CLIMATE ADAPTIVE IRRIGATION AND SUSTAINABLE AGRICULTURE FOR RESILIENCE (CAISAR) AIIB PPSF GRANT S0452A, CODE 00-452-PPSF-DTA

ENVIRONMENTAL, SOCIAL, AND CLIMATE IMPACT ASSESSMENT REPORT

Submitted To:

Project Management Unit
Ministry of Water Resources and Meteorology,
AIIB and IFAD

Submitted By:

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EXECUTIVE SUMMARY

This summary provides a detailed overview of the Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project in Cambodia, drawing on information from the provided sources. The project, designed to improve irrigation systems and enhance agricultural productivity, spans four (4) provinces and six (6) sub-schemes. The project has undergone thorough environmental and social impact assessments to mitigate potential adverse effects, and it prioritizes community engagement and information disclosure.

Project Origins and Goals

The CAISAR project emerged from the Royal Government of Cambodia's (RGC) strategic framework for the irrigation sector, aiming to achieve the goals outlined in their National Water Resources Management and Sustainable Irrigation Road Map and Investment Program (2019-2023). The project aims to enhance climate adaptation and mitigate the negative impacts of extreme climate events on smallholder farmers and vulnerable communities, particularly in the Mekong River and Tonle Sap region.

Project Scope and Coverage

The project focuses on six (6) sub-schemes: Ou Ta Paong, Lum Hach, Brambei Mom, Krapeu Troum, Yutasas, and Steung Krang Bat, covering a total command area of 25,604 hectares and benefiting approximately 22,500 farmers. The project will conduct a comprehensive Environmental, Social, and Climate Impact Assessment (ESCIA) covering all six (6) sub-schemes and formulate Environmental, Social, and Climate Management Plans (ESCMP) for three (3) selected sub-schemes: Ou Ta Paong, Krapeu Truom, and Yutasas.

Legal and Policy Framework

The project's impact assessment adheres to international standards, including the Asian Infrastructure Investment Bank's (AIIB) Environmental and Social Framework (ESF), the International Fund for Agricultural Development's (IFAD) Social, Environmental, and Climate Assessment Procedures (SECAP), and the Green Climate Fund's (GCF) environmental and social standards. The assessment also considers the RGC's legal framework, including provisions for environmental protection, land acquisition, and involuntary resettlement. The project proposes measures to address any gaps between international standards and the RGC's legal framework.

Defining the Area of Influence

The project recognizes three (3) categories of influence: areas affected by project activities, areas affected by cumulative impacts from past and planned projects, and areas impacted by associated facilities. During the construction phase, air quality, noise, and vibration impacts are anticipated, primarily affecting areas within approximately 100 meters of construction sites, including rehabilitated rivers and canals, upgraded structures, and transportation routes. Water quality is also a concern during both construction and operation phases, with potential impacts arising from sedimentation, chemical contamination, and agricultural runoff. These

impacts could extend downstream along various rivers and ultimately affect the Tonle Sap Lake, impacting water availability for agriculture and domestic use.

Soil quality is anticipated to be affected by erosion, compaction, and contamination during construction, while operational impacts include salinization, nutrient imbalance, and waterlogging. The project acknowledges the potential impacts on biodiversity, particularly on wildlife movement patterns and habitats. Specific areas of concern have been identified for each of the six (6) sub-schemes, including the Boeng Kanseang Lake, Toul Samraong, Phnom Banon, and Chan Trak Community Forests, the Stoeung Krang Ponley River, and the Tonle Sap River.

Social impacts are expected to extend beyond the immediate project sites and will be influenced by changes in land use, water availability, and employment opportunities. The project recognizes the potential for shifts in livelihoods, migration patterns, and community dynamics, and aims to address potential negative impacts through community engagement and consultation, particularly with vulnerable groups. The report emphasizes the importance of mitigation measures to minimize these impacts, such as environmental monitoring, sustainable farming practices, and social safeguards to protect workers and communities.

Baseline Environmental and Social Conditions

This assessment covers a range of environmental and social factors, including geological, hydrological, climatic, and socio-economic conditions, and identifies key considerations for sustainable project implementation.

Geological and Topographical Features: The project area exhibits diverse geological formations, including deltaic deposits, organic deposits, and alluvial plains. Elevations range from less than 40 meters in Ou Ta Paong to 40-145 meters in Prambei Mom, indicating variations in terrain and land use potential. Soil types also vary across sub-schemes, with red-yellow podzols being the most common in Brambei Mom.

Hydrological Resources and Water Availability: Cambodia, particularly the CAISAR project area, possesses abundant water resources, primarily from the Mekong River and Tonle Sap Lake. However, water availability fluctuates seasonally, leading to challenges in the dry season. The project relies on several rivers and reservoirs, including the Pursat River, Ou Ta Paong River, and Svay Don Keo River. Existing irrigation infrastructure varies in condition and capacity, with some systems facing limitations due to damage, neglect, or inadequate design.

Climatic Conditions and Climate Change: Cambodia's climate is characterized by distinct wet and dry seasons, with precipitation ranging from 1,300 to 1,500 mm in the project areas. Historical climate data reveals rising temperatures, particularly during the dry season, and projections indicate a continued warming trend in the future. Flooding is a significant concern, with the project area highly susceptible to both riverine and flash floods.

Air and Water Quality: Air quality in the project area is generally good, though dust and smoke from agricultural activities can periodically affect local conditions. Noise and vibration levels vary across sub-schemes, with locations near major roads experiencing higher noise levels. Water quality assessments reveal concerns regarding nutrient pollution and microbial contamination in certain areas, particularly elevated levels of nitrogen, phosphorus, and total coliform.

Biodiversity and Species Distribution: The project area supports diverse ecosystems and a range of endangered and critically endangered species. Assessments have identified key species in various sub-schemes, including turtles, fish, birds, mammals, and plants. However, some species face population declines due to habitat loss, overfishing, and limited flooding events, highlighting the need for conservation efforts.

Socio-economic Conditions: The project area is predominantly rural, with agriculture as the primary occupation. The population is generally young, but educational levels vary across sub-schemes. Access to energy and sanitation facilities is high, but water supply reliability remains a concern. Rice production is the dominant agricultural activity, with varying yields and challenges across sub-schemes. Vegetable production is also prevalent, with farmers facing limitations related to market access, pest management, and water availability.

Cultural Heritage: The project area contains important cultural sites, including the Longvek Capital and Bardez Stupa, which require protection during project implementation.

Institutional Capacity and Needs: The report highlights capacity gaps in water resources and irrigation management at various levels, including within the Ministry of Water Resources and Meteorology (MOWRAM), Provincial Departments of Water Resources and Meteorology (PDOWRAM), and Farmer Water User Communities (FWUCs). Recommendations for capacity building include training programs on technical and administrative aspects of water management, environmental awareness, and social safeguards.

Climate Change Adaptation: The project recognizes the need to address climate change risks, including projected temperature increases, changes in rainfall patterns, and increased flood frequency and intensity. Mitigation measures, such as promoting drought-resistant crops, improving water storage and distribution systems, and strengthening early warning systems, are crucial for enhancing resilience.

Identifying and Assessing Potential Impacts

The project's environmental and social impact assessment meticulously identifies and analyzes potential risks and impacts associated with project activities, such as the construction and rehabilitation of irrigation canals, river dredging, and intensified crop production. These potential impacts are categorized as direct, indirect, and cumulative.

Direct Impacts: These are immediate and localized consequences of project activities. Examples include noise and dust pollution from construction, soil erosion from earthworks, and habitat disturbance during the construction of irrigation canals.

Indirect Impacts: These are secondary effects extending beyond the immediate project area. They may include water pollution from agricultural chemical runoff, increased demand for wildlife products due to labor influx, and changes in local economic activities due to project-related employment opportunities.

Cumulative Impacts: These arise from the combined effects of the project and other past, present, and reasonably foreseeable future projects in the area. Examples include the cumulative impact on water resources from multiple irrigation projects, the combined effects of agricultural intensification on biodiversity, and the overall impact of development projects on the socio-economic landscape.

Mitigating Environmental and Social Impacts

To minimize potential environmental and social impacts, the project proposes several management measures. The report highlights the potential environmental and social risks and impacts associated with the project, particularly during the construction and operation phases, and proposes mitigation measures to address these concerns.

The construction phase involves activities such as dredging, excavation, and the establishment of worker camps, which can lead to environmental pollution, habitat loss, and increased greenhouse gas emissions. The operation phase, characterized by intensified farming practices, poses risks related to water and soil pollution from agricultural chemicals and potential social inequalities.

To mitigate these risks, the report proposes several measures. These include implementing strict environmental monitoring programs to track air and water quality, conducting biodiversity assessments, and promoting sustainable farming practices. Social mitigation strategies focus on preventing child and forced labor, addressing potential sexual exploitation and abuse, and ensuring community health and safety through awareness campaigns and training programs. The report emphasizes the importance of community engagement and consultation, particularly with vulnerable groups, to ensure equitable access to resources and benefits from the project. Clear roles and responsibilities are outlined for various stakeholders, including government agencies, the Project Management Unit (PMU), contractors, and local communities, to ensure effective implementation and monitoring of these measures. The report also establishes an environmental and social compliance framework with detailed reporting procedures to ensure transparency and accountability throughout the project lifecycle.

Public Consultation and Information Disclosure

The project emphasizes public consultation and information disclosure throughout its lifecycle. Consultations were held with local communities, relevant authorities, and other stakeholders to inform them about the project's objectives, gather feedback, and address concerns. Concerns raised during consultations included potential pollution from construction, impacts on biodiversity, labor and working conditions, and community health and safety. The project is committed to disclosing the Environmental and Social Climate Impact Assessment (ESCIA) report and the Environmental and Social Climate Management (ESCM) Plan to the public in both English and Khmer. This includes a Non-Technical Summary (NTS) in Khmer, which provides a simplified explanation of the project.

Grievance Redress Mechanism (GRM)

The project establishes a comprehensive Grievance Redress Mechanism (GRM) to address concerns and complaints from affected communities and individuals. The GRM provides multiple channels for submitting grievances, a system for logging and tracking complaints, and procedures for resolving issues in a timely and transparent manner. The GRM aims to ensure accountability and responsiveness to community concerns throughout the project lifecycle.

Cost and Budget

The project's ESCIA includes detailed cost and budget analysis for mitigating potential environmental and social impacts. The budget outlines financial requirements for implementing mitigation measures, monitoring environmental and social indicators, capacity-building initiatives, and community engagement programs. The estimated cost for implementing the Environmental and Social Climate Management Plan (ESCMP) is $2,260,000, covering additional costs not originally factored into the project's budget. The ESCMP budget allocates funds to various stakeholders, including the Ministry of Water Resources and Meteorology (MOWRAM), exclusive of the land acquisition and land resettlement cost which is going to be estimated after the availability of conceptual design which will be used for the detailed engineering design. A significant portion of the budget is dedicated to the Biodiversity Plan, supporting protected areas and biodiversity actions in specific locations like Ou Ta Paong, Lum Hach, and Stung Krang Ponley. The budget also covers UXO clearance, consultation outreach, awareness-raising campaigns, and a comprehensive Environmental and Social Monitoring Program. This monitoring program involves regular assessments of soil quality, air quality, noise and vibration levels, and water quality at designated locations within the project area.

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CHAPTER 1 – INTRODUCTION

1.1 RATIONALE

The Project originated from the Royal Government of Cambodia (RGC)'s National Water Resources Management and Sustainable Irrigation Road Map and Investment Program (2019 -2023), which provides a Strategic Framework for the Irrigation Sector. It is designed to assist the Ministry of Water Resources and Meteorology (MOWRAM) with plans to make the irrigation sector climate resilient, The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project will be focusing on climate change adaptation with cross-cutting benefits through the reduction of Green House Gas (GHG) emissions linked to the use of high-efficiency smart irrigation systems use of renewable energy for pumping, and cover techniques to reduce evapotranspiration and enhance GHG reduction. Cambodia's Irrigated agriculture faces increasing challenges from adverse impacts of climate change, especially the changes in rainfall patterns, duration and timing of the rainy season, and climate induced water disasters such as floods and droughts. Climate Resilient (CR) and low emission practices and investments in agriculture and water management are therefore crucial to protect and enhance Cambodia's agricultural production and productivity which will in turn contribute to poverty reduction and increased food security.

CAISAR's Theory of Change is premised on the experience that addressing the complex impacts of climate change on rain fed and irrigated agriculture requires action at three (3) levels; farm level; irrigation scheme level and at the national level for creating a strong institutional base and an enabling environment. The theory of change of the project has therefore premised its investments on an understanding of the pathways that can help to reduce GHG emissions and help smallholder farmers adapt to climate change by applying climate resilient agricultural technologies. The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project will adopt a three-pronged strategy to bring about a paradigm shift in the farming systems and the water management governance in Cambodia. The integrated actions combining the various elements of the strategy can have a transformative impact on reducing vulnerability of water and agriculture systems to climate change impacts while also reducing GHG emissions and enhancing the livelihood of rural populations who primarily depend on agriculture.

The Theory of Change of the project assumes if the irrigation system is upgraded and modernized, farmers are made aware of improved energy efficient and water use technologies, and value chains of key agricultural commodities are strengthened. The country will then be able to transform agriculture to become more climate resilient and sustainable because through the positive changes in cropping pattern and production techniques that reduce GHG emissions, farmers communities are able to better adapt to climate change and increase and productivity and their incomes from agriculture, irrigation, and infrastructure is made more resilient and able to withstand extreme climate events, and institutional and regulatory capacity strengthened for low-emission climate-resilient development pathway. Some of the co-benefits that will emerge includes reduction in GHG emissions due to change in cropping pattern, switching to solar pumps and reduction in use of diesel pumps, improved

health, and well-being due to increased incomes from increased crop, poultry and aquaculture production, enhanced community collaboration and participation of women in managing water systems and much more active participation of the private sector in the water economy.

The CAISAR project will be co-financed by the Asian Infrastructure Investment Bank (AIIB), International Fund for Agricultural Development (IFAD), and Green Climate Fund (GCF) along with in kind contribution of the Royal Government of Cambodia.

1.2 PREPARING THE ESCIA

1.2.1 Objectives of the ESCIA

The overall objective of the study is to conduct a comprehensive assessment on the Environmental, Social, and Climate Impact Assessment (ESCIA) that covers the entire scope of the project, inclusive of its six sub-schemes, as one sub-scheme was removed from the project, which will lead to the formulation of the Environmental, Social, and Climate Management Plans (ESCMP) for three (3) selected sub-schemes.

The specific objectives of the assessment involve two (2) key tasks:

- To conduct and develop a comprehensive Environmental, Social, and Climate Impact Assessment (ESCIA) report that covers the entire scope of the project, inclusive of its six (6) sub-schemes.
- To formulate Environmental, Social, and Climate Management Plans (ESCMP) for selected sub-schemes, specifically focusing on:
    - ESCMP for the Ou Ta Paong sub-scheme in Pursat Province.
    - ESCMP for the Krapeu Truom sub-scheme in Kampong Speu Province.
    - ESCMP for the Yotassas sub-scheme, also in Kampong Chhnang Province.

1.2.2 Project Location

The assessment covers the CAISAR project's areas situated in Pursat, Kampong Chhnang, Kampong Speu and Kandal provinces in six (6) sub-schemes, namely Out Ta Paong, Lum Hach, Krapeu Truom, Yutasas, Soeung Krang Bat, and Brambei Mom. The size and proportional area of the sub-schemes are provided in Table 1.1:

Table 1.1: List of six (6) sub-schemes under CAISAR

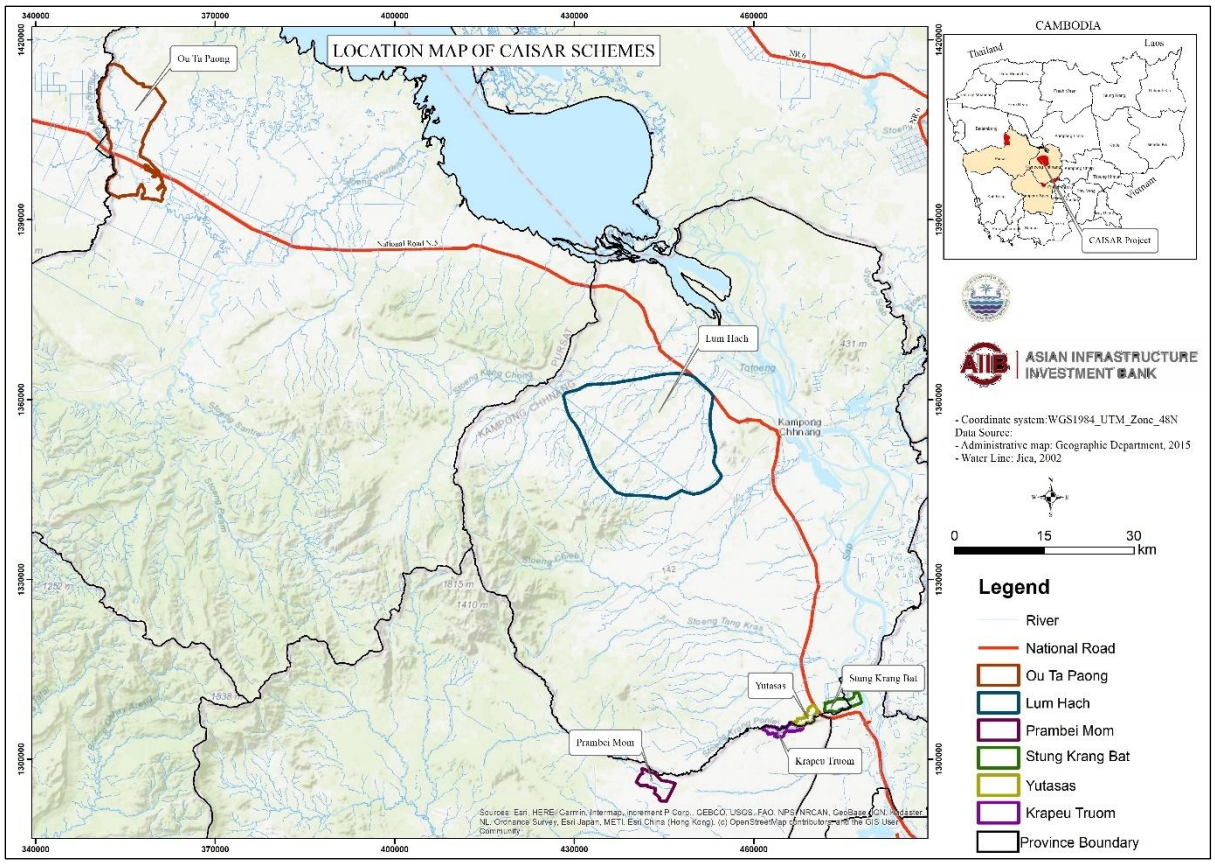
No.	Scheme Name	Component 2				Total	
		Irrigation		Rainfed area			
		Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
1	Ou Ta Paong	14,874	67%	1,200	16%	16,074	55
2	Lum Hach	3,900	18%	2,400	32%	6,300	21
3	Brambei Mom	1,000	5%	2,400	32%	3,400	12
4	Krapeu Truom	690	3%	400	5%	1,090	4
5	Yutasas	593	3%	600	8%	1,193	4
6	Stoeung Krang Bat	994	5%	400	5%	1,394	5
Total		**22,051**	**100%**	**8,600**	**100%**	**34,204**	**100**

1.2.3 Scope and Coverage

1.2.3.1 Geographical Scope

As stated in the objectives of the assessment, the ESCIA will cover the entire project areas while the ESCMPs will be prepared for three (3) sub-schemes: Out Ta Paong, Krapeu Truom and Yutasas.

Figure 1.1: Map of the CAISAR Schemes



1.2.3.2 Conceptual Framework Coverage

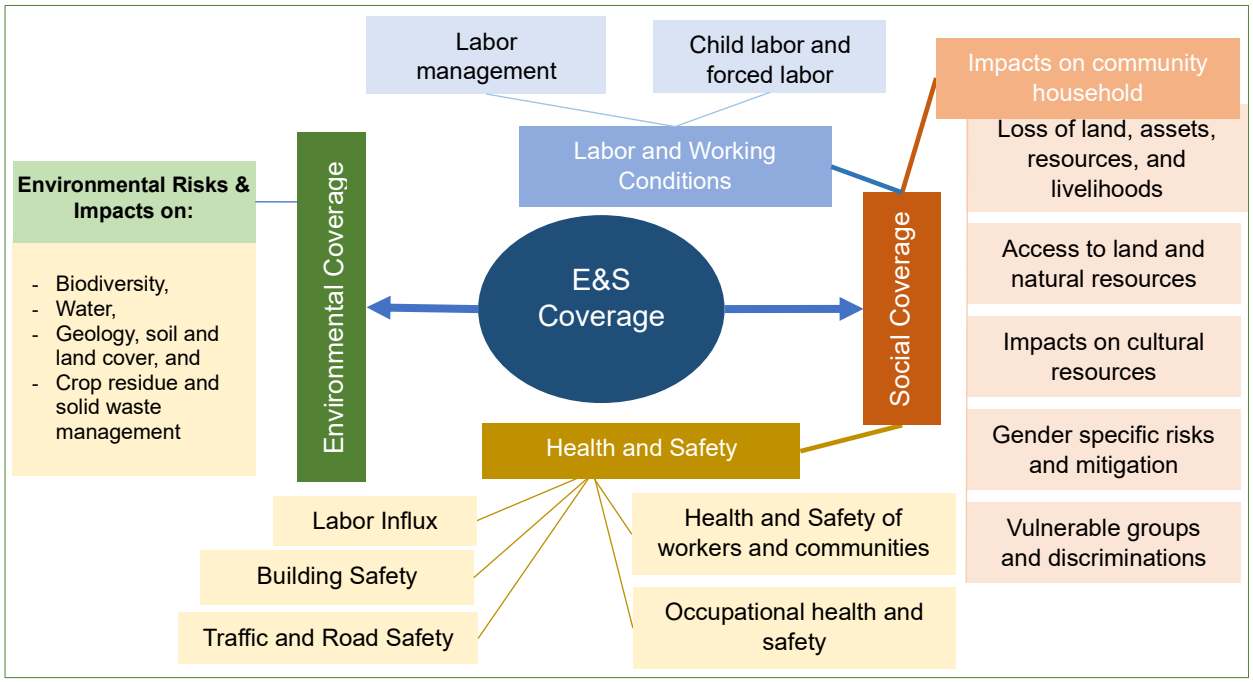
According to the Terms of Reference (ToR), the E&S study addresses two (2) key dimensions: social and environmental, both of which potentially affect the living conditions and/or income generation activities of the affected households - directly or indirectly

Firstly, the social dimension covers the impacts on community people either individual or collectively as a community due to the causes of the construction, which may lead to loss of their assets, income, access to their land and natural resources, etc. due to land acquisition for the purpose of construction. Moreover, some of these locations might be sacred, representing their cultural and religious worship. The presence of the infrastructure systems may also lead to conflicts or foster positive recognition among genders and vulnerable groups. In addition to the long-term impacts of the infrastructure after its completion, there are also immediate effects during the construction phase, including health and safety concerns. These may involve an influx of labour, traffic and road safety issues, building safety, and the health and safety of workers and the surrounding community. The influx of labour could be caused by the labour forces required during the construction and the ongoing operations of the infrastructure, which may lead to migration to the areas, causing conflicts over land and water,

or migration of local people due to increasingly competitive living conditions. This situation may lead to increased or decreased utilization of child labour during both the construction phase and after the completion of the project.

A diagram illustration of the project conceptual coverage is provided below:

Figure 1.2: Illustration of key assessment conceptual coverage



Secondly, the environmental dimension also includes the potential effects of climate change, which the project intervention might mitigate positively, thereby potentially enhancing agricultural resilience. However, the project could also lead to degradation of ecosystem services and biodiversity, especially endangering certain species mainly the endangered species and the critically endangered species, either directly or indirectly because of the infrastructure projects, whether individually or collectively. The water quality for both surface and groundwater and hydrology are also required to be studied while geology, soil and land cover are part of the ESCIA. Lastly, crop residue and solid waste management are required to ensure that hazardous and non-hazardous waste will be properly considered.

The environmental and social impact assessment will incorporate the characteristics of the impacts, their nature and duration, significance/magnitude, likelihood, spatial scale, measures to mitigate or enhance, and significance/magnitude of residual impacts where relevant receptor sensitivity/vulnerability.

1.2.3.3 Legal Coverage

It is expected that the formulation of the reports will encompass relevant national policies, laws, regulations, as well as international guidelines and standards specified by the Asian Infrastructure Investment Bank (AIIB), International Fund for Agricultural Development (IFAD), Green Climate Fund (GCF), and the regulatory of the country. The list of the standard is provided here:

- **AIIB's Environmental and Social Framework (ESF) (2022):**

- Environmental and Social Standard 1: Environmental and Social Assessment and Management
- Environmental and Social Standard 2: Land Acquisition and Involuntary Resettlement
- Environmental and Social Standard 3: Indigenous Peoples

- **IFAD's Social, Environmental and Climate Assessment Procedures (SECAP, 2021 edition)**
  - Standard 1: Biodiversity conservation
  - Standard 2: Resource efficiency and pollution prevention
  - Standard 3: Cultural heritage
  - Standard 4: Indigenous peoples
  - Standard 5: Labor and working conditions
  - Standard 6: Community health and safety
  - Standard 7: Physical and economic resettlement
  - Standard 9: Climate change
- **GCF's Environmental and Social Policy**
  - All ILO conventions signed and ratified by the country, all ILO conventions covering core labor standards and all ILO conventions covering the basic terms and conditions of employment.
  - Other relevant international treaties and conventions to which Cambodia is a signatory; and
  - Other relevant good international industry practices (GIIP)
- **National Legal Framework:** In addition to the provided legal framework, PPIC will also undertake the Environmental Impact Assessment (EIA) for the Project, examining the law and key regulatory requirements related to environment of the Kingdom, in which is also relevant to the project on infrastructure.

CHAPTER 2 – PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter provides a comprehensive overview of the project, detailing the specific conditions and characteristics of each sub-scheme, along with the proposed structures and planned investments. It also includes a brief analysis of the various alternatives that were considered during the planning and design stages of the project. The analysis explores the potential impacts of each alternative, assessing both positive and negative outcomes, and evaluating their respective benefits. This chapter aims to provide a thorough understanding of the rationale behind the chosen design, ensuring that the proposed project aligns with the overall goals while minimizing potential risks and maximizing benefits for all stakeholders.

2.2 PROJECT DESCRIPTION

2.2.1 Background

The projects' intention is to increase climate adaptation, mitigate the negative impact of extreme climate events, and improve the livelihoods of smallholder farmers and vulnerable rural communities in four (4) provinces of Cambodia, including Pursat, Kampong Chhnang, Kampong Speu, and Kandal. The Mekong River and its tributaries dominate the hydrology of the Tonle Sap region in Cambodia, making it especially vulnerable to floods, storms and droughts. Agriculture is the primary source of livelihood for the people in most provinces of Cambodia and it accounts for 22.5% of the country's Gross Domestic Product and employs over 3 million people. Rice is the primary food crop grown on an estimated 2.3 million hectares or nearly 85% of the country's total cultivated area.

This objective will be achieved through implementing three (3) project components that aim at addressing climate change vulnerabilities, increasing agricultural productivity, and strengthening institutional capacities. The components include:

The project will be implemented through various activities organized under the following three (3) components:

Component 1. Improving farm-level climate adaptation, resilience, and water use efficiency

The objective of this component is to build climate resilience (CR) of smallholder farmers and enhance sustainable production through evidence-based planning and context-relevant climate resilient practices at the farm level. This component is designed to address the lack of knowledge and skills to deploy technologies and practices at farm level by farmers and the lack of appropriate extension services to propagate them. It will introduce farmers with various climate resilient technologies and practices for both rice and non-rice activities such as vegetable production, poultry and aquaculture.

Sub-component 1.1 Deployment of farm-level climate adaptation and water use efficiency measures

Output 1.1: Increased capacity of farmers to deploy climate resilient (CR) practices at farm level. This output will focus on developing farmer's capacity in deploying CR technologies and practices to transform the agricultural production system to adapt to the changing climate context. Farmer's will be trained to first develop Action Plans (AP) to re-orient farmer behaviour and assist them in transforming the agriculture production system in a manner that is better adapted to factoring in the agro-ecological context and expected climate change impacts.

- Activity 1.1.1 Preparation of community-based action plans (AP) to transform agriculture with CR practices.
- Activity 1.1.2 Preparation of training materials to support implementation of the AP.
- Activity 1.1.3 Conduct trainings to create a pool of expertise to demonstrate and propagate the CR technologies and practices.
- Activity 1.1.4 Train farmers on applying CR technologies using the FFS approach.
- Activity 1.1.5 Strengthening and fostering tailored mechanization service providers for improved mechanization service delivery.
- Activity 1.1.6 community-based monitoring and evaluation (CBME) of implementation

Sub-Component 1.2 Climate adapted, value added, and market led agricultural investments

Output 1.2 CR value added, and market led agriculture investments secured. This output involves improving and enhancing some value chains that are key for the project area and include rice, vegetable, chicken and aquaculture value chains, through the use of Public Private Producer Partnerships (4Ps) and increased access to finance, which will improve market access, climate adaptability, and ensure increased income for smallholders in the value chains.

- Activity 1.2.1 Value chain study and planning
- Activity 1.2.2 Establish District Multi-Stakeholder Platforms (MSPs)
- Activity 1.2.3 Public Private Producer Partnership Facility (4PF)

Sub-component 1.3 Improve enabling conditions, capacities and disaster risk management strategies

Output 1.3. Increased access to and use of climate information and advisory services for climate responsive agriculture planning. This sub-component will strengthen the production and dissemination of tailored agro-meteorological information to inform climate responsive management and planning of agriculture in the project target areas through ICT technologies. The aim is to ensure that agro-meteorological services are accessible and useful to farmers to manage climate risks, access to and use of water and efficient cropping systems.

- Activity 1.3.1 Establish ICT based multi-disciplinary platform at provincial level.

- Activity 1.3.2 Building the capacities of the platform to deliver services.
- Activity 1.3.3. Establish the agromet information systems and the outreach mechanisms.
- Activity 1.3.4 Awareness raising and capacity building of farmers and stakeholders in applying the services.

Sub-component 1.4 Rural roads

Output 1.4: Increased resilience of farm road infrastructure to climate change

- Activity 1.4.1 Initial planning and identification
- Activity 1.4.2 Technical survey and design considerations, preparation of cost estimation
- Activity 1.4.3 Improve 50 Kilometers of farm roads.
- Activity 1.4.4 Handing over of the completed works.

Component 2: Irrigation Infrastructure for increased resilience

Component 2 is linked with Component 1 such that it facilitates the implementation of CR on farm crop and water management practices through improved field level water supply delivery and drainage. It will focus on rehabilitating and modernizing of irrigation and flood protection/drainage infrastructure in the six (6) sub-projects, including irrigation and drainage canals, flood control embankments, and ponds, to provide high-efficiency climate-resilient irrigated agriculture systems for adapting to both increasing flood and drought conditions.

Sub-

Component 2.1: Modernization of irrigation scheme and ponds

- Activity 2.1.1 Technical analysis, field surveys and preparation of plans for system upgrading.
- Activity 2.1.2 Implementation of infrastructure upgrading.

Activity 2.1.3 Preparation of canal O&M plans including application of ICT and SCADA for operation***Sub-Component 2.2: Flood-proofing and Drainage improvements***

- Activity 2.2.1 Establish flood monitoring, information, and early warning systems.
- Activity 2.2.2 Strengthening and construction of flood control and drainage infrastructures.

Sub-Component 2.3: Establishments and training of Farmers Water User Communities (FWUC)

- Activity 2.3.1 Formation of institutional strengthening of the FWUC
- Activity 2.3.2 Build technical capacities of FWCU for canal structure O&M
- Activity 2.3.3 prepare long term financing plan for O&M of the systems including the WUAS.

Sub-Component 2.4: Water information and Management (SCADA)

Component 3. Institutional Strengthening

Sub-Component 3.1 MOWRAM capacity Support.

Output 3.1 Strengthened MOWRAM Capacity

- Activity 3.1.1 Preparation of climate resilient design manuals for irrigation and train staff
- Activity 3.1.2 Building capacities on application of ICT and RS technologies, data management
- Activity 3.1.3 Capacity building in water Accounting and Auditing

Sub-Component 3.2 Strengthening of NDA and NCDD.

Output 3.2 Improved capacities for climate action monitoring

- Activity 3.2.1 Preparation of Loss and Damage Strategy
- Activity 3.2.2 Strengthen national M&E process for climate action
- Activity 3.2.3 Enhancing Capacity of NDA and other stakeholders.

2.2.2 Project Area and Beneficiaries

The CAISAR project covers a total command area of 25,604 ha and is composed of six (6) sub-schems – Ou Ta Paong (Pursat Province), Lum Hach (Kampong Chhnang Province).

Brambei Mom (Kampong Speu province), Krapeu Troum (Kampong Speu and Kampong Chhnang), Yutasas (Kampong Chhnang), and Steung Krang Bat Kampong Speu and Kampong Chhnang.

Table 2.1 (below) provides a summary of project communes (by district and province) that each sub-scheme covers.

Table 2.1: Summary of the CAISAR project targeted area

No.	Sub-Schemes	Provinces	Districts	Communes
1	Ou Ta Pong	Pursat	Bakan	1. Beung Khnar 2. Ou Ta Paong 3. Rumlech 4. Svay Doun Keo 5. Me Teok 6. Khnar Torteung
2	Lum Hach	Kampong Chhnang	Toek Phus	1. Krang Skear
			Rolea B'ear	1. Banteay Preal 2. Krang Leav 3. Prasneob
			Boribour	1. Anchanh Rung
3	Brambei Mom	Kampong Speu	Thpong	1. Brambei Mom 2. Rung Reung
4		Kampong Speu	Odoung Maechey	1. Veal Pong

	Krapeu Troum	Kampong Chhnang	Sameakki Meanchey	1. Thbeng Khpos 2. Svay
5	Yotasas	Kampong Chhnang	Sameakki Meanchey	1. Svay
6	Steung Krang Bat	Kampong Chhnang	Kampong Tralach	1. Longvek
		Kandal	Ponnhea Leu	2. Kampon Leung

With a coverage of 25,604 ha, CAISAR is expected to provide support to an estimated 22,500 people who do farming in the six (6) sub-scheme area (See table below).

Table 2.2: List of six (6) sub-schemes under CAISAR

No.	Scheme Name	Component 2						Beneficiaries	
		Irrigation		Rainfed area		Total			
		Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	HH	Ratio
1	Ou Ta Paong	14,874	67%	1,200	16%	16,074	55	15,000	67%
2	Lum Hach	3,900	18%	2,400	32%	6,300	21	3,900	18%
3	Krapeu Truom	690	3%	400	5%	1,090	4	1,100	3%
4	Yutasas	593	3%	600	8%	1,193	4	700	3%
5	Stoeung Krang Bat	994	5%	400	5%	1,394	5	650	5%
6	Brambei Mom	1,000	5%	2,400	32%	3,400	12	1,050	5%
Total		**22,051**	**100%**	**8,600**	**100%**	**34,204**	**100**	**22,500**	**100%**

2.2.3 Description of the Sub-Schemes

2.2.3.1 Ou Ta Paong

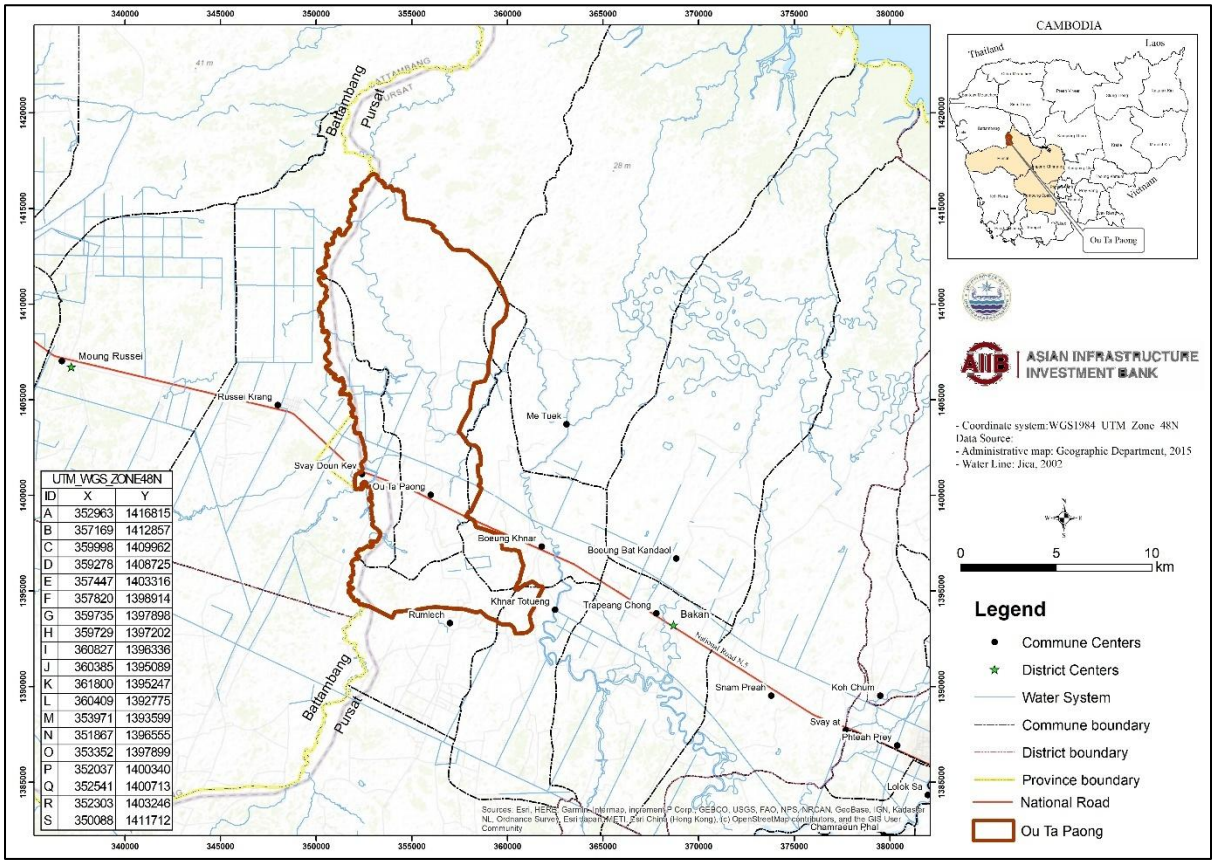
2.2.3.1.1 Location and Coverage

The OTP command area, located in Bakan District, Pursat Province, spans approximately 16,074 hectares and is a crucial rice-producing region. The Ou Ta Paong scheme encompasses five (5) communes within Bakan district, Pursat province: Ou Ta Paong, Boeung Khnar, Svay Duon Kev, Khnar Totueng, and Rulech. Additionally, three (3) surrounding communes affect the scheme: Me Tuek commune in Bakan district, Pursat province, Russei Krang Moung in Russei district, and Prey Tralach in Rokkiri district, Battambang province. For detailed information, please refer to table 2.3.

Table 2.3: Administrative coverage of Ou Ta Paong sub-scheme

Category	Commune Name	District	Province
Within the Scheme	Ou Ta Paong	Bakan	Pursat
	Boeung Khnar	Bakan	Pursat
	Svay Duon Kev	Bakan	Pursat
	Khnar Totueng	Bakan	Pursat
	Rulech	Bakan	Pursat
Surrounding the scheme	Me Tuek	Bakan	Pursat
	Russei Krang Moung	Russei	Battambang
	Prey Tralach	Rokkiri	Battambang

Figure 2.1: Map of Ou Ta Paong Sub-Scheme



UTM_WGS_ZONE48N		
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B	357169	1412857
C	359998	1409962
D	359278	1408725
E	357447	1403316
F	357820	1398914
G	359735	1397898
H	359729	1397202
I	360827	1396336
J	360385	1395089
K	361800	1395247
L	360409	1392775
M	353971	1393599
N	351867	1396555
O	353352	1397899
P	352037	1400340
Q	352541	1400713
R	352303	1403246
S	350088	1411712

2.2.3.1.2 Agro- and Hydrological Characteristics

The command area utilizes water from multiple sources, including the Pursat River, Svay Donkeo River, and Ou Ta Paong River. These rivers create distinct hydraulic zones within the scheme, influencing water availability and agricultural productivity. The upper part of the scheme, south of National Road 5, primarily relies on the Pursat River, which feeds the Damnak Apil Canal and its irrigation network. Due to the area's natural slope from south to north, gravity-fed irrigation is possible, but the existing infrastructure is inadequate. To improve water distribution, it is necessary to enhance the canal networks and build additional regulating structures.

The eastern part of the scheme lies between the Ou Ta Paong River to the west, Wat Chre scheme to the east, and National Road 5 to the north. Water in this region comes from a combination of southern infrastructure, including the Damnak Apil and Kbal Hong hydraulic systems, the Wat Loung canal, and parts of the Svay Donkeo and Ou Ta Paong rivers. However, the area's low hydraulic gradient prevents gravity irrigation, necessitating one-stage pumping and the development of more efficient distribution networks. Similarly, the western section of the scheme, between the Svay Donkeo River on the west and the Ou Ta Paong River on the east, also requires pumping due to the low gradient, with Svay Donkeo serving as the primary water source. As shown in table2.4.

Table 2.4: The Water Resources by Region of Ou Ta Paong sub-scheme

Region	Water Resources
Upper Part	Pursat River, Damnak Apil Canal
Eastern Part	Damnak Apil, Kbal Hong, Wat Loung, Svay Donkeo River, Ou Ta Paong River
Western Part	Svay Donkeo River, Ou Ta Paong River

In all these blocks there are ample opportunities to develop two (2) wet season rice crops by developing proper canal system. This blocks proper canal bed slope of the canal, tertiary canals, regulating structures and most importantly the canal management. As per study there is also an opportunity to develop dry season in 10% command area.

Several key facilities potentially impact the water availability for the Ou Ta Pong (OTP) command area, including Dam 1, Dam 2, Dam 3, Dam 5, the Damnak Cheukrom barrage, and the Damnak Apil Headwork. Each of these structures' influences water flow and availability in various ways within the OTP sub-scheme.

Dam 1, currently under construction and expected to be operational by 2026, is the largest contributor to the Pursat River, which serves as the primary water source for the OTP area. With a catchment area of 3,499 km², Dam 1 is projected to provide a substantial water supply of 1,014 MCM, far exceeding the contributions of Dams 3 and 5 but the purpose of the dam is for hydropower generation. Meanwhile, Dam 2, approved for construction in June 2024, will add significant water capacity to the region with its reservoir covering 4,016 hectares and a storage capacity of 861.75 MCM. Its completion in 2026 is expected to ensure that the province's water needs are fully met, particularly when combined with the existing water supplies from Dams 1, 3, and 5 (Please see table 2.5).

The water distribution system for Ou Ta Pong is managed by the Farmer Water User Community (FWUC), which coordinates with the Provincial Department of Water Resources and Meteorology (PDWRAM) in Pursat. The FWUC handles requests from local farmers and oversees the allocation of water to the various villages within the command area. Water from the Damnak Apil Headwork is diverted into the OTP scheme based on these requests. Additionally, the Damnak Cheukrom barrage, which manages a 16,100-hectare command area, will receive priority water supply from Dam 1 once it becomes operational, potentially affecting the water availability downstream to the OTP area.

Table 2.5: Key Characteristics of the Ou Ta Pong Irrigation Scheme

Aspects	Description
Water Sources	Pursat River, Svay Donkeo River, Ou Ta Paong River
Hydraulic Zones	Upper, Eastern, and Western Zones
Irrigation Methods	Gravity-fed irrigation (upper zone), Pumped irrigation (eastern and western zones)
Infrastructure Needs	Canal network improvement, regulating structures, pumping stations
Cropping Potential	Two (2) wet season rice crops, potential for dry season cropping in 10% of the command area

Annual flooding, particularly in the downstream areas near Tonle Sap, impacts farming activities. Farmers in these flood-prone areas typically cultivate two (2) crops: one rain-fed crop before the flood and another after the floodwaters recede. Despite the challenges, the existing canal system provides ample opportunity to develop two (2) wet-season rice crops across the scheme, and there is potential for dry-season cultivation in about 10% of the command area, provided that proper canal management and infrastructure improvements are implemented.

2.2.3.2 Lum Harch Scheme

2.2.3.2.1 Location and Coverage

The Lum Harch Irrigation scheme encompasses a command area situated downstream the old Lum Harch canal built during Pol Pot period (1975-1977), drawing its water supply from various streams crossing the canal. These sources comprise several other rivers that traverse the scheme and have very limited catchment area and flow.

The sub-scheme is situated across three (3) districts in Kampong Chhnang province: Baribour, Rolea B'ier, and Tuek Phos. Within its command area, six (6) communes' benefit from its water supply: Prasneb, Banteay Preal, Krang Leav, Prey Mul, Anhchanh Rung, and Krang Skear. Additionally, several communes surrounding the scheme also utilize its water resources, including Phsar, Melum, Svay Chrum, Chrey Bak, Tang Krasang, Pech Changvar , and Khlong Popok.

Figure 2.2: Map of Lum Hach Sub-Scheme

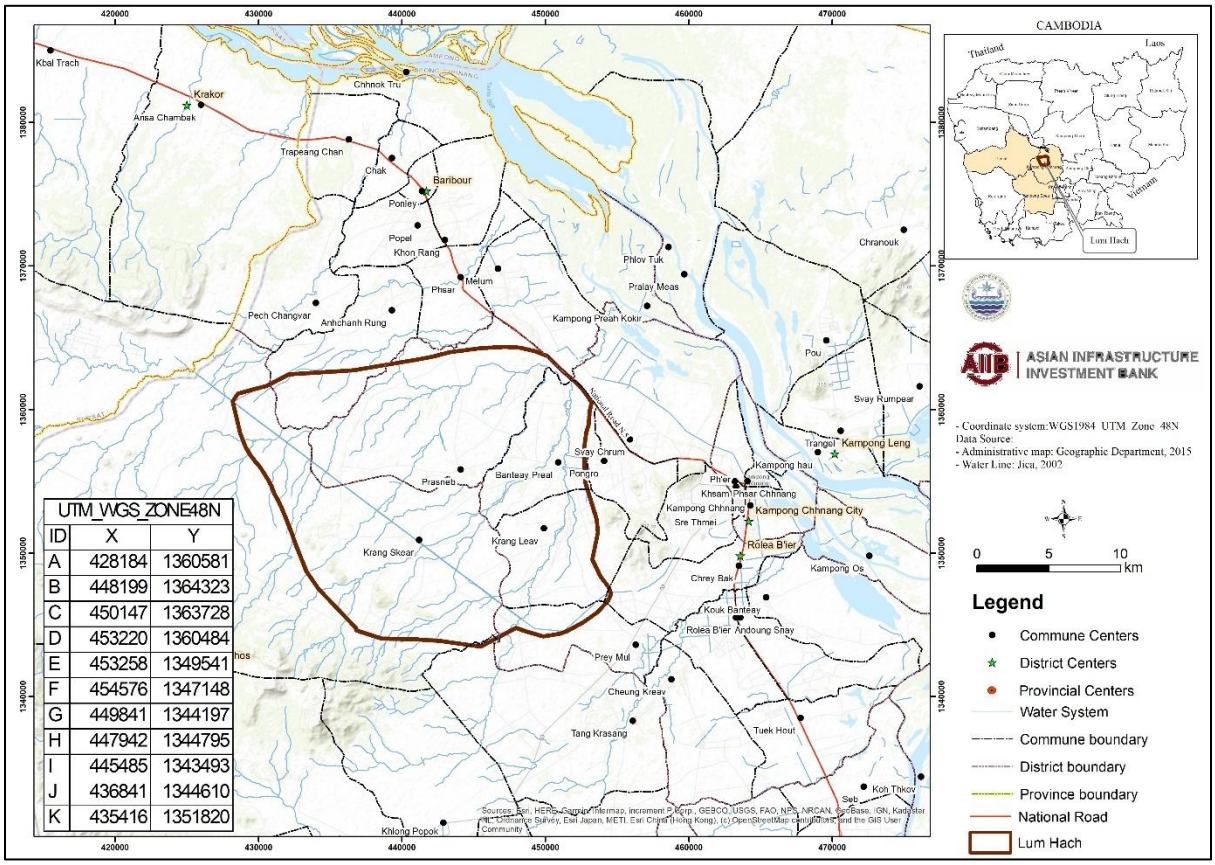


Table 2.6: Administrative coverage of Ou Ta Paong sub-scheme

District	Communes within the scheme	Communes surrounding the scheme
Baribour	Anhchanh Rung	Phsar, Melum, Pech Changvar
Rolea B'ier	Prey Mul, Prasneb, Banteay Preal, Krang Leav	Svay Chrum, Chrey Bak
Tuek Phos	Krang Skear	Tang Krasang, Khlong Popok

2.2.3.2.2 Agro- and Hydrological Characteristics

The Lum Hach area spans 25,142 hectares, but only 30% of this land is currently used for agriculture, while the rest consists of shrubland and grassland, some of which is intermittently farmed. Most farmers cultivate a single paddy crop annually, relying on medium or late-maturity rice varieties, with multiple cropping being rare. Planting typically begins around May or June, depending on rainfall patterns. The primary irrigation infrastructure, known as the 1st of January Canal, was built in the mid-1970s, including a headworks on the Boribo River and a 30-kilometer main canal. However, shortly after its completion, severe flooding caused the collapse of the headworks, leaving the canal in a state of disrepair.

This water supply system results in the creation of distinct hydraulic zones within the scheme, each characterized by specific water availability levels, which in turn have a direct impact on agricultural output.

The area presents a general slope in the direction from south-west to north-East. This explains that the area is mainly supplied by the super streams and makes it challenging to divert water from other sources. The gradient hydraulic is low and due to the existing infrastructure design (Existing Lum Harch irrigation), the area cannot be irrigated by the existing infrastructure. Gravity irrigation will not be possible and will require one stage pumping. In all the schemes there is an opportunity to improve the river training and develop two (2) wet season rice crops by developing proper irrigation system adapted to the local context: limited of water resource, soils conditions, lack of road access, low agricultural activities. Some upper land could also diversify crops all through the year.

In response to these challenges, the JICA-led Lum Hach 1 Scheme was initiated in 2005-2006, identifying a 3,100-hectare potential irrigation area. The project, completed in 2020, involved constructing a new barrage and modifying the main canal's first section. However, the lowered headworks require exploring alternative water supply options, such as utilizing natural streams and water storage solutions, as much of the irrigation infrastructure remains underdeveloped. Additionally, in 2016, the Achang Irrigation Scheme, supported by China, was built downstream, covering 10,300 hectares. Despite its larger water demand, Lum Hach's upstream location allows it to divert its share of the Boribo River’s flow which may affect the Achang scheme. However, significant improvements are still needed to fully realize Lum Hach's irrigation potential (please see Table 2.7).

Table 2.7: Irrigation Resources and Development Potential for Lum Hach sub-scheme

Aspects	Description
Water Sources	Boribo River, Canals, Ponds

Nearby Irrigation Schemes	JICA-led Lum Hach 1 Scheme, Achang Irrigation Scheme (Downstream)
Irrigation Methods	Rainfed, Gravity-fed irrigation, Pumped irrigation
Infrastructure Needs	Canal network improvement, regulating structures, pumping stations
Cropping Potential	Paddy rice expansion, vegetable and perennial crops as the alternatives

2.2.3.3 Krang Ponley Sub-scheme

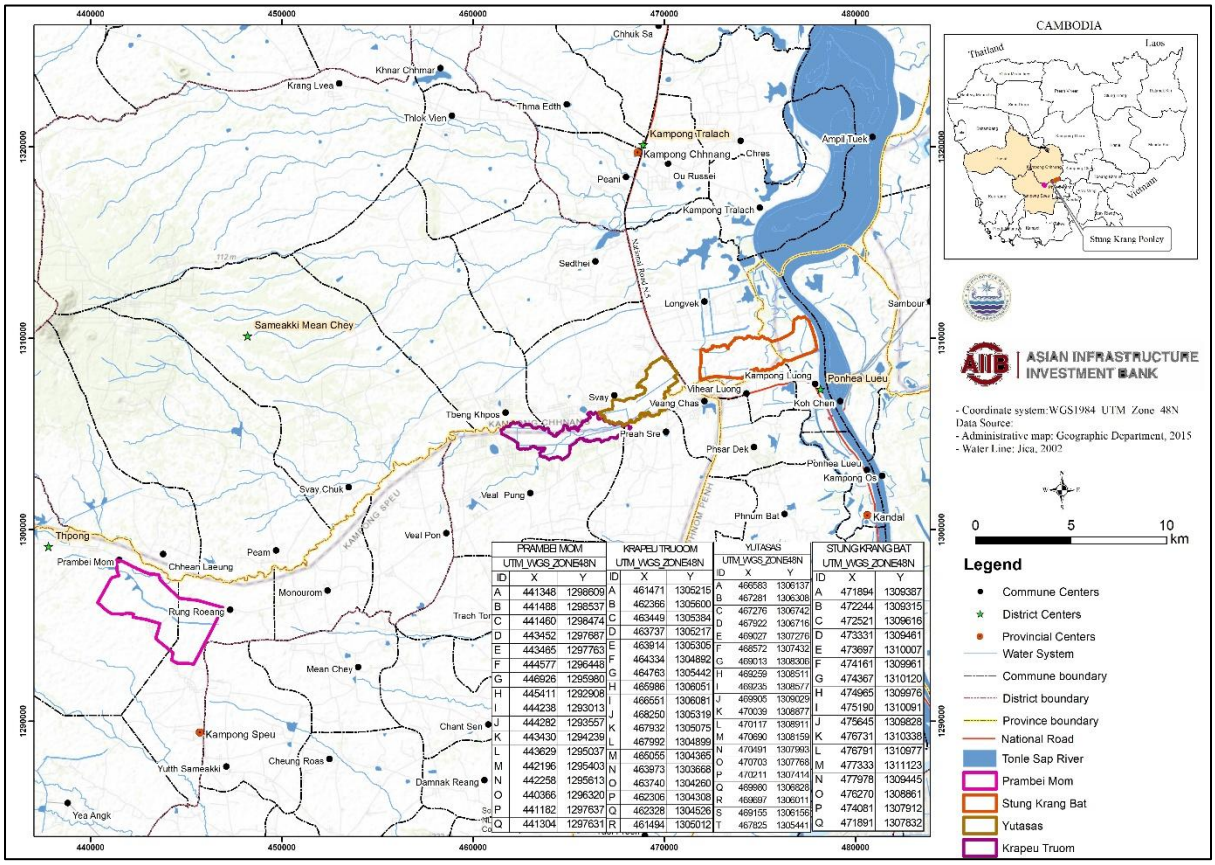
2.2.3.3.1 Location and Coverage

The Krang Ponley Sub-project encompasses four (4) distinct irrigation schemes—Brambei Mom, Krapeu Troum, Yutasast, and Stung Krang Bat—spanning across Kampong Speu, Kampong Chhnang, and Kandal provinces. The four (4) schemes of the Krang Ponley sub-project, Brambei Mom, Krapeu Troum, Yutasast, and Stung Krang Bat, are situated across Kampong Speu, Kampong Chhnang, and Kandal provinces. Each scheme encompasses specific communes within its designated district. Additionally, surrounding communes from neighboring districts contribute to the overall regional context, as shown in Table 2.8.

Table 2.8: Administrative coverage of the Krang Ponley Sub-scheme

Sub-Scheme	Location	Communes Within	Communes Surrounding
Brambei Mom	Brambei Mom and Rung Roeang commune, Phpong district, Kampong Speu	Brambei Mom, Rung Roeang	Yuth Sameakki, Monourom, Peam, Chhean Laeung
Krapeu Troum	Preah Sre and Veal Pung commune, Odongk district, Kampong Speu	Preah Sre, Veal Pung	Svay, Tbeng Khpos
Yutasast	Svay commune, Sameakki Mean Chey district, Kampong Chhnang	Svay	Veang Chas, Preah Sre, Veal Pung, Longvek
Stung Krang Bat	Longvek, Kampong Tralach district, Kampong Chhnang and Kampong Luong, Ponhea Lueu district, Kandal	Longvek, Kampong Luong	Vihear Luong

Figure 2.3: Map of Sub-Scheme in Krang Ponley Basin



The floodplain of Krang Ponley, located at an elevation of approximately 10 meters above sea level, is characterized by low permeability due to its fine soil particles, making it highly susceptible to frequent flooding. Although river-based flooding is minimal, the project areas in Krang Ponley face severe flooding during the wet season and periods of heavy rainfall. Floodwater from the Bassac and Mekong rivers regularly inundate the floodplain, eventually draining into the Tonle Sap, with the lower sections experiencing the most persistent flooding.

The Krang Ponley River serves as the main water source for these irrigation schemes, except for the Brambei Mom scheme, which is situated along the Ou Khley River. Brambei Mom has a small reservoir but can receive supplementary water from the Anlong Chrey Reservoir via an outlet, ensuring a more reliable water supply for irrigation.

2.2.3.3.2 Agro- and Hydrological Characteristics

The Krang Ponley scheme is a unique irrigation system comprising four (4) interconnected areas, drawing water primarily from the Anlong Chrey reservoir and secondarily from the Kdol Dam. This integrated approach ensures a reliable water supply for the scheme's agricultural needs (Table 2.9).

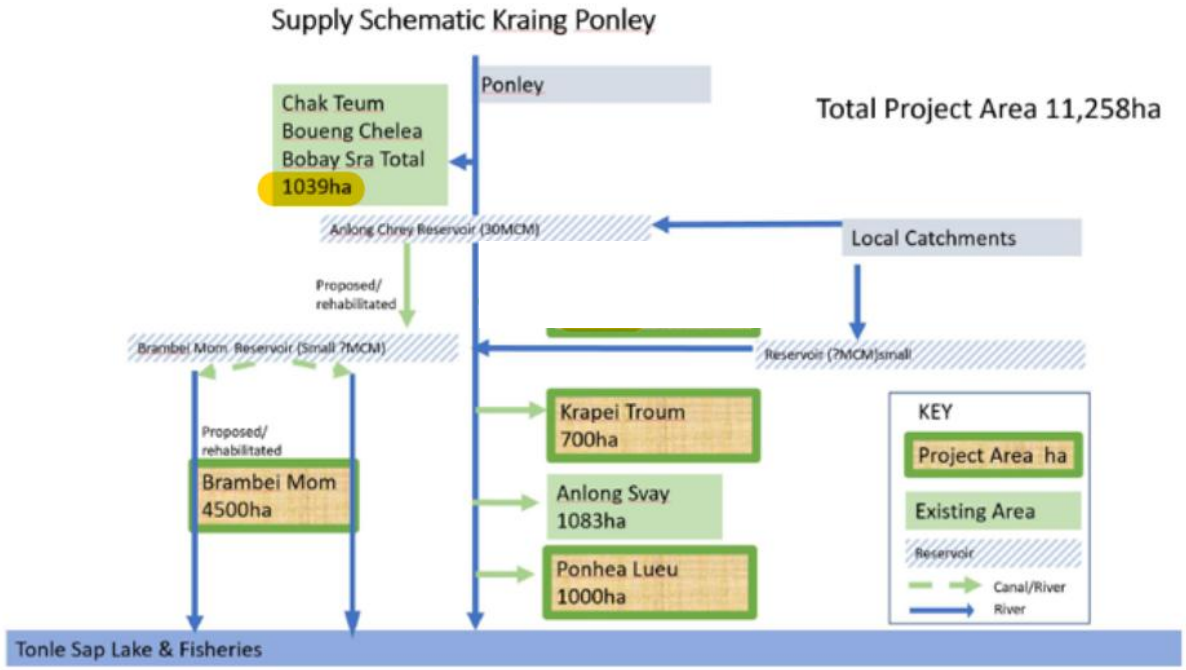
Table 2.9: Main Water Resources for the Krang Ponley sub-scheme

Resource	Description
Anlong Chrey Reservoir	Primary water source for the Krang Ponley scheme

Kdol Dam	Secondary water source, providing additional water supply
Ponley River	Connects the four (4) separate scheme areas, facilitating water transfer

The Krang Ponley River Basin serves as the primary water source for the Krang Ponley subproject and its irrigation schemes. The basin includes several key reservoirs and irrigation infrastructures, developed over time to support agricultural needs and water management in the region. The river itself is extensive, and irrigation infrastructure exists across various subproject areas. Much of this infrastructure dates to the Khmer Rouge era (1975–1979) but has fallen into disrepair due to a lack of maintenance. Despite efforts by local farmers to maintain some main and branch canals, sediment buildup, embankment erosion, and damaged concrete structures have resulted in an inefficient irrigation system.

Figure 2.4: Schematic Supply Map of Krang Ponley



Three (3) main reservoirs—Anlong Chrey, Brambei Mom, and Kdol—were constructed under the Krang Ponley Water Resources Development Project in 2012. These reservoirs have improved water availability for downstream irrigation and play a significant role in flood protection. However, the Anlong Chrey reservoir, with a capacity of only 30 million cubic meters (Mm^3), is small compared to the estimated annual inflow of 123 Mm^3 and the irrigation demands of the area. A small hydropower station was installed at the site, but it remains unused due to insufficient water supply.

One of the irrigation schemes, Stung Krang Bat, is in the lower basin and partially within the active floodplain of the Tonle Sap River. During the rainy season, floodwaters from the Mekong cause the Tonle Sap River to rise, submerging agricultural land for up to three (3) months, with water depths reaching 3 meters. This seasonal flooding shapes local agricultural practices. Additionally, local rivers cause flash floods that can last 5 to 7 days, damaging rice crops. This flooding is further aggravated by vegetation growth, silt buildup in drainage

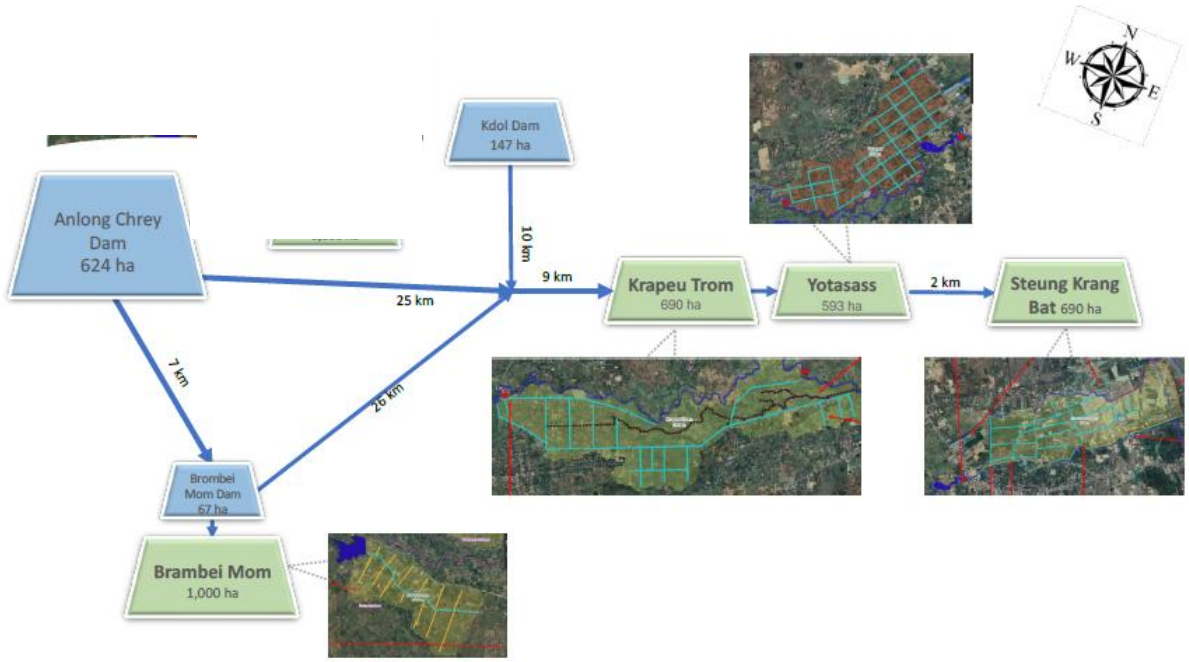
channels, and encroachment on these channels by residents, leading to inadequate drainage and extended flood durations.

The subproject's five (5) proposed irrigation schemes aim to irrigate nearly 3,000 hectares, largely dependent on the Anlong Chrey reservoir (Table 2.10). However, the reservoir's capacity is insufficient to meet full irrigation demands during the dry season. The primary management goal is to release water early in the wet season (May and June) to allow for the timely planting of Early Wet Season crops, followed by a Late Wet Season paddy crop. Nevertheless, challenges remain, including potential conflicts between hydropower generation and irrigation needs, a lack of clarity in reservoir operating rules, and inconsistent runoff that may prevent the reservoir from reaching full capacity in some years.

Table 2.10: Water sources for the four (4) sub-schemes in Krang Ponley area

No	Irrigation scheme	Proposed target command area (ha)	Main Water source	Secondary water source
1	Brambei Mom	1,000	Brambei Mom dam (2 MCM) from Ou Khley Ou Rumlich Meun Ram rivers)	Anlong Chrey Dam
2	Kropeau Truom	690	Anlong Chrey Dam (30 MCM)	Kdol dam (4.7 MCM), Kdol river
3	Yutasas	593	Anlong Chrey Dam (30 MCM)	Kdol dam (4.7 MCM), Kdol river
4	Steung Krang Bat	690	Anlong Chrey Dam (30 MCM)	Kdol dam (4.7 MCM), Kdol river

Figure 2.5: Length from Sub-Scheme to Another of Krang Ponley



2.2.3.3.3 Krapeu Troum

Water Availability

The Krapeu Truom sub-scheme, located within the Krang Ponley River Basin, relies primarily on the Anlong Chrey Reservoir as its principal water source. The Kdol Dam and River serve as secondary sources, supplementing water supply when needed. This integrated system is crucial for ensuring reliable irrigation for the sub-scheme's target command area of 690 hectares.

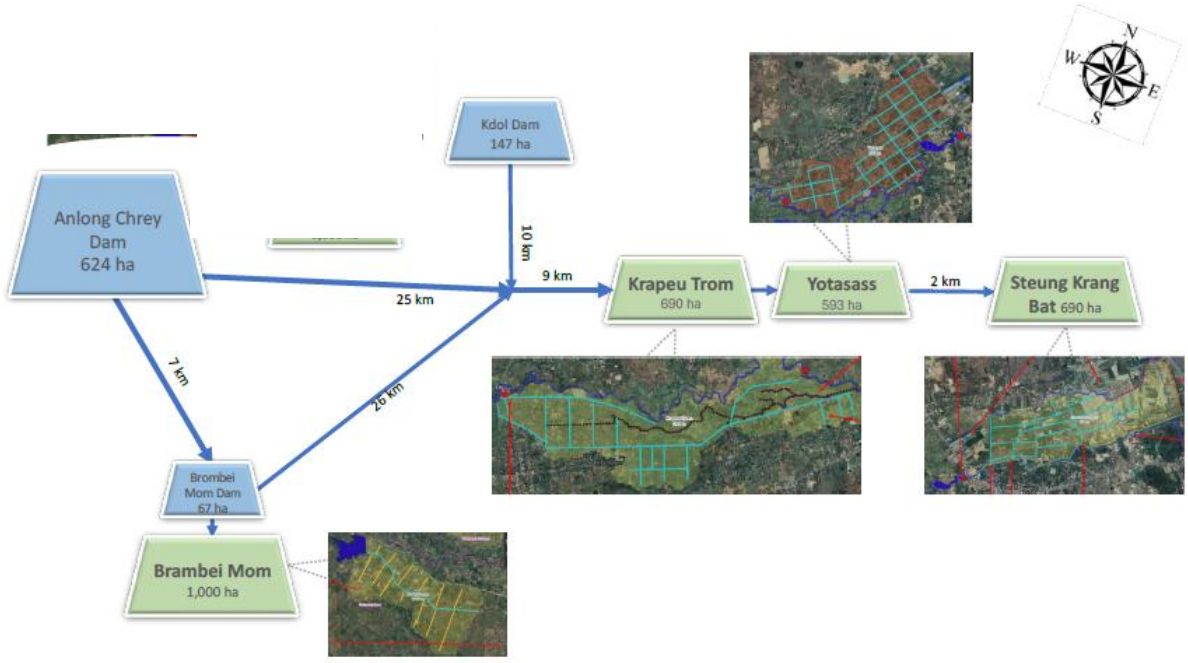
The Anlong Chrey Reservoir, while essential for the Krang Ponley sub-project's water needs, has a relatively small capacity of 30 million cubic meters (Mm³). This poses a challenge as the estimated annual inflow into the reservoir is 123 Mm³, significantly exceeding its storage capacity. This discrepancy highlights the need for efficient water management strategies to balance irrigation demands with the reservoir's limitations (please see in Table 2.11).

Despite efforts to manage water release for optimal crop planting during both early and late wet seasons, the reservoir's limited capacity may struggle to meet full irrigation demands, particularly during the dry season. Factors like inconsistent runoff, which could prevent the reservoir from reaching full capacity, further complicate water availability.

Table 2.11: Water sources for the Krapeu Truom sub-schemes

No	Irrigation scheme	Proposed target command area (ha)	Main Water source	Secondary water source
2	Kropeau Truom	690	Anlong Chrey Dam (30 MCM)	Kdol dam (4.7 MCM), Kdol river

Figure 2.5: Length from Sub-Scheme to Another of Krang Ponley



Anlong Chrey and Kdol Dam are the main water sources for Krapeu Truom sub-scheme. Given its close location to the two (2) dams, the sub-scheme is at an advantageous position

compared to the other sub-scheme downstream of Krang Ponley River basin (Please Table 2.12).

Table 2.12: Main water Resources for the Krapeu Truom sub-schemes

Resource	Description
Anlong Chrey Reservoir	Primary water source for the Krang Ponley scheme
Kdol Dam	Secondary water source, providing additional water supply
Ponley River	Connects the four (4) separate scheme areas, facilitating water transfer

Irrigation Management

The Kropeau Troum Irrigation Project was constructed by PDWRAM with Korean Support. By operating gates on the main canal, water can be raised and brought onto some of the fields by gravity; other fields need to pump water from the canals. The FWUC was established in 2016 and is referred to by PDWRAM as a very successful one. The main management strategy focuses on releasing water early in the wet season (May and June) to support the timely planting of Early Wet Season crops, followed by a Late Wet Season rice crop. Despite these efforts, challenges persist, including potential conflicts between hydropower and irrigation needs, unclear reservoir operating rules, and inconsistent runoff that may prevent the reservoir from reaching full capacity in some years.

Natural challenges

Over the past 10 years, the Krapeu Truom irrigation sub-scheme has encountered several natural challenges. Drought was the most frequently reported, affecting 58% of respondents, with an average of three (3) occurrences over the decade. However, two (2) of these occurrences were considered serious. Floods were the second most reported issue, noted by 36% of respondents, with an average of three (3) events, of which one was deemed serious. Storms were the third most common natural disaster, reported by 31% of respondents and occurring three (3) times, with one of these events considered serious. Insect outbreaks were experienced by 27% of respondents, with an average of two (2) occurrences over the last decade, but only one event was considered serious (shown in Table 2.13).

Table 2.13: Frequency and seriousness of natural disasters in Krapeu Truom sub-scheme

Types	Figures	Percent	Times	Number of Seriousness
Drought	39	58%	3	2
Flood	24	36%	3	1
Storms	21	31%	3	1
Insect outbreak	18	27%	2	1

2.3 PROPOSED INFRASTRUCTURE

2.3.1 Ou Ta Paong

2.3.1.1 Activities and Timeline

Should the feasibility study for the Ou Ta Paing subproject proceed to detailed design, then allowing for the design process, procurement process and approvals, it has been assumed the following planning as displayed in the **Error! Reference source not found.**

The following assumptions have been made:

- The detailed design will start in January 2025; it will take two (2) years to get a better understanding of the upstream hydraulic infrastructure, conduct additional survey and propose the best solution for a sustainable water supply of the scheme.
- The procurement process will not take more than three (3) quarters.
- The work construction will start after the rainy season in Cambodia with a mobilization period (last quarter of the year).
- The work construction duration will not last more three (3) dry seasons.

Hence the construction would be able to commence at the last quarter 2027, with completion by mid-2030

Table 2.14: Tentative implementation schedule of Ou Ta Paong irrigation scheme.

COMPONENTS, SUB-COMPONENTS, OUTPUTS AND ACTIVITIES	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				YEAR 6			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
2.1.1 - Ou Ta Paong	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Activity 2.1.1.1 - Pursat West Hydraulic system masterplan	●	●	●																					
Activity 2.1.1.2 - Detailed design			●	●	●	●	●	●																
Activity 2.1.1.3 - Procurement									●	●	●													
Activity 2.1.1.4 - Work construction and supervision												●	●	●	●	●	●	●	●	●	●	●		

2.3.1.2 Design Concepts and Options

The Ou Ta Paong River system is divided into three (3) distinct blocks for irrigation purposes as per the block colour in Figure below. Block A, located south of National Road shaded in light yellow colour, is supplied by the Pursat River through the Dam Ampil Canal and upstream infrastructure, covering an area of 4,198 hectares. Some of the upstream infrastructure may require rehabilitation to increase its hydraulic capacity and fully irrigate the area. Block B, situated in the northwest and covering approximately 4,400 hectares shaded in light green colour, is currently supplied by the Svay Donkeov River. It relies on existing canals, which require upgrades to improve water delivery, with additional overflow from Block A and drainage from National Road 5 also contributing to water supply. Block C, in the northeast, covers around 6,276 hectares shaded in light blue colour and is the most challenging area to irrigate, as it depends on multiple sources of water, including the Svay Donkeov River, Kbal Canal, and Dam Ampil Canal, all of which require rehabilitation and upgrades to meet irrigation needs.

