sub-basins shared by two of MRC's member countries. This network will be hosted and scaled by harnessing the existing regional cooperation facilitated by the MRC, and supporting via a communication strategy.

4.5.4 Strategic Priority 5: Build regional capacity

- **Outcome 5.1: Enhanced capacity for rehabilitation and maintenance of the basin through nature based and hybrid measures.**
- **Outcome 5.2: Enhanced capacity in river basin planning and transboundary management.**
- **Outcome 5.3: Enhanced capacity in flood and drought modelling, interpretation, and communication of results.**

Strategic Priority 5 and its outcomes build needed capacities in support of the other four priorities. Special emphasis is given to capacity building of engineers, natural resource managers, urban planners, and forest and protected area managers in the design and practical application of nature-based solutions. Their role and ways of using them are not well understood, especially within the conventional infrastructure sectors. Skills, policies, standards, and high-level commitment are required in both countries for systematic field implementation of nature-based solutions so that they benefit biodiversity, enhance ecosystem services, and provide multiple co-benefits, such as carbon sequestration.

The master plan seeks to build capacities in the design and application of these solutions including landscape-scale interventions for forests and natural wetlands restoration and site-specific interventions such as constructed wetlands, erosion control and urban water management and quality measures. Restoration of forests and floodplain wetlands can reduce risks of floods, droughts, water pollution and water scarcity, that are likely to become worse under future climates.

Healthy ecosystems can play a critical role in river basin management. Ecosystems can help attenuate flows by storing water in the system and releasing it gradually over time, thereby reducing the intensity and likelihood of destructive flood events. They help store water and keep rivers and drainage systems supplied during periods of drought. Ecosystems can act as natural infrastructure, mitigating disaster impacts by reducing physical vulnerability and strengthening resilience. A wide range of capacities are needed before the water resources development agencies in both countries fully integrate the requirements of ecosystem maintenance into their investments and field practice with support from other relevant sectors.

Taking a nature-based approach to flood and drought risk reduction requires an improved understanding of the dynamics of the 9C-9T hydrological system and consideration of the upstream-downstream linkage of development activities and the risks they generate. Adopting such an approach is pivotal to addressing flood and drought risk in an integrated manner that goes beyond administrative and sectoral boundaries. This approach calls for collective action across multiple levels, stakeholders and sectors, with the entire 9C-9T sub-basin as the central unit of planning and decision-making, and for its governance as well. That requires fresh capacities in river basin planning and transboundary management, and in flood and drought modelling, interpretation, and effective communication of results so that high level decision makers fully appreciate and commit to basin management strategies with confidence they are based on the best available science and analysis.

4.6 Action plan

Detailed outputs proposed under each component are provided according to the objectives, outcomes and outputs listed in Table 2. Three levels of intervention are considered – bilateral, national and local – as relevant to achievement of each output. Both external and national funding will be required to implement the actions identified within this Master Plan. Indicative budgets for the contributions from each source are also provided alongside each output in Table 3.

Table 2 Strategic priorities, outcomes, interventions and indicative budgets of the action plan

Strategic priority	Outcomes	Outputs	Intervention levels	First five years of a 15 year program					Budget – 2022-2026 (USD)			Total
				2022	2023	2024	2025	2026	International	National Cambodia	National Thailand	
Priority 1: Review, revise and implement a 9C-9T river basin master plan	Outcome 1.1: Aligned legal frameworks and practice for transboundary water resource management to support resilience to flood and drought	Output 1.1.1: Review and update the 9C-9T flood and drought master plan as part of the existing five year national development planning and budget cycles.	Bilateral						200,000	20,000	50,000	270,000
		Output 1.1.2: Review and revise legal and administrative frameworks for river basin planning in both countries so they are well aligned, including a requirement for strategic environmental assessment as part of plan preparation.	National – with bilateral consultation to ensure consistency						60,000	20,000	20,000	100,000
		Output 1.1.3: Review and revise legal and administrative frameworks for spatial planning and zoning with safeguards on a catchment basis and ensure associated tools and capacities are in place.	National, and bilateral for transboundary catchments						60,000	20,000	20,000	100,000
		Output 1.1.4: Review and revise legal and administrative frameworks for environmental impact assessment systems to ensure cumulative assessments of many developments (small and large scale) within a catchment are conducted.	National, and bilateral for transboundary catchments						60,000	20,000	20,000	100,000
	Outcome 1.2: Strengthened mechanisms to improve IWRM planning and integrated basin management for flood and drought	Output 1.2.1: Conduct a transboundary 9C-9T river basin climate change vulnerability assessment and adaptation planning as an input to the river basin planning process and plan	Bilateral						60,000	20,000	50,000	130,000
		Output 1.2.2: Establish the Cambodia 9C river basin committee to improve cross-sector and community participation in river basin management based on the existing 9C-9T cross-sectoral institutional structure for transboundary cooperation.	Cambodia national with bilateral consultation and learning						60,000	50,000	0	110,000
		Output 1.2.3: Conduct a transboundary SEA of the 9C-9T basin action plan and assign management zones according to conservation and use values, with linked guiding principles for their rehabilitation and management and associated policy and institutional reforms.	Bilateral						200,000	20,000	50,000	270,000
		Output 1.2.4: Carry out comprehensive and transparent cumulative impact assessment of planned infrastructure in the 9C-9T basin such as weirs, ponds, wells, reservoirs and dams, and irrigation systems including pumping systems (for example listed infrastructure in the Thai National Water Resource Master Plan and MOWRAM sector development master plan)	National, and bilateral for transboundary catchments						30,000	150,000	200,000	380,000
		Output 1.2.5: Prepare and implement a gender and vulnerable communities strategy and action plan for mainstreaming within flood and drought resilience sector plans and measures	Bilateral and national						30,000	20,000	20,000	70,000
		Output 1.2.6: Review, prepare and adopt harmonized sector action plans for 9C and 9T sub-basin areas to build flood and drought resilience (ie plans by relevant national government sector agencies responsible for water management, irrigation, forestry and agriculture, other infrastructure development and environmental management for example)	Bilateral and national						150,000	50,000	50,000	250,000
		Output 1.2.7: Harmonise the design regulation and guidelines for dams to ensure net gain in watershed condition and biodiversity – and the consideration of cumulative affects	Bilateral with national application and implementation						20,000	20,000	20,000	60,000

Strategic priority	Outcomes	Outputs	Intervention levels	First five years of a 15 year program					Budget – 2022-2026 (USD)			Total
				2022	2023	2024	2025	2026	International	National Cambodia	National Thailand	
	Outcome 1.3: Sustainable financing of ecosystem-based adaptation measures for flood and drought resilience	Output 1.3.1: Conduct economic valuation of ecosystem services to assess benefits of climate-sensitive, gender-sensitive, ecosystem-based adaptation for flood and drought resilience measures.	Bilateral						60,000	0	0	60,000
		Output 1.3.2: Identify opportunities to set up impact bonds for ecosystem based flood and drought resilience building measures, to incentivize private sector investment for implementation of the 9C-9T basin action plan.	Bilateral with national application						30,000	0	0	30,000
Priority 2: Manage urban and rural flood and drought to reduce risk	Outcome 2.1: Strengthened urban flood and drought resilience through innovative climate-sensitive and ecosystem-based planning tools and adaptation interventions	Output 2.1.1: Conduct climate change vulnerability assessments and adaptation planning leading to adaptation plans for two target towns (one either side of the border)	National – with bilateral consultation to ensure consistency						80,000	10,000	20,000	110,000
		Output 2.1.2: Prepare local flood and drought risk management plans for two target transboundary urban areas either side of the Cambodia-Thailand border and ensure consistency with relevant sector master plans	Bilateral, national and local						60,000	10,000	20,000	90,000
		Output 2.1.3: Review and revise urban spatial zoning and safeguards, and enforcement mechanisms to improve resilience to flood and drought with a focus on urban waterways, urban canopy cover and greening measures, and Identification of floodway potential and flood zoning in two towns (one in each country) ⁵	Bilateral for transboundary areas, national and local						60,000	10,000	20,000	90,000
		Outputs 2.1.4: Develop and implement protective, hybrid (green and grey) infrastructures to reduce urban flood risks (e.g. urban river channel improvement, bank stabilization and natural flood retention areas) and enhance water quality in two target towns (one in each country)	Bilateral for transboundary areas, national and local						2,000,000	1,000,000	1,000,000	4,000,000
		Output 2.1.5: Develop and implement demand-side water management measures to reduce the amount of water that is being used by households, municipal and industrial sectors, focused on building ecosystem and climate resilience	Bilateral, national and local						1,000,000	500,000	500,000	2,000,000
	Outcome 2.2: Strengthened rural flood and drought resilience through ecosystem-based planning tools and adaptation interventions	Output 2.2.1: Develop and implement rural landscape rehabilitation measures including agro-forestry activities and changes to agricultural practices through plant diversification and intercropping, innovative irrigation measures to conserve water and apply demand side management approaches, less tillage, and improvements to soil water holding capacity and carbon sequestration.	Bilateral for transboundary areas, national and local						1,500,000	500,000	500,000	2,500,000
		Output 2.2.2: Develop spatial zoning and safeguards across rural landscapes, especially relating to existing and new infrastructure, and implement by installing sediment traps, conducting dredging to maintain capacity, maintenance to prevent encroachment of agriculture into reservoir banks, and establishing vegetated buffers along drainage and transport corridors and along allotment boundaries	Bilateral for transboundary areas, national and local						1,000,000	500,000	500,000	2,000,000
		Output 2.2.3: Develop and implement at least six sets of nature based and hybrid interventions (three in each country) to reduce flood and drought risk in rural areas with a focus on EbA measures for water channel rehabilitation and vegetated buffers, riverbank stabilization and for maintenance of waterways.	Bilateral for transboundary areas, national and local						2,000,000	1,000,000	1,000,000	4,000,000
	Outcome 2.3: Rehabilitated basin headwaters and wetlands , to improve water	Output 2.3.1: Develop and implement at least six (3 in each country) interventions for rehabilitation and effective management of protected areas and upper watersheds in river basin headwaters – to improve and maintain the delivery of ecosystem services, with an emphasis on safeguarding transboundary biodiversity of international importance.	Bilateral for transboundary areas, national and local						2,500,000	1,000,000	1,000,000	4,500,000

⁵ To be conducted in close coordination with the ADB TA CAM: Technical Support and Capacity Development in Urban Planning - TA Implementation Consultant (53199-001) Project

