2025

ICFMS - Xonnabuly District

Integrated Climate-Resilient Flood Management Strategy

Aluvium and Hydrotech Consulting

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Abbreviations

DAFO	District Agriculture and Forestry Office
DoNRE	District Office of Natural Resources and Environment
DWR	Department of Water Resources
DMH	Department of Meteorology and Hydrology
EbA	Ecosystem-based Adaptation
EWS	Early Warning System
GEDSI	Gender Equality, Disability, and Social Inclusion
ICFMS	Integrated Climate-Resilient Flood Management Strategy
ICM	Integrated Catchment Management
Lao PDR	Lao People's Democratic Republic
IWRM	Integrated Water Resources Management
LPC	Luang Prabang City
MoLSW	Ministry of Labour and Social Welfare
MoNRE	Ministry of Natural Resources and Environment
NDMC	National Disaster Management Committee
MTC	Ministry of Technology and Communications
MoICT	Ministry of Information, Culture and Tourism
MWPT	Ministry of Public Works and Transport
PoNRE	Provincial Office of Natural Resources and Environment
UNDP	United Nations Development Programme
XBH	Xe Bang Hieng River Basin

Definitions

Flood extent: Areas affected by flood water

Riverine Flooding: Riverine flooding, also known as fluvial flooding, happens when a river, stream, or other watercourse overflows its banks due to excessive rain. This leads to the inundation of surrounding land.

Hazard mapping: This is a map that highlights areas that are affected by or are vulnerable to a particular hazard

Representative Concentration Pathways (RCP): RCP are prescribed pathways for greenhouse gas concentrations, together with land use change, that are consistent with a set of broad climate outcomes used by the climate modelling community. Emissions in RCP 4.5 peak around 2040, then decline. In RCP 8.5 emissions continue to rise throughout the 21st century.

Other technical terms are described directly in the document.

Preface

The Integrated Climate-Resilient Flood Management Strategy (ICFMS) for Xonbuly District, Savannakhet Province, provides a detailed Action Plan to enhance the resilience of communities to the impacts of floods and droughts—both of which are projected to become more intense and frequent with climate change – and ensure effective socio-economic development that achieve the best outcome for the economy, communities and the environment. The ICFMS aligns with the direction of the Law on Water and Water Resources (revised in 2017), the Strategic Plan for the Management and Use of Water and National Water Resources until 2030, the Plan of the Natural Resources and Environment Sector, and National to district level Socio-Economic Development Plans.

The ICFMS has been developed in cooperation with related sectors such as the Department of Water Resources, the Provincial Department of Natural Resources and the Environment and the Administration of Xonbuly District under the IWRM-EBA Project which is supported by the World Environment Fund (GEF) and the United Nations Development Organization (UNDP).

We on behalf of Xonbuly District Administration, the Natural Resources and Environment Department of Savannakhet Province and the Water Resources Department, Ministry of Natural Resources and Environment have coordinated harmoniously in developing this Strategy with support from central and local stakeholders. We will continue this close cooperation in implementing the Action Plan including with international organizations, private sector, project developers and the community in order to achieve the goal and objectives of the Strategy.

We would like to express our gratitude to the responsible committee for their hard work, conscientiousness and authority in creating this Strategy and its implementation. We also express our gratitude to the relevant parties who have contributed information and comments on this Strategy. In particular, I would like to express my gratitude to the donors who provided financial and technical support. The document will be implemented and integrated with the Socio-Economic Development Plan of the district, and relevant plans for other sectors. It will also be reviewed and updated periodically.

At Xonbuly District, December 20, 2024

Director of DWR | Head of the Savannakhet PoNRE | The Governor of Xonbuly District

1 Enhancing climate resilience of communities to floods and droughts

1.1 Background

Savannakhet Province consists of 15 districts (including Xonbuly District) and 1,022 villages with a total population of about 1 million people (Lao Census, 2016). Agriculture is particularly important for the Province, with 75% of the population living in rural areas and relying on subsistence farming for livelihoods. Approximately 15,000 km^2 of the province area is used for agriculture. Rice paddy cultivation in the province supplies ~25% of the rice consumed in Lao PDR. Most of Savannakhet Province lies within the ~19,500 km^2 Xe Bang Hieng River Basin, with the river's headwaters located in the Annamite mountains along the Lao PDR–Vietnam border, in the north-eastern region of the province.

The Integrated Climate-Resilient Flood Management Strategy (ICFMS) for Xonbuly District aims to enhance the resilience of communities to the impacts of floods in the district, which are projected to become more intense and frequent with climate change. Flood hazard mapping for the Xe Bang Hieng River Basin shows that the floodplain area in the lower valley of the Xe Champhone and Xe Xangxoy Rivers (in the western part of Xonbuly district) is exposed to riverine flooding resulting in significant social and economic impacts. The western area of Savannakhet Province which includes Xonbuly District is also prone to more severe drought of longer duration. Whilst intensity of agriculture in Xonbuly district is lower compared to other lowland districts (e.g. Songkhone and Champhone districts), there is potential for significant damage costs to agriculture from drought in Xonbuly district.

The ICFMS for Xonbuly District outlines a strategy and set of actions over the next five years (2025-2029) to enhance the resilience of communities to the impacts of floods and droughts (including the effects of climate change) in the district. It serves as a blueprint for enhancing resilience by adopting Integrated Catchment Management (ICM), Integrated Water Resources Management (IWRM), Ecosystem-based Adaptation (EbA), and Early Warning approaches, while promoting sustainable, inclusive, and gender-responsive solutions. The ICFMS is also designed to strengthen both technical and institutional capacities, ensuring that communities can better plan for, respond to, and recover from floods and droughts.

The ICFMS covers the following key areas within its scope:

- Geographical Coverage: The strategy applies to the Xonbuly District within the Xe Bang Hieng River Basin, with a focus on the target rural communities in the villages of Nonsavang, Meuanghong, and Nachanyai.
- Sectors: The strategy involves cross-sectoral collaboration, focusing on water resource management, land-use planning, ecosystem management, infrastructure implementation, early warning and preparedness to ensure a holistic approach to flood and drought resilience.
- Stakeholders: The project engages national and local government bodies, community organizations, civil society, and development partners to co-develop and implement the strategy. Attention is also given to involving vulnerable groups, such as ethnic minorities and women, in the planning and decision-making process.
- Timeframe: The proposed action plan spans five years, from 2025-2029, and includes short-term actions to build immediate resilience, as well as longer-term structural and non-structural actions, including infrastructure investments and ecosystem restoration initiatives.

1.2 Alignment with existing policies, plans and strategies

The ICFMS has been developed aligning with the existing policies, plans, strategies and initiatives as summarised below.

Socio-Economic Development

District

This ICFMS contributes to the goals and focus directions of the Social Economic Development Plan of Xonbuly District, in particular with regards to:

- Goal 1: To make the economy of the district grow with quality. Focus work plan 1: Macroeconomy is strong and stable. Focus work plan 2: Develop agriculture-forestry in a modern and sustainable direction.
- Goal 3: To improve and upgrade the material and mental living conditions of the people, especially in rural areas, to be able to do stable production, and gradually increase family income. Focus work plan 1: Develop rural areas and solve poverty so that people's lives are improved. Focus work plan 4: To promote the role and participation of women, youth, disadvantaged, disabled and senior citizens in socio-economic development.

Province

The ICFMS contributes to the 5-year Socio-Economic Development Plan (2021-2025) of Savannakhet province by supporting the target economic growth rate, protection of nature and the environment, and use of natural resources effectively to benefit society.

National

The ICFMS contributes to the National Strategy on Socio-Economic Development (2016-2025) by supporting continuous economic growth in the direction of quality, balance, and sustainability. The ICFMS also aligns with the protection of nature and the environment and use of natural resources effectively in a sustainable, effective and green direction. Finally, it contributes to Goal 8 of the National Sustainable Development Goals (SDGs) to promote continuous, inclusive and sustainable economic growth.

Watershed Management

This ICFMS contributes to the Xe Bang Hieng Watershed Management Plan (2021-2025) six programs: (1) Create a management mechanism and participate in the management of the catchment area (2) Manage the use of water and water resources (3) Manage information on water and water resources (4) Protect and restore water and Water resources (5) reduce the effects of floods, droughts and climate change and (6) manage land, forests, environmental protection and pollution control.

Disaster Management

This ICFMS contributes to the “Disaster Risk Reduction Strategy in Savannakhet Province until 2035” in particular with regards to capacity building for disaster prevention and risk reduction, and disaster control.

Climate Change

The ICFMS contributes to the Actions Plans in the National Strategy for Climate Change By 2030 in particular: 1) Develop, manage information systems, report conditions, events and effects of climate change; 2) Strengthen the resilience and the ability to adapt to climate change for basic infrastructure, production systems, businesses, services, ecosystems and communities as well as all sectors that are vulnerable and affected; 3) Promote education, awareness and public participation on climate change; 4) Connect and create a favourable environment to manage the impacts of climate change; 5) Strengthen organisations and human resources to manage climate change. The ICFMS also contributes to Sustainable Development Goal 13 to take urgent measures to combat climate change and its impacts.

Anticipatory Actions

The Lao Government is currently collaborating with the Food and Agriculture Organisation (FAO) to develop Anticipatory Action Protocols for agricultural drought. It is an Early Warning System consisting of trigger points (risk level) informed by an Effective Drought Index (EDI) using rainfall observations and forecast data. Anticipatory Actions are proposed to reduce negative impacts of droughts including food security and farmers’ income due to crop and livestock damage and loss. The FAO is also working the Department of Meteorology and Hydrology (DMH) on flood trigger points and Anticipatory Actions for livestock evacuation. The trigger points are informed by rainfall observations and forecast which are in turn used to forecast river water levels. The system is being tested with the intent that it will be deployed to DMH.

Early Warning

Early Warnings For All (EW4ALL) 2024-27 is a special initiative of the United Nations (UN) Secretary General, which aims to spearhead action to ensure every person on Earth is protected by early warning systems by 2027. Under the umbrella of EW4ALL, Lao People’s Democratic Republic (Lao PDR) aims to scale up prior efforts and strengthen national early warning systems

According to the EW4ALL Road Map for Lao PDR (United Nations, 2024), the DMH has undergone major upgrades in terms of their observation network and forecasting systems. However, there is now an increased demand for localized and actionable early warning information among agencies and end-users from different sectors, including agriculture and disaster risk management. This is important to help build trust in warning services amount communities. The report also outlines that communities lack of knowledge about risks and appropriate responses. Furthermore, the 9th National Socio-Economic Development Plan (NSEDP) emphasizes the need to strengthen the capacity of disaster management committees in central, provincial and district level in disaster risk reduction and preparedness. It also aims to improve the quality of reporting and effectiveness of news alerts related to temperature, weather, earthquakes, and water levels. Gaps and proposed activities in the Road Map that are relevant to addressing challenges at the district and village community levels for this project are outlined in Section 5.

Conservation Strategy

This ICFMS contributes to Goal 4 and focus directions of the Social Economic Development Plan of Xonbuly District – Focus on development within the province to be green and friendly to the environment. Work plan 1: to protect the environment and prepare to deal with and respond to risks from natural disasters. Work plan 2: To manage and use natural resources sustainably. The ICFMS will contribute to the Sustainable Development Goal 15 – To protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

1.3 Process for developing strategy

The ICFMS for Xonbuly District forms part of a larger project titled “Integrated Water Resource Management and Ecosystem-based Adaptation in the Xe Bang Hieng River Basin and Luang Prabang city” (referred to as the IWRM & EBA Project).

The IWRM & EBA Project is funded by the Global Environment Facility (GEF) and delivered by the United Nations Development Programme in the Lao People's Democratic Republic (Lao PDR). This project aims to support the government of Lao PDR to promote the integrated management of land and water resources for targeted rural and urban communities in the Xe Bang Hieng River Basin (XBH) and Luang Prabang City (LPC).

The IWRM & EBA Project has three Outcomes:

- Outcome 1: Enhanced national and provincial capacities for integrated catchment management and integrated water resource management in target rural and urban communities.
- Outcome 2: Reduced flood risk through headwater conservation, restoration and protective infrastructure, supported by climate-resilient and alternative livelihoods.
- Outcome 3: Effective knowledge management and Monitoring and Evaluation (M&E) through awareness/advocacy and monitoring of climate change impacts and adaptation opportunities in target rural and urban communities.

Outcome 1 consists of two Outputs:

- Output 1.1: An assessment of EbA and protective infrastructure options for XBH and LPC, flood- and drought-risk maps of XBH, and an economic evaluation of urban ecosystem services for LPC.
- Output 1.2: ICFMS developed for LPC and the XBH Basin, supported by an updated hydrometeorological monitoring network, early-warning systems (EWS) and revised emergency procedures for the XBH Basin.

This ICFMS is part of Outcome 1.2 and builds on the data gathered from previous risk mapping and hydrological models (from Output 1.1). These strategies will align with broader IWRM and ICM goals, ensuring that interventions are sustainable and support long-term climate resilience.

The development of the Xonbuly district ICFMS has been highly consultative, with multiple stakeholder consultations to seek inputs and review from village, district, provincial and central level stakeholders (Figure 1). The process was also guided by the key approaches outlined below – ICM, IWRM, EbA and Early Warning Systems..

Figure 1. *Process and timeline adopted in developing ICFMS*

Integrated Catchment Management

ICM is a process that recognises "catchment" as the organising unit for understanding and managing ecosystem processes in a context that includes social, economic and political considerations, and guides communities towards an agreed vision of sustainable natural resource management in their catchment.

Integrated Water Resource Management

IWRM is a process that promotes the coordinated development and management of water, land and related resources to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. The basis of IWRM is that the many different uses of finite water resources are interdependent, and that unregulated use of scarce water resources (surface and groundwater) is wasteful and inherently unsustainable.

Ecosystem based Adaptation

EbA, also referred to as Nature-based Solutions (NbS), harnesses biodiversity and ecosystem services to enhance the resilience and reduce the vulnerability of people and the environment to climate change (Figure 2). EbA involves the conservation, sustainable management and restoration of ecosystems (such as forests, floodplains, rivers and wetlands).