Figure 2.6: Three (3) blocks (sub-scheme) of Ou Ta Pong sub-project

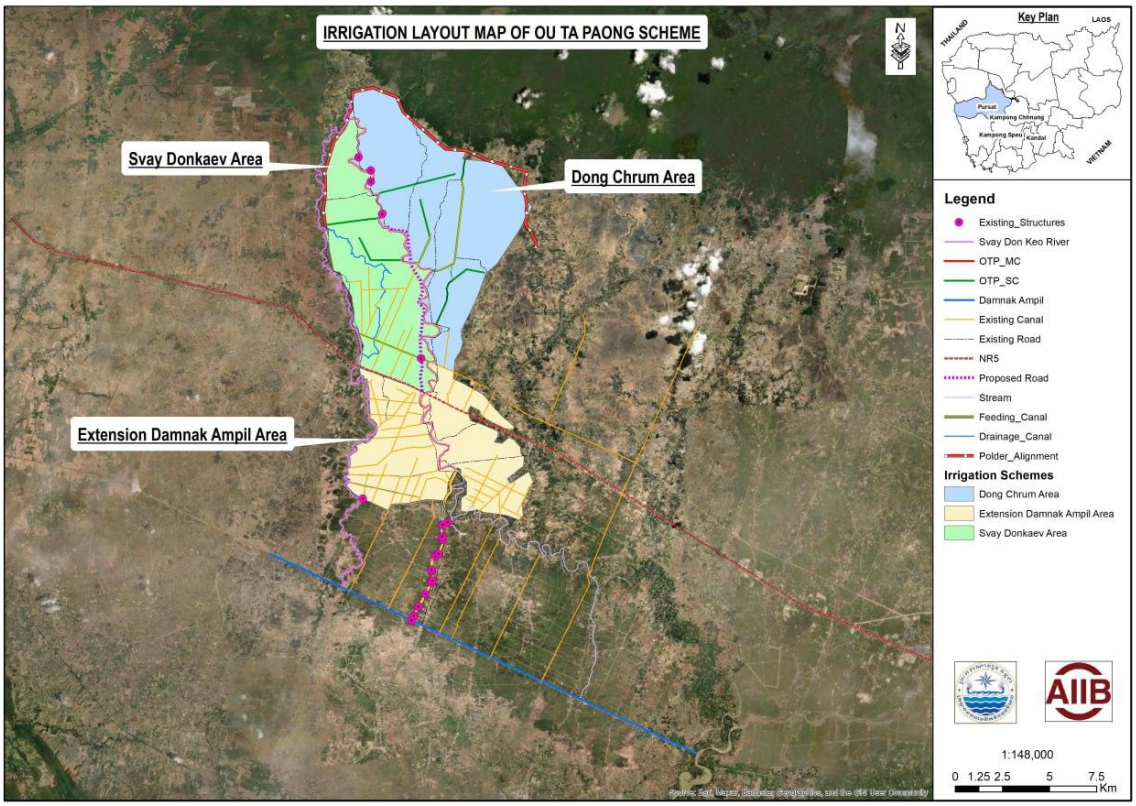
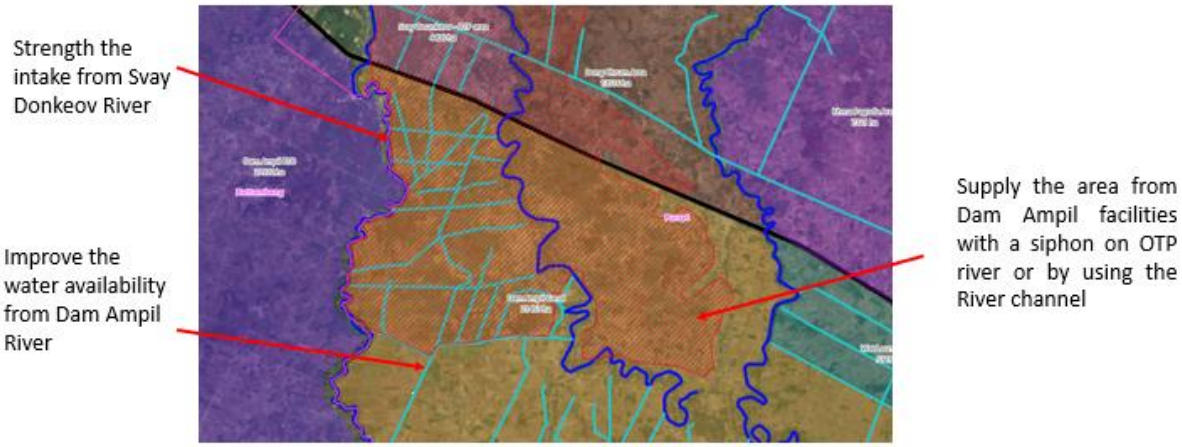


Figure 2.7: Concept design of Block A of Ou Ta Pa Ong Scheme



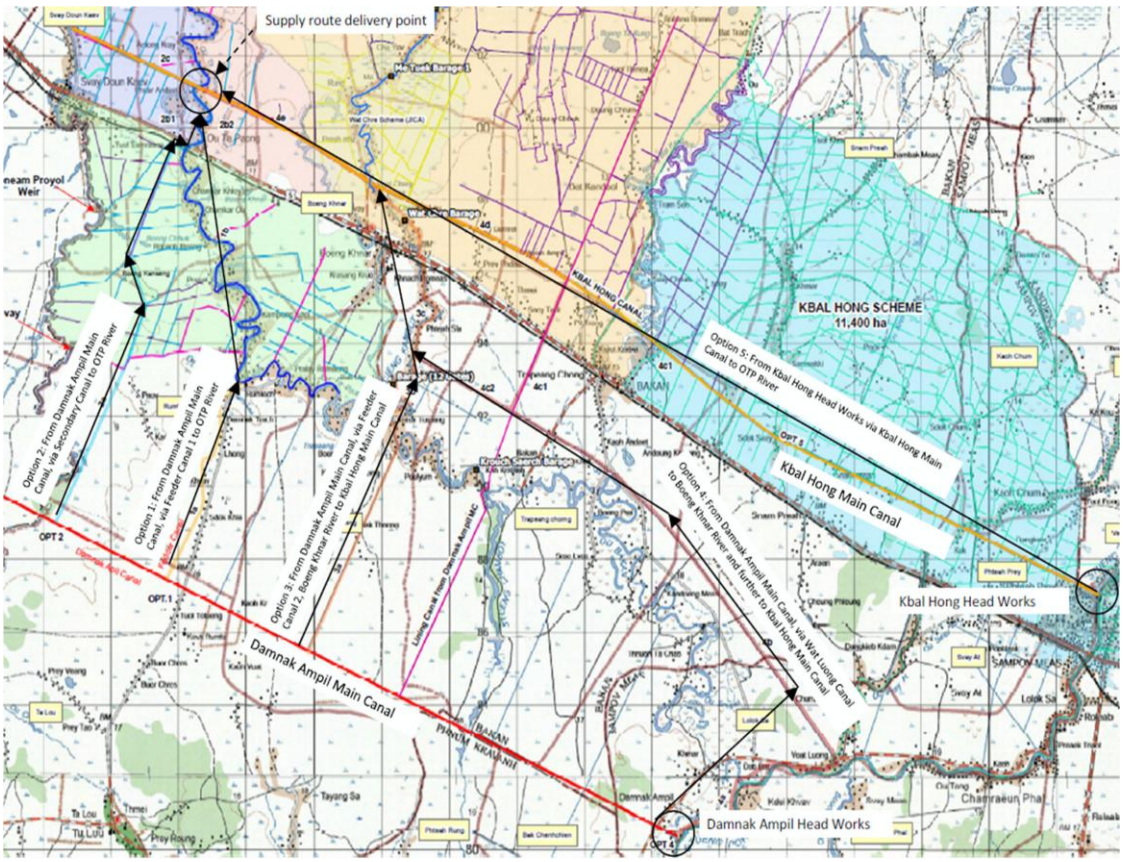
In addition, existing infrastructure along the Svay Donkeov river should be investigated at the design study to see if the western side can still be irrigated partially from the stream or directly from Dam Ampil Canal which intercept the river upstream. The eastern part is more difficult to be irrigated by Dam Ampil existing infrastructures as the Ou Ta Paong River creates a natural upstream barrier. Five options were proposed and considered (described bellow). But only three options were finally selected to proceed with detailed design: including Option 1, Option 3 and Option 5 (See description of5 options and picture below):

- **Option 1**: The option will release part of the required water of the Damnak Ampil secondary canal to the Ou Ta Paong River and create necessary work rehabilitation/

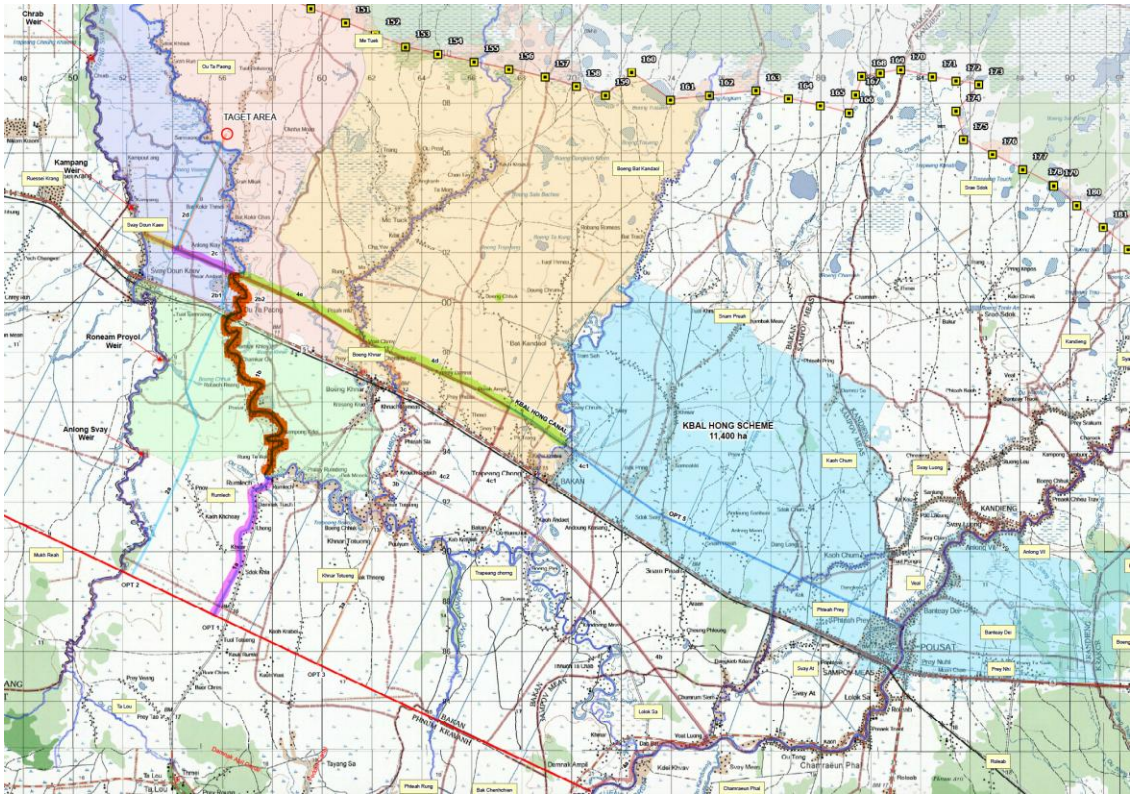
construction to divert the extra flow to the eastern area (river rehabilitation under component 2.2 and river diversion). **Route description:** From DAHW, via DAMC (18.7 km), via the Secondary Canal ('Feeder Canal 1', 8.8 km), into OTP River, and via OTP River's section (13.8 km) South of the National Road to the supply point. Total length of this route is 41.3 km.

- **Option 2:** The feeder canal is parallel to Option 1 but it extends further down. Prior to releasing water into Ou Ta Paong River, the canal releases water into Boeng Kanseng, flowing across the block allowing the irrigation to take place at this area. With the extension, the canal is about 12 km in length. Once again, the issue of land acquisition along the canal will be encountered due to the expansion.
- **Option 3**: Parallel to Option 1, the canal will additionally release water from Damnak Ampil but extended further reaching Kbal Hong Canal, then continues to Ou Ta Paong River. **Route description:** From DAHW, via DAMC (16.7 km), via the Secondary Canal at km 16.7 ('Feeder Canal 2', 6.1 km), into Boeng Khnar River's section (9.9 km) South of the National Road to Wat Chrey Head Works, and via link canal (0.5 km) into KHMC, and via KHMC (7.2 km) to the supply point. Total length of this route is 40.4 km.
- **Option 4:** The option carries water from Wat Loang canal, flowing through the barrage at Damnak Ampil. The option will require the expansion of the canal to ensure that an adequate volume of water can be carried to Ou Ta Paong. The canal length to reach Ou Ta Paong is approximately 30 km. The expansion of the canal would result in the acquisitions of land areas along the main canal.
- **Option 5:** The option begins at Kbal Hong barrage at Pursat provincial town involving the enhancement of the Watergate height and the distance of carrying water will be approximately like Option 4. However, the increase in the height of the Watergate will cause inundation of the upper area of the Pursat River which may cause flooding in the town. This may bring in huge discontentment of the people in the city as height water level may cause in delay of storm water flow during raining period. **Route description:** From KHHW, via IWRM KHMC (17.0 km) into KHMC Extension (17.0 km) to the supply point on OTP River. **Total length of this route is 34.0 km**.

Figure 2.82: Proposed 5 options at Ou Ta Paong sub-scheme



Selected 3 options



2.3.1.3 Types of Infrastructure and Design

The Ou Ta Paong sub-project utilize water from the Pursat River and Svay Don Keo. It integrates nature-based solutions such as the restoration of the Ou Ta Paong River, fish passages on Don Keo and OTP, and natural management of Tonle Sap floods. The project includes 35 solar pump installations. Canal infrastructure development comprises a main/feeder canal of 8 km with 29 structures, secondary canals totalling 65.8 km with 121 structures, and tertiary canals extending 198.5 km with 1,591 structures. Additionally, there are 36.3 km of drains and 21 km of flood embankments with five (5) structures. Storage solutions include local ponds, fish refuges, and two (2) existing reservoirs within the Pursat catchment, with the Pursat Dam 1 hydropower project under construction and Dam 2 water storage. Please see also Table 2.15.

Table 2.15: Ou Ta Paong Sub-Project Key Characteristics

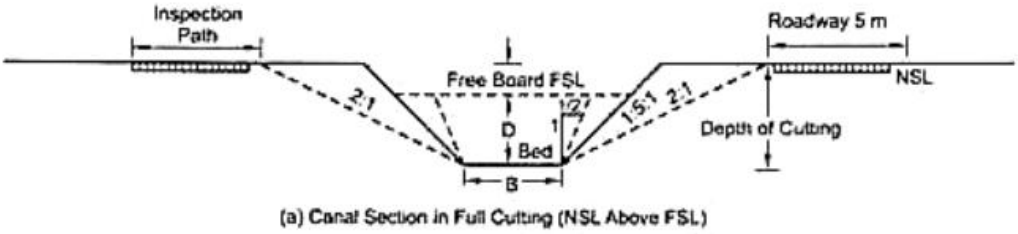
Sub Project	Ou Ta Paong
Area Cultivated (ha)	13,000
Water Source	Pursat River and Svay Don Keo
Nature Based Solution	Restoration of Ou Ta Paong River, fish passage on Donkeo and OTP, Natural Management of TS floods.
Solar Pump Installations	35 (Not suitable in flood areas)
Main/Feeder Canals C/L(km)/N	1_8.0km_29
Secondary Canal C/L (km)/N (Exist and New)	8_30.0km_ 13_35.8km_108
Tertiary Canal C/L (km)/N Exist and New	34_47.5km 139_151.0km_1452
Main/Secondary Drains (C/L km/N)	7_36.3km_15
Flood Embankments /structures (Km/N)	1_21.0km_5
Storages	Local Ponds and fish refuge. Storage within OTP river. 2 Existing reservoirs in Pursat catchment, Pursat 1 hydropower under construction
Land Area of Canals (Existing proposed Ha)	299_575
Cost Estimate (USD/m)	70.8
Cost/ha $	5,450

The key components of OTP include a canal system with concrete linings, a polder system to protect against flooding, and water regulation structures. Two (2) tertiary canal options are proposed, one using diesel pumps and another employing solar-powered pumps for improved sustainability. Expansion of existing feeder canals is also planned, though specifics remain subject to change. The following are the conceptual design for each of the design where the detail design is supposed to be considered:

Canal. The design of the canal system aims to serve both irrigation and drainage functions, considering the topography, limited water resources, and potential land resettlement issues. Where possible, the canals will follow existing paths to minimize social impacts. The size of the canals will be adjusted based on the irrigated area and the local topography. To ensure

long-term sustainability and reduce water loss through percolation, it is recommended to construct the main canals using concrete linings or suitable alternatives. This approach will help maintain water distribution efficiency and improve the durability of the infrastructure.

Figure 2.11: Typical canal section in full cutting



River Training and Drainage: A well-designed drainage system will be a critical component of the project, intended to manage excess runoff during the rainy season and prevent waterlogging in the command area. This system will also serve as the outlet for the on-farm drainage network, which is designed to control groundwater levels and drain surplus irrigation water. The layout of the drainage system will be based on the main natural drainage channels, upstream watersheds, rainfall over the command area, and changes in water levels in the Tonle Sap. It will also consider land use, crop types, and the planned irrigation systems to ensure efficient water management.

Water Regulation and Structures: Water will be diverted from multiple sources into the main canals according to water availability and a demand schedule prepared by the FWUC and PDoWRAM, based on crop needs. Various cross structures (off-take structures) will be installed to maintain the full supply level in the main and secondary canals where necessary. The flow of water into each canal will be controlled by operating the gates of the head regulators, ensuring efficient delivery to the tertiary canals, which will distribute water to individual fields. Farmers will have the option to irrigate their plots either through plot-to-plot irrigation or by constructing field ditches through the diversion of water using these off-take structure (See also Figure 2.12).

Figure 2.12: Typical canal section in full cutting

Tertiary System: The irrigation system design extends to the tertiary canal level, which is the final distribution point before water reaches individual plots. Two (2) options are considered for the tertiary canals. The first option involves creating traditional tertiary canals through excavation, where farmers will individually pump water using diesel pumps based on their needs. However, this requires significant cooperation from beneficiaries, as canal alignment must be accepted without land compensation. The second option is to install collective solar pumping stations, a more sustainable and cost-effective solution that eliminates the need for diesel pumps and reduces CO2 emissions.

Collective Solar Pumping System: The project aims to implement a solar-powered pumping system as a low-tech, sustainable alternative to diesel pumps, with a pilot test covering 30-50 hectares in each irrigation block. The solar pumping system requires minimal maintenance and has no fuel costs, making it an environmentally friendly and cost-effective solution for farmers. The southern part of Block A is particularly suitable for the implementation of this system due to its proximity to villages and protection from floods. The solar pumping system could cover 4,198 hectares with 80-90 units, improving water efficiency by 20% and reducing the risk of land conflicts along the canal alignment. This system would ensure reliable water delivery and support sustainable agricultural practices.

2.3.2 Lum Hach

2.3.2.1 Activities and Timeline

Should the feasibility study for the Lum Harch subproject proceed to detailed design, then allowing for the design process, procurement process and approvals, it has been assumed the following planning as displayed in the Table 6.

The following assumptions have been made:

- The detailed design will start in January 2025.
- The procurement process will not take more than three (3) quarters.
- The work construction will start after the rainy season in Cambodia with a mobilization period (last quarter of the year);
- The work construction duration will not last more three (3) dry seasons.

Hence the construction would be able to commence at the last quarter 2027, with completion by mid-2030.

Table 2.16: Tentative implementation schedule of Lum Harch irrigation scheme.

COMPONENTS, SUB-COMPONENTS, OUTPUTS AND ACTIVITIES	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				YEAR 6			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
2.1.2 - Lum Harch	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Activity 2.1.2.1 - Detailed design	●	●	●	●	●	●	●	●																
Activity 2.1.2.2 - Procurement									●	●	●													
Activity 2.1.2.3 - Work construction and supervision												●	●	●	●	●	●	●	●	●	●	●		

2.3.2.2 Design Concepts and Options

The Lum Harch Irrigation scheme serves an area downstream of the old Lum Harch canal, built during the Pol Pot era (1975-1977). The system pulls water from multiple streams that intersect the canal, but the catchment areas of these rivers are small, limiting water availability

and creating distinct hydraulic zones that affect agricultural productivity. The region's slope, from southwest to northeast, primarily relies on upstream streams, making it difficult to divert water from other sources, such as the Mouribor River. An initial proposal to divert water from the Mouribor River with an impoundment option was removed due to environmental and social concerns. The project has shifted to a “Nature-Based Solution” approach, focusing on rehabilitating existing streams and ponds to improve irrigation, diversify crops, and protect against flooding. The project includes:

- Rehabilitation of streams crossing the command area.
- Creation or rehabilitation of 50-80 ponds along the scheme for irrigation development.
- Rehabilitation of the old Lum Harch Canal to be used as a reservoir.

Figure 2.133: Principles of river rehabilitation for Lum harch scheme

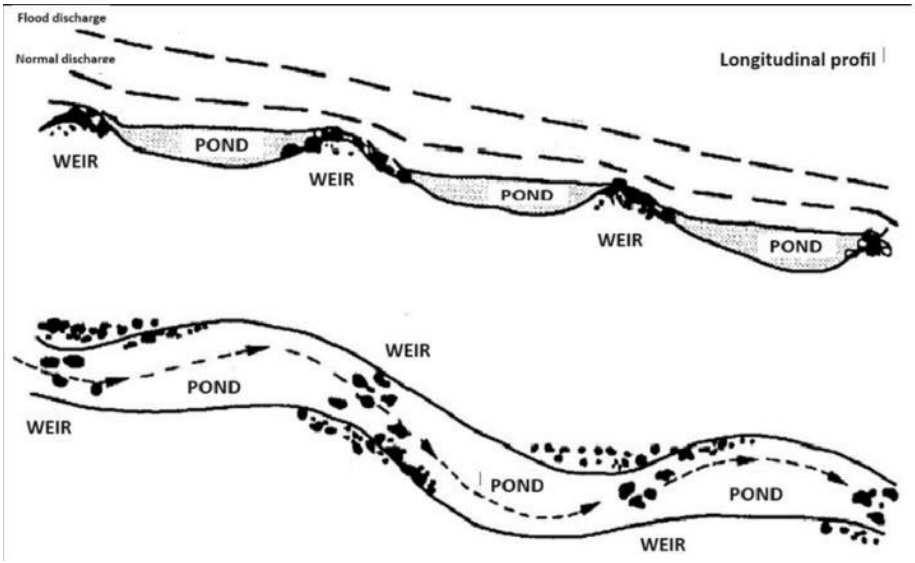


Table 2.17: Summary of design options in Lum Hach

Sub Project	Lum Hach
Area Cultivated (ha)	3,900
Water Source	Local Streams and diversion of Boribo tributary
Nature Based Solution	Enhancement of Main Canal environmental features, local storages and riparian corridors along local rivers. 200 Ponds
Solar Pump Installations	179
Main/Feeder Canals C/L(km)/N	1_30.0_52
Secondary Canal C/L (km)/N (Exist and New)	12_12.2km_673
Tertiary Canal C/L (km)/N Exist and New	179_107km_1487
Main/Secondary Drains (C/L km/N)	12_107km_99
Flood Embankments /structures (Km/N)	Main Canal Bank included above
Storages	Development of upstream storage area, local ponds
Land Area of Canals (Existing proposed Ha)	65_532
Cost Estimate (USD/m)	85.4

Cost/ha $	5,400

Canals: No new canals are planned for this sub-project.

River Training and Drainage: The drainage system layout will focus on using the main natural drainage channels to manage excess runoff during the rainy season and prevent waterlogging. The system will also control groundwater levels and drain surplus irrigation water. The drainage system is designed with a 5-year return period (5% probability) for main rivers and a 5-year (20% probability) return period for all other drains. The layout will be based on natural drainage channels, upstream watersheds, rainfall over the command area, and Tonle Sap water level changes. It will also consider land use, crop types, field management, and planned irrigation systems. Additional drains will be built upstream and parallel to the main canal to divert floodwaters and protect the canal.

Water Sources: Lum Hach Will take advantage of Watershed protection in the Aural Mountain and a new regulator to provide storage of 40MCM at an existing site is proposed. This will be linked to the Lum Hach 2 area through a small link canal.

Flood Management: Flood issues in the area are limited to floodplain flows along the smaller streams and management of flood flows across the main canal. The proposed regulator may offer some flood control function to downstream communities on the Boribo. Improvement of drainage will help reduce flood damages.

Water Distribution:

(a) Restoration of main canal for 26.3km will improve control as a distribution between inflow from creeks and main supply and outflows at secondary canals and river channels. Improve eroded spills to operate during flood and enhance environmental functioning and bank on east side. The canal banks however maintain significant riparian vegetation and restoration as a functioning river and the spine of the conveyance system will have multiple benefits.
(b) Secondary Canals: 31 secondary canals with a length of 104km most of these canals will be newly buil as the original Lum Hach scheme was not fully completed.
(c) Tertiary and Quaternary Canals

2.3.3 Stung Krang Ponley

2.3.3.1 Activities and Timeline

Should the feasibility study for the Krang Ponley subproject proceed to detailed design, then allowing for the design process, procurement process and approvals, it has been assumed the following planning as displayed in the Table .

The following assumptions have been made:

- The detailed design will start in January 2025.
- The procurement process will not take more than three (3) quarters.
- The work construction will start after the rainy season in Cambodia with a mobilization period (last quarter of the year);

- The work construction duration will not last more two (2) dry seasons.

Hence the construction would be able to commence at the last quarter 2026 for the four (4) first schemes (Chhean Laeung, Kropeu Trom, Yotosast, and Stoeung Krang Bat) with total completion by mid-2030 for Brambei Mom irrigation scheme.

Table 2.18: Tentative implementation schedule of Krang Ponley irrigation scheme.

COMPONENTS, SUB-COMPONENTS, OUTPUTS AND ACTIVITIES	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				YEAR 6			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
2.1.4 - Kropeu Trom	●	●	●	●	●	●	●	●	●	●	●	●	●	●										
Activity 2.1.4.1 - Detailed design	●	●	●	●																				
Activity 2.1.4.2 - Procurement					●	●	●																	
Activity 2.1.4.3 - Work construction and supervision								●	●	●	●	●	●	●										
2.1.5 - Yotasast	●	●	●	●	●	●	●	●	●	●	●	●	●	●										
Activity 2.1.5.1 - Detailed design	●	●	●	●																				
Activity 2.1.5.2 - Procurement					●	●	●																	
Activity 2.1.5.3 - Work construction and supervision								●	●	●	●	●	●	●										
2.1.6 - Stoeung Krang Bat	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●						
Activity 2.1.6.1 - Detailed design	●	●	●	●																				
Activity 2.1.6.2 - Procurement					●	●	●																	
Activity 2.1.6.3 - Work construction and supervision								●	●	●	●	●	●	●	●	●	●	●						
2.1.7 - Brambei Mom				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Activity 2.1.7.1 - Detailed design				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Activity 2.1.7.2 - Procurement									●	●	●													
Activity 2.1.7.3 - Work construction and supervision												●	●	●	●	●	●	●	●	●	●	●		

2.3.3.2 Design Concept and Options

The current planning coverage area of Krang Ponley sub-project is around 3,000 hectares, drawing water from the Krang Ponley River, with existing storage at Anlong Chrey and Brambei Mom. Nature-based solutions include controlling the flood regime at Krang Bat for flood recession and fisheries, alongside the rehabilitation of 31 major ponds. Solar pump installations total 184 units distributed across Brambei Mom (110), Chrey Loeu (47), and Krang Ponley Teuk (27). Canal infrastructure includes 31.3 km of main/feeder canals, 29.2 km of secondary canals, and 63.5 km of tertiary canals. Drainage infrastructure comprises 42.8 km of main and secondary drains, while flood embankments and channels are planned for flood management, with raised canal banks in Krang Ponley Teuk. Storage facilities include the upgrade and safety improvement of the Anlong Chrey Reservoir, 31 rehabilitated ponds at Brambei Mom, and support for local storages and fish refuges. The land area for canals is 383 hectares, comprising 144 existing and 239 proposed hectares (Table 2.19).

Table 2.19: Key Features of the Krang Ponley Sub-Project

Sub-Project	**Krang Ponley**
Area Cultivated (ha)	3,000
Water Source	Krang Ponley River with existing storage at Anlong Chrey and Brambei Mom
Nature Based Solution	Control of flood regime at Krang Bat for flood recession and fisheries. Rehabilitate 31 major ponds.
Solar Pump Installations	110 (BBM) + 47(CL) + 27(KPT)
Main/Feeder Canals C/L(km)/N	6_31.3km
Secondary Canal C/L (km)/N (Exist and New)	35_29.2km
Tertiary Canal C/L (km)/N Exist and New	77_ 63.5km
Main/Secondary Drains (C/L km/N)	17_42.8km
Flood Embankments /structures (Km/N)	Storage/Operation in AC reservoir for flood, Raised canal bank on KPT, flood channels in KPT and embankment on TS

Storages	Existing Anlong Chrey Reservoir to be upgraded and safety improvements. 31 major ponds on Barambei Mom. Support local storages and fish refuge.
Land Area of Canals (Existing proposed Ha)	144/239

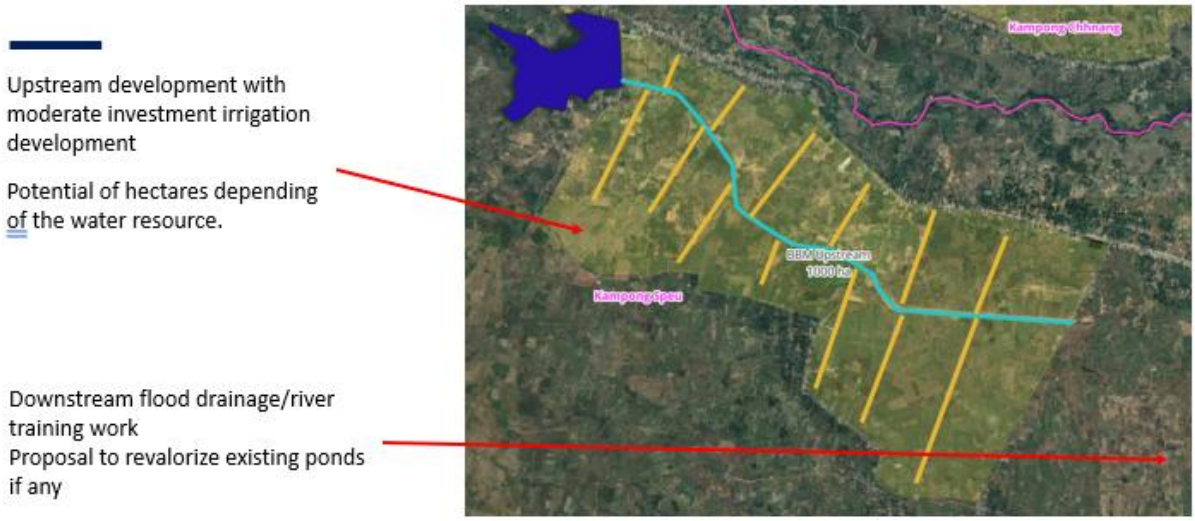
2.3.3.2.1 Brambei Mom

The Brambei Mom irrigation system consists of:

- The creation of irrigation distributary canals to irrigate 1,000 ha. It is envisaged to investigate the possibility of collective solar pumping system at the tertiary level.
- The rehabilitation of the downstream river to prevent flooding and water disaster.
- Some small work on repairing the existing dam.

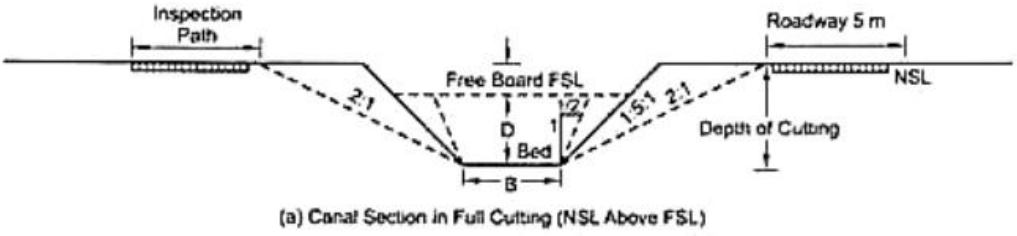
These concerted activities aim to enhance irrigation capabilities, optimize water distribution, and reduce potential water-related risks within the project area.

Figure 2.14: Concept design of Brambei Mom irrigation scheme



Canal Design: The canal design will serve both irrigation and drainage purposes, considering the topography, limited water resources, and potential land resettlement issues. Wherever possible, canal alignments will follow existing paths to minimize social impacts. Canals should be constructed with measures to reduce percolation and infiltration, using concrete linings or suitable alternatives to enhance long-term sustainability and water distribution efficiency. All canal characteristics will be finalized during the detailed design phase.

Figure 2.15: Canal section on full cutting section



River Training and Drainage

The drainage system layout for the project will focus on utilizing the main natural drainage channels to manage excess runoff during the rainy season and mitigate waterlogging in the command area. This system will also serve as the outlet for the on-farm drainage system, which is designed to drain surplus irrigation water and control the groundwater table.

The primary goal of the drainage system is to support increased agricultural production in the area. To achieve this, the drainage system will be designed for a 5-year return period with a 5% probability for main rivers, and a 20% probability for all other drains.

The drainage layout will consider:

- Main natural drainage channels as the foundation.
- Incoming sources, such as upstream watersheds, direct rainfall over the command area, and water level changes in the Tonle Sap.
- Land use, including crop types, field layout, and management practices.
- Planned irrigation systems.

The main drains will be based on existing natural rivers, and the internal drainage system will be adapted to the layout of agricultural plots and irrigation systems. Additional drains will be constructed upstream and parallel to the main canal to act as diversion and interception drains, reducing crossings over the canal and protecting it from floodwater. These additional drains will divert floodwater according to the topography to effectively integrate into the overall drainage system.

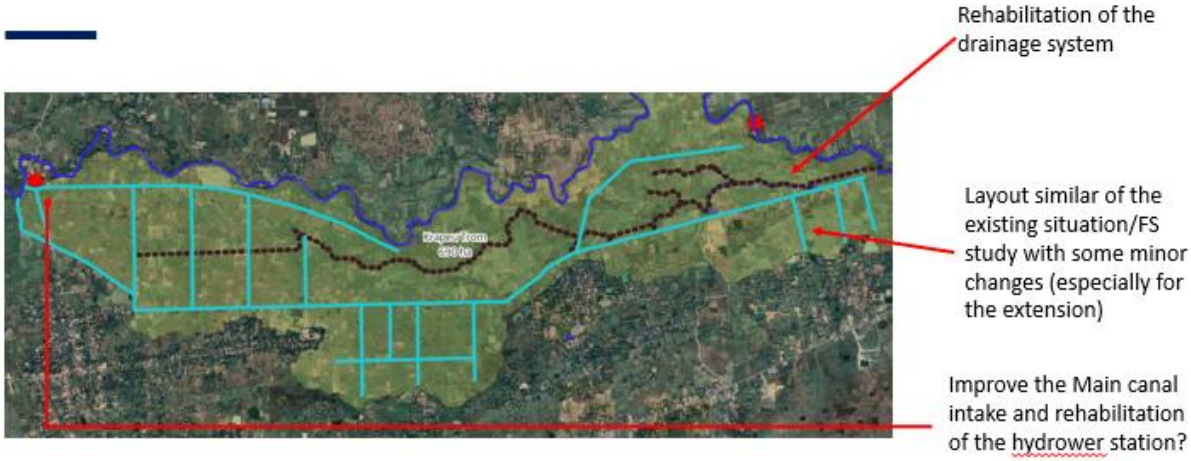
2.3.3.2.2 Kropeu Trom

The proposed Kropeu Trom project includes several key components aimed at enhancing irrigation capabilities and mitigating water-related hazards. These include:

- Rehabilitation of the Intake Structure on the Anlong Chrey stream.
- Rehabilitation of Irrigation Distributary Canals to irrigate 690 hectares, with the possibility of lining key canals.
- Development of Sub-distributary Canals (tertiary level), with investigations into implementing a collective solar pumping system.
- Rehabilitation of Drainage Systems, including the Anlong Chrey stream and main drainage systems to mitigate flooding.

These activities collectively aim to enhance irrigation capabilities, improve water distribution, and mitigate potential water-related hazards in the project area.

Figure 2.16: Concept design of Kropeu Trom irrigation scheme.



Preferred Technical Design Option

The rehabilitation, construction and activities of CAISAR project in Krapeu Truom sub-scheme consist of canals, river training and drainage, improvement of water regulation and structure and tertiary systems, and installation of solar power systems.

Canal. The design of the canal system aims to serve both irrigation and drainage functions, considering the topography, limited water resources, and potential land resettlement issues. Where possible, the canals will follow existing paths to minimize social impacts. The size of the canals will be adjusted based on the irrigated area and the local topography. To ensure long-term sustainability and reduce water loss through percolation, it is recommended to construct the main canals using concrete linings or suitable alternatives. This approach will help maintain water distribution efficiency and improve the durability of the infrastructure.

River Training and Drainage: A well-designed drainage system will be a critical component of the project, intended to manage excess runoff during the rainy season and prevent waterlogging in the command area. This system will also serve as the outlet for the on-farm drainage network, which is designed to control groundwater levels and drain surplus irrigation water. The layout of the drainage system will be based on the main natural drainage channels, upstream watersheds, rainfall over the command area, and changes in water levels in the Tonle Sap. It will also consider land use, crop types, and the planned irrigation systems to ensure efficient water management.

Water Regulation and Structures: Water will be diverted from multiple sources into the main canals according to water availability and a demand schedule prepared by the FWUC and PDoWRAM, based on crop needs. Various cross structures will be installed to maintain the full supply level in the main and secondary canals where necessary. The flow of water into each canal will be controlled by operating the gates of the head regulators, ensuring efficient delivery to the tertiary canals, which will distribute water to individual fields. Farmers will have the option to irrigate their plots either through plot-to-plot irrigation or by constructing field ditches. Once again, the off-take structures (Figure 2.12) will be installed for farmers to divert

water into their field using plot-to-plot irrigation method or they can construct small canals as per agreement within their groups.

Tertiary System: The irrigation system design extends to the tertiary canal level, which is the final distribution point before water reaches individual plots. Two (2) options are considered for the tertiary canals. The first option involves creating traditional tertiary canals through excavation, where farmers will individually pump water using diesel pumps based on their needs. However, this requires significant cooperation from beneficiaries, as canal alignment must be accepted without land compensation. The second option is to install collective solar pumping stations, a more sustainable and cost-effective solution that eliminates the need for diesel pumps and reduces CO_2 emissions.

Collective Solar Pumping System: The project aims to implement a solar-powered pumping system as a low-tech, sustainable alternative to diesel pumps, with a pilot test covering 30-50 hectares in each irrigation block. The solar pumping system requires minimal maintenance and has no fuel costs, making it an environmentally friendly and cost-effective solution for farmers. The southern part of Block A is particularly suitable for the implementation of this system due to its proximity to villages and protection from floods. The solar pumping system could cover 4,198 hectares with 80-90 units, improving water efficiency by 20% and reducing the risk of land conflicts along the canal alignment. This system would ensure reliable water delivery and support sustainable agricultural practices.

2.3.3.2.3 Yutasas

The Yutasas irrigation system consists of:

- The rehabilitation of the intake structure on Anlong Chrey stream.
- The rehabilitation of the irrigation distributary canals to irrigate 593 ha. It is envisaged to have canal lining for the main infrastructures (main and secondary canal)
- The development of sub-distributary canals (tertiary). Investigation will be performed to envisage the possibility of collective solar pumping system at the tertiary level.
- The rehabilitation of the Anlong Chrey and existing main drainage system to prevent flooding and water disaster.

These combined efforts seek to elevate irrigation capabilities, refine water distribution, and alleviate potential water-related risks within the project area.

Figure 2.17: Concept design of Yotasast irrigation scheme

2.3.3.2.4 Stoeung Krang Bat

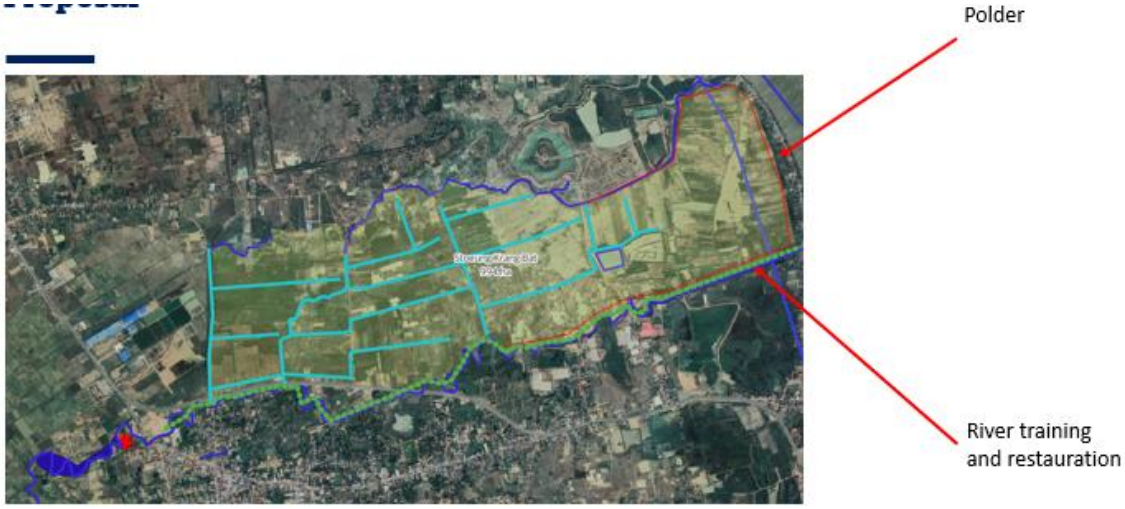
The Steung Krang Bat irrigation system consists of:

- The rehabilitation of the intake structure on Anlong Chrey stream.
- The rehabilitation of the irrigation distributary canals to irrigate 994 ha. It is envisaged to have canal lining for the main infrastructures (main and secondary canal)
- The development of sub-distributary canals (tertiary). Investigation will be performed to envisage the possibility of collective solar pumping system at the tertiary level.
- The rehabilitation of the Anlong Chrey and existing main drainage system to prevent flooding and water disaster.
- The creation of a polder on the eastern side to protect the area from flooding of Tonle Sap.

These joined activities aim to enhance irrigation capabilities, optimize water distribution, and reduce potential water-related risks within the project area.

Polder System. This polder system will be added along the existing road of the system, allowing for the cultivation of wet-season paddy and providing protection for homes and property from floods. A typical polder includes an encircling embankment that keeps water out, drainage canals inside the polder to remove excess water, and a sluice gate that releases water during low tides. The sluice gate will also serve as an irrigation intake during water shortages, ensuring water availability even during dry spells within the rainy season (Please see Figure 2.18 for the location of the polder).

Figure 2.184: Concept design of Stoeung Krang Bat irrigation scheme



2.3.4 Project Activities

The infrastructure investment of the project, as outlined in the previous section, involves several key activities during the pre-construction phase. These activities set the foundation for the successful implementation of the project's construction work and ensure that resources and personnel are well-prepared for the task.

The project is divided into two (2) key components. Component 1 focuses on improving farm-level climate adaptation, resilience, and water use efficiency. This involves planning and training activities to develop community-based action plans and build capacity among farmers. Additionally, mechanization efforts and farm road improvements will enhance agricultural productivity and accessibility. Component 2 aims to strengthen irrigation infrastructure for increased resilience. This includes a range of activities such as river dredging, canal rehabilitation, construction of small-scale structures, river training, polder system development, solar pumping system installation, feeder canal construction, and pond construction or rehabilitation. These interventions will improve water management, increase water storage capacity, and ensure efficient water distribution to agricultural fields. The information is shown in Table 2.20.

Table 2.20: Overview of Project Activities

Key Project Activities	Descriptions
COMPONENT 1	**Improving farm-level climate adaptation, resilience, and water use efficiency**
Planning	Preparation of community-based action plans (AP) to transform agriculture with Climate Resilience (CR) practices.
Training	Preparation of training materials to support implementation of the Action Plan.
	Conduct trainings to create a pool of expertise to demonstrate and propagate the CR technologies and practices.
	Train farmers on applying CR technologies using the FFS approach.

Key Project Activities	Descriptions
Mechanization	Strengthening and fostering tailored mechanization service providers for improved mechanization service delivery.
Farm road	Improve 50 Kilometers of farm roads.
COMPONENT 2	Irrigation Infrastructure for increased resilience
River dredging or rehabilitation	The activities will involve the excavation of existing river/stream which have become shallow or too small to store water or limit the water flow regime.
Canal rehabilitation / minor expansion canals	These activities will include the widening, deepening, or structural improvement of both main and tertiary canals to enhance their capacity for water conveyance, ensuring efficient irrigation and water distribution to agricultural fields.
Installing small–scaled structure (e.g cross structure, head regulator)	This includes the construction or enhancement of hydraulic control structures that regulate water flow, ensuring proper water distribution across irrigation systems and improving the overall efficiency of water management.
River training	These activities will focus on reshaping river channels and constructing drainage systems to manage water flow effectively, reduce the risk of flooding, and protect agricultural lands and surrounding communities.
Polder system construction	This will involve creating an embanked area to prevent flooding by controlling water levels, typically through the construction of levees or dikes, enabling the reclaimed land to be used for agriculture or habitation.
Solar pumping system installation	These activities will involve the installation of solar-powered water pumps, providing a sustainable and energy-efficient means of extracting water from rivers, canals, or groundwater sources for irrigation and community use.
Construction of feeder canals	This includes the development of smaller, subsidiary canals designed to distribute water from main canals to agricultural fields, improving the reach and efficiency of irrigation systems.
Pond construction/ rehabilitation	This will involve the excavation or repair of ponds to increase water storage capacity, providing reliable water sources for irrigation, livestock, and community use, especially during dry seasons.

2.3.4.1 Pre-construction Phase

At the pre-construction phase, there are several activities that need to be done where disturbance to local people as well as natural resources may occur. These activities are:

1. Land and Right of Way Negotiation: This initial step focuses on securing the necessary land and access rights for the construction. Negotiations with local authorities, landowners, and other stakeholders ensure that all legal and logistical requirements are met, minimizing potential delays or disputes that could arise during the project.
2. Contracting and Training of Staff: The project then engages in the recruitment and contracting of skilled personnel, including construction teams, engineers, and project management staff. This step is critical to ensure that the workforce has the necessary

expertise and experience. Alongside recruitment, training programs are provided to align staff with the project's goals, safety standards, and technical requirements.

3. Mobilization of Construction Materials, Consumables, Machinery, Equipment, and Staff: Once the team is in place, the project moves into the mobilization phase, where all essential materials, machinery, and equipment are transported to the construction site. This also includes the deployment of consumables and other resources required for ongoing construction. Ensuring the timely arrival and organization of these assets is crucial for avoiding disruptions in the construction timeline. Similarly, staff are mobilized to ensure a coordinated start to the construction activities.

These pre-construction activities are integral to establishing a strong foundation for the project, ensuring that the necessary infrastructure, workforce, and materials are in place to proceed smoothly with the subsequent phases of construction.

2.3.4.2 Construction Phase

The construction phase of the project involves a comprehensive set of activities aimed at establishing the required infrastructure while ensuring safety, environmental management, and efficient use of resources. Key construction activities include:

1. Mine and UXO Clearance: In areas with potential unexploded ordnance (UXO), safety is the highest priority. Before any construction begins, the project undertakes mine and UXO clearance to ensure that the site is free of hazardous materials, creating a safe environment for workers and preventing accidents.
2. Installation and Operation of Temporary Infrastructure: Temporary facilities, such as worker camps, asphalt plants, concrete mixing stations, and ground material processing plants, are set up to support the construction process. These facilities are critical for providing on-site accommodation for workers and ensuring the continuous supply of construction materials.
3. Site Clearing and Cleaning: This phase involves clearing the construction site of any obstructions such as vegetation, debris, and existing infrastructure. It ensures that the land is prepared and ready for subsequent construction activities.
4. Demolition and Removal of Existing Infrastructure: In areas where existing structures need to be replaced or upgraded, demolition and removal are necessary. This ensures that the site is clear for the installation of new infrastructure and allows for efficient use of the available land.
5. Land Movements (Excavations, Dredging, and Fills): Major land movements, including excavations and dredging, are conducted to reshape the land and prepare it for new infrastructure. These activities also involve filling areas to achieve the required ground levels for construction stability and support.
6. Construction of Hydraulic Works (Including Occupation of Waterways): Hydraulic works, such as dams, levees, or irrigation systems, are constructed to manage water resources effectively. This stage often requires temporary occupation of waterways, making careful planning and environmental considerations critical.

7. River Training: As part of managing water flow and preventing erosion, river training is conducted to stabilize riverbanks and direct water movement, which is essential for protecting both the construction site and surrounding ecosystems.
8. Dismantling of Temporary Facilities and Camps: Once the primary construction activities are completed, temporary infrastructure such as camps and material plants are dismantled. This marks the transition toward the final stages of the construction process.
9. Final Cleanup of Intervened Areas: A thorough cleanup of the construction site is conducted to remove debris, materials, and any temporary installations. This is a critical step in restoring the site to its intended post-construction state.
10. Landscaping Management: To ensure the aesthetic and environmental sustainability of the project, landscaping efforts are undertaken, including replanting vegetation, managing drainage, and shaping the landscape to blend with the natural surroundings.

This series of construction activities ensures that the project is completed according to design specifications, with an emphasis on safety, environmental responsibility, and efficient resource management.

2.3.4.3 Operation and Maintenance

The post-construction phase of the project involves the transition from infrastructure development to its operational use, with a focus on agricultural intensification, resource management, and long-term maintenance. The key activities during this phase include:

1. Intensifying Agricultural Production: Following the completion of the infrastructure, there is a focus on enhancing agricultural productivity. The improved infrastructure allows for more efficient farming practices, increased crop yields, and the introduction of advanced agricultural techniques. This intensification contributes to greater food security and economic development in the region.
2. Increased Use of Energy and Fuel for Agriculture Production: With the intensification of agricultural activities, there is a corresponding rise in the use of energy and fuel to power farming machinery, irrigation systems, and other agricultural equipment. This increased demand for energy supports the scaling up of production but also requires careful management to ensure sustainability and minimize environmental impacts.
3. Operation and Maintenance: To ensure the long-term functionality and durability of the newly constructed infrastructure, regular operation and maintenance activities are critical. This includes monitoring the condition of the infrastructure, performing repairs, and ensuring that the systems in place continue to function as designed. Routine maintenance helps prevent deterioration and ensures that agricultural productivity remains high.
4. Water Management: Effective water management becomes a priority in this phase, especially with the new hydraulic infrastructure in place. This includes controlling irrigation systems, managing water levels in reservoirs, and ensuring that water resources are used efficiently to support agricultural activities. Sustainable water management is crucial for balancing agricultural demands with environmental conservation.

These post-construction activities ensure the long-term success of the project, contributing to sustainable agricultural growth, resource efficiency, and the ongoing maintenance of infrastructure to support continued productivity in the agricultural sector.

Table 2.21: Summary of the Project Activities in relation to the infrastructure investment

No.	Stage	Activities
1	Pre-Construction	Land and right of way negotiation
		Contracting and training of staff
		Mobilization of construction materials, consumables, machinery, equipment and staff
2	Construction	Mine and UXO clearance
		Installation and operation of temporary infrastructure (camps, asphalt, concrete and ground material plants)
		Site clearing and cleaning
		Demolition and removal of existing infrastructure in areas to be intervened
		Land movements (excavations, dredging and fills)
		Construction of hydraulic works (includes occupation of waterways)
		River training
		Dismantling of temporary facilities and camps
		Final cleanup of intervened areas
		Landscaping management
	After Construction	Intensifying agricultural production
		Increased use of energy and fuel for agriculture production
		Operation and maintenance
		Water management

2.3.5 Project Status

At the time of preparing the ESCIA report, the project is going through the consultation process of the preparation of the engineering design option. The final decision is going to be made very soon. Then, detailed engineering design will take place.

CHAPTER 3 – PROJECT ALTERNATIVES ANALYSIS

3.1 INTRODUCTION

Chapter 3 analyzes project alternatives, comparing the implications of implementing or not implementing the proposed interventions across various sub-schemes. It contrasts the "without-project" baseline scenario with the anticipated benefits of the "with-project" scenario, including improved irrigation, enhanced water management, and increased agricultural productivity. The chapter also examines design options and their technical, environmental, social, and economic impacts. By focusing on each sub-scheme, it highlights the potential for the project to boost farmer incomes, enhance resilience to climate and market risks, and promote sustainability through better water management and community participation.

3.2 SCOPING

3.2.1 Definitions

The **"without" project alternative** refers to the scenario in which the proposed project is not implemented. In this case, the existing conditions and ongoing practices within the project area are assumed to continue without any intervention or improvements. This scenario is used as a baseline to assess the potential benefits or disadvantages of implementing the project. In the context, the "without" project alternative examines the current state of agricultural activities, such as the cultivation of paddy fields, and assumes that these practices will persist as they are, without any changes or enhancements.

The **project alternative** refers to the various options or strategies considered for implementing the proposed project. These alternatives are analyzed based on their alignment with the project's objectives, environmental impact, social implications, technical feasibility, and financial viability. In the context, the **project alternative** involves different potential approaches or methods to achieve the project's goals. Each alternative is assessed for how well it meets the desired outcomes while balancing environmental, social, technical, and financial considerations.

3.2.2 Design Options and Alternatives

At the time of preparing the ESCIA, there are a number of design options being discussed, especially at the OTP sub-scheme where feeder canal is the most aspect to make decision. In this regard, the design options at OTP will be considered as the scenario for the analysis whereas without project alternative and with project alternative will be the two (2) options for the other sub-schemes.

3.3 ALTERNATIVE ANALYSIS

3.3.1 Ou Ta Pong

3.3.1.1 Site Selection

The number of hectares of Ou Ta Paong is approximately 14,000 hectares. This command area will be the same regardless of any options being proposed.

3.3.1.2 Project Layout and Design

The feasibility study of Ou Ta Paong indicated no other design layout except the construction of the feeder canals to abstract water to feed the irrigation system. All options have its own specific strengths and shortage as describe below:

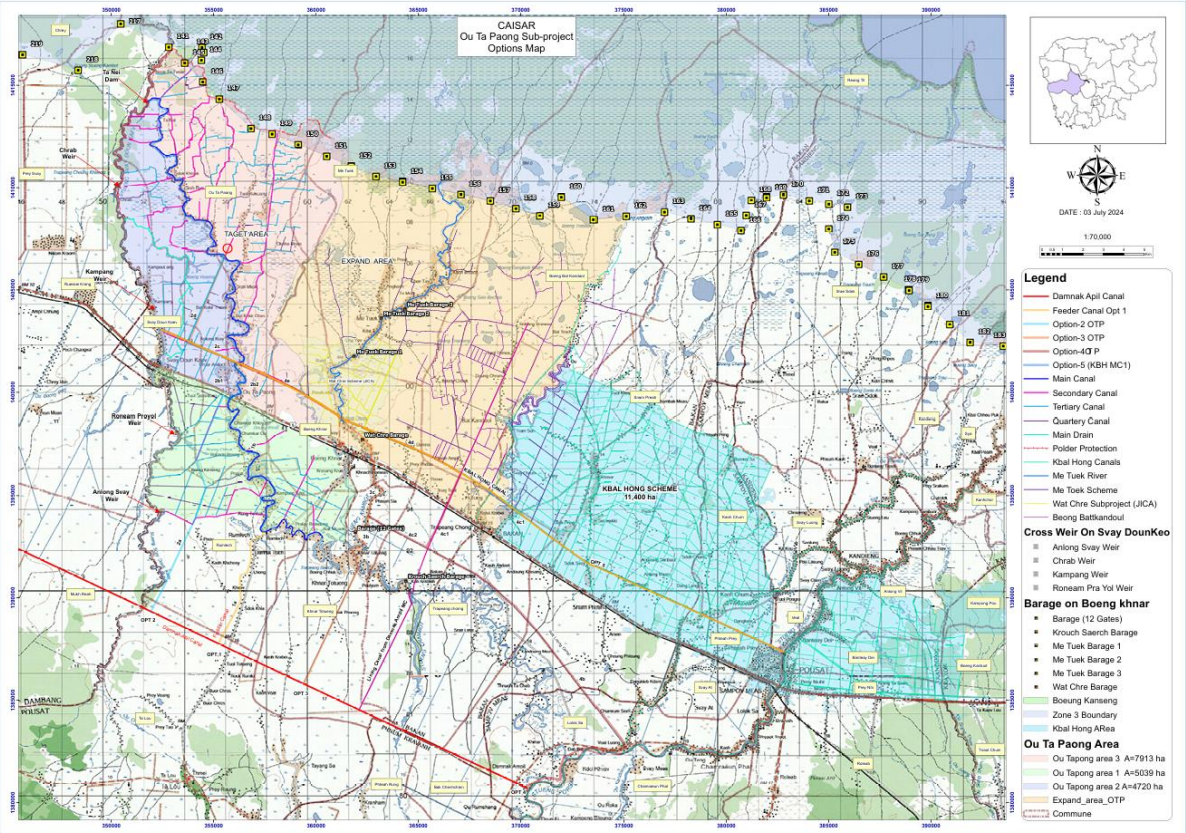
Option 1: Water is extracted from Pursat River through Damnak Ampil Main canal with a length of 6.5 km extended from the main canal feeding into Ou Ta Paong River. The option is one of the best choices, given its shortest length from the main canal to reach command area. However, expanding only the feeder canal reaching a width that can carry adequate water to the sub-scheme will acquire a huge land area along the canal for canal expansion, and side road.

Option 2: The feeder canal is parallel to Option 1 but it extends further down. Prior to releasing water into Ou Ta Paong River, the canal releases water into Boeng Kanseng, flowing across the block allowing the irrigation to take place at this area. With the extension, the canal is about 12 km in length. Once again, the issue of land acquisition along the canal will be encountered due to the expansion.

Option 3: Similar to Option 1, the feeder canal extends further, allowing the water to flow into Kbal Hong main canal prior to the connection to Ou Ta Paong River at further downstream at the middle part of the catchment, making the total length of the canal at about 14 km from Damnak Ampil to Kbal Hong. This option may cause the water availability at the upper part of the sub-scheme being concerned while water will be fed into another area prior to Ou Ta Paong. The option, therefore, requires the budget for excavation to be around twice as much as Option 1.

Option 4: The option carries water from Wat Loang canal, flowing through the barrage at Damnak Ampil. The option will require the expansion of the canal to ensure that an adequate volume of water can be carried to Ou Ta Paong. The canal length to reach Ou Ta Paong is approximately 30 km. The expansion of the canal would result in huge acquisitions of land areas along the main canal.

Option 5: The option begins at Kbal Hong barrage at Pursat provincial town involving the enhancement of the Watergate height and the distance of carrying water will be approximately like Option 4. However, the increase in the height of the Watergate will cause inundation of the upper area of the Pursat River which may cause flooding in the town. This may bring in huge discontentment of the people in the city as height water level may cause in delay of storm water flow during raining period.



Evaluation of Options:

Evaluating the OTP Options is not easy as there are many factors that need to be considered, which makes the matter complex. So, the approach below are proposed for adoption:

- Reduce the number of cross regulators on OTP River
- Focus on improving the existing distribution system
- No new canals (in principle)
- No lining of canals
- No construction of the tertiary canals
- No pump stations, and
- No canals in fill

With the above approach, which aims to maximize water distribution (to support prefered crop patterns) while minimizing investment costs (including potential social and environmental impacts, three options (Option 1, Option 3 and Option 5) were extensively discussed, agreed, and finally selected by MOWRAM and AIIB. The combination of these three options does not only complement each other (minimizing costs related to construction and land acquisition) but also water use efficiency is enahnced through improved water distribution across thre three blocks within the command area.

3.3.1.3 Project Technology

There are different technological options being proposed for the project activities. The key technological options are provided here:

Table 3.1: Irrigation System Options

Options	Component	Options	Description
Pumping	1	Diesel water pump	Traditional water pumping systems powered by diesel engines. These are commonly used in areas where electricity is unavailable but it has higher operational cost and environmental impacts. However, it can be used anywhere in the sub-scheme.
		Solar pumps	Sustainable and cost-effective water pumping systems that harness solar energy, suitable for remote areas with abundant sunlight. They offer lower long-term costs but may require higher initial investment.
		Electric pumps	Powered by electricity from the grid or other sources, these pumps are efficient but depend on the availability of consistent electrical supply which maybe inapplicable at farm level in most of the sub-scheme
IPM	1	Pesticide application	A conventional approach involving chemical pesticides to manage pests, often leading to quick results but with potential risks to health, environment, and biodiversity. The times of application without IPM will be up to 6 times as per the reported from the field survey.
		With IPM*	The application of pesticides will be reduced to only around 3 times, minimizing the impacts on the quality and health of water, environment, wildlife, fauna and flora, human and animal
Agromet	1	Without Agromet	Farming practices carried out without the use of weather and climate data, potentially leading to inefficiencies and higher vulnerability to climate risks.
		Agromet	Incorporates meteorological data and forecasts into agricultural decision-making, enhancing productivity, resource optimization, and resilience to climate variability. However, the major challenge is mainly the operational cost of the system.
SCADA**	2	Convention	Manual or semi-automated control systems for monitoring and managing operations, which may be labour-intensive and less efficient in handling complex systems.
		SCADA	Advanced digital systems that provide real-time monitoring, data analysis, and remote-control capabilities for improved efficiency and operational oversight.

*. IPM = Integrated Pest Management

**. SCADA = Supervisory Control and Data Acquisition

For pumping, there is a need to be case specific to each of the option. Applying these technological options are important since the technologies will facilitate the agricultural production and complimenting each other is needed. The promotion of only one option would decrease the effective farming activities. Regarding the IPM, it is quite important to promote the technologies as it will reduce the negative impacts which will be caused by the farming activities. The application of agromet will require technical skill and management capacity

3.3.1.4 Project Scenario Analysis

In the without-project scenario, the net command area in OTB (14,874 ha), will continue to be cultivated with a cropping intensity of 155% (23,055 ha). This includes 14,131 ha of wet-season paddy and 8,924 ha of dry-season paddy. In addition, the land area for vegetable production within the sub-scheme is reported to be approximately 141 ha, approximately 1% of the total command area.[1] The without-project scenario suggests that continuation of ongoing agricultural practices in the project area, with suboptimal yields for rice cultivation and poor crop diversification resulting in low farmer income and high vulnerability to climate risk. With poor rice yield and agricultural productivity, there is the possibility that farmers will alternate their livelihood options to seeking for additional sources of income such as illegal fishing, hunting, and migrating to other areas for income making to feed their families. Without adequate water, their livelihood is highly depending on climate which tends to be highly variated over the past years with series of climate occurrence at a high level of severity and frequency, reported to be approximately occurred every two (2) years both drought and flood and 29% of migration rate. This would be likely to be accelerated when the level of climate impact continues to increase.

In the with-project scenario, it is anticipated that the net command area will be cultivated with greater intensity, increasing from one cropping cycle to two (2) or three (3) cycles per year. This improvement is attributed to enhanced water availability, better water management, higher water transmission efficiency, and improved drainage as a result of the project's investments. The rehabilitation of existing irrigation canals and the construction of new ones will enable an increase in cropping intensity of up to 270%, covering 40,161 hectares. This will yield a net increase of up to 17,106 hectares with reliable irrigation access, including 26,776 hectares of wet-season paddy, 11,899 hectares of dry-season paddy, and 1,488 hectares of high-value crops, such as fruits and leafy vegetables.

The project is expected to deliver the following agricultural outcomes for the 8,130 farming households in the OTP scheme: i) improved yields for wet-season rice, ii) expanded cultivation area and increased yields for dry-season rice, and iii) the introduction of high-value crops like leafy and fruit vegetables for dry-season cultivation. These changes are projected to boost agricultural production, raise farmer incomes, and enhance farmer resilience to drought, pests, diseases, and market risks through crop diversification.

3.3.2 Lum Hach

3.3.2.1 Site Selection

[1] MoP (2023). Commune Database 2023. Ministry of Planning.

The sub-project area was chosen as the area has the potential in terms of agricultural production while limited water availability for production. The command area is changing as per the available design options due to water availability. The feasibility aims at achieving up to 8,000 ha, if water being adequately stored for irrigation. However, with huge acquisition of land area for construction of water storage, the command area was reduced to approximately 3,900 ha.

3.3.2.2 Project Layout and Design

The Lum Hach Irrigation Scheme is being rehabilitated under the CAISAR project, with the aim of improving agricultural productivity in the area. The project feasibility study has identified two (2) design options for improving agricultural productivity.

The first design option involves rehabilitating existing irrigation infrastructure, such as main, secondary, and tertiary canals, and improving water availability and irrigation management. The project will also work with PDWRAM and MOWRAM to establish, train, and manage FWUCs, which will provide farmers with training specific to their land type, improving their land management capabilities. Farmers will be encouraged to diversify their cropping patterns and include short term horticultural crops, such as watermelon, on their dry paddies. The benefits of crop rotation in terms of returns and improvements in soil quality have been identified as important, particularly given the poor soil quality in Lum Hach.

The second design option involves constructing impoundments upstream to provide a storage system that will improve water availability both now and in the future under climate change. Although this option comes with additional costs, the benefits and improvement in agricultural productivity are expected to far outweigh the costs. The command area is expected to increase from 8,000 ha to 14,000ha, benefiting a greater number of farmers in the area and enabling them to be more resilient to climatic changes.

With limited hydrological analysis of water availability and the high potential of land acquisition for the construction of water storage at the upstream, option 2 is not feasible, leaving the first option as the option for the construction of the irrigation within the command area. The option reduces the command area to be around 3,900 ha.

3.3.2.3 Project Technology

Similar to Ou Ta Paong, the project will involve different technology options for irrigating and cultivating. All pumping technologies and sustainable agricultural practices are important to the command area. However, the application of SCADA would be inapplicable since the construction of ponds would not be connected.

3.3.2.4 Project Scenario Analysis

In the without-project scenario, the net command area of 3,900 ha will continue to be cultivated with a cropping intensity of 100% (3,900 ha). This includes 1,950 ha of late wet-season paddy, 1,560 ha of medium wet season paddy and 390 ha of early wet season paddy. According to the commune database, the sub-scheme contains approximately 156 ha of vegetable production, given the land area for horticulture of 4%. Farmers will continue to produce crop production with limited sources of water, which is high risk of failure, even during wet season.

In the with-project scenario, although the net command area will remain unchanged, improvements in water availability, management, transmission efficiency, and drainage will

increase cropping intensity to 110% (covering 4,290 hectares). This includes 1,170 hectares of late wet-season paddy, 1,560 hectares of medium wet-season paddy, 1,170 hectares of early wet-season paddy, and 390 hectares allocated to high-value crops such as fruits and vegetables.

The project is expected to deliver the following agricultural benefits for the 7,958 farming households in the LH scheme: i) improved yields for wet-season rice, ii) expanded cultivation area and higher yields for dry-season rice, and iii) the introduction of high-value crops like leafy vegetables and fruit vegetables for dry-season cultivation. These changes are expected to increase agricultural productivity, boost farmer incomes, and enhance farmer resilience to drought, pests, diseases, and market risks through crop diversification.

In contrast, the without-project scenario would see the continuation of existing agricultural practices, leading to suboptimal rice yields, limited crop diversification, lower farmer incomes, and heightened vulnerability to climate risks.

3.3.3 Stung Krang Ponley

3.3.3.1 Site Selection

The Krang Ponley sub-project is located within the Krang Ponley catchment, made of four (4) sub-areas: Brambei Mom, Krapeu Troum, Yutasas and Krang Bat covering a total area of 3,277 hectares.

3.3.3.2 Project Layout and Design

Rehabilitation and enhancement of the existing irrigation system is the main design option under the project opting out from the feasibility design stage as huge land area acquisition found to be critical and generate high social impacts on community people.

3.3.3.3 Project Technology

The feasibility study has assessed the climate vulnerabilities of the Command Areas and their communities to design suitable, sustainable, and climate-resilient irrigation systems. The scheme will make use of nature-based, adaptive, and data-driven technologies to ensure its resilience to extreme floods and climate change. Smart SCADA technology will be installed to monitor the system for leaks and flood damages, while drainage systems will also be installed to reduce waterlogging, flood impacts, and crop failures.

Solar pumping will be employed in place of costly and high-carbon diesel alternatives to create a self-sustaining system. The lining of canals is an important feature of the system's climate resilience, and a range of investment options exist depending on the extent of lining in the new network. Concrete will be used for certain sections to reduce the carbon footprint.

3.3.3.4 Project Scenario Analysis

3.3.3.4.1 Brambei Mom

In the without-project scenario, the net command area of 1,000 ha will continue to be cultivated with a cropping intensity of 100% (1,000 ha). This includes 200 ha of late wet-season

paddy and 800 ha of medium wet season paddy. There are also proportion of vegetable production approximately 40 ha[2] continue to grow with limited water sources.

In the with-project scenario, while the net command area will remain unchanged, improvements in water availability, management, transmission efficiency, and drainage will result in a cropping intensity increase to 130% (covering 1,300 hectares). This will include 100 hectares of late wet-season paddy, 400 hectares of medium wet-season paddy, 500 hectares of early wet-season paddy, and 300 hectares dedicated to high-value crops, such as fruits and vegetables.

The project is expected to achieve the following agricultural outcomes for the 1,914 farming households in the Brambei Mom scheme: i) higher yields for wet-season rice cultivation, ii) expanded cultivation area and higher yields for dry-season rice, and iii) the introduction of high-value crops like leafy vegetables and fruit vegetables for dry-season farming. These improvements are projected to increase agricultural productivity, raise farmer incomes, and enhance farmer resilience to drought, pests, diseases, and market risks through crop diversification.

In contrast, the without-project scenario would maintain the current agricultural practices, leading to suboptimal rice yields, limited crop diversification, lower farmer incomes, and higher vulnerability to climate risks.

The proposed Brambei Mom scheme will install secondary and tertiary irrigation canals along with associated infrastructure in the existing Brambei Mom irrigation system, thereby improving dry-season water availability for 1,000 hectares of nearby farmland. Additionally, the project will establish and train Farmer Water User Communities (FWUCs) to operate and maintain the irrigation infrastructure, ensuring its long-term sustainability. Agricultural extension services will also be provided to local farmers, focusing on improved agricultural techniques, value chain optimization, the use of improved seed varieties, cover crop application, and the optimal use of fertilizers and pesticides.

3.3.3.4.2 Krapeau Truom

Without-project scenario, the net command area of 690 has will continue to be cultivated with a crop intensity of 100% whereas the 15% of command area (73 ha) will continue to produce vegetables with limited water sources, facing the risk of crop failure even during rainy season.

In the with-project scenario, although the net command area will remain unchanged, improvements in water availability, management, transmission efficiency, and drainage will increase cropping intensity to 115% (covering 793 hectares). This will consist of 69 hectares of late wet-season paddy, 276 hectares of medium wet-season paddy, 345 hectares of early wet-season paddy, and 103 hectares of high-value crops, including fruits and vegetables.

The project is expected to bring the following agricultural benefits for the 2,430 farming households in the Kropeau Truom scheme: i) improved yields for wet-season rice, ii) expanded cultivation area and higher yields for dry-season rice, and iii) the introduction of high-value crops like leafy vegetables and fruit vegetables for dry-season cultivation. These changes are

[2] MoP (2023). Commune Database 2023. Ministry of Planning.

expected to increase agricultural productivity, raise farmer incomes, and enhance farmer resilience to drought, pests, diseases, and market risks through crop diversification.

In contrast, the without-project scenario would maintain current agricultural practices, resulting in suboptimal rice yields, poor crop diversification, lower farmer incomes, and heightened vulnerability to climate risks.

The proposed Kropeau Truom sub-scheme aims to install secondary and tertiary irrigation canals and related infrastructure within the existing system, enhancing dry-season water availability for 690 hectares of nearby farmland. Additionally, the project will establish and train Farmer Water User Communities (FWUCs) to manage and maintain the irrigation infrastructure, ensuring long-term sustainability. Further agricultural extension services will be provided to local farmers, focusing on improved agricultural techniques, value chain optimization, the use of improved seed varieties, cover crop application, and optimal fertilizer and pesticide use.

3.3.3.4.3 Yutasas

In the without-project scenario, the net command area of 593 ha will continue to be cultivated with a cropping intensity of 100% (593 ha). This includes 119 ha of late wet-season paddy and 474 ha of medium wet season paddy. This is the same to the land area of 1% (6 ha) continue to grow vegetable with the risk of crop failure due to limited water sources.

In the with-project scenario, while the net command area will remain unchanged, improvements in water availability, water management, transmission efficiency, and drainage will increase cropping intensity to 117% (covering 693 hectares). This will include 59 hectares of late wet-season paddy, 237 hectares of medium wet-season paddy, 297 hectares of early wet-season paddy, and 100 hectares dedicated to high-value crops such as fruits and vegetables.

The proposed Yutasas scheme aims to install secondary and tertiary irrigation canals along with related infrastructure within the existing scheme, enhancing water availability during the dry season for 593 hectares of nearby agricultural fields. The project will also establish and train Farmer Water User Communities (FWUCs) to manage and maintain the irrigation infrastructure, ensuring its long-term sustainability. Additional agricultural extension services will be offered to local farmers, focusing on improved agricultural practices and value chain development, the use of improved seed varieties, cover crop application, and optimal fertilizer and pesticide use.

The project is expected to deliver the following agricultural benefits for the 1,339 targeted farming households: i) higher yields for wet-season rice, ii) expanded cultivated areas and increased yields for dry-season rice, and iii) the introduction of high-value crops like leafy and fruit vegetables for dry-season farming. These improvements are projected to enhance agricultural productivity, increase farmer incomes, and boost farmer resilience against drought, pests, diseases, and market risks through crop diversification.

In the without-project scenario, ongoing agricultural practices would persist, leading to suboptimal rice yields, limited crop diversification, low farmer incomes, and increased vulnerability to climate risks.

3.3.3.4.4 Steung Krang Bat

In the without-project scenario, the net command area of 994 ha will continue to be cultivated with a cropping intensity of 100% (994 ha). This includes 199 ha of late wet-season paddy and 795 ha of medium wet season paddy. As it is reported that 10% of the land area within this location are using for growing vegetable, the 9 ha of vegetable production will also continue to grow with the water sources.

In the with-project scenario, although the net command area will remain the same, improvements in water availability, management, transmission efficiency, and drainage will result in a cropping intensity increase to 124% (covering 1,235 hectares). This will include 99 hectares of late wet-season paddy, 389 hectares of medium wet-season paddy, 497 hectares of early wet-season paddy, and 250 hectares of high-value crops, such as fruits and vegetables.

The proposed Stoeung Krang Bat scheme seeks to install secondary and tertiary irrigation canals and related structures in the existing Stoeung Krang Bat irrigation system, improving water availability during the dry season for 994 hectares of nearby agricultural fields. The project will also establish and train Farmer Water User Communities (FWUCs) to manage and maintain the irrigation infrastructure, ensuring its long-term sustainability. Additional agricultural extension services will be provided to farmers in the area, focusing on enhanced agricultural practices, value chain development, the use of improved seed varieties, cover crop application, and optimal fertilizer and pesticide use.

The project is expected to bring the following agricultural benefits to the 1,020 farming households targeted in the Stoeung Krang Bat scheme: i) increased yields for wet-season rice, ii) expanded cultivated areas and higher yields for dry-season rice, and iii) the introduction of high-value crops, such as leafy and fruit vegetables, for dry-season cultivation. These improvements are anticipated to boost agricultural productivity, raise farmer incomes, and strengthen resilience to drought, pests, diseases, and market risks through crop diversification.

However, the sub-scheme is located closest proximity to Phnom Penh. The land value was very high ranging from USD 100,000 to USD 250,000 per hectare and highly potential to be converted into residential area. If the area is converted, the residential area is not suitable for agriculture production anymore and the benefit from the investment would be turned into nothing.

CHAPTER 4 – LEGAL AND POLICY FRAMEWORK

4.1 INTRODUCTION

This chapter reviews environmental and social legal and policy frameworks that apply to the CAISAR project. Since CAISAR implementation is financed by the AIIB, IFAD, GEF, and the Royal Government of Cambodia (RGC), policies and stardards that are relevant to CAIRSAR are reviewed and key policy objectives and requirements are reviewed. Where policy gaps are identified, measures are proposed to address such policy gaps – in a manner that are in harmony with the policy objectives of the AIIB, IFAD, GEF, and the Royal Government of Cambodia and for improved regulatory alignment.

4.2 RELEVANT LAW AND REGULATIONS OF THE ROYAL GOVERNMENT OF CAMBODIA

Following a framework for effective project development as well as environmental sustainability, MOWRAM shall observe the national legal framework and protocols ratified by the Kingdom of Cambodia. For CAISAR Project, the following laws, regulations and guidelines are relevant:

4.2.1 The Constitution of the Kingdom of Cambodia (1993)

The Constitution is the highest legal authority in Cambodia and establishes the fundamental rights and duties of citizens and the state. It sets the groundwork for environmental protection, governance, social inclusion, and public well-being, ensuring that environmental and social rights are integrated into national laws.

4.2.2 Legal Framework on the Management and Conservation of Natural Resources and Biodiversity

This framework aims to ensure sustainable use and conservation of Cambodia's natural resources, including water, land, biodiversity, and ecosystems. Laws under this framework help guide ESCIA processes to minimize environmental degradation.

- **Law on Environmental Protection and Natural Resource Management (1996)**: Establishes principles for sustainable development and environmental protection, requiring environmental assessments for projects impacting natural resources.
- **Environmental and Natural Resources Code 2023**: Provides a comprehensive approach to natural resource governance, setting standards for the sustainable management of resources.

- **Law on Land Management, Urban Planning and Construction (1994)**: Governs land use, urban development, and construction to ensure that environmental and social impacts are mitigated.
- **Law on Water Resource Management (2007)**: Regulates water usage, conservation, and management, ensuring that development projects do not negatively impact water resources.
- **Law on Fisheries (2006)**: Focuses on sustainable fisheries management and biodiversity conservation in aquatic ecosystems, crucial for ESCIA in projects affecting water bodies.
- **Protected Areas Law (2008)**: Establishes protected areas to conserve biodiversity and natural resources, ensuring that development projects respect these protected regions.
- **Land Law (2001)**: Regulates land ownership and management to promote sustainable land use practices.
- **Sub-Decree on Water Pollution Control (1999)**: Sets standards for water quality and pollution control in development projects.
- **Sub-Decree on Environmental Impact Assessment (1999)**: Requires EIA for development projects, ensuring environmental impacts are assessed and mitigated.
- **Sub-Decree on Air Pollution Control and Sound Disturbance (2000)**: Provides standards to control air pollution and noise disturbances from development projects.
- **Sub-Decree on Solid Waste Management (1999)**: Governs solid waste management in projects, preventing environmental harm from improper waste disposal.
- **Prakas on Environmental Impact Assessment Reports (1999)**: Offers guidelines for preparing EIA reports to ensure thorough assessment of environmental impacts.
- **Prakas on Hazardous Substances (2015)**: Sets limits on the disposal of toxic substances, preventing environmental contamination from hazardous materials.

4.2.3 Legal Framework on Labour, Public Well-Being, and Safety

This framework emphasizes the protection of workers' rights, public safety, and well-being in project development. It ensures that development projects comply with labor laws and safety standards.

- **Labor Law (1997)**: Protects workers' rights, ensuring safe and fair working conditions during project implementation.
- **Law on Roads (2014)**: Governs the construction and maintenance of roads, with provisions for minimizing environmental and social impacts.
- **Law on Road Traffic (2014)**: Addresses traffic management and safety measures to prevent accidents and disruptions during development.

- **Law on Suppression of Human Trafficking and Sexual Exploitation (2008)**: Protects vulnerable populations during project implementation from exploitation and trafficking.

4.2.4 Legal Framework on Governance and Social Inclusion

This framework ensures that development projects promote inclusive governance, respect cultural heritage, and safeguard social rights. It includes provisions for tax obligations, land acquisition, resettlement, and social protection schemes.

- **Law on Taxation (1997)**: Governs the taxation of development projects, ensuring they contribute to national revenue and economic sustainability.
- **Sub-Decree on Construction Permit (1993)**: Requires permits for construction activities, ensuring they comply with environmental standards and social safeguards.
- **Law on Protection of the Rights of Persons with Disabilities (2009)**: Ensures that development projects consider the needs and rights of persons with disabilities.
- **Law on Social Security Schemes (2002)**: Provides social protection for workers, ensuring their well-being during project execution.
- **Sub-Decree on Health Care Scheme (2016)**: Extends social security and health care protection to workers involved in development projects.
- **Law on the Protection of Cultural Heritage (1996)**: Safeguards cultural heritage sites, ensuring that development projects do not damage or destroy culturally significant areas.
- **Expropriation Law (2010)**: Regulates land acquisition for public purposes, ensuring fair compensation and minimizing the impact on affected populations.
- **Sub-Decree on Land Acquisition and Resettlement (2018)**: Provides procedures for land acquisition and involuntary resettlement, particularly for externally financed projects.
- **Sub-Decree on Social Land Concession (2003)**: Allows for the allocation of state land to landless citizens, particularly when development projects displace communities.
- **Sub-Decree on State Land Management (2005)**: Regulates the management of state land, ensuring its sustainable use in development.
- **Sub-Decree on River Basin Management (2015)**: Promotes sustainable management of river basins, ensuring that development projects do not harm water systems and dependent ecosystems.

4.3 AIIB'S ENVIRONMENTAL AND SOCIAL FRAMEWORK (ESF)

The Environmental and Social Framework (ESF) of the AIIB outlines the principles and standards to ensure environmentally and socially sustainable development practices for projects it finances. The framework consists of several Environmental and Social Standards (ESS) that provide comprehensive guidance on managing potential impacts and risks associated with AIIB-financed projects. The following AIIB's Environmental and Social Framework (ESF) apply to CAISAR.

- **Environmental and Social Standard 1: Environmental and Social Assessment and Management**: This ESS guides the assessment and management of environmental and social risks, requiring projects to evaluate alternatives, mitigate impacts, and disclose information. It emphasizes protecting the natural environment, particularly biodiversity and critical habitats, while addressing pollution, resource efficiency, and climate change. Social risks, including impacts on vulnerable groups, gender, and access to resources, must be considered. The standard also covers labor conditions, community health and safety, child labor, and security, ensuring proper grievance mechanisms, monitoring, and implementation plans.
- **Environmental and Social Standard 2: Land Acquisition and Involuntary Resettlement.** The ESS provides guidance to avoid Involuntary Resettlement where possible. The requirements under the standard contain 18 points of action to which the executing agency needs to follow.
- **Environmental and Social Standard 3: Indigenous Peoples.** The ESS aims to design and carry out projects in a way that fully respects Indigenous Peoples' identity, dignity, human rights, economies, and cultures. This ensures that Indigenous Peoples: (a) receive social and economic benefits that are culturally appropriate; (b) do not experience negative impacts from the projects; and (c) can actively participate in projects that affect them. The standard contains 15 points to follow.