Strategic priority	Outcomes	Outputs	Intervention levels	First five years of a 15 year program					Budget – 2022-2026 (USD)			Total
				2022	2023	2024	2025	2026	International	National Cambodia	National Thailand	
	security and climate resilience through ecosystem-based adaptation interventions	Output 2.3.2: Develop and implement at least four (2 in each country) interventions to rehabilitate and manage wetlands in the multiple use areas to strengthen PA buffer zones and improve ecological integrity for the delivery of ecosystem services (water storage/treatment/habitat).	Bilateral for transboundary areas, national and local						1,000,000	500,000	500,000	2,000,000
		Output 2.3.3: Increase forest cover and condition in the headwaters through enrichment planting, reforestation and rehabilitation of degraded areas to achieve net gain in biodiversity and improved soil and forest carbon stock to mitigate and build resilience to climate change	Bilateral for transboundary areas, national and local						1,000,000	500,000	500,000	2,000,000
Priority 3: Exchange information and knowledge	Outcome 3.1: Flood and drought resilience and climate-sensitive IWRM through knowledge sharing	Output 3.1.1: Maintain and apply the Joint Project Decision Support System (DSS) Atlas for the 9C-9T basin to inform basin planning and management and facilitate data sharing between ONWR and MOWRAM and other stakeholders.	Bilateral and national						150,000	24,000	24,000	198,000
		Output 3.1.2: Development and implement a system for interactive, transboundary communication of water availability and effective coordination of reservoir operations for water security.	Bilateral and national						80,000	10,000	20,000	110,000
		Output 3.1.6: Establish a system for community reporting on watershed and water body health, as a key input to reviewing and updating the 9C-9T basin management plan including local level support in ongoing monitoring, data collection, and preparing ecosystem health report cards including community based hazard mapping and response analysis.	Bilateral and national						150,000	20,000	30,000	200,000
	Outcome 3.2: Replicate best practices and share lessons learnt from the 9C-9T Joint Project within the Lower Mekong Basin	Output 3.2.1: Replicate transboundary flood and drought M&E and resilience measures throughout the Mekong region through sharing of project lessons learnt within Cambodia, Thailand and via South-South exchanges ⁶	Bilateral and national						60,000	20,000	30,000	110,000
		Output 3.2.2: Develop and implement a communication strategy to share project knowledge and lessons learnt	Bilateral and national						80,000	10,000	20,000	110,000
Priority 4: Strengthen hydromet network and flood and drought warning	Outcome 4.1: Strengthened joint hydrological monitoring and warning protocols to reduce the impacts from flood and drought	Output 4.1.1: Review, update and expand the joint monitoring network of equipment and systems for river level and flash floods, including verification of gauging stations with hydraulic modelling, improved disaster risk coordination and protocols, to enhance efficiency and data sharing for monitoring and early warning.	Bilateral and national						500,000	100,000	200,000	800,000
		Output 4.1.2: Establish joint mechanisms for exchange of real time hydrological monitoring data and early warning (national, provincial and local level at target communities).	Bilateral and national						100,000	20,000	30,000	150,000
		Output 4.1.3: Strengthen, expand existing communication and knowledge management tools and technologies for early warning to increase climate resilience of urban communities to floods.	Bilateral and national						500,000	100,000	200,000	800,000
		Output 4.1.4: Review, update and expand the joint monitoring network of equipment and systems for drought including seasonal forecasting and identification of drought early warning trigger values to improve efficiency and data sharing for monitoring and early warning	Bilateral and national						60,000	10,000	20,000	90,000
		Output 4.1.5: Develop procedures and capacities for the regular integration of remote sensing data into flood and drought management	Bilateral and national						80,000	10,000	20,000	110,000

⁶ Covering: i) joint basin planning and management; ii) flood and drought warning arrangements; and iii) application of methods and tools for EbA, including support for establishing collaborative arrangements for replicating the 9C-9T experience in other shared sub-basins of the Mekong region.

Strategic priority	Outcomes	Outputs	Intervention levels	First five years of a 15 year program					Budget – 2022-2026 (USD)			Total
				2022	2023	2024	2025	2026	International	National Cambodia	National Thailand	
Priority 5: Build regional capacity	Outcome 5.1: Enhanced capacity for rehabilitation and maintenance of the basin through nature based and hybrid measures	Output 5.1.1: Provide detailed field-based training for engineers, foresters, watershed managers and other specialists in nature based and hybrid measures for all flood and drought interventions	Bilateral and national						250,000	20,000	50,000	320,000
		Output 5.1.2: Design and implement a training program to build capacities of local sector and river basin organizations for detailed design, implementation and management of ecosystem-based adaptation measures in target areas	Bilateral and national						60,000	10,000	10,000	80,000
	Outcome 5.2: Enhanced capacity for river basin planning and transboundary management	Output 5.2.1: Design and implement a training program for senior staff in the public and private sector covering SEA of river basin management plans, economic valuation of ecosystem-based adaptation and supporting financial mechanisms, and cumulative impact assessment of existing and planned development in catchments.	National and local						60,000	10,000	10,000	80,000
		Output 5.2.2: Design and implement a central and provincial training programs for climate change vulnerability assessment and ecosystem-based adaptation planning as part of river basin planning.	National and local						40,000	10,000	10,000	60,000
		Output 5.2.3: Design and implement central and provincial training programs for climate risk-informed water management practices in target urban and rural areas.	National and local						40,000	10,000	10,000	60,000
	Outcome 5.3: Enhanced capacity in flood and drought modelling, interpretation and communication of results.	Output 5.3.1: Develop capacities at regional and national levels for flood modelling, interpretation, and communication of results, with involvement of the MRC Flood and Drought Management Centre.	Bilateral and national						150,000	20,000	30,000	200,000
		Output 5.3.2: Develop capacities at regional and national levels for drought modelling, interpretation and communication of results, with involvement of the MRC Flood and Drought Management Centre.	Bilateral and national						150,000	20,000	30,000	200,000
					SUB-TOTALS USD					15,730,000	6,364,000	6,804,000
				TOTAL USD					28,898,000			

Table 3: Detailed budget breakdown for international and national contributions

Strategic priority	Outcomes	Outputs	Budget – 2022-2026 (USD)																
			International					National Cambodia					National Thailand					Total	
			2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	2022	2023	2024	2025	2026		
Priority 1: Review, revise and implement a 9C-9T river basin master plan	Outcome 1.1: Aligned legal frameworks and practice for transboundary water resource management to support resilience to flood and drought	Output 1.1.1: Review and revise the transboundary 9C-9T river basin flood and drought management plan as part of the existing five year national development planning and budget cycles.					200,000					20,000					50,000	270,000	
		Output 1.1.2: Review and revise legal and administrative frameworks for river basin planning in both countries so they are well aligned, including a requirement for strategic environmental assessment as part of plan preparation.		30,000	30,000				10,000	10,000				10,000	10,000				100,000
		Output 1.1.3: Review and revise legal and administrative frameworks for spatial planning and zoning with safeguards on a catchment basis and ensure associated tools and capacities are in place.		30,000	30,000				10,000	10,000				10,000	10,000				100,000
		Output 1.1.4: Review and revise legal and administrative frameworks for environmental impact assessment systems to ensure cumulative assessments of many developments (small and large scale) within a catchment are conducted.		30,000	30,000				10,000	10,000				10,000	10,000				100,000
	Outcome 1.2: Strengthened mechanisms to improve IWRM planning and integrated basin management for flood and drought	Output 1.2.1: Conduct a transboundary 9C-9T river basin climate change vulnerability assessment and adaptation planning as an input to the river basin planning process and plan		60,000					20,000					50,000					130,000
		Output 1.2.2: Establish the Cambodia 9C river basin committee to improve cross-sector and community participation in river basin management based on the existing 9C-9T cross-sectoral institutional structure for transboundary cooperation.	20,000	20,000	20,000				16,500	16,500	17,000			-					110,000
		Output 1.2.3: Conduct a transboundary SEA of the 9C-9T basin action plan and assign management zones according to conservation and use values, with linked guiding principles for their rehabilitation and management and associated policy and institutional reforms.			100,000	100,000				10,000	10,000					25,000	25,000		

Strategic priority	Outcomes	Outputs	Budget – 2022-2026 (USD)														Total		
			International					National Cambodia					National Thailand						
			2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	2022	2023	2024	2025		2026	
		Output 1.2.4: Carry out comprehensive and transparent cumulative impact assessment of planned infrastructure in the 9C-9T basin such as weirs, ponds, wells, reservoirs and dams, and irrigation systems including pumping systems (for example listed infrastructure in the Thai National Water Resource Master Plan and MOWRAM sector development master plan)		15,000	15,000				75,000	75,000				100,000	100,000			380,000	
		Output 1.2.5: Prepare and implement a gender and vulnerable communities strategy and action plan for mainstreaming within flood and drought resilience sector plans and measures	15,000	15,000					10,000	10,000				10,000	10,000			70,000	
		Output 1.2.6 : Review, prepare and adopt harmonized sector action plans for 9C and 9T sub-basin areas to build flood and drought resilience (ie plans by relevant national government sector agencies responsible for water management, irrigation, forestry and agriculture, other infrastructure development and environmental management for example)		50,000	50,000	50,000			16,500	16,500	17,000			16,500	16,500	17,000			250,000
		Output 1.2.7: Harmonise the design regulation and guidelines for dams to ensure net gain in watershed condition and biodiversity – and the consideration of cumulative affects		10,000	10,000				10,000	10,000				10,000	10,000				60,000
	Outcome 1.3: Sustainable financing of ecosystem-based adaptation measures for flood and drought resilience	Output 1.3.1: Conduct economic valuation of ecosystem services to assess benefits of climate-sensitive, gender-sensitive, ecosystem-based adaptation for flood and drought resilience measures.	30,000	30,000				0	0				0	0				60,000	
		Output 1.3.2: Identify opportunities to set up impact bonds for ecosystem based flood and drought resilience building measures, to incentivize private sector investment for implementation of the 9C-9T basin action plan.		30,000					0					0				30,000	
Priority 1 Budget Annual Sub-total (USD)			65,000	320,000	285,000	150,000	200,000	0	178,000	168,000	44,000	20,000	0	206,500	191,500	42,000	50,000	1,930,000	

Strategic priority	Outcomes	Outputs	Budget – 2022-2026 (USD)														Total				
			International					National Cambodia					National Thailand								
			2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	2022	2023	2024	2025		2026			
Priority 2: Manage urban and rural flood and drought to reduce risk	Outcome 2.1: Strengthened urban flood and drought resilience through innovative climate-sensitive and ecosystem-based planning tools and adaptation interventions	Output 2.1.1: Conduct climate change vulnerability assessments and adaptation planning leading to adaptation plans for two target towns (one either side of the border)		80,000						10,000					20,000				110,000		
		Output 2.1.2: Prepare local flood and drought risk management plans for two target transboundary urban areas either side of the Cambodia-Thailand border and ensure consistency with relevant sector master plans		30,000	30,000					5,000	5,000					10,000	10,000			90,000	
		Output 2.1.3: Review and revise urban spatial zoning and safeguards, and enforcement mechanisms to improve resilience to flood and drought with a focus on urban waterways, urban canopy cover and greening measures, and Identification of floodway potential and flood zoning in two towns (one in each country)		30,000	30,000						5,000	5,000				10,000	10,000			90,000	
		Outputs 2.1.4: Develop and implement protective, hybrid (green and grey) infrastructures to reduce urban flood risks (e.g. urban river channel improvement, bank stabilization and natural flood retention areas) and enhance water quality in two target towns (one in each country)		500,000	500,000	500,000	500,000				250,000	250,000	250,000	250,000			250,000	250,000	250,000	250,000	4,000,000
		Output 2.1.5: Develop and implement demand-side water management measures to reduce the amount of water that is being used by households, municipal and industrial sectors, focused on building ecosystem and climate resilience				300,000	350,000	350,000					150,000	150,000	200,000			150,000	150,000	200,000	2,000,000
	Outcome 2.2: Strengthened rural flood and drought resilience through ecosystem-based planning tools and adaptation interventions	Output 2.2.1: Develop and implement rural landscape rehabilitation measures including agro-forestry activities and changes to agricultural practices through plant diversification and intercropping, innovative irrigation measures to conserve water and apply demand side management approaches, less tillage, and improvements to soil water holding capacity and carbon sequestration.		375,000	375,000	375,000	375,000				125,000	125,000	125,000	125,000			125,000	125,000	125,000	125,000	2,500,000
		Output 2.2.2: Develop spatial zoning and safeguards across rural		250,000	250,000	250,000	250,000				125,000	125,000	125,000	125,000			125,000	125,000	125,000	125,000	2,000,000