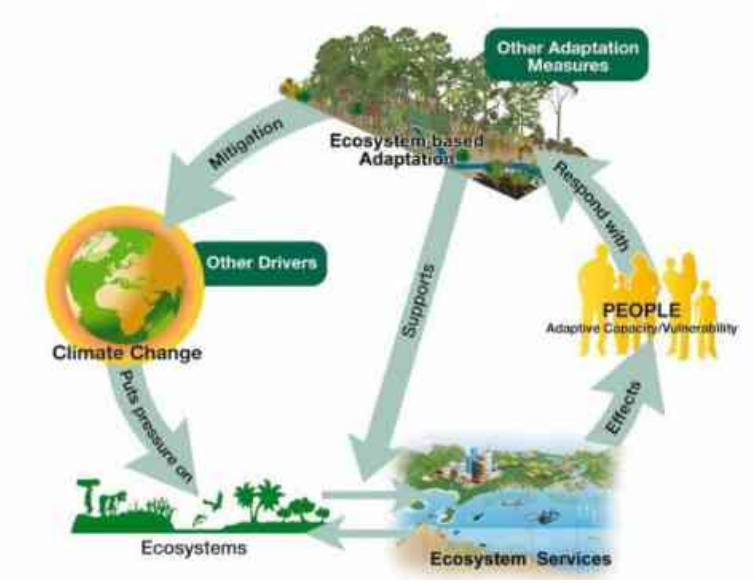

Figure 2. *Ecosystem-based Adaptation conceptualised in the Driving Forces-Pressures-State-Impacts-Responses framework (Source: UNEP-UNDP-IUCN (2010)*

Early Warning Systems

The Early Warning System (EWS) analysis presented in this strategy draws on the UNDP framework for Early Warning Systems (UNDP, 2018) (Figure 3). The framework provides expected elements of successful EWS across the following themes: i) risk knowledge; ii) monitoring and warning system service; iii) dissemination and communication; and iv) the response capability of agencies and communities.

Figure 3. *UNDP framework for early warning systems (Source: UNDP, 2018)*

2 Situation Assessment

2.1 Geography

Savannakhet Province, situated in the central region of Lao PDR, is the country's largest and most populous province (over 1 million people). The majority, more than 75%, reside in rural areas, relying on subsistence agriculture in small villages. The province's significance lies in its connection to the Xe Bang Hieng river basin, particularly the lowland region which is crucial for agriculture. These areas contribute approximately 25% of the rice consumed in Lao PDR, playing a pivotal role in the nation's food security.

Xonbuly District is located in the lowland of the Xe Bang Hieng River Basin (Figure 4) with a total land area of 1,628 km^2. The district population of 65,935 is spread across 62 villages with 2 main ethnic groups living together: Lao and Breu. Among them, the Lao people account for 51% and the Breu tribe accounts for 49% (Xonbuly City Planning Office, 2019). Villages and population are concentrated to the east, north and west of the district along the network of rural roads and the Provincial/District road that runs from the east to the north of the district. The centre of the district where the Ong Mang Provincial Conservation Forest (Eld's deer sanctuary) is less populated. The median village population is about 895. The most populous villages include La ha nam thong, Nonh sa wang, Kong yark neua, and B. Tang vai kork. The Xe Bang Hieng River forms part of the southern boundary of the district, where the target villages of Meuanghong and Nachanyai are located. The proportion of the village population considered poor (poverty headcount) is higher in the centre, as well as in the southern, eastern and northwestern parts of the district where poverty headcount is generally >50% (Figure 5). It should be noted that incidence of poverty in Xonbuly district is higher compared to other lowland districts such as Champhone and Songkhone districts.

The gross domestic product (GDP) of the district in 2019 reached 510 billion kip, an increase of 161 billion kip compared to 2014, in which:

- Agricultural sector account for 82.6 % of GDP.
- The industrial sector account for 5.8 % of GDP
- The service sector account for 11.6 % of GDP.

The average GDP per capita of the district is 7.7 million kip or equivalent to 920 US dollars.

2.2 Ecosystems

A considerable area of Savannakhet Province and Xe Bang Hieng River Basin, particularly the central and eastern region (which include the upland catchments), is highly forested. The ecosystem services provided by forested land in regulating the catchment hydrology and in protecting river water quality benefit communities across the basin. Forested land promotes infiltration of rainfall and reduces surface runoff, regulating baseflow in the dry season and floods in the wet season. Forested land also uses less water than agricultural land, protecting yield in surface water systems including springs, local watercourses and main river stems.

Table 1. Xonbuly District land cover

Land cover classification	Area (ha)	%
Dry Dipterocarp Forest	39,208	32.51
Rice Paddy	37,506	31.10
Mixed Deciduous Forest	33,658	27.91
Evergreen Forest	3,862	3.20
Regenerating Vegetation	2,911	2.41
Water	1,399	1.16
Savannah	1,239	1.03
Forest Plantation	369	0.31
Urban	251	0.21
Other Agriculture	166	0.14
Other Land	20	0.02

The land cover in Xonbuly District comprise largely of dry dipterocarp forests (32.5%) rice paddy fields (31.1%) and mixed deciduous forests (27.9%) (see Table 1 and Figure 6). Rice paddy fields are concentrated to the east, north and west of the district where villages are also located. The centre of the district is largely dry dipterocarp forests with the Ongmang Provincial Conservation Forest (68,465 ha) falling mostly within Xonbuly district providing important sanctuary for the Eld's deer (Figure 4). However, expansion of rice paddy fields within the Ongmang Provincial Conservation Forest is also evident (Figure 6).

The Xonbuly District is characterised by a multitude of rivers and streams, including the Xe Xangxoy River to the west of the district and the Xe Koumham River to the west (Figure 4). Part of the southern boundary of the district is set by the Xe Bang Hieng River. Rivers and streams are important natural resources for the communities providing domestic and irrigation water supply. Indeed, most of the villages in the district are located in proximity of rivers and streams.

The Xe Champhone River and Xe Xangxoy River confluence close to the western boundary of the district. The Xe Champhone wetlands of Savannakhet Province supports important ecosystems including bird communities. A "proposed" Ramsar site boundary include the floodplains and associated wetlands in the lower valley of the Xe Champhone and Xe Xangxoy Rivers (Timmins, 2014), part of which falls in Xonbuly district. These systems provide refuge for fish in permanently flooded deep ponds and marshes in the dry season. In the wet season, fish use the site as a spawning area and as a migration path. Local people also use the site for farming, communal fishing, and livestock raising.

2.3 Climate and hydrology

The Xonbuly District is situated in a tropical area, which also extends into a monsoonal zone. It experiences two primary seasons – a dry season from November to early May and a wet season from May to October. The monthly average temperature in the district is relatively stable throughout the year with a peak of around 42 °C in April (based on Kengkok station weather data 1990-2020). The district receives an average annual rainfall of about 1,354 mm (based on B. Nonsavang station weather data 2003-2022) with most of the rainfall occurring during the wet season. About 87.6% of the flow in the Xe Xangxoy River is therefore during the wet season with flow increasingly significantly from June until September (based on Phalan station flow data 2003-2018).

While country specific data on climate change is limited, the average daily temperatures in Southeast Asia have already risen by 0.5 to 1.5°C between 1951 and 2000 (Mastrorillo, 2016). Additionally, a Lao PDR Government report of climate vulnerability assessment in Lao PDR illustrated that the average maximum temperature in Savannakhet Province is expected to rise (2021-2050) by 1.10°C for Representative Concentration Pathways (RCP) 4.5 and 1.36°C for RCP8.5 (MoNRE, 2020). MoNRE (2020) also indicated that from 2021-2050, the average maximum rainfall in Savannakhet province was expected to rise 12.32mm and 49.6mm for RCP 4.5 and RCP8.5 respectively. Southeast Asia is also expected to see significant increases in average annual economic losses between 2005 and 2050 due to flooding with impacts on freshwater availability, food security, human health and industrial outputs (IPCC Sixth Assessment Report, 2023). This is a significant issue for Lao PDR which depends heavily on natural resources.

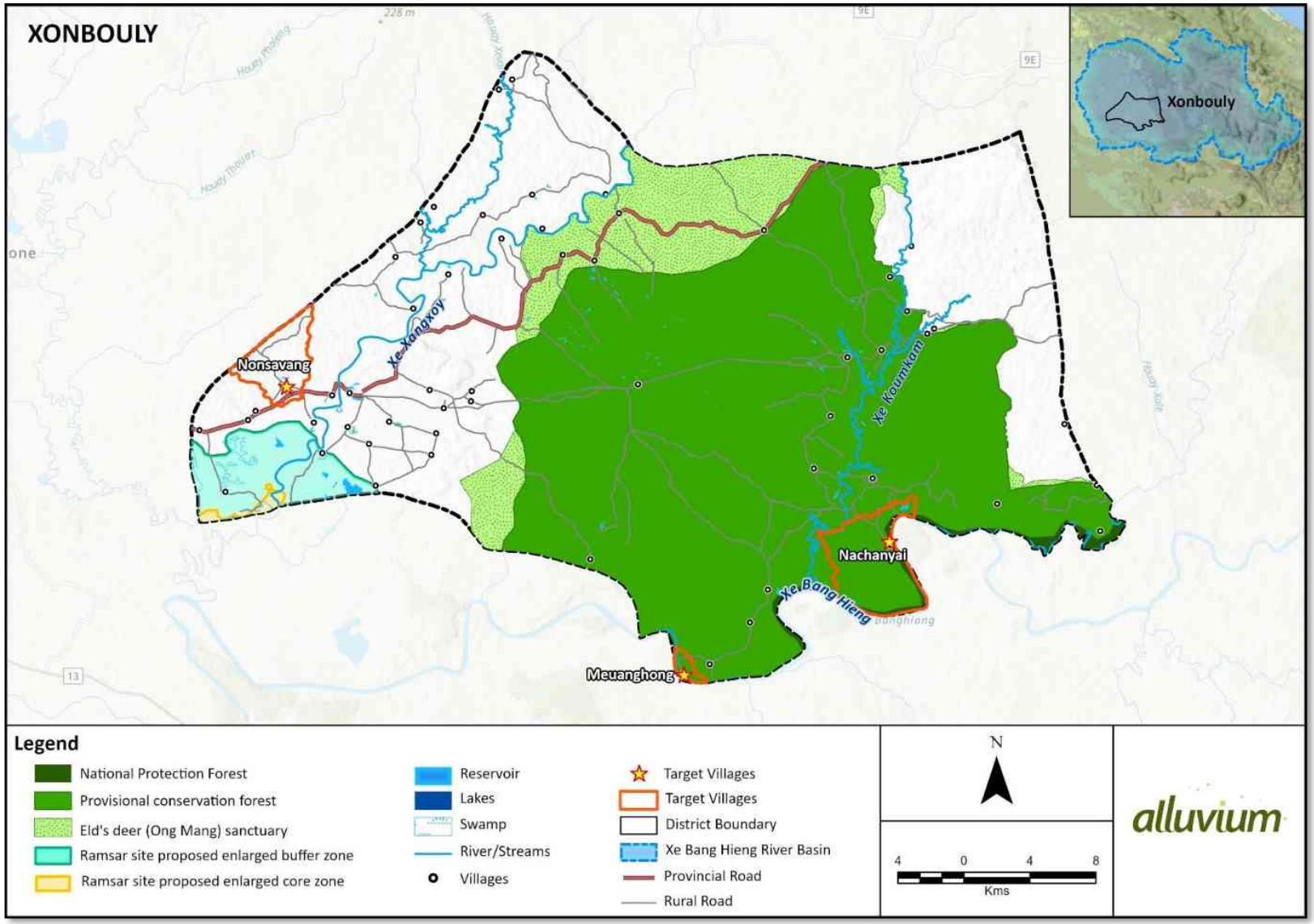

Figure 4. *Xonbuly District – Geographic features*

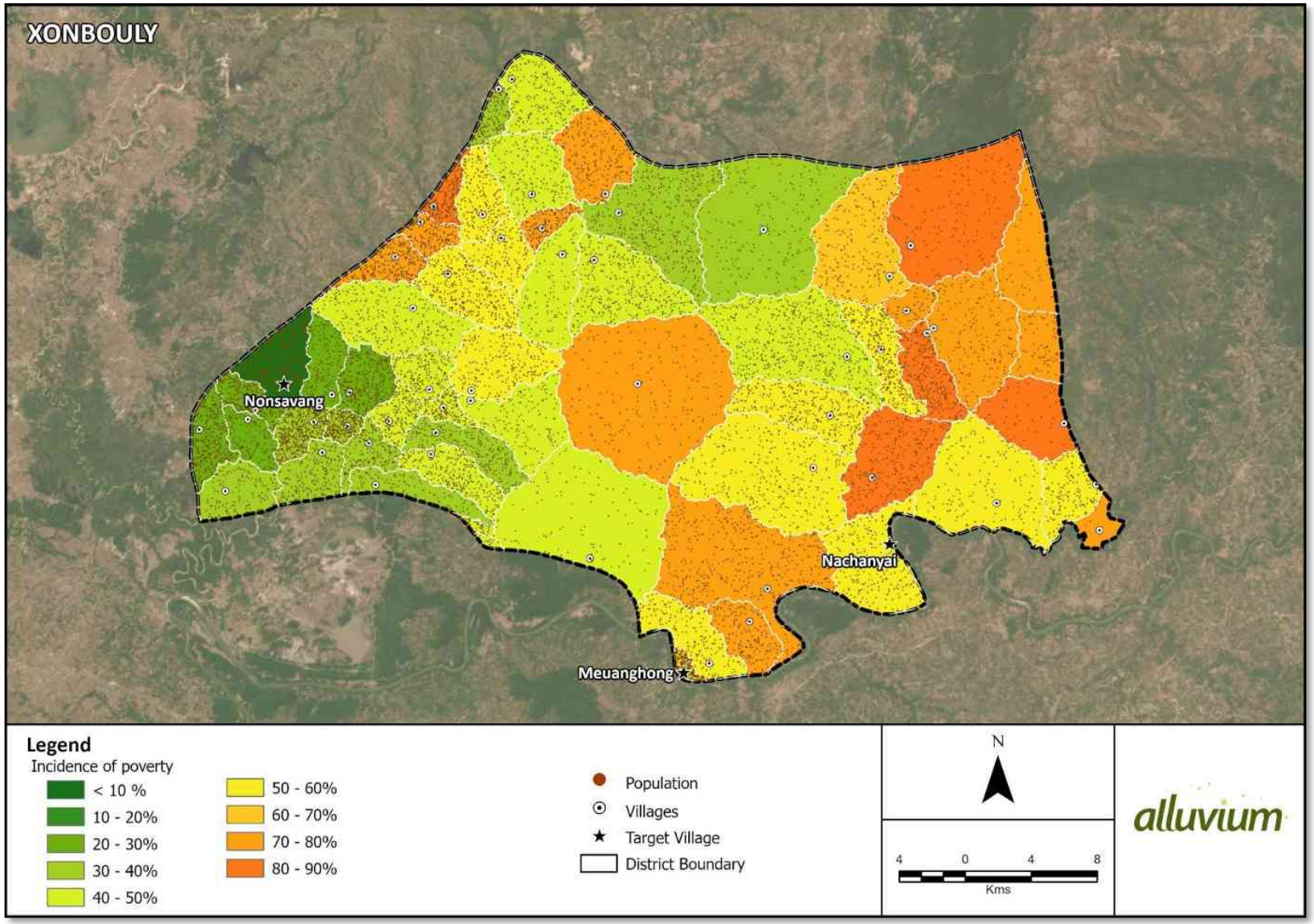

Figure 5. *Incidence poverty in Xonbuly District (Source: https://apps.k4d.la/analyst/)*