4.4 IFADs' SECAP

The International Fund for Agricultural Development's (IFAD) Social, Environmental, and Climate Assessment Procedures (SECAP) provide a framework to ensure that IFAD-financed projects are sustainable, socially inclusive, and environmentally sound. The following Standards apply to CAISAR:

- **Standard 1: Biodiversity Conservation**: This standard ensures the protection of biodiversity by requiring projects to assess and mitigate biodiversity risks, avoid critical habitats, and provide compensation for unavoidable damages. It promotes sustainable use of genetic resources, discourages invasive species, and emphasizes expert advice and adherence to protected area laws.

- **Standard 2: Resource Efficiency and Pollution Prevention**: Focuses on efficient use of resources and pollution control. It requires projects to reduce energy, water, and material use, manage hazardous materials safely, and prevent pollution, with an emphasis on sustainable natural resource management, including water, soil, fisheries, and forests.
- **Standard 3: Cultural Heritage**: This standard ensures the protection of tangible and intangible cultural heritage by screening and managing impacts, consulting local communities, and preserving access to cultural sites. Projects must avoid, minimize, or mitigate damage and follow legal requirements in protected areas.
- **Standard 4: Indigenous Peoples**: Supports and empowers indigenous communities by requiring free, prior, and informed consent (FPIC), promoting equitable resource access, and protecting cultural heritage. Projects must involve indigenous peoples in decision-making, ensure fair benefits, and avoid involuntary resettlement.
- **Standard 5: Labor and Working Conditions**: Sets requirements for safe, non-discriminatory workplaces, prohibiting forced and child labor. It requires the establishment of grievance mechanisms, safety protocols, and equal opportunities, with contractors and suppliers adhering to these standards.
- **Standard 6: Community Health and Safety**: Requires projects to assess and manage health risks, prevent exposure to hazards, and ensure infrastructure safety. It includes emergency preparedness, traffic and security management, and protection against gender-based violence.
- **Standard 7: Physical and Economic Resettlement**: Ensures resettlement is conducted legally and fairly, avoiding forced evictions. It requires special consideration for vulnerable groups, economic displacement, and establishing grievance mechanisms for affected communities.
- **Standard 9: Climate Change**: Ensures projects address climate risks and reduce GHG emissions. It mandates climate risk screening, adoption of climate-smart practices, and GHG accounting to guide project design towards reducing environmental impacts.

4.5 GEF'S ENVIRONMENTAL AND SOCIAL SAFEGUARDS POLICIES

GEF adopts the interim environmental and social safeguards to identify, measure, and mitigate environmental and social risks based on IFC Performance Standards (PS). Under CAISAR, the following PSs are applied:

- Performance Standard 1 – Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2 – Labor and Working Conditions
- Performance Standard 3 – Resource Efficiency and Pollution Prevention

- Performance Standard 4 – Community Health, Safety, and Security
- Performance Standard 5 – Land Acquisition and Involuntary Resettlement
- Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Performance Standard 7 – Indigenous Peoples
- Performance Standard 8 – Cultural Heritage

4.5.1 International Conventions and Treaties

Cambodia has ratified all eight (8) of the International Labor Organisation (ILO)'s conventions which cover core labour standards recognized as human rights. These conventions focus on issues such as freedom of association, elimination of forced labour, abolition of child labour, and elimination of discrimination in employment.

- **Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)**: Ratified by Cambodia in 1999, this convention protects workers' and employers' rights to freely form and join organizations without interference, ensuring autonomy and safeguarding against dissolution by authorities.
- **Right to Organise and Collective Bargaining Convention, 1949 (No. 98)**: Ratified in 1999, it protects workers' rights to organize, engage in collective bargaining, and prevents discrimination for union activities, promoting fair wage negotiations and just working conditions.
- **Forced Labour Convention, 1930 (No. 29)**: Ratified in 1969, this convention aims to eliminate all forms of forced labour, including coercive work for public works or political purposes, protecting workers' rights and dignity.
- **Abolition of Forced Labour Convention, 1957 (No. 105)**: Ratified in 1999, it strengthens the prohibition of forced labour for political coercion, discipline, or discrimination, ensuring freedom and justice in the workplace.
- **Minimum Age Convention, 1973 (No. 138)**: Ratified in 1999, it sets a minimum age for employment (usually 15) to prevent child labour, promoting access to education and protection from hazardous work.
- **Worst Forms of Child Labour Convention, 1999 (No. 182)**: Ratified in 2006, this convention seeks to eliminate extreme forms of child labour like slavery, trafficking, and hazardous work, prioritizing children's safety and rehabilitation.
- **Equal Remuneration Convention, 1951 (No. 100)**: Ratified in 1999, it promotes equal pay for men and women for work of equal value, combating gender-based wage discrimination and fostering economic justice.
- **Discrimination (Employment and Occupation) Convention, 1958 (No. 111)**: Ratified in 1999, this convention addresses workplace discrimination based on race, gender, religion, and other factors, promoting equal treatment and opportunities for all workers.

- **Employment Policy Convention, 1964 (No. 122)**: Ratified in 1971, it requires active employment policies to promote full, freely chosen employment, aiming to reduce unemployment and support economic and social development.
- **Weekly Rest (Industry) Convention, 1921 (No. 14)**: Ratified in 1969, this convention guarantees a weekly rest period of at least 24 consecutive hours for workers, helping protect their health and well-being.
- **Labour Inspection Convention, 1947 (No. 81)**: Ratified by Cambodia in 1974, this convention establishes labour inspections in industrial and commercial workplaces to ensure compliance with national labour laws, promoting safe, fair, and decent working conditions.
- **Labour Inspection (Agriculture) Convention, 1969 (No. 129)**: Ratified in 1999, it extends labour inspection to agriculture, ensuring workers in this sector, including migrant and seasonal labourers, are protected by labour laws and safe working conditions are maintained.
- **Tripartite Consultation (International Labour Standards) Convention, 1976 (No. 144)**: Ratified by Cambodia in 2009, this convention promotes consultation between governments, employers, and workers on international labour standards. It ensures that all stakeholders are involved in the implementation of labour policies, enhancing social dialogue and cooperation for fair labour practices.

4.6 GAP ANALYSIS OF NATIONAL LEGAL FRAMEWORK AND POLICIES OF AIIB, IFAD AND GCF

The study and analysis of the national legal framework against the requirements under the policies of AIIB, IFAD and GCF can be summarised as Table 4.1 below:

Table 4.1: Summary of the RGC's legal framework corresponding to the policies of AIIB, IFAD and GCF

No.	Standards/ Policies of AIIB and IFAD			Coverage	RGC's Corresponding Legal Framework	Gap Analysis and suggestions	Proposed measures to address the gaps
	AIIB	**IFAD**	**GCF**				
1	ESS1		PS1	Environmental and Social Assessment and Management	• Environmental and Natural Resources Code (2023), • Law on Water Resource Management (2007), • Law on fisheries (2026), • Sub-Decree on Water Pollution Control (1999), • Sub-Decree on Environmental Impact Assessment (1999), • Sub-Decree on Air Pollution Control and Sound Disturbance (2000), • Sub-Decree on Solid Waste Management (1999), • Prakas on the General Guideline for Preparing the Initial and Full Environmental Impact Assessment Reports (1999), • Prakas on the Launch of Standards of the Quantity of Toxins or Hazardous Substances Allowed to be Disposed (2015)	The RGC has established a wide range of regulations especially in the recent Environmental and Natural Resources Code (2023) that aim to environmental protection and natural resource management are well aligned to the provisions of the AIIB ESS1.	This ESCIA covers both direct, indirect, and cumulative impacts and mitigation measures, taking a holistic approach to the project and looking at impacts in an integrated way.
2	ESS2	S7	PS5	Land Acquisition and Involuntary Resettlement	• Law on Land Management, Urban Planning and Construction (1994), • Land Law (2001), • The Expropriation Law (2010), • RGC's Sub-Decree No. 22 ANK/BK (2018) on the Promulgation of the Standard Operating Procedures for Land Acquisition and Involuntary Resettlement (SOP-LAR) for Externally Financed Projects in Cambodia, • Sub-Decree No.19 on Social Land Concession of March 2003,	The RGC has the SOP-LAR which is well aligned with the provisions in the AIIB ESS 2. The AIIB ESS 2 on land acquisition and involuntary resettlement recognizes that project related land acquisition and land use can have impacts on communities. The RGC's SOP-LAR is consistent with the specific requirements under the AIIB ESS 2 on consultation, grievance redress, social support, resettlement assistance, standard of living	According the RGC's SOP-LAR, an income restoration program would be provided in order to re-estalbish sources of livelihoods for those affected households who have permanently lost their sources of livelihood. In this CAISAR project, the DRPs will include provisions to ensure livelihood

No.	Standards/ Policies of AIIB and IFAD			Coverage	RGC's Corresponding Legal Framework	Gap Analysis and suggestions	Proposed measures to address the gaps
	AIIB	IFAD	GCF				
					• RGC's Sub-Decree No.118 ANK/BK (2005) on State Land Management, • RGC's Sub-Decree No.98 ANK/BK (2015) on River Basin Management	of poor and vulnerable, entitlements for persons without title or legal rights except for land, information disclosure, payment of compensation and entitlements prior to physical displacement, and the supervision and monitoring of implementation of resettlement plans. However, there are gaps on negotiated settlement and livelihood restoration. The SOP-LAR does not describe procedures for negotiated settlement and lack of clear benchmark to assist monitoring and evaluation to confirm if the affected households restore their livelihood to the level prevailing prior to the beginning of the project implementation.	restoration program are robust and can accurately meet the aim of livelihood restoration in line the AIIB ESS2.
3	ESS3	S4	PS7	Indigenous Peoples	• The Constitution of Cambodia (1993) • Land Law (2001)	No detailed regulations on how to avoid impacts to Indigenous Peoples or how to include them in project benefits. Lack of requirement to consult IP(s) in a manner that is culturally appropriate and special disclosure and consultation requirements as described in the AIIB ESS3.	An IPPF has been prepared on the basis of the AIIB ESS3. The IPPF details procedures on the preparation of IPP(s) and how to conduct meaningful consultation and disclose that is culturally appropriate.
4	ESS1	S1	PS6	Biodiversity conservation	• Environmental and Natural Resources Code (2023),	The code requires a proper consideration of biodiversity resources and payment of ecosystem services which support the conservation process. There is limited	This ESCIA include the biodiversity assessment and management plan.

No.	Standards/ Policies of AIIB and IFAD			Coverage	RGC's Corresponding Legal Framework	Gap Analysis and suggestions	Proposed measures to address the gaps
	AIIB	IFAD	GCF				
						guidance on how to compensate in the ecosystem services once its pristine condition is affected.	
5	ESS1	S2	PS3	Resource efficiency and pollution prevention	• Environmental and Natural Resources Code (2023), • Sub-Decree on Environmental Impact Assessment (1999), • Sub-Decree on Air Pollution Control and Sound Disturbance (2000), • Sub-Decree on Solid Waste Management (1999), • Prakas on the General Guideline for Preparing the Initial and Full Environmental Impact Assessment Reports (1999), • Prakas on the Launch of Standards of the Quantity of Toxins or Hazardous Substances Allowed to be Disposed (2015)	The RGC has in place a set of separate provision and requirements for pollution prevention and management that are well align with the AIIB ESS 1 that aims to promote the sustainable use of resources and avoid or minimize the pollution from sources/project activities.	This ESCIA has included all relevant national laws and regulation as well as the requirement for AIIB ESS1.
6	ESS1	S3	PS8	Cultural heritage	• Environmental and Natural Resources Code (2023), • Law on the Protection of Cultural Heritage (1996)	The RGC has in place the law on protection of cultural heritage aligns with the requirement of the AIIB ESS1. However, there is lack of detail procedures for protection of the intangible cultural heritage.	This ESCIA provided details procedures and requirement to protect both tangible and intangible cultural heritage through Chance Find Procedure (Annex xx).
7	ESS1	S5	PS2	Labor and working conditions	• Labor Law (1997), • Law on Taxation (1997), • Sub-Decree on Construction Permit (1993), • Law on Social Security Schemes for Persons defined by the Provision of the Labor Law (2002),	The RGC has in place a set of law and regulations on labour and working conditions which is consistent with the requirement of the AIIB ESS1. However, the enforcement of these law and regulation is still limited. For example,	The ESCIA provides provisions to monitor compliance by contractor and of their primary suppliers in bidding documents and supervision contracts in order

No.	Standards/ Policies of AIIB and IFAD			Coverage	RGC's Corresponding Legal Framework	Gap Analysis and suggestions	Proposed measures to address the gaps
	AIIB	IFAD	GCF				
					• Sub-Decree on Establishment of Social Security Scheme "Health Care Scheme" for Persons Defined by the Provisions of the Labor Law (2016)	regulation against forced labor and using child labor are not strictly enforced.	to prohibit using forced labour and child labour.
8	ESS1	S6	PS4	Community health and safety	• Law on Road Traffic (2014), • The Law on Suppression of Human Trafficking and Sexual Exploitation 2008, • Law on the Protection and the Promotion of the Rights of Persons with Disabilities 2009,	The RGC has established Labor Law the protect the health and safety of the workers. However, the concern and mitigation are more on individual rather than community as a whole. The AIIB ESS1 aims on protection of both individual and community for health and safety.	The ESCIA provides provisions to monitor compliance by contractor on community and health safety in bidding documents and supervision contracts. The requirement on raising awareness to local community on health and safety are also included in the bidding documents.
9	ESS1	S9	PS1	Climate change	• Environmental Code and Natural Resource Management 2023	The newly adopted code requires all relevant sectors to integrate climate resilient concepts into their strategic action plan along with different measures to tackle the issues. No gap being identified.	

Overall, the Royal Government of Cambodia (RGC) has established various legal documents ranging from royal decrees, sub-decrees, and circulars framing the management, and implementation of all types of development projects and activities within the country at the pre-construction, construction and implementation periods. The laws cover the management and protection of the natural resources, and biodiversity including underground, inland and water bodies. These legal frameworks also contain the standards that are applicable to the country context including water quality, soil quality, air, noise quality and vibration. Regarding human well-being including health, safety, labour and sexual exploitation, the country has made significant progress over the past years promoting the working environment of workers and labour forces embracing various laws and policies for ensuring the well-being of workers as well as the compliances that employers must comply. Laws to protect sexual exploitation, and social protection guarded the public, especially the vulnerable including the poor, and people with disability. Although the country's legal frameworks cover the requirements, there are still limited report in terms of actual enforcement which need to be taken care where a proper implementation plan and resources are needed.

CHAPTER 5 – PROJECT AREA OF INFLUENCE

5.1 INTRODUCTION

This chapter outlines the areas of influence where the project may have potential impacts. It examines the geographical regions, ecosystems, and communities likely to be affected, addressing both environmental and socio-economic considerations. The analysis aims to inform mitigation strategies and ensure project activities align with sustainability while minimizing adverse effects.

5.2 SCOPING

5.2.1 Definitions

Under CAISAR project, term "Areas of Influence" (AoI) comprise, as appropriate, areas that are likely to be affected by the following:

(i) **Project activities**, including i) CAISAR project's activities and the facilities that are directly owned, operated or managed (including by contractors) and; ii) the impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or indirect project impacts on biodiversity, or on ecosystem services upon which affected communities' livelihoods are dependent;

(ii) **Cumulative impacts**[3] that result from the incremental impacts (direct and indirect) from a) CAISAR project activities on the project command area, and b) CAISAR, and combined cumulative effect from CAISAR, past and planned projects, on the area downstream the CAISAR and other relevant projects; and

(iii) **Associated** facilities are activities that are not included in the description of the Project set out in the agreement governing the Project, but which, following consultation with the Client, the Bank determines are: (a) directly and materially related to the Project; (b) carried out, or planned to be carried out, contemporaneously with the Project; and (c) necessary for the Project to be viable and would not be constructed or expanded if the Project did not exist.

5.2.2 Project Areas of Influence

5.2.2.1 Project Area

[3] Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities.

Under CAISAR, since project design is still ongoing, area of influence (of each of the six (6) sub-schemes) is anticipated based on: a) target command area of each scheme (where most proposed project activities will take place during project construction, and later during project operation), and b) the environmental footprint that are likely caused by project activities during project construction (as direct and indirect impacts due to activities under Component 2), and by project activities (mainly cumulative impacts due to intenstified crop production activities under component 1).

These above anticipated areas of influence need to be updated when more information becomes available to allow a more reliable assessment, particularly when project detailed design is completed, and construction measures proposed by construction constractors are identified. Future update on area of influence (at respective sub-scheme) will be made on the basis of updated environmental and social assessments once a) locations of construction sites, auxiliary facilities (such as borrow pits), and logistics operations are confirmed, and b) the full scope of the project's impacts (direct, indirect, and cumulative) is firmed up based on detailed engineering design (for Component 2) and project implementation approach (for Component 1).

It is noted that while direct and indirect impacts could be reasonably anticipated based on currently proposed scope of works and prior experience for similar works, cumulative impacts, particularly their spatial extent and severity (over the time) require collection of supporting scientific evidence from data collected under project's environmental and social monitoring program (See also Chapter 9 - Environmental & Social Management).

5.2.2.2 Associated Facilities

Under CAISAR, the screening for potential Associated Facilties (AF) was conducted by SECAP team. The definition for "Associated facilities" (AF) in the AIIB's Environmental and Social Framework (May 2021 version) are activities that are not included in the description of the Project set out in the Legal Agreements governing the Project, but they are qualified to the following criteria:

> (a) **directly** and **materially** related to the Project.
>
> (b) **carried** out, or **planned to be carried out**, **contemporaneously** with the Project; and
>
> **(c) necessary** for the Project to be **viable** and would **not be carried out if the Project did not exist**".

This section summarizes a) methods that was used by the team to screen for AF, and b) results of the AF screening.

Methods

Interpretation of AF definition in the context of CAISAR project

Under CAISAR project, the key terms used in the above definition are interpreted as follows:

- **Project**: refers to CAISAR project
- **Direct**, in the context of environmental and social risk and impact assessment, refers to the **impact, which is caused by the project**, and **occurs contemporaneously in**

the location of the project. This is to differentiate with an indirect impact which is an impact which is caused by the project and is later in time or farther removed in distance than a direct impact, but is still reasonably foreseeable, and will not include induced impacts. “Direct”, in the context of AIIB’s ESF refers to the “direct” relationship between a potential associated facilities (e.g. dam, reservoir, barrage) and its impact on the achievement of the intended project development.

- **Material**: significant, important, substantive. In the context of CAISAR, “material” refers to the strength of the above “direct” relationship between the impact of a potential AF on the intended outcome for each subproject which is indicative of **reliable and increased water access** for the target project groups – as per project plan, to achieve expected development outcome.
- **Contemporaneous**: at the same time, which is the relative overlap of time with regards to planning and actual implementation of potential AF and CAISAR project activities (defined by project planning period and project implementation life).
- **Viable**: for CAISAR sub–schemes to **achieve** mostly the **intended impacts** (expected outcome, i.e. increased irrigated area and/or number of crops per year/reliable irrigation access).
- **Not be carried out if the Project did not exist.** Indicates the functional interdependency between the AF and CAISAR project.

Findings

As per the consultation with the CAISAR PMU and SECAP team, the document regarding the AF had already been approved. Therefore, the result from the assessment were used in this report. Further assessment will be conducted on any emerging facilities after the consultation and agreement being provided by the PMU. Based on the screening by the SECAP team, five (5) existing works have been screened and assessed if they are associated facilities (See table next page). The screening results indicates that none of the five (5) water resources facilities met the definition of AIIB’s Environmental and Social Framework on Associated Facilities. Therefore, no further actions are required in connection with these five (5) works (please see in table 5.1).

Table 5.1: Screening of potential Associated Facilties under CAISAR*

Assessment criteria	Anlong Chrey Dam	Kdol Dam	Brambei Mom Dam	Kropeau Truom diversion work	Yutasas barrage
a) **directly** and **materially** related to the Project; and	Directly and materially (substantially) related to Chheang Leung command area. Directly and materially (substantially) related to Brambei Bom, Kropeau Truom, Yutasas, and Stoeng Krang Bat.	Directly and materially (moderately) related to Kropeau Truom, Yotasas, and Stoeung Krang Bat	Directly and materially (substantially) related to Brambei Mon sub–scheme	Directly and materially (substantially) related to Kropeau Truom sub–scheme	Directly and materially (substantially) related to Yutasas sub–scheme
b) **carried out**, or **planned to be carried out**, **contemporaneously** with the Project; and	The Anlong Chrey construction was completed in 2012 under Krang Ponley Water Resources Development Project. **Not carried out contemporaneously** with Chheang Leung, Brambei Bom, Kropeau Truom, Yotasas, and Stoeung Krang Bat sub–schemes.	Kdol Dam construction was completed in 2012 under Water Resources Development Project. **Not carried out contemporaneously** with Kropeau Truom, Yutasas, and Stoeung Krang Bat	The Brambei Mom Dam construction was completed in 2012 Krang Ponley Water Resources Development Project. Not carried out contemporaneously with Brambei Mom sub–scheme	The Kropeau Truom Dam construction was completed in 2015 **Not carried out contemporaneously** with Kropeau Truom sub–scheme	The Yutasas Dam construction was completed in 2015 **Not carried out contemporaneously** with Yutasas sub–scheme
c) **necessary** for the Project to be **viable** and **would not be carried out** if the Project did not exist.	**Necessary** for Chheang Leung, Brambei Mon, Kropeau Truom, Yutasas, and Stoeung Krang to be **viable** and **still carried out** even if these schemes did not exist	**Necessary** for Kropeau Truom, Yutasas, and Stoeung Krang to be **viable** and **still carried out** if even these schemes did not exist	**Necessary** for the Brambei Mom sub–scheme to be **viable** and **still carried out** even if Brambei Mom sub–scheme did not exist.	**Necessary** for the Kropeau Truom sub–scheme to be **viable** and **still carried out** even if Kropeau Truom sub–scheme did not exist.	**Necessary** for the Yutasas sub–scheme to be **viable** and **still carried out** even if Yutasas sub–scheme did not exist.
Initial screening	NOT AF	NOT AF	NOT AF	NOT AF	NOT AF

*. Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) Project

Source: *Report on Screening of potential Associated Facilties under CAISAR (prepared by SECAP team)*

Table 5.2: Area of influence

Assessment criteria	**Dam 1**	**Dam 3**	**Dam 5**	**Damnak Cheukrom Headwork**	**Damnak Ampil Headwork**
a) **directly** and **materially** related to the Project; and	**Not directly related** to, but **materially (substantially)** related to OTP because water released from Dam 1 is mostly fed into the Damnak Cheukrom command area (16,100 ha) located upstream the OTP and various other commands areas	**Not directly related** to OTP but **materially (moderately) related to** OTP because water from Dam 3 contributes the total water volume in Pursat river which is the main source of water for OTP	**Not directly related** to OTP but **materially (moderately) related to** OTP because water from Dam 5 contribute water to Pursat river which is the main source of water for OTP	**Not directly and materially to** OTP because water from this dam is for Damnak Cheukrom command area only (upstream the OTP)	**Directly and materially related to** OTP sub–scheme because its function and operations affects water volume diverted into OTP and thus affect intended outcome of the OTP sub–scheme.
b) **carried out**, or **planned to be carried out**, **contemporaneously** with the Project; and	Carried contemporarily with OTP	Not carried out, or planned to be carried out with OTP (It was built and completed in 2013)	Not carried out, or planned to be carried out with OTP (It was built and completed in 2013)	Not carried out, or planned to be carried out with OTP	Not carried out, or planned to be carried out with OTP (it was built during Khmer rouge time and was built in 2006.
c) **necessary** for the Project to be **viable** and **would not be carried out** if the Project did not exist.	Necessary for OTP to be viable but still carried out if OTP did not exist	Not necessary. Still carried out if OTP did not exist	Not necessary. Still carried out if OTP did not exist	Not necessary. Still carried out if OTP did not exist	Necessary for OTP to be viable (TBC based on final engineering design) but has been built with no intention to serve water to the OTP sub–scheme.
Initial screening	NOT AF	NOT AF	NOT AF	NOT AF	NOT AF

5.2.2.3 Description of Activities that Potentially Cause Impact

5.2.2.3.1 Air, Noise and Vibration

The area of influence for air quality, noise, and vibration during the construction and rehabilitation of irrigation systems extends beyond the construction site, affecting nearby communities and the environment. Dust, emissions from machinery, and material handling can temporarily increase particulate matter and pollutants in the air. Noise from heavy equipment may disturb residents and wildlife, while vibrations from activities like dredging and excavation can affect nearby structures, potentially causing discomfort or minor damage. These impacts, though short-term, typically extend up to 100 meters from the site, with heavier activities affecting a larger area. Post-construction, greenhouse gas emissions from farming activities could have minimal long-term impacts at a global scale. Each of the sub-scheme the area of influence include:

- Surrounding the sites of the rehabilitated/dredged rivers/stream
- Surrounding the rehabilitated main and tertiary canals, and
- Surrounding the rehabilitated/upgraded structure
- Along the road used for transporting materials by the construction activities

These effects occur only during the construction period while the emission of greenhouse gas emission from farming activities. The following are maps indicating the area of influence at each sub-scheme.

Figure 5.1: Locations of irrigation structures in Ou Ta Paong

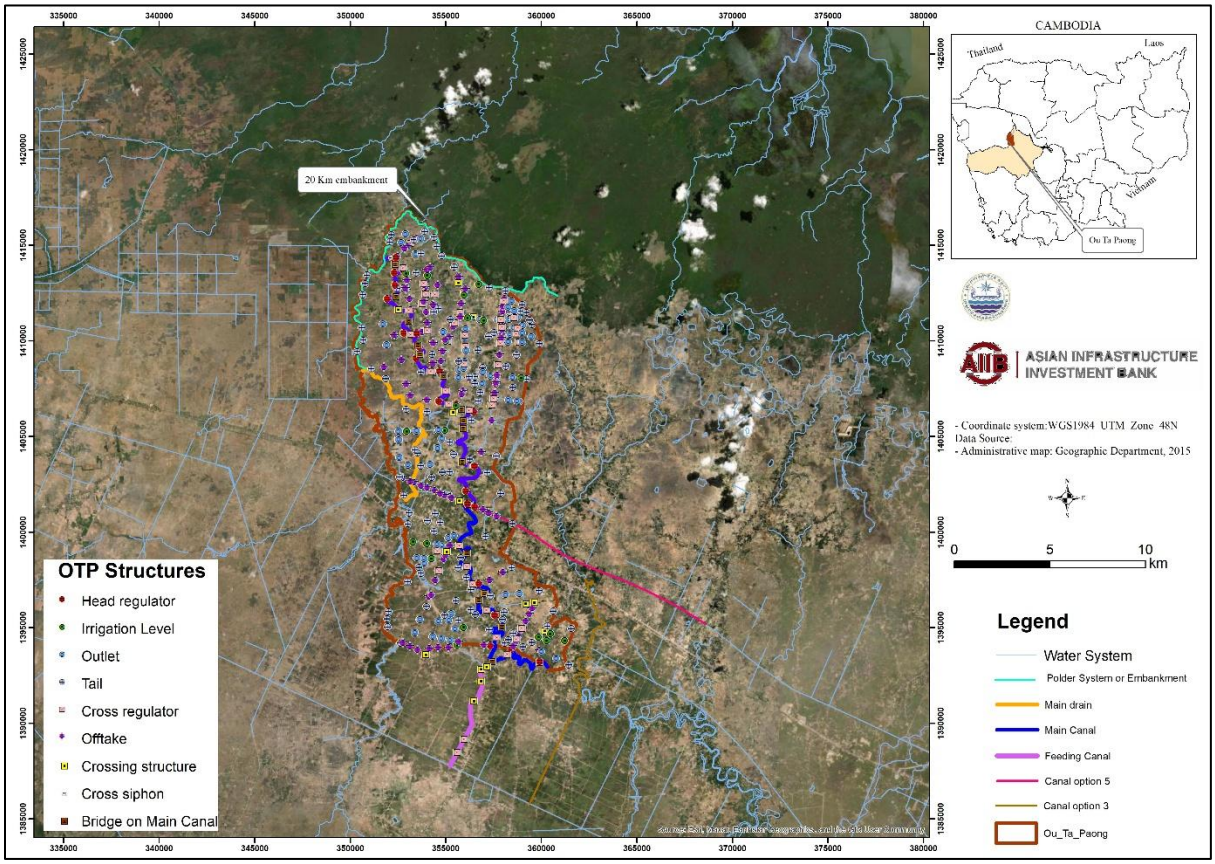


Figure 5.2: Locations of irrigation structures in Lum Hach

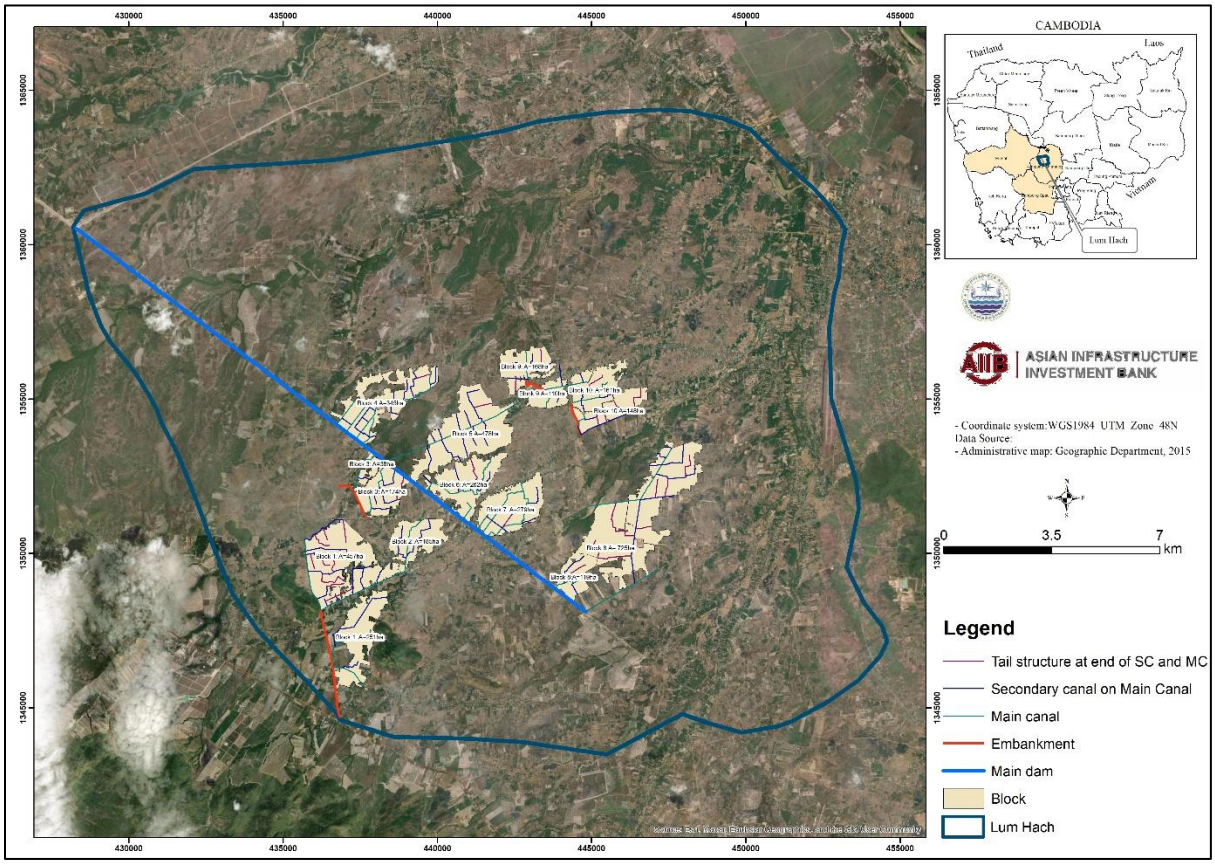


Figure 5.3: Locations of irrigation structures in Prambei Mom

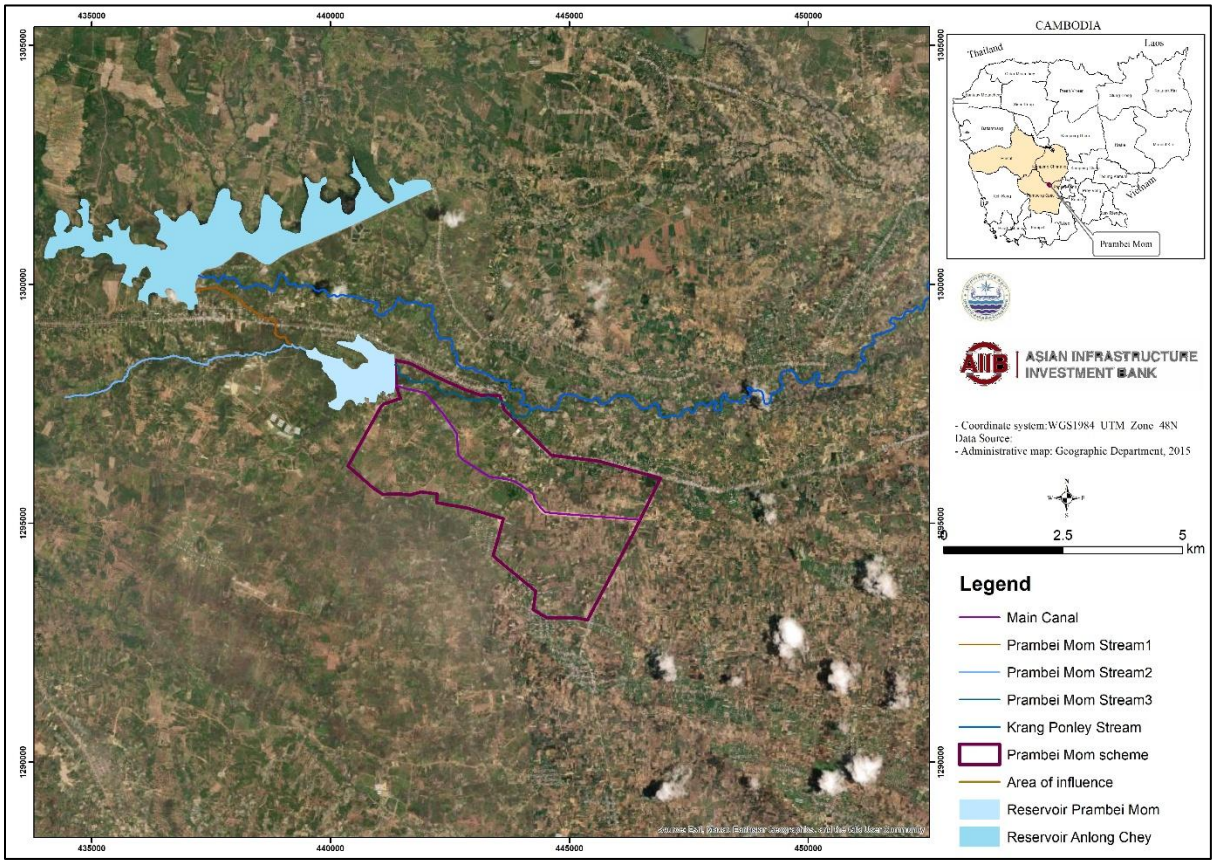
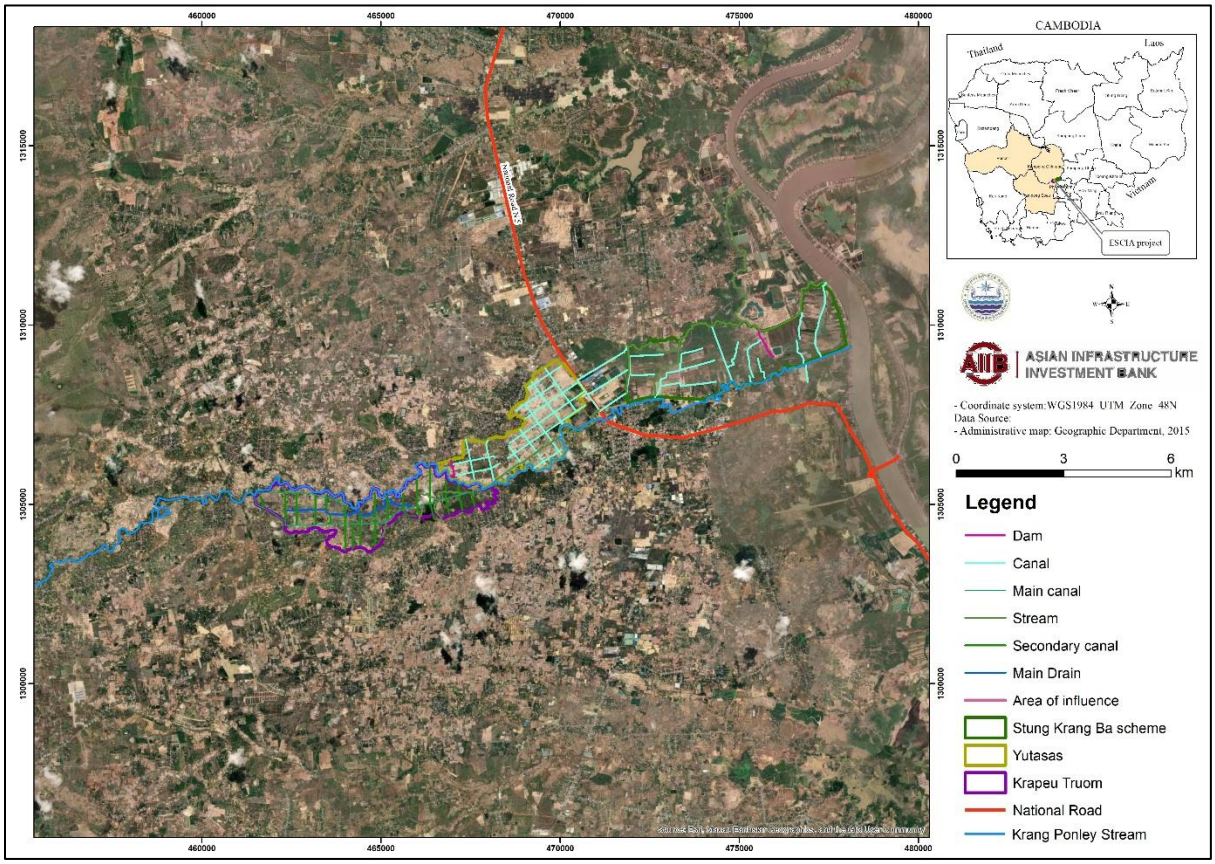


Figure 5.4: Locations of irrigation structures in Kropeau Truom, Yutasas, and Stoeng Krang Bat



5.2.2.3.2 Water Quality

The construction and operation of irrigation systems can significantly impact water quality, both in terms of surface water and groundwater.

Construction Phase:

- **Surface Water:** During the construction phase, sedimentation due to excavation, dredging, and earthworks is a primary cause of water quality degradation. Loose soil can be washed into nearby water bodies, increasing turbidity, reducing light penetration, and altering the aquatic habitat. Additionally, the use of machinery and equipment introduces risks of oil spills, fuel leaks, and chemical contamination, which can enter water sources through surface runoff, affecting aquatic life and water usability downstream.
- **Groundwater:** Construction activities, such as drilling and excavation, can disrupt the soil and rock layers, potentially allowing contaminants from surface activities, such as chemicals, to infiltrate groundwater. Chemical spills or leaching from construction materials can further degrade groundwater quality. Additionally, the disruption of natural flow patterns in the subsurface may allow pollutants to spread more easily, threatening water quality over a wide area.

Operation Phase:

- **Surface Water:** Once the irrigation system is in operation, water quality can be affected by the increased use of fertilizers and pesticides in the command areas. Runoff from agricultural fields may carry these chemicals into nearby rivers, streams, and lakes, causing nutrient pollution, algal blooms, and eutrophication, which can lead to oxygen depletion and harm aquatic ecosystems. Over-irrigation can also lead to increased runoff, carrying sediments and pollutants into surface water bodies.
- **Groundwater:** The operation of irrigation systems may result in groundwater contamination, particularly through leaching of agricultural chemicals such as nitrates and phosphates. Excessive irrigation can cause these chemicals to infiltrate the soil and reach groundwater aquifers, leading to long-term contamination. Furthermore, changes in water table levels due to extensive irrigation can alter the flow patterns of groundwater, potentially mobilizing contaminants that would otherwise remain contained.

In both phases, the key impacts on water quality include contamination of water resources with sediments, nutrients, chemicals, and reduced ecosystem health in the affected water bodies. These impacts can lead to long-term environmental damage and human health effects downstream along Ou Ta Paong River, Svay Don Keo River, the Tonle Sap Lake, Boribour River, Stung Krang Ponley and The Tonle Sap Lake due the reduction of the availability of clean water for agricultural, and domestic uses.

5.2.2.3.3 Soil Quality

The area of influence for soil quality during the construction and operation of irrigation systems extends well beyond the immediate project site, affecting surrounding agricultural land, natural habitats, and downstream regions impacted by runoff and water movement. In both phases, the area of influence extends beyond the construction site, impacting nearby agricultural land, natural habitats, and drainage systems. Proper management is essential to minimize long-term soil degradation across the broader irrigation zone.

Construction Phase:

- **Soil Erosion:** The area of influence for soil erosion encompasses not just the construction site but also adjacent areas, as excavation, grading, and vegetation removal expose large sections of land to wind and water erosion. This can lead to topsoil loss, affecting soil fertility on-site and causing sedimentation in nearby fields and water bodies.
- **Soil Compaction:** The influence of soil compaction extends several meters beyond the worksite, particularly where heavy machinery is used for construction or access. Compacted soil reduces water infiltration and root penetration, impacting surrounding agricultural land and natural ecosystems.
- **Soil Contamination:** While soil contamination from fuel spills and construction debris is often localized, it can spread through surface runoff during rainfall or irrigation, affecting nearby fields and watercourses, potentially degrading soil quality in those areas.

Operation Phase:

- **Salinization:** The area of influence for soil salinization covers the entire irrigated zone. Poor drainage and excessive irrigation can lead to salt buildup, particularly in low-lying areas, reducing soil productivity across large sections of the command area.
- **Nutrient Imbalance:** Nutrient leaching or accumulation affects the entire irrigated region and nearby fields. Over-irrigation can cause essential nutrients to wash away, while poor management of fertilizers can lead to nutrient buildup, creating imbalances that degrade soil quality.
- **Waterlogging:** The impact of waterlogging is concentrated in the irrigated fields but can extend to neighboring areas due to the movement of water through the soil layers. Prolonged waterlogging reduces soil aeration and affects soil structure, ultimately diminishing productivity.

At Ou Ta Paong sub-scheme, the area of influence will include the areas along the feeder canals which will extend beyond the command area. This includes the construction activities as described earlier and the acquisition of land and resettlement along the feeder canals.

5.2.2.3.4 Biodiversity

The environmental impact of the project on biodiversity extends across a larger landscape, as it influences the movement of wildlife, including birds, mammals, reptiles, and fish. The project's area of influence, determined through biodiversity assessments, encompasses regions identified as key habitats for these species, where they actively move and interact with their environment. Each sub-scheme of the project impacts these areas, reflecting the interconnectedness of ecosystems and wildlife movement patterns.

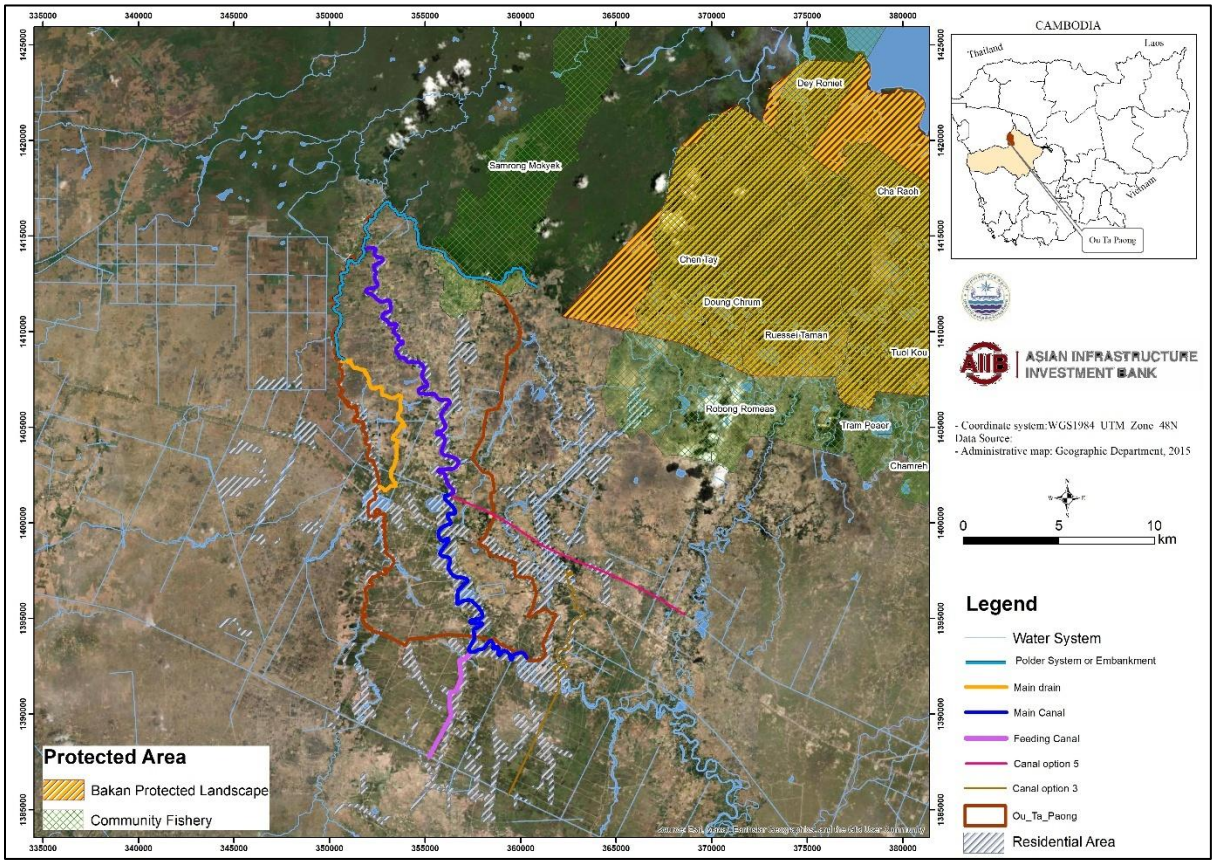
- **Ou Ta Paong**

The Ou Tapaong Irrigation Sub-scheme's estimated area of influence encompasses a) the entire command area (some 14,000 hectare, including the upper, middle, and lower parts), and b) any other areas outside the command area that project activities leave environmental footprint during project implementation, and sub-scheme operations. While the first is clear in terms of the boundary, the latter needs additional information based on the final project engineering design, and environment monitoring data to establish the additional area of influence that is outside of the command area (due to project's environmental footprint).

It is noted within the command area, there is a lake called Boeng Kanseang or Kanseang Lake which is home to fishes and birds. There are four (4) area located downstream the sub-scheme. The preliminary assessment focuses on the two (2) that are closest to the Ou Ta Paong: Flood Forest Conservation, b) Bakan Grassland protected area[4].

[4] Bakan grassland is a protected area for birds designated by sub-decree No. 144 in 2023.

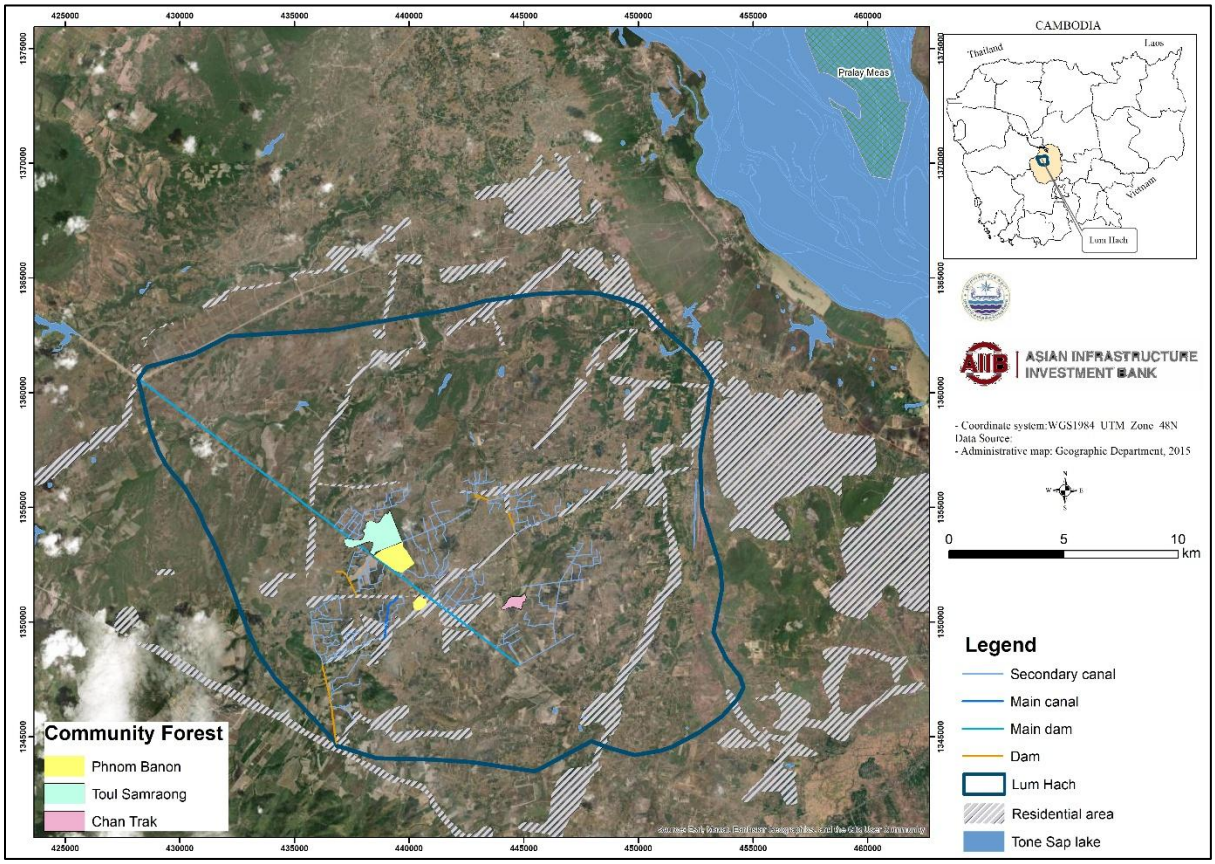
Figure 5.6: Map of Residential Area and protected areas in Ou Ta Paong



- **Lum Hach**

The Lum Hach Irrigation Sub-scheme has a limited area of influence due to its small size and the surrounding farmland. The initial identified critical habitats within the area include Toul Samraong, Phnom Banon, and Chan Trak Community Forests. These areas are characterized by small, fragmented, and degraded dry deciduous forests (DDFs). However, these forests are crucial for the conservation of Green Peafowl, which have been confirmed to be present in these areas. The protection and restoration of these community forests should be a priority in the biodiversity action plan.

Figure 5.7: Map of Construction Sites and Residential Area in Lum Hach



- **Stung Krang Ponley**

Brambei Mom. The Brambei Mom Irrigation Innovation sub-scheme has an extensive area of influence that includes adjacent communities and ecosystems dependent on its water resources. The areas directly affected by the project's activities include agricultural lands within a certain radius from irrigation canals or reservoirs.

Krapeu Truom. Potential areas of influence might include:

- **Downstream areas:** The lower reaches of the Stoeung Krang Ponley River and the Tonle Sap Lake, which may be affected by water quality, sediment loads, and fish migration from Krapeu Trom.
- **Upstream areas:** The upper reaches of the Stoeung Krang Ponley River and its tributaries, which may be influenced by water flow regulation and sediment transport from Krapeu Trom.
- **Adjacent ecosystems:** Forests, wetlands, and agricultural areas that are connected to Krapeu Trom through hydrological or ecological processes.

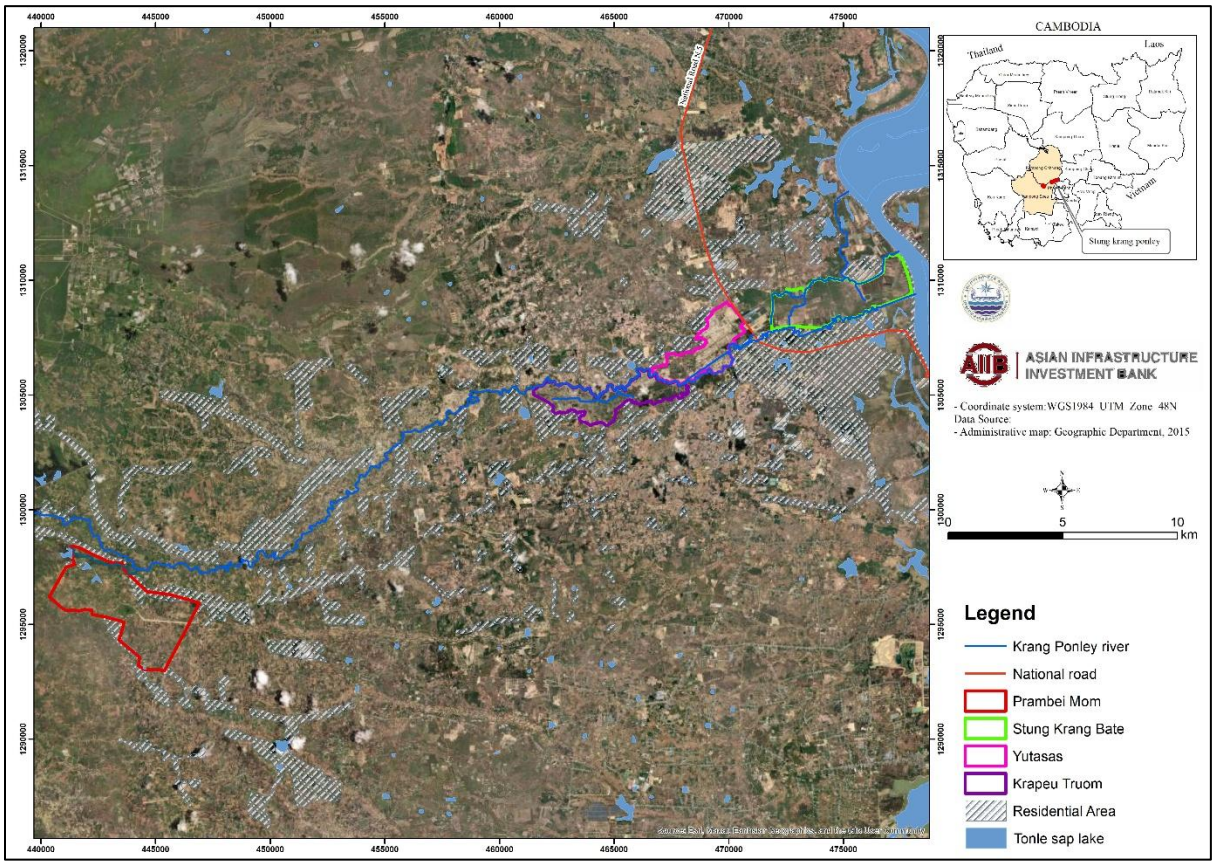
Yutasas. The area of influence for the Yatasas irrigation renovation scheme encompasses the direct and indirect impacts of the project. This includes:

- **Direct Impacts:** The immediate area where the irrigation infrastructure will be constructed and operated, including canals, pumping stations, and reservoirs.
- **Indirect Impacts:** The surrounding areas that may be affected by changes in water flow, land use, or other project-related activities. This includes the Stueng Krang Ponlai River, the Tonle River, and the habitats of endangered species within the Yotasas command area.

Stung Krang Bat. The area of influence for the Stueng Krang Bat irrigation sub-scheme encompasses both modified and natural habitats within its command area. It extends along the Tonle Sap River, encompassing floodplains, wetlands, and associated ecosystems. The project activities have the potential to directly or indirectly impact biodiversity within this region.

The area of influence for the Stueng Krang Bat irrigation sub-scheme includes both direct and indirect impacts. Direct impacts may occur within the project area itself, such as construction sites and irrigation canals. Indirect impacts may extend to surrounding areas, including the Tonle Sap River, wetlands, and adjacent ecosystems.

Figure 5.8: Map of Construction Sites and Residential Area in Stung Krang Ponley



5.2.2.3.5 Extent of Social Impacts

The Project's Area of Influence for social aspects extends beyond the immediate project site to include the broader region where the project's effects will be felt throughout its implementation

phases. This area encompasses not only the physical location of the project but also regions affected by environmental, physical, and biological changes resulting from project activities. Social interactions in this area of influence may involve communities and stakeholders impacted by changes in land use, water availability, employment opportunities, and local infrastructure development. These interactions might include shifts in livelihoods, migration patterns, or community dynamics because of project-related opportunities and disruptions, land acquisition and resettlement along the main canals, feeder canal, polder system, and farm roads, ethnic minority, gender, and loss of access to natural resources. Additionally, the area of influence considers the indirect impacts on health, education, and social services, as local populations respond to new economic and environmental conditions brought about by the project's operations. The social area of influence often aligns with the environmental footprint but also includes areas affected by induced socio-economic changes and community adaptations to these footprints. In addition, although the construction activities are at the existing systems, the impacts on cultural sites need to be carefully considered at the surrounding area ranging up to 500 m from the identified cultural sites.

We don't have any thing to say about the land acquisition only once the design is completed, the land acquisition needs to be conducted and update to the sub-scheme.

Figure 5.9: Maps of archaeological and cultural sites in and near Ou Ta Paong Sub-scheme

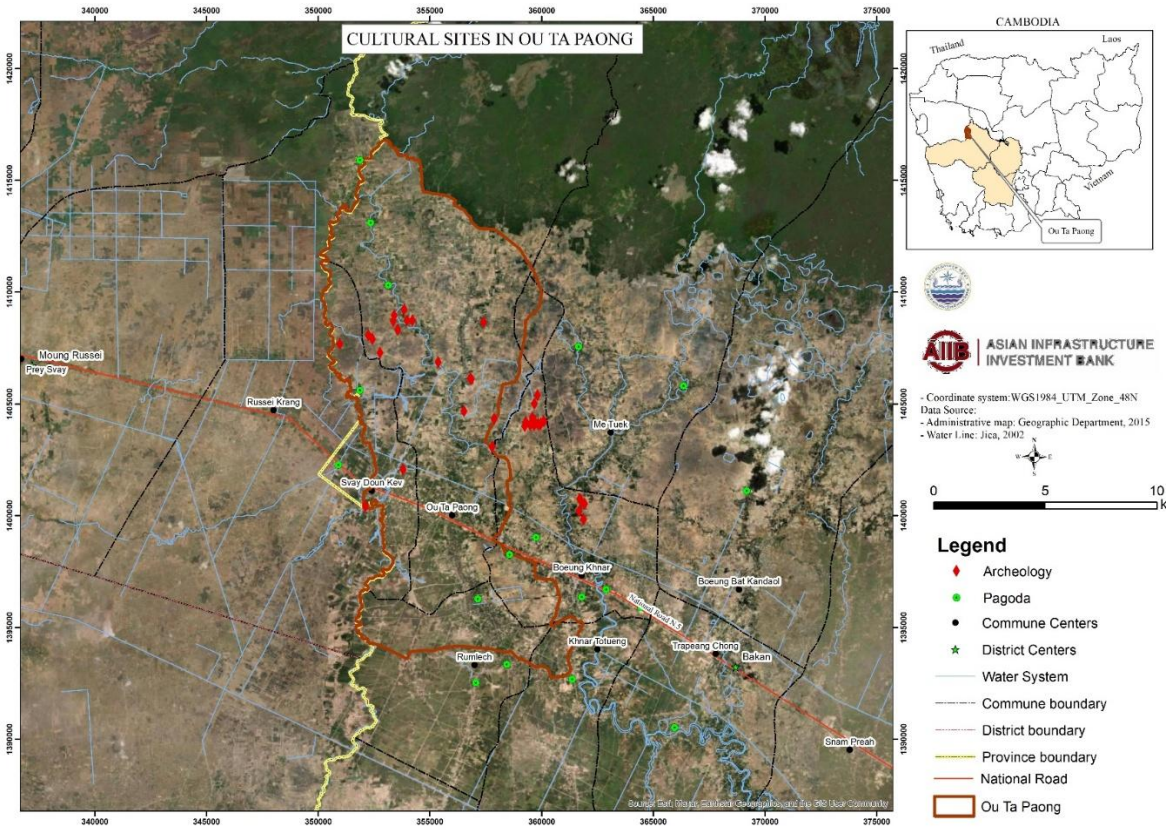


Figure 5.10: Maps of archaeological and cultural sites in and near Lum Hach Sub-scheme

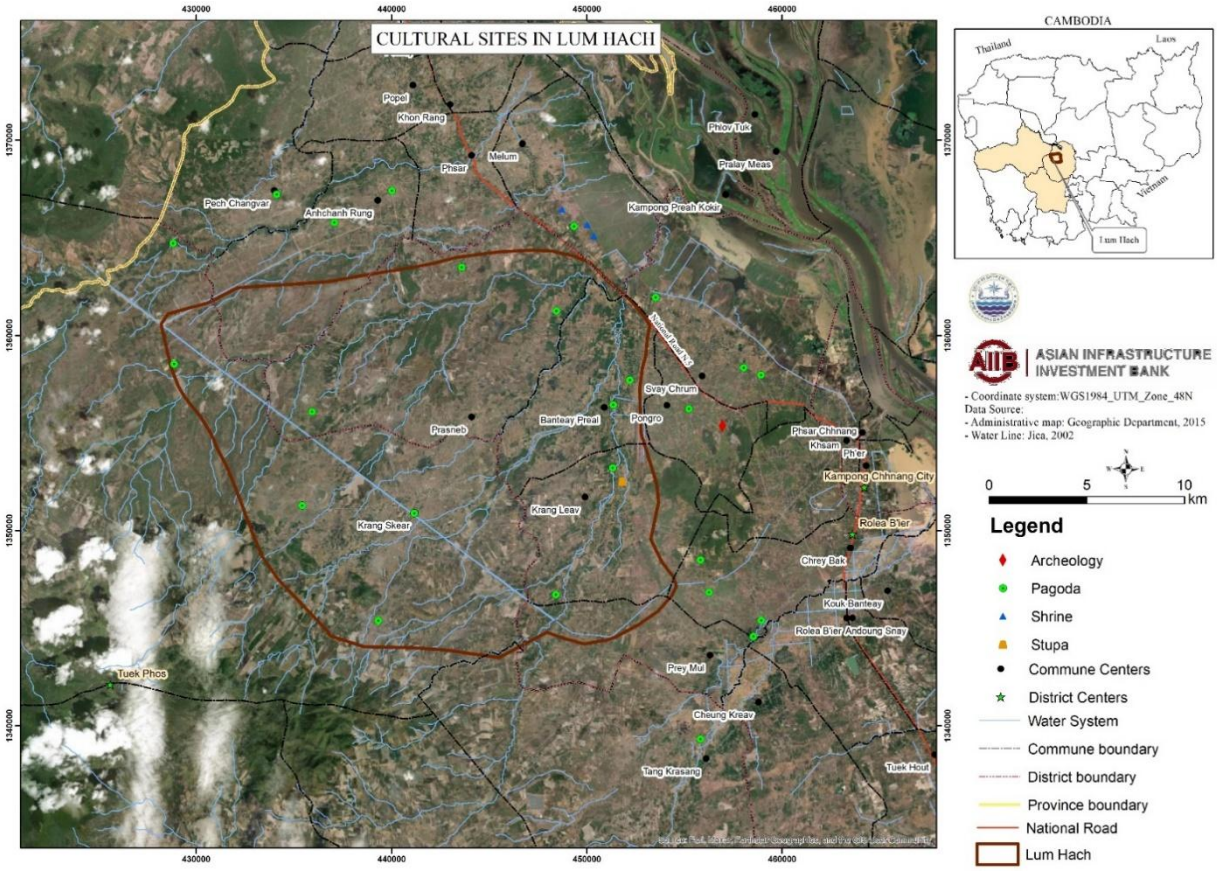
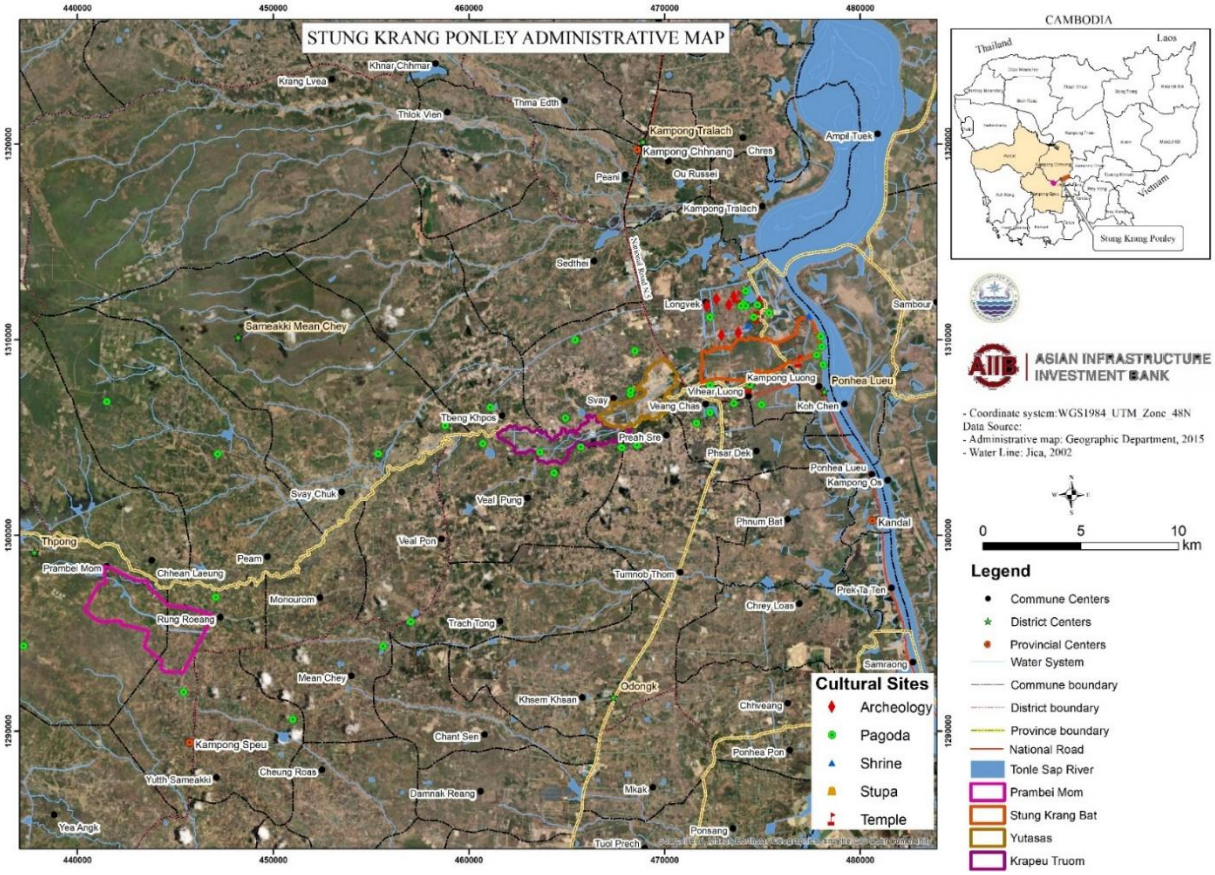


Figure 5.11: Maps of archaeological and cultural sites in Stung Krang Ponley Sub-scheme



CHAPTER 6 – BASELINE CONDITIONS

6.1 INTRODUCTION

This chapter provides a comprehensive overview of the existing environmental and social conditions within the project target areas. It serves as the baseline data, capturing the current state of the environment and social dynamics that may be influenced by the proposed project. Understanding these baseline conditions is crucial as environmental factors significantly contribute to poverty reduction and socio-economic development. This chapter focuses on the physical, biological, and socio-economic resources present in the area, establishing a foundation for assessing the potential impacts of the project. By presenting this detailed baseline information, we aim to highlight the intricate relationships between these resources and the broader environmental impacts within the project area. This understanding is essential for identifying the potential changes and influences the project may have, ensuring that all environmental and social aspects are carefully considered in the decision-making process.

6.2 METHODOLOGY

The collection and analysis of secondary and primary data to establish a set of environmental and social baseline conditions is an important part to identification and assessment of E&S risks and impacts. The method for collecting baseline information –as per the ToR, is described below.

6.2.1 Environmental and Natural Resources

6.2.1.1 Climate and Meteorology

Weather and climatic condition are essential to implementation and achieving expected results for project activities under Component 1 & 2.

a. Objective

The baseline data was collected to establish an overall understanding of the weather patterns and climatic conditions in the project area. This exercise was used to assess the current meteorological conditions in the project area, to analyze historical and existing weather patterns in the region, and to determine the meteorological characteristics specific to the project site.

b. Scope and Method

To establish baseline weather and climate conditions, the study will review and analyze climatic variability using available on-site data and records from Nasa Power website for each sub-scheme location. The parameters gathered from the study include rainfall, temperature, humidity, and wind speed.

6.2.1.2 Hydrological System and Water Quality

The construction of the irrigation system under CAISAR Project is expected to improve irrigation access for a total of 21,747 hectares[5] or rice field in six (6) (6 sub-schemes located across four (4) above mentioned provinces. The rehabilitation and operation of the irrigation systems may affect the water regime and quality of the river systems.

c. Objectives

This baseline data were to characterize the current baseline surface/groundwater quality of major streams and rivers that are directly connected with the command area of the six (6) sub–schemes, to compare the baseline water quality to relevant national and international standards, to identify and assess if project activities (during construction and during operation) would potentially affect the ground and survey water quality and the existing streams and rivers, and to identify measures to minimize potential impacts on water quality.

d. Scope and Method

The focus was on the environmental impacts, especially the natural water systems and the associated facilities which may limit the function of the system. The existing studies on hydrology and water systems within the project areas and water quality both surface and groundwater.

Parameters for water and soil testing were determined based on the environmental risks that are identified due to project activities for each of the six (6) sub–schemes (Table 6.1). The locations that are considered in the process of baseline information are provided below:

Table 6.1: Potential Risks at Different Activities/Stages should conduct water quality testing

No	Names of Sub–Schemes	Contamination of s**urface and ground water** due to project operation (increased use of chemical inputs) (Comp 1)	Contamination of **surface water** due to construction activities (Comp 2)	Contamination of **soils** due to construction (Comp 2)
1	Ou Ta Paong	X	X	X (upper part of OTB)
2	Lum Hach	X	X	X (main canal)
3	Brambei Mom	X	X	
4	Krapeau Trom	X	X	
5	Yutasas	X	X	
6	Steung Krang Bat	X	X	

Based on the nature of the risks, the following tests are proposed, including the time when the tests could be conducted to ensure result reliability.

- ***Testing for Surface Water Quality***

To establish a general baseline for **survey quarter quality**, the following parameters as per sub-decree 103 on water quality monitoring were tested in accordance with the Cambodia Drinking Water Quality Standard (CDWQS) of Cambodia.

[5] ToR for the ESCIA and ESCMP of the CAISAR Project

Table 6.2: List of parameters for surface and groundwater quality to be tested[6]

No.	Parameters	Unit	Standard		
			River	Lake and reservoir	CDWQS*
1	Depth				
2	pH	-	6.5-8.5	6.5-8.5	6.5-8.8
3	Electrode Conductivity (EC)	mg/l	500-1500	500-1500	-
4	Arsenic (AS)	mg/l	<0.01	<0.01	0.05
5	Cadmium (Cd)	mg/l	<0.003	<0.003	<0.003
6	Lead (Pb)	mg/l	<0.01	<0.01	0.01
7	Total Nitrogen (TN)	mg/l	<3	<2	-
8	Total Phosphorus (TP)	mg/l	<0.25	<0.15	-
9	Total Dissolved Solid (TDS)	mg/l	<1000	<1000	<800
10	Total Suspended Solid (TSS)	mg/l	<100	<100	-
11	Dissolved Oxygen (DO)	mg/l	>3	>4	-
12	Total Coliform	MPN/100ml	<1000	<1000	0

*. Cambodia Drinking Water Quality Standard

To obtain a representativeness for **surface water testing**, samples for surface water quality were taken as in table below. The number of samples are proposed based on the size of each sub–scheme and the connectivity of these sub–schemes. More samples are proposed for Ou Ta Paong because OTP is the largest and most complex scheme. Brambei Mom, Krapeau Trom, Yutasas, and Steung Krang Bat are connected and close to each other geographically. Thus 1 sample is proposed for each site (Table 6.3).

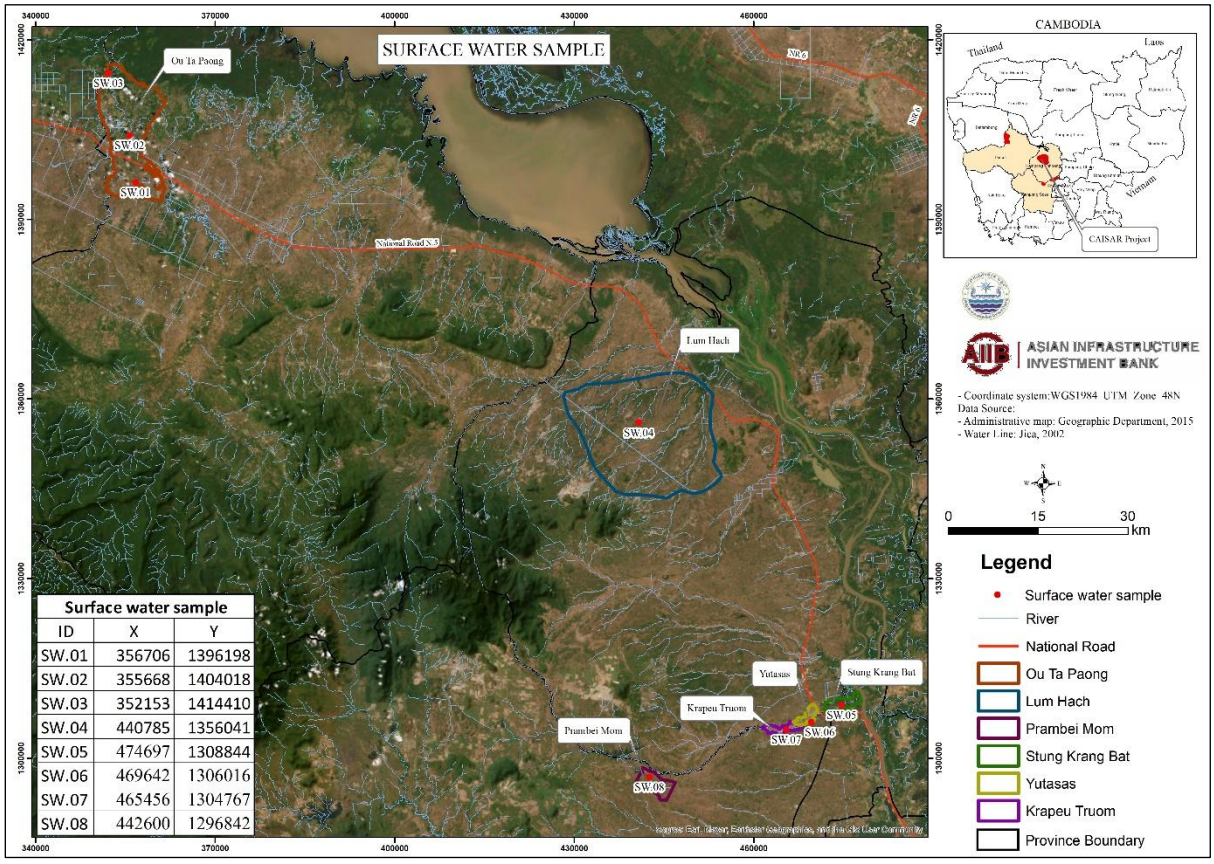
Table 6.3: The selected locations for surface water sample collection

No	Names of Sub–Schemes	Upstream	Middle	Downstream	Total
1	Ou Ta Paong	1	1	1	3
2	Lum Hach		1		1
3	Brambei Mom		1		1
4	Krapeau Trom		1		1
5	Yutasas		1		1
6	Steung Krang Bat		1		1
	Total	**1**	**6**	**1**	**8**

The locations of the sample collection are presented in Figure 6.1. The samples, labelled SW1 to SW8 respectively, were selected between 10 and 11 August 2024.

[6] Sub-decree No. 103 on the amendment of article #4, $9, #11, #12, and #17 and Appendix 2, Appendix 3, Appendix 5 Sub-decree No. 27 on Water Quality Control

Figure 6.1: Map showing the locations of selected surface water samples



Surface water sample		
ID	X	Y
SW.01	356706	1396198
SW.02	355668	1404018
SW.03	352153	1414410
SW.04	440785	1356041
SW.05	474697	1308844
SW.06	469642	1306016
SW.07	465456	1304767
SW.08	442600	1296842

The geographical positions and descriptions of the surface water sampling points are given in Table 6.4.

Table 6.4: Locations of surface water quality sampling

Sub-Scheme	Label	Location				UTM	
		Province	District	Commune	Village	X	Y
Ou Ta Paong	SW1	Pursat	Bakan	Rumlech	Prasat	356706	1396198
	SW2	Pursat	Bakan	Ou Ta Paong	Bat Kokir Thmei	355668	1404018
	SW3	Pursat	Bakan	Ou Ta Paong	Ta Nai	352153	1414410
Lum Hach	SW4	Kampong Chhnang	Rolea Bíer	Prasneb	Chonleav	440785	1356041
Stung Krang Bat	SW5	Kampong Chhnang	Kampong Tralach	Longvek	Wat	474697	1308844
Yutasas	SW6	Kampong Speu	Odongk	Preah Sre	Ta Cheal	469642	1306016
Krapeu Truom	SW7	Kampong Speu	Odongk	Veal Pung	Phkor	465456	1307467

Prambei Mom	SW8	Kampong Speu	Thpong	Prambei Mom	Tang Pou	442600	1296842

In addition, since some community people use groundwater for irrigation, **three (3) groundwater samples** were collected for testing, including one (1) in Ou Ta Paong sub-scheme, one (1) in Lum Hach sub-scheme and one (1) for Krang Ponley. The water from tube wells will be sampled after 5–10 min of pumping to flush the standing water out. The groundwater analytical method follows the same method as surface water quality testing whereas the parameters are following the minimum standard of the Cambodian Drinking Water Quality Standard (CDWQS) (Figure 6.2 and table 6.5).