Strategic priority	Outcomes	Outputs	Budget – 2022-2026 (USD)															
			International					National Cambodia					National Thailand					Total
			2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	
		landscapes, especially relating to existing and new infrastructure, and implement by installing sediment traps, conducting dredging to maintain capacity, maintenance to prevent encroachment of agriculture into reservoir banks, and establishing vegetated buffers along drainage and transport corridors and along allotment boundaries																
		Output 2.2.3: Develop and implement at least six sets of nature based and hybrid interventions (three in each country) to reduce flood and drought risk in rural areas with a focus on EbA measures for water channel rehabilitation and vegetated buffers, riverbank stabilization and for maintenance of waterways.		500,000	500,000	500,000	500,000		250,000	250,000	250,000	250,000		250,000	250,000	250,000	250,000	4,000,000
	Outcome 2.3: Rehabilitated basin <u>headwaters and wetlands</u> , to improve water security and climate resilience through ecosystem-based adaptation interventions	Output 2.3.1: Develop and implement at least six (3 in each country) interventions for rehabilitation and effective management of protected areas and upper watersheds in river basin headwaters – to improve and maintain the delivery of ecosystem services, with an emphasis on safeguarding transboundary biodiversity of international importance.		625,000	625,000	625,000	625,000		250,000	250,000	250,000	250,000		250,000	250,000	250,000	250,000	4,500,000
Output 2.3.2: Develop and implement at least four (2 in each country) interventions to rehabilitate and manage wetlands in the multiple use areas to strengthen PA buffer zones and improve ecological integrity for the delivery of ecosystem services (water storage/treatment/habitat).			250,000	250,000	250,000	250,000		125,000	125,000	125,000	125,000		125,000	125,000	125,000	125,000	2,000,000	
Output 2.3.3: Increase forest cover and condition in the headwaters through enrichment planting, reforestation and rehabilitation of degraded areas to achieve net gain in biodiversity and improved soil and forest carbon stock to mitigate and build resilience to climate change			250,000	250,000	250,000	250,000		125,000	125,000	125,000	125,000		125,000	125,000	125,000	125,000	2,000,000	
Priority 2 Budget Annual Sub-total			0	2,890,000	3,110,000	3,100,000	3,100,000	0	1,270,000	1,410,000	1,400,000	1,450,000	0	1,290,000	1,470,000	1,400,000	1,450,000	23,290,000

Strategic priority	Outcomes	Outputs	Budget – 2022-2026 (USD)															
			International					National Cambodia					National Thailand					Total
			2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	
Priority 3: Exchange information and knowledge	Outcome 3.1: Flood and drought resilience and climate-sensitive IWRM through knowledge sharing	Output 3.1.1: Maintain and apply the Joint Project Decision Support System (DSS) Atlas for the 9C-9T basin to inform basin planning and management and facilitate data sharing between ONWR and MOWRAM and other stakeholders.	30,000	30,000	30,000	30,000	30,000	0	6,000	6,000	6,000	6,000	0	6,000	6,000	6,000	6,000	198,000
		Output 3.1.2: Development and implement a system for interactive, transboundary communication of water availability and effective coordination of reservoir operations for water security.			26,000	27,000	27,000			3,000	3,500	3,500			6,500	6,500	7,000	110,000
		Output 3.1.6: Establish a system for community reporting on watershed and water body health, as a key input to reviewing and updating the 9C-9T basin management plan including local level support in ongoing monitoring, data collection, and preparing ecosystem health report cards including community based hazard mapping and response analysis.		37,500	37,500	37,500	37,500		5,000	5,000	5,000	5,000		7,500	7,500	7,500	7,500	200,000
	Outcome 3.2: Replicate best practices and share lessons learnt from the 9C-9T Joint Project within the Lower Mekong Basin	Output 3.2.1: Replicate transboundary flood and drought M&E and resilience measures throughout the Mekong region through sharing of project lessons learnt within Cambodia, Thailand and via South-South exchanges.				30,000	30,000				10,000	10,000			15,000	15,000	110,000	
		Output 3.2.2: Develop and implement a communication strategy to share project knowledge and lessons learnt		20,000	20,000	20,000	20,000		2,500	2,500	2,500	2,500		5,000	5,000	5,000	5,000	110,000
		Priority 3 Budget Annual Sub-total	30,000	87,500	113,500	144,500	144,500	0	13,500	16,500	27,000	27,000	0	18,500	25,000	40,000	40,500	728,000
Priority 4: Strengthen hydromet network and flood and drought warning	Outcome 4.1: Strengthened joint hydrological monitoring and warning protocols to reduce the impacts from	Output 4.1.1: Review, update and expand the joint monitoring network of equipment and systems for river level and flash floods, including verification of gauging stations with hydraulic modelling, improved disaster risk coordination and protocols, to enhance efficiency and data sharing for monitoring and early warning.		125,000	125,000	125,000	125,000		25,000	25,000	25,000	25,000		50,000	50,000	50,000	50,000	800,000

Strategic priority	Outcomes	Outputs	Budget – 2022-2026 (USD)																	
			International					National Cambodia					National Thailand					Total		
			2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	2022	2023	2024	2025	2026			
flood and drought		Output 4.1.2: Establish joint mechanisms for exchange of real time hydrological monitoring data and early warning (national, provincial and local level at target communities).		30,000	35,000	35,000			6,500	6,500	7,000			10,000	10,000	10,000		150,000		
		Output 4.1.3: Strengthen, expand existing communication and knowledge management tools and technologies for early warning to increase climate resilience of urban communities to floods.		165,000	165,000	170,000			30,000	35,000	35,000			65,000	65,000	70,000		800,000		
		Output 4.1.4: Review, update and expand the joint monitoring network of equipment and systems for drought including seasonal forecasting and identification of drought early warning trigger values to improve efficiency and data sharing for monitoring and early warning		15,000	15,000	15,000	15,000			2,500	2,500	2,500	2,500			5,000	5,000	5,000	5,000	90,000
		Output 4.1.5: Develop procedures and capacities for the regular integration of remote sensing data into flood and drought management		40,000	40,000					5,000	5,000					10,000	10,000			110,000
Priority 4 Budget Annual Sub-total			0	375,000	380,000	345,000	140,000	0	69,000	74,000	69,500	27,500	0	140,000	140,000	135,000	55,000	1,950,000		
Priority 5: Build regional capacity	Outcome 5.1: Enhanced capacity for rehabilitation and maintenance of the basin through nature based and hybrid measures	Output 5.1.1: Provide detailed field-based training for engineers, foresters, watershed managers and other specialists in nature based and hybrid measures for all flood and drought interventions		125,000	125,000				10,000	10,000				25,000	25,000			320,000		
		Output 5.1.2: Design and implement a training program to build capacities of local sector and river basin organizations for detailed design, implementation and management of ecosystem-based adaptation measures in target areas		30,000	30,000				5,000	5,000				5,000	5,000			80,000		
	Outcome 5.2: Enhanced capacity river basin planning and transboundary management	Output 5.2.1: Design and implement a training program for senior staff in the public and private sector covering SEA of river basin management plans, economic valuation of ecosystem-based adaptation and supporting financial mechanisms, and cumulative impact assessment of existing and planned development in catchments.			30,000	30,000				5,000	5,000				5,000	5,000		80,000		

Strategic priority	Outcomes	Outputs	Budget – 2022-2026 (USD)															
			International					National Cambodia					National Thailand					Total
			2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	2022	2023	2024	2025	2026	
		Output 5.2.2: Design and implement a central and provincial training programs for climate change vulnerability assessment and ecosystem-based adaptation planning as part of river basin planning.		20,000	20,000				5,000	5,000				5,000	5,000			60,000
		Output 5.2.3: Design and implement central and provincial training programs for climate risk-informed water management practices in target urban and rural areas.		20,000	20,000				5,000	5,000				5,000	5,000			60,000
	Outcome 5.3: Enhanced capacity in flood and drought modelling, interpretation and communication of results.	Output 5.3.1: Develop capacities at regional and national levels for flood modelling, interpretation, and communication of results, with involvement of the MRC Flood and Drought Management Centre.			75,000	75,000				10,000	10,000				15,000	15,000		200,000
		Output 5.3.2: Develop capacities at regional and national levels for drought modelling, interpretation and communication of results, with involvement of the MRC Flood and Drought Management Centre.			75,000	75,000				10,000	10,000				15,000	15,000		200,000
Priority 5 Budget Annual Sub-total			0	195,000	375,000	180,000	0	0	25,000	50,000	25,000	0	0	40,000	75,000	35,000	0	1,000,000
Budget Annual Sub-Total by Source			95,000	3,867,500	4,263,500	3,919,500	3,584,500	0	1,555,500	1,718,500	1,565,500	1,524,500	0	1,705,000	1,851,500	1,652,000	1,595,500	28,898,000
Budget 5-Year Total by Source			15,730,000					6,364,000					6,804,000					

4.7 Implementation

An effective implementation strategy is needed to achieve the strategic objectives and actions set out in this Master Plan. The following sections describe the overarching institutional arrangements, proposed funding sources and monitoring and evaluation framework required for implementation of the Master Plan within the 9C-9T sub-basin by Cambodia, Thailand and regional partners.

Most outputs set out in the Master Plan require cross-sectoral coordination for their implementation. Specific institutions will be assigned responsibilities associated with each output according to their agency mandates. This will be determined during the first stage of implementation. For each action, the Master Plan partners will need to assign responsibilities for preparation of a detailed Terms of Reference for the action, stakeholder engagement planning, specific tasks for involved agencies, associated capacity building and relevant monitoring. The first stage of implementation will also include preparation of detailed design concepts for the nature-based solution interventions.

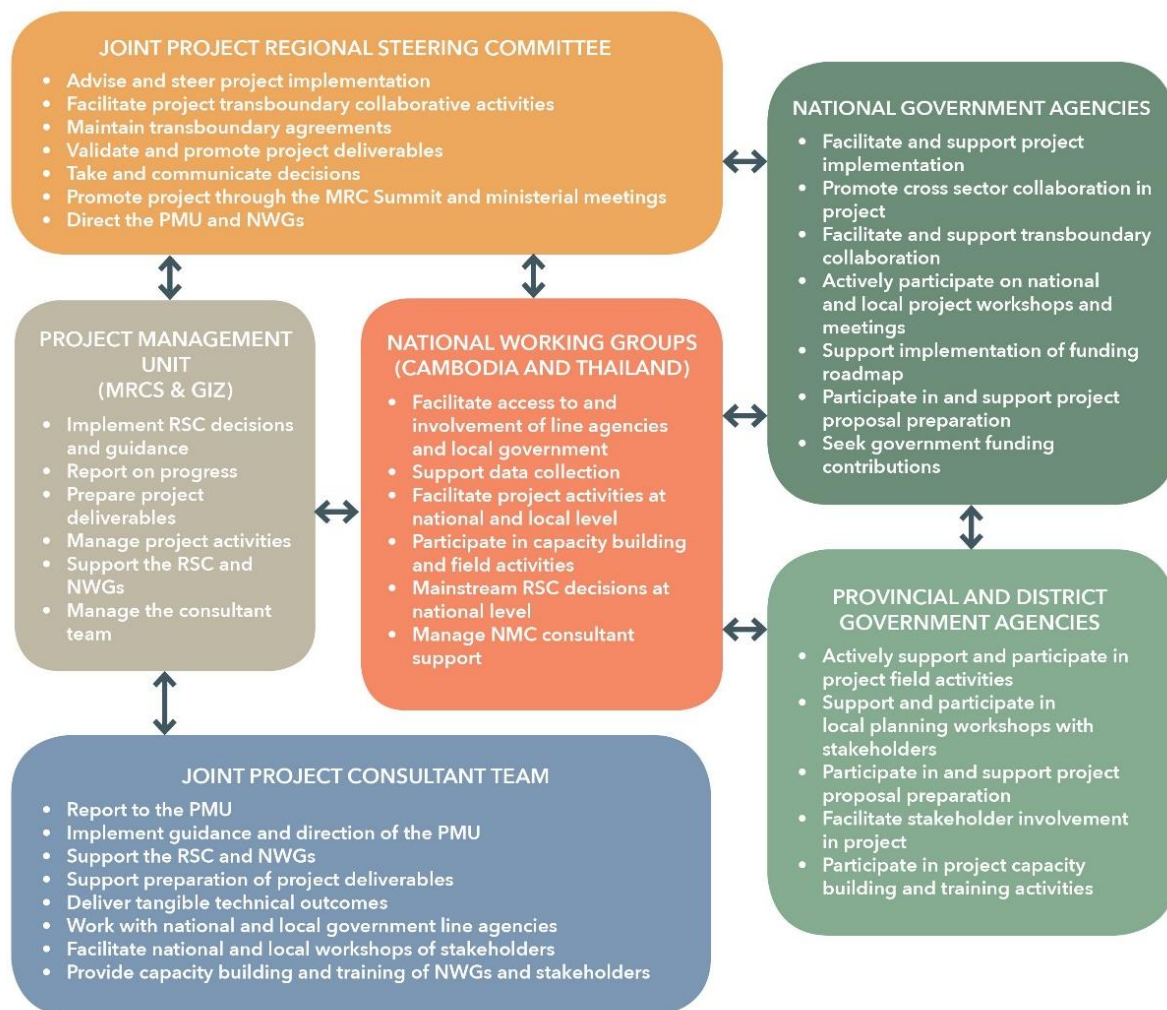
4.7.1 *Institutional arrangement*

Cross-sectoral and multi-level cooperation nationally and bilaterally is essential for successful implementation of Integrated Water Resources Management, river basin planning and transboundary resilience to flood and drought. Institutional arrangements for implementation of the Master Plan will therefore retain and expand the existing governance structure established for the 9C-9T Joint Project.