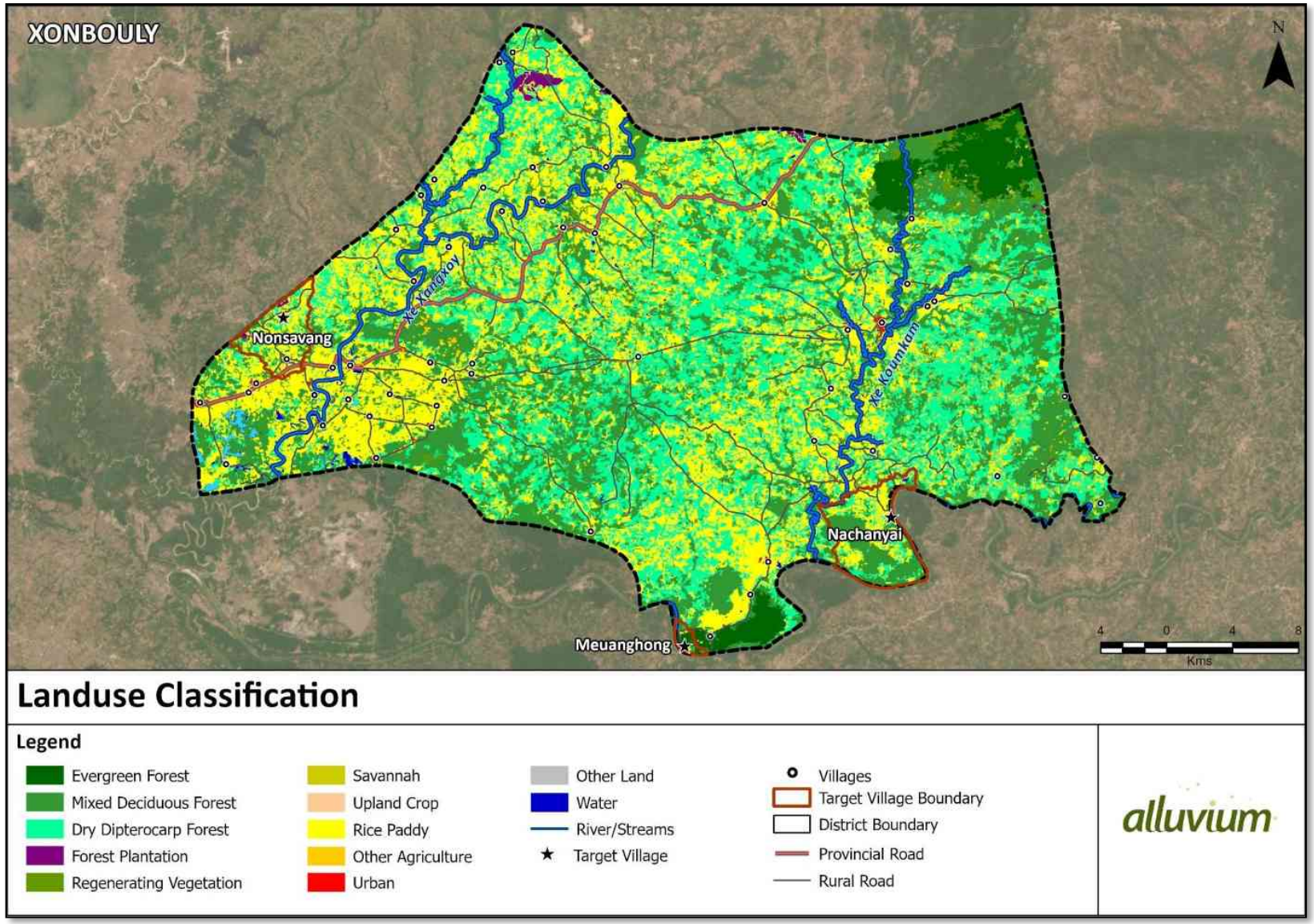

Figure 6. *Land cover in Xonbuly District (Source: https://apps.k4d.la/analyst/)*

2.4 Water resources

There are numerous irrigation schemes operating in Xonbuly District with extraction from Xe Xangxoy River to support rice production. According to the report on agriculture production planning for dry season (2024) from District office of Agriculture and Forest, there are 10 main reservoirs, 11 pumping stations; and 6 irrigation systems in Xonbuly District.

There are aquifers over the Xonbuly District including Basement, Volcanic, Schists), Sedimentary Paleozoic, Karstic, Sedimentary, Mesozoic, and Alluvial. The groundwater potential in Savannakhet as well as Xonbuly District is approximately 0.1-6.0 L/s (MoNRE, 2022). Groundwater extraction via community wells or household tube wells is the predominant source of water supply for domestic use villages.

Meuanghong village

Meuanghong consists of two village clusters – one to the north and another to the south – both along the Xe Bang Hieng River. The village is home to 1115 people living in 378 households. The villagers rely on 1) household borewells for cooking and washing, and 2) nearby springs for drinking water with spring water also supporting rice cultivation. Stakeholder consultation indicate that villagers do not see groundwater as fit for drinking but would consider it if groundwater is filters (e.g. using household water filters). Villagers carry water in buckets or large drums (on tuk-tuk) from springs. There is flow in the springs year-round, however during the site inspection it was observed that the flow was small and therefore it was time consuming for villagers to fill water buckets and drums. The village stakeholders requested support for protection of the spring catchment areas – one forest catchment area of 5 ha and another one of 20 ha. Land clearing and burning in the water supply catchment areas was also observed during the site visit. The area of rice paddy fields managed by the village is 350 ha. The village does not have an irrigation scheme for rice cultivation, however rice paddy fields to the south are fed by spring water. The villagers also rely on the ponds in the vicinity of the rice paddy fields for fishing and livestock water supply.

Nonsavang village

Nonesavang village is located about 2 km from the Xe Xangxoy River which is about 16 km from the confluence with the Xe Champhone River. The village is home to 3333 people living in 545 households. The villagers rely on 1) bottled water for drinking, 2) groundwater for cooking and washing. They also collect rainwater during the wet season using rainwater tanks. Stakeholder consultation indicated that groundwater availability has reduced over the last twenty years, with groundwater no longer available in general within the first 45 m below ground surface. Groundwater can be collected at five wells in the village – one well is accessible at no charge; another four wells are operated by private operators supplying water at a cost of 10,000 Kip per drum. There are many privately-owned constructed ponds within the village fed by rainfall and overland flow, providing a source of irrigation water for small-scale farming and other uses such as fishing. There are also two public ponds in the village – one owned by the Cabinet office, and another pond to the north owned by the District Agriculture and Forestry Office (DAFO) with a privately owned groundwater well (40 m deep) located in proximity of that pond. The local tributaries of Xe Xangxoy River which flow in proximity of the village are likely to be seasonal ceasing to flow during parts of the dry season. The area of rice paddy fields managed by the village is 406 ha. There is no irrigation scheme for rice cultivation.

Nachanyai village

Nachanyai is situated in the eastern part of Xonbuly district. It consists of two clusters – a larger cluster along the Xe Bang Hieng River and a smaller cluster further inland. The village is home to 1095 people living in 223 households. The villagers rely on two springs, which are about 4 km from the larger cluster, for drinking water. In the wet season, they also harvest rainwater for cooking and washing. Villagers use a filter cloth to treat the rainwater. There is no known issue with rainwater quality, however it has not been tested. About 50 households do not have drums for collecting rainwater. In the dry season, about 60 households have access to groundwater for cooking and washing using groundwater tube wells (35-40m deep). The remaining households rely on Xe Bang Hieng river water in the dry season. Groundwater has iron content which villagers find unsuitable for drinking. There are three community groundwater wells, however they are not functional. The area of rice paddy fields managed by the village is 88 ha. There is an existing irrigation infrastructure with a large pump to extract water from the Xe Bang Hieng River for irrigation of rice fields. The irrigation system however is not being operated as the benefit (income) does not meet the operational cost (electricity cost for pumping). Villagers grow food in small plots (vegetables/cassava) on the banks of the Xe Bang Hieng River using river water

for irrigation. Part of the forested spring water supply catchment is being converted to cassava plantation. It is understood that about ½ ha has been allocated per family (40 ha for 80 families). The village also has very few remaining trees and therefore the community lacks shade for relief from heat.

Flood and drought risks

Floods

Floods and droughts impact on communities in the Xe Bang Hieng River Basin. Riverine flooding is caused by high rainfall throughout the basin including in the upper areas, and overflow of rivers leading widespread inundation of the surrounding areas. Flood hazard mapping show that riverine flooding occurs primarily in the western area of the basin in the lowland regions, particularly within Champhone, Songkhone and Xonbuly districts (Antea, 2024). These districts are affected by flooding primarily due to their geographical and hydrological characteristics. They are traversed by several rivers, including the Xe Bang Hieng and Xe Champhone Rivers, which are prone to overflow during the wet season. The topography of this region is predominantly low-lying, making it more susceptible to water accumulation and flooding.

Flood hazard mapping shows that the floodplain area in the lower valley of the Xe Champhone and Xe Xangxoy Rivers (in the western part of Xonbuly district) is exposed to riverine flooding for storm event with a 2-, 10-, 50- and 100-year return period (Figure 7 to Figure 10). A summary of flood impacts - damage costs and population affected – is provided in Table 2 (Antea, 2024). Homes and dwellings are exposed to flooding for the 1 in 100-year storm event (current climate) in 14 villages.

Flood mapping shows a relatively small number of dwellings are exposed to flooding in the target village of Nonsavang for the storm event with a 100-year return period under current climate scenario (see Appendix A). Along the Xe Bang Hieng River on the southern boundary of the district, flood mapping show no significant risk of riverine flooding in the target villages of Meuanghong and Nachanyai. In Meuanghong, a few dwellings closest to the river may be exposed to riverine flooding for the 1 in 100-year event.

In the western end of the district where riverine flooding is a risk, a lack of flood early warning, emergency response preparedness and resources, and flood defence infrastructure exacerbates the impacts of flooding on agriculture, infrastructure, and local communities. With climate change (RCP8.5 scenario), flood depth is expected to increase significantly putting population and infrastructure at greater risk, although the flood extent 10-, 50- and 100-year return period is not expected to change much (Antea, 2024).

These findings highlight the need to raise awareness of flood risks in the communities (particularly in the west of the district) and their preparedness and capability to respond, as well as flood defence infrastructure where feasible. Whist attention is required in villages impacted by riverine flooding, protection of forested areas and floodplains in the upstream catchment areas is also important to regulate hydrology and buffer peak flows.

Table 2. Flood exposure and estimates of impacts (based on data in Antea, 2024)

	Return period			
	2 years	10 years	50 years	100 years
Current climate (historical data)				
Number of villages exposed to flooding	16	18	21	23
Number of people severely impacted	56,239	58,138	60,897	86,430
Potential damage cost across district	$ 1,383,707	$ 1,829,088	$ 27,033,487	$ 49,850,283
Future climate (RCP8.5 scenario)				
Number of villages exposed to flooding	19	24	26	28
Number of people exposed to flooding	58,474	57,028	85,652	87,121
Potential damage cost across district	$ 261,041	$ 21,442,206	$ 49,796,099	$ 52,204,998

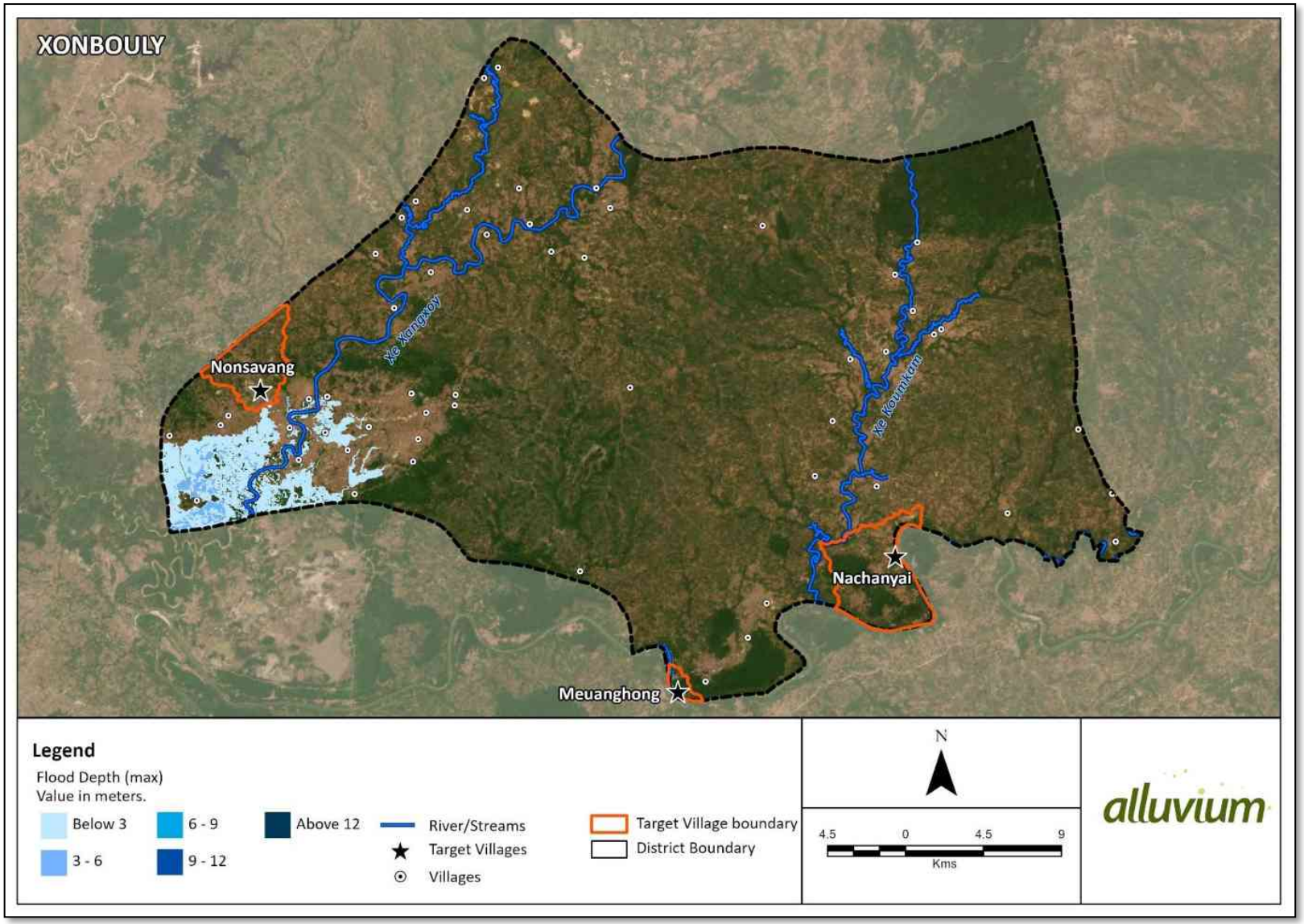

Figure 7. *Flood extent and depth for storm event with a 2-year return period (current climate)*