Figure 6.2: Map showing the locations of selected groundwater samples

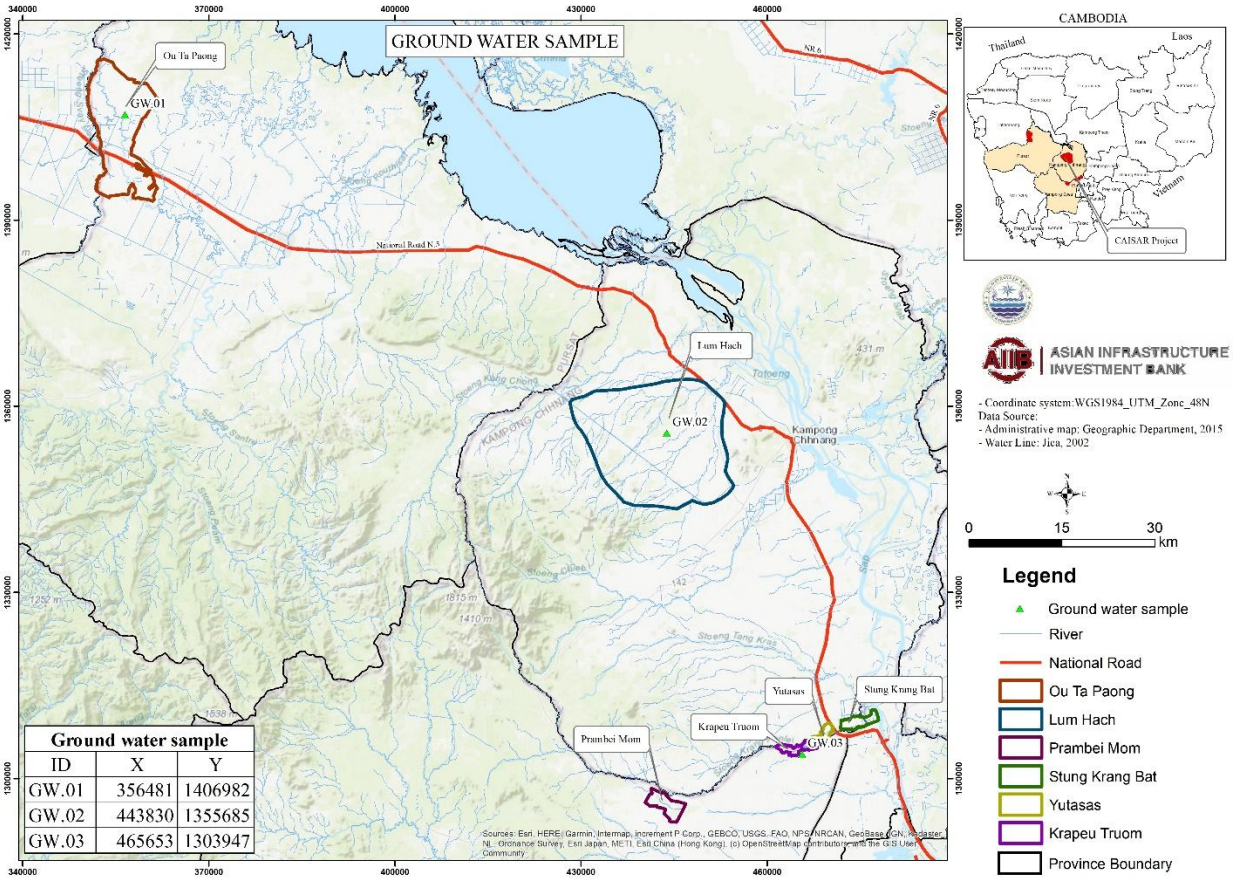


Table 6.5: Groundwater sampling locations

No.	Location				UTM	
	Province	District	Commune	Village	X	Y
GW1	Pursat	Bakan	Ou Ta Paong	Oknha Moan	356481	1406982
GW2	Kampong chhnang	Rolea Bíer	Prasneb	Prey Sampov	443830	1355685

GW3	Kampong Speu	Odongk	Veal Pung	Khnaor Ampil	465653	1303947

- ***Testing for contamination of surface and ground water due to project operation (increased use of chemical inputs) (Comp 1)***

It is anticipated that use of chemical inputs such as pesticides and chemical fertilizers would be increased due to intensified crop production (rice) – indicative of increased area of cultivation per year and increased use of shorter rice varieties. Since testing of pesticide has not been yet available in Cambodia, the ESCIA suggests the testing of pesticides to be done at year 1 of project implementation and testing potentially carried out abroad as per the suggestion in Table 9.1 and Table 9.3 of Chapter 9.

- **Testing for contamination of surface water due to project construction (Comp 2)**

Since the scope and location where canal would be rehabilitated have not yet been confirmed at this stage, testing for contamination of surface water due to project construction will be determined when detailed design is available.

- **Test for soil**

Testing for soil will be taken focusing on 1) materials that will be dredged at certain part of Ou Ta Paong River and the main canal of Lum Hach and 2) disposal sites. Since exact locations where dredging will be carried out and where materials will be disposed of have not been determined at this stage, soil testing for these locations will not be carried out as part of this ESCIA until the detailed design stage for Ou Ta Paong and Lum Hach.

6.2.1.3 Air Quality, Noise and Vibration

At the time of construction, the project may cause generation of noise, emission of dust and gases, and vibration.

a. Objectives

The purpose of the noise, vibration, and air quality assessment is to ensure the project maintains a safe and healthy environment for the local community and ecosystem by evaluating current conditions and identifying potential impacts and mitigation measures.

- Review the available baseline for air quality, noise, and vibration in the project area.
- Determine the potential for vibration, air, and noise emissions from the project, and identify any potential impacts on sensitive and vulnerable locations.
- Identify suitable management and mitigation measures to minimize any direct adverse effects from vibration, noise, and air emissions associated with the project.

b. Scope of Work and Methodology

As the construction is expected to begin at the end of 2027, the ESCIA recommends the baseline data collection of the air quality and noise and vibration to be conducted prior to the construction (early 2027) as this period holds high potential of being changed. Therefore, ESCIA leveraged the existing data from the Ministry of Environment and other ESIA reports within the locations

nearby to the project. In addition, the project's rural location, it is anticipated that project activities will have minimal impact on these environmental factors. Moreover, key Informant Interviews with village leaders included rating questions regarding the status of these parameters. The proposed locations for air quality, noise and vibration are proposed as Table 6.6 bellow.

Table 6.6: Locations of air quality, noise and vibration

Sub-Scheme	Label	Location				UTM	
		Province	District	Commune	Village	X	Y
Ou Ta Paong	ANV1	Pursat	Bakan	Rumlech	Prasat	356908	1395649
	ANV2	Pursat	Bakan	Ou Ta Paong	Bat Kokir Thmei	355879	1404046
Lum Hach	ANV3	Kampong Chhnang	Rolea Bíer	Prasneb	Chonleav	444325	1355032
	ANV4	Kampong Chhnang	Rolea Bíer	Banteay Preal	Ou Leach	450811	1357200
Stung Krang Bat	ANV5	Kampong Chhnang	Kampong Tralach	Longvek	Wat	473811	1311192
Yutasas	ANV6	Kampong Speu	Odongk	Preah Sre	Ta Cheal	470186	1305388
Krapeu Truom	ANV7	Kampong Speu	Odongk	Veal Pung	Phkor	465547	1304414
Prambei Mom	ANV8	Kampong Speu	Thpong	Prambei Mom	Tang Pou	443191	1297797

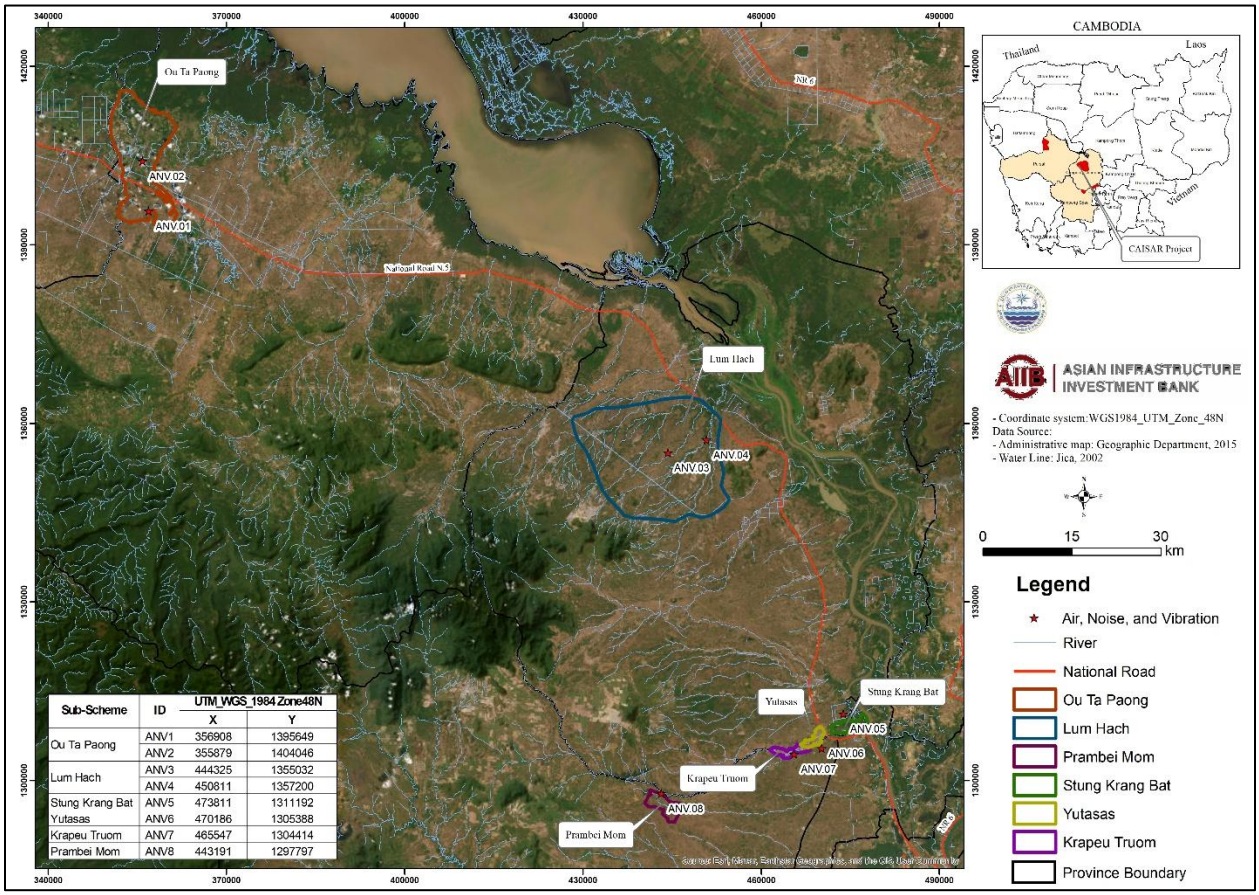
The standard of air quality and noise of the IFC EHS is required to be used as the national standard of Cambodia, sub-decree No. 42 on Air Pollution Control and Noise Disturbance (2000) is less stringent. This standard is slightly different from the IFC standard.

Table 6.7: The noise standard

No.	Area	Period of Time[7]			IFC[8]	
		From 6 to 18	From 18 to 22	From 22 to 6	Daytime 07.00-22.00	Nighttime 22.00-07.00
1	Quiet Areas - Hospitals - Libraries - School - Kindergarten	45	40	35		
2	Residential area - Hotels - Administration offices	60	50	45	55	45
3	Commercial and service areas	70	65	50	70	70

[7] Sub-decree No. 42 on Air Pollution Control and Noise Disturbance (2000)
[8] IFC Environmental, Health, and Safety (EHS) Guidelines 2007

4	Small industrial industries intermingling in residential areas	75	70	50		



Sub-Scheme	ID	UTM_WGS_1984 Zone48N	
		X	Y
Ou Ta Paong	ANV1	356908	1395649
	ANV2	355879	1404046
Lum Hach	ANV3	444325	1355032
	ANV4	450811	1357200
Stung Krang Bat	ANV5	473811	1311192
Yutasas	ANV6	470186	1305388
Krapeu Truom	ANV7	465547	1304414
Prambei Mom	ANV8	443191	1297797

6.2.1.4 Geology, Soil and Land Cover

The project promotes intensification of agricultural production, and the construction of the irrigation system which will, potentially if not manage properly, cause the degradation of soil and land cover.

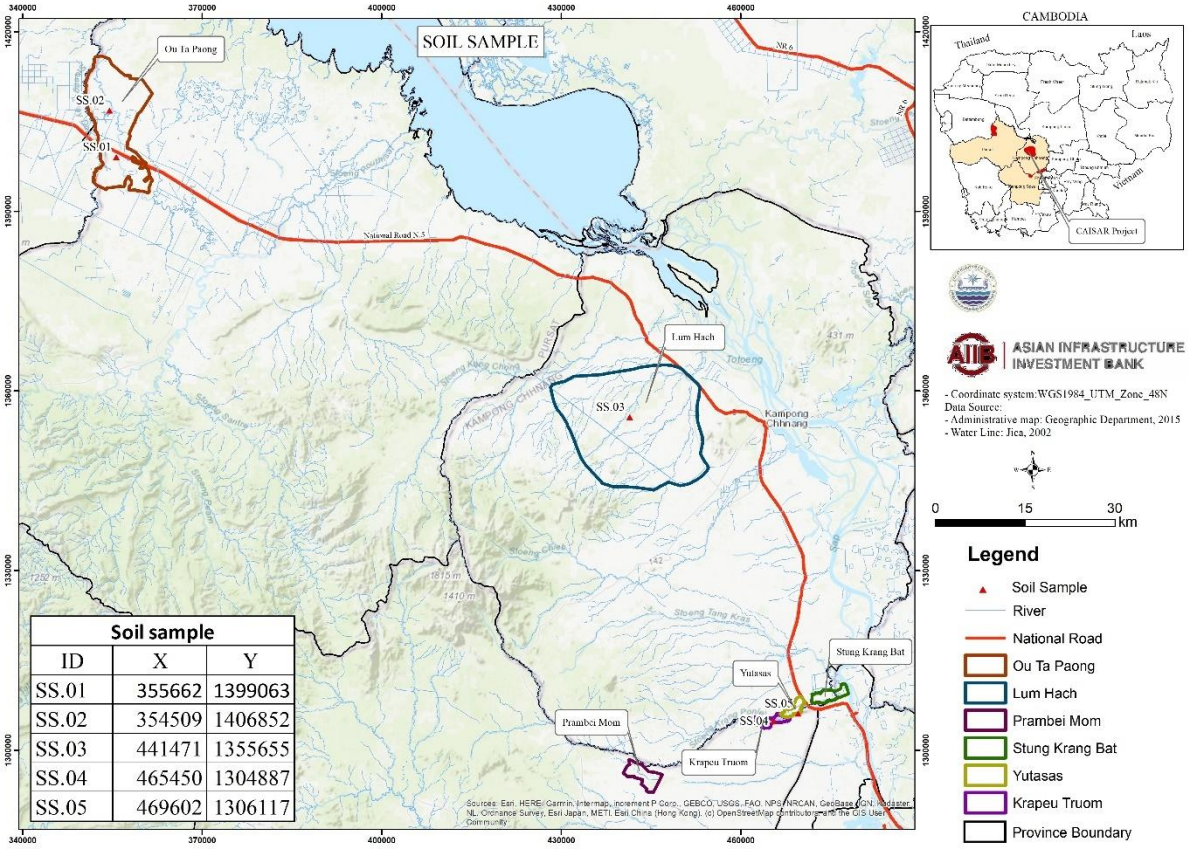
a. Objectives

The purpose of the soil quality baseline studies is to ensure sustainable land use and minimize adverse impacts on soil quality due to the project. The objectives of the study are to identify the current soil quality in key areas (e.g., land/plantation) near the project site, and to compare the primary data to national standards.

b. Scope of Work and Methodology

The primary data on soil quality and land pollution were determined through testing and reviewing the existing document relevant to the contamination of the soil within the area. Soil quality for agriculture were tested in five (5) locations as per shown in Figure 6.3.

Figure 6.3: Map with illustration of locations of soil quality samples



Soil sample		
ID	X	Y
SS.01	355662	1399063
SS.02	354509	1406852
SS.03	441471	1355655
SS.04	465450	1304887
SS.05	469602	1306117

As per the guidance of MoE, the process will involve the collection of soil samples through the division of soil sampling area into equal-sized squares. Within each square, soil samples will be collected at the four (4) corners and the center, reaching a depth of approximately 50 centimeters below the topsoil. The collected soil from each square will be thoroughly mixed before being divided into four (4) equal portions. Subsequently, one (1) of these portions will be further divided into four (4) equal parts, with one (1) of the resulting sub-samples placed in a sample bag for storage taken for testing.

The primary data on soil quality and land pollution will be analyzed and compared to the national standard. Thirteen soil quality parameters in the context of agriculture as per the Circular No. 120 of Ministry of Environment were tested including:[9]

- ✓ Soil classification or particle size,
- ✓ Soil moisture,
- ✓ Nitrogen (N), Phosphorus (P), Potassium (K), Magnesium (Mg), Sodium (Na),
- ✓ Organic Metter
- ✓ Ratio of the mass of carbon to the mass of nitrogen in organic residues (C/N Ratio),

[9] Circular No. 120 on the Guidance for the development of Terms of Reference for the Infrastructure and Tourism development, MoE

- ✓ Total phosphorus (P),
- ✓ Cation exchange capacity (CEC),
- ✓ pH,
- ✓ Electrode Conductivity.

6.2.1.5 Biodiversity Assessment

a. Objectives

The specific purposes of the biodiversity and ecosystem services assessment is to confirm the status of key wildlife species and endangered and critically endangered fish species in each project site/catchment area for ensuring the protection and sustainable management of natural resources and livelihood improvement. This includes evaluating current conditions, potential impacts, and developing mitigation and compensation measures. The identification and evaluation of Priority Biodiversity Values (PBV) help prioritize areas with exceptional biodiversity or crucial ecological functions

b. Scope and Methodology

The assessment of the biodiversity involved the reviews of existing documents regarding the status of species as well as the engagement and consultations with stakeholders who have the necessary expertise at the target areas. In combination with the biodiversity screening report from the E&S screening team, 25 species (EN and CR) that are potentially present in the project's area of influence (Please see list of the 25 species in Table 5).

As part of the biodiversity assessment, the following key works were carried out.

- Review the habitat types contained within the Project area and classify the habitat as either natural, critical, or modified (as per IFC Performance Standards (PS) 6, Guidance Note (GN) paragraph 39).
- Review the data available from the ESDD, online data sources including the Integrated Biodiversity Assessment Tool and from interviews/consultation to screen for any critical habitat values that may be present within an appropriate area of assessment for the Project as per the IFC PS6 GN.
- Map the extent and condition of Natural and Modified Habitats, as defined in IFC PS6.
- Conduct the consultation with local experts to assess potential for the presence of sensitive species identified from IBAT screening to occur on-site.
- Consult the survey results with local and international NGOs to assess potential impacts to sensitive/protected areas identified from IBAT and other screening, e. g., Important Bird Area (IBA), including potential impacts from the Project's Associated Facilities.
- Provide a list of potential priority biodiversity values associated with the project according to the principles of vulnerability and irreplaceability per IFC PS 6 Guidance Note 6.
- Confirm Habitat designation based on priority biodiversity values, and conducted Critical Habitat Assessment as per IFC PS6 requirements.

- Analysis of survey results and data to provide the level of details to assess potential impacts to avifauna (birds and bats).
- Propose mitigation measures (including Biodiversity Action Plan).

The methodology is applied to both Forest Resources and Wildlife and Aquatic Biodiversity and Fisheries.

6.2.2 Socio-Economic Resources

6.2.2.1 Socio-Economic Survey

The project is estimated to benefit 100,000 households[10] residing within the six (6) sub-schemes of the four (4) provinces. Paddy rice is the main agricultural production for the benefited households, using the irrigation water from the systems. The assessment of socio-economic situation is to determine the scale of the impacts which they may face.

c. Objectives

The purpose of the socio-economic survey is to establish a baseline information of the project's beneficiaries and the potentially affected households within the project areas.

d. Scope of Work and Methodology

The socio-economic survey was conducted through various approaches including focus group discussion (FGDs), Key Informant Interviews (KIIs) and household survey.

Qualitative Information

The selection of the communes is conducted based on geographical location of each commune within the sub-schemes, i.e. upstream, middle and downstream. In addition, the commune with larger administrative boundary within the sub-scheme command area will be prioritized. The number of selected communes equal to 70% (14/20) of the total communes within the command areas whereas the number of selected villages represent 37% of the total villages in all sub-scheme (31/83 villages). The result of the number of selected communes and villages for each sub-scheme is presented in Table 6.8.

Table 6.8: The selected communes and villages for consultation in the six (6) sub-schemes

No.	Scheme Name	No. of Commune	No. of Selected Commune	No. of Total Village	No. of Selected Villages
1	Ou Ta Paong	7	4	26	8
2	Lum Harch	5	3	32	9
3	Kropeu Trom	3	2	9	4
4	Yotasass	1	1	5	3
5	Stoeung Krang Bat	2	2	2	2
6	Brambei Mom	2	2	9	5

[10] The latest figure from the engineering team of CAISARP

No.	Scheme Name	No. of Commune	No. of Selected Commune	No. of Total Village	No. of Selected Villages
Total		**20**	**14**	**83**	**31**

The consultations which were conducted including Focus Group Discussion (FGD) and Key Informant Interviews (KII). The question guides for KIIs with Farmer Water User Group (FWUG), Community Forestry (CF), Community and Fisheries (CFi) will be asked on relevant aspects to their situation and impact from the project. Vegetable farmers, rice farmers, poultry farmers and agricultural cooperatives (ACs) will be also consulted to understand changes as per the result of the project, both positive and negative. The identified list of KII is provided in Table 6.9 below:

Table 6.9: List of identified KIIs at local level

No.	Scheme Name	# of KII			
		FWUG	CF/CFi	AC	Total
1	Ou Ta Paong	1	1	3	5
2	Lum Hach	1	2	1	4
3	Kropeu Trom	1	1	3	5
4	Yotasass	1	1	1	3
5	Stoeung Krang Bat	1	0	1	2
6	Brambei Mom	1	1	1	3
Total		**6**	**6**	**10**	**22**

List of tools used for data collection of each group is provided as Annexes.

In addition, 30% of the FGDs will be given to the vulnerable groups for the number of FGDs in the target villages. The figures of the FGDs are provided in Table 6.10.

Table 6.10: List of FGDs to be consulted for agricultural production

No.	Scheme Name	No. of Selected Villages	# of FGDs				
			Veg. Farmers	Rice Farmers	Chicken Farmers	Duck Farmers	Total
1	Ou Ta Paong	8	3	6	2	2	**13**
2	Lum Hach	9	3	6	2	2	**13**
3	Krapeu Truom	4	3	3	2	2	**10**
4	Yutasas	3	3	3	2	2	**10**
5	Stoeung Krang Bat	2	1	2	1	1	**5**
6	Brambei Mom	5	3	4	2	2	**11**
Total		**31**	**16**	**24**	**11**	**11**	**62**

Quantitative Information

As per the household survey is also important, the household survey was conducted to gather additional information regarding socio-economic data at household level. The calculation of sample size for the survey used the following formula:

$$x = Z^2 * r * (100 - r)$$

$$n = \frac{N * x}{(N-1)E^2 + x}$$

Where (Z) is confidence level, (r) is sample proportion rate, and (E) is error margin. Using the margin error of 6%, confidence level of 95%, sample proportion rate at 50%, the number of sample size to be interviewed is calculated at 263. The project rounded the number to 270 HHs. This sample size is distributed across the 3 target ESCMP sub-schemes and types of the benefits they are expected to obtain from the project. The proposed sample size and distribution is provided in Table 6.11.

Table 6.11: Sample sizes for socio-economic data collection at household level

No.	Scheme Name	No. of HHs	HH Survey		
			Beneficiary HHs	Potentially Adversely Affected HHs	Total
1	Ou Ta Paong	15,000	95	45	140
3	Krapeu Truom	700	45	20	65
4	Yutasas	650	45	20	65
Total		**16,350**	**185**	**85**	**270**

6.2.2.2 Cultural Heritage and Archaeology

a. Objectives

The purpose of the archaeology and cultural heritage assessment is to ensure the protection and preservation of cultural and historical sites potentially affected by the project. This involves identifying significant sites and developing strategies to mitigate impacts.

b. Scope of Work and Methodology

All existing archaeological and cultural heritage were recorded for each sub-scheme. Consultations were conducted with relevant authorities as applicable to determine any potential negative impacts on cultural heritages so that the construction can be avoided and mitigation measures can be proposed, if not avoidable.

Key questions regarding the cultural heritages and archaeological sites were included in the KIIs with provincial department of culture and fine art, district governors, and commune leaders.

6.3 PHYSICAL AND ENVIRONMENTAL CONDITIONS

6.3.1 Geological Conditions

6.3.1.1 Ou Ta Poang

The geology of Ou Ta Poang is predominantly characterized by deltaic deposits, which cover 83.91% of the area, indicating that this region is primarily formed by sediment deposits from rivers, likely contributing to fertile land. Organic deposits, which are found in swamp areas, make up 6.64%, suggesting the presence of wetlands that might play a role in sustaining biodiversity.

Floodplains account for 7.68%, indicating seasonal flooding, while a small portion, 1.77%, is water, likely from rivers or lakes within the area.

6.3.1.2 Lum Hach

The geology of Lum Hach is dominated by pediments, which make up 88.66% of the area. These gently sloping rock formations suggest significant erosion processes shaping the landscape. The sub-scheme has minor deltaic deposits (3.49%) and floodplains (6.52%), indicating some water-influenced geological features. Additionally, small percentages of various rock types such as rhyolite, dacite, granite, and metamorphic rocks reflect a diverse and complex geological structure, with potential implications for mineral resources or variations in soil properties.

6.3.1.3 Stung Krang Ponley

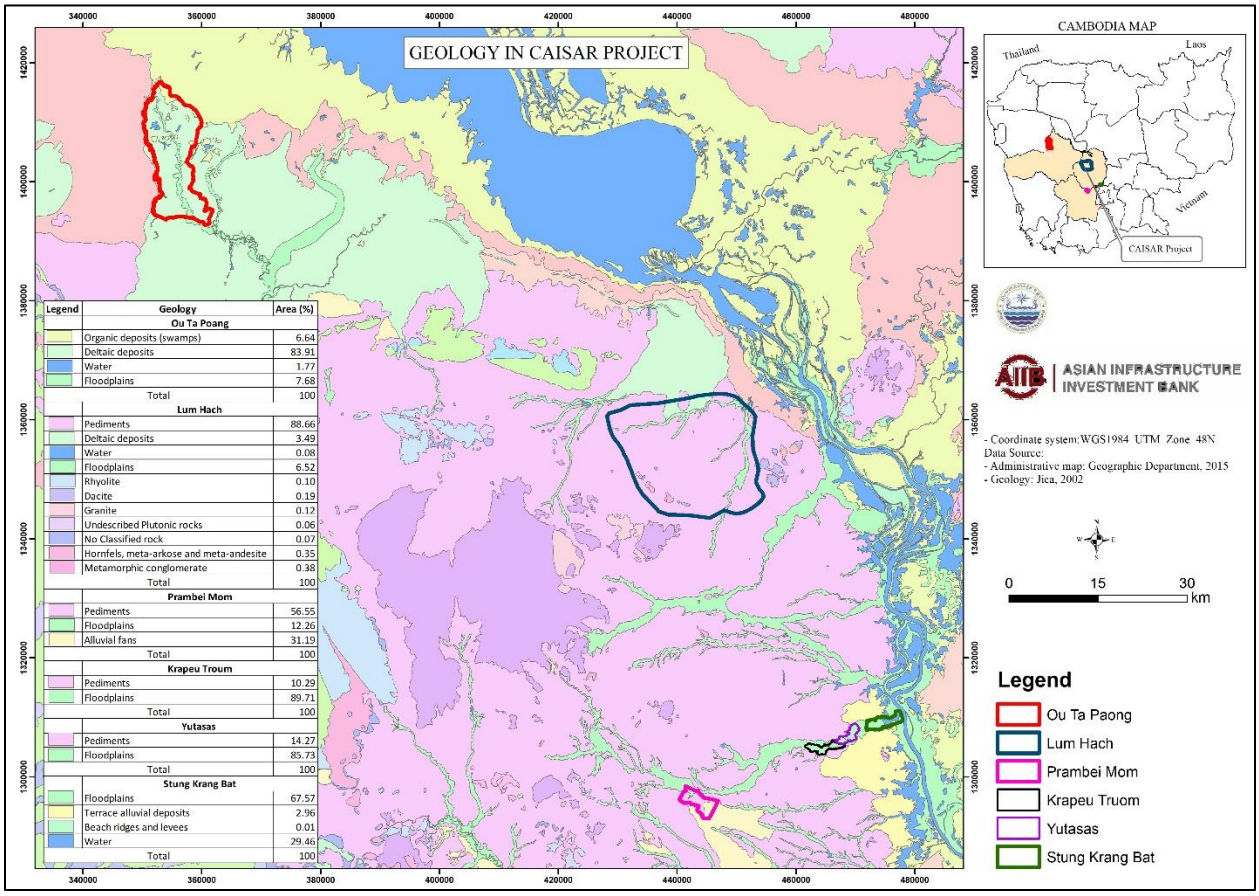
Prambei Mom. Prambei Mom is primarily composed of pediments, covering 56.55%, indicating the dominance of weathered rock formations. Alluvial fans account for 31.19%, suggesting areas where sediments are deposited by flowing water, often near mountain bases. Floodplains occupy 12.26%, reflecting regions that are seasonally flooded and may be important for agriculture or water management.

Krapeu Troum. The geology of Krapeu Troum is overwhelmingly characterized by floodplains, which cover 89.71% of the area, indicating that the region is highly influenced by periodic flooding, likely contributing to fertile soils for agricultural use. Pediments, which account for the remaining 10.29%, suggest some areas of more stable and eroded rock formations.

Yutasas. Yutasas is dominated by floodplains, which constitute 85.73% of the area, indicating frequent flooding and fertile soil suitable for agricultural practices. Pediments cover 14.27% of the area, suggesting some eroded rock formations. This geological composition highlights the importance of water management in this sub-scheme due to the extensive floodplain areas.

Stung Krang Bat. The geology of Stung Krang Bat is mainly composed of floodplains (67.57%), which indicates a landscape shaped by seasonal flooding, likely suitable for farming. Water bodies cover 29.46% of the area, emphasizing the significance of water features in this region. Terrace alluvial deposits make up a small portion (2.96%), which could represent old floodplain areas, while beach ridges and levees, though minimal (0.01%), suggest some coastal or riverine features.

Figure 6.4: Geological Map of the sub-schemes



Legend	Geology	Area (%)
	Ou Ta Poang	
	Organic deposits (swamps)	6.64
	Deltaic deposits	83.91
	Water	1.77
	Floodplains	7.68
	Total	100
	Lum Hach	
	Pediments	88.66
	Deltaic deposits	3.49
	Water	0.08
	Floodplains	6.52
	Rhyolite	0.10
	Dacite	0.19
	Granite	0.12
	Undescribed Plutonic rocks	0.06
	No Classified rock	0.07
	Hornfels, meta-arkose and meta-andesite	0.35
	Metamorphic conglomerate	0.38
	Total	100
	Prambei Mom	
	Pediments	56.55
	Floodplains	12.26
	Alluvial fans	31.19
	Total	100
	Krapeu Troum	
	Pediments	10.29
	Floodplains	89.71
	Total	100
	Yutasas	
	Pediments	14.27
	Floodplains	85.73
	Total	100
	Stung Krang Bat	
	Floodplains	67.57
	Terrace alluvial deposits	2.96
	Beach ridges and levees	0.01
	Water	29.46
	Total	100

6.3.2 Topography

6.3.2.1 Ou Ta Paong

Ou Ta Paong lies at a low elevation of less than 40 meters, indicative of flat, low-lying terrain. This relatively low elevation, combined with its predominant deltaic deposits and floodplains, suggests a region that is prone to seasonal flooding and is likely situated near river systems or coastal plains. The flat terrain, coupled with its elevation, makes it well-suited for agriculture but vulnerable to waterlogging.

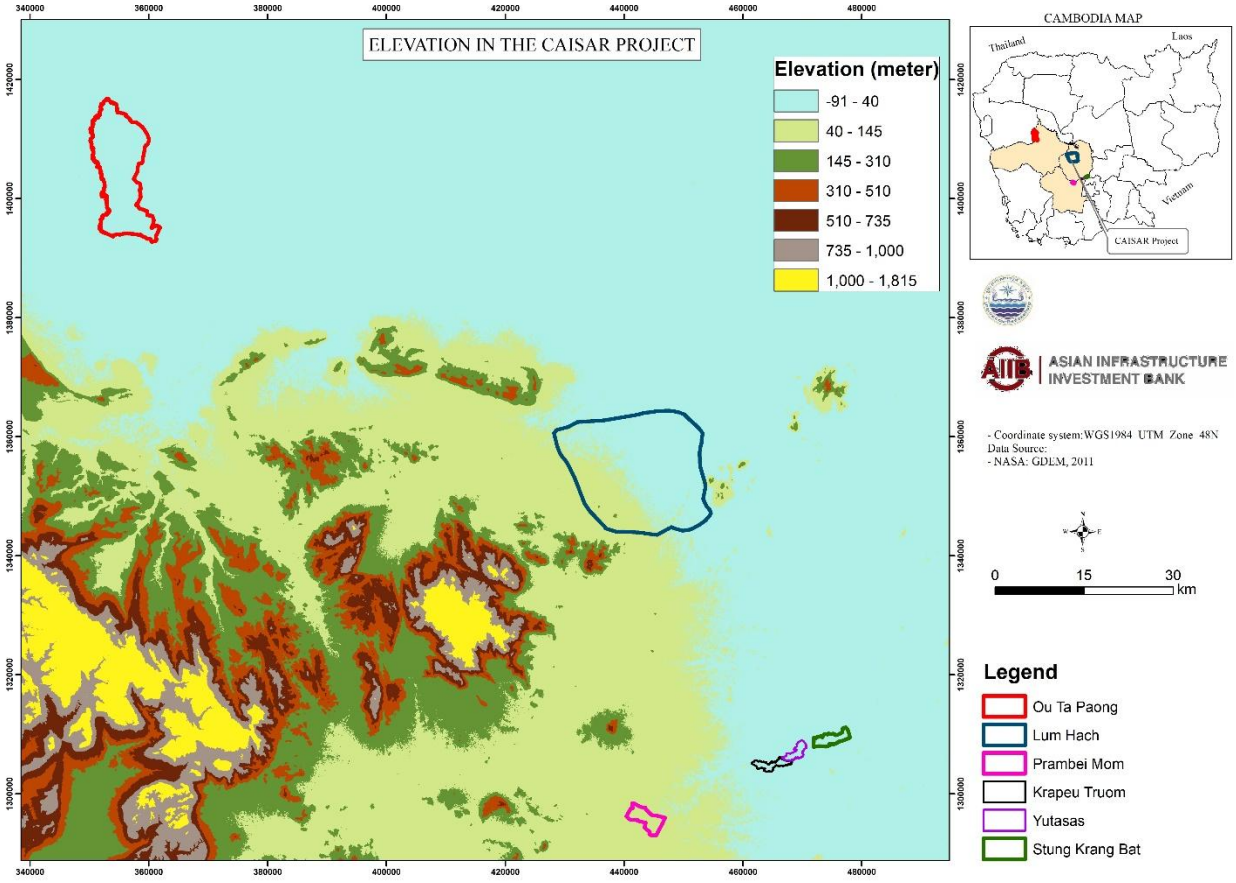
6.3.2.2 Lum Hach

Lum Hach features a more varied topography, with some areas having an elevation between 40 and 145 meters and others below 40 meters. The higher elevation areas (40-145 m) are likely associated with pediments, suggesting gently sloping terrain or foothills that may have experienced significant erosion. Meanwhile, the lower elevation areas (<40 m) are likely to be floodplains or deltaic regions, indicating a mix of flat and slightly undulating landscapes. The variation in elevation indicates more diverse landforms and potential differences in land use practices.

6.3.2.3 Stung Krang Ponley

Prambei Mom. Prambei Mom is situated in an elevation range between 40 and 145 meters, indicating moderate terrain with gentle to more noticeable slopes, particularly in pediment areas. The presence of alluvial fans further supports the idea of sloping land, as they are formed by sediment deposition on sloped surfaces. The higher elevation, relative to the other sub-schemes, suggests that the region might have less flooding risk compared to the floodplains, but the terrain is still conducive to water flow and drainage from nearby hills or mountains.

Figure 6.5: Topographical map of the project area



Krapeu Troum. The sub-scheme, with an elevation of less than 40 meters, has a predominantly flat topography. This low-lying region is dominated by floodplains, reflecting its susceptibility to seasonal flooding and water accumulation. The low elevation also suggests proximity to rivers, lakes, or coastal areas where sediment deposition has shaped the landscape. The flat terrain at this low elevation is likely ideal for wetland ecosystems or agriculture but may require careful water management.

Yutasas. The area is another low-elevation sub-scheme with terrain less than 40 meters. The topography here is mostly flat, with large expanses of floodplains. The presence of pediments suggests there may be minor elevations or gentle slopes within the otherwise flat landscape. However, the general topography is primarily low-lying, prone to seasonal

floods, and likely situated near river systems. This type of terrain is typically fertile but may face waterlogging challenges.

Stung Krang Bat. Stung Krang Bat is characterized by low-lying terrain with an elevation of less than 40 meters, like several other sub-schemes. The predominance of floodplains and significant water bodies at this elevation indicates that the region is flat, with large areas subject to periodic flooding. The overall flatness and low elevation suggest that the region may be part of a larger river basin or coastal plain, contributing to fertile soil and abundant water resources, but also presenting challenges related to flood risk management.

6.3.3 Soil Types

6.3.3.1 Cambodia

Dr. Crocker travelled across Cambodia to create a map, with a scale of 1 to 1,000,000 and it was publicly published by the Ministry of Agriculture in 1963 (Crocker, Charles D, 1962). The soil of Cambodia is classified into 16 types according to the soil taxonomy of the Ministry of Agriculture, the United States of America. Table below is the detailed information on 16 types of soil in Cambodia (please see in table 6.12).

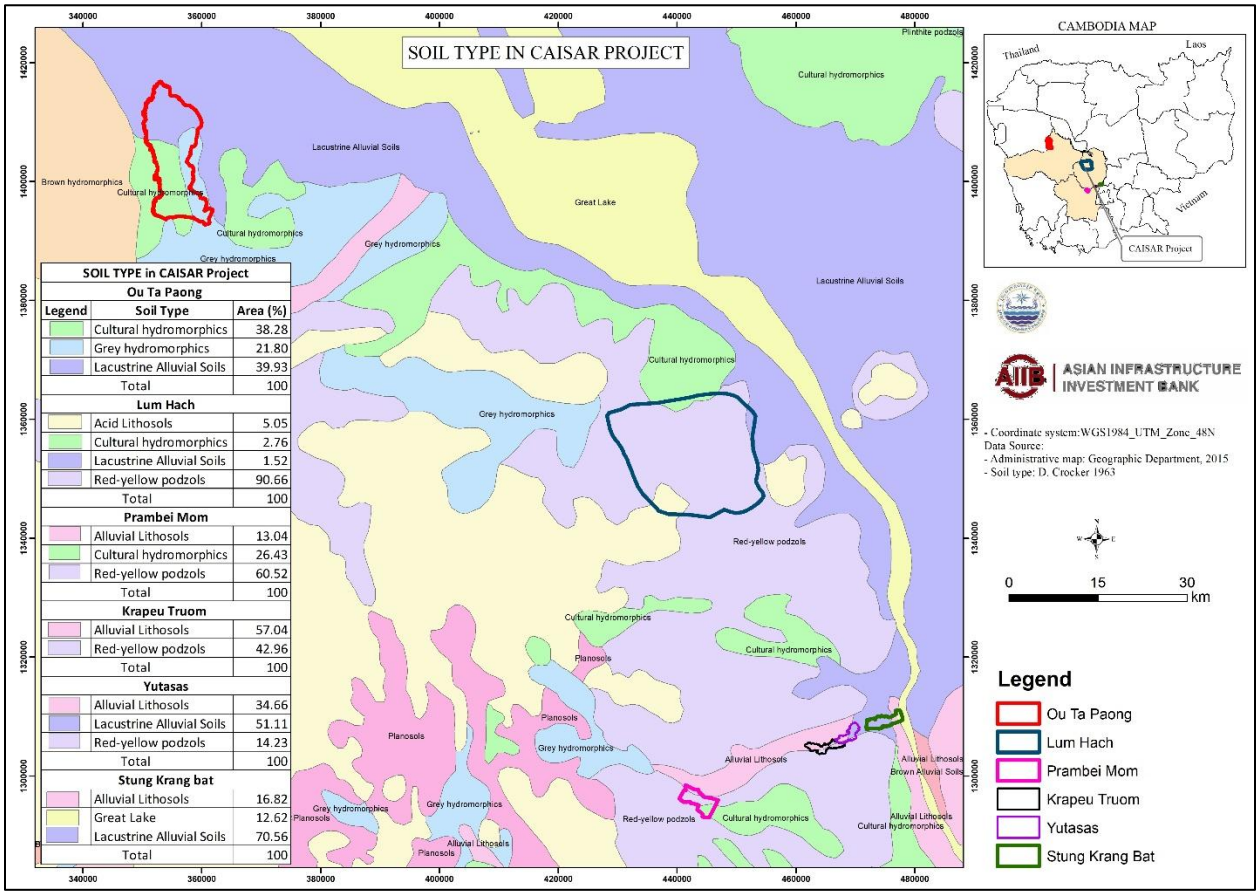
Table 6.12: Soil types and area in Cambodia

No.	Classification	Land area	
		Km^2	%
1	Red, yellow podzols	22,763.00	12.57%
2	Latosols	7,123.00	3.93%
3	Planosols	1,666.00	0.92%
4	Plinthite podzols	17,147.00	9.47%
5	Cultural hydromorphics	12,896.00	7.12%
6	Grey hydromorphics	17,252.00	9.53%
7	Plenthitic hydromorphics	1,275.00	0.70%
8	Brown hydromorphics	6,701.00	3.70%
9	Alumisols	2,782.00	1.54%
10	Regurs	6,570.00	3.63%
11	Acid lithosols	45,271.00	25.01%
12	Basic lithosols	3,418.00	1.89%
13	Alluvial soils	17,064.00	9.43%
14	Brown alluvials	2,764.00	1.53%
15	Lacustrine alluvials	10,373.00	5.73%
16	Coastal complex	2,229.00	1.23%
	Total (land area)	177,295.00	97.94%
	Water area	3,721.00	2.06%

	Total	181,035.00	100.00%

(Source: Dr. Crocker, 1962)

Figure 6.6: Map of soil types within the sub-schemes



SOIL TYPE in CAISAR Project		
Ou Ta Paong		
Legend	**Soil Type**	**Area (%)**
	Cultural hydromorphics	38.28
	Grey hydromorphics	21.80
	Lacustrine Alluvial Soils	39.93
	Total	100
Lum Hach		
	Acid Lithosols	5.05
	Cultural hydromorphics	2.76
	Lacustrine Alluvial Soils	1.52
	Red-yellow podzols	90.66
	Total	100
Prambei Mom		
	Alluvial Lithosols	13.04
	Cultural hydromorphics	26.43
	Red-yellow podzols	60.52
	Total	100
Krapeu Truom		
	Alluvial Lithosols	57.04
	Red-yellow podzols	42.96
	Total	100
Yutasas		
	Alluvial Lithosols	34.66
	Lacustrine Alluvial Soils	51.11
	Red-yellow podzols	14.23
	Total	100
Stung Krang bat		
	Alluvial Lithosols	16.82
	Great Lake	12.62
	Lacustrine Alluvial Soils	70.56
	Total	100

6.3.3.2 Ou Ta Paong

According to the soil type data collected by Dr. Crocker in 1962[11], three (3) distinct soil types were identified within the Ou Ta Paong scheme site including Cultural hydromorphics, Gray hydromorphics, and Lacustrine alluvial Soils. The first type is the cultural hydromorphics soils which human societies interact with, modify, and influenced by water bodies and landscapes over time. This type is characterized by a dense layer beneath the plow as per the continuous changes of soil nutrients due to human interaction including cultural practices, adaptation and modification in combination with hydrological regime influences. The second type is gray hydromorphics, a type of soil characterized by a wet, dry, and watery composition. They typically feature a gray layer overlying a yellow-gray clay layer. Lastly, lacustrine alluvial soils are annual, submerged soils that can accumulate varying amounts of sediment based on the surrounding topography.

[11] Crocker, Charles D. (1962). *The general soil map of the Kingdom of Cambodia and the exploratory survey of the soils of Cambodi*.

6.3.3.3 Lum Hach

The Lum Hach sub-scheme features a diverse range of soil types, each contributing uniquely to the area's agricultural and environmental landscape. The dominant soil type in this region is red-yellow podzols, which make up 90.66% of the area. These soils are characterized by their distinct A2 layer (iron brick) and a B layer with a mix of red, yellow, or gray hues, lacking clear divisions between layers.

In addition to red-yellow podzols, the Lum Hach area includes acid lithosols, cultural hydromorphics, and lacustrine alluvial soils. Acid lithosols cover 5.05% of the sub-scheme and are derived from the underlying bedrock in the hilly and foothill regions of Cambodia, characterized by their acidic nature. Cultural hydromorphics, occupying 2.76% of the area, are notable for their dense layer beneath the plow, distinguishing them from other soil types. Lacustrine alluvial soils, which cover 1.52% of the sub-scheme, are periodically submerged soils that accumulate sediment influenced by local topography.

6.3.3.4 Stung Krang Ponley

Stung Krang Ponley area, encompassing the Brambei Mom, Krapeu Truom, Yutasas, and Steung Krang Bat sub-schemes, features a diverse range of soil types that influence land use and agricultural practices. The distribution of these soil types varies significantly across the different sub-schemes, affecting their suitability for various uses.

Brambei Mom is characterized by three (3) predominant soil types. The most widespread is red-yellow podzols, covering 60% of the area. This type is followed by cultural hydromorphics, which occupy 26.43% of the site. Alluvial lithosols are present but constitute a smaller proportion at 13.4%. This distribution suggests that red-yellow podzols are the primary soil type influencing land use in the Brambei Mom project area, with the other types providing supplementary characteristics.

Krapeu Truom also features a two-soil type distribution but with a different balance compared to Brambei Mom. Alluvial lithosols dominate 57.04% of the area, while red-yellow podzols make up 42.96%. This balance indicates that alluvial lithosols are the more prevalent soil type, which may influence agricultural practices and land management strategies within the project area.

Yutasas presents a diverse soil composition with three (3) types present. Lacustrine alluvial soils are the most common, covering 51.11% of the area, followed by alluvial lithosols at 34.66%. Red-yellow podzols are less common, comprising 14.23% of the site. The predominance of lacustrine alluvial soils suggests their significant role in shaping agricultural and land use practices in the Yutasas area.

Steung Krang Bat is characterized by a predominance of lacustrine alluvial soils, which cover 70.56% of the area. This is followed by alluvial lithosols at 16.82% and great lake soils at 12.62%. The dominance of lacustrine alluvial soils highlights their importance in the land management and agricultural planning of the Steung Krang Bat project site. The smaller proportions of the other soil types indicate their supplementary roles in the overall soil profile of the area.

6.3.4 Hydrological Resources

6.3.4.1 Cambodia

Cambodia has considerable water resource potential, with abundant surface water and aquifers and a high level of seasonal rainfall. In spite of the abundance of water sources, many areas in the central plains and plateaus lack water in the dry season and are therefore dependent on unreliable rainfall patterns. The country's water resources are dominated by the Mekong River system (86% of country's territory), including the catchments of the Bassac River, the Tonle Sap River, and the Lake Tonle Sap and its tributaries[12], and the river system flowing into the Gulf of Thailand (remaining 14%) (**Error! Reference source not found.**).

Figure 6.7: River Basin Groups in Cambodia[13].

However, **75% renewable freshwater comes from upstream transboundary** sources via the Mekong River system (355.5 km^3/year of surface water), mainly from Lao PDR (91.3%), but also Thailand (8.4%) and Viet Nam (0.3%). As an intermediate basin country, up to 471.51 km^3/year of surface water flows out of the country to Vietnam through the Mekong and its tributaries. This emphasizes the critical inter-dependency of Mekong states, and their sensitivity to the actions of

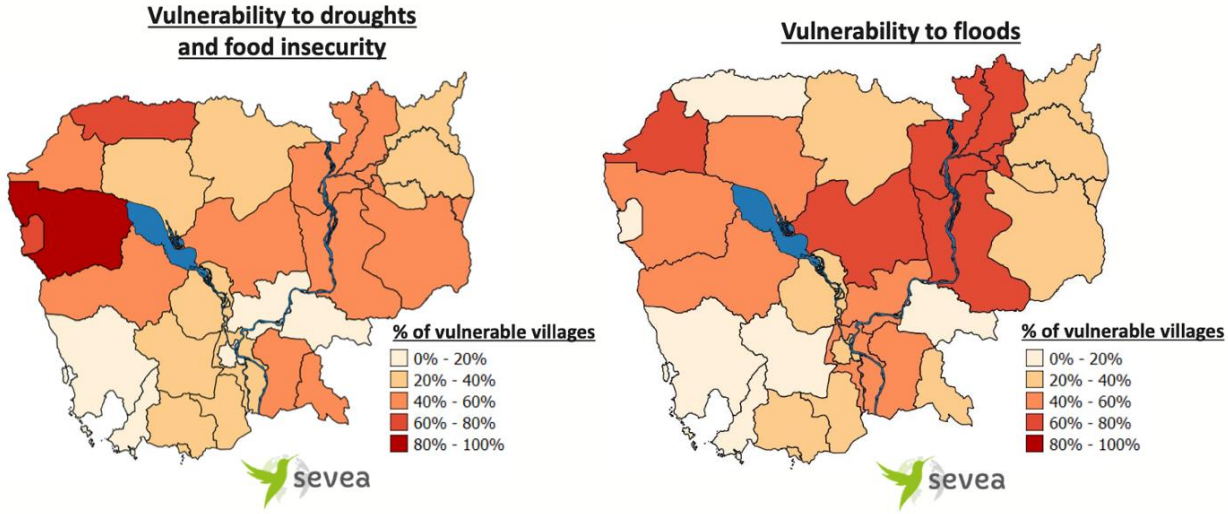
[12] The Mekong River and Lake Tonle Sap are connected by the Tonle Sap River, which twice a year reverses its direction of flow. From July to October, when the level of the Mekong is high, water flows into the Tonle Sap River, which fills Lake Tonle Sap, thereby increasing the size of the lake from 2,600 km^2 to about 10,500 km^2 at its maximum. The storage capacity of Lake Tonle Sap is estimated at 72 km^3. In November, when the level of the Mekong decreases, the Tonle Sap river reverses its flow, and water flows from Lake Tonle Sap to the Mekong river and thence to the Mekong Delta (https://wateractionhub.org/geos/country/37/d/cambodia/).

[13] Government of Cambodia, Ministry of Water Resources and Meteorology.

neighboring countries, particularly those that are upstream[14]. In terms of groundwater, 17.6 km^3/year is estimated to be produced in-country, although there is no register of transboundary for inflow or outflow of groundwater.

Agriculture accounts for 96% of all **water use,** domestic rural use 1%, and industry, domestic urban, and aquaculture use less than 1%15. Although the amount of water used is estimated to be only about 2% of total surface water volume[16], water shortages do occur during the dry season, especially in the Tonle Sap River system—due to the lack of stored water and limited access to water. [17]

Figure 6.8: Vulnerability to droughts and floods by provinces (Sevea)



Cambodia's water resources sector faces a range of multisectoral, geographical, and hydro-meteorological issues. The Mekong River, particularly the Lower Mekong Basin (LMB), has been identified as a region that is highly vulnerable to the impacts of climate change, more frequent and intense. Climate change is affecting the water cycle, bringing change in the hydrology of major rivers and tributaries as well as groundwater recharge. Recurrent floods occurred in the last decade, with important economic losses, mainly on rice crops, but also people's lives[18]. Farmers, who depend on rain-fed agriculture, will be increasingly at risk of disasters, and especially droughts and floods, causing severe damage to rice harvests[19]. In short, Cambodia faces the

[14] https://tableau.apps.fao.org

[15] Government of Cambodia. 2019. *National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019–2033*. Phnom Penh.

[16] ADB. 2014. Cambodian National Water Status Report 2014. Phnom Penh.

[17] https://MoWRAM.adb.org/sites/default/files/publication/689106/adb-brief-171-surface-water-resouces-rbgs-cambodia.pdf

[18] i.e. Floods accounted for 70% of rice production losses between 1998 and 2002, whereas droughts accounted for 20% of those losses. The most recent report on floods showed that the country had lost 40, 45, 188, 250, and 43 lives in 2020, 2014, 2013, 2011, and 2009, respectively. In addition, the economic loss was estimated at USD 1.000, 521, 70, and 132 million due to floods in 2013, 2011, 2010, and 2009, respectively.

[19] Mak Sithirith (2017). Water Governance in Cambodia: From Centralized Water Governance to Farmer Water User Community. MDPI.

common climate change challenges of **too much** water in the wet season, **too little** in the dry season, and gradually **too dirty** due the increasing pollution, particularly in populated cities.

The feasibility study report indicates that Cambodia is likely to face changes in water balances and flood regimes due to projected increases in temperature and altered precipitation patterns. An increase in consecutive dry days is expected to worsen water scarcity, especially during the dry season, impacting communities in rain-fed areas around the Tonle Sap more severely than those with year-round access to the Mekong River or irrigation systems.

6.3.4.2 Ou Ta Pong

The water sources for irrigation in Ou Ta Paong primarily come from three (3) rivers: the Pursat River, Ou Ta Paong River, and Svay Don Keo River. The Pursat River is the largest water source for Ou Ta Paong, originating approximately 25–35 km upstream and covering a catchment area of around 4,245 km². Water from the Pursat River is stored in three (3) main dams located on the river's tributaries: Dam No. 3, Dam No. 5, and Dam No. 1. The available water from Dam No. 3 and Dam No. 5 is relatively small (24.5 MCM and 25.5 MCM, respectively), while Dam No. 1, currently under construction, is expected to have a storage capacity of 1,014 MCM. However, the primary purpose of Dam No. 1 is hydropower. Downstream of the Pursat River, several headworks have been constructed to store and divert water mainly for irrigation, including Damnak Chheu Krom, Damnak Ampil, and Kbal Hong, which supply water to a series of agricultural lands along the river, primarily for paddy rice cultivation.

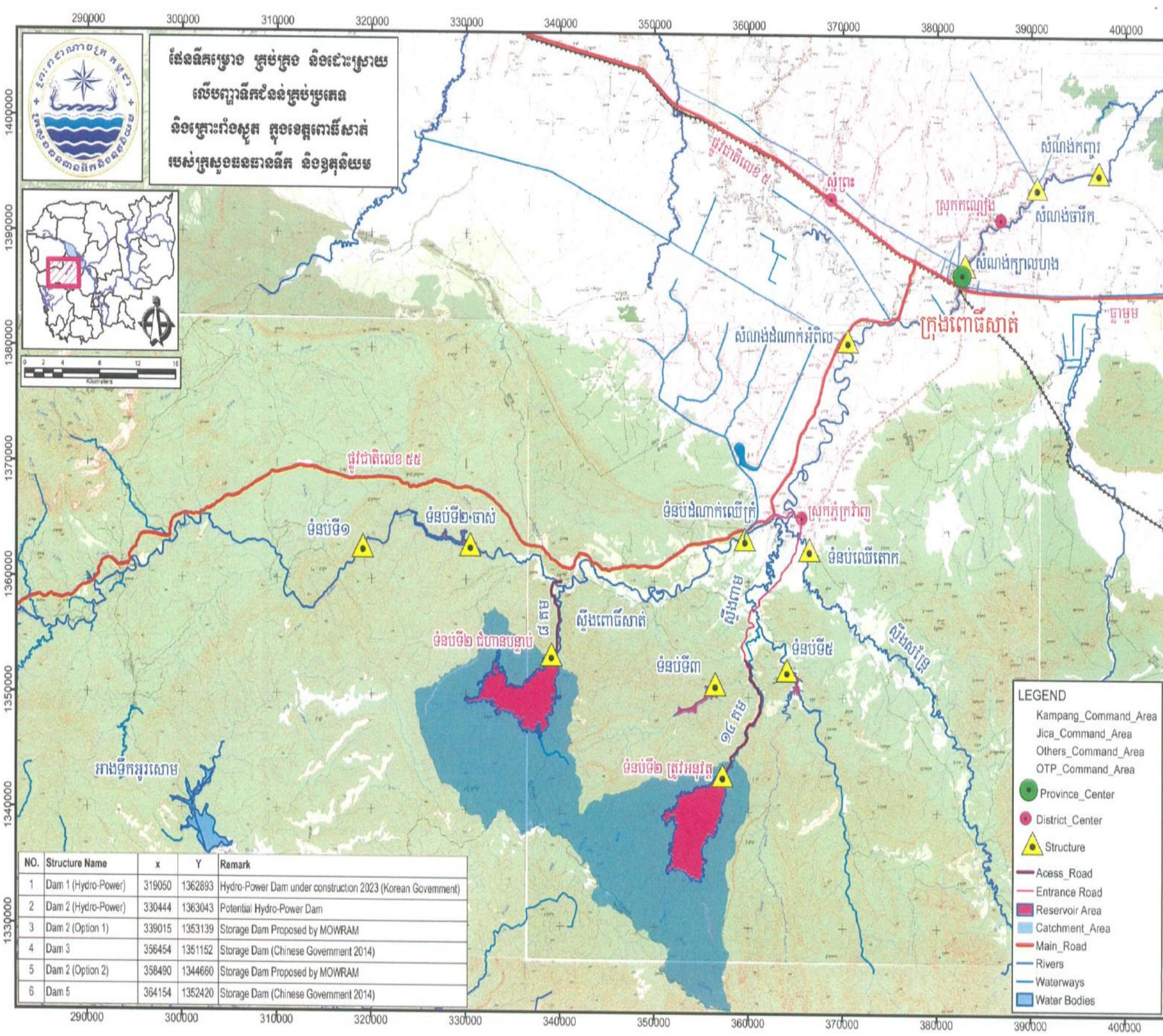
In contrast, the Svay Don Keo River is relatively small, with a catchment area of 322 km², and is situated on the left side of the command area. This river runs parallel to the Ou Ta Paong River, with both rivers discharging into Tonle Sap Lake at the end of their watercourses. Due to water diversions along the stream for agricultural production, Ou Ta Paong has now transformed into a series of ponds, especially in the lower part of the river.[20]

The CAISAR Feasibility Study reported that water availability will be adequate at the time that Dam No. 1 is completed, provided there is proper coordination among the stated dams. At the current stage, Pursat Provincial Department of Water Resources and Meteorology (PDoWRAM) has reported that the available water is insufficient for irrigation purposes within the province, with a shortfall of approximately 700 MCM. Additionally, PDoWRAM acknowledged that the water from Dam No. 1 is designated solely for hydroelectric purposes, which may limit the amount available for agriculture or irrigation. There is, however, another dam, Dam No. 2, which was approved by the government in late June 2024. PDoWRAM also reported that the construction is in the process of mobilizing equipment to the site. The reservoir for this dam covers 4,016 hectares, with a storage capacity of 861.75 MCM. The dam is expected to be completed by the end of 2026 (Figure 6.9). Earlier projections indicated that the combined water supply from Dam No. 1, Dam No. 3, and Dam No. 5 would likely be sufficient. With the addition of Dam No. 2, it is highly likely that the province’s water needs will be fully met.

[20] MoWRAM. 2024. Report on Screening of Associated Facilities. CAISAR Project.

The current discussion with farmers on water availability at Ou Ta Paong showed that during the periods that the crop requires irrigation, conflicts about water tend to arise. The available water along the river was diverted into the rice field via secondary canals along the river. The limited availability of water regulated from the upstream, mainly the Damnak Ampil canal cannot flow until the end of the river where the river has become a string of ponds, causing some locations of the rivers to have been turned into backyard garden of the residents along the river. As water is limited, water shortage has become the main cause for financial losses. This causes much stress, because of the risk of drought damage to the crops, and the cost of pumping from low water levels. The risks reduce farmers' motivation to invest in new technologies and climate-smart agriculture.

Figure 6.9: Map with Illustration of Dam No. 2



NO.	Structure Name	x	Y	Remark
1	Dam 1 (Hydro-Power)	319050	1362893	Hydro-Power Dam under construction 2023 (Korean Government)
2	Dam 2 (Hydro-Power)	330444	1363043	Potential Hydro-Power Dam
3	Dam 2 (Option 1)	339015	1353139	Storage Dam Proposed by MOWRAM
4	Dam 3	356454	1351152	Storage Dam (Chinese Government 2014)
5	Dam 2 (Option 2)	358490	1344660	Storage Dam Proposed by MOWRAM
6	Dam 5	364154	1352420	Storage Dam (Chinese Government 2014)

(Source: Pursat PDoWRAM, 2024)

6.3.4.3 Lum Hach

Water availability in the Lum Hach area has been a significant challenge, primarily due to the poor functionality and disrepair of the original irrigation infrastructure. The '1st of January Canal,' constructed in the mid-1970s, was intended to provide water from the Boribo River through a 30 km main canal and branch canals. However, a major flood soon after its completion caused the collapse of the headworks, rendering the canal non-operational. Since then, the canal has been neglected, with its hydraulic gradient too low to transport water effectively. In 2005, a study by JICA identified the potential for irrigation development in the area, focusing on a 3,100-ha command area under the first branch canal. JICA's efforts culminated in the completion of the Lum Hach 1 Scheme in 2020, which included a new barrage and modified canal systems. However, the new lower barrage required additional excavation work to fully re-establish water flow in the canal system.

Despite these improvements, water shortages remain a concern. The lower levels of the new headworks and canals prompted the CAISAR project to explore alternative water sources, including utilizing the network of streams to the southwest of the 1st of January Canal. Additionally, the sparse and inadequate irrigation infrastructure in the area limits the system's ability to function efficiently. Compounding the issue, the Achang Irrigation Scheme, constructed downstream in 2016, now competes for water from the Boribo River. Because the Lum Hach headworks are upstream, they can divert water, leaving the downstream Achang Scheme vulnerable to water shortages. This competition, coupled with the need for further canal excavation and improvements, presents ongoing challenges for reliable water supply in Lum Hach.

6.3.4.4 Stung Krang Ponley

The Stung Krang Ponley irrigation scheme relies on various water sources to support its sub-schemes, with water availability playing a crucial role in agricultural productivity. The Brambei Mom scheme is supplied by the Ou Khley River and its reservoir, completed in 2012 as part of the Krang Ponley Project. The reservoir, covering 67 hectares, supports domestic use and small-scale agriculture, particularly during the dry season. Water is also drawn from the larger Anlong Chrey Reservoir, enhancing the scheme's capacity. However, the system is incomplete, with canals that are too short and in poor condition, requiring rehabilitation. The siltation of the 37-kilometer-long Ou Khley River further complicates water management, leading to frequent flooding and reduced irrigation capacity, especially during the wet season.

Krapeu Truom, another sub-scheme, primarily relies on the Anlong Chrey Reservoir and the Kdol Dam as secondary water sources. The system consists of two (2) main canals, 11 secondary canals, and multiple distribution and check structures. While the canals are largely functional, some design defects have led to damage in the downstream structures. Additionally, the crest elevations of some offtakes are lower than the adjacent rice fields, hindering irrigation. Despite these challenges, the Farmer Water User Community (FWUC), established in 2016, has been successful in managing water distribution, although improvements are needed to enhance overall efficiency.

Yutasas and Steung Krang Bat, the remaining sub-schemes, also depend heavily on water from Anlong Chrey Dam and Kdol Dam. Yutasas, added to the CAISAR project in 2023, is located between Krapeu Truom and Steung Krang Bat, and shares a similar layout with its neighboring schemes. Steung Krang Bat, with an extensive canal network, includes over 13 kilometers of main canals and over 20 kilometers of drainage canals. While functional, the scheme requires repairs to its crosscheck and offtake structures and extensions to its drainage system. Both schemes face infrastructure challenges but remain vital to the region's irrigation system, with ongoing efforts needed to ensure sustainable water availability.

6.3.5 Climatic Conditions

6.3.5.1 Overview

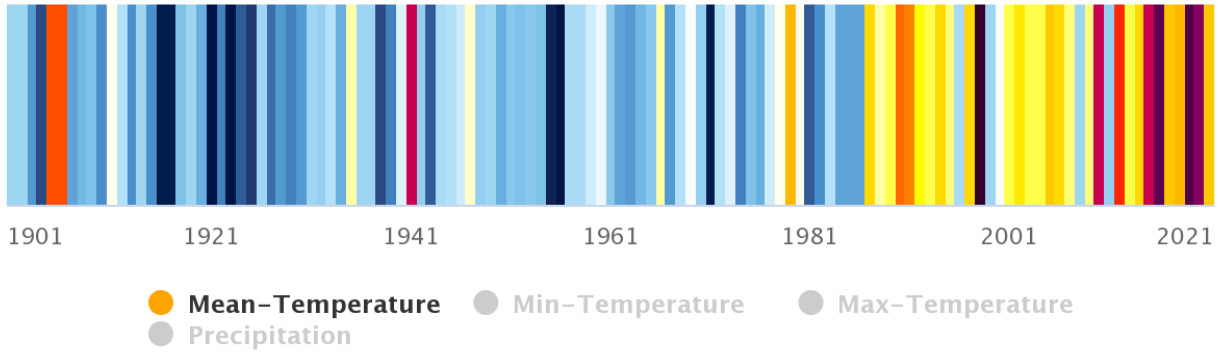
The feasibility study document of the project highlighted the vulnerability of Cambodia to climate change impacts at a high level, ranked at 12th out of 181 countries in the Global Climate Risk Index between period 1999 and 2018 as its score provided by the Notre Dame Global Adaptation Index between a high-vulnerability score and low-readiness score. The high-risk rating of Cambodia is attributable to geographical condition being highly exposed to climatic extreme events such as floods and droughts, high reliance on agriculture sector and low adaptive capacity of the country given its limited financial, institutional and technical resources. Such a trend has caused the projection of the country's GDP to be reduced by nearly 10% by 2050. It is also reported that the climatic changes will alter how land and natural resources are accessed and used as they are expected to induce geographic shifts in resource productivity and availability and land use patterns. Moreover, the general trend shows that the country will have less rainfall certainty with more and shorter duration and higher intensity posing significant challenges to water resource management of the country.[21]

6.3.5.2 Past Trends

The historical change of the country had been severely impacted by longer dry seasons and more intense "El Niño" related droughts with the delay of the monsoon season; increased rain intensity and frequency, leading to floods; and unexpected dry periods during the rainy season. The increase of the annual mean temperature anomaly in Cambodia is at a rate of 0.23 °C per decade since 1950, with a stronger signal during the dry season along with increasing number of hot days since 1960 to an average of 46 by 2016 (Temperature maximum >35 °C[2]).

[21] WAPCOS (2023). CAISAR Feasibility Study – Main Volume. Ministry of Water Resources, and Meteorology, Cambodia

Figure 6.10: Observed Annual Mean-Temperature, 1901 - 2021



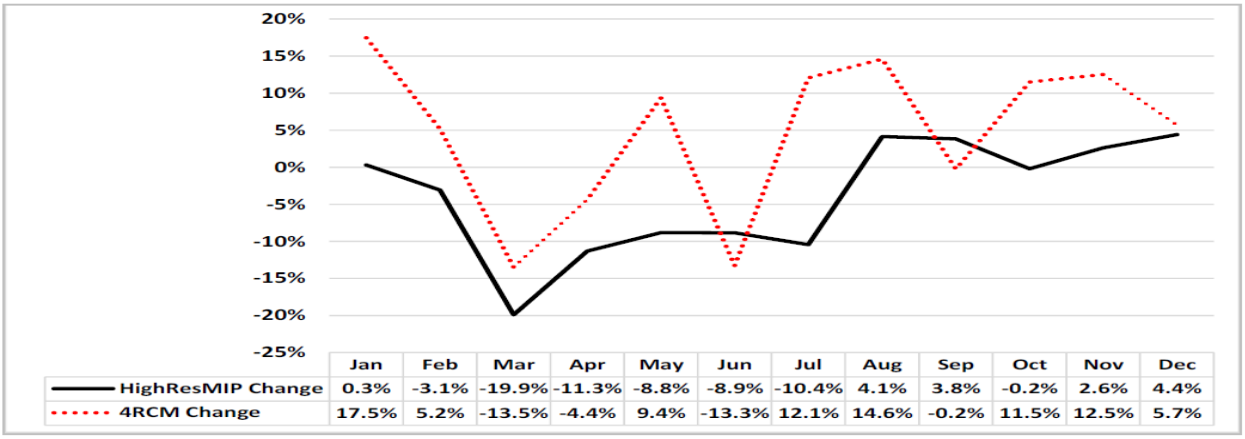
It was also reported that precipitation across Cambodia varies significantly, ranging from 4,000mm annually near the Cardamom mountains to 1,400mm in the central lowlands, with the CAISAR project areas receiving 1,300–1,500mm mostly during the rainy season (May–October). Rainfall variability is linked to the El Nino Southern Oscillation, which correlates with periods of drought. Historical patterns show that floods and droughts have caused widespread damage to crops, infrastructure, and economic activities, while also increasing water-borne diseases. Although no significant trend in overall precipitation has been statistically confirmed, anecdotal evidence suggests an increase in rainfall intensity, floods, and severe droughts, leading to greater crop yield losses and pressures on authorities to manage these events.

6.3.5.3 Future Trends

According to the Feasibility Study Report, the climate projections for Cambodia indicate an increase in average rainfall, with precipitation becoming more concentrated and leading to dry spells even during the wet season, which may result in more frequent flood events. Additionally, mean temperatures are expected to rise, extending drought periods and potentially causing significant economic impacts. A detailed analysis of the effects of climate change on agriculture reveals that changes in precipitation and temperature will critically affect water availability and crop yields, emphasizing the need for effective adaptation and resilience strategies.

The Climate Vulnerability Analysis (CVA) report – using historical data between 1990 and 2021 – compared historical climate data with future projections for 2026–2050 using various climate models, revealing variability and uncertainty in the results. While some models, such as the 4RCM, showed an annual increase in rainfall of about 6%, others, like HighREsMIP, suggested a slight decrease of around 1%. Seasonal fluctuations were evident, with some months experiencing significant increases in rainfall and others facing notable decreases. These findings highlight the complex nature of climate change predictions and the necessity for thorough analysis beyond annual averages. Overall, the models consistently indicate reduced rainfall during the dry season and increased rainfall during the wet season, which poses challenges for sustainable agriculture in Cambodia and underscores the importance of adaptive measures to cope with changing water availability.

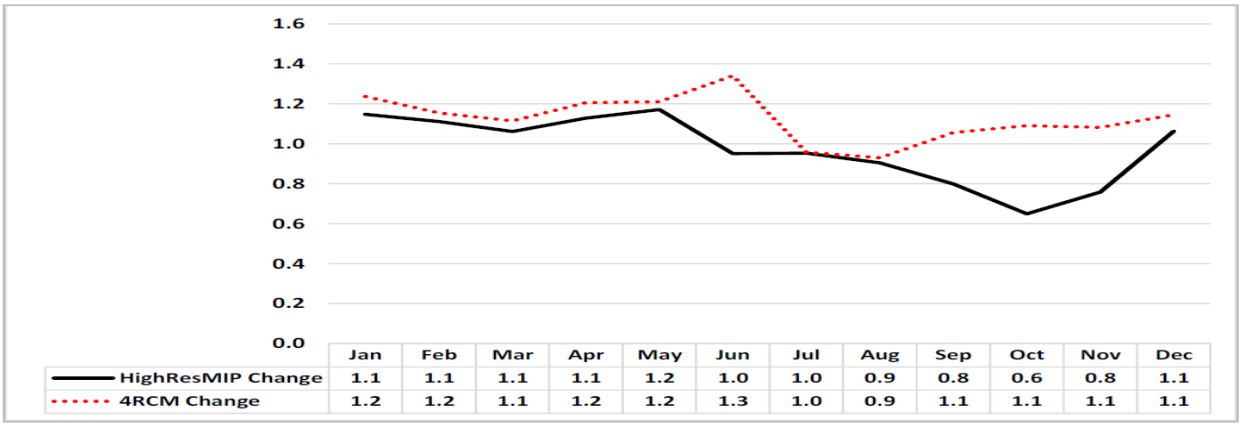
Figure 6.11: Change factors for rainfall (%) in Pursat gauge



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HighResMIP Change	0.3%	-3.1%	-19.9%	-11.3%	-8.8%	-8.9%	-10.4%	4.1%	3.8%	-0.2%	2.6%	4.4%
4RCM Change	17.5%	5.2%	-13.5%	-4.4%	9.4%	-13.3%	12.1%	14.6%	-0.2%	11.5%	12.5%	5.7%

Modelled changes in temperature between the historic period 1995 – 2021 and the future scenario 2026 – 2050 are consistent, with a general projected increase of 1°C (Figure 6.11). Temperature increases are expected to be marginally higher during the dry season compared to the wet season although there is still some degree of variability observed throughout the year (Figure 6.12).

Figure 6.12: Temperature change factor in °C between ’95-’21 and ’26-‘50



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HighResMIP Change	1.1	1.1	1.1	1.1	1.2	1.0	1.0	0.9	0.8	0.6	0.8	1.1
4RCM Change	1.2	1.2	1.1	1.2	1.2	1.3	1.0	0.9	1.1	1.1	1.1	1.1

6.3.5.4 Floods

The feasibility study report also described Cambodia as the most flood-prone countries in Southeast Asia due to its monsoonal climate condition with two (2) distinct hydrological regimes. There are two (2) main types of flooding in the country: seasonal overflows from the Mekong River, its tributaries, and the Tonle Sap, and flash floods from heavy rains in mountainous areas. Seasonal flooding can be beneficial by providing fertile soil for agriculture, but if it becomes severe, it can cause extensive damage to crops, infrastructure, and communities. Flash floods, often triggered by heavy rains, can destroy crops and damage infrastructure, particularly in the tributaries of the Tonle Sap Lake. Extreme flood events in recent years have led to significant economic losses, crop failures, and infrastructure damage, underscoring the need for improved flood management and disaster preparedness.

Inadequate maintenance of drainage channels and irrigation infrastructure exacerbates the impact of floods, leading to prolonged inundation and increased damage to agriculture and

communities. The unpredictability of flood events, influenced by upstream development and climate change, highlights the vulnerability of Cambodia's agricultural sector and rural livelihoods. Understanding the expected annual damage from floods is crucial for managing risks and planning for future impacts, as it helps estimate the long-term economic effects of recurring flood events on rice cultivation and other agricultural activities.

6.3.5.5 Droughts

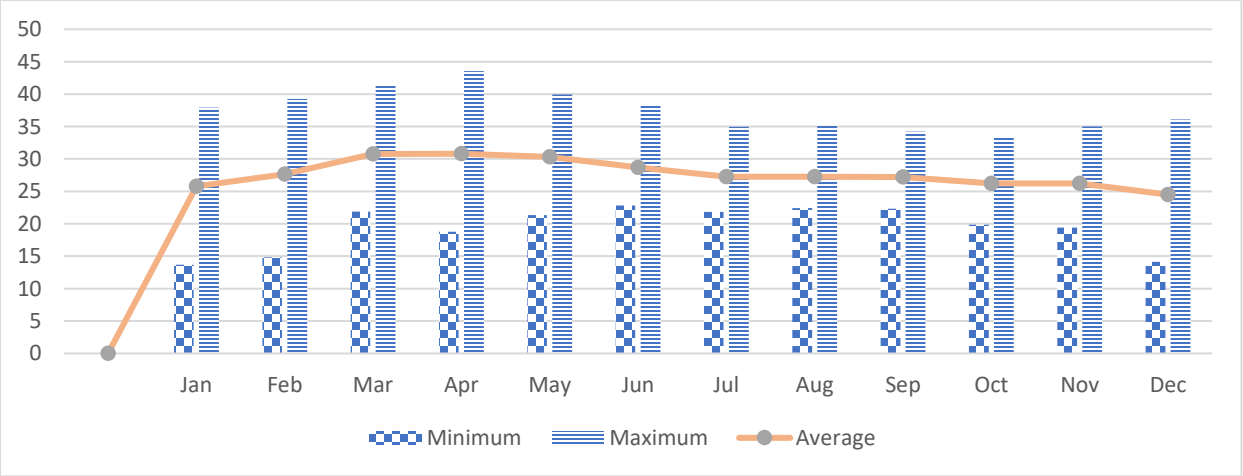
Droughts are a significant hazard in Cambodia, particularly affecting agricultural productivity for rain-fed rice farmers. Droughts are often linked to El Niño events, such as the severe 2015/16 drought that affected 2.4 million people across 18 provinces. During this period, many households reported water shortages, crop failures, decreased agricultural production, and high animal mortality rates, leading to significant income losses. Recent surveys indicate that consecutive years of drought have made farming economically unviable for many, forcing them to seek employment in neighboring countries like Thailand. Climate change is expected to exacerbate drought conditions by increasing the number of consecutive dry days, further straining limited water resources and impacting rain-fed agricultural communities.

6.3.5.6 Ou Ta Paong

Temperature

This temperature study was conducted over the last 10 years (2013-2022) using NASA POWER data. For the last decade, the annual average maximum temperature was 43.55 °C, the annual average minimum temperature was 13.68 °C, and the annual average temperature was 36.95 °C. In addition, for each 10-year monthly, the lowest minimum monthly temperature was in January at 13.68 °C and the highest maximum monthly temperature in April was 43.55°C.

Figure 6.13: The maximum average and minimum monthly temperature for the last 10 years (°C)

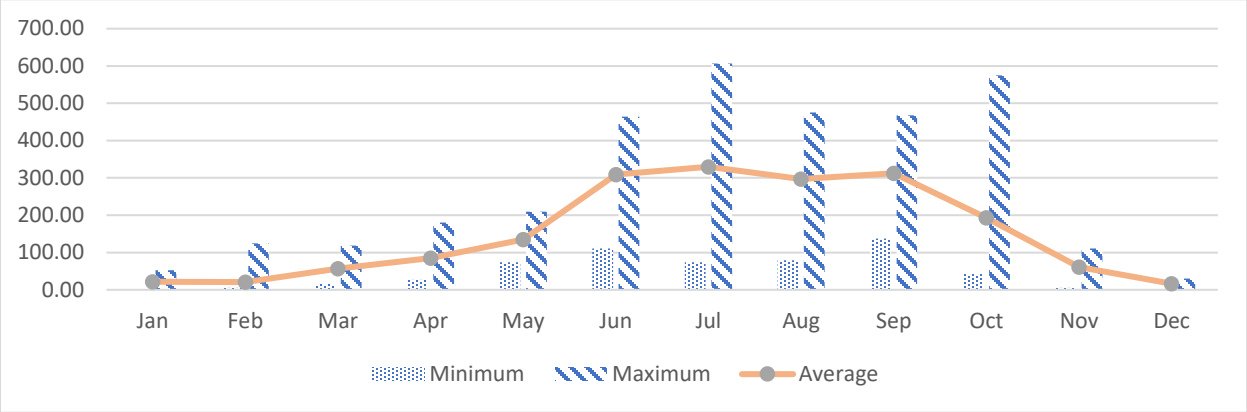


Source: NASA POWER (2024)

Precipitation

According to the latest 10-year rainfall data (2013-2022) by NASA POWER, the average annual rainfall was 1837.37 mm, the minimum annual rainfall was 791.02 mm in 2016, and the maximum annual total was 2591.04 mm in 2022. While the monthly rainfall indicates that July was the month with the highest average monthly rainfall of 329.81 mm, and the lowest average monthly rainfall was December, which had a rainfall of 16.39 mm.