At the regional scale, the bilateral cooperation between Cambodia and Thailand is facilitated by the Mekong River Commission, an inter-governmental organization that works directly with Member Countries to jointly manage the shared water resources and the sustainable development of the Mekong River. National Mekong Committees in each member country coordinate MRC work programmes at the national level and provide links between the MRC Secretariat and the national ministries and line agencies. The principal implementing bodies of the MRC work programmes and projects are the line agencies.

The Cambodian and Thai National Mekong Committees supervise the 9C-9T Joint Project on flood and drought through the Regional Steering Committee (SC) and National Working Groups (NWGs) that coordinate with the Project Management Unit (PMU) of MRCS and GIZ and other partners providing technical support for planning and implementation (Figure 10).

Figure 10. Governance structure for the Joint Project



The regional SC provides overall regional perspective and guidance which ensures that the project keeps within each country’s plans, procedures and regulations. It also provides a higher-level forum for discussing and promoting transboundary cooperation in project implementation and data sharing. The regional SC directs and advises the NWGs and PMU on how to progress with implementation of the joint project.

The NWGs are made up of line agency officials and NGO representatives. A key role of the regional SC and the NWGs is to promote and facilitate the involvement of relevant national and local government agencies in the project. The NWGs are the catalysts for nurturing those relationships and driving stakeholder engagement as needed to implement this Master Plan.

The governance of this Master Plan will need to evolve across its implementation. This process is described by the following steps.

Step 1: Expand the membership of the existing joint governance structure for the 9C-9T sub-basin

Membership of the National Working Group in each country should be diverse across agencies with responsibilities for land use, water management, forests and watershed rehabilitation, biodiversity conservation and environmental management, development planning and disaster preparedness. The membership of the National Working Groups should be flexible and adjusted in response to the priority actions at each stage of implementation, with additional, occasional participants invited to consult as appropriate to meeting objectives. The first step is to expand the membership of the

National Working Group to ensure it provides cross-sectoral representation at the national sub-national levels.

In Cambodia, the Water Law mandates MOWRAM to oversee river basin planning in collaboration with all concerned ministries. The Cambodia National Mekong Committee, with a mandate to represent Cambodia within the Mekong River Commission, is part of MOWRAM. A range of other ministries and agencies have responsibilities of relevance to integrated water resources management and watershed resilience (Table 4) and will be required to participate in implementation of this Master Plan. Particularly important is the Ministry of Agriculture, Forestry and Fisheries (MAFF) due to the inter-relationship between water and agriculture, in addition to its broader role in watershed rehabilitation and maintenance through its Department of Forestry. The Ministry of Rural Development (MRD) is concerned with providing clean water to rural areas while the Ministry for Environment (MOE) has a greatly expanded role in the conservation and management of Cambodia's extensive protected areas network as well as in environmental impact assessment.

Table 4 Agencies participating in the Cambodian National Working Group for the 9C-9T Sub-basin

Ministry	Department
Ministry of Water Resources and Meteorology (MOWRAM)	Cambodian National Mekong Committee (CNMC)
	Department of Meteorology
	Department of Hydrology and River Works
	Tonle Sap Authority
	PDoWRAM from Battambang, Banteay Meanchey, Pailin
Ministry of Agriculture, Forestry and Fisheries (MAFF)	Department of Agriculture
	Department of Forests
Ministry of Environment (MOE)	National Council for Sustainable Development (GEF Secretariat)
	General Department of Administration for Nature Conservation and Protection
Ministry of Rural Development (MRD)	
Ministry of Economic and Finance (MoEF)	
Ministry of Planning (MoP)	
Ministry of Public Works and Transport (MPWT)	
National Committee on Disaster Management (NCDM)	
Ministry of Land Management, Urban Planning and Construction (MLUC)	
Representatives of the Stung Mongkol Borey River Basin Committee, once established	
Sub-national staff of all above line agencies as needed to consult on specific activities.	

For Thailand, the ONWR was established in 2017 under the direct control of the Office of the Prime Minister as the main body for strategic policy and planning for water resources management. Based on Ministerial Regulations on the Division of Work Units, ONWR is responsible for: proposing policies; formulating strategic plans, master plans and measures; integrating information, plans, projects and budgets; and monitoring and evaluating on water resources management. ONWR is supported by 22 River Basin Committees setup in June 2020 including one for the 9T Tonle Sap river basin. Their duties include advising on the content of action plans for the use, development, management, maintenance, rehabilitation and conservation of water resources in their respective river basins, as well as on plans for prevention and solving of flood and drought situations. Development of action plans will be proposed by the provincial government water resources subcommittees. The River Basin Committees provide feedback and ensure alignment with river basin management plans for ONWR's final review and approval. Other agencies are involved for funding and implementation of various aspects of flood and drought management including watershed rehabilitation and maintenance (Table 5) and will be required to participate in implementation of this Master Plan.

Table 5 Agencies participating in the Thai National Working Group for the 9C-9T Sub-basin

Ministry	Department
The Office of National Water Resources (ONWR)	Thai National Mekong Committee (TNMC)
National Economic and Social Development Council (NESDC)	
Ministry of Natural Resources and Environment (MONRE)	Department of Water Resources (DWR),
	Department of National Park, Wildlife and Plant Conservation
	ONEP
Ministry of Agriculture and Cooperatives	Royal Irrigation Department (RID)
	Department of Agriculture (DoA)
Ministry of Interior	Department of Disaster Prevention and Mitigation (DDPM)
Ministry of Digital Economy and Society	Thai Meteorological Department
Provincial authorities from Chanthaburi and Sa Kaeo provinces	
Representatives from the Tonle Sap 9T River Basin Committee	
Sub-national staff of all above line agencies as needed to consult on specific activities.	

Step 2: Strengthen and align the River Basin Committees (RBCs) for 9C Stung Mongkol Borey Sub-basin and 9T Tonle Sap Sub-basin.

In the medium-term, the river basin committees for the Cambodian and Thai portions of the 9C-9T sub-basin must be strengthened to ensure effectiveness in leading the local consultation and integrated planning required for the cyclical refresh of the 9C-9T action plan. Again, cross-sectoral and multi-level representation is crucial to ensure the RBCs can coordinate across and consult with all agencies and local government conducting activities within the basin. As a second step, the membership, structure and mandate of the RBCs should be reviewed, revised and aligned in both countries. A working relationship between the two 9C-9T RBCs should be established on both sides of the border.

Step 3: Review governance of the 9C-9T sub-basin Master Plan implementation and monitoring

The national policy framework for river basin management in both countries situates the RBCs under the guidance of a national basin committee – the National River Basin Committee in Cambodia chaired by the Minister of Water Resources and Meteorology and in Thailand, the National Water Resource Committee (NWRC) chaired by the Deputy Prime Minister.

The third step is therefore to review and revise the existing governance structure (the NWGs and regional SC facilitated by MRC) and to determine the institutional responsibilities for preparation, implementation and monitoring of this Master Plan to the RBCs with close cooperation of local government and community.

4.7.2 Stakeholders

As well as cross-sectoral participation, most actions within this Master Plan will require consultation and engagement with a broad range of stakeholders for detailed planning, design and implementation. Stakeholders will include the public of the targeted area, community leaders and civil society, academic and research institute, NGOs and private stakeholders.

Prior to implementing each action, the local community in the vicinity and particularly in downstream area should be consulted to request their free, prior, and informed consent. This approach can be integrated within community conservation agreements where the community is an active partner, as well as establishment of and consultation with community-led committees.

For each action, opportunities should be sought to involve private sector participation to develop business support for the benefits of watershed restoration, flood and drought resilience and integrated water resources management.

4.7.3 Funding

Funding for implementation of this Master Plan has been identified according to guiding principles of integration, simplicity, sustainability and respect for funding bodies. The objectives, strategies and budgets of national, bilateral, multilateral and global funders have been assessed for suitability to contribute funding towards project activities to be located in Cambodia, Thailand and regionally.

The funding strategy for this Master Plan must be founded in national funding contributions via sectoral and agency budget of the Royal Government of Cambodia and the Government of Thailand. This commitment is essential to sustainability of project activities. This national funding will be supplemented by bilateral and global funding to add momentum and scale for implementation of the identified action plan across the short-to-medium term.

Potential external sources of funding for the implementation of the Master Plan have been identified as:

- The German Federal Ministry for Economic Cooperation and Development (BMZ)
- The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) via
 - The International Climate Initiative (IKI)
 - The Global Ecosystem based Adaptation Fund
 - the NAMA facility
- The Global Environment Facility, particularly through their International Waters programme
- Australian Government Department of Foreign Affairs via the Australian Water Partnership (AWP)
- Other bilateral partners including USAID, JICA
- Other global environment funds such as the Green Climate Fund, the Adaptation Fund

Concept notes for funding of the 2022-2026 action plan will be pursued for the following timeframes:

- Royal Government of Cambodia's budget for the next 5-year development cycle starting 2024
- Government of Thailand's budget for the next 5-year development cycle starting 2022
- The BMZ (implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)) for 2022-2024
- The Global Environment Facility Tranche 8 for implementation starting in 2024
- The IKI, via submission of a concept note in 2022

4.7.4 Monitoring and evaluation

The governance structure established by the Joint Project to implement this Master Plan will be responsible for ensuring monitoring and evaluation of implementation is conducted twice each implementation cycle (interim at the end of year 3, and final at end of year 5) as input to preparation of the Action Plan for the following five-year period. Regular annual reporting will also be conducted aligned with the schedule of actions. The overall indicator framework and annual reporting schedule is shown in Table 6. This will be further detailed to specific indicators against each output at the detailed design phase, once implementation of the Master Plan begins. These will be designed with reference to the common strategic priorities of both countries as well as global best practice indicators.

Table 6 Indicator framework for monitoring and evaluation of the 9C-9T Sub-basin Master Plan

Strategic priority	Outcomes	Indicator	Intervention levels	Annual reporting				
				2022	2023	2024	2025	2026
Cross-cutting	Joint governance	Twenty-four (twelve in each country) meetings conducted for the National Working Group for the 9C-9T sub-basin. Ten meetings conducted for the regional Steering Committee for the 9C-9T sub-basin.	Bilateral					
Priority 1: Review, revise and implement a 9C-9T river basin master plan	Outcome 1.1: Aligned legal frameworks and practice for transboundary water resource management to support resilience to flood and drought	One revised Master Plan/action plan for the 9C-9T sub-basin (2027-2032)	Bilateral					
		Two sets of legal and administrative frameworks for river basin planning (Cambodia and Thailand) include a requirement for strategic environmental assessment.	National – with bilateral consultation to ensure consistency					
		One set of zoning overlays and safeguards for the 9C-9T sub-basin is available to agencies in both countries.	National, and bilateral for transboundary catchments					
		Two sets of legal and administrative frameworks for environmental impact assessment systems (Cambodia and Thailand) include a requirement cumulative assessments of many developments (small and large scale) within a catchment.	National, and bilateral for transboundary catchments					
	Outcome 1.2: Strengthened mechanisms to improve IWRM planning and integrated basin management for flood and drought	One climate change vulnerability assessment and adaptation plan for the 9C-9T sub-basin.	Bilateral					
		One river basin committee established for the Cambodian Stung Mongkol Borey basin.	Cambodia national with bilateral consultation and learning					