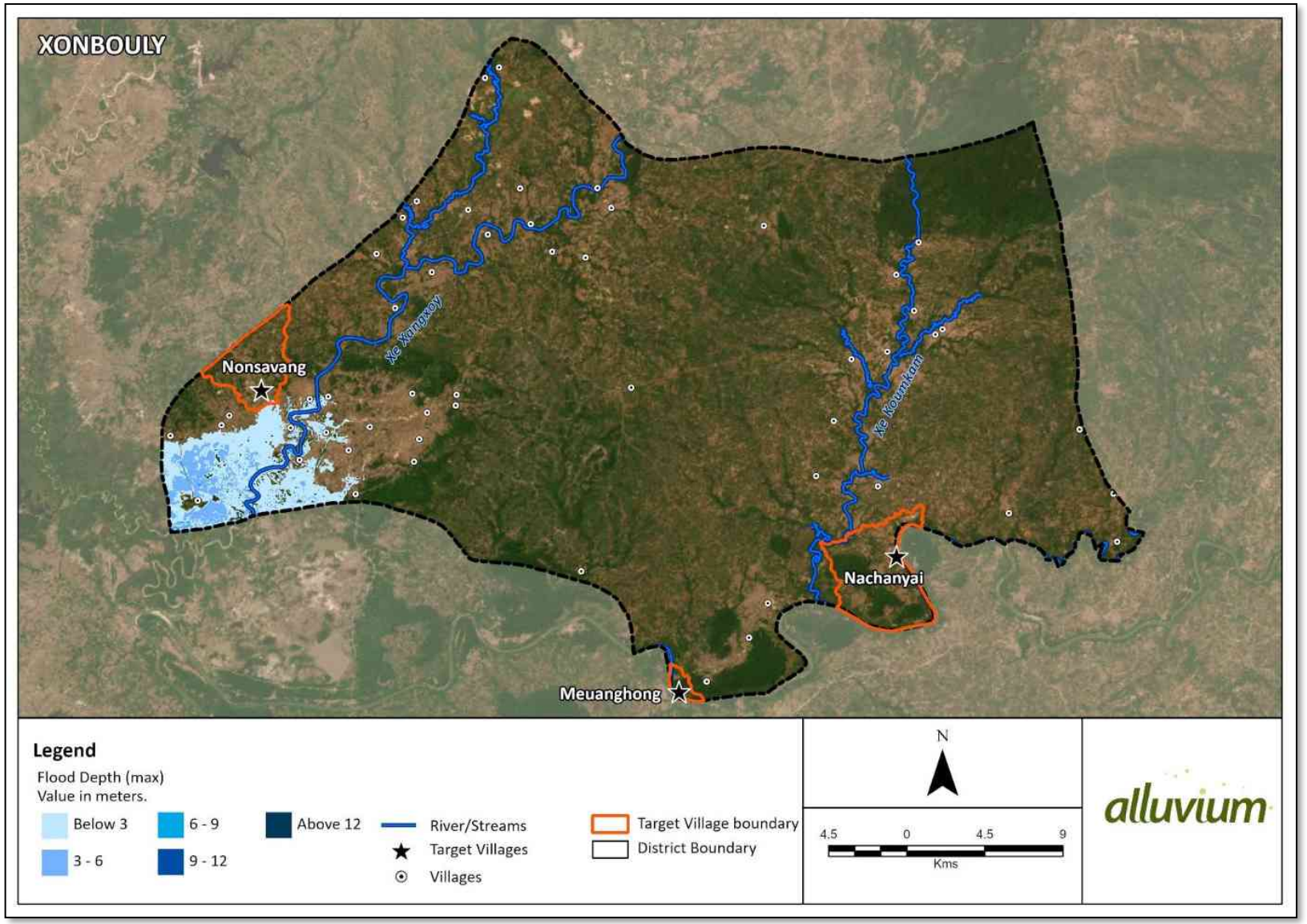

Figure 8. *Flood extent and depth for storm event with a 10-year return period (current climate)*

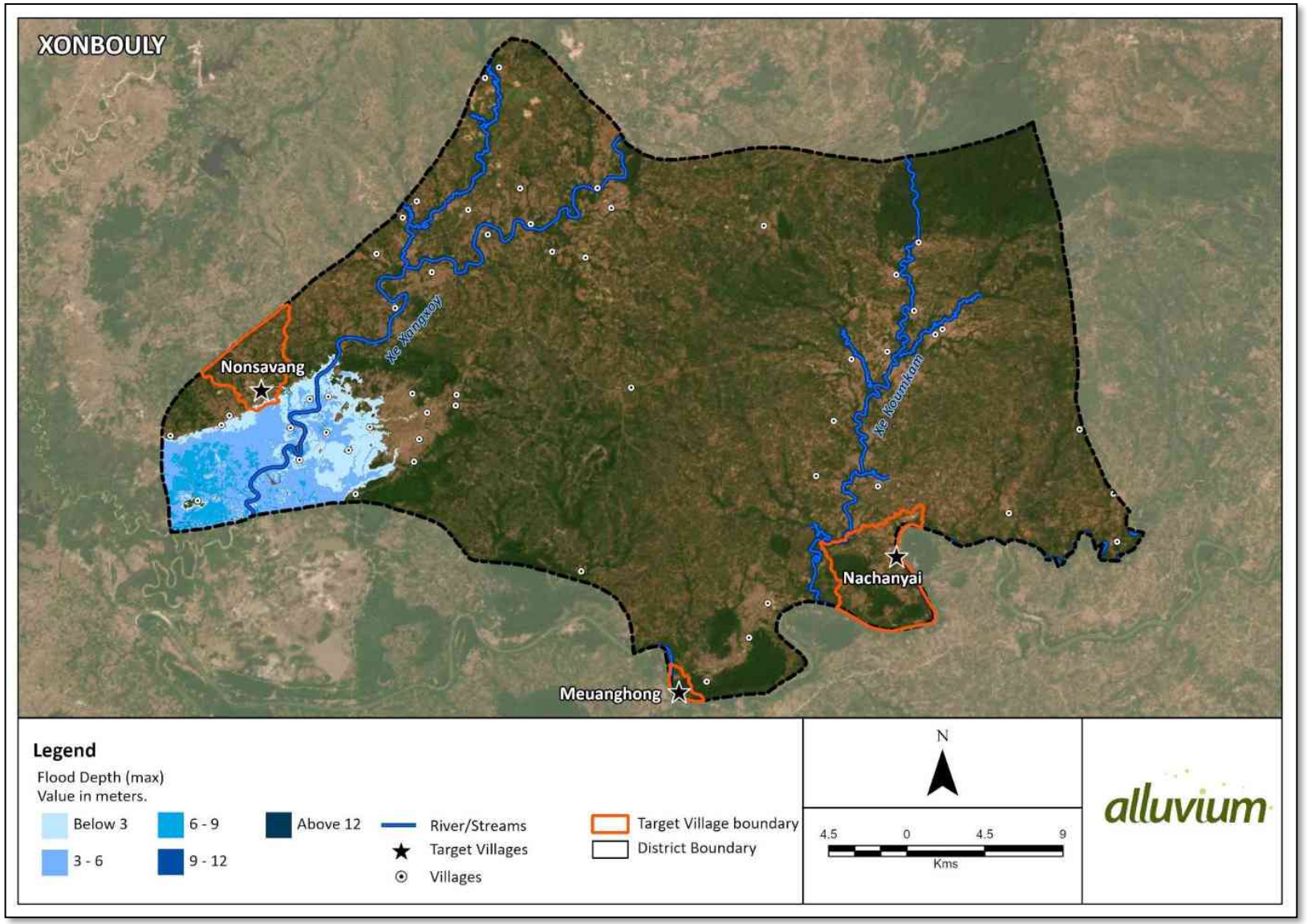

Figure 9. *Flood extent and depth for storm event with a 50-year return period (current climate)*

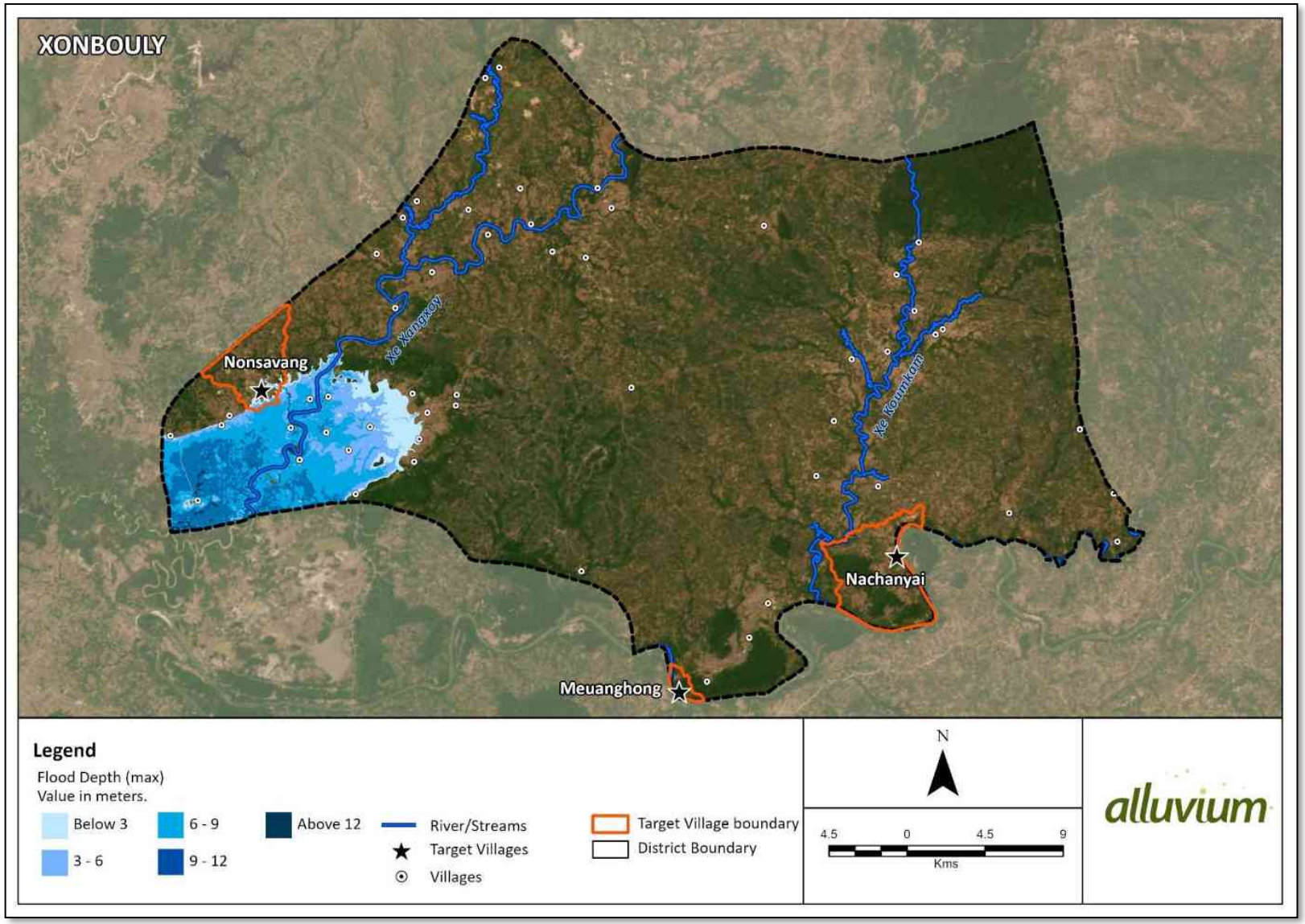

Figure 10. *Flood extent and depth for storm event with a 100-year return period (current climate)*

Droughts

The rainfall pattern in the west of the Xe Bang Hieng River Basin (lowland region) is different to the east (upland region), with longer duration of consecutive dry days (i.e. periods without any rainfall) in the west for the 5-, 10, 50- and 100-year return periods (Figure 11) (Antea, 2024). This suggests that the security of water supply from rainfall driven systems such as ponds, local watercourses, and shallow springs is more vulnerable in the lowland region (including Xonbuly District) with such systems drying up or ceasing to flow more regularly.