Figure 6.14: The maximum, average, and minimum monthly precipitation for the last 10 years (mm)

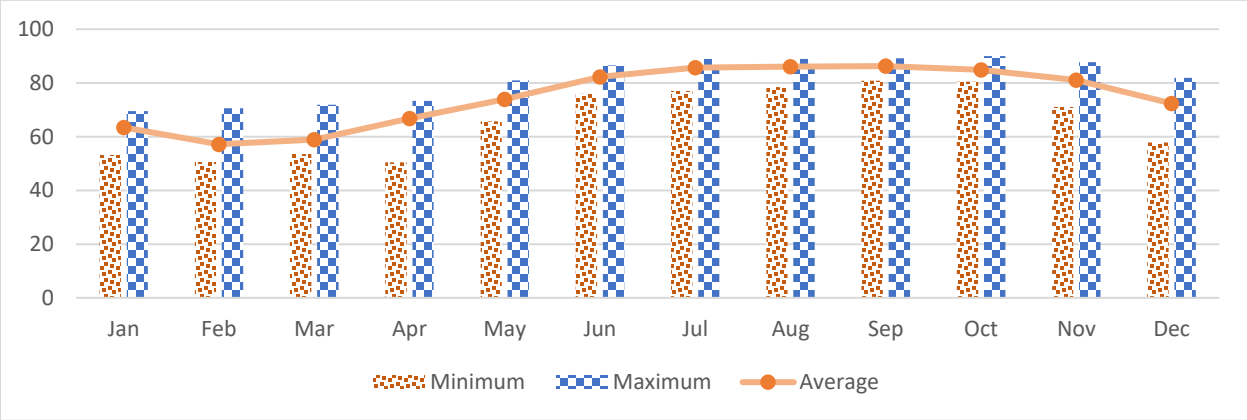


Source: NASA POWER (2024)

Humidity

Humidity data in the Ou Ta Paong scheme area for the last 10 years (2013-2022) show that the annual minimum average humidity was 69.62% in 2016, the maximum annual average humidity was 80.19% in 2022, and the annual average humidity equals 75.01%. On the other hand, the highest monthly maximum humidity was 90.06% in October, and the lowest monthly minimum humidity was in April at 50.5%.

Figure 6.15: The maximum, average, and minimum monthly humidity for the last 10 years (%)



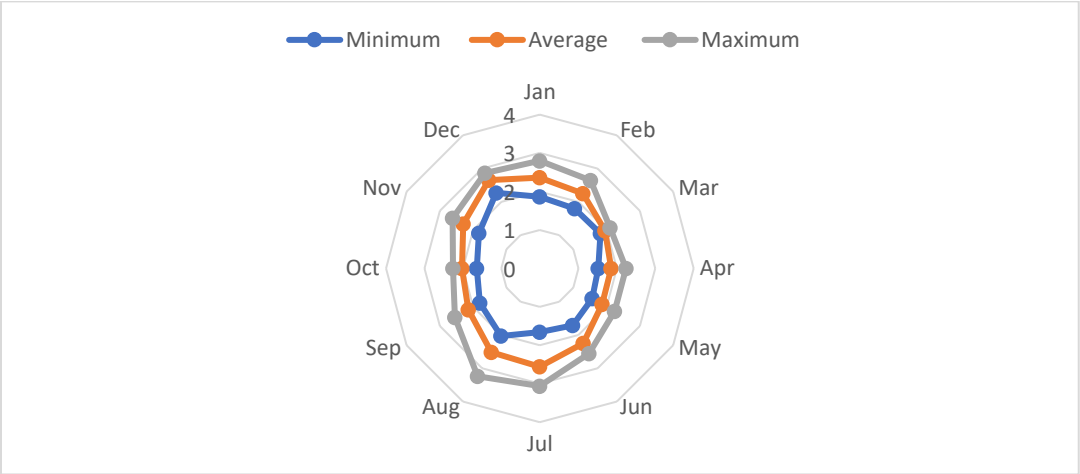
Source: NASA POWER (2024)

Wind speed

The table below shows the monthly wind speed in the Ou Tan Paong scheme area for the last 10 years (2013-2022). The annual minimum wind speed was 2.09 m/s in 2020, the annual average

wind speed was 2.23 m/s, and the annual maximum wind speed was 2.38 m/s in 2016. In addition, the lowest monthly wind speed in April was 1.52 m/s, and the maximum wind speed in August was 3.24 m/s.

Figure 6.16: The maximum, average, and minimum monthly wind speed for the last 10 years (m/s)



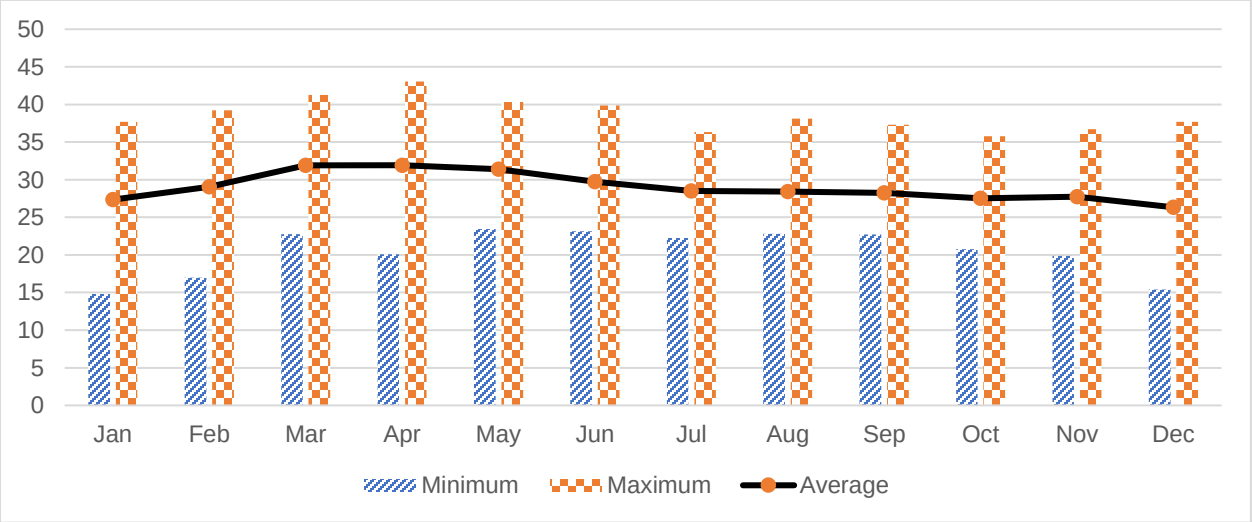
Source: NASA POWER (2024)

6.3.5.7 Lum Hach

Temperature

The table presents monthly temperature data for the Lum Hach scheme area from 2013 to 2022, based on NASA POWER data. In the table below also provides the overall minimum and maximum temperatures recorded during the decade, as well as average monthly and annual temperatures. In fact, the lowest monthly minimum temperature in January was 14.80°C, and the highest maximum temperature in other months was in April at 43.06°C.

Figure 6.17: The maximum, average, and minimum monthly temperature for the last 10 years (°C)

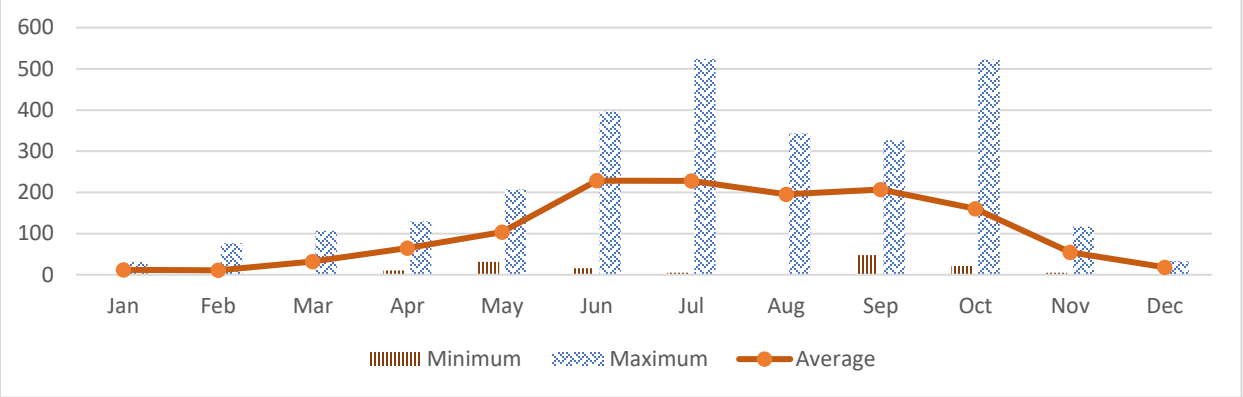


Source: NASA POWER (2024)

Precipitation

The table presents monthly precipitation data for the Hum Hach scheme area from 2013 to 2022. The lowest minimum precipitation recorded was 0 mm in multiple months throughout the decade. The highest monthly precipitation occurred in August 2021, reaching 342.77 mm. This indicates significant rainfall variability in the region, with some months experiencing no precipitation while others receiving a lot.

Figure 6.18: The maximum, average, and minimum monthly precipitation for the last 10 years (mm)

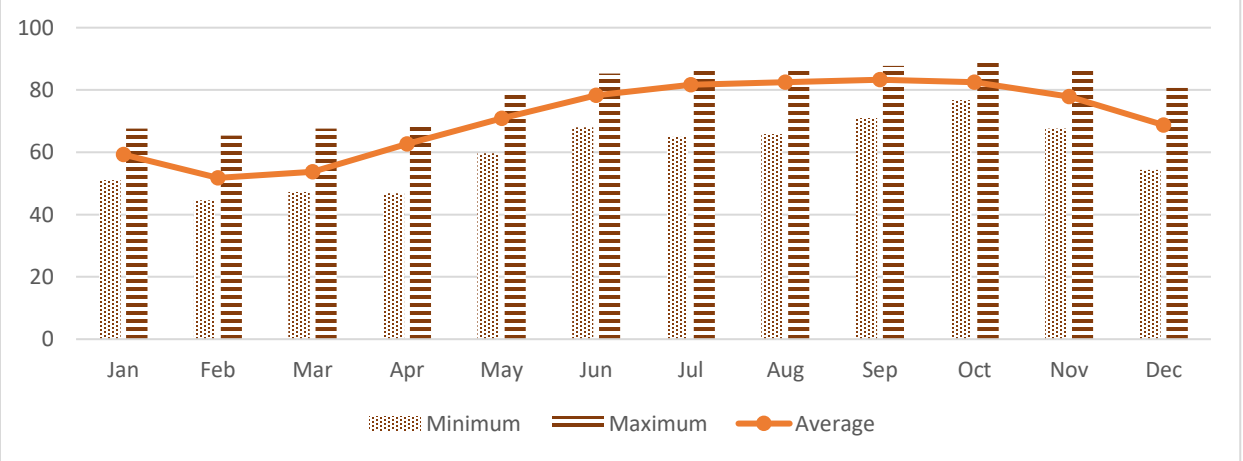


Source: NASA POWER (2024)

Humidity

The table presents monthly humidity data for the Lum Hach scheme area from 2013 to 2022. The annual minimum average humidity was 62.38% in 2016, while the maximum annual average humidity was 77.94% in 2022. Overall, the annual average humidity 71.19% over the decade. Regarding monthly variations, the highest monthly maximum humidity was observed in October 2020 at 89.06%, and the lowest monthly minimum humidity was recorded in February 2014 at 44.56%.

Figure 6.19: The maximum, average, and minimum monthly humidity for the last 10 years (%)

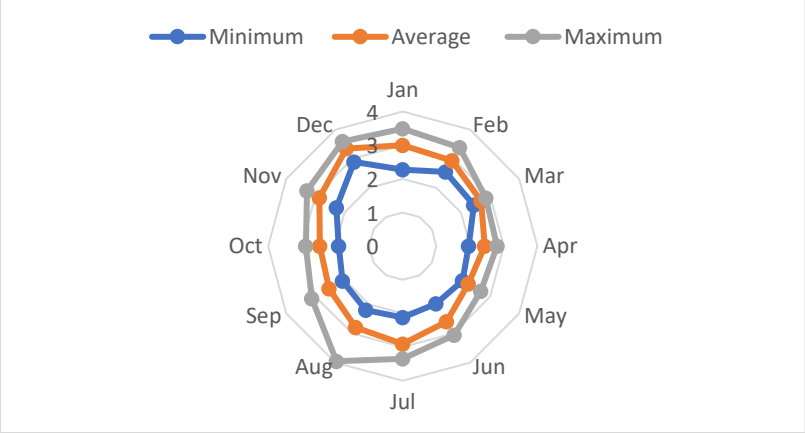


Source: NASA POWER (2024)

Wind Speed

The annual minimum average wind speed was 2.57 m/s in 2014, while the maximum annual average wind speed was 2.98 m/s in 2016 and 2022, and the annual average wind speed was 2.73 m/s over the decade. Regarding monthly variations, the highest monthly maximum wind speed was observed in August 2016 at 3.95 m/s, and the lowest monthly minimum wind speed was recorded in October 2015 at 1.9 m/s.

Figure 6.20: The maximum, average, and minimum monthly wind speed for the last 10 years (m/s)



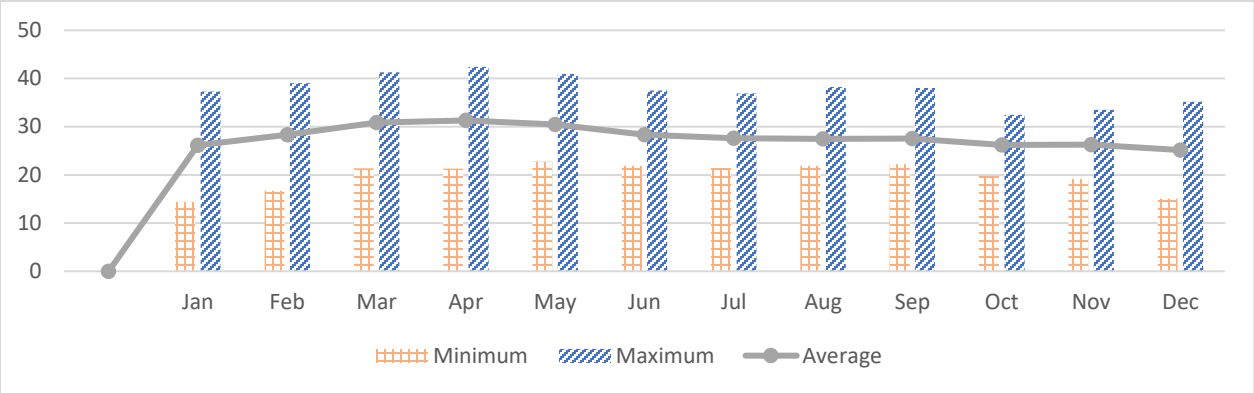
Source: NASA POWER (2024)

6.3.5.8 Stung Krang Ponley

Temperature

Temperatures in the Stung Krang Ponley scheme area for the last 10 years between 2013-2022 using NASA POWER data. According to the table below shown, the annual average temperature was 27.96 °C, the annual average minimum temperature was 14.37 °C in 2014, and the annual average maximum temperature in 2016 at 42.4 °C. Regarding monthly temperature extremes, the lowest minimum temperature of 14.37°C was observed in January, and the highest maximum temperature of 42.4°C occurred in April.

Figure 6.21: The maximum, average, and minimum monthly temperature for the last 10 years (°C)

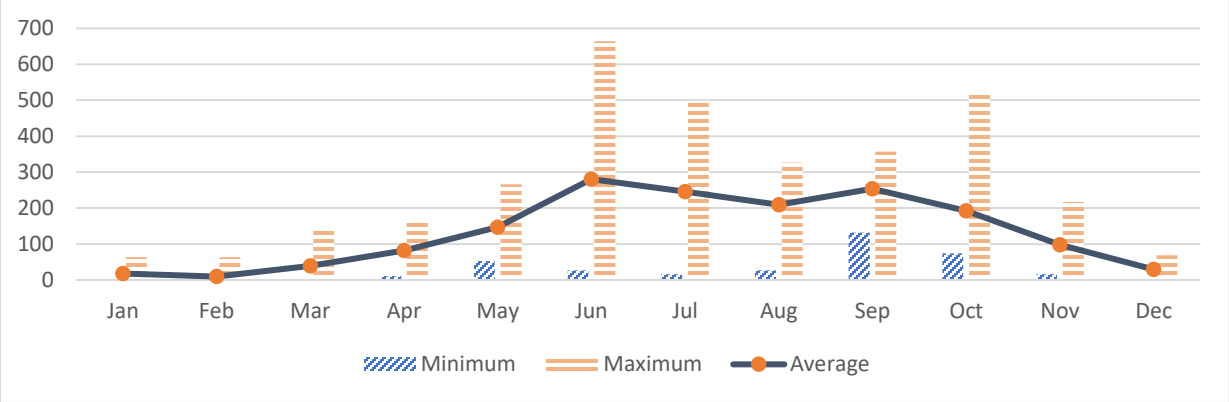


Source: NASA POWER (2024)

Precipitation

The Stung Krang Ponley scheme area shows an average annual precipitation of 1604.14 mm over the decade from 2013 to 2022. The annual minimum precipitation was recorded in 2016 at 653.91 mm, while the annual maximum precipitation occurred in 2020, reaching 2293.95 mm. The lowest minimum rainfall data were found in January, February, March, and December at 0 mm. In October, the highest average monthly rainfall was 516.6 mm.

Figure 6.22: The maximum, average, and minimum monthly precipitation for the last 10 years (mm)

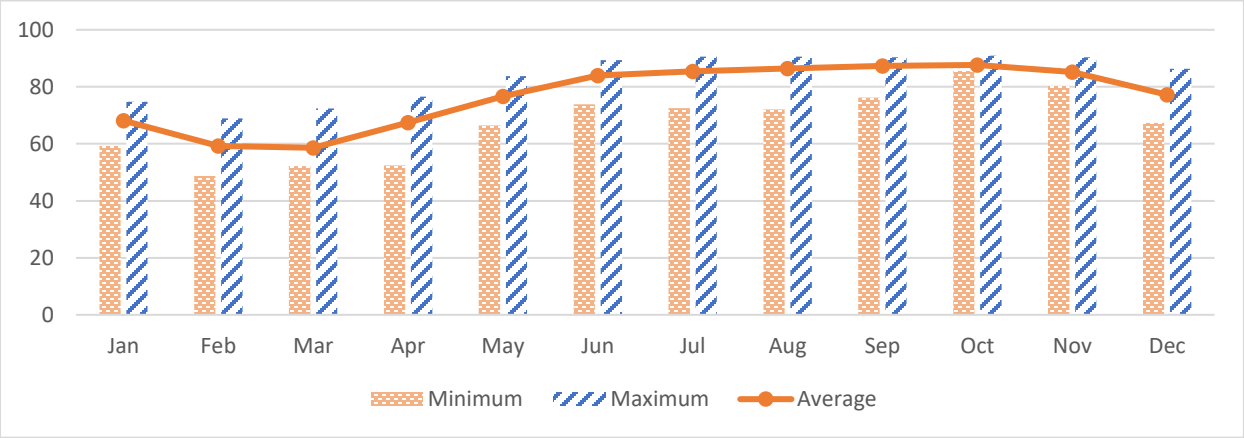


Source: NASA POWER (2024)

Humidity

The table presents monthly humidity data for the Stung Krang Ponley scheme area from 2013 to 2022. The annual minimum average humidity was 69.44% in 2016, while the maximum annual average humidity was 82.81% in 2022. In additional, the annual average humidity was 77.03% over the decade. Regarding monthly variations, the highest monthly maximum humidity was observed in October 2020 at 90.88%, and the lowest monthly minimum humidity was recorded in January 2016 at 48.69%.

Figure 6.23: The maximum, average, and minimum monthly humidity for the last 10 years (%)

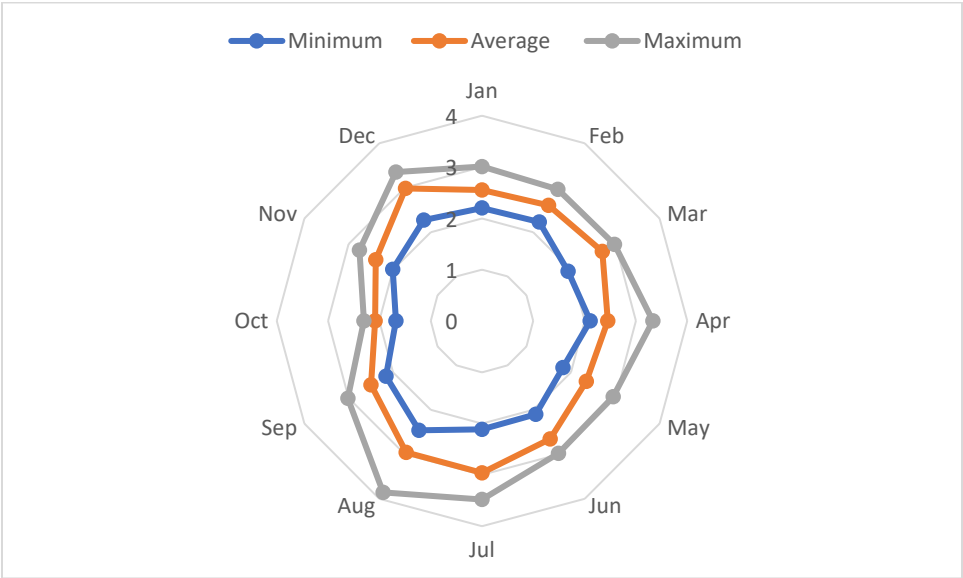


Source: NASA POWER (2024)

Wind Speed

The monthly wind speed data for the Stung Krang Ponley scheme area from 2013 to 2022. The annual minimum average wind speed was 2.45 m/s in 2022, and the maximum annual average wind speed was 2.85 m/s in 2016. While the annual average wind speed was 2.60 m/s in the last 10 years. Regarding monthly variations, the highest monthly maximum wind speed was in August 2016 at 3.86 m/s, and the lowest monthly minimum wind speed was recorded in October 2013 at 1.68 m/s.

Figure 6.24: The maximum, average, and minimum monthly wind speed for the last 10 years (m/s)



6.4 BASELINE ENVIRONMENTAL QUALITY

6.4.1 Ambient Air quality, Noise and Vibration

6.4.1.1 Air Quality

Overall, air quality in Cambodia has been reported to be at an acceptable level, given limited disturbance and emission of dust and gases within the country. In February 2024, Ministry of Environment (MoE) reported at the average air quality in Cambodia at excellent condition (MoE, 2024). Moreover, the air quality of the project target provinces is excellent, except Pursat which is good in quality. The same sources also reported the level of $PM_{2.5}$ in average in the four (4) provinces were below the permit standard of 50 ug/m^3.

6.4.1.1.1 Ou Ta Paong

At provincial level, the air pollution level is considered moderate[22]. The AQI is 58, which is equivalent to 13.1 µg/m^3. The ambient air quality, noise, and vibration is being linked to increases in industrial development, and the rapid urbanization. However, the Ou Ta Paong sub-scheme is located in the rural settings and about 35km from the major population centers and industrial areas in Pursat town. The baseline ambient air quality, noise and vibration in Ou Ta Paong scheme is considered generally good. Ambient air quality is sometime affected by dust from tillage and unpaved road users, including smoke from burning of rice stubble after harvest. Whilst noise and vibration disturbance are sometime affected by motorist. However, the impacts are minor and short time.

6.4.1.1.2 Lum Hach

At provincial level, the air pollution level is considered moderate[23]. The AQI is 58, which is equivalent to 12.8 µg/m^3. The Lum Hach scheme is located in the rural settings and about 60km from the major population centers and industrial areas in Kampong Chhnang town. The baseline ambient air quality, noise and vibration in Lum Hach scheme is considered generally good. Ambient air quality is sometime affected by dust from tillage and unpaved road users, including smoke from burning of rice stubble after harvest and burning from swidden cultivation activities. Whilst noise and vibration disturbance are sometime affected by motorist. However, the impacts are minor and short time.

6.4.1.1.3 Stung Krang Ponley

Stung Krang Ponly located in two (2) provinces – Kampong Chhnang and Kampong Speu. At provincial level, the air pollution level in Kampong Chhnang province is considered moderate. The air pollution level in Kampong Speu province also consider moderate. The AQI is 58[24], which is equivalent to 12.7 µg/m^3. The Stung Krang Ponly is in the rural settings; therefore, the baseline ambient air quality, noise and vibration is considered generally good. Ambient air quality is sometime affected by dust from tillage and unpaved road users, including smoke from burning of rice stubble after harvest and burning from swidden cultivation activities. Whilst noise and

[22] https://www.iqair.com/cambodia/pursat, accessed on 23rd September 2024
[23] https://www.iqair.com/cambodia/pursat, accessed on 23rd September 2024.
[24] https://www.iqair.com/cambodia/kampong-speu, accessed on 23rd September 2024.

vibration disturbance are sometime affected by motorist. However, the impacts are minor and short time.

6.4.1.2 Noise and Vibration

Noise and vibration of the project locations in each sub-scheme are currently affected mainly by the commuters mainly along the roads within the areas which can be either the national or local road. As they are subjected to change over time, the testing of noise and vibration are required to be conducted right before the beginning of the construction.

6.4.2 Soil Quality

The soil quality study for this project took soil samples from five (5) agricultural locations across different schemes in the region. The Ou Ta Paong sub-scheme was represented by two (2) sites (SS.01 & SS.02), one (1) for Lum Hach (SS.03) and two (2) (SS.04 & SS.05) for Stung Krang Ponley. The analysis results, presented in the table below, provide valuable insights into the physical, chemical, and biological properties of the soils at these locations, which can inform agricultural management practices and decision-making.

Table 6.13: Soil analysis results in an agricultural context

No.	Description Parameter		Result				
			SS.01	SS.02	SS.03	SS.04	SS.05
1	Particle Size (Pipette Method)	(<0.002mm), Clay %	9.90	14.01	1.23	14.95	7.30
		(0.002-0.02 mm), Fine Silt, %	37.65	35.55	3.40	30.00	21.10
		(0.02-0.05 mm), Coase Silt, %	21.71	22.69	5.23	19.81	11.70
		(0.05-0.2 mm), Fine Sand, %	30.59	32.75	33.52	31.12	30.29
		(0.2-2 mm), Coase Sand, %	3.22	2.32	55.72	5.92	28.78
2	Ninnu Moisture %, (Oven dry at 105 °C and 24 hours)		1.67	1.73	0.20	2.64	2.62
3	Total Carbon (Black & Walkey Method), C%		2.22	1.84	1.80	1.63	1.87
4	Total Nitrogen (Kjeldal Sulfuric Method),N%		0.19	0.17	0.17	0.14	0.17
5	C/N Ratio (Unit)		12	11	11	12	11
6	Organic Matter (0M)%		3.82	3.16	3.10	2.80	3.22
7	Total Phosphorus (Nitric Digestion) P %		0.051	0.043	0.046	0.044	0.094
8	Available Phosphorus (Bray II), P (ppm)		51	41	46	29	37
9	Cation Exchange Capacity C.E.C meq/100g Soil (Method,1M Ammonium Acetate at pH=7 & Leach with 10% NaCl)		13.00	12.40	10.00	16.50	16.30
10	Exchangeable Cation (meq/100g Soil),	Calcium (Ca)	3.06	3.77	3.56	8.30	5.43
		Magnesium (Mg)	1.28	1.38	1.58	2.37	1.48

No.	Description Parameter		Result				
			SS.01	SS.02	SS.03	SS.04	SS.05
	(Method, IM Ammonium Acetateat H=7)	Sodium (Na)	1.42	0.75	0.30	2.57	1.50
		Potasium (K)	0.77	0.27	0.13	0.36	0.35
	Total Exchangeable Bases (meq/100g soil)		6.53	6.17	5.57	13.60	8.76
11	Bass Saturation %		50	50	56	70	54
12	Exchange Acidity meq/100g Soil, (1 M KCl Method)		20.00	15.00	5.00	10.00	10.00
13	Exchange Al meq/100g Soll, (1 M KCl Method)		0.20	0.12	0.04	0.12	0.12
14	Electrode Conductivity µS/cm, (1:5 Soil: water)		96.80	36.10	99.30	108.40	63.00
15	pH H2O (1:5 Soil: water)		5.36	5.29	7.67	7.41	5.66
16	pl KCL (1:5 (Soil: IN KCL)		4.21	4.12	6.51	6.23	4.47

(Source: Laboratory of the General Directorate of Agriculture, MAFF, 2024)

The soil characteristics of three (3) areas—Ou Ta Paong, Lum Hach, and Stung Krang Ponley—were analyzed for their agricultural suitability.

- **Ou Ta Paong** has loam soil, ideal for agriculture due to its balance of sand, silt, and clay, with moderate organic matter and slightly acidic pH (4.12 to 5.36). However, low nitrogen and potassium levels may need supplementation for optimal crop growth.
- **Lum Hach** is classified as sandy loam, with a higher sand content that improves drainage but reduces water retention. The soil is slightly acidic (pH 6.51-7.67) with low nitrogen and potassium, which may limit crop yields. The organic matter content is moderate, supporting soil health, but nutrient and irrigation management is necessary due to sandy texture.
- **Stung Krang Ponley** soils are also sandy loam, with similar challenges of low water retention due to the high sand content. The pH ranges from slightly acidic to neutral (4.47-7.41), and nutrient analysis shows low nitrogen and potassium levels. Despite these limitations, the soil is generally suitable for agriculture with careful nutrient and water management.

Overall, all three (3) areas show potential for agriculture, but improvements in nitrogen, potassium, and organic matter, along with proper irrigation, are necessary for sustained productivity.

6.4.3 Surface Water Quality

Water quality does not seem to be a critical issue for surface water, but the overuse of fertilizers and domestic wastewater are important threads. It is known to be a black market of all sorts of fertilizers, pesticides, insecticides, rodenticides, etc. sold at the borders with Viet Nam and applied

indiscriminately by farmers to increase the numbers of crops a year[25]. Sub-Degree 103 on Water Pollution Control of Ministry of Environment (MoE) in 2021 with the purpose of regulating water pollution to prevent and reduce water pollution of public water areas so that the protection of human health and the conservation of biodiversity can be ensured. The collected water samples were measured at the premises as well as at the laboratory, commissioned by Innovation Lab which is partner of Royal University of Phnom Penh (RUPP).

6.4.3.1 Ou Ta Paong

The water quality data of Ou Ta Paong compared to the Ministry of Environment (MoE) standards reveals several concerns. Key parameters such as arsenic, cadmium, lead, pH, total dissolved solids, and electrical conductivity are within acceptable limits, meeting the MoE standards for rivers and lakes/reservoirs. However, total nitrogen, total phosphorus, and total coliform levels exceed the standard limits, with nitrogen levels (3.5-4.8 mg/l) surpassing the river and lake limits (<3 and <2 mg/l, respectively), and total phosphorus (0.4-0.8 mg/l) significantly higher than the allowed levels (<0.25 and <0.15 mg/l). Additionally, total coliform levels are alarmingly high, far exceeding the permissible limit of 1000 CFU/100mL. Dissolved oxygen levels are adequate, remaining above the minimum requirement (>3 and >4 mg/l). These results indicate potential nutrient pollution and microbial contamination in the water.

6.4.3.2 Lum Hach

The water quality data of Lum Hach, when compared to the Ministry of Environment (MoE) standards, shows compliance in several parameters but also some significant deviations. Parameters such as arsenic, cadmium, lead, total dissolved solids, electrical conductivity, temperature, and dissolved oxygen meet the required standards for both river and lake environments. However, the total nitrogen level (6.8 mg/l) is well above the MoE standards for rivers and lakes (<3 and <2 mg/l), and total phosphorus (0.6 mg/l) also exceeds the permissible limits (<0.25 and <0.15 mg/l). Additionally, total coliform levels are extremely high (19,100 CFU/100mL), far surpassing the allowed limit of 1000 CFU/100mL, indicating severe microbial contamination. The pH is slightly below the standard range, suggesting slightly acidic conditions. These results suggest nutrient pollution and microbial contamination in Lum Hach, posing environmental and health concerns.

6.4.3.3 Stung Krang Ponley

The water quality data for Stung Krang Ponley shows that while some parameters are within acceptable limits set by the Ministry of Environment (MoE), several issues are evident. Parameters such as arsenic, lead, total dissolved solids, electrical conductivity, temperature, and dissolved oxygen meet the MoE standards. However, the cadmium concentration at SW8 (0.009 mg/l) exceeds the standard limit of <0.003 mg/l. The total nitrogen levels are particularly high across most sampling points (4.7 to 18.1 mg/l), significantly exceeding the limits. Total phosphorus is also elevated at SW6 (0.9 mg/l) and SW7 (0.7 mg/l), far above the permissible levels (<0.25

[25] The sustainable rice platform, supported by MAFF, is working towards controlling this market and training farmers on proper use (products' labels are not translated to Khmer). https://sustainablerice.org

and <0.15 mg/l). Furthermore, total coliform levels are alarmingly high at all sampling points. These results suggest substantial nutrient pollution and microbial contamination, especially concerning for health and environmental safety.

Summary of the water quality testing is provided in Table 6.14 below:

Table 6.14: Result of surface water quality

No	Parameter	Unit	Ou Ta Paong			Lum Hach		Stung Krang Bat	Yutas as	Krapeu Truom	Brambei Mom	Standard (MoE)	
			SW1	SW2	SW3	SW4	SWS1[26]	SW5	SW6	SW7	SW8	River	Lake and reservoir
1	Arsenic	mg/l	0.005	0.005	0.005	0.005	0.18	0.005	0.005	0.005	0.005	<0.01	<0.01
2	Cadmium	mg/l	0.001	0.001	0.001	0.001	ND	0.001	0.001	0.001	0.009	<0.003	<0.003
3	Lead	mg/l	0.005	0.005	0.005	0.005	ND	0.005	0.005	0.005	0.005	<0.01	<0.01
4	pH	-	6.32	6.2	6.44	6.42	7.58	6.78	6.91	6.53	7.49	6.5-8.5	6.5-8.5
5	Total dissolved solids	mg/l	30.76	38.07	40.71	14.95	18	71.07	91.58	83.43	99.21	<1000	<1000
6	Total suspended solids	mg/l	11	29	39	5	2	17	43	93	21	<100	<100
7	Total Nitrogen	mg/l	4.8	3.8	3.5	6.8	2.90	18.1	17.7	4.7	5.1	<3	<2
8	Total Phosphorus	mg/l	0.8	0.6	0.4	0.6	0.11	0.3	0.9	0.7	0.3	<0.25	<0.15
9	Total coliform	CFU/100mL	50,200	38,750	31,650	19,100	430	85,000	157,500	92,500	82,850	<1000	<1000
10	Electrical conductivity	µs/cm	61.4	76.12	81.43	29.91	-	138.7	183.4	167.1	197,1	500-1500	500-1500
11	Temperature	^{0}C	31.3	30.8	30.9	31.7	-	32.8	33.4	33.7	38.7	<45	<45
12	Dissolved oxygen	mg/l	5.34	5.6	5.7	5.21	7.70	5.62	5.65	6.84	5.4	>3	>4

(Source: Water Innovation Lab, 2024)

[26] Laboratory of Ministry of Environment 2024.

6.4.4 Groundwater Quality

6.4.4.1 Sampling Locations

Groundwater quality was collected from various locations within the project sites. Water testing is used to determine the existing groundwater quality at the project sites before construction and operation. Note that the GW1 is a dug well with a depth of up to 40 meters that can be used in both dry and wet seasons. In the dry season, the water level is about 25 meters, while in the rainy season, the water level is about 7 meters above the surface. GW2 and GW2 is a type of open well with a depth of 10 meters and can only be used during the rainy season. In both wells, the water level is around two (2) meters above the surface during the rainy season.

6.4.4.2 Results of the Groundwater Quality Testing

The selected samples were analysed and the results of the testing both at the field and at laboratory is provided in Table 6.15 below. In addition to the selected samples, another groundwater quality testing result from another ESIA was also included to compare the groundwater quality of the sites. The reference sample was named “GWR1” and only some of the parameters are available for comparison due to the purpose of the ESIA was different.

Table 6.15: Result of groundwater quality

No	Parameter	Unit	Results				CDWQS
			GW1	GW2	GW3	GWR1[27]	
1	Arsenic	mg/l	0.005	0.005	0.005	0.00	0.05
2	Cadmium	mg/l	0.003	0.001	0.001	0.001	0.003
3	Lead	mg/l	0.0004	0.005	0.005	-	0.01
4	pH	-	**6.01**	**6.5**	**6.48**	7.49	6.5-8.8
5	Total dissolved solids	mg/l	345.8	58.12	325.5	213	800
6	Total suspended solids	mg/l	13	5	3	-	-
7	Total Nitrogen	mg/l	6.4	3.5	21.5	-	-
8	Total Phosphorus	mg/l	0.3	0.29	2.2	-	-
9	Total coliform	CFU/ 100mL	14,065	1,600	1,200	73	0
10	Electrical conductivity	µs/cm	691.4	116.1	651.6	442	-
11	Temperature	^{0}C	30.4	30.3	30.5	-	-
12	Dissolved oxygen	mg/l	1.92	1.45	1.25	-	-

(Source: Water Innovation Lab, 2024)

Test results show that almost all parameters are below Cambodia's drinking water quality standards of the Ministry of Industry, Science, Technology, and Innovation (MISTI) in 2004, except pH parameters are below the standard range and the total coliform exceeds the standard. Total coliforms are a common group of related bacteria found in soil, vegetation, and water. Boiling or filtering groundwater before drinking is required. Overall, the quality of groundwater in the project sites are safe for daily use, such as cooking, bathing, as well as laundry but not for drinking.

6.5 BIODIVERSITY

[27] Laboratory of the Ministry of Environment 2024

6.5.1 Existing Species

A comprehensive biodiversity assessment included the utilization of the Integrated Biodiversity Assessment Tool (IBAT) and a literature review. The coordinates of this command area (via KMZ file) are used to inform the IBAT radius of screening, giving the default radius of IBAT screening between 20 to 50km depending on species ecological requirement and movement ranges. Steps to narrow down to the sub-scheme's area of influence were conducted to identify only EN and CR species that are potentially present in the sub-scheme area of influence. The final results were used to consult with experts at national level, identified a total of 25 endangered and critically endangered species across reptiles, mammals, birds, fish, amphibians, plants, and fungi. Sixteen of these species were concentrated in the Ou Tapong (OT) sub-scheme, while five (5) were screened in Lum Hach (LC), two (2) in Prambei Mom (BM) and Krapeu Truom (KT), and five (5) in Yutasas (YT) and Stung Krang Bat (SKB) (Table 6.16).

Table 6.16: Second screening list of Endangered and Critically Endangered Birds, Mammals, Reptile and Fishes

No.	Local Name	English Name	Scientific Name	IUCN Category	OTP	LH	BM	KT	Yotasas	SKB
	Reptile spices									
1	អណ្តើកព្រោច	Elongated Tortoise	*Indotestudo elongata*	CR					Yes	
2	កន្ធាយក្បាលកង្កែប	Asian giant softshell turtle	*Pelochelys cantorii*	CR						
3	អណ្តើកក្អែក	Black Marsh Turtle	*Siebenrockiella crassicollis*	EN	Yes		Yes			Yes
4	អណ្តើកសោម	Giant Asian Pond Turtle	*Heosemys grandis*	CR	Yes					
5	អណ្តើកបិទមុខ	Southeast Asian Box Turtle	*Cuora amboinensis*	EN	Yes					Yes
	Mammal species									
6	កេរោមច្រមុះ	Hairy-nosed Otter	*Lutra sumatrana*	EN	Yes					
7	ស្វាព្រាម	Indochinese Silvered Langur	*Trachypithecus germaini*	EN	Yes					
8	ស្វាក្តាម	Long-tailed Macaque	*Macaca fascicularis*	EN	Yes					
9	ឆ្កែព្រៃ	Dhole	*Cuon alpinus*	EN		Yes				
10	ជ្រីងធំ	Large Flying-fox	*Pteropus vampyrus*	EN		Yes				
	Fish species									
11	ត្រីក្រែសក់ក្រហម	Jullien's Golden Carp	*Probarbus jullieni*	CR				Yes	Yes	
12	ត្រីចង្វាស្ទឹង	Leaping barb/Flying Minnow	*Laubuka caeruleostigmata*	EN				Yes	Yes	
13	ត្រីជ្រោងំ	Striped catfish	*Pangasianodon hypophthalmus*	EN	Yes		Yes			Yes
14	ត្រីការ៉ោ /ត្រីកុលរ៉ាង	Mekong giant barb/Giant Carp	*Catlocarpio siamensis*	CR					Yes	Yes
15	ត្រីកន្ទ្រែប់ខ្លា	Siamese Tiger Perch	*Datnioides pulcher*	CR	Yes	Yes				Yes

	Bird species									
16	ត្រដក់ជំ	Greater Adjutant	*Leptoptilos dubius*	EN	Yes					
17	រនៀលស	Milky Stork	*Mycteria cinerea*	EN	Yes					
18	ចាបព្រៃវែង	Yellow-breasted Bunting	*Emberiza aureola*	CR	Yes					
19	ខ្ទីប ឬ ទ្រមាក់អណ្តើក	Bengal Florican	*Houbaropsis bengalensi*	CR	Yes					
20	ក្ងោក	Green Peafowl	*Pavo muticus*	EN		Yes				
21	ពពូលទឹក	Masked Finfoot	*Heliopais personatus*	CR	Yes					
22	ទាព្រៃស្លាបស	White-winged Duck	*Asarcornis scutulata*	EN	Yes				Yes	
	Fungi, amphibians, and aquatic plants									
23	ផ្សិតកែរ	Puffball mushrooms	*Calostoma insigne*	EN		Yes				
24	កញ្ជាញ់ចេកភ្នំក្រវាញ	Cardamon Shrub Frog	*Philautus cardamonus*	EN	Yes					
25	ស្មៅស្ទឹង / ទន្លេ	River-weed	*Terniopsis chanthaburiensis*	EN	Yes					

6.5.2 EN and CR Species Availability

6.5.6.1 Ou Ta Paong

The biodiversity assessment at Ou Ta Paong had made comprehensive reviews and consultation to reach a final confirmation of the presence of endangered (EN) and critically endangered (CR) species through observations and key informant interviews. The findings highlight significant ecological importance and potential for conservation in the region.

- **Reptile Species**: Four (4) turtle and tortoise species were observed within and around the Ou Ta Paong Command Area. The *Black Marsh Turtle* was found in both the upper and lower sections, while the *Elongated Tortoise* was limited to the upper reaches. The *Giant Asian Pond Turtle* and *Southeast Asian Box Turtle* were only seen in the lower section near Tonle Sap Zone 3. Informants struggled to differentiate between the *Milky Stork* and *Painted Stork*, a common challenge in bird identification, but it was noted that sightings of larger groups of Milky Storks were likely due to misidentification. The *Yellow-breasted Bunting* was reported as a winter visitor, although no locals could confirm sightings. It was identified as a potential species in the area due to its preference for lowland rice fields and marshes. Confusion was also reported with the *Wild-winged Duck*, which was mistakenly identified as the *Knob-billed Duck*, with no actual sightings confirmed.
- **Mammal Species**: No sightings of three (3) mammal species were confirmed in the upper section of Ou Ta Paong, but two (2) primate species were observed in the lower section, including the *Indochinese Silvered Langur*, regularly seen in the flooded forests of Tonle Sap Zone 3. Reports also confirmed the presence of *Long-tailed Macaques* in the same area. Additionally, sightings of *Hairy-nosed Otters* were noted in deep waters near the Tonle Sap Great Lake.

- **Fish Species**: Key informants confirmed sightings of *Siamese Tiger Perch* in Boeng Kansaeng Lake, located in the southwest part of Ou Ta Paong. Encounters were reported in 2023-2024, with one (1) informant having last seen the species 20 years ago. *Striped Catfish* were reported by one (1) informant, who recalled seeing them during a major flood seven (7) years ago. These species migrate to specific areas when the region is submerged.
- **Bird Species**: Informants reported sightings of critically endangered bird species, including the *Bengal Florican*, with recent observations in the lower section of Ou Ta Paong. The area provides suitable habitats such as wetlands, grasslands, and paddy fields, contributing to the species' potential survival. The *Greater Adjutant* was also confirmed, with reports indicating its presence in the region, although it may have migrated to Prek Toal Ramsar Site. Further monitoring and research are necessary to understand its population status.

Table 6.17: List of endangered and critically endangered species based on the IBAT Screening result vs. key informant interview at Ou Tapaong Command Area

No.	Local Name	English Name	Scientific Name	IUCN Cate	Screened Species	Confirmed Species
	I. Reptile spices					
1	អណ្តើកក្អែក	Black Marsh Turtle	*Siebenrockiella crassicollis*	EN	Yes	Yes
2	អណ្តើកសោម	Giant Asian Pond Turtle	*Heosemys grandis*	CR	Yes	Yes
3	អណ្តើកបិទមុខ	Southeast Asian Box Turtle	*Cuora amboinensis*	EN	Yes	Yes
4	អណ្តើកព្រេច	Elongated Tortoise	*Indotestudo elongata*	CR	No	Yes
	II. Mammal species					
5	តេរោមច្រមុះ	Hairy-nosed Otter	*Lutra sumatrana*	EN	Yes	No
6	ស្វាព្រាម	Indochinese Silvered Langur	*Trachypithecus germaini*	EN	Yes	Yes
7	ស្វាក្តាម	Long-tailed Macaque	*Macaca fascicularis*	EN	Yes	Yes
	III. Fish species					
8	ក្រីប្រាជំ	Striped catfish	*Pangasianodon hypophthalmus*	EN	Yes	No
9	ក្រីកន្ត្រៀប់ខ្លា	Siamese Tiger Perch	*Datnioides pulcher*	CR	Yes	No
	IV. Bird species					
10	ក្រដក់ធំ	Greater Adjutant	*Leptoptilos dubius*	EN	Yes	Yes
11	រនៀលស	Milky Stork	*Mycteria cinerea*	EN	Yes	Yes
12	ចាបព្រៃវែង	Yellow-breasted Bunting	*Emberiza aureola*	CR	Yes	No
13	ឌ្រីប ឬ ទ្រមាក់អណ្តើក	Bengal Florican	*Houbaropsis bengalensi*	CR	Yes	Yes
14	ពពូលទឹក	Masked Finfoot	*Heliopais personatus*	CR	Yes	No
15	ទាព្រៃស្លាបស	White-winged Duck	*Asarcornis scutulata*	EN	Yes	No
	V. Amphibians, and aquatic plants					

No.	Local Name	English Name	Scientific Name	IUCN Cate	Screened Species	Confirmed Species
16	កញ្ចាញ់ចេកភ្នំក្រវាញ	Cardamon Shrub Frog	*Philautus cardamonus*	EN	Yes	No
17	ស្មៅស្ទឹង / ទន្លេ	River-weed	*Terniopsis chanthaburiensis*	EN	Yes	No

6.5.6.2 Lum Hach

The biodiversity assessment at Lum Hach Irrigation Sub-scheme employed the Integrated Biodiversity Assessment Tool (IBAT) and key informant interviews to screen for endangered (EN) and critically endangered (CR) species in the area. The assessment identified the following species:

- Mammal Species: *Dhole (Cuon alpinus)* – Despite initial screenings, no confirmed sightings of the dhole were made within the study area. This absence may be attributed to factors such as habitat fragmentation, human disturbance, or low population densities.
  Flying-fox (Pteropus vampyrus) – Similarly, no flying-foxes were confirmed in the study area. Their absence could be due to habitat loss, hunting pressure, or other environmental stressors affecting their population.
- Fish: *Siamese Tiger Perch (Datnioides pulcher)* – This species was not observed in the study area, likely due to its preference for larger water bodies, such as the Tonle Sap Great Lake. Three (3) key informants reported encountering this species when fishing at Tonle Sap annually, but none had observed it within the Lum Hach region.
- Birds: *Green Peafowl (Pavo muticus)* – Green Peafowl were found across all three (3) community forests in the area, indicating their adaptability to the local environment and highlighting the critical role these habitats play in their conservation.
- Amphibians and Aquatic Plants: *Puffball Mushrooms (Calostoma insigne)* – Although not confirmed within the study area, there is potential for their presence in the higher elevations of the Cardamom Mountains, suggesting further exploration may be necessary to confirm their existence.

6.5.6.3 Stung Krang Ponley

The biodiversity assessments at the four (4) sub-schemes (Brambei Mom, Krapeu Truom, Yutasas, and Stueng Kang Bat) in the Stoeung Krang Ponley River catchment system provide insights into the species distribution and ecological significance of the area, with key findings focused on reptiles and fish.

- **Brambei Mom**: Semi-structured interviews with fishermen at Brambei Mom and Anlong Chrey reservoirs revealed frequent misidentifications of species, with fishermen mistakenly identifying Mekong Giant Barb as Rohu. No confirmed sightings of Jullien's Golden Carp or Striped Catfish were reported, and no turtles were observed. Historical releases of fish during National Fisheries Day may explain the presence of Pangasianodon species, though their identity remains uncertain.
- **Krapeu Trom**: Interviews in the Krapeu Trom sub-scheme targeted the Jullien's Golden Carp and Flying Minnow species. Only one (1) informant reported a sighting of Jullien's Golden Carp in 2022 during a flooding event. The species appeared to have

migrated upstream from the Tonle Sap but got trapped in the spillways, and it was suggested that a lack of flooding may affect fish populations.

- **Yutasas**: The Yutasas area supports several endangered species. Confirmations were made for Jullien's Golden Carp, Flying Minnow, and Mekong Giant Barb. A female fisher reported catching five (5) Jullien's Golden Carp during a flood, and two (2) informants confirmed sightings of Flying Minnow in their ponds and the lower reservoir. Mekong Giant Barb were found in the reservoir after heavy rains, with informants indicating that the species were likely attempting to migrate upstream.
- **Stueng Krang Bat**: This sub-scheme was identified as hosting several endangered and critically endangered species, including the Black Marsh Turtle, Southeast Asian Box Turtle, Striped Catfish, Mekong Giant Barb, and Siamese Tiger Perch. Fishermen in the area consistently reported declining populations of Striped Catfish and Mekong Giant Barb. These fish species were noted to migrate from the Tonle Sap to the floodplain, but catches have significantly decreased over the years. Reptile sightings were scarce, with only occasional encounters of the Black Marsh Turtle and Southeast Asian Box Turtle.

This assessment highlights the ecological importance of these sub-schemes, with several species facing population declines due to habitat changes and limited flooding events. Further conservation efforts are recommended to protect the vulnerable species confirmed in these areas.

Table 6.18: List of endangered and critically endangered species based on the IBAT Screening result vs. key informant interview at Stueng Krang Bat Sub-scheme

No.	Local Name	English Name	Scientific Name	IUCN Category	Screened Species	Confirmed Species
I.	**Reptile spices**					
1	កន្ធាយក្បាលកង្កែប	Asian giant softshell turtle	Pelochelys cantorii	CR	No	Yes
2	អណ្តើកភ្លែក	Black Marsh Turtle	Siebenrockiella crassicollis	EN	Yes	Yes
3	អណ្តើកចិចមុខ	Southeast Asian Box Turtle	Cuora amboinensis	EN	Yes	Yes
III.	**Fish species**					
4	ត្រីប្រាំង	Striped catfish	Pangasianodon hypophthalmus	EN	Yes	Yes
5	ត្រីកាហា /ត្រីគុលព័ង	Mekong Giant Barb	Catlocarpio siamensis	CR	Yes	Yes
6	ត្រីកន្ត្រៃប៉ឌ្ឍា	Siamese Tiger Perch	Datnioides pulcher	CR	Yes	Yes

The result of the biodiversity assessment in the full report is annexed to this report for detailed information.

6.6 SOCIO-ECONOMIC AND CULTURAL CONDITIONS

6.6.1 Administrative and Social Structure

Cambodia's administrative system at sub-national level is organized into three (3) tiers: capital city/province, district/municipality/khan, and sangkat/commune. Phnom Penh, the capital, is divided into khans and further into sangkats, while provinces are divided into municipalities and districts, with municipalities subdivided into sangkats and districts into communes and sangkats. The sub-national government is guided by organic laws, including the Law on Administration of Commune/Sangkat and the Law on Administration of Capital City, Province, Municipality, District, and Khan, supporting decentralization and deconcentration. Commune/sangkat administrations operate with legal, financial, and administrative autonomy, governed by elected councils responsible for budgets, development, and public order. Higher levels, such as provinces and districts, are governed by councils (legislative) and boards of governors (executive), with council members indirectly elected by commune/sangkat councils and supported by technical committees. Boards of governors, nominated by the Ministry of Interior, implement policies and supervise ministry units in their jurisdiction. Recent legal amendments aim to expand local administrations' authority over civil servants from national bodies, awaiting implementation through sub-decrees.

Another institution which are playing an important role in the development of the country at sub-national level is the civil society. The civil society in Cambodia, particularly the NGOs plays a vital role in development and democratization. These organizations address challenges such as poverty, education, human rights, gender equality, and environmental conservation, filling gaps in governance and social services. NGOs contribute by providing microfinance, vocational training, and livelihood programs to alleviate poverty; supporting education through school construction, scholarships, and inclusive learning; and improving health outcomes with maternal health programs, HIV/AIDS awareness, and mental health support. They advocate for human rights, labor rights, and good governance, engaging in election monitoring and raising awareness about corruption and land rights. Additionally, NGOs promote environmental sustainability and climate resilience while advancing gender equality by combating violence and discrimination and empowering women in leadership. Within the project area, there are a number of NGOs being identified within the area in different sectors including environment, community development, such as Wildlife Conservation Society (WCS), Adventist Development Relief Agency (ADRA), Advocacy Policy Institute (API), and People In Need (PIN).

Another social organization is Community-based organizations (CBOs). Cambodia, CBOs play a critical grassroots role, directly addressing local needs. Unlike NGOs, they are often less formalized and focus on mobilizing local resources for infrastructure, livelihood improvements, and strengthening community networks. CBOs contribute significantly to disaster resilience, especially in flood-prone areas, and foster cultural preservation and social cohesion through community events and initiatives. Together, NGOs and CBOs empower communities, protect rights, and promote inclusive development, offering hope for a more equitable and sustainable future despite ongoing challenges. Types of CBOs include Community Fishery, Forestry Community, Agricultural Cooperatives, and social organizations such as saving groups, old age association, etc. All of these types are reported within the project target areas.

Cambodia's culture reflects its rich history and diversity, shaped by the ethnic Khmer majority (90%) and minority groups like ethnic Vietnamese, Cham Muslims, and indigenous highland

communities. While Khmer is the official language, many minorities maintain unique languages and traditions. Buddhism, practiced by 95% of the population, deeply influences cultural norms, often blended with Hindu and animist elements such as ancestor worship. As per the commune database and consultation with local authorities regarding the indigenous people, there is no indigenous people being present within the target areas.

6.6.2 Social Conditions

The project covers a large and distinctive areas in four (4) provinces: Pursat, Kampong Chhnang, Kampong Speu and Kandal province. Ou Ta Paong and Lum Hach sub-schemes are administratively and geographically independent whereas Prambei Mom, Krapeu Truom, Yutasas and Stung Krang Bat are connected to each other as the sub-schemes share the same river basin and somehow have associated water sources. The sociological conditions of the sub-schemes are described in the following sections.

6.6.2.1 Ou Ta Paong

Ou Ta Pong command area is located solely in Bakan District, Pursat Province. The command area is approximately 16,074 hectares, comprising of cultivation area, residential, and non–residential areas (e.g. farm roads, other infrastructure works). The sub-scheme spans across parts of six (6) communes in Bakan district including Boeung Khnar, Ou Ta Paong, Rumlech, Svay Don Keo, Me Teok, and Khnar Torteng. In total, there are 38 villages from these communes that are geographically located within the command areas, resulting from the verification with commune councils, the SECAP II team and overlaying of map between the administrative boundary of the communes and the command area. The total number of households within these 38 villages were reported at 8,130 HHs, given the total population of 34,189 people (out of which 17,602 are females).

Table 6.19: Administrative and population coverage of Ou Ta Paong sub-scheme

No.	Province/ District	Communes	Number of Villages	Total HH	Total Population	Female Population
1	Pursat/ Bakan	Beung Khnar	1	254	1040	516
		Ou Ta Paong	19	3,973	17,263	8,949
		Rumlech	1	263	960	503
		Svay Doun Keo	6	1,178	2,691	5,143
		Me Teok	8	2,176	4,385	8,686
		Khnar Torteung	3	286	1,097	558
	Total	**6**	**38**	**8,130**	**34,189**	**17,602**

(Source: Ministry of Planning, Commune Database, 2023)

6.6.2.2 Lum Hach

The updated gross command area of Lum Hach is estimated at approximately 3,900 ha situated within three (3) districts of Kampong Chhnang province including Toek Phus, Rolea B'ear, and Boribour districts. The sub-scheme spans across five (5) communes including Krang Skear commune, Toek Phus district, Banteay Preal, Krang Leav, and Praseob commune in Rolea B'ear district and Anchang Rong commune in Boribour district. In total,

there are 36 villages from these communes that are geographically located within the command areas as the result of the verification with commune councils, the SECAP II team and overlaying of map between the administrative boundary of the communes and the command area. The total number of households within these 36 villages in 2023 were reported at 7,958 HHs, given the total population of 30,844 people (out of which 16,019 are females).

Table 6.20: Administrative and population coverage of Lum Hach sub-scheme

No.	Province/ District	Communes	Number of Villages	Total HH	Total Population	Female Population
1	Kampong Chhnang / Toek Phus	Krang Skear	6	2,044	7,746	3,926
2	Kampong Chhnang / Rolea B'ear	Banteay Preal	10	1,301	4,929	2,568
		Krang Leav	8	1,729	6,647	3,528
		Prasneob	6	1,412	5,377	2,767
3	Kampong Chhnang / Boribour	Anchanh Rung	6	1,472	6,145	3,230
Total		**5**	**36**	**7,958**	**30,844**	**16,019**

(Source: Ministry of Planning, Commune Database, 2023)

6.6.2.3 Stung Krang Ponley

The command areas of Stung Krang Ponley under the project is 3,277 ha, home to four (4) sub-schemes of the project including Brambei Mom (1,000 ha), Krapeu Truom (700 ha), Yutasas (650 ha), and Steung Krang Bat (1,000 ha).

Administratively, the command areas located in three (3) provinces including Kampong Chhnang, Kampong Speu, and Kandal span across the 7 communes of the three (3) provinces, giving the total of 30 villages, giving the total households of 6,702 HHs with a total population of 28,163 people (out of which 14,612 are females). One (1) commune, Svay Commune, Sameaki Meanchey district, Kampong Chhnang province, stretches across two (2) sub-schemes: Krapeu Truom and Yutasas.

Table 6.21: Administrative and population coverage of Lum Hach sub-scheme

No.	Province/ District	Communes	Number of Villages	Total HH	Total Population	Female Population
	Brambei Mom					
1	Kampong Speu / Thpong	Brambei Mom	5	1,042	4,405	2,288
		Rung Reung	4	872	3,832	1,964
	Sub-Total	**2**	**9**	**1,914**	**8,237**	**4,252**
	Krapeu Trom					
1	Kampong Speu / Odoung Maechey	Veal Pong	8	932	4,165	2,201
2	Kampong Chhnang /Sameakki Meanchey	Thbeng Khpos	4	1,281	5,207	2,688
		Svay	1	217	1,163	594
	Sub-Total	**3**	**13**	**2,430**	**10,535**	**5,483**
	Yutasas					

No.	Province/ District	Communes	Number of Villages	Total HH	Total Population	Female Population
1	Sameakki Meanchey (Kampong Chhnang)	Svay	5	1,339	5,330	2,773
	Sub-Total	**1**	**5**	**1,339**	**5,330**	**2,773**
	Steung Krang Bat					
1	Kandal/ Ponnhea Leu	Kampon Leung	1	369	1,653	856
2	Kampong Chhnang/ Kampong Tralach	Longvek	2	651	1,248	2,408
	Sub-Total	**2**	**3**	**1,020**	**4,061**	**2,104**
	Total	**7**	**31**	**6,703**	**28,163**	**14,612**

(Source: Ministry of Planning, Commune Database, 2023)

6.6.3 Demographic and Facilities

As per the description from above section on sociological condition, the ESCIA extracted the data from Commune Database, Ministry of Planning to obtain the statistics of all villages located within and nearby the command areas. It is noticeable that not all households hold the land assets within the command areas whereas it is possible that villagers from the other residential locations can also own the land within the command areas. The later population are not included in this information describes in the following section. It is noted that the commune database in 2023 is the full recorded information of village chief in every village across the country being submitted to commune further submitted to district, province and national level for compilation. Annually the data is collected during June or July and the release will be around 6 to 8 months later.

According to the commune database in 2023, the total number of households who are residing within and nearby the command area is 21,319 HH (out of which 3,941 HHs (17%) are female headed), giving the total population of 86,876 people (48,233 females). Moreover, the population are young with more than 64% of them are aging below 34 years old. More than half of the people (54%) completed education at primary school and below whereas those with secondary, high school, and higher education is only 23%, 14%, and 4%, respectively. It is noticeable that illiterate people have still existed at 4%.

Overall, it is apparent that all the sub-schemes contain young population indicating its high potential in future development activities. However, it is a concern as the population have very limited education, especially for Lum Hach, Brambei Mom, and Krapeu Tuom. Stung Krang Bat was found to be the best among the 6 sub-schemes.

Table 6.22: Demographic information of the HH living within and the vicinity of the command areas

Parameters	Sub-scheme						Total
	Ou Ta Paong	Lum Hach	Brambei Mom	Krapeu Truom	Yutasas	Stung Krang Bat	
Overall							
Total HH	8,130	6,486	1,914	2,430	1,339	1,020	22,791
Female HH Head	1,397 (17%)	1,065	317 (17%)	379 16%)	247 (18%)	179 (18%)	3,941 (17%)

Parameters	Sub-scheme						Total
	Ou Ta Paong	Lum Hach	Brambei Mom	Krapeu Truom	Yutasas	Stung Krang Bat	
Total Population	34,189	24,699	8,237	10,360	5,330	4,061	93,196
Female	17,602	12,789	4,252	5,308	2,773	2,104	48,233
Age							
<18 years old	37%	37%	40%	36%	37%	32%	37%
18 – 34 years old	25%	28%	29%	27%	32%	28%	27%
35 – 60 years old	26%	25%	24%	25%	24%	26%	25%
> 60 years old	12%	10%	7%	12%	7%	15%	11%
Educational Level							
Kindergarten	23%	14.6%	15.7%	13.2%	20.7%	10.2%	17%
Primary school	22%	51.3%	51.5%	52.1%	10.5%	15.3%	37%
Secondary school	22%	20.5%	23.4%	24.8%	41.6%	22.1%	23%
High School	16%	10.2%	7.2%	8.1%	21.0%	25.8%	14%
College/University	6%	2.3%	1.4%	1.3%	1.7%	15.0%	4%
TVET	2%	0.9%	0.4%	0.0%	0.2%	9.2%	2%
Illiterate	10%	0.3%	0.4%	0.6%	4.2%	2.5%	4%

(Source: Ministry of Planning, Commune Database, 2023)

Energy access of the population within the target area was found to be high, giving its proportion at 93% access to electricity and only a minority of them continue using battery (4%), solar energy (2%), and biogas (0.1%). However, the sources of water for domestic consumption were low with only 27% of them having access to water supply system while the rest continue using pump well, tube-well, opened-well, rainwater and river, indicating the access to clean water continue to be a huge constraint within the project target areas. A good sign for the people is how they are using water for drinking purposes which was found to be almost all using safe water for drinking (tape water 21%, filtered water 61%, and boiled water 19%). There is a concern, however, regarding the reliability of the tape water quality which may create significant impact on the people's health, if they are not properly monitored. Interestingly, almost all the people within the target areas own a toilet showing their understanding of the importance of water, sanitation and hygiene.

Across the sub-schemes, Lum Hach has the lowest access to energy, water and sanitation facilities while the rest was found to be at a high proportion. Interestingly, Brambei Mom has the highest rate of utilizing solar energy (6%) indicating potential in promoting this type of clean energy.

Table 6.23: Access to energy and water and sanitation facilities

Parameters	Sub-scheme						Total
	Ou Ta Paong	Lum Hach	Brambei Mom	Krapeu Truom	Yutasas	Stung Krang Bat	
Source of Energy							
Electricity	99.8%	78%	93.3%	98.1%	100%	100%	93%

Battery	0.1%	16%	0.6%	0.0%	0%	0%	4%
Solar	0%	6%	6.1%	1.9%	0%	0%	2%
Biogas	0.1%	0%	0.0%	0.0%	0%	0%	0.1%
Water Source for HH consumption							
Tape water	19%	3%	14%	83%	64%	92%	27%
Pump well	13%	69%	23%	5%	19%	5%	30%
Wells	4%	14%	0%	2%	2%	3%	6%
Opened Well	3%	14%	0%	0%	0%	0%	8%
Pond	27%	0%	42%	2%	4%	0%	14%
Rainwater	22%	0%	1%	5%	11%	0%	9%
River	11%	0%	21%	2%	0%	0%	6%
Drinking Water							
Tape water	30%	0.1%	47%	53%	39%	53%	21%
Filtration	61%	81.3%	27%	20%	40%	13%	61%
Boiled	9%	18.6%	26%	26%	21%	35%	19%
Toilet							
Pour Toilet	99%	98%	100%	100%	100%	100%	99%
Flush toilet	1%	2%	0%	0%	0%	0%	1%
Total toilet	100%	100%	100%	100%	100%	10%	100%

(Source: Ministry of Planning, Commune Database, 2023)

6.6.4 Socio–economic Conditions of the Beneficiaries

Agriculture was reported as the main occupation of the population within the command areas. However, the second rank for the main occupation varies from one (1) sub-scheme to another. Whle business and services is the second highest proportion (22%) for all command areas, full-time worker was found to be the highest in Brambei Mom (23%), Krapeu Truom (24%) and Yutasas (29%). It is observable that Lum Hach is the most agricultural dependent sub-scheme with 62% of the households engaged in agriculture as their main occupation. Another significant main occupation is working as laborers, giving its proportion at 6% with the highest proportion in Ou Ta Paong (9%), followed by Lum Hach and Stung Krang Bat at 5%.

As a secondary occupation, rice and crop production remains the most prevalent among the population, with animal raising as the second most common activity, followed by business and service sectors.

Table 6.24: Occupation of the HHs living within and the vicinity of the command areas

Parameters	Sub-Schemes						Total
	Ou Ta Paong	Lum Hach	Brambei Mom	Krapeu Truom	Yutasas	Stung Krang Bat	
Main Occupation							
Rice and crop production	57%	65%	42%	37%	29.6%	19%	52%
Fishing	1%	0%			-	2%	1%
Animal raising	3%	2%		2.5%	0.9%	6%	2%

Non-Timber	0%	0%			0.0%	0%	0.1%
Handcraft	1%	0%			0.1%	0%	0.2%
Business and trade	3%	2%	2%	1.1%	0.5%	4%	2%
Repair	0%	0%	1%	0.2%	0.2%	0%	0.4%
Transportation	2%	0%		0.2%	0.2%	0%	1%
Laborers	9%	5%	3%	4.1%	3.0%	5%	6%
Workers (full-time, private sector)	3%	7%	23%	23.8%	29.0%	20%	12%
Government officer	2%	2%	1%	1.1%	1.9%	7%	2%
Business & service	19%	16%	19%	30%	34.7%	37%	22%
Secondary Occupation							
Rice and crop production	45%	48%	61%	55%	77.5%	31%	49%
Fishing	2%	2%				4%	1%
Animal raising	7%	20%	1%	14%	8.3%	20%	15%
Non-Timber	0%	1%					0.5%
HandCraft	0%	4%			0.2%		2%
Business and trade	3%	4%	1%	2%	0.3%	7%	3%
Repair	1%	0%	0.1%	0.2%	0.2%		0.3%
Transportation	1%	0%		1%	2.7%	1%	0.5%
Labor sale	19%	6%	9%	5%		12%	10%
Workers (full-time, private sector)	10%	2%	9%	8%	3.7%	2%	5%
Business & service	12%	13%	19%	15%	7.0%	22%	13%

(Source: Ministry of Planning, Commune Database, 2023)

A significant proportion of the population with poor 1 & 2 is reported at 14%, indicating the level of economic condition of the areas while the proportion of the people with disability (PWD) is at 1.5%. The highest rate of poverty is reported at Ou Ta Paong (15%), followed by Lum Hach (8%), Brambei Mom (6%), Stung Krang Bat (4%), Krapeu Truom (2%), and Yutasas (1%), indicating the project should pay attention the most to Ou Ta Paong and Lum Hach. People are migrated to both inside and outside the country with the highest one is within the country (6.4%) while only 2.7% migrated to abroad. This makes the total migration of 9.1%.

Table 6.25: Migration and vulnerability of the people within the sub-schemes

Parameters	**Sub-Schemes**						**Total**
	Ou Ta Paong	**Lum Hach**	**Brambei Mom**	**Krapeu Truom**	**Yutasas**	**Stung Krang Bat**	
Vulnerability							
Poor 1	9.5%	6%	6%	1.5%	1%	3%	6.4%
Poor 2	5.4%	2%	0.5%	0.4%	0%	1%	2.7%
Total	**15%**	**8%**	**6.5%**	**2%**	**1%**	**4%**	**9.1%**
Disable person	1.1%	1.1%	1%	1.1%	0.36%	2.4%	1.1%
Old people	0.2%	0.3%	0%	0.0%	0.13%	0.1%	0.2%
Orphan	0.2%	0.2%	0%	0.1%	0.06%	0.0%	0.2%
Total	**1.5%**	**1.6%**	**1%**	**1.2%**	**0.54%**	**2.5%**	**1.5%**

Migration							
Inside the country	5%	5%	6%	2%	1%	3%	6.4%
Out of the country	5.4%	2%	0%	0%	0%	1%	2.7%
Total	**15%**	**7%**	**6%**	**2%**	**1%**	**4%**	**9.1%**

(Source: Ministry of Planning, Commune Database, 2023)

Wooden houses are the most dominated shelter of the people comprising of 57% of the total settlement. One floor or brick wall is the second most popular (34%) while the rest belong to apartments, semi-permanent, and villa. Interestingly, 1% of them live in temporary houses. Stung Krang Bat is the one with the highest proportion of wooden houses (72%) while Brambei Mom is the highest in one floor or brick wall. Lum Hach is the one with the highest proportion of temporary houses being reported indicating the people are spreading their living associated with the most agricultural occupation sub-scheme. The assets that people own the most are Television (73%), followed by motorbike (70%), and bicycle (58%), and power tiller (34%) while the rest are in small proportion.

Table 6.26: Houses and Assets of the HHs within the Sub-Schemes

Parameters	Sub-Schemes						Total
	Ou Ta Paong	Lum Hach	Brambei Mom	Krapeu Truom	Yutasas	Stung Krang Bat	
Type of Houses							
Wooden house, thatched	68%	51%	41%	41%	64%	72%	57%
Semi-permanent	6.%	3%	1%	5%	2%	1%	4%
One floor or more/brick wall	23%	40%	57%	42%	28%	18%	34%
Apartment	2.6%	5%	1%	12%	6%	5%	5%
Villa	0.3%	2%	0%	0%	0%	3%	1%
Temporary house	0.8%	5%	0%	2%	0%	0%	2%
Assets							
HH with Tractor	1.4%	1%	1%	0.1%	0.0%	0.2%	1%
Power Tiller	25.4%	69%	40%	11%	8.1%	7%	34%
HH with Rice Harvester	0.8%	0%	0%	0.0%	0.0%	0.1%	0.4%
Threshing Machine	0.0%	1%	1%	0.2%	0.1%	0%	0.5%
Harvest and Threshing Machine	0.2%	0%	0.4%	0%	0.0%	0%	0.1%
Mobile rice mill	0.0%	0%	0%	0.2%	0.0%	0%	0.1%
Car	6.2%	4%	9%	6%	8.4%	6%	6%
Other Machinery	0.3%	0%	0%	0%	0.0%	0%	0.2%
Motorbike	59.2%	90%	86%	71%	73.0%	90%	70%
Tricycle	0.2%	0%	1%	1%	0.7%	2%	0.5%
Bike cycle	51.0%	93%	50%	39%	48.9%	49%	58%
Boat	7.0%	0%	0%	0%	0.0%	7%	3%
TV	-	72%	71%	81%	95.2%	88%	73%

(Source: Ministry of Planning, Commune Database, 2023)

The data highlights family violence (2.2%) and drug use (1.7%) as the most pressing issues, followed by land disputes (1.3%). In contrast, sexual harassment, human trafficking, and crime report no cases, suggesting potential areas for further investigation into reporting mechanisms or community dynamics.

Table 6.27: Issues in the project communities

Parameters	Sub-Schemes						Total
	Ou Ta Paong	Lum Hach	Bramb ei Mom	Krapeu Truom	Yutasa s	Stung Krang Bat	
Sexual Harassment	0.00%	0.00%	0.0%	0.00%	0.0%	0.0%	0.0%
Human Trafficking	0.00%	0.00%	0.0%	0.00%	0.0%	0.0%	0.0%
Violence in the family	0.71%	0.38%	0.6%	0.07%	0.5%	0.0%	2.2%
Drug using	0.36%	0.03%	0.9%	0.19%	0.2%	0.0%	1.7%
Crime	0.00%	0.00%	0.0%	0.00%	0.0%	0.0%	0.0%
Stolen Cases	0.02%	0.03%	0.5%	0.01%	0.1%	0.0%	0.6%
Land Issues	0.28%	0.59%	0.1%	0.00%	0.3%	0.1%	1.3%

6.6.5 Cultural Sites

A key aspect of the environmental and social safeguards assessment (SECAP) includes the consideration of sites of cultural importance and heritage. Cultural heritage is an important component of the cultural identity of local communities, groups and individuals. It is key to social cohesion and therefore cultural heritage sites, structures and values should be protected, where possible, from construction of project components which could cause disturbance or disruption. Sites of cultural and heritage importance within the CAISAR command areas shall be protected and not affected during or after the irrigation system design and construction phases.

Across the command areas of CAISAR, there are two (2) important cultural sites, the post-Angkorian capital of Longvek, the 16th century king's palace, near the Stung Krang Bat command area and Bardez Stupa in Lum Hach command area. Firstly, the Longvek Capital is an ancient complex containing varies of cultural important sites across vast areas. A canal, Preak Longvek', connects the site of the King's palace to the Tonle Sap River. Creeks through the paddy field area connect Preak Kruos/Chumnik in the South with Preak Longvek in the North. The preaks were for navigation towards/out from Krang Ponley/Krang Bat, and perhaps also functioned as a flood way to protect the low-lying paddy field area from water coming in from the Krang Ponley, via the Krang Bat. The alignment of the walls of the capital can still be distinguished and is indicated on the topographic map.

Another important cultural site is the Bardez Stupa, a standalone stupa located in the Lum Hach command area. This stupa was built in commemoration of a French administrator who was killed by the Krang Leav villagers in 1925 for attempting to collect taxes considered excessive at the time. The murder angered the French, and the King later ordered to change the village's name from Krang Leav to Derichhan Village.

In addition to these two (2) historic and culturally important sites, there are also many cultural sites being identified in each of the sub-scheme as per shown in the following maps of each sub-scheme.