Strategic priority	Outcomes	Indicator	Intervention levels	Annual reporting				
				2022	2023	2024	2025	2026
		One transboundary SEA of infrastructure planned by both countries for the 9C-9T sub-basin.	Bilateral					
		One cumulative impact assessment of infrastructure planned by both countries for the 9C-9T sub-basin for the 2027-2032 period.	National, and bilateral for transboundary catchments					
		One gender and vulnerable groups strategy and action plan for flood and drought resilience	Bilateral and national					
		At least two sector action plans in each country harmonized with this Master Plan	Bilateral and national					
		Harmonised dam design regulations in Cambodia and Thailand, for the 9C-9T sub-basin.	Bilateral with national application and implementation					
	Outcome 1.3: Sustainable financing of ecosystem-based adaptation measures for flood and drought resilience	Economic valuation conducted for a set of ecosystem based adaptation measures.	Bilateral					
		One impact bond opportunity identified and conceptualized.	Bilateral with national application					
	Priority 2: Manage urban and rural flood and drought to reduce risk	Outcome 2.1: Strengthened urban flood and drought resilience through innovative climate-sensitive and ecosystem-based planning tools and adaptation interventions	Two sets of urban climate change vulnerability assessment and adaptation plans prepared for target towns (one in each country)	National – with bilateral consultation to ensure consistency				
Two harmonized local flood and drought risk management plans prepared (one in each country).			Bilateral, national and local					

Strategic priority	Outcomes	Indicator	Intervention levels	Annual reporting				
				2022	2023	2024	2025	2026
		Two sets of urban spatial zoning and safeguards prepared (one in each country) for Poipet/Aranyaprathet SEZs.	Bilateral for transboundary areas, national and local					
		Detailed designs and implementation of interventions in two towns (one in each country) prepared to reduce urban flood risk and enhance water quality.	Bilateral for transboundary areas, national and local					
		Two interventions implemented to improve water efficiency.	Bilateral, national and local					
	Outcome 2.2: Strengthened <u>rural flood and drought resilience</u> through ecosystem-based planning tools and adaptation interventions	Two interventions for livelihood-diversifying rural landscape rehabilitation measures implemented through existing Community Conservation Agreements.	Bilateral for transboundary areas, national and local					
		Four (two in each country) sediment traps, vegetated buffers or other climate-smart maintenance measures implemented for new and/or existing water infrastructure.	Bilateral for transboundary areas, national and local					
		Six nature-based interventions (three in each country) implemented to reduce flood and drought risk in rural areas..	Bilateral for transboundary areas, national and local					
	Outcome 2.3: Rehabilitated basin <u>headwaters and wetlands</u> , to improve water security and climate resilience through	Detailed design of six (three in each country) interventions prepared for rehabilitation and effective management of protected areas and upper watersheds in river basin headwaters.	Bilateral for transboundary areas, national and local					
		Detailed design and implementation of four (two in each country) interventions prepared to	Bilateral for transboundary					

Strategic priority	Outcomes	Indicator	Intervention levels	Annual reporting				
				2022	2023	2024	2025	2026
	ecosystem-based adaptation interventions	rehabilitate and manage wetlands in the multiple use areas.	areas, national and local					
		Six (three in each country) interventions implemented for rehabilitation and effective management of protected areas and upper watersheds in river basin headwaters.	Bilateral for transboundary areas, national and local					
Priority 3: Exchange information and knowledge	Outcome 3.1: Flood and drought resilience and climate-sensitive IWRM through knowledge sharing	9C-9T Basin Atlas website is maintained and publicly available to inform planning and data sharing.	Bilateral and national					
		One system established for transboundary communication of water availability in reservoirs.	Bilateral and national					
		One system (or integration with existing system) of questions established for community reporting on watershed and water body health.	Bilateral and national					
	Outcome 3.2: Replicate best practices and share lessons learnt from the 9C-9T Joint Project within the Lower Mekong Basin	Two south-south exchange events on transboundary river basin planning hosted (one in each country).	Bilateral and national					
		One communications strategy developed and implemented for the implementation of Master Plan actions.	Bilateral and national					
Priority 4: Strengthen hydromet network and flood and drought warning	Outcome 4.1: Strengthened joint hydrological monitoring and warning protocols to reduce the impacts from flood and drought	One joint monitoring network for flood early warning established by Cambodia and Thailand. At least three new hydro met stations installed. All existing gauging stations verified by hydraulic modelling.	Bilateral and national					
		One joint mechanism for multi-level exchange of real-time hydrological monitoring data and early warning.	Bilateral and national					

Strategic priority	Outcomes	Indicator	Intervention levels	Annual reporting				
				2022	2023	2024	2025	2026
		20% improvement in dissemination of urban flood and drought warnings to community level.	Bilateral and national					
		One joint monitoring network for drought early warning established by Cambodia and Thailand.	Bilateral and national					
		One set of procedures for use of remote sensing data in flood and drought management.	Bilateral and national					
Priority 5: Build regional capacity	Outcome 5.1: Enhanced capacity for rehabilitation and maintenance of the basin through nature based and hybrid measures	One field-based specialist training event conducted for nature based and hybrid measures for all flood and drought interventions	Bilateral and national					
		One training program conducted for local level experts on design, implementation and management of ecosystem based adaptation measures	Bilateral and national					
	Outcome 5.2: Enhanced capacity river basin planning and transboundary management	One senior staff training program designed and implemented (public and private sector) for SEA of river basin plans	National and local					
		One set of central/provincial training designed and implemented on climate change vulnerability assessment and ecosystem based adaptation as part of river basin planning	National and local					
		One set of central/provincial training designed and implemented on climate risk-informed water management practices in target rural and urban areas.	National and local					
	Outcome 5.3: Enhanced capacity in flood and drought modelling, interpretation and communication of results.	One annual training event for flood modelling, analysis and communication.	Bilateral and national					
		One annual training event for drought modelling, analysis and communication.	Bilateral and national					

4.7.5 Risk and adaptation

An adaptive implementation and management approach will be taken by the two countries to ensure that the objectives of this Master Plan can be met in the face of hazards and obstacles that might arise across the coming 20 years. Risks that would delay the full implementation of this Master Plan, and can be proactively managed by the two countries, are identified as follows:

1. Shortfalls or delays in commitment of national budget contributions by the two countries.
2. Shortfall or delay in commitment of international funding support.
3. Data sharing protocols are not fulfilled in a timely manner to facilitate joint integrated assessment, planning and hazard warning.
4. Cross-sectoral engagement in integrated, basin-wide implementation of the Master Plan is not achieved in a timely manner.

In the case of a funding shortfall or delay, it is envisaged that the MRCS would continue to support the Joint Project for a more modest implementation of the Master Plan components within the limits of available resources. Progressive increases in national budget and technical support would then be sought to ensure sustainable implementation.

ANNEX 1 ALIGNMENT OF OUTPUTS WITH THE SIX COMMON NATIONAL STRATEGIC PRIORITIES

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
Priority 1: Review, revise and implement a 9C-9T river basin master plan	Outcome 1.1: Aligned legal frameworks and practice for transboundary water resource management to support resilience to flood and drought	Output 1.1.1: Review and update the 9C-9T flood and drought master plan as part of the existing five year national development planning and budget cycles.			✓			✓
		Output 1.1.2: Review and revise legal and administrative frameworks for river basin planning in both countries so they are well aligned, including a requirement for strategic environmental assessment as part of plan preparation.			✓		✓	✓
		Output 1.1.3: Review and revise legal and administrative frameworks for spatial planning and zoning with safeguards on a catchment basis and ensure associated tools and capacities are in place.					✓	✓
		Output 1.1.4: Review and revise legal and administrative frameworks for environmental impact assessment systems to ensure cumulative assessments of many developments (small and large scale) within a catchment are conducted.					✓	✓

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
	Outcome 1.2: Strengthened mechanisms to improve IWRM planning and integrated basin management for flood and drought	Output 1.2.1: Conduct a transboundary 9C-9T river basin climate change vulnerability assessment and adaptation planning as an input to the river basin planning process and plan		✓	✓		✓	
		Output 1.2.2: Establish the Cambodia 9C river basin committee to improve cross-sector and community participation in river basin management based on the existing 9C-9T cross-sectoral institutional structure for transboundary cooperation.						✓
		Output 1.2.3: Conduct a transboundary SEA of the 9C-9T basin action plan and assign management zones according to conservation and use values, with linked guiding principles for their rehabilitation and management and associated policy and institutional reforms.			✓	✓	✓	
		Output 1.2.4: Carry out comprehensive and transparent cumulative impact assessment of planned infrastructure in the 9C-9T basin such as weirs, ponds, wells, reservoirs and dams, and irrigation systems including pumping systems (for example listed infrastructure in	✓	✓	✓			

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
		the Thai National Water Resource Master Plan and MOWRAM sector development master plan)						
		Output 1.2.5: Prepare and implement a gender and vulnerable communities strategy and action plan for mainstreaming within flood and drought resilience sector plans and measures			✓			✓
		Output 1.2.6: Review, prepare and adopt harmonized sector action plans for 9C and 9T sub-basin areas to build flood and drought resilience (ie plans by relevant national government sector agencies responsible for water management, irrigation, forestry and agriculture, other infrastructure development and environmental management for example)	✓	✓	✓	✓	✓	✓
		Output 1.2.7: Harmonise the design regulation and guidelines for dams to ensure net gain in watershed condition and biodiversity – and the consideration of cumulative affects		✓	✓		✓	✓
	Outcome 1.3: Sustainable financing of	Output 1.3.1: Conduct economic valuation of ecosystem services to assess benefits of climate-sensitive,			✓		✓	✓

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
	ecosystem-based adaptation measures for flood and drought resilience	gender-sensitive, ecosystem-based adaptation for flood and drought resilience measures.						
		Output 1.3.2: Identify opportunities to set up impact bonds for ecosystem based flood and drought resilience building measures, to incentivize private sector investment for implementation of the 9C-9T basin action plan.			✓		✓	✓
Priority 2: Manage urban and rural flood and drought to reduce risk	Outcome 2.1: Strengthened urban flood and drought resilience through innovative climate-sensitive and ecosystem-based planning tools and adaptation interventions	Output 2.1.1: Conduct climate change vulnerability assessments and adaptation planning leading to adaptation plans for two target towns (one either side of the border)	✓				✓	✓
		Output 2.1.2: Prepare local flood and drought risk management plans for two target transboundary urban areas either side of the Cambodia-Thailand border and ensure consistency with relevant sector master plans			✓			✓
		Output 2.1.3: Review and revise urban spatial zoning and safeguards, and enforcement mechanisms to improve resilience to flood and drought with a focus on urban waterways, urban canopy cover and greening measures, and			✓		✓	✓

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
		Identification of floodway potential and flood zoning in two towns (one in each country) ⁷						
		Outputs 2.1.4: Develop and implement protective, hybrid (green and grey) infrastructures to reduce urban flood risks (e.g. urban river channel improvement, bank stabilization and natural flood retention areas) and enhance water quality in two target towns (one in each country)			✓	✓	✓	
		Output 2.1.5: Develop and implement demand-side water management measures to reduce the amount of water that is being used by households, municipal and industrial sectors, focused on building ecosystem and climate resilience		✓	✓			
	Outcome 2.2: Strengthened rural flood and drought resilience through ecosystem-based planning tools and adaptation interventions	Output 2.2.1: Develop and implement rural landscape rehabilitation measures including agro-forestry activities and changes to agricultural practices through plant diversification and intercropping, innovative irrigation measures to conserve water and		✓	✓		✓	

⁷ To be conducted in close coordination with the ADB TA CAM: Technical Support and Capacity Development in Urban Planning - TA Implementation Consultant (53199-001) Project

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
		apply demand side management approaches, less tillage, and improvements to soil water holding capacity and carbon sequestration.						
		Output 2.2.2: Develop spatial zoning and safeguards across rural landscapes, especially relating to existing and new infrastructure, and implement by installing sediment traps, conducting dredging to maintain capacity, maintenance to prevent encroachment of agriculture into reservoir banks, and establishing vegetated buffers along drainage and transport corridors and along allotment boundaries		✓	✓		✓	✓
		Output 2.2.3: Develop and implement at least six sets of nature based and hybrid interventions (three in each country) to reduce flood and drought risk in rural areas with a focus on EbA measures for water channel rehabilitation and vegetated buffers, riverbank stabilisation and for maintenance of waterways.			✓		✓	
	Outcome 2.3: Rehabilitated basin headwaters and	Output 2.3.1: Develop and implement at least six (3 in each country) interventions for			✓	✓	✓	