The Standardized Precipitation Index (SPI) is an index which quantifies precipitation deficits relative to the normal local climate. It is calculated using accumulation periods of 3-months, 6-months and 1-year to reflect relevance for agricultural practices. The SPI shows that the longer dry period in the western area of the basin tends to occur during the dry season and is less divergent from a normal year compared to the east. For a 3-month moving average under current climate, the SPI indicates that the western area (including Xonbuly District) is likely to experience 'moderately dry' condition with a 5-year return period. For a 6-month moving average under current climate, the western area (including Xonbuly District) is likely to experience 'severely dry' condition with a 5-year return period. For a 6-month moving average under current climate, the western area (including Xonbuly District) is likely to experience 'extremely dry' condition with a 50-year return period.

Impact of droughts in terms of damage cost to agriculture is found to be higher in the lowland region given the higher intensity of agriculture compared to the upland region. Damage costs in the lowland increases to the west of the basin where there is higher intensity of rice paddy cultivation. In Xonbuly District, damage to agriculture is estimated at about $ 165,000 USD, $140,000 USD and $13,000 USD for target villages of Nachanyai, Nonsavang, Meuanghong respectively for a 6-month drought period with a 100-year return period (Antea, 2024).

These findings highlight that effort to mitigate the impacts of drought is required across Savannakhet Province. However, districts in the lowland region will require higher level of investment given their larger population, higher intensity of agriculture, and higher vulnerability of rainfall driven systems to droughts.

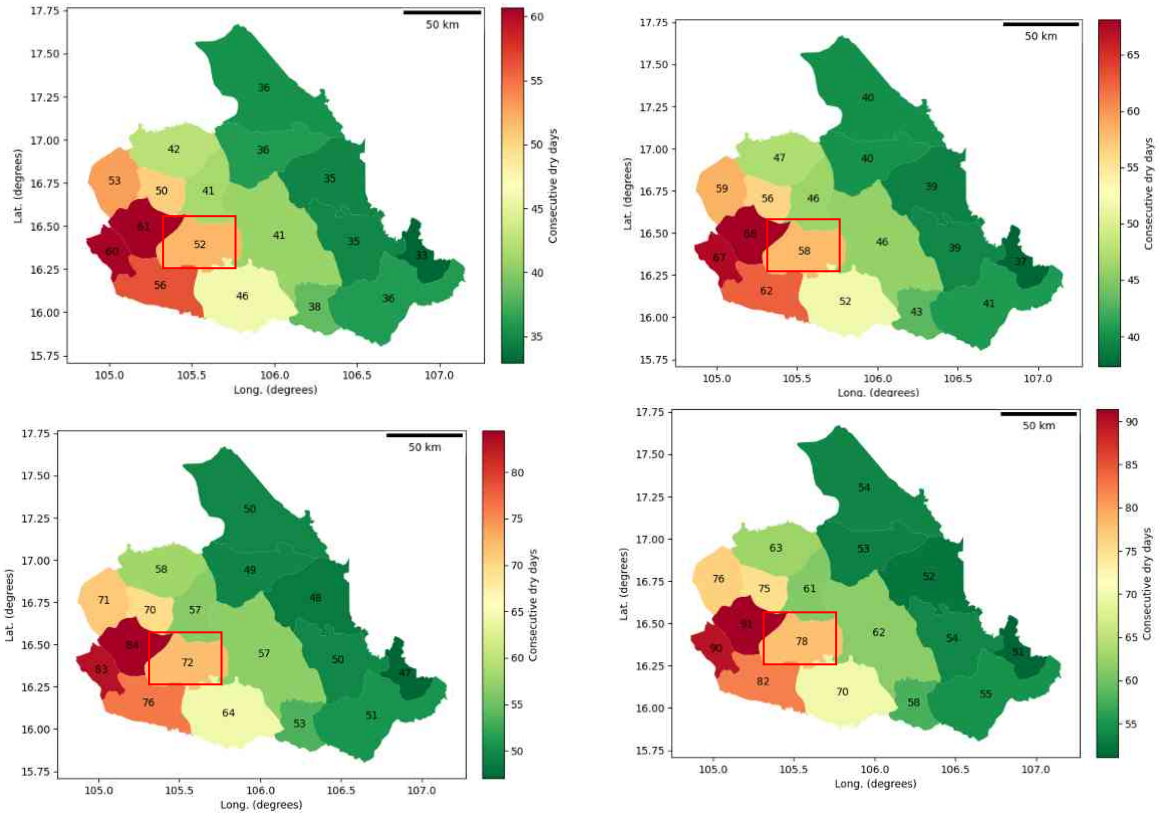

Figure 11. *Consecutive dry days (yearly mean per district) for a 5-year (left top), 10-year (right top), 50-year (left bottom), and 100-year (right bottom) return period (Source: Antea, 2024). Red Box indicates Xonbuly District*

Early Warning System (EWS)

The system for forecasting and warning for flood and drought in Savannakhet Province is presented in Figure 12. Under this system, the DMH of MoNRE is mandated to collect, evaluate, and disseminate information on hydrometeorological parameters including rainfall, evaporation, river water level, and flow. Monitoring and observation systems run by DMH consist of observation stations, data transmission and telecommunication networks, data processing and storage systems, and data management systems.

At provincial level, the "Water Resources" and "Meteorology and Hydrology" sectors of the Provincial Natural Resources and Environment (PoNRE) have direct responsibility for hydrometeorological data collection on daily weather data and daily water level change in each river, and provision of this data to DMH in Vientiane. At the district level, the DoNRE is responsible for compiling and collecting daily water level and rainfall data from stations installed in the district. This data is reported twice per day, except in emergency times, when they are reported more frequently depending on the level of emergency. It should be noted that the collection of hydrometeorological data is still mainly the responsibility of central agencies.

The "Meteorology and Hydrology" sector of PoNRE also has responsibility for receiving and disseminating weather forecasting from DMH to relevant agencies in the province and districts such as the Provincial Flood and Drought Steering Committee, and other line agencies including the district Office of Natural Resources and Environment (DoNRE). DoNRE in turn sends the information to District Governor and District line agencies. Information is then sent to village communities by phone. Warnings are issued to villagers through megaphones or other facilities that villages have. On a normal day, weather forecasting information from DMH is sent directly to Provincial Meteorology and Hydrology at 11 am. In the case of an emergency, DMH sends information twice per day depending on weather situation and water level, with average synoptic every 6-12 hours. It takes on average 24 hours for weather forecasting information from DMH to reach villages, but longer for remote communities that have limited communication and telecommunication services.

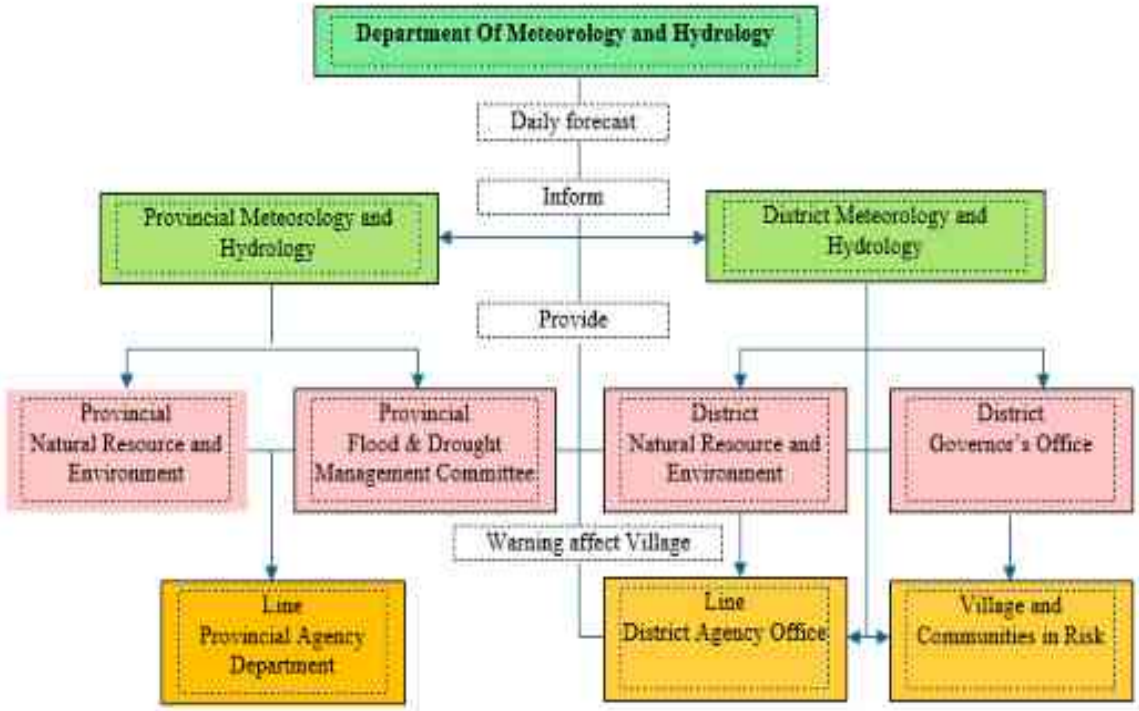

Figure 12. *The system of forecasting and warning for flood and drought in Savannakhet Province.*

Hydrometeorological infrastructure

Hydrometeorological data collection is needed for flood and drought forecasting. To improve collection of hydrometeorological data in Xe Bang Hieng River basin, the Department of Meteorology and Hydrology DMH under MONRE has recently collaborated with the Korea International Cooperation Agency (KOICA) to survey the hydrometeorological network and upgrade and install new infrastructure within several districts in the basin, including Xonbuly District as shown in Table 3 and Figure 13 (KOICA, 2024). In Xonbuly District, there is one automatic meteorological station in Keokhamdy Village which has been established in 2019 by a project supporting of Dry dipterocarp forest ecosystem villages. There are 3 rain gauge stations in the district located in Nonsavang, Keokhamdy Village and Muanghong. There are 2 water level gauge stations located along Xe Xangxoy River at Xianghome Village and along Xe Bang Hieng River at Muanghong Village established in 2015 and 2019 respectively. There are also water level gauge stations installed for specific projects in Xonbuly district including for the Climate change Adaptation in Wetland Area (CAWA) project (2017-2022).

Table 3. List of Meteorology and hydrology station in Xonbuly District, Savannakhet Province

No	Station name	Location			Coordination		Installed Year
		Village	District	Province	Latitude	Logitude	
I	**Meteorology station**	Keokhamdy	Xonnabouly	Savannakhet	16.424722	105.469722	UNDP 2019
II	**Rainfall stations**						
1	Nonsavang	Nonsavang	Xonnabouly	Savannakhet	16.381667	105.372222	PMH 1994
2	Keokhamdy	Keokhamdy	Xonnabouly	Savannakhet	16.424722	105.469722	UNDP 2019
4	M.Hong	Hong	Xonnabouly	Savannakhet	16.248889	105.560833	UNDP 2019
III	**Water level stations**						
1	Xexangxoy	Xianghom	Xonnabouly	Savannakhet	16.393056	105.367778	DMH 2015
2	Xexangxoy	Xianghom	Xonnabouly	Savannakhet	16.393439	105.368172	KOICA 2024
3	Xebanghieng	M.Hong	Xonnabouly	Savannakhet	16.248889	105.560833	UNDP 2019
4	Xexangxoy	Thakhamleum	Xonnabouly	Savannakhet	16.33663	105.337512	CAWA project, 2022
5	Koutlong Pond	Thakhamleum	Xonnabouly	Savannakhet	16.345046	105.348799	CAWA project, 2022
6	Nongsim Pond	Toumnhae	Xonnabouly	Savannakhet	16.363652	105.31355	CAWA project, 2022
7	NongLuang	Sayaek	Xonnabouly	Savannakhet	16.240573	105.378849	CAWA project, 2019
sources: Provincial Natural resources and Environment of Savannakhet Province							

Warning service

Early warning service is crucial for safeguarding communities and ensuring resilience against floods and droughts. However, the system of early warning in provinces and districts across the country is not well established. Early warning messaging as often advice is too broad, has a large geographic area and does not use easily understood language as to the expected timelines, impacts and actions communities should take. For instance, in Xonbuly District, flood warnings are issued via mobile phones or in the form of an official letter from the responsible agencies. However, these are generally issued during the storm event or when river water levels are already high. Furthermore, the early warning system information is not widely known among local people, despite government and project efforts to improve these systems in the Xe Bang Hieng River Basin. Specific gaps in early warning are outlined in Table 4. Addressing these gaps is essential for improving the overall effectiveness of flood and drought risk management systems and ensuring the safety and resilience of vulnerable communities.