Figure 6.32: Maps of archaeological and cultural sites in and near Ou Ta Paong Sub-scheme

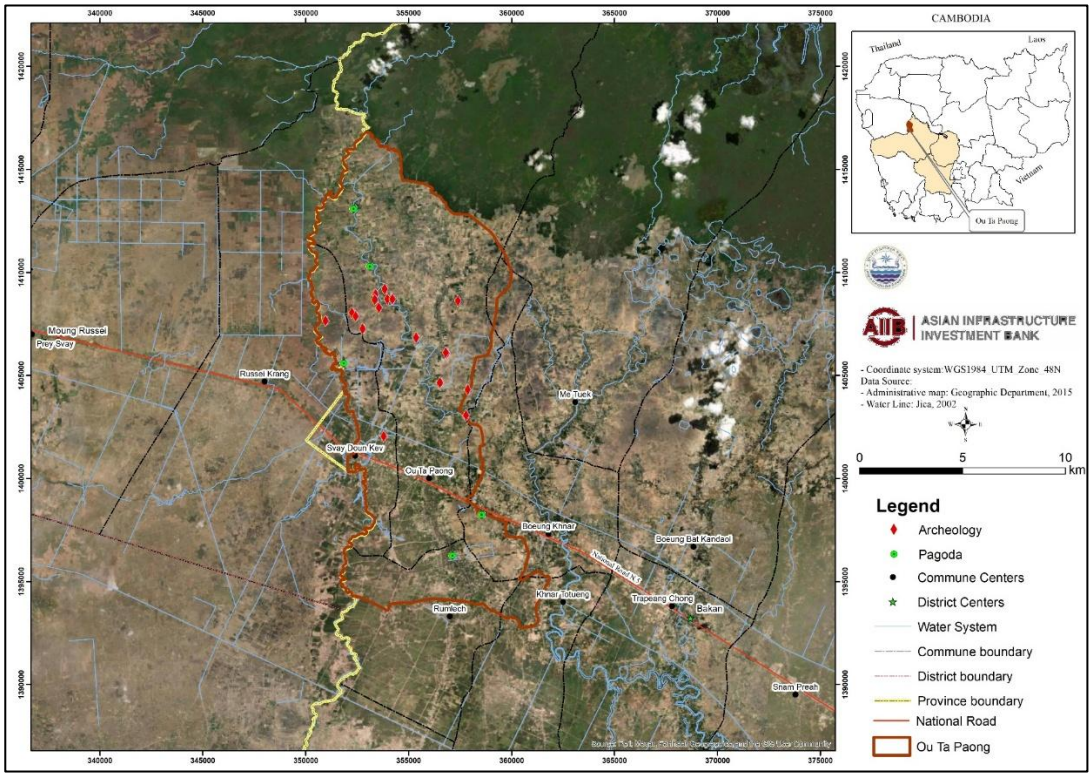


Figure 6.33: Maps of archaeological and cultural sites in and near Lum Hach Sub-scheme

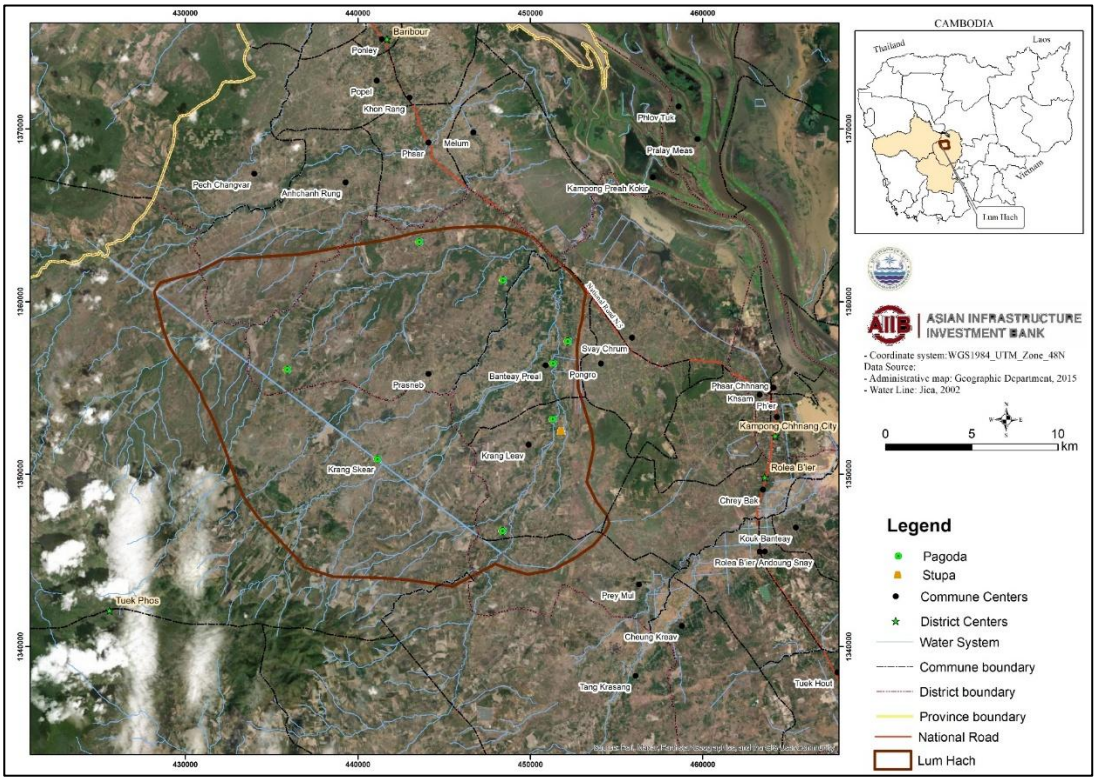
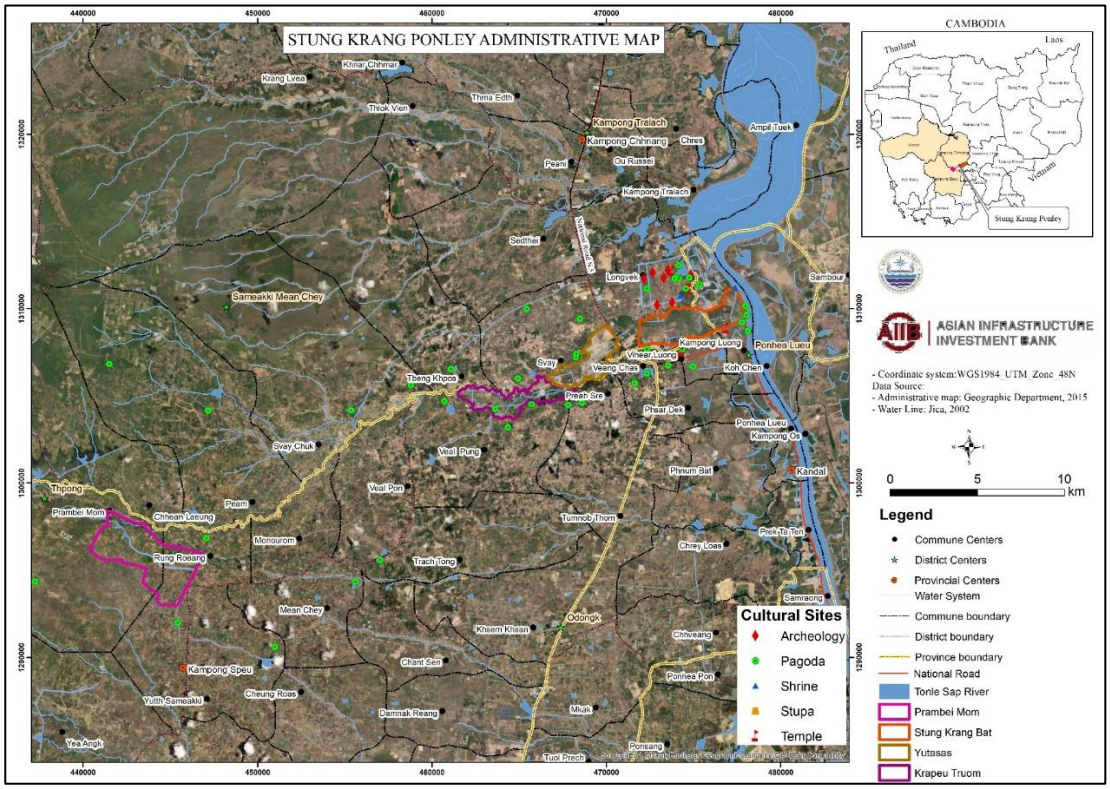


Figure 6.34: Maps of archeological and cultural sites in Stung Krang Ponley Sub-scheme



6.6.6 Agricultural Production

6.6.6.1 Rice Production

Ou Ta Paong

In the Ou Ta Paong area, farmers adapt to seasonal flooding from the Tonle Sap Lake, which lasts about three (3) months annually. They plant long-duration, flood-resistant crops in areas prone to shallow flooding, and short-duration, rain-fed crops before the floods in more severely flooded areas. After the floodwaters recede, a second short-duration crop is planted, though it is vulnerable to drought without irrigation. The dominant crop is rice, with most farmers cultivating about 2.15 hectares per household. Roughly 40% of the area is rain-fed, while 60% benefit from irrigation. Farmers typically plow in May, seed in May-June, and harvest in September. Wet season rice yields range from 4 to 5.5 tons per hectare, slightly higher than dry season yields, which range from 4 to 5 tons per hectare.

About 5% of farmers plant traditional, long-duration rice varieties, which are more drought-tolerant and yield around 2.5 to 3 tons per hectare. In irrigated, flood-free areas, farmers can grow two (2) wet-season crops, with short-growth varieties like OM 5451, known for high yield and pest resistance, being popular. Direct seeding is common, and seed sources include both saved seed and purchases. Fertilizer use is higher in the dry season, with application rates ranging from 180 to 250 kg/ha, while pesticide application occurs 3 to 5 times per season. Urea and di-ammonium phosphate (DAP) are the most used fertilizers.

Farmers face challenges such as water shortages during the dry season, shallow riverbeds, water conflicts, high input costs, and labor shortages. Some farmers hire labor for seeding and

pesticide spraying, while machinery is used for soil preparation, harvesting, and threshing. The average rice production cost is about $615 per hectare. In addition to rice, around 5% of farmers grow non-rice crops, like watermelon and sweet corn, during the dry season, with potential to expand into exportable crops such as soybeans, mung beans, and maize if irrigation improves.

Lum Hach

With limited access to irrigation systems, most farmers can only cultivate one (1) paddy crop per year, primarily using medium or late-maturity rice varieties such as Romdoul and Krasang Teap, with growth periods ranging from 130 to 150 days. The areas capable of producing two (2) or more crops annually are few and rare. Planting usually begins between May and June when the rains start, but yields vary across regions. In Rolea B'ier district and parts of Krang Skear commune, yields range from 3.2 to 3.8 tons per hectare, whereas lower yields of 1 to 2 tons per hectare are reported in Prasneb and Krang Leav communes. The average yield across the region is estimated at 1.75 tons per hectare.

Labor shortages are a significant challenge in the area, as many men and young women seek jobs in construction or factories, leaving behind the elderly and children who cannot meet the labor demands. This lack of labor affects the potential for horticulture, and the few vegetables grown near homes are shared among neighbors with no market for sales. The average land size for rice production is 1.56 hectares, and farmers rely on self-produced seeds, purchasing only when necessary. On average, 120 kg of seed is used per hectare during the wet season, while no rice is grown during the dry season due to water scarcity.

Farmers use 235 kg of chemical fertilizer and 450 kg of compost per hectare in the wet season, along with three (3) pesticide applications for pests and one for weeds. Challenges include a lack of capital, weed management, and unreliable water sources. Straw is typically used as cattle feed, burned, or left in the field for 2-3 months before plowing into the soil for the next season. The cost of rice production is $403.13 per hectare, and while some farmers have received training on transplanting, organic production, and crop management, others have not received any capacity-building support.

Stung Krang Ponley

Brambei Mom. Rice cultivation in the area is primarily for household consumption, but there are opportunities for commercialization during the wet season (WS) due to low production costs, particularly for medium to late-maturity rice varieties, and the aromatic qualities of the chosen strains. Despite the proximity to the Anlong Chrey water reservoir, dry season (DS) rice cultivation is limited because the land is not suitable for large-scale farming, lacking the vast plains needed for effective DS production.

The average land size for rice farming ranges from 1 to 3 hectares, with common rice varieties including Chhmar Lait, Chhmar Prum, Phka Mlis, and Phka Rumduol. During the wet season, farmers use approximately 100-150 kg of rice seed per hectare, while no rice is grown in the dry season due to water scarcity. Most farmers produce their own seeds and only purchase additional supplies when community shortages arise. Fertilizer use during the wet season varies, with 150-300 kg of chemical fertilizers and 500-1000 kg of compost applied per hectare. Pesticide use is minimal.

Household labor is the primary source for rice production, but external labor is often hired for tasks such as soil preparation, harvesting, and transporting rice from the field. The average yield during the wet season is 4.25 tons per hectare, but challenges such as water scarcity, high soil preparation costs, and lack of capital hinder production. Environmental issues like heavy rains during broadcasting, pest outbreaks (especially fall armyworm), and weed infestations further complicate cultivation efforts.

After harvesting, straw is typically stored for cattle feed, while stubble is left in the field for three (3) months before either being burned or plowed under. The average cost of production ranges from 1,200,000 to 1,500,000 riel per hectare, approximately $350. Unfortunately, none of the four (4)-focus group discussion reported having received any formal capacity-building training to improve their practices.

Krapeau Truom. In Kropeau Troum, most farmers cultivate paddy rice during the wet season, while some areas grow watermelon, wind gourd, and cucumber in the dry season between March and May. The average land size for rice production ranges from 0.3 to 1 hectare. Common rice varieties grown include Neang Menh, Phka Mlis, Reang Chey, and Phka Rumduol. Farmers typically use about 120 kg of rice seed per hectare during the wet season, with no rice production in the dry season due to water scarcity. Most seeds are self-produced, and farmers only purchase additional supplies when shortages arise.

Fertilizer use during the wet season averages 100 kg of chemical fertilizer and 200 kg of compost per hectare, while pesticide application is not common. Labor for rice farming is primarily household-based, but machinery is hired for tasks such as soil preparation, harvesting, and transporting rice. The average rice yield during the wet season is 4.25 tons per hectare, but production faces significant challenges due to damaged irrigation gates, which lead to water shortages, along with pests like the walker insect and weed infestations.

After harvesting, straw is typically kept for cow feed, sold, or left in the field for 2-3 months before being either burned or ploughed under. The average cost of production ranges from 1,500,000 to 2,000,000 riel, approximately 400 USD per hectare. Farmers in the area have received training on water consumption management, techniques for rice seed storage and use, as well as proper fertilizer and pesticide application techniques.

Yotasas. In Yotasas, rice is the main crop cultivated by most farmers, with a small number of households also growing cash crops like watermelon and vegetables. The average land size for rice production ranges from 1 to 1.5 hectares. Common rice varieties include Reang Chey, Changkuah Ampeak, Angka No 55, and Angka No 85. Farmers use between 70 to 200 kg of rice seeds per hectare, with traditional varieties being self-produced, while Angka No 55 and 85 are purchased from the market.

Fertilizer use varies between the wet and dry seasons, with 100-300 kg of chemical fertilizer and 40-60 kg of compost applied per hectare during the wet season, and 100-320 kg of chemical fertilizer during the dry season. Pesticide usage is focused on controlling pests and weeds, with application occurring 2-4 times for pests and 1-2 times for weeds in the wet season, and 4-5 times for pests and 1-2 times for weeds in the dry season. Labor for rice farming is primarily sourced from households, but rented labor is used for soil preparation, pesticide spraying, harvesting, and transporting rice.

The average rice yield ranges from 2.5 to 5 tons per hectare in the wet season and about 3 tons per hectare in the dry season. Farmers face several challenges, including water scarcity for both rice and crop production, with canals often lacking water and no inflow sources. Other issues include limited capital, pest infestations (such as the walker pest during the boosting stage), and weed management.

After harvesting, straw is either kept for cow feed or sold, while stubble is typically left in the field for 2-3 months before being burned or plowed under. The average cost of rice production is between 1,500,000 and 2,000,000 riel per hectare. In terms of capacity building, some groups have received training on rice production (three (3) times) and crop production (once), but one (1) group has not received any training.

Stung Krang Bat. In the Krang Bat area, which spans an estimated 1,000 hectares of low-lying rice fields, farmers primarily cultivate paddy rice. The area is intersected by several creeks and experiences seasonal flooding from the Mekong River via the Tonle Sap River, with inundation depths reaching up to three (3) meters for about three (3) months. This flooding affects the crop patterns, with farmers planting paddy rice as soon as the water recedes sufficiently. By the end of the crop cycle, the fields dry out, creating a need for irrigation, and during severe dry seasons, there is a high risk of crop failure. The area's agricultural potential is declining as parts of the command area are being converted into residential and commercial developments due to rising land prices.

The average land size for rice production ranges from 0.5 to 2 hectares. Farmers cultivate rice varieties like Reang Chey, Phka Rumduol, Chhmar Prum, Kang Soay, and Angka No 85. They use 200-300 kg of rice seeds per hectare, with most seeds being self-produced and additional supplies purchased from the market when necessary. Fertilizer usage varies, with 170-300 kg of chemical fertilizer applied per hectare during the wet season and 300 kg per hectare during the dry season. Pesticide use is minimal, applied twice for pest control in both seasons, and weeds are only treated once during the dry season.

Household labor is the primary source of manpower, though machinery is rented for tasks like soil preparation, harvesting, and transporting rice from the field. The average yield in the wet season ranges from 1 to 2.5 tons per hectare, while the dry season yield reaches 4 tons per hectare. Farmers face several challenges, including a lack of water and an insufficient irrigation system, frequent flooding from Anlong Chrey, rising fertilizer costs, and issues with pests (particularly walker pests during the boosting stage) and weeds. After harvesting, straw is either kept for cow feed, sold, or left in the field for 2-3 months before being burned or plowed under. The average cost of rice production is between 1,200,000 and 1,400,000 riel per hectare. Notably, neither farming groups in the area have received any capacity-building training.

6.6.6.2 Vegetable Production

Ou Ta Paong

In the area, very few households are involved in vegetable production for the market, with small-scale horticulture activities taking place around homesteads during the dry season. These activities are supported by water from wells and ponds and are observed in two (2) 'Agriculture Communities' (AC): Psar Andeth AC and Chamkar Khluy AC, as well as in the neighboring Rumlech Commune, where farmers grow crops like watermelon on dry paddies.

The most popular vegetables grown in the area include pumpkin, cucumber, eggplant, wax gourd, long bean, luffa gourd, morning glory, mustard, and green onion. The average land size for vegetable cultivation ranges from 450 to 600 square meters. Farmers use both organic and chemical cultivation practices, applying compost and chemical fertilizers. Seeds are typically purchased from the market, and water sources for irrigation include canals, ponds, rainwater, and rivers. There are no agricultural cooperatives or associations in the area.

Farmers spend between 250$ and 450$ on vegetable production, covering expenses for seeds, pesticides, water, fertilizers, labor, and land preparation. The income from vegetable sales is approximately 500$ per year, which constitutes about 10% to 30% of their total income. The main markets for these vegetables are local markets and brokers. Key challenges faced include a lack of water during the dry season, extreme heat, insect pests, low prices, poor soil fertility, diseases, and climate change. Farmers have received agricultural services related to seed variety selection, nursery management, crop irrigation, and the use of fertilizers and pesticides.

Lum Hach

In the area, the most popular vegetables grown include luffa gourd, morning glory, pumpkin, wax gourd, long bean, white radish, cucumber, mustard green, amaranth, and corn. The average land size dedicated to vegetable cultivation ranges from 100 to 1,000 square meters. Farmers employ both organic and chemical cultivation practices, using manure and chemical fertilizers along with pesticides.

Water sources for irrigation include rainwater, wells, and ponds. In terms of agricultural associations, two (2) out of three (3) areas have associations, while one (1) does not. Farmers' expenditures on vegetable production typically range from 100,000 to 400,000 riels, covering costs for seeds, fertilizers (both manure and chemical), and irrigation materials. Income from vegetable sales varies between 1,600,000 and 3,000,000 riels, or approximately USD 325 and USD 750.

Vegetables are sold through household consumption, village markets, and brokers. Challenges faced by farmers include insect pests, low market prices, diseases, water shortages, and the impacts of climate change. They have received some agricultural services related to planting techniques, though these are not specified in detail.

Stung Krang Ponley

Brambei Mom. In Brambei Mom district, particularly in Doun Tip village, horticultural activities are prominent, with a focus on vegetables like curly cabbage, cucumber, choy sum, pumpkin, luffa gourd, long bean, peanut, green bean, and morning glory. The average land size for vegetable cultivation varies from 200 to 8,000 square meters. Farmers use a combination of organic and chemical cultivation practices, including Good Agricultural Practices (GAP). They primarily use compost and manure fertilizers and apply pesticides less frequently.

Irrigation for these vegetable farms is sourced from the Stung Krang Ponley river, accessed mainly through diesel-powered pumps with a pumping distance of up to 500 meters. Some areas have agricultural associations. The expenditures on vegetable production are highly varied ranging from 150 USD to USD 1,500 per household, covering costs for seeds, labor, pesticides, manure, plastic covers, fertilizers, nets, and other materials. Income from

vegetable sales ranges between USD 500 and USD 3,500 per household with GAP cultivation yielding higher income and involving larger land areas.

Vegetables are sold in local markets and through brokers, including wholesalers at Oudong market. Challenges include insect pests, diseases, high temperatures, water shortages, and water containing limestone. Farmers have received agricultural services related to smart climate agriculture and planting techniques.

Krapeu Truom. The average land size for vegetable cultivation ranges from 200 to 2,000 square meters. During the dry season, watermelon fields are situated near Stung Krang Ponley, with water accessed through short-distance pumping. In the wet season, some farmers relocate their watermelon cultivation to upland areas, relying on rainwater for irrigation. Rice fields used for watermelon in the dry season are converted back to rice paddies for the wet season. Farmers practice both chemical and organic cultivation methods. Water sources include rainwater, ponds, canals, rivers, and tap water. There are no agricultural associations in the area. Expenditures for vegetable production, including seeds, fertilizers (both chemical and manure), labor, and irrigation (pump rentals), range from USD 50 to USD 500. The average income from vegetable sales is around USD 1,000.

Vegetables are sold for household consumption and at local markets. Challenges faced include insect pests, diseases, water shortages, inadequate planting techniques, lack of materials, high temperatures, low prices, and climate change. Farmers have received agricultural services such as seed provision from the provincial department, market information, and farm demonstrations on planting techniques.

Yutasas. In the area, vegetable cultivation includes a variety of crops such as cucumber, watermelon, curly cabbage, luffa gourd, wax gourd, morning glory, long bean, and peanut. The average land size for vegetable farming ranges from 1,000 to 10,000 square meters. Farmers employ both traditional and chemical cultivation practices, using water sourced from canals, ponds, and wells from the Yutasas scheme. Some areas have agricultural associations.

Expenditures for vegetable farming range from USD 250 to USD 3,500, covering seeds, manure, fertilizers, pesticides, pump machines, petroleum, straw, nets, drip systems, and soil covering materials. Income varies between USD 500 and USD 6,000, with higher earnings in areas that use land covering and irrigation systems.

Vegetables are sold at local markets, through brokers for Phsar Doem Kor, Phsar Odoung, and supermarkets. Key challenges include insect pests, diseases, low soil fertility, and water shortages. Farmers have received agricultural services such as growing techniques, compost making, market information from social media, and support from trainers and agriculture district officers.

Stung Krang Bat. The area is not popular in terms of vegetable production. In the area, vegetable cultivation features crops such as luffa gourd, morning glory, long bean, eggplant, cucumber, and wax gourd. The average land size used for vegetable farming is between 700 and 1,000 square meters. Farmers practice traditional cultivation methods, utilizing manure fertilizer and chemical pesticides. Water for irrigation is sourced from ponds and pump wells.

There are no agricultural associations in the area. Expenditures for vegetable farming range from USD 100 to USD 135, covering seeds, manure, and pesticides, while income is between

USD 135 and USD 150. Vegetables are sold at local markets, including village and district markets.

Challenges faced by farmers include insect pests, diseases, low prices, lack of water, and water containing limestone. Agricultural services received include learning growing techniques from social media.

6.6.6.3 Animal Production

In the CAISAR Project area, a diverse range of animal production activities is prevalent among local households. Cattle farming is the most common, with 38% of households raising cows. Buffaloes are also kept, though by a smaller proportion of households, with only 9% engaging in buffalo farming. Pig farming is similarly practiced by 9% of households. Chicken farming is the most widespread, with 66% of households involved in raising chickens, reflecting their significant role in the local economy and diet. Ducks are the least common among the livestock options, with just 4% of households raising them. This distribution highlights the varied livestock practices within the area, with a strong emphasis on poultry farming and a notable presence of cattle and buffalo farming.

6.6.7 Profiles of the Beneficiaries

6.6.7.1 Demographic Information

The survey conducted by the ESCIA with 272 households (HHs) reported a total of 1,274 family members, averaging 4.68 members per household. Of the total population, 644 are female (50.55%) and 630 are male (49.45%), with an average of 2.37 female members and 2.32 male members per household. The near-equal distribution of male and female members indicates a balanced gender ratio across the surveyed households. In addition to this figure, there are 25 HHs (9%) of the households are categorized as poor households (table 6.28).

Table 6.28: Demographic Information of the beneficiaries HHs (n=272)

Family Members	Figure
Total HHs	272
Total HH members	1274
Avg. member per HH	4.68
Total female members	644
Avg. female member per HH	2.37
Total male members	630
Avg. male member per HH	2.32
% of female members	50.55%
% of male members	49.45%

6.6.7.2 Occupation

The majority of household heads are primarily engaged in rice and crop production, accounting for 72% of the main occupations whereas animal production is reported the most as secondary occupation, accounting for 22% of the respondents. Other notable occupations include trade (5% for main and 3% for secondary), government staff (4% for main and 1% for secondary), and seasonal private sector work, which, though only 3% report it as their main job, represents

7% of secondary occupations. The service and handicraft sectors provide modest contributions to both primary and secondary employment. Interestingly, a considerable portion (32%) of household heads report having no secondary occupation, while 3% also indicate having no primary job. This data highlights the heavy reliance on agriculture as the backbone of household livelihoods, supplemented by a mix of other occupations, particularly in secondary roles.

Table 6.29: Occupation of the beneficiaries HHs (n=272)

HH head	Main Occupation		Secondary Occupation	
	#	%	#	%
Rice and crop production	197	72%	37	14%
Animal production	3	1%	61	22%
Fishing/aquaculture	1	0%	4	1%
Forest	0	0%	0	0%
Trade	14	5%	7	3%
Service	8	3%	15	6%
Handicrafts	2	1%	4	1%
Government staff	12	4%	4	1%
Workers (full-time, private sector)	7	3%	5	2%
Workers, (seasonal, private sector)	8	3%	20	7%
Housewife	6	2%	16	6%
Student	0	0%	0	0%
Other (specify)	7	3%	12	4%
No job	7	3%	87	32%
Total	**272**	100%	**272**	100%

Table 6.30 shows the occupations of the members of the potentially affected households showing a diverse distribution, with rice and crop production being the predominant one for main occupation, representing 31% of households, while also serving as a secondary occupation for 18%. A notable 22% of household heads are students, which is consistent across both main and secondary occupations. Full-time workers in the private sector make up 16% of both main and secondary occupations, reflecting significant engagement in formal employment. Government staff account for 2% of main occupations and 3% of secondary occupations, while trade represents 4% of main occupations and 3% of secondary occupations. Interestingly, 14% of household heads report having no main job, while a higher proportion, 20%, report no secondary job. Seasonal private sector work, services, and housewives contribute smaller percentages to the household economy, with some variation between main and secondary roles. Overall, the data highlights a strong reliance on agriculture and formal employment, supplemented by a variety of other roles, while a significant portion of the population is engaged in education or lacks formal employment.

Table 6.30: Occupation of the members of the potentially affected beneficiaries HHs

Variable	Main Occupation		Secondary Occupation	
	#	%	#	%

Rice and crop production	397	31%	232	18%
Animal production	4	0%	66	5%
Fishing/aquaculture	2	0%	5	0%
Forest	-	0%	-	0%
Trade	48	4%	41	3%
Service	28	2%	34	3%
Handicrafts	4	0%	6	0%
Government staff	42	3%	34	3%
Workers (full-time, private sector)	207	16%	204	16%
Workers, (seasonal, private sector)	26	2%	38	3%
Housewife	31	2%	44	3%
Student	280	22%	280	22%
Other (specify)	28	2%	32	3%
No job	177	14%	258	20%
Total	**1,274**	**100%**	**1,274**	**100%**

The data on the types of houses of beneficiarie households (Table 6.31) indicates that the majority (48.53%) live in semi-permanent houses, which are likely more durable but not fully modern, with a larger average size of 67.23 square meters. Wooden houses with thatched roofs, with an average size of 54.85 square meters, accounting for 39.34%. These homes represent traditional, simpler structures commonly found in rural or less developed areas. A smaller proportion, 9.19%, live in more modern and durable houses made of brick walls or reinforced concrete roofs, which are typically larger, with an average size of 107.24 square meters, indicating better living conditions for these households.

Only 2.57% of the households live in temporary houses, which are the smallest, with an average size of just 20.43 square meters, suggesting highly vulnerable living conditions. Another 0.37% fall into the other category, with an average size of 48 square meters, but no further details are provided. Overall, the majority of the affected households live in relatively simple and modest housing, with a small proportion living in more durable and spacious homes.

Table 6.31: Houses of the beneficiaries HHs (n=272)

Types of the houses	Number	Figure	Average size (m²)
Semi-permanent	107	48.53%	67.23
Wooden house, thatched	132	39.34%	54.85
House built of 1 floor or more/brick wall, reinforced concrete roof	25	9.19%	107.24
Temporary houses	7	2.57%	20.43
Other	1	0.37%	48.00

6.6.7.3 Land Ownership/Land Tenure

Table 6.32 shows different levels of land ownership and documentation across various land types. Residential land is owned all households (270), with an average land size of 1,298 m². Of these, 75% hold official title deeds, 15% have soft title deeds, and 10% do not have any form of title. Riceland, which is much larger at an average size of 14,237 m², is owned by 256

households, with the same percentage (75%) holding official title deeds. However, 12% hold soft title deeds, and 13% have no title. Garden land, owned by 52 households with an average size of 4,709 m², has lower formal ownership rates, with only 63% holding official title deeds. 12% have soft title deeds, and 25% of garden landowners do not have any form of title. This data highlights a strong degree of formal land ownership for residential, Riceland, and other land categories, but garden land shows a considerable gap in formal land documentation. Additionally, households without any form of land title are most prevalent in garden land and Riceland, pointing to potential areas of concern for securing land rights.

Table 6.32: Lands of the surveyed HHs (n=270)

No.	Type of Land	N	Size (m2)	Tittle Deed	Soft Tittle Deed	None
1	Residential land	270	1,298	75%	15%	10%
2	Riceland	256	14,237	75%	12%	13%
3	Garden land	52	4,709	63%	12%	25%
4	Other land	2	37,500	100%	0%	0%

6.6.7.4 Labor Division and Decision Making

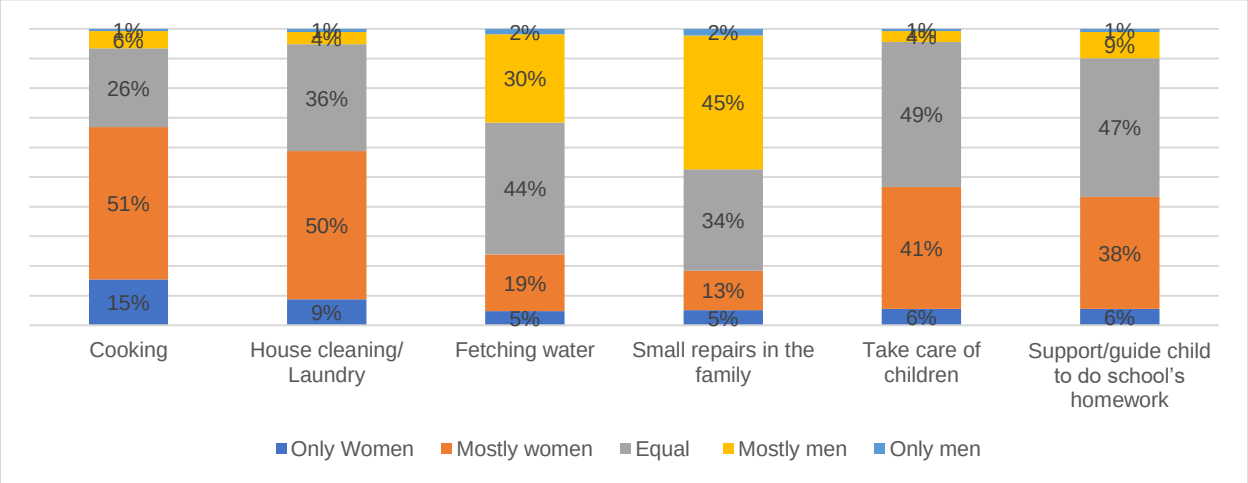
CAISAR Gender Assessment and Social Inclusion Plan reported that men spend on average of 59.4% of their time for farming whereas women spend only 40.5%. In traditional farming context, men involve the most during cultivation stage while women are more engaged in the later production. Heavy duty tasks such as land preparation are designated to men while seedling preparation and weeding are commonly assigned to women. Transplanting, uprooting, harvesting, and marketing are generally shared by both. However, the practices have been changed lately due to the presence of mechanization where land preparation, harvesting and threshing have been replaced by machinery.[28]

Coming comes to household chores; women handle 90% of the workload. During the COVID-19 outbreak, women spent even more time on domestic and caregiving tasks. Elderly family members bear the full responsibility for raising grandchildren when their mothers have migrated. In the project area, similarly, in families where women work in nearby garment factories or migrate for paid employment, domestic duties are often shifted to young girls and the elderly. [29]The ESCIA field survey showed that cooking, housing and cleaning, child caring and schooling are mainly at the hand of women, except repairing in the household and fetching water where men involve the most (Figure 6.35).

[28] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.

[29] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.

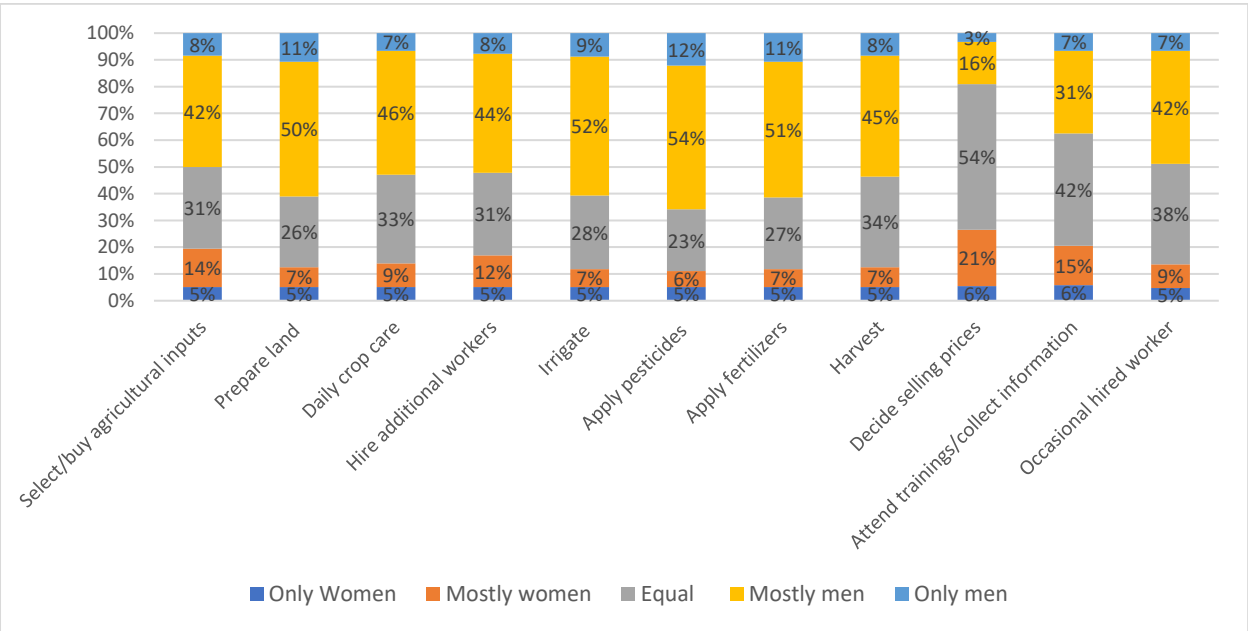
Figure 6.35: Division of Roles in Household Chores of the Beneficiaries HHs (n=270)



(Source: ESCIA Field Survey, 2024)

In crop production, the distribution of labor was found to be male dominated for majority of the tasks, especially at production level. However, women were found to be a slightly higher dominated at the time of selling prices for their produces. Interestingly, men are the one involves the most in the production, but it tends to be women who participated the most in the occasion of training or obtaining any agriculture related information (Figure 6.36).

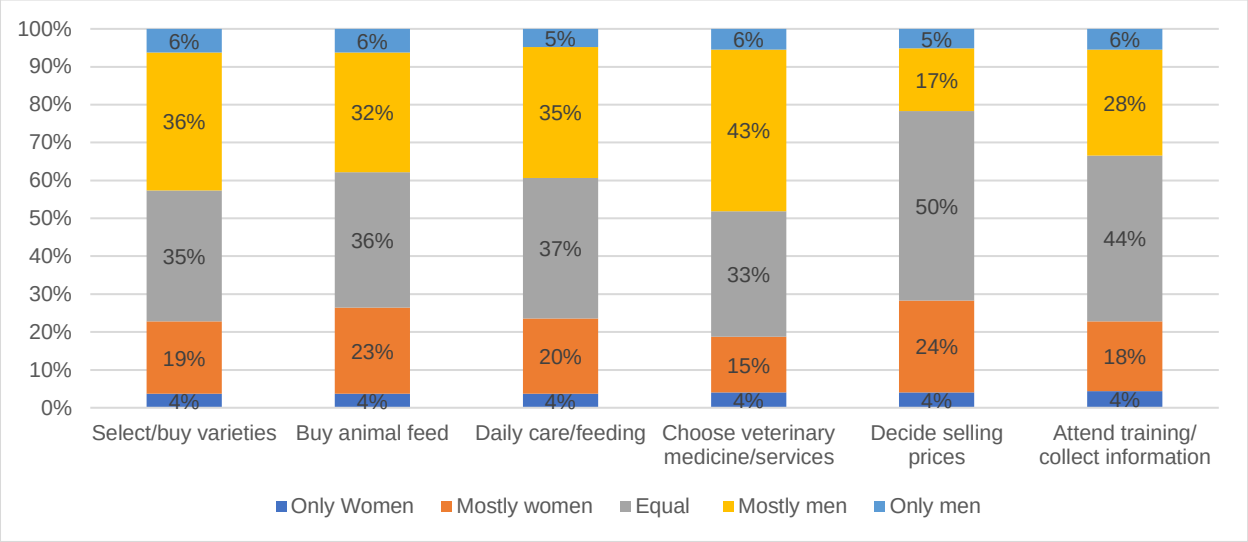
Figure 6.36: Share of Roles in Crop Cultivation of the Beneficiaries HHs (n=272)



(Source: ESCIA Field Survey, 2024)

In animal production, the distribution of labor is still found to be male dominated for majority of the tasks at production level. Once again, women were found to be a slightly higher dominated at the time of selling prices for their animals. Interestingly, the involvement of men and women are bias to a more equally contributed at the time of selling and training and obtaining related information.

Figure 6.37: Share of roles in Animal Husbandry of the Beneficiaries (n=272)



(Source: ESCIA Field Survey, 2024)

6.6.7.5 Income

According to the ESCIA survey, the average annual household income is USD 10,490, given the average annual income amounts to USD 2,239.54 per household member. Table 31 reported the distribution of annual household income across 272 households. A total of 37 households (14%) earns less than USD 2,500 annually, while 56 households (21%) fall within the USD 2,500 to 5,000 income range. Another 51 households (19%) earn between USD 5,001 and 7,500, and 27 households (10%) report an income between USD 7,501 and 10,000. The largest group, comprising 101 households (37%), earns more than USD 10,000 annually. This distribution shows that a significant portion of the households (37%) are in the higher income bracket, while a smaller proportion (14%) earns below USD 2,500 annually (table 6.33).

Table 6.33: Average annual income per household of the survey households (n=272)

Total annual income (US$)	Figure	%
Less than 2,500	37	14%
2,500 - 5,000	56	21%
5001 - 7,500	51	19%
7,501 - 10,000	27	10%
Higher than 10,000	101	37%
Total	**272**	**100%**

The CAISAR Gender Assessment and Social Inclusion Plan revealed notable findings regarding income differences by gender. On an individual level, the average monthly income for female household members is $121.4 (n=238), which is lower than the $166.6 earned by male members (n=366), showing a statistically significant income gap of $45.2. However, at the household level, there is no significant difference in average income between female-headed and male-headed households, with a small mean difference of $17.3. Nationally, 48% of married men (aged 15–49) reported making joint decisions with their wives on income use, 46% said their wives mainly make these decisions, and 6% said they decide alone.

Additionally, 97% of married women (aged 15–49) who earn cash from employment participate in decisions about their earnings, with 63% making these decisions mainly on their own.[30]

6.6.8 Profiles of the Potentially Affected Households

6.6.8.1 Demographic Information

The survey conducted by the ESCIA with 85 affected households (HHs) reported a total of 387 family members, averaging 5 members per household. Of the total population, 204 are female (52.71%) and 183 are male (47.29%), with an average of 2.4 female members and 2.2 male members per household. The near-equal distribution of male and female members indicates a balanced gender ratio across the affected households. In addition to this figure, there are 5 HHs (6%) of the households are categorized as poor households (please see table 6.34).

Table 6.34: Demographic Information of the potentially affected HHs (n=85)

Family Members	Figure
Total HHs	85
Total HH members	387
Avg. member per HH	5
Total female members	204
Avg. female member per HH	2.4
Total male members	183
Avg. male member per HH	2.2
% of female members	52.71%
% of male members	47.29%

6.6.8.2 Occupation

The majority of household heads are primarily engaged in rice and crop production, accounting for 69% of the main occupations whereas animal production is reported the most as secondary occupation, accounting for 25% of the respondents. Other notable occupations include government staff (7% for main and 4% for secondary), trade (5% for main and 1% for secondary), and seasonal private sector work, which, though only 4% report it as their main job, represents 8% of secondary occupations. The service and handicraft sectors provide modest contributions to both primary and secondary employment. Interestingly, a considerable portion (34%) of household heads report having no secondary occupation, while 5% also indicate having no primary job. This data highlights the heavy reliance on agriculture as the backbone of household livelihoods, supplemented by a mix of other occupations, particularly in secondary roles.

Table 6.35: Occupation of the potentially affected HHs head (n=85)

HH head	Main Occupation		Secondary Occupation	
	#	%	#	%
Rice and crop production	59	69%	10	12%
Animal production	0	0%	21	25%

[30] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.

HH head	Main Occupation		Secondary Occupation	
	#	%	#	%
Fishing/aquaculture	1	1%	0	0%
Forest	0	0%	0	0%
Trade	4	5%	1	1%
Service	3	4%	4	5%
Handicrafts	1	1%	1	1%
Government staff	6	7%	3	4%
Workers (full-time, private sector)	0	0%	1	1%
Workers, (seasonal, private sector)	3	4%	7	8%
Housewife	1	1%	4	5%
Student	0	0%	0	0%
Other (specify)	3	4%	4	5%
No job	4	5%	29	34%
Total	**85**	**100%**	**85**	**100%**

Table 6.36 shows the occupations of the members of the potentially affected households showing a diverse distribution, with rice and crop production being the predominant one for main occupation, representing 31% of households, while also serving as a secondary occupation for 18%. A notable 22% of household heads are students, which is consistent across both main and secondary occupations. Full-time workers in the private sector make up 14% of both main and secondary occupations, reflecting significant engagement in formal employment. Government staff account for 5% of main occupations and 4% of secondary occupations, while trade represents 4% of both categories. Interestingly, 13% of household heads report having no main job, while a higher proportion, 19%, report no secondary job. Seasonal private sector work, services, and housewives contribute smaller percentages to the household economy, with some variation between main and secondary roles. Overall, the data highlights a strong reliance on agriculture and formal employment, supplemented by a variety of other roles, while a significant portion of the population is engaged in education or lacks formal employment.

Table 6.36: Occupation of the members of the potentially affected HHs

Variable	Main Occupation		Secondary Occupation	
	#	%	#	%
Rice and crop production	120	31%	71	18%
Animal production	0	0%	21	5%
Fishing/aquaculture	2	1%	1	0%
Forest	0	0%	0	0%
Trade	17	4%	14	4%
Service	11	3%	11	3%
Handicrafts	1	0%	1	0%
Government staff	18	5%	15	4%
Workers (full-time, private sector)	55	14%	55	14%
Workers, (seasonal, private sector)	10	3%	14	4%
Housewife	8	2%	12	3%
Student	86	22%	86	22%

Variable	Main Occupation		Secondary Occupation	
	#	%	#	%
Other (specify)	10	3%	11	3%
No job	49	13%	75	19%
Total	**387**	**100%**	**387**	**100%**

The data on the types of houses of potentially affected households (Table 6.37) indicates that the majority (48.24%) live in wooden houses with thatched roofs, with an average size of 48.54 square meters. These homes represent traditional, simpler structures commonly found in rural or less developed areas. Semi-permanent houses, which are likely more durable but not fully modern, account for 40% of the households, with a larger average size of 55.38 square meters. A smaller proportion, 9.41%, live in more modern and durable houses made of brick walls or reinforced concrete roofs, which are typically larger, with an average size of 96.13 square meters, indicating better living conditions for these households.

Only 1.18% of the households live in temporary houses, which are the smallest, with an average size of just 21 square meters, suggesting highly vulnerable living conditions. Another 1.18% fall into the other category, with an average size of 48 square meters, but no further details are provided. Overall, the majority of the affected households live in relatively simple and modest housing, with a small proportion living in more durable and spacious homes.

Table 6.37: Houses of the potentially affected HHs (n=85)

Types of the houses	Number	Figure	Average size (m^2)
Wooden house, thatched	41	48.24%	48.54
Semi-permanent	34	40.00%	55.38
House built of 1 floor or more/brick wall, reinforced concrete roof	8	9.41%	96.13
Temporary houses	1	1.18%	21.00
Other	1	1.18%	48.00

6.6.8.3 Land Ownership/Land Tenure

The potentially affected households hold various types of land with different levels of tenure security. Residential land is the most common, averaging 1,452 square meters, with 75% of households having hard title deeds, 12% holding soft titles, and 13% lacking documentation. Riceland, with an average size of 14,741 square meters, is similarly well-secured, with 74% holding hard titles, 12% soft titles, and 14% without documentation. Garden land, averaging 6,012 square meters, with only 52% of households having hard titles, 19% soft titles, and 29% have no documentation. The other land is owned by one household with a secure hard title. Overall, while most households have secure tenures for residential and Riceland, a significant portion, particularly in garden land, lacks formal documentation.

Table 6.38: Lands of the potentially affected HHs (n=85)

Type of Land	N	Size (m2)	Types and Land Titles					
			Hard title deed		Soft title deed		None	
Residential land	85	1,452	64	75%	10	12%	11	13%
Riceland	77	14,741	57	74%	9	12%	11	14%

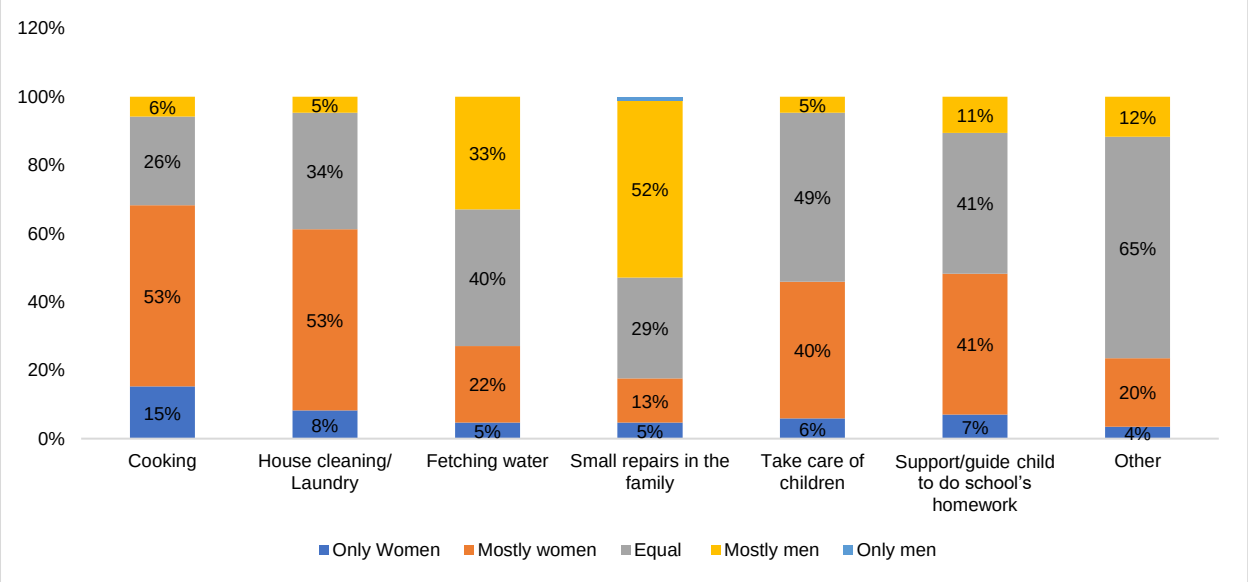
Garden land	21	6,012	11	52%	4	19%	6	29%
Other land	1	5,000	1	100%	0	0%	0	0%

6.6.8.4 Labor Division and Decision Making

CAISAR Gender Assessment and Social Inclusion Plan reported that men spend on average of 59.4% of their time for farming whereas women spend only 40.5%. In traditional farming context, men involve the most during cultivation stage while women are more engaged in the later production. Heavy duty tasks such as land preparation are designated to men while seedling preparation and weeding are commonly assigned to women. Transplanting, uprooting, harvesting, and marketing are generally shared by both. However, the practices have been changed lately due to the presence of mechanization where land preparation, harvesting and threshing have been replaced by machinery.[31]

Coming comes to household chores; women handle 90% of the workload. During the COVID-19 outbreak, women spent even more time on domestic and caregiving tasks. Elderly family members bear the full responsibility for raising grandchildren when their mothers have migrated. In the project area, similarly, in families where women work in nearby garment factories or migrate for paid employment, domestic duties are often shifted to young girls and the elderly. [32]The ESCIA field survey with affected household showed that cooking, and housing and cleaning, are mainly at the hand of women, except repairing in the household where men involve the most while fetching water, take care of their children and other tasks addressed to be equal both men and women (Figure 6.38).

Figure 6.38: Division of Roles in Household Chores of Affected HHs (n=85)



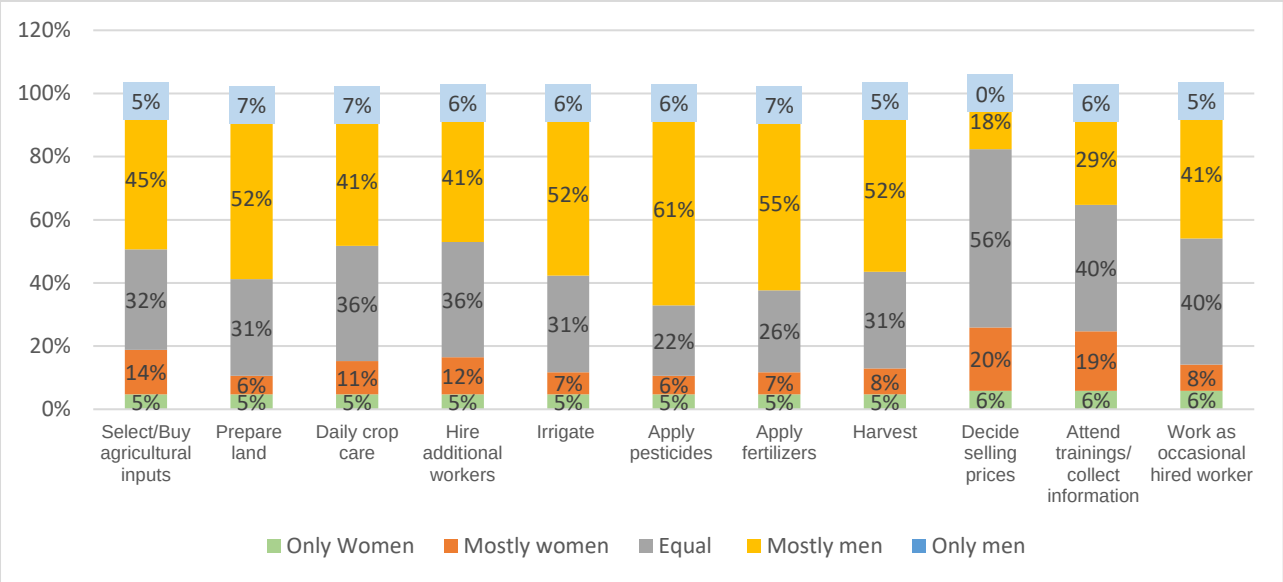
(Source: ESCIA Field Survey, 2024)

[31] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.

[32] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.

In crop production, the distribution of labor was found to be male dominated for majority of the tasks, especially at production level. However, women were found to be a slightly higher dominated at the time of selling prices for their produces. Men are the one involves the most in the production and they participated the most in the occasion of training or obtaining any agriculture related information (Figure 6.39).

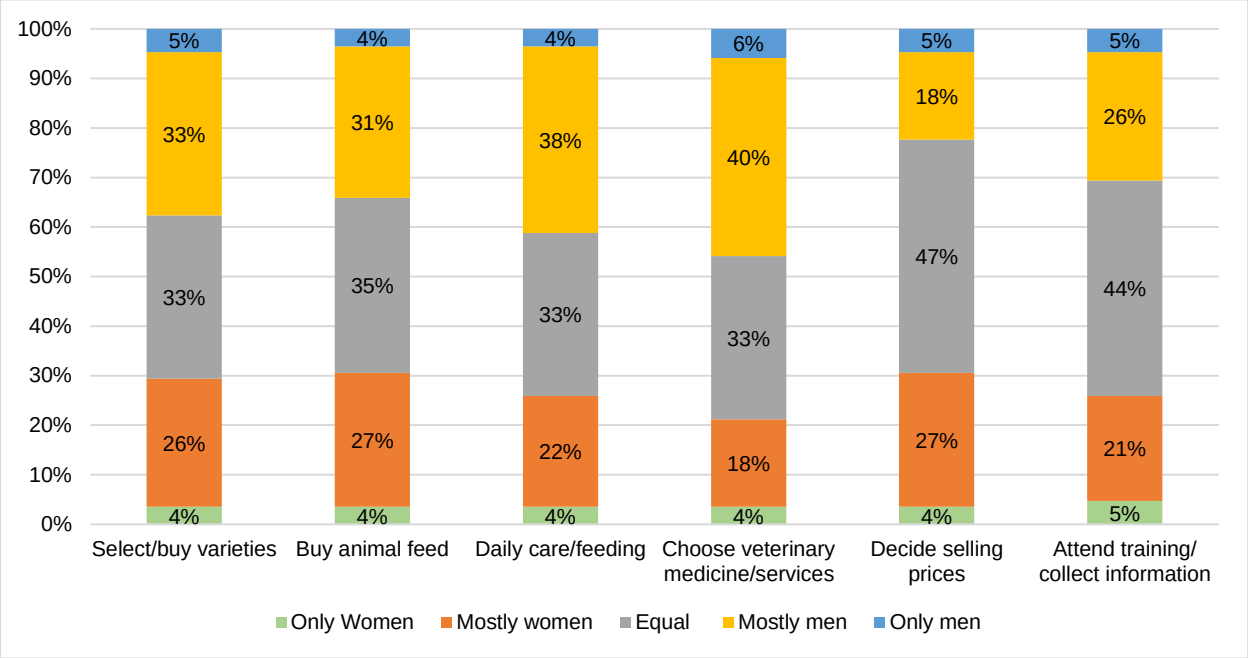
Figure 6.39: Share of Roles in Crop Cultivation of the Affected HHs (n=85)



(Source: ESCIA Field Survey, 2024)

In animal production, the distribution of labor is still found to be male dominated for majority of the tasks at production level. Once again, women were found to be a slightly higher dominated at the time of selling prices for their animals. Interestingly, the involvement of men and women are bias to a more equally contributed at the time of selling and training and obtaining related information.

Figure 6.40: Share of roles in animal husbandry of the affected HHs (n=85)



6.6.8.5 *Income*

According to the ESCIA survey, the average annual household income is USD 10,490, given the average annual income amounts to USD 2,239.54 per household member. Table 31 reported the distribution of annual household income across 85 households. A total of 8 households (9%) earns less than USD 2,500 annually, while 16 households (19%) fall within the USD 2,500 to 5,000 income range. Another 22 households (26%) earn between USD 5,001 and 7,500, and 9 households (11%) report an income between USD 7,501 and 10,000. The largest group, comprising 30 households (35%), earns more than USD 10,000 annually. This distribution shows that a significant portion of the households (35%) are in the higher income bracket, while a smaller proportion (9%) earns below USD 2,500 annually.

Table 6.39: Average annual income per household of the affected HHs (n=85)

Total annual income (US$)	Figure	%
Less than 2,500	8	9%
2,500 - 5,000	16	19%
5001 - 7,500	22	26%
7,501 - 10,000	9	11%
Higher than 10,000	30	35%
Total	**85**	100%

The CAISAR Gender Assessment and Social Inclusion Plan revealed notable findings regarding income differences by gender. On an individual level, the average monthly income for female household members is $121.4 (n=238), which is lower than the $166.6 earned by male members (n=366), showing a statistically significant income gap of $45.2. However, at the household level, there is no significant difference in average income between female-headed and male-headed households, with a small mean difference of $17.3. Nationally, 48% of married men (aged 15–49) reported making joint decisions with their wives on income use, 46% said their wives mainly make these decisions, and 6% said they decide alone.

Additionally, 97% of married women (aged 15–49) who earn cash from employment participate in decisions about their earnings, with 63% making these decisions mainly on their own.[33]

6.7 CLIMATE CHANGE SCENARIOS

In this section, climate assessment and projection for climate change was drawn from the works of the Feasibilty Study team and the FAO team who do the Climate Change Project using EXACT model (This information was drawned from Annex 2 of the Funding Proposal which is prepared to fulfil the requirements of the Green Climate Fund).

6.7.1 Current Impacts of Climate Change

On average, annual damage and loss of wet season rice caused by floods and droughts is approximately 120,501 hectares, of which 70 percent of the damage and loss is due to floods and 30 percent is the result of droughts. Flooding occurs frequently and extensively in Cambodia. The source of these floods can be the Mekong River including the Tonle Sap Great Lake, tributary flash floods, urban flooding, and failure of structures such as protection levees and storages.

The agricultural sector accounts for 94-98% of the water use in Cambodia, with 1-2% from industry and 4% from domestic sectors (FAO 2005).[34,35] Water use across sectors is 2-7% of available water that flows through the country annually, and water scarcity results primarily from limited access to irrigation and a lack of water storage capacity, particularly in the dry season[36]. Projections in 2003 suggested that industrial and domestic uses will increase to 15% and 11% by 2025 in Cambodia and other South-east Asian countries, and while this may no longer apply, it is plausible that there will be increased competition in the near-future due to climate impacts and economic changes upstream of the river basins (industrial use, deforestation, etc.) that are transboundary or national. Therefore, enhancing water use efficiency in agriculture and the agro-industrial sector are critical – including through tailoring advisories linked to agrometeorological information and climate forecasts.

Floods also damage roads, collapse ponds and cause canal breakages – impacting the irrigation infrastructure directly, and this then results in inadequate water supply for cultivation in subsequent years. Of the estimated[37] US$ 356.23 million loss and damage from 2013

[33] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.

[34] Cambodia National Mekong Committee (CNMC) Water Security, Food Security and Livelihoods in Cambodia and the Lower Mekong Basin. https://ppcrcambodia.files.wordpress.com/2012/11/watt-1106-w-food-security.pdf

[35] https://www.worldometers.info/water/cambodia-water/

[36] ADB Cambodia Agriculture, Natural Resources, and Rural Development, Sector Assessment, Strategy and Road Map. https://www.adb.org/sites/default/files/publication/718806/cambodia-agriculture-rural-development-road-map.pdf

[37] Note: WATSAN was a separate category from water and irrigation infrastructure. Roads included drainage structures such as pipe and box culverts and spillway locations. Government of Cambodia (2014). Post-flood early recovery need assessment report. https://www.undp.org/sites/g/files/zskgke326/files/migration/kh/Cambodia-post-flood-recovery-need-assessment-report.pdf

floods, water and irrigation infrastructure accounted for US$ 52 million (14.5%) and national / rural roads for another US$ 79.61 million (22.3%). It is also the case that when irrigation infrastructure is designed without taking climate scenarios into account — as they are currently, it can affect water flow and drainage from fields. Stakeholder consultations[38] identified at least one instance when a drain that passes under the main canal was too small in diameter to handle large flows, resulting in rice fields upstream becoming flooded during the wet season, breakage of main canal embankment and drainage water entering the main canal, and another where the opening of the water gates was too narrow and under conditions of large discharge, the flow and velocity of turbulence causes soil erosion.

Climate change affects women, men, and vulnerable people differently, and their responses to its impacts also differ, including in relation to safeguarding food security and livelihoods and coping with hazards and risks. In the project area, women have significantly less access than men to financial instruments, land, natural resources, climate change resources and technologies, education, and other development services for successful adaptation to climate change. Women are also underrepresented in FWUCs, and typically perform administrative roles. A study of 10 selected irrigation schemes: three (3) in Kompong Thom, three (3) in Pursat and four (4) in Kompong Chhnang showed that among 43 members of FWUCs in the study areas, only nine (9) are female (21%)[39]. Most of the important positions in FWUCs, such as chair and first and second vice-chair, are dominated by men. While women mostly hold positions as treasurers and accountants in the committees. Cambodia's Women's Resilience Index found women less resilient in times of disaster than men due to women's unstable and insecure sources of income, limited access to shelters or safe places, inadequate climate information and early warning systems, poor housing, weak social safety nets and absence of emergency networks. Furthermore, women's responsibilities in household resources position them well to contribute to livelihood strategies adapted to changing environmental realities. However, lack of information, access to planning processes, and care obligations, limit their ability to contribute.

6.7.2 Climate Change Projections

Precipitation and temperature have become increasingly unpredictable. The temperature anomalies by 2040-2059 against the reference period of 1986-2006 for Cambodia and CAISAR provinces are presented in Table 6.40. The average monthly temperature is projected to increase by 1.83°C by 2040-59. By mid-century, climate change will result in more frequent heavy precipitation days: from 2.4 days to 4.9 days in the rainy season, and an increase in the number of consecutive dry days in the same season: from 0.8 days to 4.4 days.

Table 6.40: Projected anomaly (changes °C) for average monthly temperatures, using median values of CCKP multi-model ensembles and showing 10-90th percentile in brackets

Region	Average Monthly temperature, 2040-2059	
	RCP 4.5	RCP 8.5
Kampong Speu	1.35 (0.22, 2.05)	1.75 (0.49, 2.54)

[38] Field visits 17-20 May 2022: Learning about and from FWUCs. Annex 4, CAISAR – Feasibility Study and Project Preparation.

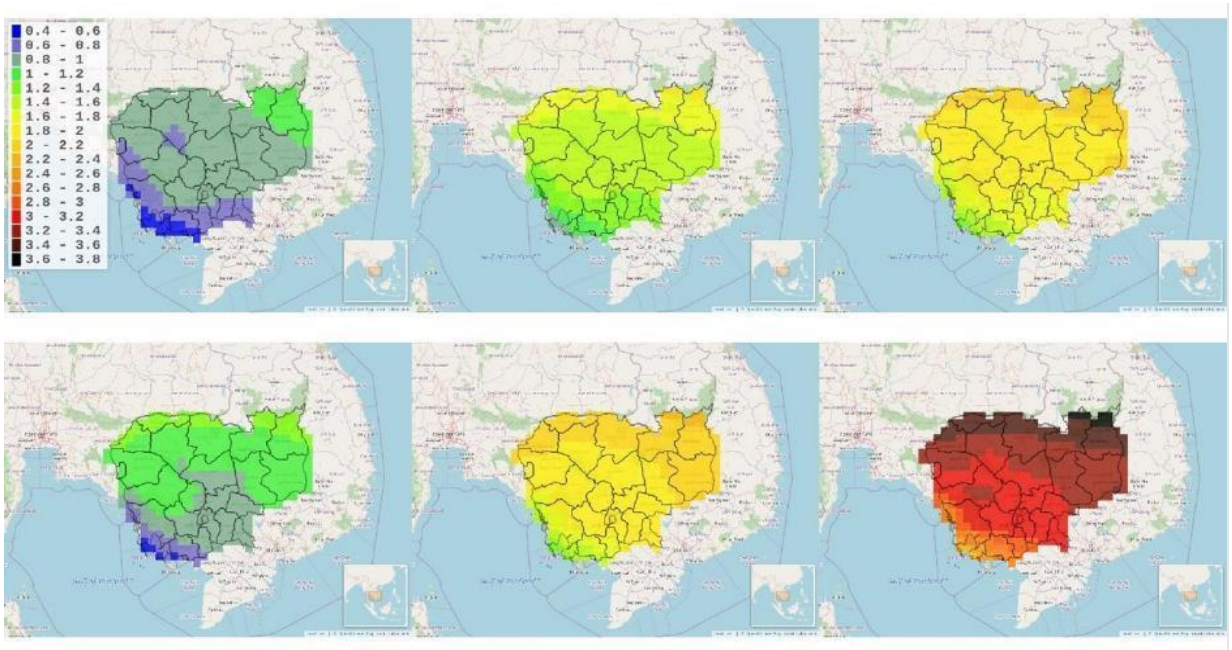
[39]Gender and Water Governance: Women's Role in Irrigation Management and Development in the Context of Climate Change. CDRI Working Paper Series No. 89 -2014

Kampong Chhnang	1.37 (0.13, 2.21)	1.81 (0.34, 2.83)
Kandal	1.34 (0.17, 2.1)	1.76 (0.49, 2.62)
Pursat	1.36 (0.10, 2.29)	1.72 (0.35, 2.89)
National	1.39 (0.04, 2.23)	1.83 (0.22, 2.78)

Future projections of climate change in the project area under the RCP4.5 scenario (Figure 6.41) indicate a temperature increase of 1.4-1.6°C by mid-century (2040-2070) and up to 2.2°C by the end of the 21st century (2070-2100); the increase is much higher under RCP8.5 scenario (3.6°C, 2070-2100). With regards to the spatial variability, the inner Cambodia will experience a higher temperature change compared to coastal areas. While the changes over time will be lower than 1°C along the coastal areas, the inner parts of the country will experience a temperature rise of more than 2°C in both RCPs.

Nights exposed to high temperatures are projected to become more frequent during the 21st century (+114 nights by mid-century and +151 nights by the 2080s). Population, crop and livestock systems will also experience heat extremes more frequently in comparison to the reference period (42 days by mid-century and reaching 62 days by the 2080s) and IFAD is expecting a drastic reduction in the productivity of crops and livestock.

Figure 6.41: Temperature maximum deviation from historical baseline period (1980-2005) under RCP 4.5 (top row) for the period 2011-2040 (left), 2040-2070 (middle) and 2070-2100 (right) and RCP8.5 (bottom row) for the same time periods. The deviation highlights the projected changes into the future in degree Celsius based on projections from bias corrected regional CORDEX data (FAO analysis, CAVA tool).



While annual rainfall is expected to increase, the number of days with rain is decreasing and daily rain intensity is increasing, resulting in extreme rainfall events and flooding risks[40].

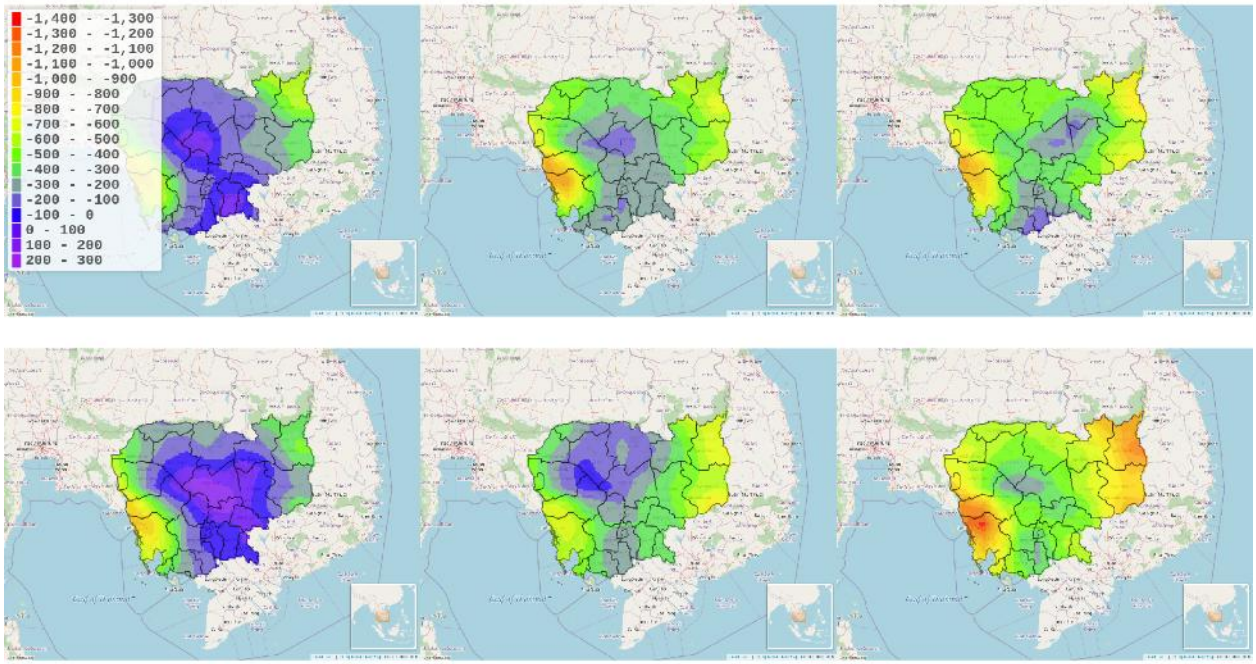
Across Southeast Asia, a modest increase in precipitation is projected – from 1-8% by 2100 (IPCC AR5), but there are some uncertainties in the direction of changes in annual

[40] World Bank and ADB, 2021.

precipitation and river flows for the Mekong River Basin[41]. In general, it can be said that for the CAISAR observation points, models[42] show a reduction in rainfall during the dry season but an increase in rainfall during the wet season and an increase in frequency and intensity of heavy rainfall events which is described in more detail later.

For the Lower Mekong Basin, both an increase in drought days by 2100[43] and an increase in drought frequency[44] is predicted, and flooding is expected to increase in frequency, severity, and duration[45]. Studies find more severe flood inundation magnitude in the Lower Mekong Basin, in the future (2075-2099) compared to 1979-2003, under four (4) RCP scenarios and sea surface temperature patterns[46].

Figure 6.42: Cumulative precipitation per year deviation from historical baseline period (1980-2005) under RCP 4.5 (top row) for the period 2011-2040 (left), 2040-2070 (middle) and 2070-2100 (right) and RCP8.5 (bottom row) for the same time periods. The deviation highlights the projected change into the future in millimeter/year based on projections from bias corrected regional CORDEX data (FAO analysis).



[41] Piman, T., Cochrane, T.A., Arias, M.E., Dat, N.D. and Vonnarart, O., 2014. Managing Hydropower under Climate Change in the Mekong Tributaries. Chapter 11 in S. Shrestha et al. (Ed.), Managing Water Resources under Climate Uncertainty: Examples from Asia, Europe, Latin America, and Australia, In Press, Springer. https://doi.org/10.1007/978-3-319-10467-6_11

[42] Global Climate Models and Regional Climate Models comparing data for 1995-2001 with 2026-2050 projections. WAPCOS and Phnom Penh International Consultants, 2023. CAISAR Feasibility Report D8, Version 1.2.

[43] Hirabayashi, Y., Kanae, S., Emori, S., Oki, T., and Kimoto, M., 2008. Global projections of changing risks of floods and droughts in a changing climate. Hydrological Sciences, 53 (4): 754-772. https://doi.org/10.1623/hysj.53.4.754

[44] MRC, 2010. State of the Basin Report 2010. Mekong River Commission: Vientiane.

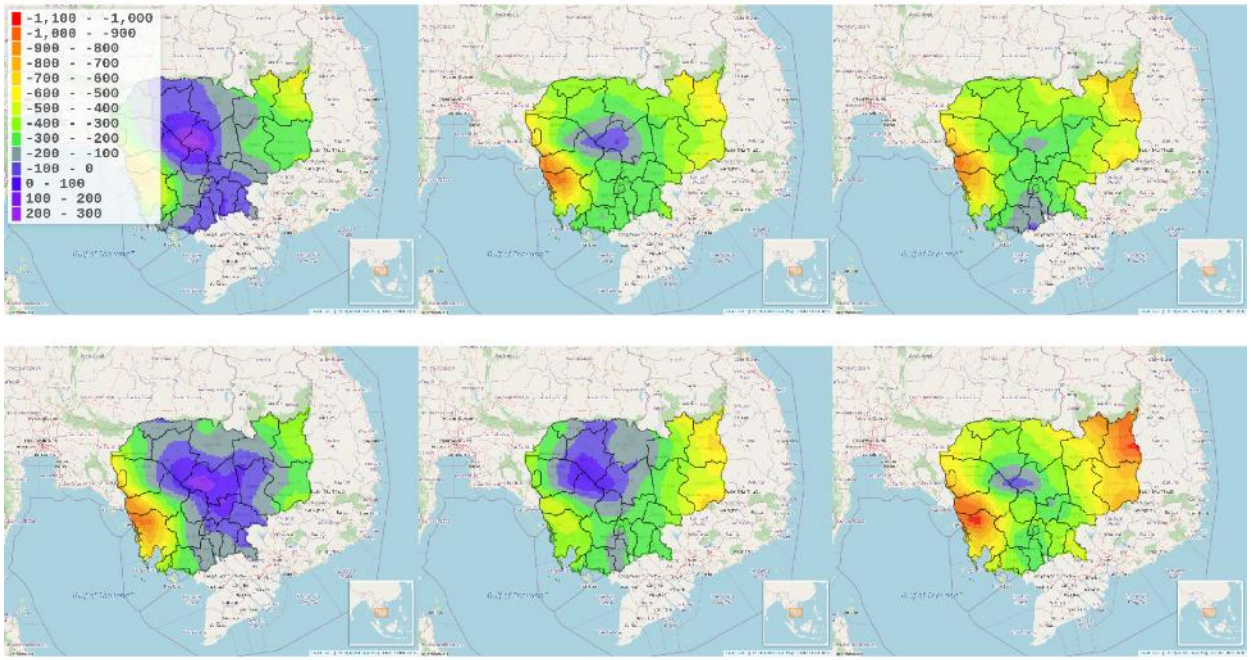
[45] Thoeun, 2015.

[46] Try, S., Tanaka, S., Tanaka, K., Sayama, T., Lee, G., and Oeurng, C., 2020. Assessing the effects of climate change on flood inundation in the lower Mekong Basin using high-resolution AGCM outputs. Progress in Earth and Planetary Science, 2020 (7): 34. https://doi.org/10.1186/s40645-020-00353-z

Although there is significant variability in modelled future precipitation projections in Cambodia, most estimates of the mean annual rainfall indicate a decrease in rainfall into the near future (Figure 6.42) with potential more intense decreases in the medium to far future. There is an increasing trend in seasonal rainfall between June and August in the northwest, and a decreasing trend in the northeast of the country. Precipitation deviation from the historical average period (1980-2005), shows the largest increase in the near future, with subsequent decreases in annual precipitation in the medium and far future, with variation geographically.

As many agricultural producers rely on rainfed production in the wet season, Figure 6.43 shows changes in cumulative precipitation in the wet season precipitation and deviation from the historical average in the wet season, respectively. This analysis suggests decreasing wet season precipitation into the future, to a higher degree under RCP8.5 and with changes up to -500 mm/year.

Figure 6.43: Deviation in cumulative precipitation in rainy season (May-October) from historical baseline period (1980-2005) under RCP 4.5 (top row) for the period 2011-2040 (left), 2040-2070 (middle) and 2070-2100 (right) and RCP8.5 (bottom row) for the same time periods. The deviation highlights the projected change into the future in millimeters based on projections from bias corrected regional CORDEX data (FAO analysis).



Other studies[47] find that climate change, in combination with land use change and other developments, could significantly reduce river flows within the Mekong River basin. That is, climate change will also likely induce a decrease in both wet and dry season river flows in all 11 sub-basins contributing to Tonle Sap Lake: mean annual projected flow reductions range from 9-29% for 2030s, 10-35% for 2060s, and 7-41% for 2090s. Additionally, future flood magnitudes are projected to reduce for all 11 sub-basins over a majority of time horizons and

[47] Oeurng, C., Cochrane, T.A., Chung, S., Kondolf, M.G., Piman, T., and Arias, M.E., 2019. Assessing Climate Change Impacts on River Flows in the Tonle Sap Lake Basin, Cambodia. Water, 11(3): 618. https://doi.org/10.3390/w11030618

under at least one (1) scenario; reductions are also projected for other scenarios used in the simulation for most sub-basins. Since a decrease in extreme river flows is also modeled, this would cause a decline in flood magnitudes and an increase in drought occurrences (in both wet and dry season) throughout the basin as well as an increase in extreme droughts in most sub-basins.

6.7.3 Greenhouse Gas Emissions and Agriculture Sector in NDCs

In Cambodia, GHG emissions (2016) are dominated by the Forestry and Other Land Uses (FOLU) sector (60.9%)– the main driver for which is deforestation – and agriculture (16.9%), followed by energy (12.0%), IPPU (7.9%) and waste (2.1%) sectors. Forest cover of Cambodia was 73% in 1960 and had declined to 57% in 2010 and 54% in 2014[48]. GHG emissions without the FOLU sector are dominated by the agriculture sector (43.3%), followed by energy (30.9%), waste (5.5%), and IPPU (20.3%). Agricultural emissions increased by ~3% each year between 1994 and 2016 – the main driver being rice cultivation. Under a business-as-usual (BAU) scenario, Cambodia forecasts an increase in emissions from 125.2 MtCO2eq in 2016 (Table 6.41, Col A) to 155.0 MtCO2eq in 2030 (Table 6.41, Col C).

The NDC emissions reduction scenario by 2030 (Table 31) largely targets FOLU and energy but also IPPU sectors with 40-50% reduction. Agriculture emissions will only reduce by 23% in the same period – the sector contributing about 9.6% of the overall 64.5MtCO2eq reduced (difference between Table 4 Col C and Col D); but owing to the links between FOLU (land-use and forest conversion) and agriculture, actions to increase productivity of agricultural lands and interventions such as land management and organic input agriculture are likely to have an indirect effect on FOLU targets. Improving water use efficiency of rice cultivation using techniques such as AWD or SRI, introducing stress-tolerant and improved seed varieties, and deploying drip irrigation for certain crops can directly reduce methane emissions from rice and indirectly reduce intensity of agricultural emissions (CO2eq per ton of production) through better yield stability or increased yields. Finally, gravity irrigation is not feasible in all parts of the command area, and farmers resort to pumping water from rivers and canals using diesel engines to irrigate their rice fields. In fact, even farmers who primarily rely on gravity irrigation may resort to pumping groundwater or surface water from ponds during the dry season or dry days in the rainy season. Shifting to solar irrigation would help reduce costs in the long run and reduce energy emissions associated with agriculture.

Table 6.41: GHG emissions and scenarios (BAU, NDC)

Sector	A. BAU 2016[49], MtCO2eq (% of total)	B. 2016 GHG inventory[50],	C. BAU scenario 2030[51], MtCO2eq	D. NDC scenario 2030[52],	E. BAU scenario 2050[53],

[48] Cambodia, Third National Communication, September 2022.
[49] Cambodia, First NDC (Updated submission), Dec 2020
[50] Cambodia, First Biennial Update Report, August 2020 & NCSD, MOE
[51] Cambodia, First NDC (Updated submission), Dec 2020
[52] Cambodia, First NDC (Updated submission), Dec 2020. FOLU has 3 NDC scenarios, and the numbers presented here correspond to scenario 2: reduction of 50% of historical emissions by 2030 (REDD+ programme).
[53] Cambodia, National Inventory Report (NIR), November 2020.