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
	wetlands, to improve water security and climate resilience through ecosystem-based adaptation interventions	rehabilitation and effective management of protected areas and upper watersheds in river basin headwaters – to improve and maintain the delivery of ecosystem services, with an emphasis on safeguarding transboundary biodiversity of international importance.						
		Output 2.3.2: Develop and implement at least four (2 in each country) interventions to rehabilitate and manage wetlands in the multiple use areas to strengthen PA buffer zones and improve ecological integrity for the delivery of ecosystem services (water storage/treatment/habitat).			✓	✓	✓	
		Output 2.3.3: Increase forest cover and condition in the headwaters through enrichment planting, reforestation and rehabilitation of degraded areas to achieve net gain in biodiversity and improved soil and forest carbon stock to mitigate and build resilience to climate change			✓			✓
Priority 3: Exchange information and knowledge	Outcome 3.1: Flood and drought resilience and climate-sensitive	Output 3.1.1: Maintain and apply the Joint Project Decision Support System (DSS) Atlas for the 9C-9T basin to inform basin planning and						✓

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
	IWRM through knowledge sharing	management and facilitate data sharing between ONWR and MOWRAM and other stakeholders.						
		Output 3.1.2: Development and implement a system for interactive, transboundary communication of water availability and effective coordination of reservoir operations for water security.		✓	✓			✓
		Output 3.1.6: Establish a system for community reporting on watershed and water body health, as a key input to reviewing and updating the 9C-9T basin management plan including local level support in ongoing monitoring, data collection, and preparing ecosystem health report cards including community based hazard mapping and response analysis.				✓	✓	✓
	Outcome 3.2: Replicate best practices and share lessons learnt from the 9C-9T Joint Project within the	Output 3.2.1: Replicate transboundary flood and drought M&E and resilience measures throughout the Mekong region through sharing of project lessons learnt within Cambodia, Thailand and via South-South exchanges ⁸			✓			✓

⁸ Covering: i) joint basin planning and management; ii) flood and drought warning arrangements; and iii) application of methods and tools for EbA, including support for establishing collaborative arrangements for replicating the 9C-9T experience in other shared sub-basins of the Mekong region.

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
	Lower Mekong Basin	Output 3.2.2: Develop and implement a communication strategy to share project knowledge and lessons learnt						✓
Priority 4: Strengthen hydromet network and flood and drought warning	Outcome 4.1: Strengthened joint hydrological monitoring and warning protocols to reduce the impacts from flood and drought	Output 4.1.1: Review, update and expand the joint monitoring network of equipment and systems for river level and flash floods, including verification of gauging stations with hydraulic modelling, improved disaster risk coordination and protocols, to enhance efficiency and data sharing for monitoring and early warning.			✓			✓
		Output 4.1.2: Establish joint mechanisms for exchange of real time hydrological monitoring data and early warning (national, provincial and local level at target communities).	✓		✓			✓
		Output 4.1.3: Strengthen, expand existing communication and knowledge management tools and technologies for early warning to increase climate resilience of urban communities to floods.			✓			✓
		Output 4.1.4: Review, update and expand the joint monitoring network of equipment and systems for drought including seasonal forecasting and identification of			✓			✓

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
		drought early warning trigger values to improve efficiency and data sharing for monitoring and early warning						
		Output 4.1.5: Develop procedures and capacities for the regular integration of remote sensing data into flood and drought management			✓			✓
Priority 5: Build regional capacity	Outcome 5.1: Enhanced capacity for rehabilitation and maintenance of the basin through nature based and hybrid measures	Output 5.1.1: Provide detailed field-based training for engineers, foresters, watershed managers and other specialists in nature based and hybrid measures for all flood and drought interventions			✓		✓	
		Output 5.1.2: Design and implement a training program to build capacities of local sector and river basin organizations for detailed design, implementation and management of ecosystem-based adaptation measures in target areas		✓	✓		✓	
	Outcome 5.2: Enhanced capacity for river basin planning and transboundary management	Output 5.2.1: Design and implement a training program for senior staff in the public and private sector covering SEA of river basin management plans, economic valuation of ecosystem-based adaptation and supporting financial mechanisms, and cumulative impact assessment of		✓	✓		✓	✓

Strategic priority	Outcomes	Outputs	Common national strategic priorities for water resources management in Cambodia and Thailand					
			1. Management of water for consumption	2. Building water security in agriculture and industry,	3. Management of floods and drought	4. Management of WQ and the conservation of water resources	5. Restoring watersheds and degraded forests	6. Building effective management, administration and IS
		existing and planned development in catchments.						
		Output 5.2.2: Design and implement a central and provincial training programs for climate change vulnerability assessment and ecosystem-based adaptation planning as part of river basin planning.			✓		✓	
		Output 5.2.3: Design and implement central and provincial training programs for climate risk-informed water management practices in target urban and rural areas.			✓		✓	
	Outcome 5.3: Enhanced capacity in flood and drought modelling, interpretation and communication of results.	Output 5.3.1: Develop capacities at regional and national levels for flood modelling, interpretation, and communication of results, with involvement of the MRC Flood and Drought Management Centre.			✓			✓
		Output 5.3.2: Develop capacities at regional and national levels for drought modelling, interpretation and communication of results, with involvement of the MRC Flood and Drought Management Centre.			✓			✓

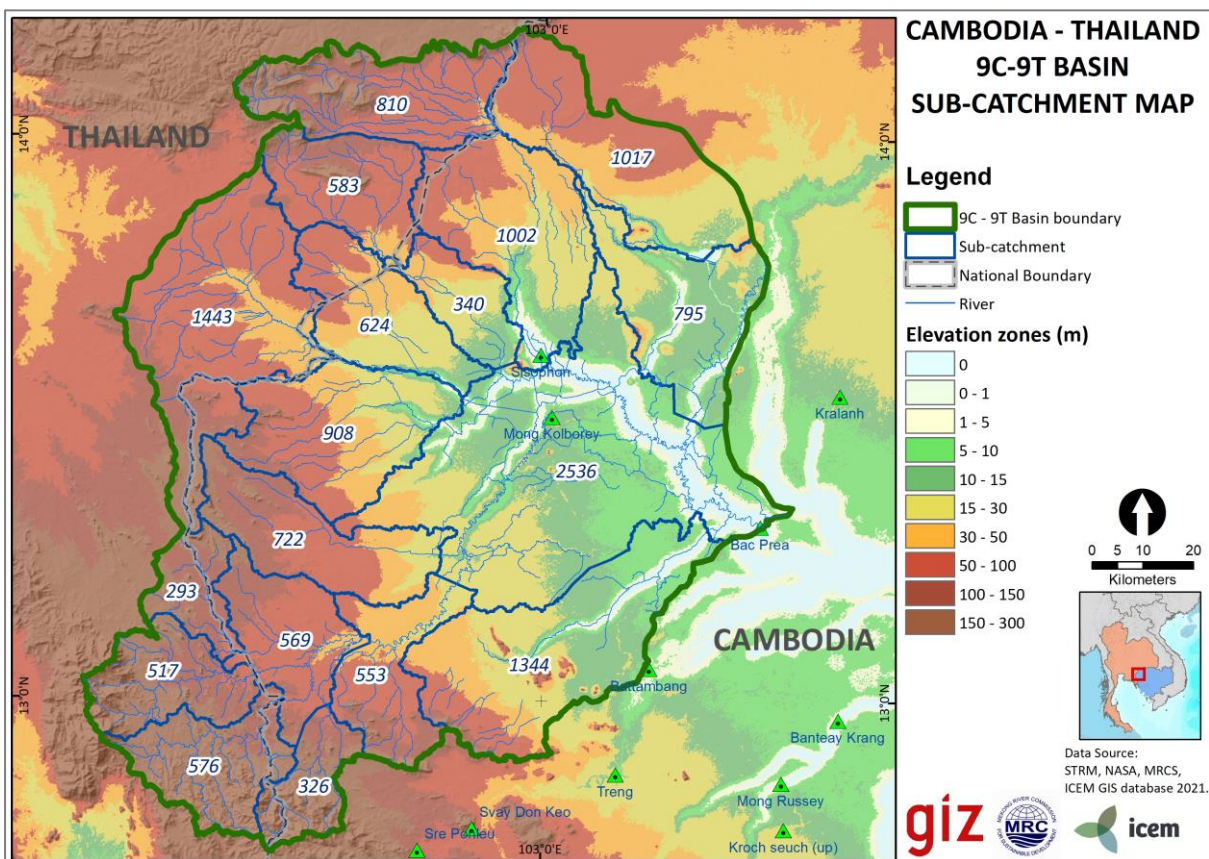
ANNEX 2 WATERSHED IDENTIFICATION AND RANKING

For identifying hotspot areas for priority flood and drought management within the 9C-9T basin, the basin was divided into sub-catchments, each with distinctive biophysical and socio-economic characteristics. The name of each of the 18 sub-catchment starts with “S” for “sub-catchment” followed by four numbers representing the sub-catchment area in square kilometres.

Method for defining the catchments

First, the most up to date and accurate DEM was used and cropped for 9C-9T basin as input for catchment delineation using ArcSWAT. The D8 routing method was applied to determine how the water from a cell will be routed to one of 8 surrounding cells allowing for the formulation of a dataset on flow direction and accumulation. By defining the number of cells accumulated to get streams, stream networks were created and defined at stream junctions and the main outlet (stream flow out of DEM area). Then, the outlets were manually edited to arrive at the desirable number of sub-catchments for planning and management purposes. The outlets were identified at the main outlet, hydrology station location, main junction or irrigation/drainage canal. Some outlets were placed on the Thailand - Cambodia border for Thai sub-catchments. Finally, 18 sub-catchments were defined from selected outlets (Figure 11). The name of each sub-catchment starts with “S” followed by 4 numbers representing the sub-catchment area in square kilometres.

Figure 11. Sub-catchments in 9C-9T basin



Multi-criteria analysis

Figure 12 shows the MCA process applied to rank sub-catchments according to urgency for flood and drought management and investment.

Figure 12. Overall ranking process leading to identification of demonstration sites



Criteria selection and scoring

Many parameters are important for the sub-catchment ranking process. Therefore, five key indexes made up of several relevant parameters were defined as follows:

1. **Drought risk:** A composite score based on sub-catchment soil and water characteristic (Total Available Water, Interception, Exfiltration, Evapotranspiration), evidence of historical drought events and trends, and projected dry season precipitation.
2. **Flood risk:** A composite score based on average flood depth, flood area, and evidence of historical flash floods.
3. **Soil erosion risk:** A composite score based on historical soil loss and local knowledge on soil erosion.
4. **Biodiversity and forest loss risk:** A composite score based on forest coverage, recent forest loss, and biodiversity importance (i.e., Protected Areas, Multiple Use Areas).
5. **Socio-economic importance:** A composite score based on population density and economic importance of the area.

Sub-catchments scorings for each of those indexes are mapped from least (1) to most at risk (5).