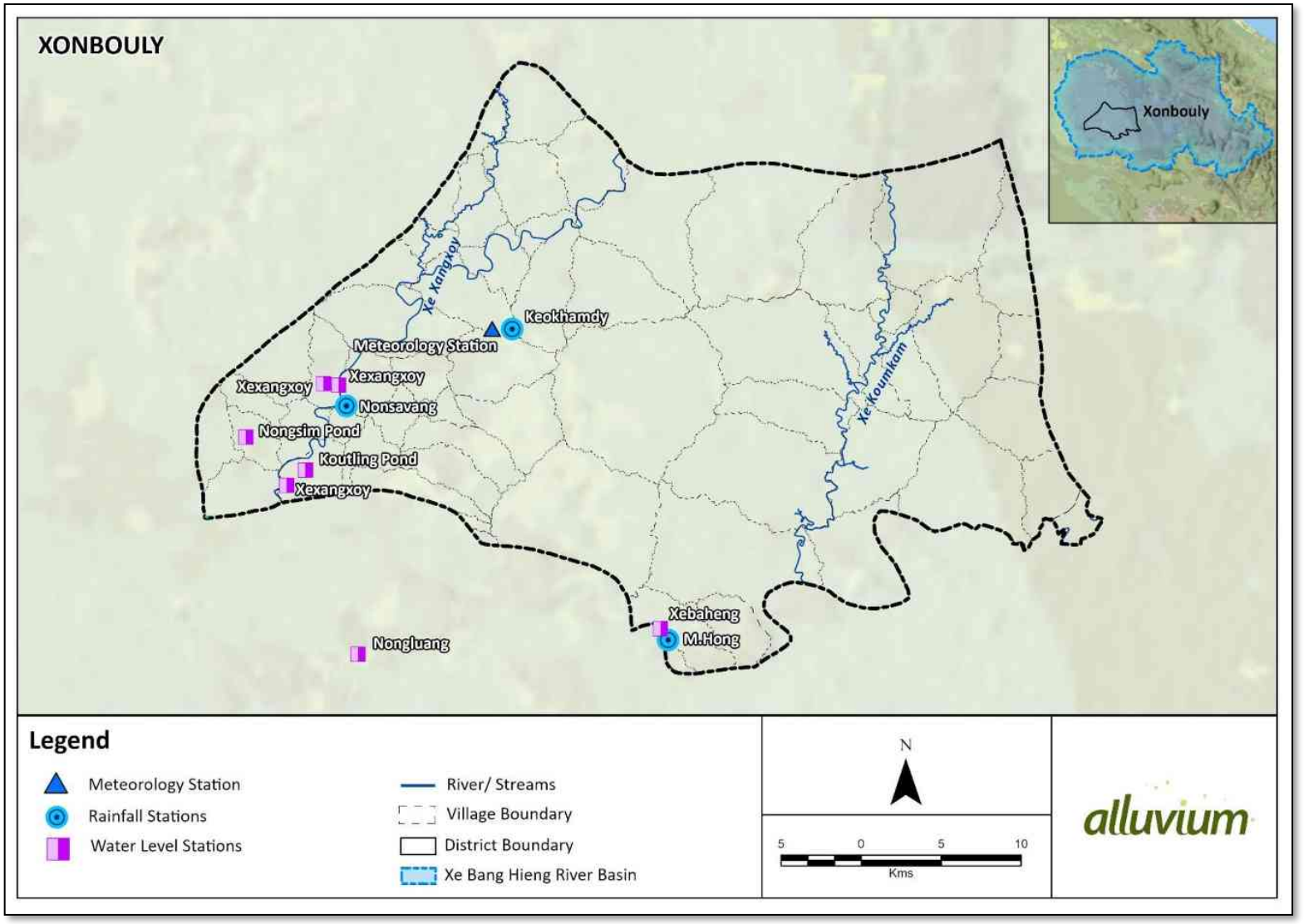

Figure 13. *Meteorology and hydrology station in Xonbuly District, Savannakhet Province*

Table 4. Gaps in Xonbuly District Early Warning System (EWS) for flood and drought hazards

Component of EWS	Gaps
Risk knowledge	• Communities lack knowledge about drought risks and appropriate responses • Insufficient assessment of areas vulnerable to flood and drought risks
Monitoring and warning service	• Flood warning messages cover general weather forecast only are not specific enough to be an early warning for any particular area • Warnings are only cautionary and are not clear on what actions to take • No early warning system for drought • Lack of hydro information to support flood and drought forecasting. In Xonbuly District • Hydrometeorological equipment is outdated • Fragmented monitoring responsibilities between central, provincial, and district levels. Responsibility is largely confined to DMH • Limited number of trained staffs for data collection and analysis (for forecasting) and limited annual budget for equipment maintenance. • Village leadership do not understand the need for hydrometeorological monitoring and do not play a role in maintaining infrastructure and in data collection.
Dissemination and communication	• Gaps in telecommunication system in remote parts of district • Remote parts of districts are difficult to access by vehicles affecting timeliness of information dissemination • Forecast and warning messages can be too technical for many users particularly community representatives • Lack of sufficient trained staff in interpreting forecast and warning messages at provincial and district level • There is limitation and lack clarity regarding the coverage and reach of forecast and warning messages in the district. Early warning system information is not widely known among local people • There is no mechanism to verify that warnings have been received at the village level, communicated to residents, and how and if the information has been used. • Gaps exist in the community's understanding of the specific roles of technical agencies in providing early warning alerts and messages.
Response capability	• No common procedure at village level to respond to floods and droughts. • There is a general lack of capacity and knowledge how to respond to droughts, including water conservation in agricultural production • Community awareness and preparedness to flood emergencies is limited in some villages. However, many flood-prone villages have experience in responding to and adapting to floods • Inadequate resources to assist in flood and drought response (e.g. evacuation zones, shelters and facilities, emergency supplies) • Insufficient capacity of district officials and village leaders to improve flood resilience through land use planning, infrastructure, and building practices.

3 Action Plan 2025-2029

3.1 Goal

A 5-year Action Plan (2025-2029) is proposed for Xonbuly District to strengthen the climate resilience of communities to flood and drought risks.

3.2 Objectives and actions

This Action Plan will achieve this goal through the following objectives:

1. Raise awareness of flood and drought risks, and improve community preparedness and capability to respond
2. Improve hazard forecasting and early warning services
3. Protect, restore and manage ecosystem functions and services
4. Secure water for drought
5. Improve flood defence.

Infrastructure and non-infrastructure related actions have been developed for the district to address these five objectives. Table 5 provides a description of each objective together with an estimated budget for actions under each objective over the phase of this Action Plan i.e. 2025-2029. The actions are further detailed in Table 7. Infrastructure investment has been estimated for the district in Table 6. The Action Plan (2025-2029) proposes to cover part of the infrastructure investment need. The gap in infrastructure investment can either be covered through additional funding during this action plan phase or part of the next action plan beyond 2029.

The proposed actions and budget for this 5-year Action Plan have been informed by consultation with a range of stakeholders, as well as the following two studies:

1. Infrastructure investment recommendations for addressing flood and drought risks in target villages in the Xe Bang Hieng River Basin (Alluvium and Hydrotech consulting, 2024a). The recommended infrastructure investments for Nonsavang, Meuanghong, and Nachanyai villages are provided in Appendix B.
2. Investment recommendations for hydrometeorological network upgrades and Early Warning System updates for flood and drought (Alluvium and Hydrotech consulting, 2024b).

During implementation of the Action Plan, it is important that prioritisation of interventions in the district is guided by the flood and drought risk spatial mapping (Antea, 2024) as well as any interventions that already exist.

The proposed investment in the Action Plan do not cover personnel costs within the lead organizations which have been nominated to be responsible for delivering the actions. It is assumed that this delivery function is covered within existing resources and staffing of the lead organisations.

Table 5. Action Plan objectives and proposed investment for 2025-29 phase

Objectives	Description	Proposed investment for 2025-2029 (USD)
Raise awareness of flood and drought risks, and improve community preparedness and capability to respond	• Raise awareness and understanding of flood and drought risks (and the effects of climate change on floods and droughts), including related information and warnings sent by responsible agencies • Improve public and institution preparedness to respond to floods and droughts, including access to essential equipment and facilities during emergencies	$430,000 ($300,000 in on infrastructure)
Improve hazard forecasting and early warning services	• Upgrade infrastructure that delivers forecasts and warnings • Improve dissemination of clear and actionable warning messages to those at risk	$275,000 ($115,000 in on infrastructure)
Protect, restore and manage ecosystem functions and services	• Actions to reduce threats to and improve management of ecosystems (such as floodplains, wetlands, swamps, rivers, riparian areas, forests, etc.) to sustain their hydrologic functions and reduce effects of floods and droughts (e.g. baseflow protection and peak flow buffering) • Includes capacity building on conservation and management of ecosystems and sustainable land use practices	$765,000 ($425,000 in on infrastructure)
Secure water for drought	• Implement village-scale infrastructure to secure water for drought targeting drinking water and domestic water needs, and local-scale gardens plots and livestock needs (e.g. community borewells, household rainwater tanks, water filters, community ponds and associated water supply infrastructure such as groundwater and river water pumps.	$1,545,000 ($1,000,000 in on infrastructure)
Improve flood defence	• Implement village-scale infrastructure to protect dwellings and infrastructure from flooding (e.g. village ring levees, flood channels and flood retardation basins).	$1,475,000 ($1,000,000 in on infrastructure)
	Total	**$4,490,000**

Table 6. District infrastructure investment estimates with proposed investment for 2025-2029 phase

Objective	Infrastructure examples	Estimated investment required per village (USD)	# villages	Estimated investment required in district (USD)	Proposed investment for 2025-2029
Improve community preparedness and capability to respond	Flood evacuation areas and transport	$30,000	13	$390,000	$300,000
Improve hazard forecasting and early warning services	Communication and hydrometeorological monitoring equipment	$15,000	13	$195,000	$115,000
Protect, restore and manage ecosystem functions and services	Works to protect or improve condition of floodplains, wetlands, riparian areas, forests, water supply catchments	$25,000 - $50,000	77	$1,925,000 - $3,850,000	$425,000
Secure water for drought	Community borewells, household rainwater tanks, water filters, community ponds etc.	$60,000 - $80,000	77	$4,620,000 - $6,160,000	$1,000,000
Improve flood defence	Village ring levees, flood channels and flood retardation basins	$225,000 - $500,000	13	$2,925,000 - $6,500,000	$1,000,000

Table 7. Xonbuly District Action Plan

No.	Theme	Action	Scale D- District V - Village	Key Responsibility	Implementation timeline 2025-2029					Estimated budget ($)
					Y1	Y2	Y3	Y4	Y5	
Objective 1: Raise awareness of flood and drought risks, and improve community preparedness and capability to respond										
1	Risk awareness raising	Develop and disseminate awareness raising videos, audios, posters, pamphlets on flood and drought risks (including effects of climate change).	D/V	MoLSW, MoNRE		X	X	X	X	30,000
2		Conduct inclusive and accessible public awareness and education campaigns for target groups (e.g., Women, Children, Older People, Illiterate, and Persons with Disabilities).	V	MoLSW /MoNRE		X	X	X	X	30,000
3	Preparedness and capability to respond	Support establishment of District Disaster Preparedness and Response Plan and District Disaster Response and Recovery Fund. Conduct drills and simulation exercises periodically aligned with the District Disaster Preparedness and Response Plan.	D/V	MoLSW, NDMC, District Military		X		X		50,000
4		Develop Village level disaster response Standard Operating Procedures (SOP).	V	MoLSW, MoNRE, District Military		X	X	X		20,000
5		Inventory assessment and provision of essential infrastructure and resources including evacuation transport (e.g. motorboats).	V	MoNRE, District Military	X	X				50,000
6		Establish flood evacuation zones and temporary or permanent emergency shelters for people and livestock.	D/V	MoNRE, District Military			X	X	X	250,000
Objective 2: Improve hazard forecasting and early warning services										
8	Institutional set up and capacity	Set up clear mandates, roles, responsibilities and coordination mechanisms for all stakeholders involved in hydrometeorological data collection	D	MoNRE-DMH, MTC, MoLSW		X	X	X		30,000

No.	Theme	Action	Scale D- District V - Village	Key Responsibility	Implementation timeline 2025-2029					Estimated budget ($)
					Y1	Y2	Y3	Y4	Y5	
		and dissemination of forecasts and hazard warnings (including a feedback mechanism for two-way community engagement and real time reporting to the national-level warning authorities).								
9		Establish and operate a network of volunteers and the private sector to support early warning dissemination and communication.	D	MoNRE, MoLSW, MoICT		X	X	X		15,000
10		District staff allocation, training, and capacity building on hydrometeorological monitoring and data collection, understanding and relay of forecast and warning messages from central agencies.	D	MoNRE-DMH			X	X		30,000
11	Effectiveness of warning service including coverage and reach of warning system	Undertake study to understand coverage and reach of warnings within district.	D	PoNRE	X					15,000
12		Develop and disseminate simplified standard early warnings messages.	D	MoNRE		X	X			15,000
13		Upgrade or supply new warning equipment/tools (e.g. including Information Communication and Technology (ICT) infrastructure, public loudspeakers, etc.).	D/V	MoNRE, MTC			X	X	X	65,000
14		Maintain early warning system infrastructure.	D/V	PoNRE			X	X	X	20,000
15		Conduct regular training and demonstration for local taskforces and villagers one per year.	D/V	MoNRE		X	X	X	X	20,000
16	Upgrade hydrometeorological infrastructure	Develop guidelines for hydrometeorological and warning system.	D/V	MoNRE	X					15,000
17		Improve hydrometeorological monitoring coverage by installing new stations where gaps exist. Upgrade or repair	D	MoNRE		X		X		50,000

No.	Theme	Action	Scale D- District V - Village	Key Responsibility	Implementation timeline 2025-2029					Estimated budget ($)
					Y1	Y2	Y3	Y4	Y5	
		hydrometeorological equipment where needed.								
Objective 3: Protect, restore and manage ecosystem functions and services										
18	Prioritise restoration of high-value wetland areas critical for flood retention and other beneficial uses	Undertake baseline survey, mapping, inventory, biodiversity assessment, water balance monitoring, assessment of hydrologic functions (baseflow regulation and peak flow buffering), and economic assessment.	D	MoNRE	X					10,000
19		Research, identify and prioritize restoration efforts for wetland with high biodiversity value and provision of important hydrologic functions.	D	MoNRE	X					10,000
20		Develop protection and restoration plans tailored to the specific conditions and needs of each site.	D/V	MoNRE		X	X			10,000
21		Develop a water sharing plan to ensure best mix of social, economic and environmental outcomes at each site.	D/V	MoNRE		X	X			5,000
22	Implement reforestation and vegetation restoration	Protect and restore forested land (by planting native tree and shrub species and by demarcation works) to sustain hydrologic functions and ecosystem services.	D/V	DAFO		X	X	X	X	150,000
23		Utilize appropriate revegetation techniques, including seed dispersal, seedling planting, and natural regeneration.	D/V	DAFO		X	X	X	X	75,000
24		Monitor and maintain restored vegetation to ensure long-term success.	D/V	DAFO			X	X	X	40,000
25	Protect village local water supply	Implement river and stream riparian buffers in local catchments to protect water quality from impacts of land use	V	MoNRE		X	X	X		50,000

No.	Theme	Action	Scale D- District V - Village	Key Responsibility	Implementation timeline 2025-2029					Estimated budget ($)
					Y1	Y2	Y3	Y4	Y5	
	catchments and water sources	change. Avoid deforestation in local water supply catchments.								
26		Demarcation and establishment of buffer zones around village water sources to protect them from local disturbances.	V	MoNRE		X	X	X	X	50,000
27	Rehabilitate watercourses and waterbodies	Improve condition and retention capacity of waterbodies (including oxbow lakes, wetlands, lakes, and ponds) sustaining village communities.	D/V	MoNRE		X	X	X	X	50,000
28		Restore natural drainage patterns and condition of degraded watercourses.	D/V	MoNRE		X	X	X	X	50,000
29	Land use planning and regulations	Undertake project to integrate flood risks into land use planning by considering options for restricting land uses in flood prone areas, regulations for flood resilient building designs, relocation of infrastructure to higher grounds (e.g. homes, buildings and key village assets) and statutory protection for floodplain areas and flood buffers (e.g. swamps).	D	MoNRE		X		X		30,000
30		Undertake project to integrate drought risks into land use planning by considering options such as protection (and demarcation) of village water supply catchments (e.g. small streams and waterbodies).	D	MoNRE			X		X	30,000
31		Identify conservation zones via conducting participatory river/wetland/waterbody land-use planning with the local community.	V	MoNRE	X	X				10,000
32	Capacity building	Develop and implement comprehensive capacity building plans on land use	D/V	MoNRE	X					30,000