		MtCO2eq (% of total)	(% of total)	MtCO2eq (% of total)	MtCO2eq (% of total)
FOLU	76.3 (60.94%)	131.01 (80.08%)	76.3 (49.2%)	38.2 (42.21%)	21.2 (13.59%)
Agriculture	21.1 (16.93%)	18.39 (11.25%)	27.1 (17.5%)	20.9 (23.09%)	34.9 (22.37%)
Energy	15.1 (12.06%)	9.60 (5.87%)	34.4 (22.19%)	20.7 (22.87%)	82.7 (53.0%)
Waste	2.7 (2.16%)	2.76 (1.69%)	3.3 (2.13%)	2.7 (2.98%)	6.5 (4.17%)
IPPU	9.9 (7.91%)	1.82 (1.11%)	13.9 (8.97%)	8.0 (8.84%)	10.7 (6.86%)
Total	125.2	163.59	155.0	90.5	156.0

6.8 CAPACITY, EXPERIENCE OF THE IMPLEMENTING AGENCIES AND NEEDS

6.8.1 MOWRAM/ PMU and PDWRAM

The institutional assessment report by PPIC and WAPCOS (December 2022) highlighted that the weak and insufficient human resource capacity at all levels of irrigation management is a key factor slowing rural development in Cambodia. There is a clear need for adequately trained professionals in water resources and irrigation management, which can be addressed through education, training, and workshops.

According to the institutional assessment of the Water Resources Management Sector Development Program (WRMSDP), training for MOWRAM and PDWRAM personnel at both central and provincial levels involved in the CAISAR project is necessary. This includes officers engaged in the project, along with the need for Training of Trainers (TOT) for FWUCs. It is recommended that the training plan for the CAISAR project cover all six (6) irrigation schemes and include both CAISAR PMU and PDWRAM staff. Key training topics should include: 1) Project Orientation and Plan Presentation, 2) FWUC Formation and Strengthening, 3) Gender Awareness and Action Plan, 4) Data Management for Hydro and Meteorological Data and O&M for Equipment, 5) Environmental Awareness, 6) Construction Management and Supervision, and 7) On-Farm Water Management and O&M.

6.8.2 FWUC/FWUG/FWUSG

To ensure trainees understand and apply the training effectively, sufficient time should be allocated for each topic. FWUC management training programs should focus on strengthening capacity in key areas, including a) Basic administrative management, b) Accounting and finance, c) Conflict resolution, d) Operation and maintenance of irrigation facilities, and e) Collection of irrigation service fees.

Regular meetings between FWUCs are recommended to facilitate knowledge exchange and reduce conflicts within the same irrigation scheme or reservoir. Since each FWUC faces unique geographical and socio-economic conditions, training materials should be simplified using language familiar to local communities.

A well-structured FWUC Organizing Framework within MOWRAM/PDWRAM should align with the Water Distribution Schedule and be agreed upon by the FWUC, ensuring it is communicated to all farmer-water users in the scheme. The project will construct secondary and tertiary canals up to the tertiary gates and assist FWUCs in collecting irrigation service fees (ISF).

The institutional assessment report recommends providing technical and financial support to FWUCs managing the Ou Tapoang, Lum Hach, and Kraing Pomley schemes to ensure effective and sustainable O&M.

For consistent and effective E&S training, especially under the new IFAD SECAP (2021) and GCF ESS (2022), qualified national consultants should deliver the training. In addition to refresher training on safeguards like waste management and pesticide use, there should be a focus on improving contractor performance, particularly in ensuring adequate health and safety services for workers and local communities.

6.8.3 Training and Technical Assistance

Training and capacity building on IFAD SECAP/GCF ESS should focus on proportionality, adaptive management, and implementing safeguards related to: (i) contractor management and labor issues, (ii) community health and safety, (iii) environmental health and safety, and (iv) systematic stakeholder engagement. These E&S risk management training programs will enhance inter-agency coordination, critical for climate change adaptation. Qualified national consultants will provide support and on-the-job training for assessing and managing risks during project preparation and implementation.

During project implementation, E&S training and technical assistance will be provided at both the project and subproject levels. In the first three (3) years, the CPMU will hold at least two (2) safeguard training workshops per year (one (1) on environment, one (1) on social) for subproject owners on ESCMF and safeguard document preparation. An IFAD SECAP Specialist will participate when possible. Specific safeguard technical training will be held annually, covering:

1. ESCMF processes for preparing and supervising E&S instruments.
2. Training on IP Plans, SEP, labor management, and GRM pathways for local complaints.
3. Supervision and monitoring of contractor performance, health and safety, SEA Codes of Conduct, and communicable diseases.
4. IPM and safe use/disposal of pesticides and chemicals.
5. Waste management, including hazardous waste.
6. PPE use and best practices for construction and pesticide application.

6.8.4 Technical Assistance on E&S Capacity Building

Given the specific E&S training needs and limited capacity of some agencies regarding the latest AIIB, IFAD SECAP and GCF ESS, the CPMU may mobilize a qualified national firm to provide E&S training, supervision, monitoring, and reporting on ESCMF implementation and

SECAP/ESS compliance for IFAD and GCF. If needed, an Independent Monitoring Agency (IMA) will be engaged to monitor IP Plan implementation, voluntary land donation (if applicable), and other E&S activities. PPMUs may also hire E&S consultants to support ESCMF implementation, document preparation, and mitigation measures for their subprojects.

MoWRAM has extensive experience applying the Bank's ESF and ADB's safeguards policy from similar past projects, maintaining a strong track record for safeguards compliance. The ministry continues to develop the capacity of its Environmental and Social Office (ESO), which has staff with expertise in engineering, community development, environment, social issues, and public administration. Many of the seven (7) ESO staff (four (4) of whom are female) have been trained by the World Bank in E&S management for rural development. Additional technical support, including national consultants, will be required to assist ESO in E&S implementation during the WASAC project.

6.8.5 Review Of MOWRAM/PMUS Capacity in Prevention of SEA/SH Risks

MoWRAM PMUs have experience in identifying and managing SEA/SH risks based on lessons learned from previous projects. For this project, a framework for addressing SEA/SH risks has been proposed and integrated into the Labor Management Procedures. Each PMU will appoint a social officer and a GRM officer to monitor and report SEA/SH risks, and a gender focal point will provide on-the-job training to contractors.

Early in the project, MoWRAM PMUs will recruit E&S consultants, including a SEA/SH specialist to deliver training to PMU members and relevant MoWRAM staff. SEA/SH risks will be updated based on local conditions, and preventive actions will be incorporated into ESCMPs and contractor responsibilities. A budget will be allocated to ensure contractors can hire SEA/SH consultants to raise public awareness and manage SEA/SH risks among workers.

Land acquisition and voluntary donation training will be provided by the E&S Consultant, starting as soon as specialized staff are engaged. Additional E&S support will be required monthly or bimonthly during construction, and quarterly or biannually during maintenance, depending on project needs.

The training will be face-to-face or virtual options as per condition allow. These sessions will include knowledge sharing, discussions, role plays, and quizzes, with Q&A at the end of each day. The duration of the training will vary based on the topics, participant numbers, and time availability, typically ranging from one to three (3) days. MoWRAM will engage qualified trainers and may request support from AIIB and IFAD for new topics, including training materials and facilitation, to ensure practical, hands-on experience at the early stages of project implementation.

CHAPTER 7 – ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

7.1 INTRODUCTION

This chapter identify, and assess the nature, scope and scale of the environmental and social risks and impacts which are potentially associated with the proposed project, particularly with activities under Component 1 (intentified crop production and rehabilication of farm road) and Component 2 (rehabilitation of canal for water use efficiency). Activities under Component 1 and Component 2 are inter-related – in the sense that the results obtained under Component 2 (which focuses more on irrigation infrastructure) is desgined to facilitate the achievement of results expected under Component 1 (which introduces and facilitates farmers's uptake of climate-smart agricutlural practices to improve income, livelihoods, and enhance their resilience to climate change impact.

The risks and impacts identified, and assessed, in this chapter cover the direct, indirect, and cumulative impacts that would arise under the six (6) sub-schemes, to varying extent, during project design, implementation, and operations. In risk assessment, assessment of risks in this chapter are rated on the basis of no consideration of mitigation measures that are in place.

7.2 APPROACH TO ASSESMENT OF RISK AND IMPACTS

7.2.1 Identification and Assessment of Risks and Impacts

The assessment of environmental and social risks and impacts involves three (3) steps: identification, analysis, and assessment. Assessment of risks and impacts involves evaluating the nature, scope and scale, duration of project activities, potential impact receptors, and the magniture of impact – indicative of direct, indirect, or cumulative effects from proposed project activites.

The following factors are considered when assessing the risks and potential impacts:

- Impacts characterization (negative, positive, mixed);
- Impacts nature and duration (direct, secondary, indirect, cumulative; short-term, long term, permanent, reversible);
- Impact significance/magnitude (negligible, minor, moderate, major);
- Impacts likelihood (unlikely, possible, very likely);

- Spatial scale (national, regional, local);
- Measures to mitigate (adverse) or enhance (positive) impacts;
- Significance/magnitude of residual impacts (negligible, minor, moderate, major); and
- Where relevant receptor sensitivity/vulnerability (negligible, low, medium, high).

7.2.2 Project Activities

As per the description in Chapter 02, the project involves the construction of a number of structures aimed at enhancing agricultural productivity and flood control. River dredging and rehabilitation improve water flow and reduce siltation, while canal rehabilitation, expansion, and upgrades (both main and tertiary) facilitate better irrigation for farming. Dam upgrades and rehabilitation strengthen water storage and management capabilities. The installation or upgrading of hydraulic structures such as cross-check structures and head regulators ensures controlled water distribution. River training and drainage system construction help mitigate flooding, while the polder system provides land protection from floods by controlling water levels. Solar pumping system installation promotes sustainable water access, particularly in remote areas, and the construction of feeder canals and ponds further supports water availability for agriculture and community use, enhancing overall water management systems. Summary of the construction works in the six (6) sub-schemes are provided in Table 7.1 below:

Table 7.1: Key project activities potentially causing environmental & social risks & impacts – during project implementation & operations

No.	Key Project Activities	Descriptions	Sub-Schemes (06)					
			Ou Ta Paong	Lum Hach	Brambei Mom	Krapeu Truom	Yutasas	Stung Krang Bat
	COMPONENT 1	**Improving farm-level climate adaptation, resilience, and water use efficiency**						
1	Planning	Preparation of community-based action plans (AP) to transform agriculture with Climate Resilience (CR) practices.	√	√	√	√	√	√
2	Training	Preparation of training materials to support implementation of the Action Plan.	√	√	√	√	√	√
		Conduct trainings to create a pool of expertise to demonstrate and propagate the CR technologies and practices.	√	√	√	√	√	√
		Train farmers on applying CR technologies using the FFS approach.	√	√	√	√	√	√
3	Mechanization	Strengthening and fostering tailored mechanization service providers for improved mechanization service delivery.	√	√	√	√	√	√
4	Farm road	Improve 50 Kilometers of farm roads	√	√	√	√	√	√
	COMPONENT 2	Irrigation Infrastructure for increased resilience						
1	River dredging or rehabilitation	The activities will involve the excavation of existing river/stream which have become shallow or too small to store water or limit the water flow regime.	√	√				√
2	Canal rehabilitation / minor expansion canals	These activities will include the widening, deepening, or structural improvement of both main and tertiary canals to enhance their capacity for water conveyance, ensuring efficient irrigation and water distribution to agricultural fields.	√	√	√	√	√	√
4	Installing small–scaled structure (e.g. cross structure, head regulator)	This includes the construction or enhancement of hydraulic control structures that regulate water flow, ensuring proper water distribution across irrigation systems and improving the overall efficiency of water management.	√	√	√	√	√	√

No.	Key Project Activities	Descriptions	Sub-Schemes (06)					
			Ou Ta Paong	Lum Hach	Brambei Mom	Krapeu Truom	Yutasas	Stung Krang Bat
4	River training	These activities will focus on reshaping river channels and constructing drainage systems to manage water flow effectively, reduce the risk of flooding, and protect agricultural lands and surrounding communities.	√					
5	Polder system construction	This will involve creating an embanked area to prevent flooding by controlling water levels, typically through the construction of levees or dikes, enabling the reclaimed land to be used for agriculture or habitation.	√					√
6	Solar pumping system installation	These activities will involve the installation of solar-powered water pumps, providing a sustainable and energy-efficient means of extracting water from rivers, canals, or groundwater sources for irrigation and community use.	√	√	√	√	√	√
7	Construction of feeder canals	This includes the development of smaller, subsidiary canals designed to distribute water from main canals to agricultural fields, improving the reach and efficiency of irrigation systems.	√					
8	Pond construction/ rehabilitation	This will involve the excavation or repair of ponds to increase water storage capacity, providing reliable water sources for irrigation, livestock, and community use, especially during dry seasons.		√				

7.3 ENVIRONMENTAL AND CLIMATE RISKS AND IMPACTS

In this section, the E&S risks and impacts (that potentially arise during activity implementation and operationalization) are identified, analysed, and evaluated at project level — with regards to the nature, scope, scale, and the potential extent of activity impacts — through classification of such risks and impacts as direct, indirect, and cumulative. The assessment of E&S risks and impacts in this chapter is based on the following grounds that is fundamental to proposing measures to avoid, minimize, and mitigate for the impacts in the next chapter:

Project's original technical reports

- Feasibility Studies (August 2023)
- Feasibility Studies (updated by November 2023).
- Additional Pre–Feasibility for Ou Ta Pong Sub–scheme.
- Environmental and Social Management Framework – ESMF (Updated by October 2023)
- IBAT reports for project locations (Ou Ta Pong, Lum Hach and Stung Krang Ponley Irrigation Schemes)

Stakeholder Consultations (national, provincial, district, commune, and village levels)

- Community Meetings
- Focus Group Discussions
- Key Information Interview.

Field observation, using

- Transect walks.
- Drones (for E&S screening and biodiversity assessment)
- For detail information on Biodiversity Assessment, please refer to Biodiversity Impact Assessment Report

External technical reports

- Statistical reports/database.
- Publications and Technical Reports from national and internation institutions.

Table 7.2: Environmental risks and impacts

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
PREPARATION STAGE									
UNEXPLODED ORDNANCES (UXO)		1, 2							
Although effort have been made to demine across the country, mortar shells, aerial bombs, and other unexploded ordnance may be found within the subproject area. Some demining operations have been carried out at shallow depths, and UXO maps have been generated but it is not known if there is UXO that is located in proximity of the structures where structural upgrading would be made. Of particular concern is the hazard posed by unexploded ordinance left during the war, particularly in area where deep excavation is required.	Construction/ Rehabilication of canals, farm roads, and relevant facilities that involve earthworks, soil excavation, river dreding, and so forth.	Activity 1.4.1 Activity 1.4.2 Activity 1.4.3 Activity 2.1.1 Activity 2.1.2 Activity 2.2.2	Residents, Construction workers, animals, and any objectives nearby **High**	Based on the consultation with local authorities and community people, there have been no reported incidents of mines or unexploded ordnance (UXO) within the command areas. However, the risk remains due to the country's long history of civil war, with mine clearance efforts often limited to surface-level areas. As a result, construction activities involving deeper excavation could potentially expose mines or UXO, leading to explosion. This risk more likely to occur within the command area and at location where physical excavations are carried out.	Direct	Short term (during physical operation of machine)	Moderate to Major	Unlikely	Local
DURING CONSTRUCTION									
ENVIRONMENTAL POLLUTION		1, 2							
• **Noise:** - Earthmoving activities and operation of machineries at construction sites will	Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers/	There are limited large scale and heavy infrastructure construction being planned under the project within the areas, except the	Direct	Short and long term	Minor	Unlikely	Local

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
generate dusts and exhaust fumes. - Construction activities, operation of vehicular movement, excavation machineries, concrete mixing, and other construction activities will generate noise and vibration and will be a nuisance to workers and residents near the site. - Noise may be generated from workers' camp, particularly during living activities or entertainment at nighttime, or due to certain maintenance /repair of equipment, machinery, vehicles.			**Minor**	construction of small-scale hydraulic structures of the irrigation system. In addition, the larger ones are normally located outside the residential areas whereas some small cross check structures are located within residential area, only in Ou Ta Paong and Lum Hach whereas the construction sites at Stung Krang Ponley are located mainly at the paddy field. In this regard, they are unlikely to affect community people as the duration is short while the people along the national road in Stung Krang Ponley scheme will be possibly heard the traffic noise along the road instead.					
• **Air pollution:** Dust will be generated by transportation of material, clearing, grading, excavation, levelling, truck hauling, stockpiling, waste disposal, access road rehabilitation. In addition, the emission is also expected from machineries and vehicles, especially during dry season.	Transportation of materials, clearing, grading, excavation, levelling, truck hauling, stockpiling, waste disposal, access road rehabilitation	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers **Minor**	These activities generate dust and particulate matter (PM10 and PM2.5) from soil disturbances, stockpiles, and road works, leading to localized air pollution that can affect respiratory health. Exhaust emissions from trucks and heavy machinery release pollutants such as nitrogen oxides (NOx), carbon monoxide (CO), sulphur dioxide (SO2), and volatile organic compounds (VOCs), contributing to smog formation and greenhouse gas emissions.	Direct	Short and long term	Minor	Unlikely	Local

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
				Additionally, waste disposal, particularly through burning, can release harmful pollutants into the air, further degrading air quality. However, the level of generation is minimal as the extent of the release is gradually moved from place to place and short in duration.					
• **Water pollution** - Surface water quality reduction can occur due to construction, especially the earthwork, leakage of oils and chemical materials - Underground water quality reduction due to construction activities	Dredging and excavation activities, often required for the rehabilitation and upgrading of irrigation infrastructure in river systems	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers/ **Minor**	The dredging and excavation activities are required for all sub-schemes that can significantly impact water quality, particularly through increased sedimentation. Disturbed soil from excavation can enter water bodies, potentially polluting domestic water sources as sediment is carried downstream when water is released from rehabilitated reservoirs or canals. Large-scale dredging along Ou Ta Paong, spanning up to 30 km, may affect water quality throughout the excavation period and could extend to Tonle Sap Lake if proper mitigation measures are not in place. In addition, project activities can also impact groundwater quality, particularly through the infiltration of wastewater	Direct and indirect	Short and long term	Minor	Unlikely	Local and Regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
				from workers' camps and the leakage of hazardous materials such as oil and diesel into water bodies, further contributing to water pollution.					
• **Soil pollution/ quality reduction** Leakage of oils, and chemicals used for machinery and construction process at farming land and construction sites. The fuel storage tanks in construction sites do not provide suitable storage places to contain accidental spills that affect soil quality. .	The activities affecting soil quality during this stage include dredging and the leakage of oils used for machinery and construction processes at construction sites.	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers/ **Moderate**	Since excavation of the soil is at a large scale, the impact may be major. For example, oil leakage from construction equipment and large-scale soil excavation can significantly impact soil quality. Oil introduces harmful contaminants like hydrocarbons and heavy metals, reducing soil fertility, disrupting microbial activity, and posing risks to nearby water bodies through runoff. In addition, excavation disturbs soil structure, increasing erosion and reducing its ability to retain water and nutrients, which can decrease agricultural productivity.	Direct	Short and long term	Moderate	Likely	Local
• **Solid waste:** During construction, waste of various kinds will be generated including solid wastes, hazardous wastes, and domestic solid waste (at workers' camp site). Solid waste may include surplus excavated materials, used lumber for	• Excavation and site clearing • Demolition of existing structures • Construction of temporary worker camps	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers • Soil in the rivers and farmland **High**	The rehabilitation and upgrading construction for existing irrigation infrastructure in command areas often involves the establishment of temporary worker camps, the use of heavy machinery like trucks and excavators, and the generation of various types	Direct and Indirect	Short and long term	Moderate	Unlikely	Local

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
trenching works, waste generated from demolition of existing camp, structures, construction debris, and so forth. This is added with the domestic waste such as food waste (bone, and meat waste and vegetables), paper, glass, metals, plastics, textiles, etc. being disposed by in-migrant labourers.	• Use of heavy machinery • Trenching works			of waste. Solid waste generated during construction may include surplus excavated materials, used lumber from trenching works, debris from the demolition of existing camp structures, and other construction remnants. Domestic waste generated by construction workers at the construction site, worker camps, and other facilities can also contribute to environmental pollution. While the direct impact of this waste is often localized to the construction site and camps, improper management can lead to further environmental damage. Hazardous waste, such as oil and chemicals used in construction operations, can pose a threat to the environment. If not handled carefully, these hazardous materials can leak into the soil, causing contamination and potentially contaminating nearby water bodies.					
• **Wastewater:** - Hazardous wastewater, such as oil or fuel, chemical used for machinery and construction process at the construction site. - Domestic wastewater comes from workers/staff's water consumption daily.	• Use of heavy machinery and equipment (oil and fuel leaks, spills). • Construction processes (chemical spills, leaks). • Worker camp activities (discharge of domestic wastewater).	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers • Water body along construction site **Moderate**		Direct	Short and long term	Moderate	Likely	Local
BIODIVERSITY		*1,2*							
• **Habitat Loss and Fragmentation:**	Rehabilitation of irrigation canal and farm roads	• Activity 2.1.2 • Activity 2.2.2	Terrestrial species **Moderate**	Prior to construction, there will be clearance of bushes, forest or vegetations along the rehabilitated streams,	Direct and indirect	Short and long term	Moderate	Unlikely	Local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
- Conversion of forests and wetlands at micro or large may be needed for canal construction such as Lum Hach community forestry leading to broken down of the habitat. - Habitat fragmentation: The remaining natural habitats may become isolated patches, making it difficult for species to migrate, find mates, and maintain healthy populations.				canals, and access road. Other activities such as river dredging and rehabilitation activities, as well as dam construction and upgrading, in the Ou Ta Paong, Lum Hach, and Stung Krang Bat schemes will be potentially led to habitat loss and fragmentation. Thes project involve altering the natural course of rivers and waterways, which can disrupt existing aquatic ecosystems. Dredging activities can remove valuable aquatic vegetation and disturb sediment beds, destroying habitats for fish and other aquatic organisms. The construction of culverts or water structures can create barriers that isolate upstream and downstream populations, limiting their access to food and breeding grounds. Additionally, these projects can introduce pollutants and sedimentation into the water, further degrading habitat quality and impacting biodiversity. But these impacts are likely to be considered moderate due to biodiversity assessment, in that there is not rich of biodiversity hot					

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
				spot and the surrounding area is mostly paddy fields.					
• **Loss of biodiversity and ecosystem services** - Species Decline: Habitat loss and degradation can lead to declines in species populations in the long run, particularly those already classified as critically endangered. - Disruption of Ecosystem Services: The loss of biodiversity can disrupt ecosystem services such as water purification, flood control, and carbon storage, slightly contributing to the long-term impact.	Rehabilitation of irrigation canal and farm roads	• Activity 2.1.2 • Activity 2.2.2	Aquatic and terrestrial species **High**	While project activities in the construction phase like river dredging and canal rehabilitation can have some short-term impacts on fauna and flora, these effects are generally not considered serious. The interventions are primarily focused on restoring existing irrigation systems, and the affected areas are not known for high biodiversity. The noise from construction activities may temporarily disturb wildlife, but it is unlikely to cause long-term harm. The movement of aquatic biodiversity might be restricted due to the cut-off of waterways in certain sub-schemes. Overall, the fauna and flora effects of these projects are anticipated to be minimal and reversible. However, if the plan to construct the canal across community forestry in Lum Hach, there would be likely a significant change for wildlife in the areas.	Direct	Short and long term	High	Possibly	Local and regional
• **Hunting, trading, and consumption of wildlife**	Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Aquatic and terrestrial species	The risks can be quite severe when there is a large workforce or where the local wildlife is rare and	Direct and indirect, and short	Short and long term	High	Unlikely	Local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
- The influx of a new labour force can increase demand for exotic local foods, including wildlife and endangered species, which are often seen as interesting and delicious. - This may be done for relaxation or belief that wildlife is tasty or making people healthy.			**High**	endangered. There is also a risk to the aquatic endangered species as well. This demand drives illegal hunting and trading, threatening biodiversity and destabilizing ecosystems. The rarity of these species raises their market value, encouraging unsustainable practices that can lead to extinction. Additionally, consuming wild animals poses health risks due to zoonotic diseases and can harm local economies by depleting valuable fish stocks, affecting communities reliant on these resources. It is likely to occur not only at the local level but at the regional level as well and the impact is severe and irreversible.	and long term				
• **Loss of fauna and flora** - Construction activities, including the rehabilitation of irrigation canals and farm roads, can lead to the clearing of vegetation and the disruption of natural habitats. This is particularly concerning areas like the Lum Hach command area, where the project might involve constructing a canal across community	Construction of canals and roads, especially across community forestry	• Activity 2.1.2 • Activity 2.2.2	Various species, particularly those dependent on forests and wetlands. **High**	Construction activities could lead to habitat loss and fragmentation, directly impacting fauna and flora. This impact could be significant in areas like Lum Hach, where the project might involve construction across community forestry. The construction of new canals and roads may require clear vegetation, leading to habitat loss and fragmentation. This is	Direct	long-term	high	Likely	Local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
forestry, potentially causing a significant change for wildlife. While the overall impact on fauna and flora is anticipated to be minimal and reversible in most areas, the specific location and scale of construction activities play a crucial role in determining the severity of the impact. For instance, noise from construction might temporarily disturb wildlife but is unlikely to cause lasting harm. However, the construction of dams and other structures could alter water flow patterns, affecting fish migration and potentially leading to population decline.				especially concerning given the presence of endangered and critically endangered species, including the Elongated Tortoise, the Giant Asian Pond Turtle, and the Hairy-nosed Otter.					
• **Destruction of farming ecosystem** - Heavy machinery and construction activities can compact the soil, reducing its porosity and ability to retain water and nutrients, ultimately leading to decreased land productivity. - Soil erosion from construction sites, exacerbated by the removal of vegetation and disruption of the	• Construction activities • Alteration of water regimes due to irrigation infrastructure (dams, levees) • Pollution from agricultural runoff	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Aquatic and terrestrial species within and around farming areas **Moderate**	The project's construction of irrigation canals, flood control structures, and farm roads will involve large-scale earthworks, potentially leading to soil erosion and sedimentation, impacting water quality in rivers and canals crucial for irrigation. The removal of vegetation and ground disturbance during construction increases the risk of soil erosion and runoff, carrying sediment and pollutants into water sources used for	Indirect	long-term	Moderate	Possibly	Local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
landscape, can transport sediments and pollutants into nearby water sources, harming both crops and livestock. - The risk of pollution from construction sites, specifically mentioning potential water contamination from sourcing aggregates and construction materials. - These pollutants, along with runoff from construction sites carrying sediment, oil, and chemicals, can directly harm crops, leading to reduced yields and potential health issues.				irrigation and livestock. This pollution, coupled with the potential for increased use of agrochemicals due to enhanced irrigation capacity, could negatively affect water quality, impacting the health of both crops and livestock. Furthermore, the construction activities could disrupt natural habitats, affecting species that play vital roles in pest control and pollination, essential for a healthy farming ecosystem.					
• **GHG emission** - The construction and operation of heavy machinery, such as excavators and bulldozers, during these projects release carbon dioxide (CO2) into the atmosphere, i.e. the energy requirements for construction works can result in increased carbon emissions - Another source of GHG emission is waste burning from worker camp site.	• Rehabilitation of irrigation canals and farm roads. • Use of heavy machinery for excavation, transportation, and construction. • Waste burning at worker campsites. • Burning of rice straw in the fields by farmers.	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Atmosphere **Minor**	The production and transportation of excavated soils and materials further add to greenhouse gas (GHG) emissions. However, due to the short duration of these construction activities, the overall increase in emissions is expected to be minimal and relatively small in scale.	Direct and indirect, and short and long term	Short and long term	Minor	Likely	Local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
- In addition, at the time of construction, there are possibility of smoke generated by burning of straw in the rice field.									
DURING OPERATION									
ENVIRONMENTAL POLLUTION		1, 2							
• **Hydrology** - Increased irrigation demands could deplete water sources, if management is not properly conducted. - This may lead to poor management of environment flow for the water system	• Increased irrigation. • Poor water management practices • Climate change impacts (altered rainfall patterns)	• Output 1.1 • Output 1.2 • Output 2.3	Tonle Sap Lake. Upstream Watersheds Wetlands Aquatic Ecosystems Downstream Communities **Moderate**	Irrigation systems can have both positive and negative effects. Proper design and management are essential for reducing negative impacts on the natural hydrological cycle.	Direct and Indirect	Short and Long Term	Minor	Likely	Local and regional
• **Water pollution** - Increased use of chemical for intensified crop production may affect the overall water quality and affect people who rely on such water for domestic use. - Impacts may include two (2) levels: impact on surface water as immediate effect and underground water as long-term impact.	Intensification of agricultural production	• Output 1.1 • Output 1.2	• Famers • Nearby residents • Aquatic ecosystems within the command areas and downstream, including the Tonle Sap Lake. **Moderate**	When the irrigation become operationalize, the use of chemicals for farming activities can create potentially impact on soil and water quality, the extent of this impact is likely to be relatively moderate due to the intensification of agricultural production and changes in practices in the command areas as irrigation water become more available. The widespread use of chemical fertilizers and pesticides for rice production, particularly when	Direct, indirect, and cumulative	Short and long term	Minor to Moderate	Unlikely	Local and Regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
				optimized for higher yields, is far significant contributor to soil and water quality degradation. These agricultural practices can lead to soil nutrient depletion, salinization, and pollution, ultimately compromising the long-term sustainability of agricultural production whereas water with high concentrations of pesticides may affect the biodiversity not only within the command areas but also within the river body downstream, possible in the Tonle Sap Lake.					
• **Soil pollution/ quality reduction** (Overuse of Agri-chemicals (e.g., chemical pesticides, fertilizers, etc.))	• Increased agricultural production • Lack of training or adoption of sustainable farming practices.	• Output 1.1 • Output 1.2	• Soil Health • Water Quality • Biodiversity **Moderate**	Increased production could lead to overuse of agri-chemicals if farmers are not adequately trained or supported in adopting environmentally friendly practices.	Direct and Indirect	Short and Long Term	Moderate	Likely	Local and regional
BIODIVERSITY		**1, 2**							
• **Habitat Loss and Fragmentation:** - Conversion of land: Flooded forests and wetlands may be drained or filled to create more arable land for agriculture, leading to significant loss of habitat.	• Intensifying farming	• Output 1.1 • Output 1.2	Aquatic and terrestrial species **Moderate**	At the micro, local, and regional levels, habitat loss is likely to occur due to land clearance during the construction phase, with further possible expansion into the protected areas nearby. For instance, the planned construction of a canal through community forestry (Tropiang Mlu and	Direct and indirect	Short and long term	High	Likely	Local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
- Fragmentation: Remaining natural habitats may become isolated patches, making it difficult for species to migrate, find mates, and maintain healthy populations.				Toul Samroang) in Lum Hach can create a good access to land for settlement along the canal. In addition, the expansion of agricultural land into the protected area downstream of Ou Ta Paong may also occur which are added to the conversion of microhabitats across the command areas. This loss is driven by farmers seeking to maximize profit from available land, and the scale of habitat conversion could extend beyond the local level, potentially impacting the region.					
• **Invasive Species:** Introduction of Non-Native Species: Changes in land use and water management can introduce invasive plant and animal species that outcompete native species and alter ecosystem dynamics	• Intensifying farming	• Output 1.1 • Output 1.2	Aquatic and terrestrial species/ **Minor**	Changes in hydrological conditions, such as altered water flow and flooding patterns due to irrigation infrastructure, can create favourable conditions for invasive species to establish themselves in wetlands. These disruptions weaken the natural resilience of native species, making the ecosystem more vulnerable to colonization by invasive plants and animals. This can result in a decline in biodiversity, altered nutrient cycling, and degraded water quality. Once invasive species become established, they are difficult to remove and can cause	Direct and indirect	Short and long term	Minor	Likely	Local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
				long-term ecological damage, further diminishing the wetland's ability to provide essential ecosystem services. This is particularly concerning for areas like Ou Ta Paong and Stung Krang Bat, where water flows in both directions from and to the Tonle Sap Lake, increasing the risk of invasive species spread. The scale at Ou Ta Paong is large and the impact can be moderate.					
• **Hunting, trading, and consumption of animal from the wild:** Even after the construction being completed, there may be the continuation of the hunting as market are available.	• Intensifying farming • Increased demand for wild animal products.	• Output 1.1 • Output 1.2	Aquatic and terrestrial species, particularly those already threatened or endangered. **High**	Although the activities are likely to continue, it is not directly caused by the project activities, but it can expand further beyond the completion of the construction. The impact is minimal and considered to be regional, if trading continues to exist.	Indirect, and short and long term	Short and long term	Minor	Likely	Local and regional
CLIMATE CHANGE									
• **GHG emission** - The intensification of farming activities meaning that rice production will be increased into more times or more whereas the energy that are required for the production can be also increased.	• Intensifying farming activities • Increased used of energy for farming activities	• Output 1.1 • Output 1.2	Atmosphere **Minor**	Increased farming activities, driven by improved irrigation, can lead to higher GHG emissions due to factors such as fertilizer use, livestock production, and rice cultivation. Additionally, the energy requirements for operating pump stations,	Direct and indirect	Short and long term	Minor	Likely	local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
- Smoke may be generated due to burning of straw in the rice field, particularly when water access for irrigation being increased. - This will lead to the increase of volume of GHG emissions being emitted into the atmosphere.				flood control systems, and other infrastructure elements can contribute to increased carbon emissions if not managed efficiently. These factors collectively highlight the potential for the project to have a significant impact on GHG emissions.					
ANNUAL CROP MANAGEMENT PLAN									
WATER									
• **Water resource efficiency:** Over-extraction of water resources can lead to downstream water scarcity, altered hydrology, and damage to aquatic ecosystems.	• Inefficient irrigation practices during operation	• Output 1.3 • Output 2.3	Downstream communities, aquatic ecosystems **Moderate**	Inadequate water management poses a significant risk to the long-term sustainability of water resources and dependent ecosystems and communities.	Major, if not managed properly.	Long term	Major	Likely	Local, regional, and transboundary
SOIL AND SOIL MANAGEMENT									
• **Soil erosion and soil erosion risk:** Soil erosion can lead to loss of topsoil, reduced soil fertility, and increased sedimentation in water bodies.	• Land preparation activities such as tillage, site clearing, and the use of heavy machinery can increase the risk of soil erosion.	• Output 1.1	Soil health, water quality, and agricultural productivity. **High**	Unsuitable management techniques and land preparation activities can lead to the physical and chemical degradation of soils.	Potentially major, especially during periods of heavy rainfall or in sloping areas.	Short and long term	Major, if not effectively addressed.	likely	Local, with potential downstream impacts on water bodies.
• **Nutrient application and management:** Excessive or improper nutrient application can lead to	• Excessive or improper application of	• Output 1.1	Water quality, aquatic ecosystems,	Over-fertilization and nutrient runoff can contaminate water	Potentially major	Short and long term	Major, if not effectively addressed.	likely	local and regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
nutrient runoff and leaching, contaminating water resources and causing eutrophication.	fertilizers can lead to nutrient runoff and leaching.		and human health **High**	resources, negatively impacting aquatic ecosystems and potentially leading to eutrophication.					
PESTICIDE									
• **Use and effectiveness of pesticides:** Pesticide use can have adverse effects on human health, non-target organisms, and the environment. Pesticide resistance can develop, requiring increased application rates.	• Application of pesticides.	• Output 1.1	Human health (farmers and consumers), biodiversity, soil and water quality **High**	esticide use can have unintended consequences on human health, biodiversity, and environmental quality if not managed carefully.	potentially major	Short and long term	Minor to Moderate	Unlikely	Local and Regional
• **Pesticide residues on site soil:** Pesticide residues can accumulate in the soil, potentially contaminating groundwater and impacting soil organisms.	• Repeated pesticide applications, use of persistent pesticides, and improper disposal of pesticide containers.	• Output 1.1	Soil health, biodiversity, water quality **High**	Pesticide residues can accumulate in the soil, potentially harming soil organisms and affecting water quality.	Potentially moderate to major	Short and long term	Minor to Moderate	Unlikely	Local and Regional
• **Pesticide residues on produce:** Pesticide residues on produce can pose health risks to consumers.	• Late pesticide applications close to harvest, improper pesticide application techniques, and inadequate pre-harvest intervals.	• Output 1.1	Consumers, human health.	Pesticide residues on produce can pose a risk to consumer health. **Moderate**	Potentially major	Short and long term	Minor to Moderate	Likely	Local and Regional
AIR QUALITY, AIR EMISSIONS, AND ENERGY USE									
• **Energy use:** Energy consumption contributes to greenhouse gas emissions	• Operation of machinery and equipment for various farming	• Output 1.1	GHG emission, air quality, and operational costs	Increased energy use for farming activities, especially those powered by fossil fuels, can contribute to air	Potentially significant	Long term	Moderate	Likely	Local and Regional

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature & Duration	Significance	Likelihood	Scale
and impacts operating costs.	activities (tillage, irrigation, harvesting, transportation) and the use of energy for processing and storage.			pollution and greenhouse gas emissions. **High**					

7.4 SOCIAL RISKS AND IMPACTS

A Social Impact Assessment (SIA) is a systematic process used to analyze, monitor, and manage the social consequences of planned interventions, such as policies, programs, plans, or projects. It aims to identify, predict, and mitigate potential negative social impacts while maximizing positive ones.

Methods:

- Participatory Rural Appraisal (PRA): Engage local communities through focus group discussions, interviews, and mapping exercises to identify their concerns, needs, and perceptions of the project.
- Social Surveys: Conduct structured surveys to gather quantitative data on socio-economic conditions, livelihoods, and potential impacts on households.
- Key Informant Interviews: Interview key stakeholders, such as local leaders, government officials, and experts, to gain insights into local dynamics and potential risks.

Data/Information:

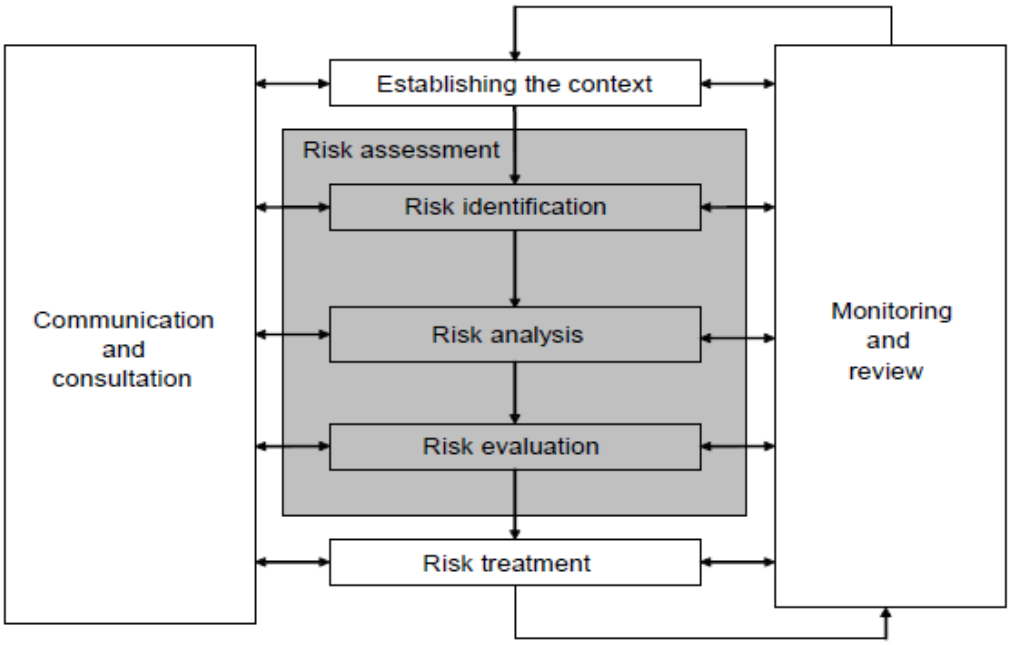
- Baseline Data: Collect baseline data on demographics, land use, water resources, livelihoods, and social indicators.
- Secondary Data: Utilize existing data from government agencies, research institutions, and other relevant sources.
- Primary Data: Gather primary data through field surveys, interviews, and observations.

Consultations:

- Individual Consultations: Conduct one-on-one consultations with key individuals and groups to address specific issues and concerns.

The assessment of environmental and social risks and impacts involves both the identification of risks and the identification of impacts. The identification of risks involves with three (3) steps: the risk identification, risk analysis, and risk evaluation (Figure 7) whereas the assessment of impacts involves with five (5) steps: characterizing the impacts, identifying the nature and duration of the impacts, determining the impact significance, determining the level of impact likelihood, determining the impact scale, determining the measures to mitigate the impacts, assessing the residual impacts after mitigation, and determining receptor sensitivity/vulnerability.

Figure 5.1: The process of risk assessment Risk assessment process (shaded) within the overall risk management process



(Source: AS/NZS ISO31000)

The activities in the rehabilitation of irrigation canals and farm roads cause risks and potential impacts prior and during construction, including child labor, forced labor, disease transmission, occupational health and safety, underpaid pay, and unequal treatment.

Table 7.3: Social risks and impacts

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
BEFORE CONSTRUCTION									
LAND ACQUISTION		1, 2							
• **Land acquisition and resettlement:** The most noticeable locations that required the acquisition of land include the feeder canals, river at Ou Ta Paong sub-scheme, mainstream at Lum Hach and along the existing canals which are planned to rehabilitate. The temporary acquisition of land for construction may also cause economic disruption while some households may lose their houses, or livelihood activities on the embankment of the river and canals. When river is rehabilitated some households along Ou Ta Paong River may loss land for housing, fruit trees, and agricultural production permanently. In command areas at Krang Ponley where existing canals need to be extended, or new canal need to be built, minor land acquisition may be required to allow canal construction.	• Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.1 • Activity 2.1.2 • Activity 2.2.2	• Landowners • Informal land users, Informal resettles • Nearby construction site business owners/ **Moderate**	Land acquisition is anticipated for all six (6) sub–schemes. However, the land acquisition varies from scheme to scheme – based on the initial concept design. It is expected that land acquisition is highest at Ou Tapaong, followed by Lum Hach. Land acquisition is anticipated to be minor for Brambei Mom, Krapeau Trom and Yutasas because these schemes are much smaller (compared to Ou Tapaong and Lum Hach) and no expansion of existing canals system is not planned during project preparation.	Direct and indirect	Before construction	Minor to Moderate	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
• **Economic displacement** - Households in Ou Ta Paong and Lum Hach's main canal, particularly those with production land along the water bodies, including non-titled land users and informal settlers, face a significant risk of economic displacement due to the project. As the systems will be upgraded, these informal farming areas may be removed due to dredging. Thus, these households may be affected and thus lose the opportunity to grow crop for food and/or income. - During the construction phase, local businesses and transportation routes may experience disruptions, potentially affecting the community's daily life and ongoing economic activities. Household infrastructure, such as pumping systems and water pipes, may also be impacted by construction activities. - Additionally, temporary housing for farm care may be necessary, further disrupting agricultural practices. Furthermore, canal blockages due to construction activities could hinder water flow,	• Nearby residents	• Activity 1.4.3 • Activity 2.1.1 • Activity 2.1.2 • Activity 2.2.2	• Landowners • Informal land users, Informal resettles Nearby construction site business owners **Moderate**	During the construction phase, the track-out of construction material transportation and the construction area will be affected directly on the economic activities of community people such as local businesses, transportation routes, rice production land, and daily movement within the command area. Diversion of water from the original channels can also cause the disruption of agricultural production, even crop failure. Once again, the estimated impact of economic displacement is still early to conclude.	Direct and indirect	Short and long term	Minor to Moderate	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
impacting cultivation during planting seasons and potentially leading to reduced agricultural yields.									
• **Facility Design.** Poorly designed irrigation systems may lead to environmental disruption, where dredging disturbs aquatic ecosystems and degrades water quality. Structural failures in poorly designed or constructed components can lead to collapses or damage during extreme weather events. Misaligned or undersized culverts and structures may obstruct water flow, causing flooding or reduced irrigation efficiency. Additionally, these activities can alter sediment transport, leading to upstream sedimentation, downstream erosion, and land instability.	• Detail Engineering Design	• Activity 1.4.3 • Activity 2.1.1	• All **High**	CAISAR project aims to achieve the environmental-friendly, and climate resilience aspect. These aspects need to be carefully considered with all possible options to be included in the design. In this regard, it is expected to be fully considered and reduce the impacts at the minimum.	Direct and indirect	Short and long term	High	Likely	Local
DURING CONSTRUCTION									
CHILD LABOR & FORCED LABOR		*1, 2*							
• **Child Labor**: The risk of child involvement in project's labour force (e.g., contractors' labour) is foreseen because subproject activities will take place in rural areas where use of child labour is common. There is a possibility that local people under 18 years is	• Construction or Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Unskilled workers (mostly local people)/ **Moderate**	Contractors are likely to employ children or youth who are under the legal working age, as defined by the country's laws due to labour shortages and the drive to maximize profits, the use of child labour may occur, especially in the context of weak law enforcement and inadequate monitoring by relevant institutions. The scale of this	Direct	Short term	Minor	Possible	Local, Regional

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
engaged by construction contractors and subcontractors to perform unskilled works.				abuse depends on the number of workers involved during the construction phase, and it can directly impact both local individuals and migrant labour forces.					
• **Forced Labor:** Risk of workers being forced to work (e.g. young people) to earn income for their family, and/or to pay debt. Additional, forced labour refers to any work or service that are not voluntarily performed by an individual under threat of force or penalty. Forced labour could happen for both children under 18 and adults, particularly for households who are in high need to cash for specific family purpose (e.g. cover a medical bill, paying debt…). The risk of engaging of forced labour might be associated with workers that are considered as "primary supply workers" as identified under the project's Labor Management Procedures.	• Construction or Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents such as children and youth • Construction workers/ **High**	Construction companies may reduce their workforce and pressure employees to work faster to save time and cut costs, often without proper negotiation or prior notice. In the absence of strong government oversight and a functioning labour monitoring system, these practices can occur during the construction phase. However, while such behaviour is likely, the impact may be mitigated, as the current presence of social media can serve as a deterrent to contractors engaging in these illegal activities.	Direct, and temporary	Short and long term	High	Unlikely	Local
COMMUNITY HEALTH AND SAFETY		*1, 2*							
• **Disease transmission:** - Spreading and contracting of communicable diseases of labour forces having direct and indirect contact among themselves - Risk of contracting non–communicable diseases of	• Construction or Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers/ **High**	During the construction period, some workers experience poor eating habits, homesickness, being away from home, and stress from demanding task which lead to poor health condition as well as they are possibly the disease carriers which can spread to the other workers and community	Direct and indirect, and temporary	Short and long term	High, Moderate	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
among workers and with community people due to their working behaviours and pressures at the time of working away from home.				people. Unsanitary living conditions may also contribute to the spread of communicable diseases. These problems are high and likely prevalent among the construction workforce and can also affect the surrounding community as short and long term.					
• **Sexual Exploitation and Abuse, Sexual Harassment** (due to labour influx): The risk of Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH SEA/SH) is anticipated to be "Moderate" due to 1) concentration of labour, 2) frequent visits of project workers, and 3) increased level of this risk due to pre-existing SEA/SH issues in the subproject's area of influence. It is noted that labour influx includes not only workers but also people who are local and nonlocal that gravitate to construction sites temporarily to provide logistics services for contractor's workers during construction stage. This risk of Violence Against Children (VAC) is also anticipated due to increased level of SEA/SH and pre-existing risk of local domestic violence that might be present before the project.	• Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Project workers • Local peoples, especially the vulnerable including female and children/ **Moderate**	Away from home labour forces, approximately 200 workers as per estimate of the ESCIA team, are lonely and possibly wanting to engage in sexual abuse either with the community people or among the workers. The magnitude of the risks depends on organizational behaviour as well as the effectiveness and efficiency of the management of the construction companies while it can occur directly within the community or the construction site. This can be regionally connected due to the association of such exploitation and human trafficking. However, it is unlikely to occur as the current human trafficking seems to be rarely reported. The consulted stakeholders, especially the province and district level, concern that the presence of construction workers will cause potential issues of sexual exploitation, gender-based discrimination, and child labour. Additionally, there are concerns about the potential for drug use and abuse among workers by community people, which could lead to unsafe working conditions and	Direct and indirect, and temporary	Short and long term	Moderate	Unlikely	Local, Regional

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
				negative impacts on surrounding communities.					
• **Security and Road and Traffic safety:** Increased risk of road accidents, local security, particularly for people living in the vicinity of the civil works and those traveling near the construction areas - Unauthorized access to construction sites, leading to theft or vandalism of equipment and materials. In addition, inadequate site surveillance or fencing may also expose the project to sabotage or delays caused by intentional interference. - During construction phase, particularly when road condition is not good, and safety measures are not effectively carried out by contractors. Risk of road accident may be due to people' failure in attending their children which put children at risks of accidents. - Given increased traffic flow between construction sites and other destination such as borrow pit, quarry, material supply warehouses, there is a risk of road traffic accident on the part of contractors' workers, and local inhabitants such as pedestrians,	• Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Project workers, • Community people • Local people traveling near construction sites and on transportation routes • Risk is mostly with those making frequent road travel **Moderate**	Unknown conditions of workers or some local people may involve in stealing thing from the construction sites or from local community. This may cause conflict within the community and feeling of unsafe as per the arrival of the influx labor. Moreover, construction vehicles transport petroleum, excavated soil, cement, and other building materials, leading to increased traffic activity in both urban and rural areas within the project zone and along the roads to the dumping sites or from access roads. This raises the risk of accidents and injuries directly for nearby residents, especially if safety measures are not rigorously followed. However, the volume of materials transported during the construction phase is still unknown and potentially medium for a short duration. As a result, the potential impact on road and traffic safety for people living along the transportation route is considered moderate. Community people showed limited concerns about the issues as they are unable to navigate the risks while some concerns were stated by authorities regarding the issues and requested for careful consideration from relevant institutions and involvement of local security forces.	Direct, and Indirect	Short and long term	Moderate to Major	Likely	Local, Regional

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
motorcyclists, cyclists, and those on animals or animal drawn carts. Reasons may also include violation of speed limits, lack of awareness of pedestrian, drivers' behaviour/drunk driving, or unexpected certain traffic circumstances. All project workers and local people near construction sites and routes connecting construction sites and material supply sites, quarry, borrow pits are exposed to traffic and road safety risks.									
• **Community Health and diseases** - Spreading and contracting of communicable diseases due influx of labour forces having direct and indirect contact with local people - Construction activities can disturb existing sediments and pollutants, temporarily increasing the risk of waterborne diseases	• Rehabilitation of irrigation canals and farm roads. • Influx of construction workers into the project area. • Construction activities disturbing soil and water bodies.	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Nearby residents • Construction workers/ **Moderate**	The influx of workers for the construction phase raises concerns about the potential spread of communicable diseases. Disturbing sediments during construction could elevate the risk of waterborne diseases, particularly if sanitation and hygiene practices are inadequate.	Direct and indirect	Short and long term	Minor to Moderate	Likely	Local, Regional
OCCUPATIONAL HEALTH AND SAFETY		*1, 2*							
• **Physical Hazards.** Physical hazards represent potential for	Construction or Rehabilitation	• Activity 1.4.3	• Construction workers	Working in the construction field can result in injuries or fatalities if the construction	Direct and indirect,	Short and long term	Minor to Moderate	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
accident or injury or illness due to repetitive exposure to mechanical action or physical activities. Physical hazards may result in a wide range of injuries, from minor that needs medical aid only, to disabling, catastrophic, and/or fatal. - Accidents due to falls: falling from ladders, scaffoldings, and vehicles, etc. - Drowning and water injury accidents: at construction sites, workers may have to walk on structure above the water. - Accident due to falling objects: tools, machinery, equipment, and materials used during construction may fall from the height, causing injuries or death. - Fall into open holes: holes, manhole, and areas of deep excavation may be commonly found at works. - Physical injury related to the operations of heavy equipment: Injury or death may result during operations of heavy equipment, such as crane, excavator, cuts, and bruises on sharp objects etc.	of irrigation canal and farm roads	• Activity 2.1.2 • Activity 2.2.2	• Inspectors • Visitors • Nearby Residents and Children • Domestic animals/ **High**	company fails to comply with laws and safety standards. This is likely to occur which may lead to injuries, illnesses, and fatalities due to unsafe practices. It will be directly occurred with the workers during their work. However, such a risk may be minimal based on the number of workers to be engaged for the construction work. Stakeholders at community level limited raised the concern regarding these aspects as they have limited understanding on the matter. At district and provincial level, there are minor concerns regarding the hazard which may cause to construction workers and community people.	and temporary				

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
• **Chemical hazards**. Chemical hazards represent potential for illnesses or injuries, both short and long term, and fatalities due to single acute exposure or chronic repetitive exposure to toxic, corrosive, sensitizing or oxidative substances. Common chemicals used in construction include Portland cement clinker (mineral binders), formaldehyde (wood-based materials), polyurethane, vinyl, cadmium, or lead (paints and resins), and solvents. They also represent a risk of uncontrolled reactions, including the risk of fire and explosion, if incompatible chemicals are inadvertently mixed.	Construction or Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Construction Workers • Inspector • Visitors **Moderate**	Working in the construction field can result in injuries or fatalities if the construction company fails to comply with laws and safety standards. This is likely to occur which may lead to injuries, illnesses, and fatalities due to unsafe practices. It will be directly occurred with the workers during their work. However, such a risk may be minimal based on the number of workers to be engaged for the construction work. Stakeholders at community level limited raised the concern regarding these aspects as they have limited understanding on the matter. At district and provincial level, there are minor concerns regarding the hazard which may cause to construction workers and community people.	Direct and indirect, and temporary	Short and long term	Minor to Moderate	Likely	Local
• **Personal Protective Equipment.** During dredging, and the construction of culverts, structures, and dams presents serious risks to worker safety and health. Workers are exposed to hazards such as falling debris, sharp objects, and heavy machinery, increasing the likelihood of injuries, including cuts, fractures, or head trauma. The lack of respiratory protection may lead to inhalation of dust, fumes, or toxic substances, while inadequate eye and hearing protection can cause vision	Construction or Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Construction Workers • Inspectors • Visitors **High**	With the construction to be occurred at the rural areas, it is possible that construction company may try to save the cost as much as possible. Absence of personal safety and consideration of individual who involve in the activities would also be the cause of being careless in using the equipment. This need to be carefully monitored and educated to ensure that the receptors are safe and sound.	Direct and indirect, and temporary	Short	High	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
impairment or hearing loss due to flying particles and high noise levels. Additionally, the absence of proper footwear and gloves increases risks of slips, trips, falls, and contact with hazardous materials. Prolonged exposure to these dangers without PPE not only compromises individual safety but also reduces overall productivity and increases liability risks for the project.									
• **Underpaid pay and unequal treatment:** Local people recruited as unskilled workers by project contractors may not be offered a written working contract. As a result, there is a possibility that they may be underpaid compared to the nature, scope, and quantity of work that they are expected to perform. Underpayment may also take place on the basis of gender, temporary work status – at the discretion of contractors. The risks of late wage payment or failing to pay workers should be assessed and included as part of the contract. The risks not only cause the Bank's reputation risk, but also delay civil works. In addition, there is the possibility that they will not comply with the law on labor of the	• Construction or Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Unskilled workers (mostly local people • Construction workers) / **Moderate**	Gender discrimination in the construction workforce may arise from the belief that men are stronger and more capable than women, leading companies to favour male workers. However, many women are equally qualified to perform these tasks. This bias, along with the presence of unregistered labour forces and weak enforcement of labour laws, can also result in mistreatment regarding worker payments, further exacerbating the inequalities faced by women in the construction sector. The risk is directly happening with labour forces. However, with the presence of social media and access to support, it is unlikely to occur at a large scale.	Direct	Short and long term	Moderate	Possible	Local, Regional

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
country due to short period contract.									
CULTURAL HERITAGE		***1, 2***							
Several cultural sites have been reported across three (3) sub-command areas: Ou Ta Paong, Lum Hach, and Stung Krang Bat. In Ou Ta Paong, these sites are reported to be minimally associated with the construction areas. However, there is a possibility that smaller sacred places within the command areas could be overlooked and cleared for canal construction. Since the detailed design has not yet been released or discussed with the community, there remains a risk that these sites could be destroyed. In Lum Hach, the two (2) identified cultural sites are reportedly outside the construction areas, but confirmation of the final design is needed to ensure that these sites are not affected. Lastly, in Stung Krang Bat, numerous historical and cultural heritage locations exist. While construction	• Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Underground cultural sites/ **Minor**	Several cultural sites have been reported across three (3) sub-command areas: Ou Ta Paong, Lum Hach, and Stung Krang Bat. In Ou Ta Paong, these sites are reported to be minimally associated with the construction areas. However, there is a possibility that smaller sacred places within the command areas could be overlooked and cleared for canal construction. Since the detailed design has not yet been released or discussed with the community, there remains a risk that these sites could be destroyed. In Lum Hach, the two (2) identified cultural sites are reportedly outside the construction areas, but confirmation of the final design is needed to ensure that these sites are not affected. Lastly, in Stung Krang Bat, numerous historical and cultural heritage locations exist. While construction is expected to focus on existing canals, there is potential that the construction will encounter archaeological artifacts buried deep in the soil, as the ancient city of Longvek, once located here, experienced many wars,	Direct	Short and long term	Minor	Unlikely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
is expected to focus on existing canals, there is potential that the construction will encounter archaeological artifacts buried deep in the soil, as the ancient city of Longvek, once located here, experienced many wars, leading to the possibility that treasures or artifacts of historical significance were hidden underground.				leading to the possibility that treasures or artifacts of historical significance were hidden underground.					
Loss access to land and other assets: - Construction activities, particularly land acquisition for canals and roads, can displace communities or restrict their access to land, homes, and other assets. - **Temporary** restriction of irrigation access during construction may occur in some areas, potentially impacting livelihoods, even though the project area is mainly rainfed.	• Temporary land acquisition for construction of: • New irrigation canals (tertiary and quaternary canals) • Roads (widening of existing roads) • Hydraulic structures (dams, reservoirs) • Temporary restriction of irrigation	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Farmers • Fishers • Households along road sections • Vulnerable groups **Moderate**	The project's construction phase presents a significant risk of temporary or permanent loss of access to land and assets for local communities. Even in cases where physical resettlement is minimal, the acquisition of land, particularly along construction road, and main canals, can disrupt farming activities, restrict access to water resources, and business impacting the livelihoods of those affected. Temporary restriction of irrigation access during construction is anticipated, particularly from farming activities along Ou Ta Paong River, feeder canals, main canal existing reservoirs. This will affect income generation for farmers reliant on irrigation, and business along the canals.	Direct	Short term	Moderate	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
	access from existing reservoirs during construction								
Loss access to natural resources: Construction activities and project operations can restrict communities' access to forests, fishing grounds, water sources, or other natural resources they depend on for livelihoods	• Upgrading of existing reservoirs. • Construction of new dams. • Implementation of river training measures. • Temporary restriction of water access from existing reservoirs during construction.	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Farmers • Fishers • Downstream communities **Moderate**	Farmers along main streams of Ou Ta Paong and Lum Hach and feeder canals in Ou Ta Paong will face the issues. Additionally, the influx of construction workers and the establishment of temporary facilities like worker camps could put pressure on local resources, including water sources and forest products, potentially leading to exploitation and environmental degradation.	Direct	Short term	Moderate	Likely	Local
CROSS-CUTTING		1							
• **Social inequality:** Risk of being unequally engaged and treated, during the design phase and construction. The vulnerable are likely to be limitedly consulted and having limited access to available irrigation water.	• Engagement and consultations during system design and construction	• Activity 1.1.1 • Activity 1.4.1 • Activity 1.4.2 • Activity 1.4.3	• Vulnerable groups/ **Moderate**	The focus group discussions confirmed that the landowners of project areas in all command areas are mainly local communities, giving similar access capacity to the consultation process. However, the field survey reported that the vulnerable are generally those who have no farmland, giving them limited access to benefit from the rehabilitated system. There are	Direct and indirect, and short and long term	Short and long term	Minor	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
		• Activity 2.1.2 • Activity 2.2.2		arguments at provincial and district level regarding the effort given to the poor which may end up limited efficiency and effectiveness due to lack of various resources and capacity in making the support reach its full potential. The scale of the impact is minimal due to the proportion of the poor is quite small at the command area. However, the poor may benefit from the system as some of them own a small piece of land at home for gardening.					
• **Elite capture** The rich have the resources to grab both available land and water resources, creating greater social disparities	• Engagement and consultations during system design and construction	• Activity 1.1.1 • Activity 1.4.1 • Activity 1.4.2 • Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	• Vulnerable groups/ **Moderate**	Since the landowners within the command areas are primarily from the local community, it is unlikely that elite land capture will occur. Additionally, the current high land prices make it unaffordable compared to the investment cost, reducing the incentive for such practices. However, there is a possibility that the wealthy may attempt to encroach upon protected areas, using their power, networks, or resources to seize land. While this is unlikely given the government's current commitment in its new mandate, if it does happen, the impact could extend to the regional level.	Direct and indirect, and short and long term	Short and long term	Minor	Likely	Local, regional
DURING OPERATION									
COMMUNITY HEALTH AND SAFETY		1, 2							
- Farmers and other labour directly involved in using chemicals inputs for crop production may be affected in terms of health (long-	• Intensifying farming activities	• Activity 1.4.3 • Activity 2.1.2	• Farmers • Local community /	According to the field survey of ESCIA, it is reported that the proportion of safe practices for farmers in their pesticide application is still a concern, given only	Direct, indirect, cumulative	Short and long term	Minor	Likely	Local, Regional

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
term) due to potential a) increased use of chemical inputs (e.g. pesticide) which affects them directly through inhalation, and through secondary sources such as contaminated surface/ underground water and produced crop. - People who consume water provided by water supply stations extracting water sources contaminated with chemical agricultural inputs may also be affected in the long run. - People who extract surface water, and underground water (through wells) that are infested with pesticide may also be affected in terms of health in the long run. - Consumers of farm produce with pesticide residue may also be affected consumers' health in the long run.	• Irrigation system operation	• Activity 2.2.2	**Moderate**	48%, 48%, 19%, and 61% of them wears close-toed shoes, long clothes which cover skin, goggle, and gloves, respectively. The figure indicated limited understanding of pesticide affecting their health condition. Since the availability of the irrigation water and the promotion of intensification of agriculture, the application of chemical fertilizers and pesticides are likely to increase over time and will directly affect the community health as well as water quality along the stream carrying them to downstream water users and the agricultural produce users. Limited concerns were reported regarding the utilization of pesticides and fertilizers, especially with wet season rice (Lum Hach and Stung Krang Ponley). However, the concern was more at Ou Ta Paong, but their concerns are more on water shortage rather than the issues, indicating their limited awareness regarding pesticide usage.					
CROSS-CUTTING		1, 2							
Gender inequality The risk during the operational phase of the project is that women may be excluded from the benefits and opportunities, despite the project's intention to promote gender equality.	• Limited access for women to training, resources, and decision-	• Activity 1.1.4 • Activity 1.1.3 • Activity 1.1.4	• Women farmers and laborers	The risk is rooted in pre-existing gender inequalities in Cambodia, where women have less access to resources, technology, and decision-making power. The assessment has shown that women are less resilient to climate change than men, and they face specific vulnerabilities in	Direct and Indirect	Short and long term	Moderate	Likely	Local

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
	making processes related to irrigation and agriculture.			terms of income, housing, and access to information and support systems. Socially determined gender roles can also impact the adoption of climate-smart technologies. Consequently, these factors could lead to unequal access to water resources, limited participation in FWUCs, and a disproportionate burden of negative impacts on women's livelihoods.					
• **Social inequality** Risk of being unequally engaged and treated, during the design phase and construction. The vulnerable are likely to be limitedly consulted and having limited access to available irrigation water at the operation stage.	• Competition for water resources among different user groups (farmers, communities, industries). • Potential displacement or restricted access to land due to irrigation infrastructure expansion. • Engagement and consultations during system design and construction	• Activity 1.1.1 • Activity 2.3.1 • Activity 2.3.2	• Farming communities • Indigenous populations (if present). • Landless or land-poor households. • Vulnerable groups/. **Minor**	The focus group discussions confirmed that the landowners of project areas in all command areas are mainly local communities, giving similar access capacity to the consultation process. However, the field survey reported that the vulnerable are generally those who have no farmland, giving them limited access to benefit from the rehabilitated system. There are arguments at provincial and district level regarding the effort given to the poor which may end up limited efficiency and effectiveness due to lack of various resources and capacity in making the support reach its full potential. The scale of the impact is minimal due to the proportion of the poor is quite small at the command area. However, the poor may benefit from the system as some of them own a small piece of land at home for gardening.	Direct and indirect, and short and long term	Short and long term	Minor	Likely	Local and regional

Potential and Causes of Risks and Impacts	Activities	Project component	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Nature and Duration	Significance	Likelihood	Scale
• **Elite capture** The rich have the resources to grab both available land and water resources, creating greater social disparities	• Unequal distribution of project benefits, favoring powerful individuals or groups at the expense of the intended beneficiaries. • Engagement and consultations during system design and construction	• Activity 1.1.1 • Activity 2.3.1 • Activity 2.3.2	• Smallholder farmers • Marginalized communities • Vulnerable groups/ **Minor**	Since the landowners within the command areas are primarily from the local community, it is unlikely that elite land capture will occur. Additionally, the current high land prices make it unaffordable compared to the investment cost, reducing the incentive for such practices. However, there is a possibility that the wealthy may attempt to encroach upon protected areas, using their power, networks, or resources to seize land. While this is unlikely given the government's current commitment in its new mandate, if it does happen, the impact could extend to the regional level.	Direct and indirect, and short and long term	Short and long term	Minor	Likely	Local and regional

CHAPTER 8 – RAPID CUMULATIVE IMPACT ASSESSMENT

8.1 INTRODUCTION

Cumulative impacts are those that result from the incremental impact of the project when added to other existing, planned and reasonably predictable future projects and developments. Under CAISAR, the implementation of infrastructure investment (Component 2) and non-infrastructure investments to support upscaled crop production (Component 1) under the six (6) sub–schemes are envisaged to result in cumulative impacts over a geographical area that is larger than the identified area of influence, particularly for Ou Ta Paong where other similar project(s) are being planned and there are a number of high biodiversity areas located to the downstream of these projects.

As part of the ESCIA exercise, a rapid assessment will be conducted to identify potential cumulative impacts and the preliminary high-level assessment of how the combined effects of the Project with other projects and activities, and natural environmental drivers, could affect valued environmental and social components (VECs) in the Project's area. As part of the ESCIA prepared for the sub–scheme, the assessment will focus on potential cumulative impacts associated with the sub–scheme, and for both intra-sub–schemes (where VEC are affected by multiple aspects of the sub–scheme) and inter-sub–scheme (where effects are enhanced due to other reasonably foreseeable activities/sub–schemes as well as from past and existing activities. Additionally, the RCIA is to assess the significance of the identified cumulative risks and impacts, evaluate the Project's contribution to these impacts and suggest management measures that could be implemented to prevent unacceptable VEC condition and for which the Project could contribute. The assessment will be conducted within the sub–scheme's area of influence and will be ex-ante[54] by nature.

The identification and management of cumulative impacts will be limited to the effects that are generally recognized as important based on a) scientific concerns and/or b) concerns of communities, including both adversely affected people and project's beneficiary community. In addition, cumulative impacts from other existing or planned projects in the neighboring projects will also be identified.

8.2 STEPS FOR CONDUCTING RCIA (PROJECT LEVEL)

The following six (6) steps, which are proposed by IFC, are adopted for this rapid Cumulative Impact Assessment:

[54] Ex-ante effect is assessed based on either modeling of original data collected under the Project, or on secondary data sources that are plausible to make an informed judgement.

Step 1: Scoping: Identification of Valued Environmental Components (VECs) and Spatial and Temporal Boundaries

The objectives of this step are:

- Identify VEC to include in the RCIA
- Identify the spatial boundary of the RCIA, and
- Identify the temporal boundary of the RCIA

During this step, the following key questions will be answered:

- Whose involvement is key?
- Which VEC resources, ecosystems, or human values are affected?
- What is the temporal boundary of the project?
- What are the spatial boundaries of identified VECs?
- Are there concerns from existing cumulative impacts?

Step 2: Identification of other Projects, Activities and External Stressors

The objectives of this step include:

- Identify other existing and reasonably predictable projects and human activities that do/would affect the VECs to be included in the RCIA.
- Identify natural environmental drivers that also impact the condition VECs

The following key questions would be answered during this step:

- Are there any other existing or planned activities affecting the same VEC?
- Are there any natural forces and/or phenomena affecting the same VEC?

Step 3: Establish Baseline Conditions of VECs

Objectives of this step include:

- Collect available information on the impacts of the other activities and natural drivers on the condition of the VECs.
- Collect available information on trends in VEC condition.
- Collect available information on regional thresholds for VEC condition

Questions to be answered in this step include:

- What is the existing condition of the VEC?
- What are the indicators used to assess such condition?
- What additional data are needed?
- Who may already have this information?

Step 4: Assess Cumulative Impacts on VECs

Objectives:

- Establish indicators for expression of VEC condition.
- Estimate the “future baseline” for condition of the VECs - i.e., the condition of VECs as affected by the other projects, human activities, and natural drivers
- Estimate the project impact on VEC condition. This estimation is done with the effects of planned project mitigation included

- Estimate the cumulative impact on VECs—the total impact on the VECs when the impacts of the development are combined with the future baseline

Questions to answer:

- What are the key potential impacts and risks that could affect the long-term sustainability and/ or viability of each VEC?
- Are there known or predictable cause-effect relationships?
- Can these impacts and risks interact with each other?

Step 5: Assess Significance of Anticipated Cumulative Impacts

Objectives:

- Assess the significance of the foreseen cumulative impacts on the VEC

Questions to answer:

- Do these impacts affect the sustainability and/or viability of the resource and/or VEC?
- What are the consequences and/or trade-offs of taking the action versus no action?

Step 6: Design and Implement Cumulative Impact Management Measures

Objectives:

- Identify, when necessary, additional project mitigation to reduce an estimated unacceptable cumulative impact on a VEC to an acceptable level.
- If necessary, identify the potential, or need for, additional mitigation of other existing or reasonably predictable future projects.
- Identify the potential for other regional strategies that could maintain VECs at acceptable conditions.
- Undertake best efforts to engage, enhance, and contribute to a multistakeholder collaborative approach for the implementation of management actions that are beyond the capacity of the project proponent.

Questions to answer:

- How can cumulative impacts be avoided, minimized, and/or mitigated?
- How can the effectiveness of proposed management measures be assessed?
- What are the triggers for specific adaptive management decisions?

8.3 SOURCES OF INFORMATION AND LIMITATIONS OF RCIA

Rapid Cumulative Impact Assessments (RCIA) rely on diverse sources of information to evaluate combined effects of multiple activities on the environment and society. Key sources include existing Environmental and Social Impact Assessments (ESIAs), scientific research, and government reports, which provide baseline data and insights on potential impacts. Geospatial data, such GIS maps, along with climate data, help analyze land use changes, and vegetation. Stakeholder input through consultations and interviews enriches the understanding of local contexts, while monitoring data from ongoing projects and biodiversity studies contribute to assessing ecological and social systems.

The limitations of the RCIA include unavailable studies being conducted at specific sites as well as relevant information being publicly disclosed. In addition, some information is incomplete or outdated information. Moreover, stakeholder engagement may be limited or biased, and institutional or regulatory frameworks often lack clear guidance on cumulative assessments, reducing effectiveness.

8.4 RESULTS OF THE RAPID CIA

The nature of this proposed RCIA will be *ex-ante* and will be based on 1) scientific concerns, 2) concerns of affected communities within the sub-scheme's area of influence, or beyond the downstream, 3) consultation with concerned project stakeholders and interested stakeholders. Based on stakeholder consultation, a list of VEC is proposed to define the scope of the proposed RCIA (See next section).

8.4.1 Identification of Valued Environmental and Social Components (VECs) (Step 1)

Based on the ESCIA, stakeholder consutlations, and scientific evidence, the folowing VECs are identified for activities proposed under project component 1 and component 2.

Table 8.1: Identification of valued environmental and social components (VECs) under the RCIA

VECs	**Criteria Rating**	**Criteria Rating Rationale**
Water Pollution	Nature	The project has the potential to contribute to water pollution in various ways, including runoff from agricultural fields, utilization of pesticides and fertilizers, construction activities, and industrial discharge.
	Duration: Long term	The impacts of water pollution can persist over extended periods, particularly if not adequately mitigated.
	Livelihood:	Water pollution directly threatens the livelihoods of communities reliant on fishing and clean water resources for domestic use and agriculture.
	Spatial scale:	Water pollution can spread beyond the immediate project area, affecting downstream water quality and potentially impacting ecosystems and communities in neighboring regions.
	Magnitude: Medium	The magnitude of potential water pollution is significant, considering the project's scale, the vulnerability of aquatic ecosystems, and the potential for cumulative impacts from existing pollution sources.
	Receptors	**Ecosystems:** Aquatic life, riparian vegetation, water-dependent species.

VECs	Criteria Rating	Criteria Rating Rationale
		Human communities: Communities reliant on clean water for drinking, sanitation, and irrigation.
	Involved Stakeholders	PMU, Line Ministries (MoWRAM, MEF, Ministry of Environment), Local Authorities, NGOs focusing on water resources and environmental protection, CBOs (FWUCs), Community People, particularly those directly dependent on water resources.
Soil Pollution	Nature	The project can contribute to soil pollution through the use of fertilizers and pesticides, construction activities, and improper waste disposal.
	Duration: Long term	Soil contamination can persist for many years, impacting soil fertility and potentially posing risks to human health and ecosystems.
	Livelihood: Medium	Soil pollution directly affects agricultural productivity and can reduce crop yields, impacting the livelihoods of farmers in the project area.
	Spatial scale:	The impacts of soil pollution are primarily localized to the project area, affecting agricultural land and potentially nearby ecosystems.
	Magnitude: Medium	While the project aims to promote sustainable agricultural practices, the potential for soil pollution from intensified agriculture and construction activities warrants a medium magnitude rating.
	Receptors	**Soil organisms:** Microorganisms, invertebrates, and plants essential for soil health and fertility. **Crops:** Agricultural productivity and food security. **Human health:** Potential risks from contaminated food and water.
	Involved Stakeholders	PMU, Line Ministries (MAFF, Ministry of Environment), Local Authorities, Agricultural Extension Services, NGOs working on sustainable agriculture, CBOs (Farmer Organizations), Community People, particularly farmers and those involved in agricultural production.
Loss of biodiversity and ecosystem services	Nature	The project has the potential to impact biodiversity and ecosystem services through habitat loss, fragmentation, water pollution, and altered flow regimes.
	Duration: Long term	Biodiversity loss and ecosystem degradation can have long-lasting and potentially irreversible impacts on ecological integrity and the provision of ecosystem services.

VECs	Criteria Rating	Criteria Rating Rationale
	Livelihood: Medium	Communities reliant on natural resources, particularly fishing and forest products, will be affected by biodiversity loss and changes in ecosystem services.
	Spatial scale: Local	The impacts on biodiversity are primarily localized to the project area and surrounding ecosystems.
	Magnitude: Medium	Considering the presence of critical ecosystems like the Tonle Sap Lake and its floodplain, the potential for habitat loss and degradation warrants a medium magnitude rating.
	Receptors	**Species:** Plants, animals, fish, and other organisms reliant on the affected ecosystems. **Habitats:** Forests, wetlands, rivers, and other areas providing essential habitat for biodiversity. **Ecosystem services:** Water purification, flood regulation, pollination, and other services essential for human well-being.
	Involved Stakeholders	PMU, Line Ministries (Ministry of Environment, MAFF, MoWRAM), Local Authorities, NGOs focused on biodiversity conservation, Research Institutions, Community People, particularly those dependent on natural resources and ecosystem services.

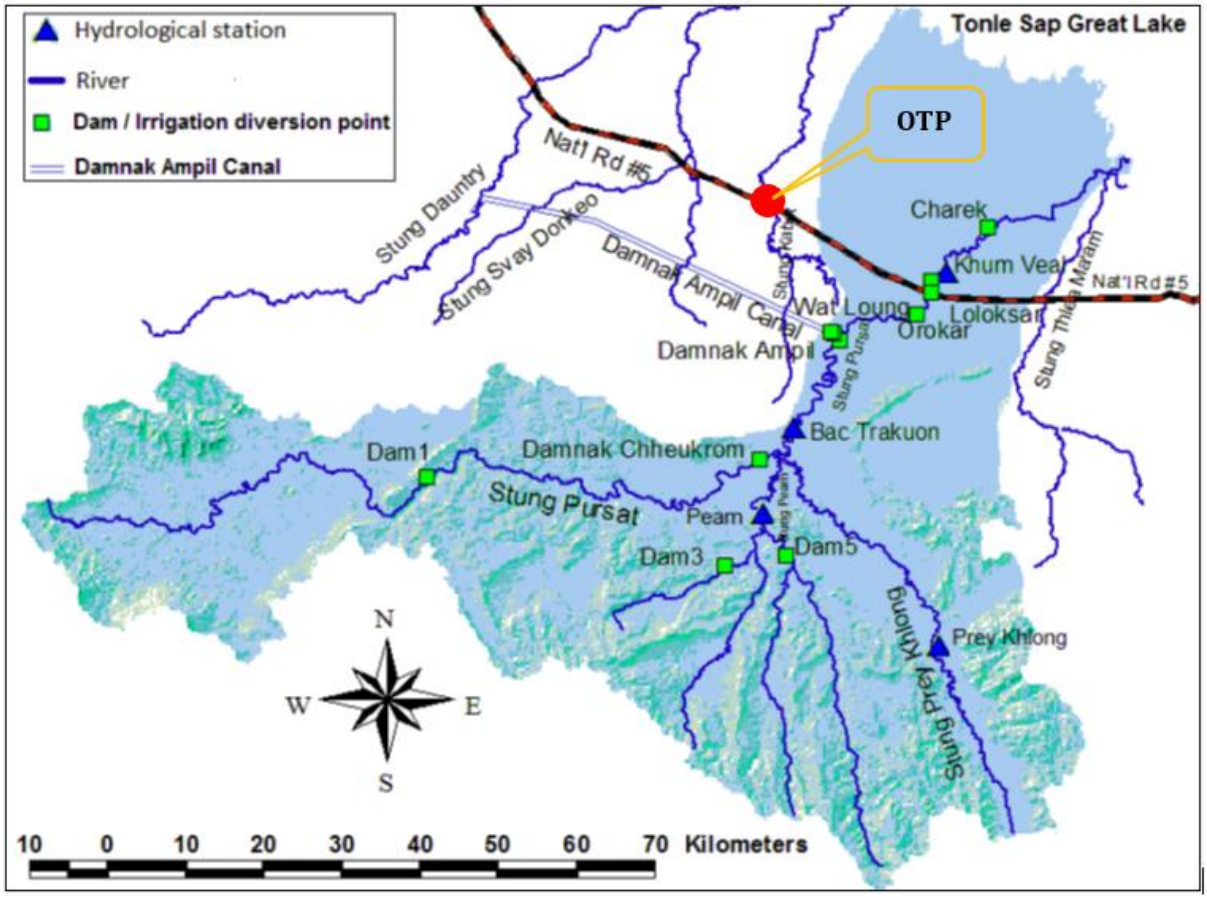
8.4.2 Identification of other Projects, Activities and External Stressors (Step 2)

The projects which are considered to accumulatively create the combined impacts with CAISAR project are mainly the irrigation projects which can be the previous, the current and the planned one. The identified projects nearby each sub-scheme are described below:

8.4.2.1 Ou Ta Paong

Pursat province has several significant hydropower and irrigation projects, including the Stung Pursat Hydropower I Dam, Damnak Chheukrom Irrigation Project, Damnak Chheu Krom Dam, and Domnak Ampil Canal. These projects are currently under construction or have already been operational, playing an important role in energy supply and the province's agricultural development. However, all these projects are located at a considerable distance from the Ou Ta Poang command area, with the exception of the Domnak Ampil canal, which is located upstream and approximately 5 kilometres away from Ou Ta Poang. The commuters along the national roads are part of the air and dust contributors as well which may reduce air quality. On the other hand, the OTP is mostly covered by paddy fields and residential areas.