Figure 13. Drought risk scoring by sub-catchments

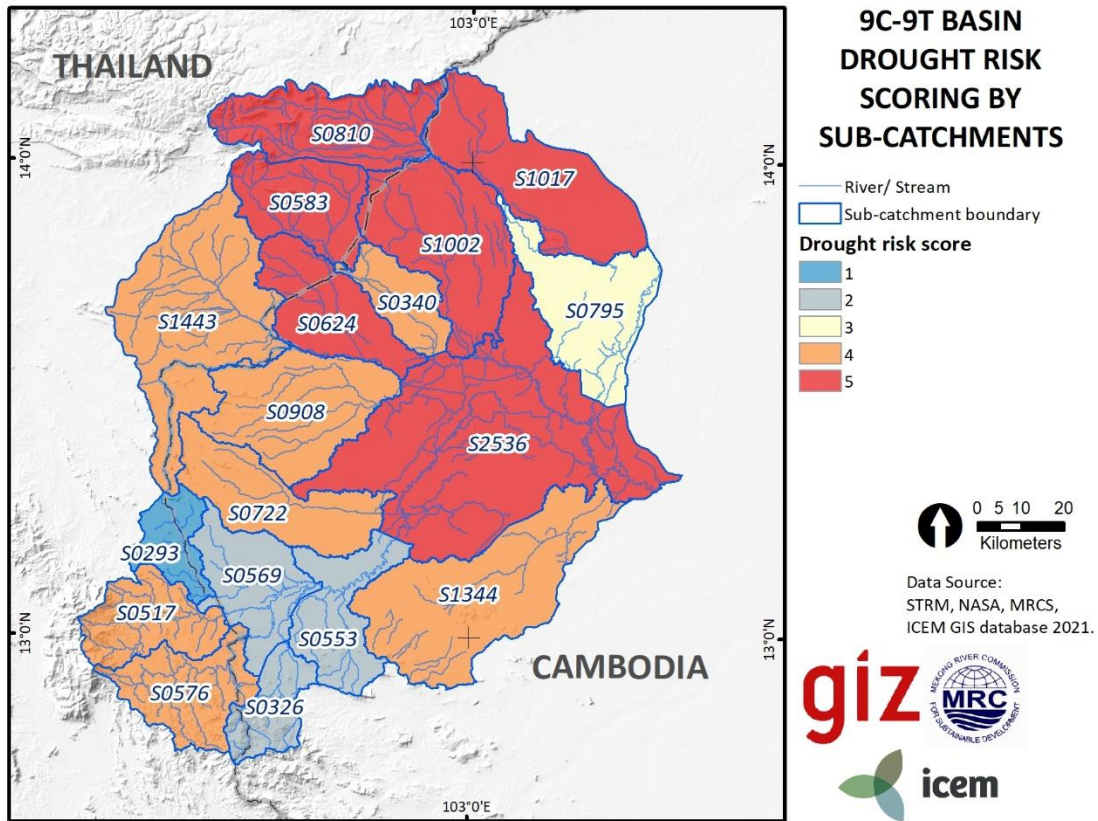


Figure 14. Flood risk scoring by sub-catchments

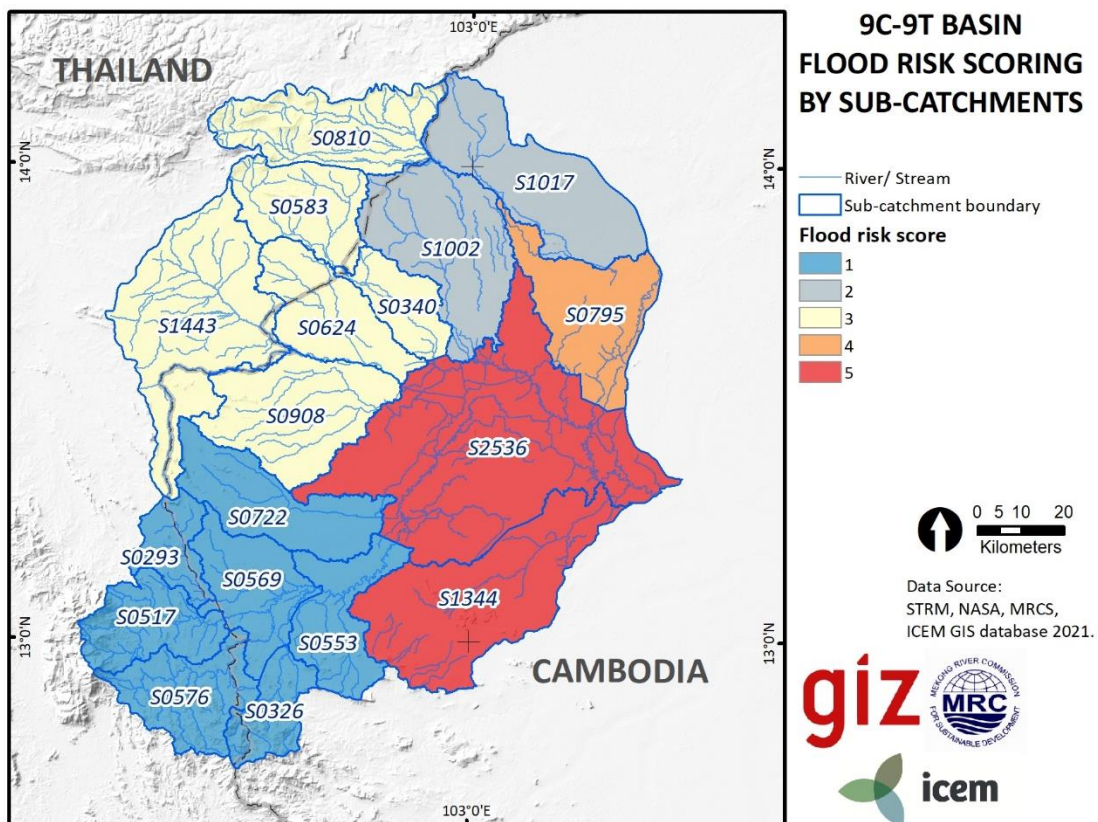


Figure 15. Soil erosion risk scoring by sub-catchments

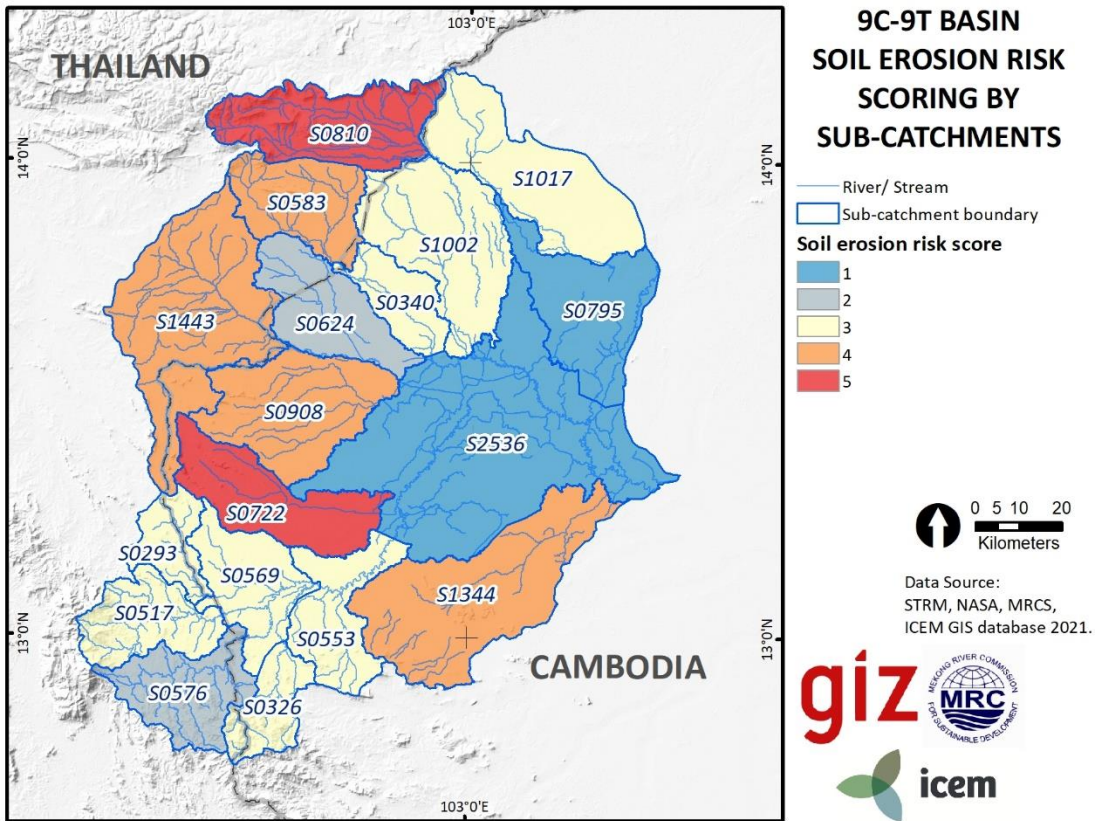


Figure 16. Biodiversity and forest loss risk scoring by sub-catchments

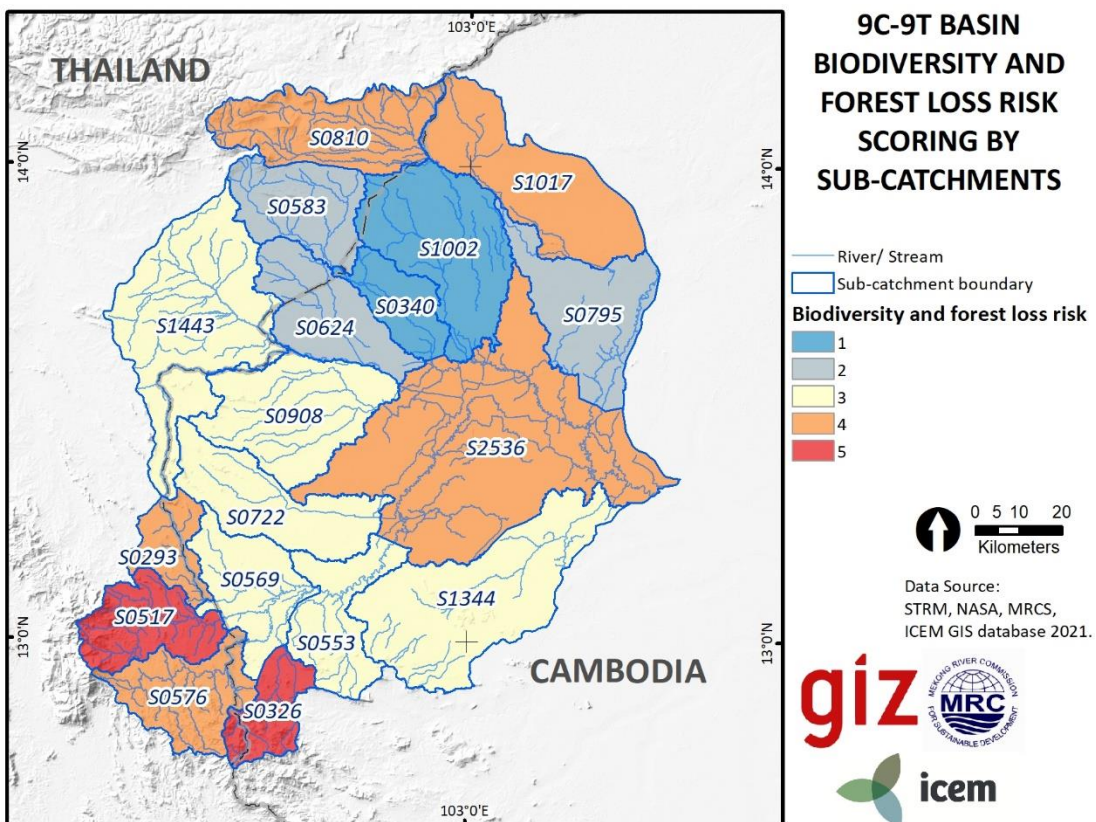
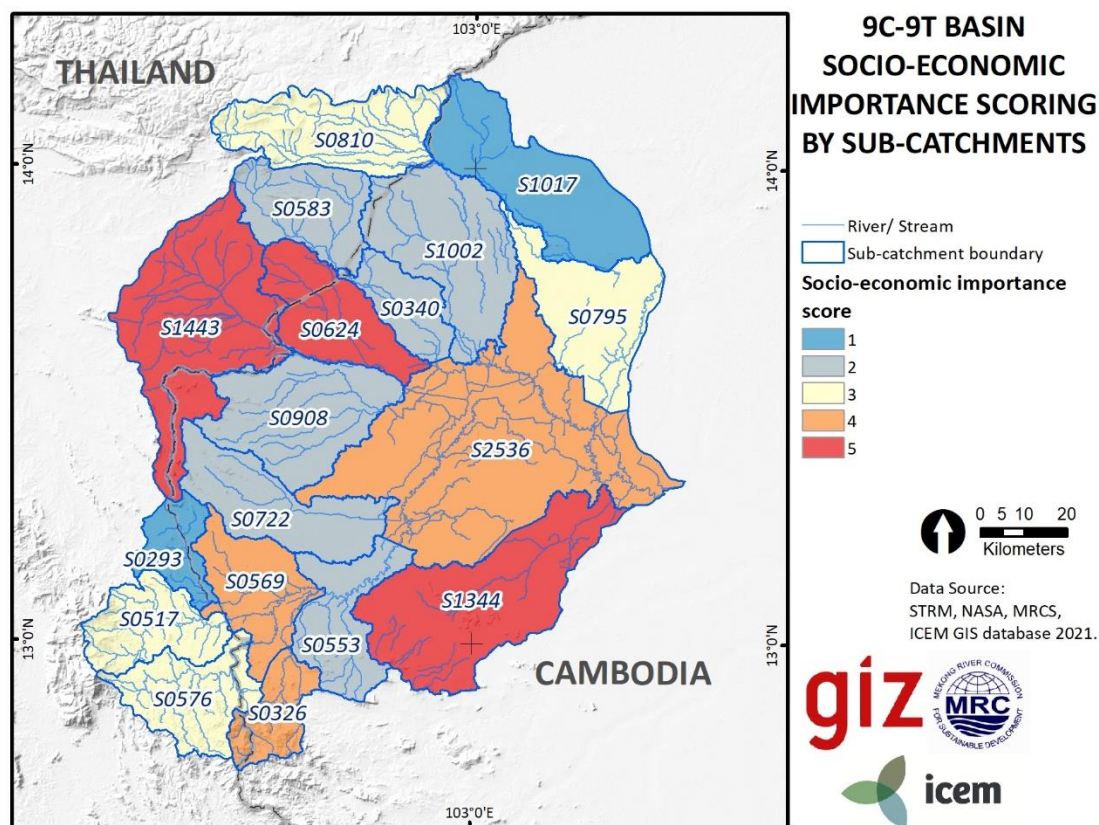