No.	Theme	Action	Scale D- District V - Village	Key Responsibility	Implementation timeline 2025-2029					Estimated budget ($)
					Y1	Y2	Y3	Y4	Y5	
		planning, ecosystem-based adaptation and ecosystem restoration.								
33		Develop and implement protocol for taskforce to implement plans.	D/V	PoNRE	X					15,000
34		Training/workshop for local taskforce.	D/V	MoNRE	X					15,000
35	Promote sustainable river basin management and raising awareness	Training, awareness campaign and exchange knowledge on basin management.	D/V	MoNRE			X		X	20,000
36		Promotion and extension on by TV, Radio, U-tube, intervention in school lecture and other media channels.	D/V	MoNRE	X	X	X	X	X	10,000
37		Video, clip competition and drama show on sustainable river basin and local livelihoods.	V	MoNRE		X	X	X	X	10,000
38	Promote integration of socio-economic development and cultural elements in river basin management	Research and survey important natural sites for conservation in river catchments for recreation (trekking/nature trails) and to support minority cultures.	D/V	MoNRE		X				15,000
39		Strengthening permanent jobs for concern local communities.	V	MoNRE/ PoNRE			X		X	20,000
40		Exchange or lessons learnt excursion and study tour program for community leaders.	D/V	MoNRE				X		30,000
41		Demonstrate some circular economy plot for communities.	V	MoNRE		X	X			30,000
Objective 4: Secure water for drought										
42	Need assessment and survey of water sources	Survey and identify keys elements of livelihood in communities affected by droughts across the district.	D/V	MoNRE	X					100,000
43		Map and survey water resources including groundwater and surface water	D/V	MoNRE	X					100,000

No.	Theme	Action	Scale D- District V - Village	Key Responsibility	Implementation timeline 2025-2029					Estimated budget ($)
					Y1	Y2	Y3	Y4	Y5	
		systems such as ponds and watercourses (including water quality).								
44	Optioneering and infrastructure investments	Undertake infrastructure optioneering study to secure water for drought (drinking, domestic uses, livestock, and small-scale agriculture). Options can include community borewells, household rainwater tanks, water filters, community ponds/waterbodies and associated water supply infrastructure (e.g. groundwater and river water pumps). Identify priority projects in the district.	D/V	MoNRE	X					100,000
45		Undertake a feasibility study for priority projects.	V	MoNRE		X				100,000
46		Based on above study, design and implement priority projects ensuring consultation and participation of local taskforces.	V	MoNRE		X	X	X	X	1,000,000
47		Monitoring of projects with local taskforces.	D/V	PoNRE			X	X	X	50,000
48	Collaboration and capacity building	Capacity building for local taskforces and engagement on key investments.	D/V	MoNRE		X	X	X	X	30,000
49		Undertake capacity building on operations and maintenance of water storage and supply systems (including household rainwater harvesting, and village-scale groundwater extraction systems, waterbodies and irrigation systems).	V	MoNRE/PoNRE			X	X		30,000
50		Undertake capacity building on water quality monitoring for household water uses including use of filtration devices.	V	MoNRE			X	X		15,000

No.	Theme	Action	Scale D- District V - Village	Key Responsibility	Implementation timeline 2025-2029					Estimated budget ($)
					Y1	Y2	Y3	Y4	Y5	
51		Establish mechanisms for collaboration and information sharing (lessons learnt) among agencies and stakeholders.	D	MoNRE					X	20,000
Objective 5: Improve flood defence										
52	Optioneering and infrastructure investments	Undertake a Needs and Optioneering study (with prioritisation) for village flood defence infrastructure including village ring levees, flood channels and retardation systems. Identify priority projects in the district.	D/V	MoNRE	X					100,000
53		Undertake a Needs and Optioneering study (with prioritisation) for riverbank stabilisation works to protect village infrastructure from erosion. Identify priority projects in the district where risks are highest.	D/V	MoNRE	X					25,000
54		Undertake a feasibility study for priority projects.	V	MoNRE	X	X				100,000
55		Based on above studies, undertake design and implementation of priority projects ensuring consultation and participation of local taskforces.	V	MoNRE		X	X	X	X	1,000,000
56		Monitoring of projects with local taskforces.	D/V	PoNRE			X	X	X	200,000
57	Collaboration and capacity building	Capacity building for local taskforces and engagement on key investments.	D/V	MoNRE		X	X	X	X	30,000
58		Establish mechanisms for collaboration and information sharing (lessons learnt) among agencies and stakeholders.	D	MoNRE					X	20,000
									Total	$4,490,000

3.3 Implementation mechanism

The Songkhone District ICFMS sets out actions for the district to strengthen the climate resilience of communities to flood and drought risks. Implementing these actions will require leadership and cooperation from Lao PDR Ministries at the central, provincial and district level.

MoNRE is responsible for multiple sectors related to the ICFMS including water resources, flood protection, hydrological monitoring and early warning, and environmental and land use planning. Therefore the success of the ICFMS rests on how effective MoNRE is in convening, engaging and coordinating all government and non-government stakeholders in the design, delivery and reporting on the proposed actions.

To avoid the risk of poor sectoral integration and coordination, a two-tiered coordination framework is proposed to provide the basis of coordination during the implementation of the ICFMS (Figure 14).

- A Coordination Team comprising representatives of central line agencies to provide high-level strategic oversight and advice to MoNRE
- A Working Group comprising government stakeholders and non-government stakeholders in Savannakhet Province and target districts.

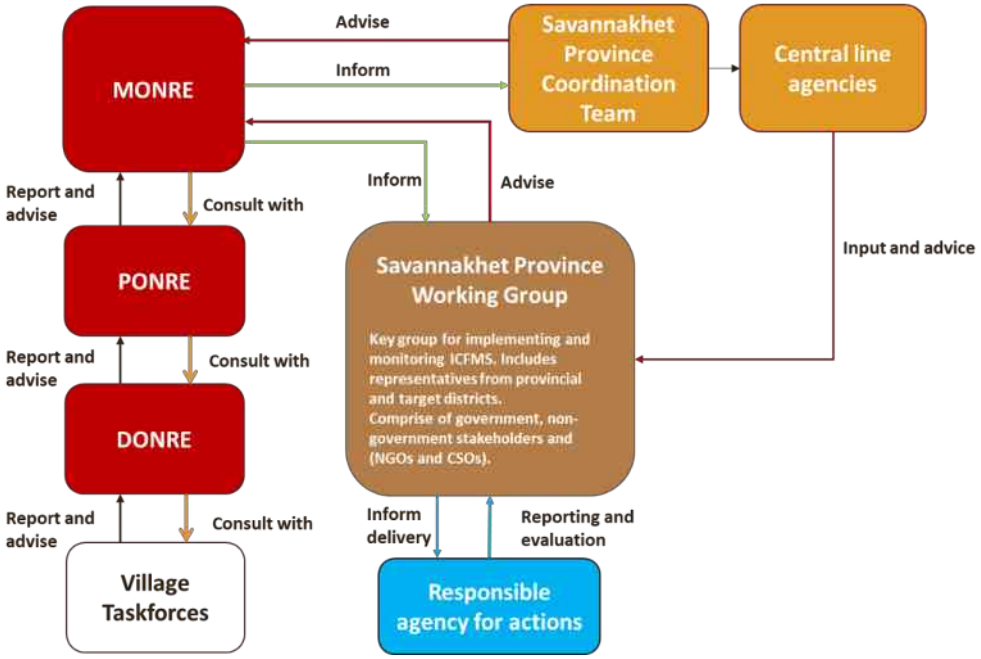

Figure 14. *Governance arrangement*

Coordination Team: The purpose of the coordination team is to involve other water-related sectors in the decision-making and implementation processes of the ICFMS. It is chaired by MoNRE and includes representatives from the central levels of water management and relevant line agencies (e.g. Ministry of Agriculture and Forestry, Ministry of Labour and Social Welfare, National Disaster Management Committee, Ministry of Technology and Communications, Ministry of Information, Culture and Tourism, and Ministry of Public Works and Transport). The Coordination Team makes decisions by consensus related to the implementation of the ICFMS.

Working Group: The purpose of the Savannakhet Province Working Group is to coordinate the on-ground activities, studies and analyses, and stakeholder collaboration which are needed to implement the Action Plan. This would include sharing of data, review of analysis and brainstorming discussion of implementation challenges. The Working Group is chaired by PoNRE and would involve technical managers from relevant agencies (e.g. provincial agencies responsible for agriculture, forestry, water resources, public works, disaster management, and communications). The Working Group can be used as the main forum for reporting and evaluating the success of implementation for the Action Plan.

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5 Appendix A – Target village flood maps

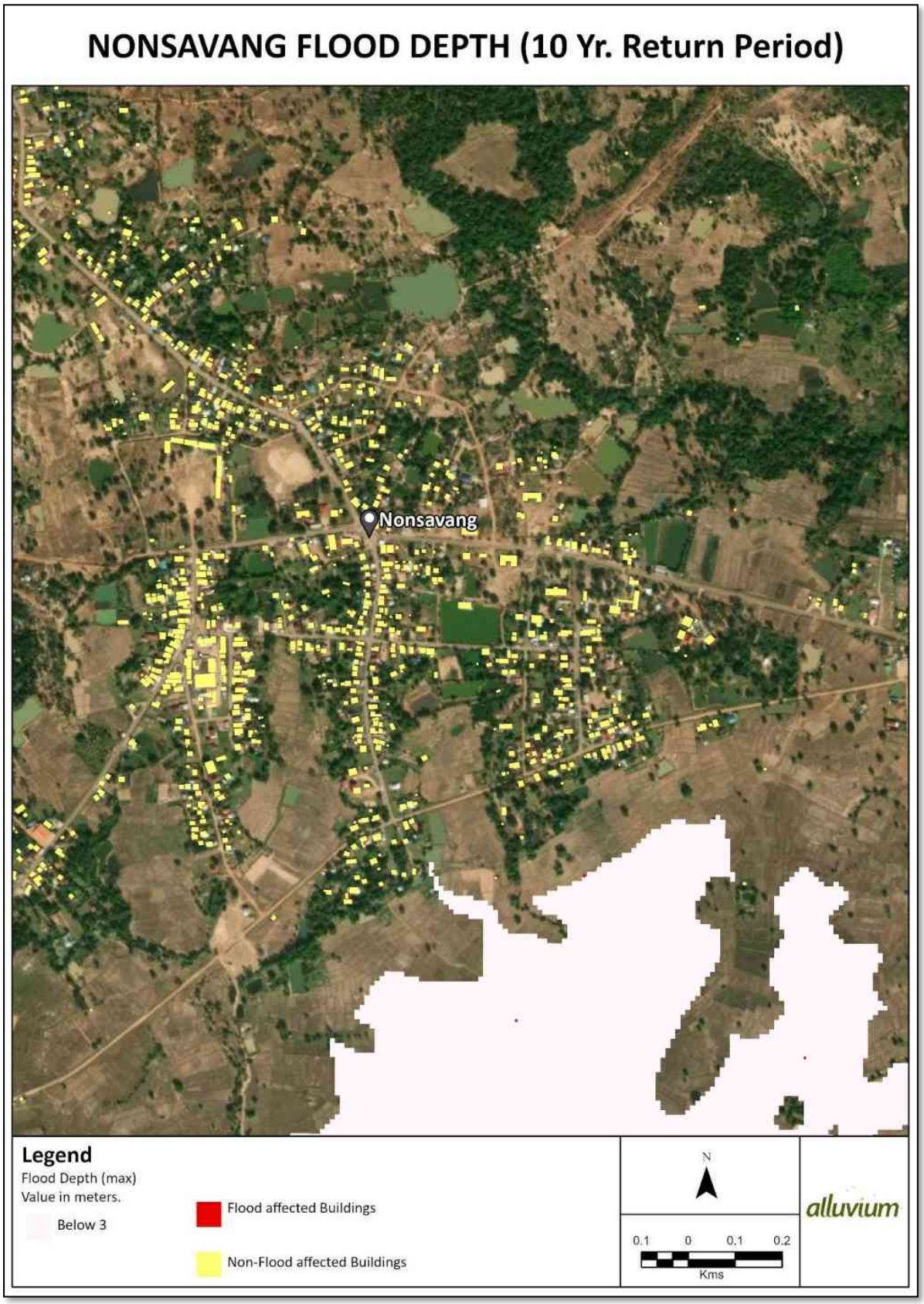

Figure 15. *Flood extent and depth for storm event with a 10-year return period (current climate) for Nonsavang Village*

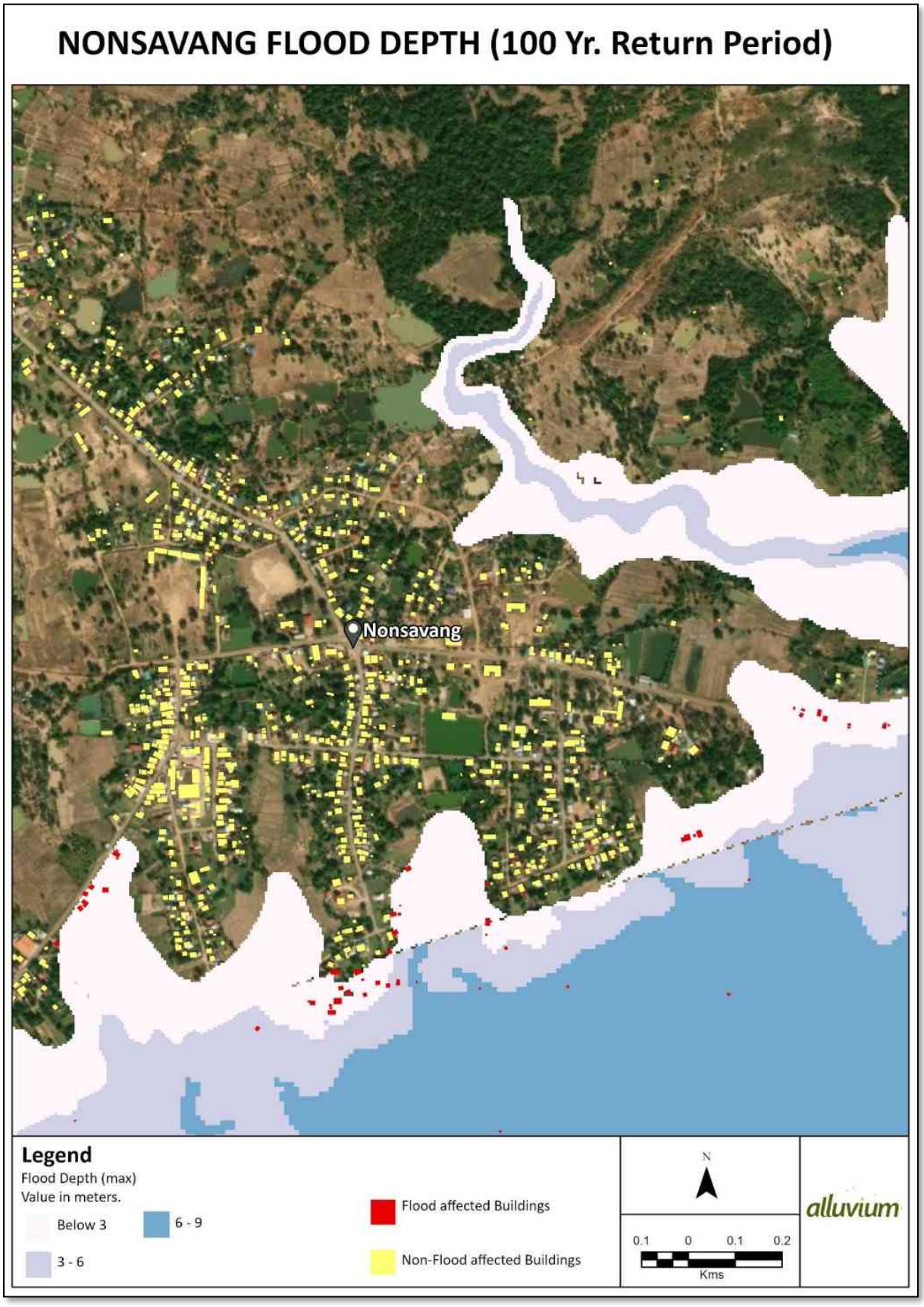

Figure 16. *Flood extent and depth for storm event with a 100-year return period (current climate) for Nonsavang Village*

6 Appendix B – Target village infrastructure proposals

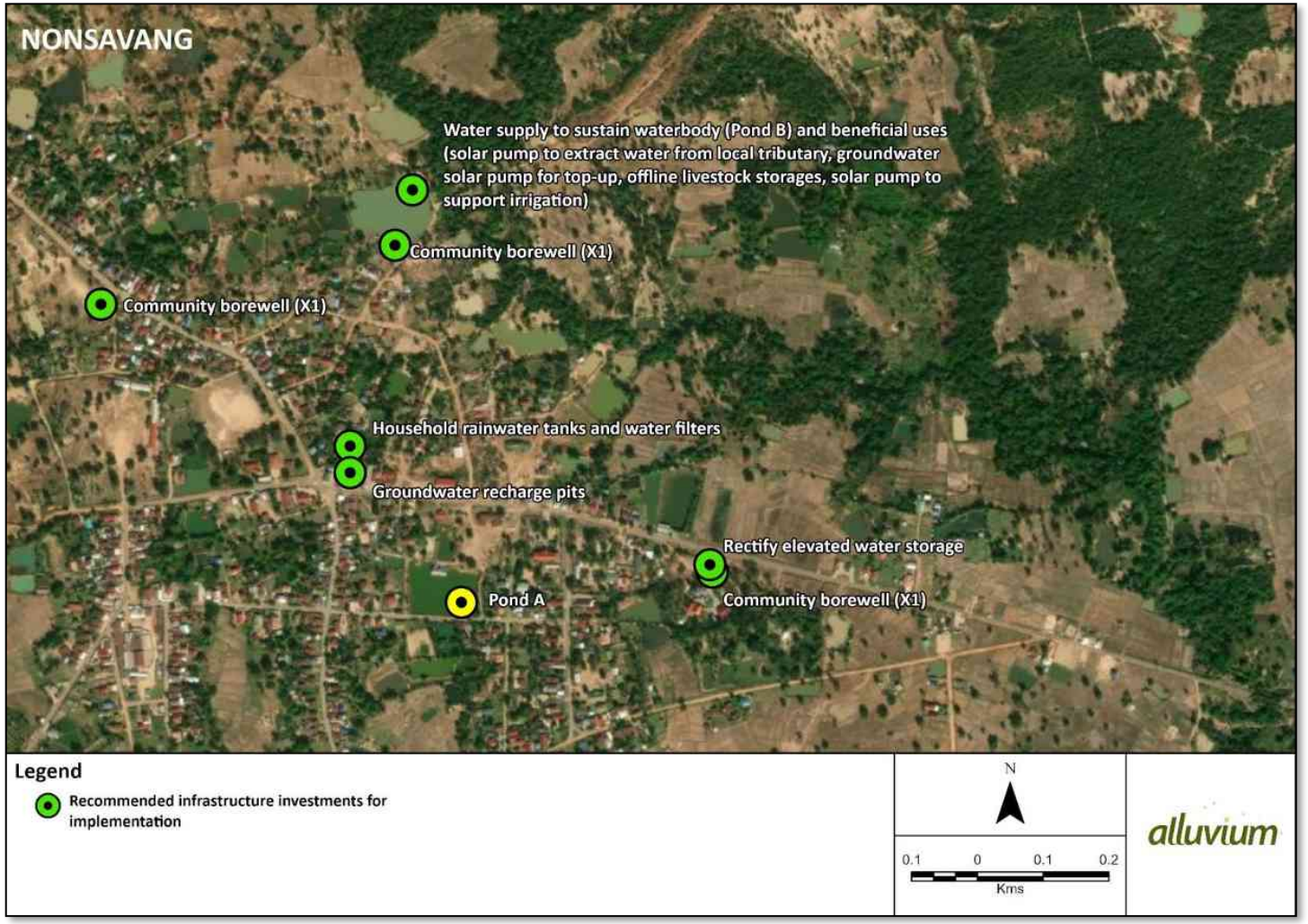

Figure 17. *Nonsavang Village – Recommended infrastructure investments for enhancing resilience to floods and droughts*

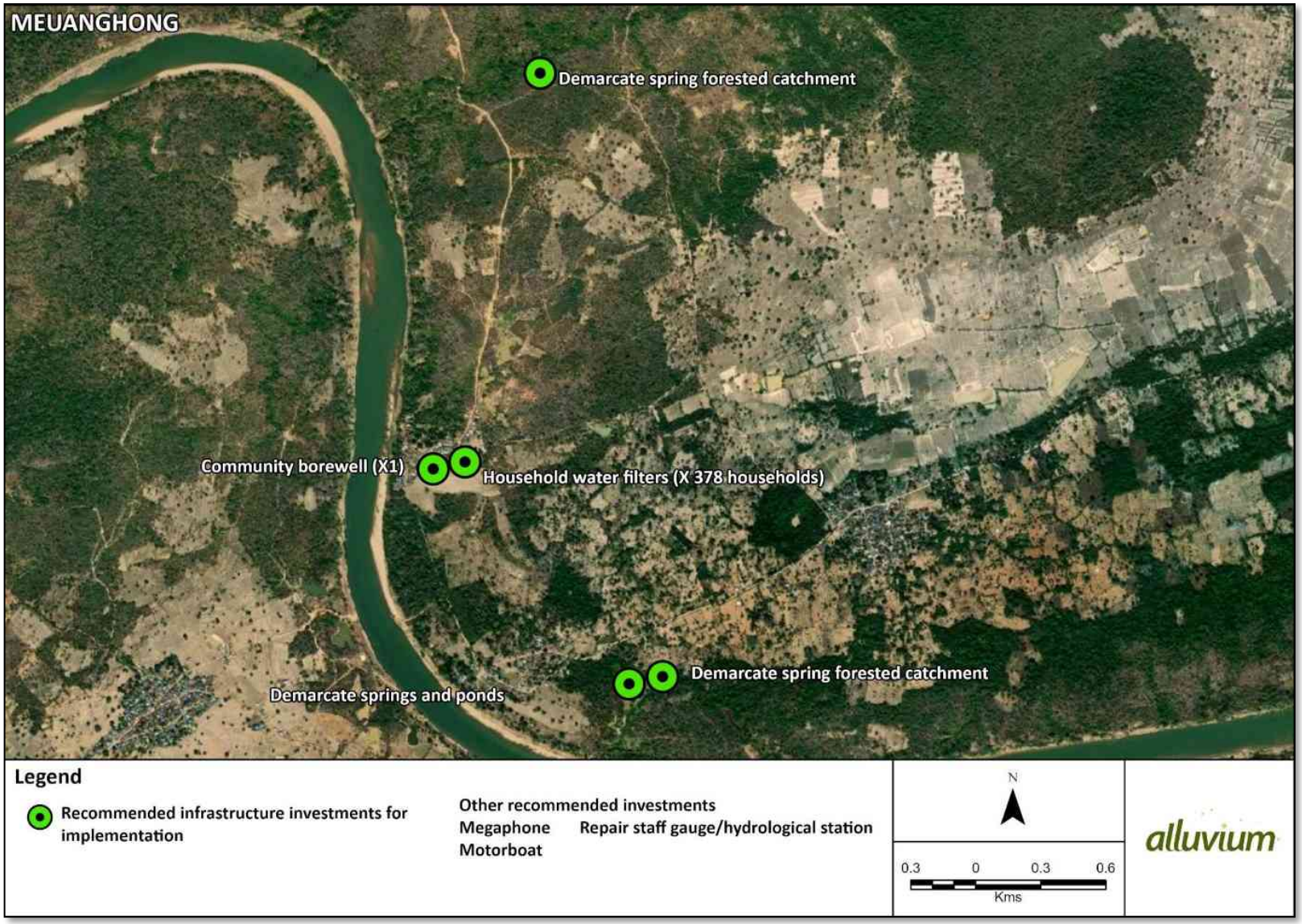

Figure 18. *Meuanghong Village – Recommended infrastructure investments for enhancing resilience to floods and droughts*

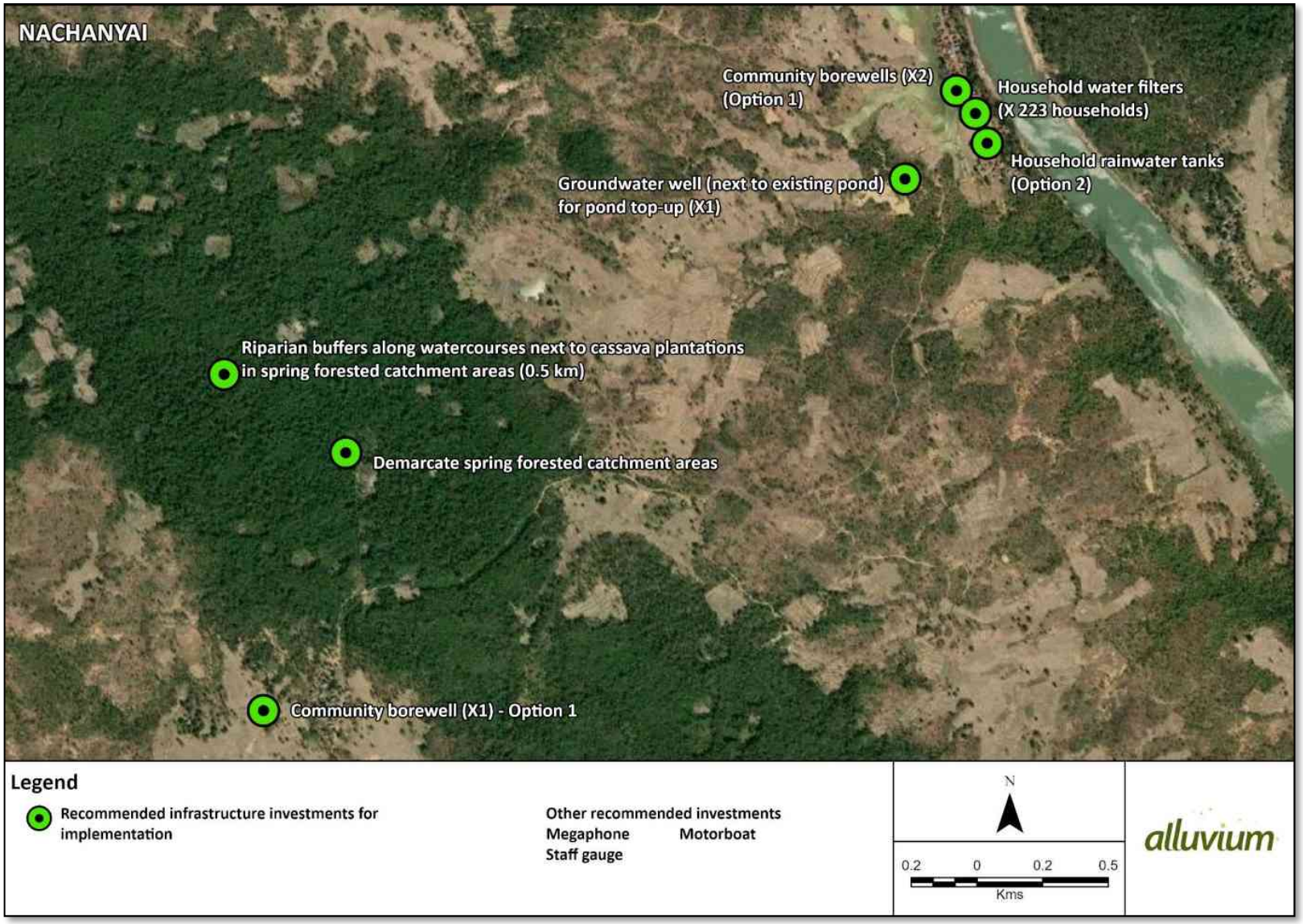

Figure 19. *Nachanyai Village – Recommended infrastructure investments for enhancing resilience to floods and droughts*

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