Figure 17. Socio-economic importance scoring by sub-catchments



Overall ranking of sub-catchments

Sub-catchments are ranked by calculating the sum of scores for the five composite parameters or indexes. From this result, 11 out of the 18 sub-catchments with the highest rankings are defined as priorities for flood and drought management (Figure 18 and Table 7). The highly ranked sub-catchments are S1344, S1443, S2536, S0810, S0624, S0517, S0583, S0908, S0326, S0722, S1017.

Most of these sub-catchments are defined as flood or drought hotspots – ie areas which frequently experience severe flooding and drought. Yet, some are upstream and head water areas where degraded forest conditions are creating downstream flood and drought problems. Their effective management has a critical role in moderating flood and drought extent and severity across the 9C-9T basin.

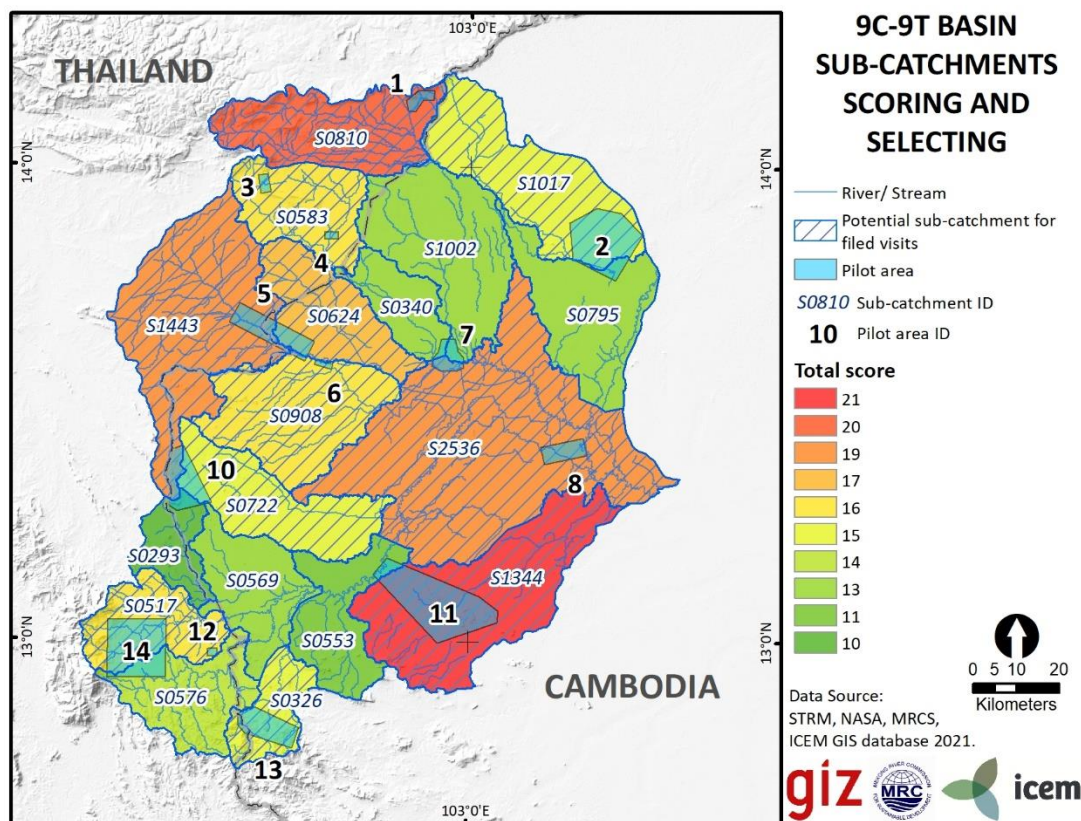
For example, sub-catchment S0810 has its head waters in Ta Phraya National Park, at the eastern end of the Sankampaeng Range which meet the Dangrek Range, near the Thai-Cambodian border. That catchment suffers serious erosion and drought issues which in part have their origin within the protected area and denuded buffer zone. S0326 partially covers Samlaut Multiple Use Area (Cambodia) and buffer zone to Khlong Kreua Wai Chaleum National Park (Thailand). Forests in those protected areas are degrading with knock-on downstream impacts. Forests in the S0722 sub-catchment have also been significantly disturbed largely converted from forest landscapes to agriculture and now suffering flood and drought challenges. S0517 too is a critical catchment for downstream water uses and conditions. Most forested areas within this area have been converted to agricultural lands, resulting in forest fragmentation and loss of watershed ecosystem services.

The selection of field sites to establish a network of demonstration projects for effective flood and drought control need to include upstream areas as well as those downstream which suffer serious impacts of flood and drought.

Table 7. Sub-catchment scoring matrix (high priority sub-catchments for flood and drought management highlighted in green)

Basin ID	Drought Risk Score	Flood Risk Score	Erosion Risk Score	Biodiversity Conservation Score	Socio-economic Score	Total Score	Ranking
S1344	4	5	4	3	5	21	1
S0810	5	3	5	4	3	20	2
S1443	4	3	4	3	5	19	3
S2536	5	5	1	4	4	19	3
S0624	5	3	2	2	5	17	5
S0517	4	1	3	5	3	16	6
S0583	5	3	4	2	2	16	6
S0908	4	3	4	3	2	16	6
S0326	2	1	3	5	4	15	9
S0722	4	1	5	3	2	15	9
S1017	5	2	3	4	1	15	9
S0576	4	1	2	4	3	14	12
S0340	4	3	3	1	2	13	13
S0569	2	1	3	3	4	13	13
S0795	3	4	1	2	3	13	13
S1002	5	2	3	1	2	13	13
S0553	2	1	3	3	2	11	17
S0293	1	1	3	4	1	10	18

Figure 18. Sub-catchments scoring and selecting



Priority areas for demonstration projects

In situations of scarce resources and when so much needs to be done to rehabilitate the 9C-9T basin to reduce the risks of flood and drought, investment priorities need to be identified. As a first step, the basin was divided into 18 catchments. Then those catchments were ranked according to rehabilitation need. Eleven catchments have been identified as high priorities for investment for flood and drought management.

As a final step, specific locations within each of those eleven priority sub-catchments have been identified as shown in Figure 18. These areas are selected based on high-resolution Google Earth images with support from ancillary field-based information. Table 8 lists 13 locations within the prioritised sub-catchments and the factors which led to their selection as demonstration sites to address the serious issues they are facing through a combination of nature based and hybrid measures.

Table 8. Field visit locations within the prioritised sub-catchments

Pilot #	Country	Sub-catchment	Project area	Specific selection factors
1	Thailand	S0810	Sampo, Tuduang and UN reservoirs and watersheds rehabilitation	<ul style="list-style-type: none"> • Low water availability in the soil • Low infiltration/exfiltration capacity • Soil erosion and sedimentation problem • High potential of crop-Evapotranspiration (indicating potential water stress) • High frequency of drought • Rainfall is projected to reduce in the dry season • Upstream of 1002 sub-catchment which has a very high total score • Reservoirs inside protected areas
2	Cambodia	S1017	Sediment management and watershed rehabilitation at Trapeang Thma Lake	<ul style="list-style-type: none"> • Low infiltration/exfiltration capacity • Soil erosion and sedimentation problem • High potential of crop-Evapotranspiration (indicating potential water stress) • Increasingly impacted by drought • Rainfall is projected to reduce in the dry season • Forest to agriculture transitions
3	Thailand	S0583	Erosion-sedimentation in Watthana Nakhon District	<ul style="list-style-type: none"> • Low water availability in the soil • Low infiltration/exfiltration capacity • Intensive soil erosion and sedimentation problem • High potential of crop-Evapotranspiration (indicating potential water stress) • High frequency of drought • Rainfall is projected to reduce in the dry season
4	Thailand	S0583	River bank stabilization on Takhian River	
5	Cambodia and Thailand	S1143, S0624	Cross-border wastewater management through nature based measures	<ul style="list-style-type: none"> • Wastewater management issues • Low water availability in the soil • Low infiltration/exfiltration capacity • Rainfall is projected to reduce in the dry season

Pilot #	Country	Sub-catchment	Project area	Specific selection factors
				<ul style="list-style-type: none"> • Medium water retention capacity • Medium flood risk (projected increasing rainfall in the wet season) • High frequency of drought • Forest to agriculture transitions
6	Cambodia	S0908	Flood retention in Phum Kouk Thum	<ul style="list-style-type: none"> • Regularly flooded area • Increasingly impacted by drought. Rainfall is projected to reduce in the dry season and increasing in the wet season • Low water availability in the soil • High potential of crop-Evapotranspiration (indicating potential water stress)
7	Cambodia	S2536, S1002	Urban flood management in Serei Saophoan City	<ul style="list-style-type: none"> • Mining areas, • landslide risk, • urban wastewater pollution
8	Cambodia	S2536	Flooded forests and wetland rehabilitation in buffer zone of Tonle Sap Biosphere Reserve	<ul style="list-style-type: none"> • High flood risk • Forest to agriculture transitions • Wetland loss
10	Cambodia	S1443, S0722	Forest stepping stone network for connecting remaining forest areas in critical watersheds	<ul style="list-style-type: none"> • Forest fragmentation issue • Forest loss • Soil erosion and sedimentation problem • Low infiltration/exfiltration capacity
11	Cambodia	S1344	Watershed management at Kamping Puoy Reservoir	<ul style="list-style-type: none"> • Low water availability in the soil • Low infiltration/exfiltration capacity • Low water retention capacity • High flood risk • High and increasing frequency of drought • Forest to agriculture transitions
12&14	Thailand	S0517	Water conservation and supply for orchard plantations Forest corridors established in critical watersheds	<ul style="list-style-type: none"> • A critical catchment for downstream water uses and conditions (water conservation and supply for orchard plantations in Pong Nam Ron) • Forest fragmentation issue • Encroachment into protected areas
13	Cambodia and Thailand	S0326	Watershed rehabilitation in Samlaut Multiple Use Area (Cambodia) and buffer zone to Khlong Kreua Wai Chaleum National Park (Thailand)	<ul style="list-style-type: none"> • Covering Samlaut Multiple Use Area (Cambodia) and buffer zone to Khlong Kreua Wai Chaleum National Park (Thailand). • Encroachment into protected areas. • Forest degradation with knock-on downstream impacts.



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