Figure 8.1: Location of Water resources development in the Pursat river (JICA, 2013)



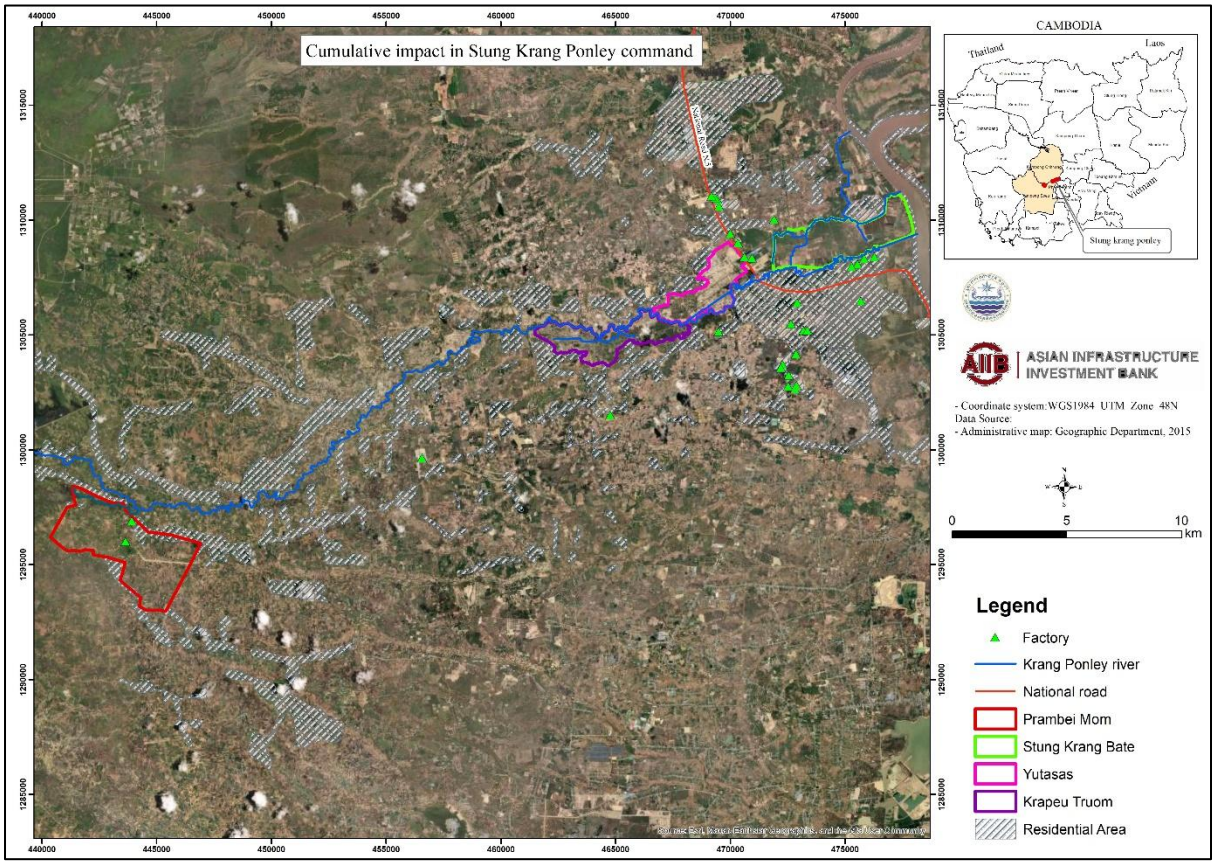
8.4.2.2 Lum Hach

In the Lum Hach irrigation scheme, apart from the existing and rehabilitated irrigation systems, there are no other projects. Additionally, the Lum Hach area is located west and near the Tonle Sap Lake, which is identified as covered by paddy fields and residential areas. Therefore, beside the construction activities in the Lum Hach scheme, there are agriculture activities that are going to have an impact on the environment, community health, and GHG emissions as well.

8.4.2.3 Krang Ponley

The Stung Krang Ponley sub-scheme, identified by a mix of residential areas, paddy fields, and factories, faces a complex interplay of environmental impacts from these diverse activities. Factory operations often contribute to air and water pollution through emissions and discharges, while agricultural activities can lead to water pollution from pesticide runoff and greenhouse gas emissions. In addition, residential areas can generate waste and contribute to noise pollution.

Figure 8.2: Cumulative impact in Stung Krang Ponley



8.4.3 Baseline Conditions of VECs (Step 3)

As per the current water pollution monitoring report, the contamination of Tonle Sap Lake (TSL) in Cambodia caused by pesticide runoff from agricultural fields and households, particularly after rainfall. This contamination pathway implies that pesticides can accumulate in the soil, potentially affecting its quality and health. Rainwater then carries these pesticides into rivers, ultimately reaching TSL and polluting the water. The anthropogenic activities, including pesticide use, threaten the lake's water quality including various pesticides such as Chlorfenapyr, Terbcarb, Atrazine, 2-Phenylphenol, Parathion, Dieldrin, Malathion, Methyl parathion, and Biphenyl, in TSL water samples. The detection of these pesticides confirms their use and presence in the lake and its surrounding areas.[55] In addition to the pollution of water and soil, the areas are gradually deteriorated in terms of biodiversity and ecosystem services due to habitat loss, pollution, and hydrological disruptions from upstream dams and climate change. These factors have led to declines in fish diversity, waterbird populations, and wetland habitats, alongside reduced ecosystem services such as fisheries productivity, water quality regulation, and nutrient cycling. The lake's seasonal flood-pulse system, essential for

[55] Meas, Mardi, May Phue Wai, Nimol Vat, Senghong Kin, Si Chheng Im, Sopheak Trerm, Sreynith Lis, and Rina Heu. "Monitoring of Pesticide Residues in Tonle Sap Lake, Cambodia."

maintaining its ecological balance, is increasingly disrupted.[56&57] The identified VECs conditions at the period are described here.

Table 8.2: Baseline Conditions of the identified valued environmental and social components (VECs) under the RCIA

VECs	Ou Ta Paong	Lum Hach	Stueng Krang Ponley
Water pollution and soil pollution	• Potential for water contamination due to the existing use of agricultural chemicals in the OTP sub-scheme and neighboring areas. • Runoff from agricultural fields could carry pollutants into water bodies and groundwater.	• Potential for water contamination from agricultural runoff and industrial discharge.	• Potential for water pollution from both agricultural and industrial sources. • Water quality in the Stueng Krang Bat sub-scheme could be impacted by runoff from upstream areas and potential industrial discharge.
Loss of Biodiversity and ecosystem services	• Degradation of flooded forest habitats due to land encroachment and conversion to rice cultivation. • Fragmentation of the Ou Ta Paong Stream/canal by earth dams, roads, and ponds, impacting its natural flow. - Presence of several Endangered and Critically Endangered reptile and fish species.	• Habitat loss and degradation due to agricultural expansion and other land use changes. • Potential impacts on endangered and critically endangered species, as identified through IBAT screening.	• The Stueng Krang Bat sub-scheme is in an ecologically important area with a diverse range of habitats, including flooded forests, grasslands, and scrublands. • Potential for habitat loss and degradation due to irrigation infrastructure development and agricultural intensification. • Presence of Endangered and Critically Endangered reptile and fish species, including the Black Marsh Turtle, Elongated Tortoise, and Mekong Giant Catfish.

8.4.4 Assessment of the Cumulative Impacts of VECs (Step 4)

The assessment of the cumulative impacts on the identified VECs is presented in Table 8.3 below.

[56] Chen, Aifang, Anping Chen, Olli Varis, and Deliang Chen. "Large net forest loss in Cambodia's Tonle Sap Lake protected areas during 1992–2019." *Ambio* 51, no. 8 (2022): 1889-1903.
[57] Lindsay, Joey, Keida Gaba, Lindsay Harmon, and Susan Jarvis. "Tonlé Sap Food Security & Agriculture III: Evaluating Changes in Ecosystem Vitality and Freshwater Health in the Tonlé Sap Basin using Remotely Sensed Data." (2021).

Table 8.3: Analysis result of the identified valued environmental and social components under the RCIA

VECs	Potential and Assessment of Impacts on the VECs	Key activities that cause risks and impacts			Potential Receptors		Supporting evidence	
		CURRENT PROJECT (CAISAR Project)	**PAST PROJECTS** (active command areas in the larger area)	**PLANNED PROJECT** (IWRM Project)	**Within current estimated area of influence**	**Beyond current estimated area of influence**	Scientific concerns	Affected Stakeholders
Water pollution & Soil pollution	- The increased use of agricultural chemicals under the OTP sub–scheme (about 14,000 ha), existing neighboring schemes, and the planned ADB financed project (IWRM), and various active command areas (See picture below). - Intensifying crop production may affect the quality of water (both surface and underground water). - Factories located along the Stung Krang Ponley command area also contribute to pollution of surface and groundwater, exacerbating the overall water quality issues	Increased crop production during operation phase (indicative of increased cultivated area per year)	Potential increased crop production (induced impact) thanks to uptaking lessons learned from CASAR	Increased crop production during operation phase of the project	Soil and water sources within the project targeted command area	Soil and water sources outside the project targeted command area and to the downstream (e.g. Ou Tapaong,	X	X
	Biodiversity							
Loss of Biodiversity and ecosystem services	- Critical habitats important to EN and CN species are potentially affected due to polluted surface, food poisoning, and decreased sources of food essential to EN and CN species due to water and soil pollution. - Disruption of Ecosystem Services: The loss of biodiversity can disrupt ecosystem services such as water purification, flood control, and carbon storage, slightly contributing to the long-term impact. - Industrial activities along the Stung Krang Ponley command further contribute to	Construction of the irrigation systems Farming activities Factory activities	Construction of the irrigation systems Farming activities Factory activities	Construction of the irrigation systems Farming activities Factory activities	Aquatic and terrestrial species	Potentially the protected area at the downstream of Ou Ta Paong and at the upstream of Lum Hach	X	X

VECs	Potential and Assessment of Impacts on the VECs	Key activities that cause risks and impacts			Potential Receptors		Supporting evidence	
		CURRENT PROJECT (CAISAR Project)	**PAST PROJECTS** (active command areas in the larger area)	**PLANNED PROJECT** (IWRM Project)	**Within current estimated area of influence**	**Beyond current estimated area of influence**	Scientific concerns	Affected Stakeholders
	biodiversity loss through the release of solid and liquid waste into water resources - Agricultural activities, including the use of fertilizers, pesticides, and machinery in paddy fields, can disturb water quality and disrupt aquatic and terrestrial ecosystems.							

8.4.5 Assessing the Impacts Significance (Step 5) and Management Measures (Step 6)

The assessment of the impact significance and management measures are provided in table 8.4 below:

Table 8.4: Analysis of the identified VECs baseline condition, Impacts Significance and Management Measures

VECs	Existing Conditions and Trends of VECs	Cumulative Impacts Expected from the Other Project Activities	Significance of Cumulative Impacts	Suggested Management Actions for Cumulative Impacts
Water pollution & Soil pollution	▪ Existing agricultural practices, including fertilizer and pesticide use, contribute to water and soil pollution. ▪ Industrial activities along the Stung Krang Ponley command area release waste into water resources. ▪ Soil quality varies across sub-schemes, with some areas facing low fertility and high hydraulic conductivity.	▪ Increased fertilizer and pesticide use associated with intensified crop production can exacerbate water and soil pollution. ▪ Construction activities can contribute to soil contamination through the release of oils and chemicals. ▪ Waste disposal from industrial activities can further impact water and soil quality.	▪ Potentially high significance, as water and soil pollution can impact human health, agricultural productivity, and ecosystem health. ▪ Cumulative impacts from multiple sources can lead to long-term degradation.	- Promote sustainable agricultural practices, including integrated pest management (IPM) and reduced fertilizer use, to minimize pollution from agricultural activities. - Implement strict measures for the handling, storage, and disposal of chemicals and waste during construction and operation. - Develop and enforce regulations for industrial waste discharge to protect water and soil quality. - Monitor water and soil quality regularly to assess impacts and identify necessary mitigation measures. - Remediate contaminated sites to restore soil health and prevent further pollution.
Loss of Biodiversity and ecosystem services	▪ Existing industrial and agricultural activities have already contributed to biodiversity loss and habitat degradation. ▪ Tonle Sap Lake and its floodplain are a critical ecosystem supporting diverse species and livelihoods. ▪ Community fish refuges and key biodiversity areas (KBAs) are present in the project region.	▪ Micro-habitat loss and fragmentation due to construction activities and expansion of agricultural land. ▪ Water pollution and altered flow regimes can impact aquatic ecosystems and fish populations. ▪ Increased pesticide use can negatively affect pollinators and other beneficial insects.	Potentially moderate to high significance, as biodiversity loss and ecosystem degradation can undermine long-term ecological resilience and the provision of ecosystem services essential for livelihoods and well-being.	- Avoid sensitive habitats and critical areas during project siting and design. - Minimize habitat disturbance and fragmentation during construction activities. - Establish buffer zones around water bodies and sensitive areas to protect biodiversity. - Restore degraded habitats and create ecological corridors to enhance connectivity. - Implement monitoring programs to assess impacts on biodiversity and ecosystem services and adapt management practices accordingly. - Engage local communities in biodiversity conservation efforts and promote sustainable land management practices.

8.5 CONCLUSION

The cumulative impact assessment for the Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project. This project aims to improve irrigation systems in three (3) sub-schemes: Ou Ta Paong, Lum Hach, and Stung Krang Ponley. The assessment identifies potential environmental and social impacts associated with the project, including air, water, and soil pollution, waste disposal, biodiversity loss, GHG emissions, and economic displacement. This assessment has analyzed that, besides the CAISAR project, there are existing activities, such as agricultural practices and industrial activities, in the surrounding project areas. These activities, when combined with the projected activities, had cumulative impacts on the environment and society in certain areas.

CHAPTER 9 – ENVIRONMENTAL & SOCIAL MANAGEMENT

9.1 INTRODUCTION

This chapter outlines the purpose, roles, and responsibilities related to the management of environmental and social impacts associated with the project. The primary purpose of the chapter is to present a structured framework for mitigating and monitoring potential environmental and social risks throughout the project lifecycle. It highlights the importance of integrating environmental and social considerations into project planning and implementation to ensure compliance with national regulations, international best practices, and the project's sustainability goals.

Key institutions involved in the environmental and social management process include government agencies, local authorities, and specialized environmental and social monitoring bodies. These institutions are responsible for ensuring adherence to environmental laws, assessing the project's social impacts, and overseeing the implementation of mitigation measures. Their roles also involve collaborating with stakeholders, including affected communities, to address concerns and facilitate transparent project execution.

Furthermore, the proposed monitoring program is designed to track the effectiveness of mitigation measures and ensure that environmental and social risks are managed proactively. This program involves regular assessments of key indicators such as air and water quality, biodiversity conservation, community health, and socio-economic conditions. Continuous monitoring ensures that any negative impacts are identified early, allowing for timely interventions to minimize adverse effects on both the environment and surrounding communities.

9.2 ENVIRONMENTAL, SOCIAL AND CLIMATE MANAGEMENT MEASURES

Based on the ESC risks and impacts identified and assessed (in Chapter 06), a summary of proposed mitigations measures is presented below.

9.2.1 Mitigation Measures for the Environmental and Climate Risks and Impacts

Table 9.1: Environmental Risks, Impacts and Mitigation Measures

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
BEFORE CONSTRUCTION					
UNEXPLODED ORDNANCES (UXO)					
Although effort have been made to demine across the country, mortar shells, aerial bombs, and other unexploded ordnance may be found within the subproject area. Some demining operations have been carried out at shallow depths, and UXO maps have been generated but it is not known if there is UXO that is located in proximity of the structures where structural upgrading would be made. Of particular concern is the hazard posed by unexploded ordinance left during the war, particularly in area where deep excavation is required.	Construction/ Rehabilication of canals, farm roads, and relevant facilities that involve earthworks, soil excavation, river dreding, and so forth.	Residents, construction workers, animals, and any objectives nearby **High**	There have been no reported incidents of mines or unexploded ordnance (UXO) within the command areas. However, the risk remains due to the country's long history of civil war, with mine clearance efforts often limited to surface-level areas. As a result, construction activities involving deeper excavation could potentially expose mines or UXO, leading to explosion. This risk more likely to occur within the command area and at location where physical excavations are carried out.	Direct	In case of finding any suspected objects during any work, UXO clearance procedure must be followed UXO screening/assessment will need to be carried out by certified UXO experts before any physical/ construction activities, including mobilization of contractors to construction site, are allowed. In case UXOs are found by certified experts during on-site screening, removal of UXO will be carried out by certified experts. A UXO clearance certificate shall be obtained from related authority for each sub-project prior to commencing any subproject activities. As part of site-specific ESCMP, conduct training and awareness activities for local community with regards to UXO risks and chance finds.
DURING CONSTRUCTION					
ENVIRONMENTAL POLLUTION					
• **Noise:** - Earthmoving activities and operation of machineries at construction sites will generate dusts and exhaust fumes. - Construction activities, operation of vehicular movement, excavation machineries, concrete mixing, and other construction activities will generate noise and vibration and will be a nuisance to workers and residents near the site.	Rehabilitation of irrigation canal and farm roads	• Nearby residents • Construction workers **Minor**	There are limited large scale and heavy infrastructure construction being planned in the project, except the construction of small-scale hydraulic structures of the irrigation system. In addition, the larger ones are normally located outside the residential areas whereas some small cross check structures are located within residential area, only in Ou Ta Paong and Lum	Direct	- Right before the construction, conduct noise testing at the sensitive locations as per the detail engineering design comparing to the IFC EHS Guideline - Avoid night-time construction in populated/village areas. - Minimize project transportation through community areas where possible. - Ensure proper maintenance and proper operation of construction machinery to minimize noise

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
- Noise may be generated from workers' camp, particularly during living activities or entertainment at nighttime, or due to certain maintenance /repair of equipment, machinery, vehicles.			Hach whereas the construction site at Stung Krang Ponley which are located mainly at the paddy field. They are unlikely to affect community people as the duration is short while the people along the national road in Krang Ponley scheme will be possibly heard the traffic noise along the road instead, making the noise from the construction will limitedly affect them. In addition, the scale of impact is at local level but there are likely some noises from transport vehicles of the construction as materials for construction are needed.		generation. - Where possible, maintain existing trees, bushes, vegetated areas, to prevent part of sound (that may be generated from construction site, vehicle, operating heavy equipment) from reaching nearby residential areas. - No noisy construction-related activities will be carried out from 21:00 hours to 06:00 hours along residential areas, hospitals, schools and during religious or cultural events near the subproject - All construction equipment and vehicles must be well maintained, regularly inspected for noise emissions, and shall be fitted with effective muffler and other appropriate noise suppression equipment consistent with applicable national and local regulations. - Use only vehicles and equipment that are registered and have necessary permits. Truck drivers and equipment operators should avoid, as much as possible, the use of horns in densely populated areas and where there are other sensitive receptors found such as schools, temples, hospitals, etc. - Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located (houses, schools, temples, hospitals, etc.

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					- Provide temporary noise barriers (3–5-meter-high barrier can reduce 5–10 dB(A)), as necessary, if site works will generate high noise levels that could disturb nearby households, hospital, school and other sensitive receptors. - Restrict use of vibrating rollers and operation of heavy equipment near sensitive structures.
• **Air pollution:** Dust will be generated by transportation of material, clearing, grading, excavation, levelling, truck hauling, stockpiling, waste disposal, access road rehabilitation. In addition, the emission is also expected from machineries and vehicles, especially during dry season	Transportation of materials, clearing, grading, excavation, levelling, truck hauling, stockpiling, waste disposal, access road rehabilitation	• Nearby residents • Construction workers **Minor**	• These activities generate dust and particulate matter (PM10 and PM2.5) from soil disturbances, stockpiles, and road works, leading to localized air pollution that can affect respiratory health. Exhaust emissions from trucks and heavy machinery release pollutants such as nitrogen oxides (NOx), carbon monoxide (CO), sulphur dioxide (SO2), and volatile organic compounds (VOCs), contributing to smog formation and greenhouse gas emissions. Additionally, waste disposal, particularly through burning, can release harmful pollutants into the air, further degrading air quality. However, the level of generation is minimal as the extent of the release is gradually moved from place to place and short in duration.	Direct	- Right before the construction, conduct ambient air quality testing at the sensitive locations as per the detail engineering design comparing to the IFC EHS Guideline - Spray or sprinkle water on work surfaces regularly in windy and dry weather, when necessary. - Avoid open burning of debris, cut vegetation (trees, undergrowth) or construction waste materials. - Reduce the operation hours of generators, machines, equipment, and vehicles as much as possible and control vehicle speed. - Ensure regular maintenance of generators, machines, equipment, and vehicles used at project site. - To protect against dust and fumes, spray water onto the ground. - Construction equipment is maintained to a good standard and conduct immediate repairs of any malfunctioning construction vehicles

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					and equipment. - Equipment and vehicles not in use should be switched off. - Machinery and vehicles causing excessive pollution (e.g., visible smoke) will be banned from construction sites. - All construction equipment and vehicles shall have valid certifications indicating compliance with vehicle emission standards. - The site of concrete mixing plants, crushing plants, quarries and other facilities that cause high dust and/or gaseous emissions should be at least 500 m from settlements and other sensitive receptors (schools, hospitals, etc.). - Tightly cover trucks transporting construction materials (sand, soil, cement, gravel, etc.) to avoid spills and dust emission.
• **Water pollution** - Surface water quality reduction can occur due to construction, especially the earthwork, leakage of oils and chemical materials - Underground water quality reduction due to construction activities	Dredging and excavation activities, often required for the rehabilitation and upgrading of irrigation infrastructure in river systems	• Nearby residents • Construction workers **Moderate**	The dredging and excavation activities are required for all sub-schemes that can significantly impact water quality, particularly through increased sedimentation. Disturbed soil from excavation can enter water bodies, potentially polluting domestic water sources as sediment is carried downstream when water is released from rehabilitated reservoirs or	Direct and indirect	- Construction diversion control should be prepared to avoid water flow, and spreading of all pollutants caused by the construction. - Do not fill up canals and creeks at the construction site. In case the filling of local drainage system is necessary, consultation with local authorities shall be undertaken and their permission obtained beforehand. - An alternative drainage should be

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			canals. Large-scale dredging along Ou Ta Paong, spanning up to 30 km, may affect water quality throughout the excavation period and could extend to Tonle Sap Lake if proper mitigation measures are not in place. In addition, project activities can also impact groundwater quality, particularly through the infiltration of wastewater from workers' camps and the leakage of hazardous materials such as oil and diesel into water bodies, further contributing to water pollution.		established before the existing canal is filled up. - Prohibit placement of construction materials, waste storage areas or equipment in or near drainage channels and water courses. - Discharge of oily wastewater, fuel, hazardous substances and wastes, and untreated sewage to watercourses/canals and on the ground/soil is prohibited. - Provide adequate drainage at the construction sites and other project areas to avoid flooding of surrounding areas and minimize flow obstruction of existing watercourses. - Include in engineering drawing the construction of retaining structures such as gabion baskets, riprap, etc. for riverbank protection. - Obtain required permits indicating water sources and permissible volumes - Maintain communication with local communities during construction stage to ensure that local water users provide timely feedback on water quality, if any, during construction process. - Conduct water quality testing from upstream and downstream of the river system for quality test during and after construction to compare with the baseline and the IFC standard for monitoring purposes.

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
• **Soil pollution/ quality reduction:** Leakage of oils, and chemicals used for machinery and construction process at farming land and construction sites	The activities affecting soil quality during this stage include dredging and the leakage of oils used for machinery and construction processes at construction sites.	• Nearby residents • Construction workers **Moderate**	Since excavation of the soil is at a large scale, the impact may be major. For example, oil leakage from construction equipment and large-scale soil excavation can significantly impact soil quality. Oil introduces harmful contaminants like hydrocarbons and heavy metals, reducing soil fertility, disrupting microbial activity, and posing risks to nearby water bodies through runoff. In addition, excavation disturbs soil structure, increasing erosion and reducing its ability to retain water and nutrients, which can decrease agricultural productivity.	Direct	- Scheduling construction activities during the dry season as much as possible. - Store fuels, oils, and chemicals safely in areas on an impermeable surface with proper containment berms. Spillage of oil and chemicals must be handled immediately to prevent infiltration. - Cover all restored areas with topsoil and re-vegetate (plant grass, fast-growing plants/trees) construction areas quickly once work is completed. - Construction diversion control should be prepared to avoid water flow, and spreading of all pollutants caused by the construction.
• **Solid waste:** During construction, waste of various kinds will be generated including solid wastes, hazardous wastes, and domestic solid waste (at workers' camp site). Solid waste may include surplus excavated materials, used lumber for trenching works, waste generated from demolition of existing camp, structures, construction debris, and so forth. This is added with the domestic waste such as food waste (bone, and meat waste and vegetables), paper, glass, metals, plastics, textiles, etc. being disposed by in-migrant labourers.	• Excavation and site clearing • Demolition of existing structures • Construction of temporary worker camps • Use of heavy machinery • Trenching works	• Nearby residents • Construction workers • Soil in the rivers and farmland **High**	The rehabilitation and upgrading construction for existing irrigation infrastructure in command areas often involves the establishment of temporary worker camps, the use of heavy machinery like trucks and excavators, and the generation of various types of waste. Solid waste generated during construction may include surplus excavated materials, used lumber from trenching works, debris from the demolition of existing camp structures, and other construction remnants. Domestic waste generated by construction workers at the	Direct and Indirect	**For hazardous waste in agricultural production** - Crop residue: straw and stub should be collected for use as animal feed or for other purposes such as for mushroom growing, or for sale, or reuse for other farming purpose (e.g. incorporating into soil to improve soil fertility) - Empty pesticide containers: collected and kept appropriately as per recommendation in IPM good practices. - Never through and leave empty pesticide contain in the field which may contaminate soil and surface water which may affect aquatic animals and even humans.

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			construction site, worker camps, and other facilities can also contribute to environmental pollution. While the direct impact of this waste is often localized to the construction site and camps, improper management can lead to further environmental damage. Hazardous waste, such as oil and chemicals used in construction operations, can pose a threat to the environment. If not handled carefully, these hazardous materials can leak into the soil, causing contamination and potentially contaminating nearby water bodies.		**For non-hazardous waste** - Reduce, recycle, and reuse waste [e.g. plastic waste, electronic waste, agricultural waste (natural, animal faces for later use as manure, plant waste)] wherever and whenever possible. - Latrines must be built at construction sites and camp sites for appropriate domestic waste management. **For dredging materials** - Use or reuse the dredge material on properties with a residential or recreational use (dredging material, if planned for reuse, will be subject to testing to ensure the material is safe for reuse). - Prepare short-term placement of dredge material during off-loading or re-handling activities. The quantity of dredge material to be stored at the site must not exceed the quantity of material that can reasonably be managed at the site during the construction periods - Consult properly regarding the selection and design of the waste disposal locations and storage facilities - Dewatering the dredge material prior to reuse of the materials.
• **Wastewater:** - Hazardous wastewater, such as oil or fuel, chemical used for machinery and construction process at the construction site.	• Use of heavy machinery and equipment (oil and fuel leaks, spills).	• Nearby residents • Construction workers	•	Direct	Segregate waste (e.g. hazardous and non-hazardous), collect, store and transport waste to designated waste disposal sites. **For hazardous waste in construction**

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
- Domestic wastewater comes from workers/staff's water consumption daily.	• Construction processes (chemical spills, leaks). • Worker camp activities (discharge of domestic wastewater).	• Water body along construction site **Moderate**			- Setting up a systematic waste management and chain of custody system considering waste reduction at source, recycling, temporary storage, transport, and final disposal. - Develop procedures for the safe collection, storage, transport, and disposal of project hazardous waste at licensing/permitting site. - Never dispose of used oil on the ground and in water courses as it can contaminate soil and groundwater (including drinking water supplies). - Have a diluted wash wastewater disposal ground tank with internal water proofing layer to protect leakage. - Store fuel and hazardous substances and wastes on bonded paved areas with roofs and interceptor traps so that accidental spills do not contaminate the environment. If spills or leaks do occur, undertake immediate clean up. - Train relevant construction personnel in handling of fuels and other hazardous substances as well as spill control and clean-up procedures. - Ensure availability of spill clean-up materials (i.e. absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are stored. - Segregate hazardous wastes (oily

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					wastes, used batteries, fuel drums) and ensure that storage, transport and disposal shall not cause pollution and shall be undertaken consistent with national and local regulations. - Store waste oil, lubricant and other hazardous materials and waste in tightly sealed containers to avoid contamination of soil and water resources. - Ensure all storage containers of hazardous substances and wastes are in good condition with proper labelling. - Regularly check containers for leakage and undertake necessary repair or replacement. - Store hazardous materials above flood level. - Storage areas for fuel, oil, lubricant, bitumen and other hazardous substances will be located at least 100 m away from any watercourses. - Storage, transport and disposal of hazardous wastes, including spilled wastes, shall be consistent with national and local regulations. - Wherever possible, refueling will be carried out at a fuel storage area. - Refueling shall not be permitted within or adjacent to watercourses. - Where a significant amount of oily wastewater or spill/leakage of oil and grease may occur (i.e. equipment

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					maintenance areas), drainage leading to an oil- water separator shall be provided for treatment of wastewater. The oil-water separator shall be regularly skimmed of oil and maintained to ensure efficiency. - Vehicle maintenance and refueling will be confined to designated areas in construction sites designed to contain spilled lubricants and fuel. - Adequate precautions will be taken to prevent oil/lubricant/hydrocarbon contamination of channel beds. Spillage if any will be immediately cleared with utmost caution to leave no traces. - All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities (i.e. firefighting equipment, sorbent pads, etc.) to combat emergency situations complying with all the applicable statutory stipulation. - For canal rehabilitation works, the project will have proper sludge handling and management procedures to manage the excavated sludge materials and to prevent harmful exposure to workers and surrounding communities.
BIODIVERSITY					
• **Habitat Loss and Fragmentation:** - Conversion of forests and wetlands at micro or large may be needed for canal construction such as Lum	Rehabilitation of irrigation canal and farm roads	Terrestrial species **Moderate**	Prior to construction, there will be clearance of micro forest along the rehabilitated streams, canals, and access road. Other	Direct and indirect	- Implement Biodiversity Action Plan -

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
Hach community forestry leading to broken down of the habitat. - The remaining natural habitats may become isolated patches, making it difficult for species to migrate, find mates, and maintain healthy populations.			activities such as river dredging and rehabilitation activities, as well as dam construction and upgrading, in the Ou Ta Paong, Lum Hach, and Stung Krang Bat schemes will be potentially led to habitat loss and fragmentation. Thes project involve altering the natural course of rivers and waterways, which can disrupt existing aquatic ecosystems. Dredging activities can remove valuable aquatic vegetation and disturb sediment beds, destroying habitats for fish and other aquatic organisms. The construction of dams can create barriers that isolate upstream and downstream populations, limiting their access to food and breeding grounds. Additionally, these projects can introduce pollutants and sedimentation into the water, further degrading habitat quality and impacting biodiversity. But these impacts are likely to be considered moderate due to biodiversity assessment, in that there is not rich of biodiversity hot spot and the surrounding area is mostly paddy fields.		
• **Loss of Biodiversity and ecosystem services** - Species Decline: Habitat loss and degradation can lead to declines in species populations in the long run,	Rehabilitation of irrigation canal and farm roads	Aquatic and terrestrial species **High**	While project activities in the construction phase like river dredging and canal rehabilitation can have some short-term impacts on fauna and flora, these effects are	Direct and indirect.	- Implement Biodiversity Action Plan - Apply Find Chance Procedure

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
particularly those already classified as critically endangered. - Disruption of Ecosystem Services: The loss of biodiversity can disrupt ecosystem services such as water purification, flood control, and carbon storage, slightly contributing to the long-term impact.			generally not considered serious. The interventions are primarily focused on restoring existing irrigation systems, and the affected areas are not known for high biodiversity. The noise from construction activities may temporarily disturb wildlife, but it is unlikely to cause long-term harm. The movement of aquatic biodiversity might be restricted due to the cut-off of waterways in certain sub-schemes. Overall, the fauna and flora effects of these projects are anticipated to be minimal and reversible. However, if the plan to construct the canal across community forestry in Lum Hach, there would be likely a significant change for wildlife in the areas.		
• **Hunting, trading, and consumption of wildlife** - The influx of a new labour force can increase demand for exotic local foods, including wildlife and endangered species, which are often seen as interesting and delicious. This may be done for relaxation or belief that wildlife is tasty or making people healthy.	Rehabilitation of irrigation canal and farm roads	Aquatic and terrestrial species/ **High**	The risks can be quite severe where there is a large workforce or where the local wildlife is rare and endangered. There is also a risk to the aquatic endangered species as well. This demand drives illegal hunting and trading, threatening biodiversity and destabilizing ecosystems. The rarity of these species raises their market value, encouraging unsustainable practices that can lead to extinction. Additionally, consuming wild animals poses health risks due to zoonotic diseases and can	Direct and indirect, and short and long term	- Implement Biodiversity Action Plan

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			harm local economies by depleting valuable fish stocks, affecting communities reliant on these resources. It is likely to occur not only at the local level but at the regional level as well and the impact is severe and irreversible.		
• **Loss of fauna and flora** - Construction activities, including the rehabilitation of irrigation canals and farm roads, can lead to the clearing of vegetation and the disruption of natural habitats. This is particularly concerning areas like the Lum Hach command area, where the project might involve constructing a canal across community forestry, potentially causing a significant change for wildlife. While the overall impact on fauna and flora is anticipated to be minimal and reversible in most areas, the specific location and scale of construction activities play a crucial role in determining the severity of the impact. For instance, noise from construction might temporarily disturb wildlife but is unlikely to cause lasting harm. However, the construction of dams and other structures could alter water flow patterns, affecting fish migration and potentially leading to population decline.	Construction of canals and roads, especially across community forestry	Various species, particularly those dependent on forests and wetlands. **High**	Construction activities could lead to habitat loss and fragmentation, directly impacting fauna and flora. This impact could be significant in areas like Lum Hach, where the project might involve construction across community forestry. The construction of new canals and roads may require clear vegetation, leading to habitat loss and fragmentation. This is especially concerning given the presence of endangered and critically endangered species, including the Elongated Tortoise, the Giant Asian Pond Turtle, and the Hairy-nosed Otter.	Direct	- Construction activities should avoid clearing vegetation outside the designated project area. Existing trees and vegetation should be protected. - Measures should be implemented to prevent sedimentation in water bodies and mitigate downstream impacts from erosion. - Construction waste should be properly managed to prevent soil and water pollution. - Wildlife protection measures should be implemented, such as exclusion fencing and wildlife corridors. Additionally, construction activities should be avoided during sensitive periods for wildlife. - Environmental impacts should be regularly monitored, and the project must comply with environmental permits. - Apply Find Chance Procedure
• **Destruction of farming ecosystem** - The construction phase of the CAISAR project poses a serious	• Construction activities	Aquatic and terrestrial species within	The project's construction of irrigation canals, flood control structures, and farm roads will	Indirect	- Restrict the movement of heavy machinery to designated areas and use appropriate construction

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
threat to farming ecosystems due to soil compaction and pollution. Heavy machinery and construction activities can compact the soil, reducing its porosity and ability to retain water and nutrients, ultimately leading to decreased land productivity. Soil erosion from construction sites, exacerbated by the removal of vegetation and disruption of the landscape, can transport sediments and pollutants into nearby water sources, harming both crops and livestock. The risk of pollution from construction sites, specifically mentioning potential water contamination from sourcing aggregates and construction materials. These pollutants, along with runoff from construction sites carrying sediment, oil, and chemicals, can directly harm crops, leading to reduced yields and potential health issues.	• Alteration of water regimes due to irrigation infrastructure (dams, levees) • Pollution from agricultural runoff	and around farming areas **Moderate**	involve large-scale earthworks, potentially leading to soil erosion and sedimentation, impacting water quality in rivers and canals crucial for irrigation. The removal of vegetation and ground disturbance during construction increases the risk of soil erosion and runoff, carrying sediment and pollutants into water sources used for irrigation and livestock. This pollution, coupled with the potential for increased use of agrochemicals due to enhanced irrigation capacity, could negatively affect water quality, impacting the health of both crops and livestock. Furthermore, the construction activities could disrupt natural habitats, affecting species that play vital roles in pest control and pollination, essential for a healthy farming ecosystem.		techniques to reduce soil compaction. - Implement erosion and sediment control measures such as silt fences, sedimentation basins, and hay bales to prevent soil loss and protect water quality. - Construction vehicles and machinery have to wash only in designated areas where runoff will not pollute natural surface water bodies. - Establish proper drainage systems to divert runoff from construction sites and prevent it from contaminating water sources used for irrigation and livestock. - Encourage the adoption of sustainable agricultural practices, such as reducing pesticide and fertilizer use, to minimize pollution from agricultural runoff. Develop and implement a comprehensive water management plan that ensures the efficient use and allocation of water resources, minimizing the risk of over-extraction and downstream water scarcity.
• **GHG emission** - The construction and operation of heavy machinery, such as excavators and bulldozers, during these projects release carbon dioxide (CO_2) into the atmosphere, i.e. the energy requirements for	• Rehabilitation of irrigation canals and farm roads. • Use of heavy machinery for excavation, transportation,	Atmosphere **Minor**	The production and transportation of excavated soils and materials further add to greenhouse gas (GHG) emissions. However, due to the short duration of these construction activities, the overall increase in emissions is	Direct and indirect, and short and long term	- Use energy-efficient machinery and equipment during construction to reduce fuel consumption and emissions. - Optimize construction logistics to reduce the number of vehicle trips and machinery usage, minimizing fuel use

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
construction works can result in increased carbon emissions - At the time of construction, there are possibility of smoke generated by burning of straw in the rice field.	and construction. • Waste burning at worker campsites. • Burning of rice straw in the fields by farmers. • Rehabilitation of irrigation canal and farm roads and burning of straw of farmers at the rice field		expected to be minimal and relatively small in scale.		and emissions. - Implement proper maintenance programs for equipment and vehicles to ensure they operate efficiently and with lower emissions. - Reduce deforestation and land-use changes that contribute to carbon emissions by preserving vegetation and replanting trees in affected areas. - Use low-carbon materials and construction techniques that reduce the embodied carbon in construction materials. - Offset unavoidable GHG emissions by investing in carbon offset projects, such as reforestation or renewable energy initiatives. - Engage with local communities and stakeholders to raise awareness of emission reduction practices and encourage their participation in sustainability efforts.
DURING OPERATION					
ENVIRONMENTAL POLLUTION					
Hydrology Increased irrigation demands could deplete water sources, if management is not properly conducted. This may lead to poor management of environment flow for the water system	Increased irrigation. Poor water management practices Climate change impacts (altered rainfall patterns)	Tonle Sap Lake. Upstream Watersheds Wetlands Aquatic Ecosystems Downstream Communities **High**	Irrigation systems can have both positive and negative effects. Proper design and management are essential for reducing negative impacts on the natural hydrological cycle.	Direct and Indirect	Implement water-saving irrigation technologies like drip irrigation and sprinkler systems to reduce water consumption and minimize the strain on water resources. Encourage the adoption of the AWD technique in rice cultivation to optimize water use and reduce water withdrawals for irrigation. Establish detailed water management plans that ensure equitable water

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					distribution and allocation, considering the needs of various users and the environmental flow requirements to maintain healthy aquatic ecosystems. Design and construct robust irrigation infrastructure, including canals, ponds, and storage areas, capable of withstanding extreme weather events like floods and droughts. This investment should also include lining canals and refurbishing storage areas to reduce water losses and improve water storage capacity. Integrate natural infrastructure, such as wetlands and forests, into water management strategies. Protect and restore degraded habitats to enhance their water regulation capabilities, improve water quality, and support biodiversity. Establish and provide training to FWUCs on sustainable water management practices, equitable water rights, and allocation procedures. These communities play a vital role in the operation and maintenance of the irrigation system, ensuring its long-term sustainability.
• **Water pollution:** - Increased use of chemical for intensified crop production may affect the overall water quality and affect people who rely on such water for domestic use. - Impacts may include two (2) levels: impact on surface water as immediate effect and underground water as long-term impact.	• Intensification of agricultural production	• Famers • Nearby residents • Aquatic ecosystems within the command areas and downstream, including the Tonle Sap Lake. **Moderate**	When the irrigation become operationalize, the use of chemicals for farming activities can create potentially impact on soil and water quality, the extent of this impact is likely to be relatively moderate due to the intensification of agricultural production and changes in practices in the command areas as irrigation water become more available. The widespread use of chemical fertilizers and pesticides for rice production, particularly when	Direct, indirect, and cumulative	- Implement Simplified Pesticide Management Plan - Conduct regular water quality test to track the change in water quality due to pesticide application using oversea laboratory testing

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			optimized for higher yields, is far significant contributor to soil and water quality degradation. These agricultural practices can lead to soil nutrient depletion, salinization, and pollution, ultimately compromising the long-term sustainability of agricultural production whereas water with high concentrations of pesticides may affect the biodiversity not only within the command areas but also within the river body downstream, possible in the Tonle Sap Lake.		
• **Soil pollution/ quality reduction:** Overuse of Agri-chemicals (e.g., chemical pesticides, fertilizers, etc.)	• Increased agricultural production Lack of training or adoption of sustainable farming practices.	• Soil Health • Water Quality • Biodiversity **Moderate**	Increased production could lead to overuse of agri-chemicals if farmers are not adequately trained or supported in adopting environmentally friendly practices.	Direct and Indirect	- Implement Simplified Pesticide Management Plan - Conduct regular water quality test to track the change in water quality due to pesticide application using oversea laboratory testing
BIODIVERSITY					
• **Habitat Loss and Fragmentation:** - Conversion of land: Flooded forests and wetlands may be drained or filled to create more arable land for agriculture, leading to significant loss of habitat. - Fragmentation: Remaining natural habitats may become isolated patches, making it difficult for species to migrate, find mates, and maintain healthy populations.	Intensifying farming	Aquatic and terrestrial species **Moderate**	At the micro, local, and regional levels, habitat loss is likely to occur due to land clearance during the construction phase, with further possible expansion into the protected areas nearby. For instance, the planned construction of a canal through community forestry in Lum Hach can create a good access to land for settlement along the canal. In addition, the expansion of agricultural land into the protected area	Direct and indirect	- Implement Biodiversity Action Plan

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			downstream of Ou Ta Paong may also occur which are added to the conversion of microhabitats across the command areas. This loss is driven by farmers seeking to maximize profit from available land, and the scale of habitat conversion could extend beyond the local level, potentially impacting the region.		
- **Invasive Species:** Introduction of Non-Native Species: Changes in land use and water management can introduce invasive plant and animal species that outcompete native species and alter ecosystem dynamics	Intensifying farming	Aquatic and terrestrial species **Minor**	Changes in hydrological conditions, such as altered water flow and flooding patterns due to irrigation infrastructure, can create favourable conditions for invasive species to establish themselves in wetlands. These disruptions weaken the natural resilience of native species, making the ecosystem more vulnerable to colonization by invasive plants and animals. This can result in a decline in biodiversity, altered nutrient cycling, and degraded water quality. Once invasive species become established, they are difficult to remove and can cause long-term ecological damage, further diminishing the wetland's ability to provide essential ecosystem services. This is particularly concerning for areas like Ou Ta Paong and Stung Krang Bat, where water flows in both directions from and to the Tonle Sap Lake, increasing the risk of invasive species spread. The scale at	Direct and indirect	- Implement Biodiversity Action Plan

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			Ou Ta Paong is large and the impact can be moderate.		
• **Hunting, trading, and consumption of animal from the wild:** Even after the construction being completed, there may be the continuation of the hunting as market are available.	• Intensifying farming • Increased demand for wild animal products.	Aquatic and terrestrial species, particularly those already threatened or endangered. **High**	Although the activities are likely to continue, it is not directly caused by the project activities, but it can expand further beyond the completion of the construction. The impact is minimal and considered to be regional, if trading continues to exist.	Indirect, and short and long term	- Implement Biodiversity Action Plan
CLIMATE CHANGE					
• GHG emission - The intensification of farming activities meaning that rice production will be increased into more times or more whereas the energy that are required for the production can be also increased. - Smoke may be generated due to burning of straw in the rice field, particularly when water access for irrigation being increased. - This will lead to the increase of volume of GHG emissions being emitted into the atmosphere.	• Intensifying farming activities • Increased used of energy for farming activities	Atmosphere **Minor**	Increased farming activities, driven by improved irrigation, can lead to higher GHG emissions due to factors such as fertilizer use, livestock production, and rice cultivation. Additionally, the energy requirements for operating pump stations, flood control systems, and other infrastructure elements can contribute to increased carbon emissions if not managed efficiently. These factors collectively highlight the potential for the project to have a significant impact on GHG emissions.	Direct and indirect	- The project is to promote sustainable practices like crop rotation and agroforestry to reduce energy consumption and improve soil health. - The project needs to introduce renewable energy sources such as solar-powered irrigation to lower the carbon footprint of rice production. - The project needs to support on training farmers to use alternatives to straw burning, such as mulching or biomass energy generation, to reduce air pollution. - The project promotes the utilization of efficient irrigation methods like alternate wetting and drying (AWD) to conserve water and minimize methane emissions. - The project need to advocate for policies that discourage straw burning and provide incentives for adopting sustainable agricultural practices.

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
ANNUAL CROP MANAGEMENT PLAN					
WATER					
• **Water resource efficiency:** Over-extraction of water resources can lead to downstream water scarcity, altered hydrology, and damage to aquatic ecosystems.	• Inefficient irrigation practices during operation	Downstream communities, aquatic ecosystems **Moderate**	Inadequate water management poses a significant risk to the long-term sustainability of water resources and dependent ecosystems and communities.	Major, if not managed properly.	Project need to implement efficient water management practices to prevent over-extraction and ensure equitable water distribution. This can include: - water use monitoring system to track consumption and identify areas for improvement. - implementing appropriate irrigation scheduling based on crop water requirements and weather conditions. - Utilizing efficient irrigation systems, such as drip irrigation or sprinkler systems, to minimize water loss. - Exploring opportunities for water reuse, such as capturing and reusing runoff water.
SOIL AND SOIL MANAGEMENT					
Soil erosion and soil erosion risk: Soil erosion can lead to loss of topsoil, reduced soil fertility, and increased sedimentation in water bodies.	• Land preparation activities such as tillage, site clearing, and the use of heavy machinery can increase the risk of soil erosion.	Soil health, water quality, and agricultural productivity. **High**	Unsuitable management techniques and land preparation activities can lead to the physical and chemical degradation of soils.	Potentially major, especially during periods of heavy rainfall or in sloping areas.	- Minimize soil compaction and disturbance by using appropriate machinery and timing land preparation activities. - Consider erosion management practices such as contour planting, terracing, and grass barriers. - Adopt reduced tillage or no-till farming practices to minimize soil disturbance. - Establish cover crops during fallow periods or in rotation with main crops to protect the soil from erosion.

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					- Practice contour farming on sloping land to reduce runoff and erosion. - Construct terraces on steep slopes to prevent soil loss. - Establish windbreaks or shelterbelts to reduce wind erosion. - Install erosion control structures, such as grassed waterways or sediment basins, to manage runoff. - Apply mulch to the soil surface to protect it from rainfall impact and erosion.
• **Nutrient application and management:** Excessive or improper nutrient application can lead to nutrient runoff and leaching, contaminating water resources and causing eutrophication.	• Excessive or improper application of fertilizers can lead to nutrient runoff and leaching.	Water quality, aquatic ecosystems, and human health **High**	Over-fertilization and nutrient runoff can contaminate water resources, negatively impacting aquatic ecosystems and potentially leading to eutrophication.	Potentially major	- Conduct periodic soil analysis to determine nutrient needs and avoid over-fertilization. - Establish buffer zones near watercourses to filter nutrient runoff. - Consider using green manures and cover crops to replenish soil nutrients and reduce leaching.
PESTICIDE					
• **Use and effectiveness of pesticides:** Pesticide use can have adverse effects on human health, non-target organisms, and the environment. Pesticide resistance can develop, requiring increased application rates.	• Application of pesticides.	Human health (farmers and consumers), biodiversity, soil and water quality **High**	esticide use can have unintended consequences on human health, biodiversity, and environmental quality if not managed carefully.	potentially major	- Promote Integrated Pest Management (IPM) strategies to minimize pesticide use. - Implement training programs for farmers on the safe handling and application of pesticides. - Ensure proper disposal of pesticide containers and leftover products.
• **Pesticide residues on site soil:** Pesticide residues can accumulate in the soil, potentially contaminating	• Repeated pesticide applications, use of	Soil health, biodiversity, water quality	Pesticide residues can accumulate in the soil, potentially harming soil	Potentially moderate to major	- Promote the use of pesticides with low persistence and mobility in the environment.

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
groundwater and impacting soil organisms.	persistent pesticides, and improper disposal of pesticide containers.	High	organisms and affecting water quality.		- Implement a soil monitoring program to assess pesticide residue levels. - Consider crop rotation and the use of cover crops to help break down pesticide residues. - Minimize pesticide use by adopting IPM strategies. - Conduct soil testing to monitor pesticide residue levels. - Rotate crops to break pest cycles and reduce the need for repeated pesticide applications. - Utilize cover crops to improve soil health and enhance pesticide degradation. - Consider bioremediation techniques to remove pesticide residues from contaminated soil.
• **Pesticide residues on produce:** Pesticide residues on produce can pose health risks to consumers.	• Late pesticide applications close to harvest, improper pesticide application techniques, and inadequate pre-harvest intervals.	Consumers, human health.	Pesticide residues on produce can pose a risk to consumer health. **Moderate**	Potentially major	- Enforce pre-harvest intervals to allow for pesticide breakdown before harvest. - Promote the use of pesticides with low toxicity to humans. - Properly wash and handle produce to remove surface residues. - Implement a monitoring program to test produce for pesticide residues. - Ensure compliance with established MRLs for pesticide residues on produce.
AIR QUALITY, AIR EMISSIONS, AND ENERGY USE					
• **Energy use:** Energy consumption contributes to greenhouse gas	• Operation of machinery and equipment for	GHG emission, air quality, and	Increased energy use for farming activities, especially those powered by fossil fuels,	Potentially significant	The project needs to: - Promote the use of energy-efficient machinery and equipment.

Risks and Impacts	Key activities that cause risks and impacts	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
emissions and impacts operating costs.	various farming activities (tillage, irrigation, harvesting, transportation) and the use of energy for processing and storage.	operational costs	can contribute to air pollution and greenhouse gas emissions. **High**		- Explore the use of renewable energy sources (solar, biofuels) for powering irrigation pumps and other farm operations. - Encourage the adoption of sustainable practices that reduce energy needs, such as crop rotation, no-till farming, and optimized irrigation scheduling.

9.2.2 Mitigation Measures for the Social Risks and Impacts

Table 9.2: Social Risks, Impacts and Mitigation Measures

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
BEFORE CONSTRUCTION					
LAND ACQUISITION					
• **Land acquisition and resettlement:** The most noticeable locations that required the acquisition of land include the feeder canals, river at Ou Ta Paong sub-scheme, mainstream at Lum Hach and along the existing canals which are planned to rehabilitate. The temporary acquisition of land for construction may also cause economic disruption while some households may lose their houses, or livelihood activities on the embankment of the river and canals. When river is rehabilitated some households along Ou Ta Paong River may loss land for housing, fruit trees, and agricultural production permanently. In command areas at Krang Ponley where existing canals need to be extended, or new canal need to be built, minor land acquisition may be required to allow canal construction.	• Rehabilitation of irrigation canal and farm roads	• Landowners • Informal land users, Informal resettles • Nearby construction site business owners **Moderate**	Land acquisition is anticipated for all six (6) sub–schemes. However, the land acquisition varies from scheme to scheme – based on the initial concept design. It is expected that land acquisition is highest at Ou Tapaong, followed by Lum Hach. Land acquisition is anticipated to be minor for Brambei Mom, Krapeau Trom and Yutasas because these schemes are much smaller (compared to Ou Tapaong and Lum Hach) and no expansion of existing canals system is not planned during project preparation.	Direct and indirect	- No physical resettlement is envisaged at the time of ESCIA study being estimated. A Resettlement Plan should be prepared in accordance with the project's Resettlement Policy Framework to compensate the affected households (e.g. loss of land, loss of economic opportunities)
• **Economic displacement** - Households in Ou Ta Paong and Lum Hach's main canal, particularly those with production land along the water bodies, including non-titled land users and informal settlers, face a significant risk of economic	• Nearby residents	• Landowners • Informal land users, Informal resettles	During the construction phase, the track-out of construction material transportation and the construction area will be affected directly on the economic activities of community people such as local businesses, transportation routes, rice production	Direct and indirect	No physical resettlement is envisaged at the time of ESCIA study being estimated. A Resettlement Plan should be prepared in accordance with the project's Resettlement Policy Framework to compensate the affected households (e.g. loss of land, loss of economic opportunities)

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
displacement due to the project. As the systems will be upgraded, these informal farming areas may be removed due to dredging. Thus, these households may be affected and thus lose the opportunity to grow crop for food and/or income. - During the construction phase, local businesses and transportation routes may experience disruptions, potentially affecting the community's daily life and ongoing economic activities. Household infrastructure, such as pumping systems and water pipes, may also be impacted by construction activities. - Additionally, temporary housing for farm care may be necessary, further disrupting agricultural practices. Furthermore, canal blockages due to construction activities could hinder water flow, impacting cultivation during planting seasons and potentially leading to reduced agricultural yields.		• Nearby construction site • Business owners **Moderate**	land, and daily movement within the command area. Diversion of water from the original channels can also cause the disruption of agricultural production, even crop failure. Once again, the estimated impact of economic displacement is still early to conclude.		
• **Facility Design.** Poorly designed irrigation systems may lead to environmental disruption, where dredging disturbs aquatic ecosystems and degrades water quality. Structural failures in poorly designed or constructed components can lead to collapses or damage during extreme weather events. Misaligned or	• Detail Engineering Design	• All **High**	CAISAR project aims to achieve the environmental-friendly, and climate resilience aspect. These aspects need to be carefully considered with all possible options to be included in the design. In this regard, it is expected to be fully considered and reduce the impacts at the minimum.	Direct	

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
undersized culverts and structures may obstruct water flow, causing flooding or reduced irrigation efficiency. Additionally, these activities can alter sediment transport, leading to upstream sedimentation, downstream erosion, and land instability.					
DURING CONSTRUCTION					
CHILD LABOR & FORCED LABOR					
• **Child Labor**: The risk of child involvement in project's labour force (e.g., contractors' labour) is foreseen because subproject activities will take place in rural areas where use of child labour is common. There is a possibility that local people under 18 years is engaged by construction contractors and subcontractors to perform unskilled works.	• Construction or Rehabilitation of irrigation canal and farm roads	• Nearby residents such as children and youth Construction workers **High**	Contractors are likely to employ children or youth who are under the legal working age, as defined by the country's laws due to labour shortages and the drive to maximize profits, the use of child labour may occur, especially in the context of weak law enforcement and inadequate monitoring by relevant institutions. The scale of this abuse depends on the number of workers involved during the construction phase, and it can directly impact both local individuals and migrant labour forces.	Direct	- Apply LMP for age check prior to engagement of labor with regular monitoring through proper screening and registering all workforce for the work - To mitigate the risk of child labor, the project will implement strict measures to ensure compliance with national and international labor laws. Regular monitoring and inspections will be conducted to identify and address any instances of child labor. - Additionally, awareness-raising campaigns will be implemented to educate communities about the harmful effects of child labor and the importance of sending children to school. The project will also collaborate with local authorities and NGOs to strengthen law enforcement and provide support services to vulnerable children and their families.
• **Forced Labor:** Risk of workers being forced to work (e.g. young people) to earn income for their family, and/or to pay debt. Additional, forced labour refers to any work or service that are	• Construction or Rehabilitation of irrigation	• Nearby residents such as children and youth	Construction companies may reduce their workforce and pressure employees to work faster to save time and cut costs, often without proper negotiation or prior notice. In the	Direct, and temporary	- Strict Code of Conduct for workers with no tolerance for physical or verbal abuse of women or children - The Project Owner and Sub-Contractors will collaborate with the relevant Government

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
not voluntarily performed by an individual under threat of force or penalty. Forced labour could happen for both children under 18 and adults, particularly for households who are in high need to cash for specific family purpose (e.g. cover a medical bill, paying debt…). The risk of engaging of forced labour might be associated with workers that are considered as "primary supply workers" as identified under the project's Labor Management Procedures.	canal and farm roads	• Construction workers **High**	absence of strong government oversight and a functioning labour monitoring system, these practices can occur during the construction phase. However, while such behaviour is likely, the impact may be mitigated, as the current presence of social media can serve as a deterrent to contractors engaging in these illegal activities.		Agency to disseminate information to local communities. This information will include the Contractor's Code of Conduct and the minimum working age as mandated by national laws and international standards. - The Ministry of Water Resources and Meteorology (MOWRAM) will provide information to local communities about the contractor's policies and responsibilities, including the Contractor's Code of Conduct and minimum working age.
COMMUNITY HEALTH AND SAFETY					
• **Disease transmission:** - Spreading and contracting of communicable diseases of labour forces having direct and indirect contact among themselves - Risk of contracting non–communicable diseases of among workers and with community people due to their working behaviours and pressures at the time of working away from home.	• Construction or Rehabilitation of irrigation canal and farm roads	• Nearby residents • Construction workers **High**	During the construction period, some workers experience poor eating habits, homesickness, being away from home, and stress from demanding task which lead to poor health condition as well as they are possibly the disease carriers which can spread to the other workers and community people. Unsanitary living conditions may also contribute to the spread of communicable diseases. These problems are high and likely prevalent among the construction workforce and can also affect the surrounding community as short and long term.	Direct and indirect, and temporary	- Conduct public awareness raising activities (IEC) to ensure local people and contractors know about the risks of contracting and spreading communicable diseases such as COVID-19, HIV/AIDS, and water-borne diseases (e.g., amoebiasis, giardiasis, and toxoplasmosis. etc. - In the event of a disease outbreak (e.g. COVID-19), provide immediate training/awareness raising to the risk groups. - Conduct training to workers on communicable diseases prior to mobilization to construction sites. - For water-borne diseases that arise due to polluted or contaminated water, mitigations measures may include: o Implement filtration, chlorination, or UV disinfection to ensure safe drinking water.

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					○ Build and maintain proper sewage systems and latrines to prevent water contamination. ○ Promote handwashing, safe food preparation, and proper sanitation practices in communities. ○ Control and properly dispose of waste to prevent water pollution. ○ Test water sources frequently for contamination and take corrective actions promptly. ○ Provide access to clean water supplies, such as bottled water or tankers, during outbreaks or disasters. ○ Promote immunizations against water-borne diseases like cholera and typhoid in high-risk areas.
• **Sexual Exploitation and Abuse, Sexual Harassment** (due to labour influx): The risk of Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH SEA/SH) is anticipated to be "Moderate" due to 1) concentration of labour, 2) frequent visits of project workers, and 3) increased level of this risk due to pre-existing SEA/SH issues in the subproject's area of influence. It is noted that labour influx includes not only workers but also people who are local and nonlocal that gravitate to construction sites temporarily to provide logistics services for contractor's workers during	• Rehabilitation of irrigation canal and farm roads	• Project workers • Local peoples, especially the vulnerable including female and children **Moderate**	Away from home labour forces are lonely and possibly wanting to engage in sexual abuse either with the community people or among the workers. The magnitude of the risks depends on organizational behaviour as well as the effectiveness and efficiency of the management of the construction companies while it can occur directly within the community or the construction site. This can be regionally connected due to the association of such exploitation and human trafficking. However, it is unlikely to occur as the current human trafficking seems to be rarely reported.	Direct and indirect, and temporary	- Contractors need to explicitly state zero tolerance for sexual harassment, exploitation, and abuse within the workplace. - Require Code of Conduct (CoC) to be signed by all construction workers. - For victims coming forward: referral to qualified SEA/SH service provider. The GRM will include a confidential channel for reporting SEA/SH. - Strict Code of Conduct for workers with no tolerance for physical or verbal abuse of women or children - Training to workers on maintaining good community relations, with emphasis on proper conduct around women and children. - Training on SEA/SH and VAC for community members, in particular women and girls (may

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
construction stage. This risk of Violence Against Children (VAC) is also anticipated due to increased level of SEA/SH and pre-existing risk of local domestic violence that might be present before the project.					be done separately for men and women). - Ensuring workers' sites are situated (at least 500m) from schools and/or other areas where children congregate. - Children are prohibited from construction sites and worker's camp. - Ensure access to grievance redress mechanisms for all project-affected persons, including both stakeholders and workers, to address Sexual Exploitation and Abuse, and Sexual Harassment. Support (in the form of training, awareness raising, etc.) to local law enforcement to act on community complaints regarding SEA/SH and VAC. - Provision of information to local communities about the contractor's policies and responsibilities, including the Contractor's Code of Conduct and minimum working age. - Provide counselling services for male and female workers, wives and other female partners of contractors' workers. - Build partnerships with local health providers and SEA/SH service providers to conduct community awareness activities, and referrals. - Implement public awareness campaigns to address sexual harassment in transport services and hubs, and training of police on women's security needs when using transport. This is included on GRM: • Accessibility for Workers • Multiple Reporting Channels • Confidentiality and Support • Contractor Accountability

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
Security and Road and Traffic safety: Increased risk of road accidents, particularly for people living in the vicinity of the civil works and those traveling near the construction areas - Unauthorized access to construction sites, leading to theft or vandalism of equipment and materials. In addition, inadequate site surveillance or fencing may also expose the project to sabotage or delays caused by intentional interference. - During construction phase, particularly when road condition is not good, and safety measures are not effectively carried out by contractors. Risk of road accident may be due to people' failure in attending their children which put children at risks of accidents. - Given increased traffic flow between construction sites and other destination such as borrow pit, quarry, material supply warehouses, there is a risk of road traffic accident on the part of contractors' workers, and local inhabitants such as pedestrians, motorcyclists, cyclists, and those on animals or animal drawn carts. Reasons may also include violation of speed limits, lack of awareness of pedestrian, drivers' behaviour/drunk driving, or	• Rehabilitation of irrigation canal and farm roads	• Project workers, • Local people traveling near construction sites and on transportation routes • Risk is mostly with those making frequent road travel **Moderate**	Construction vehicles transport petroleum, excavated soil, cement, and other building materials, leading to increased traffic activity in both urban and rural areas within the project zone and along the roads to the dumping sites or from access roads. This raises the risk of accidents and injuries directly for nearby residents, especially if safety measures are not rigorously followed. However, the volume of materials transported during the construction phase is still unknown and potentially medium for a short duration. As a result, the potential impact on road and traffic safety for people living along the transportation route is considered moderate.	Direct, and Indirect	- Arrange security guard or engage local authority to guard the construction sites - Conduct public awareness raising activities (IEC) to ensure local people and road user are aware of road safety regulations and risks and act accordingly while using road. - Monitor and observe speed limit;

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
unexpected certain traffic circumstances. All project workers and local people near construction sites and routes connecting construction sites and material supply sites, quarry, borrow pits are exposed to traffic and road safety risks.					
• **Community Health and diseases** - Spreading and contracting of communicable diseases due influx of labour forces having direct and indirect contact with local people - Construction activities can disturb existing sediments and pollutants, temporarily increasing the risk of waterborne diseases	• Rehabilitation of irrigation canals and farm roads. • Influx of construction workers into the project area. • Construction activities disturbing soil and water bodies.	• Nearby residents • Construction workers **Moderate**	The influx of workers for the construction phase raises concerns about the potential spread of communicable diseases. Disturbing sediments during construction could elevate the risk of waterborne diseases, particularly if sanitation and hygiene practices are inadequate.	Direct and indirect	- Ensure that safe drinking water and adequate sanitation facilities are available for both workers and the surrounding community to prevent waterborne diseases. - Organize health education campaigns for workers and community members, focusing on hygiene, safe water use, disease prevention, and the proper use of sanitation facilities. - Implement vector control measures, including regular drainage of stagnant water, distribution of insecticide-treated bed nets, and community spraying programs. - Provide workers with appropriate personal protective equipment (PPE) such as masks, gloves, helmets, and other safety gear to protect against respiratory diseases, dust, and physical injuries. - Implement proper waste disposal systems for construction debris and hazardous materials, along with measures to prevent air, water, and soil contamination from the construction site. - Conduct regular health screenings for construction workers, especially for communicable diseases such as tuberculosis, and other infections.

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					- Establish a grievance mechanism specifically for health-related issues, allowing community members to report any health concerns or complaints related to construction activities. - Monitor health trends in the project area, including disease outbreaks or unusual health issues, and report findings to local health authorities for coordinated action. - Implement dust suppression techniques, such as regular watering of roads, limiting construction activities during high winds, and using dust barriers where possible.
OCCUPATIONAL HEALTH AND SAFETY					
Physical Hazards. Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or physical activities. Physical hazards may result in a wide range of injuries, from minor that needs medical aid only, to disabling, catastrophic, and/or fatal. - Accidents due to falls: falling from ladders, scaffoldings, and vehicles, etc. - Drowning and water injury accidents: at construction sites, workers may have to walk on structure above the water. - Accident due to falling objects: tools, machinery, equipment, and materials used during construction may fall	Construction or Rehabilitation of irrigation canal and farm roads	• Construction workers • Nearby Residents and Children • Domestic animals **High**	Working in the construction field can result in injuries or fatalities if the construction company fails to comply with laws and safety standards. This is likely to occur which may lead to injuries, illnesses, and fatalities due to unsafe practices. It will be directly occurred with the workers during their work. However, such a risk may be minimal based on the number of workers to be engaged for the construction work. The consulted stakeholders, especially the province and district level, concern that the presence of construction workers will cause potential issues of sexual exploitation, gender-based discrimination, and child labour. Additionally, there are concerns about the potential for drug use and abuse	Direct and indirect, and temporary	- Fence off all work sites adjacent to communities to avoid unauthorized access to the project sites and to prevent potential injuries. - Display warning signs including at unsafe locations. - If school children are in the vicinity, traffic safety personnel direct traffic during school hours. - Control driving speeds of project vehicles particularly when passing through communities or nearby schools, health centers or other sensitive areas. - Make sure the community is aware of the GRM and that they can access it. - Appoint an Environmental Health and Safety Officer (EHSO) who shall be responsible for training, monitoring and reporting on ESHS concerns and implementing health and

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
from the height, causing injuries or death. - Fall into open holes: holes, manhole, and areas of deep excavation may be commonly found at works. - Physical injury related to the operations of heavy equipment: Injury or death may result during operations of heavy equipment, such as crane, excavator, cuts, and bruises on sharp objects etc.			among workers by community people, which could lead to unsafe working conditions and negative impacts on surrounding communities.		safety related programs. - Conduct orientation for construction workers regarding emergency response procedures and equipment in case of accidents (i.e. head injury from falling, burns from hot bitumen, spills of hazardous substances, etc.), fire, etc.; health and safety measures, such as on the use of hot bitumen products for paving of project roads, etc.; prevention of HIV/AIDS, malaria, diarrhea, and other related diseases, as well as Code of Conduct (including discussion of SEA/SH/VAC).
Chemical hazards. Chemical hazards represent potential for illnesses or injuries, both short and long term, and fatalities due to single acute exposure or chronic repetitive exposure to toxic, corrosive, sensitizing or oxidative substances. Common chemicals used in construction include Portland cement clinker (mineral binders), formaldehyde (wood-based materials), polyurethane, vinyl, cadmium, or lead (paints and resins), and solvents. They also represent a risk of uncontrolled reactions, including the risk of fire and explosion, if incompatible chemicals are inadvertently mixed.	Construction or Rehabilitation of irrigation canal and farm roads	• Construction Workers • Inspector • Visitors **Moderate**	Working in the construction field can result in injuries or fatalities if the construction company fails to comply with laws and safety standards. This is likely to occur which may lead to injuries, illnesses, and fatalities due to unsafe practices. It will be directly occurred with the workers during their work. However, such a risk may be minimal based on the number of workers to be engaged for the construction work. Stakeholders at community level limited raised the concern regarding these aspects as they have limited understanding on the matter. At district and provincial level, there are minor concerns regarding the hazard which may cause to construction workers and community people.	Direct and indirect, and temporary	- Regularly train/remind drivers of strictly observing speed limits and exercise good driving practices when driving construction supported vehicles through residential areas as well as other sensitive areas such as schools, pagodas, hospitals, markets, and other populated areas, including parking. - Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials by providing covers over transporting dump trucks. - Barriers (i.e., temporary fence) shall be installed at construction areas to deter pedestrian access to these areas except at designated crossing points. - Sufficient lighting at night as well as warning signs should be provided in the periphery of the construction site. - The public/residents, and in particular children, shall not be allowed in high-risk areas, i.e., excavation sites and areas where

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					heavy equipment is in operation. - Provide fencing on all areas of excavation greater than 2m deep. - Ensure reversing signals are installed on all construction vehicles. - Measures to prevent malaria if in areas where malaria is an issue, shall be implemented (i.e. provision of insecticide treated mosquito nets to workers, spraying of insecticides, installation of proper drainage to avoid formation of stagnant water, etc.). - Discharge of untreated sewage shall be prohibited. - Conduct road safety training for workers and roadside community. - Provide trainings on HIV/AIDS and STDs to workers and the community (separately) - Provide trainings on SEA/SH and VAC to workers and the community (separately) - Ensure particular attention is provided to the needs of women and other vulnerable persons. For instance, specific trainings for them should be facilitated by appropriate trainers (i.e. women-only training on HIV/AIDS and/or SEA/SH should be led by a female trainer). - Ensure access to grievance redress mechanism. - Ongoing consultations and awareness raising of local communities.
Personal Protective Equipment. During dredging, and the construction of culverts, structures, and dams	Construction or Rehabilitation of	• Construction Workers • Inspectors	With the construction to be occurred at the rural areas, it is possible that construction company may try to save	Direct and indirect, and temporary	- Continue and active use of PPE at all time of construction - Identification and provision of appropriate

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
presents serious risks to worker safety and health. Workers are exposed to hazards such as falling debris, sharp objects, and heavy machinery, increasing the likelihood of injuries, including cuts, fractures, or head trauma. The lack of respiratory protection may lead to inhalation of dust, fumes, or toxic substances, while inadequate eye and hearing protection can cause vision impairment or hearing loss due to flying particles and high noise levels. Additionally, the absence of proper footwear and gloves increases risks of slips, trips, falls, and contact with hazardous materials. Prolonged exposure to these dangers without PPE not only compromises individual safety but also reduces overall productivity and increases liability risks for the project.	irrigation canal and farm roads	• Visitors **High**	the cost as much as possible. Absence of personal safety and consideration of individual who involve in the activities would also be the cause of being careless in using the equipment. This need to be carefully monitored and educated to ensure that the receptors are safe and sound.		PPE that offers adequate protection to the worker, co-workers, and occasional visitors, without incurring unnecessary inconvenience to the individual - Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out. - Proper use of PPE should be part of the recurrent training programs for employees
• **Underpaid pay and unequal treatment:** Local people recruited as unskilled workers by project contractors may not be offered a written working contract. As a result, there is a possibility that they may be underpaid compared to the nature, scope, and quantity of work that they are expected to perform. They may also be asked to work under conditions that are hazardous to them, such as working without	• Construction or Rehabilitation of irrigation canal and farm roads	• Unskilled workers (mostly local people and construction workers) **Moderate**	Gender discrimination in the construction workforce may arise from the belief that men are stronger and more capable than women, leading companies to favour male workers. However, many women are equally qualified to perform these tasks. This bias, along with the presence of unregistered labour forces and weak enforcement of labour laws, can also result in mistreatment regarding worker payments, further	Direct	- Implement a grievance mechanism for workers where workers can report issues related to underpayment or unequal treatment without fear of retaliation. - Advise companies to provide equal opportunities for employment and promotions to all workers, regardless of gender, ethnicity, or background, to avoid discrimination. - Regularly monitor and audit payroll and employment practices to ensure compliance with labor regulations and address any

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
Personal Protective Equipment (as may be required for such work). Underpayment may also take place on the basis of gender, temporary work status – at the discretion of contractors. The risks of late wage payment or failing to pay workers should be assessed and included as part of the contract. The risks not only cause the Bank's reputation risk, but also delay civil works. In addition, there is a possibility that they are not complied with the law on labor of the country due to short period contract.			exacerbating the inequalities faced by women in the construction sector. The risk is directly happening with labour forces. However, with the presence of social media and access to support, it is unlikely to occur at a large scale.		disparities. - Offer training and capacity-building programs for all workers to enhance their skills and qualify them for higher-paying roles. - Ensure that subcontractors and suppliers also adhere to fair wage and equal treatment policies. - Set up worker committees or unions to allow collective bargaining and ensure workers have a voice in addressing wage and treatment issues. - Provide accessible information to workers about their rights, entitlements, and the proper channels to address grievances through the establishment of the GRM for workers. This includes training on topics such as: • Environmental and Social Safeguards • Gender Awareness and the Gender Action Plan • Sexual Exploitation, Abuse, and Harassment (SEA/SH) • Labor Rights and the Workers' Code of Conduct - Regularly engage with labor rights organizations or third-party auditors to evaluate labor conditions and make improvements where necessary.
CULTURAL HERITAGE					
Several cultural sites have been reported across three (3) sub-command areas: Ou Ta Paong, Lum Hach, and Stung Krang Bat. In Ou Ta	• Rehabilitation of irrigation canal and farm roads	Underground cultural sites **Minor**	Several cultural sites have been reported across three (3) sub-command areas: Ou Ta Paong, Lum Hach, and Stung Krang Bat. In Ou Ta	Direct	- Conduct archaeological surveys before construction in culturally sensitive areas. - Implement Find Chance Procedure

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
Paong, these sites are reported to be minimally associated with the construction areas. However, there is a possibility that smaller sacred places within the command areas could be overlooked and cleared for canal construction. Since the detailed design has not yet been released or discussed with the community, there remains a risk that these sites could be destroyed. In Lum Hach, the two (2) identified cultural sites are reportedly outside the construction areas, but confirmation of the final design is needed to ensure that these sites are not affected. Lastly, in Stung Krang Bat, numerous historical and cultural heritage locations exist. While construction is expected to focus on existing canals, there is potential that the construction will encounter archaeological artifacts buried deep in the soil, as the ancient city of Longvek, once located here, experienced many wars, leading to the possibility that treasures or artifacts of historical significance were hidden underground.			Paong, these sites are reported to be minimally associated with the construction areas. However, there is a possibility that smaller sacred places within the command areas could be overlooked and cleared for canal construction. Since the detailed design has not yet been released or discussed with the community, there remains a risk that these sites could be destroyed. In Lum Hach, the two (2) identified cultural sites are reportedly outside the construction areas, but confirmation of the final design is needed to ensure that these sites are not affected. Lastly, in Stung Krang Bat, numerous historical and cultural heritage locations exist. While construction is expected to focus on existing canals, there is potential that the construction will encounter archaeological artifacts buried deep in the soil, as the ancient city of Longvek, once located here, experienced many wars, leading to the possibility that treasures or artifacts of historical significance were hidden underground.		
Loss access to land and other assets: - Construction activities, particularly land acquisition for canals and roads, can displace communities or	• Temporary land acquisition for construction of:	• Farmers • Fishers • Households along road sections	The project's construction phase presents a significant risk of temporary or permanent loss of access to land and assets for local communities. Even in cases where physical resettlement is minimal, the	Direct	- Once risks and impacts have been minimized or reduced, mitigate through compensation payment for affected assets and income generation activities. - Where land acquisition impacts remain, compensate people as per the project's

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
restrict their access to land, homes, and other assets. - **Temporary** restriction of irrigation access during construction may occur in some areas, potentially impacting livelihoods, even though the project area is mainly rainfed.	• New irrigation canals (tertiary and quaternary canals) • Roads (widening of existing roads) • Hydraulic structures (dams, reservoirs) • Temporary restriction of irrigation access from existing reservoirs during construction	• Vulnerable groups **Moderate**	acquisition of land, particularly along construction road, and main canals, can disrupt farming activities, restrict access to water resources, and business impacting the livelihoods of those affected. Temporary restriction of irrigation access during construction is anticipated, particularly from farming activities along Ou Ta Paong River, feeder canals, main canal existing reservoirs. This will affect income generation for farmers reliant on irrigation, and business along the canals.		LARPF. - Prioritize public land acquisition. If not feasible, acquire private agricultural land, which is anticipated to be small-scale at the household level due to linear land impact. - Avoid impact on land collectively owned by IP communities through alternative designs. - Conduct a thorough assessment of the project area's habitats to identify potential impacts on local flora and fauna. - Establish construction exclusion zones around sensitive habitats to prevent disturbance. - Implement habitat restoration programs in areas where construction has occurred.
Loss access to natural resources: Construction activities and project operations can restrict communities' access to forests, fishing grounds, water sources, or other natural resources they depend on for livelihoods	• Upgrading of existing reservoirs. • Construction of new dams. • Implementation of river training measures. • Temporary restriction of water access from existing	• Farmers • Fishers • Downstream communities **Moderate**	Farmers along main streams of Ou Ta Paong and Lum Hach and feeder canals in Ou Ta Paong will face the issues. Additionally, the influx of construction workers and the establishment of temporary facilities like worker camps could put pressure on local resources, including water sources and forest products, potentially leading to exploitation and environmental degradation.	Direct	- Develop a water management plan: To minimize waterbody alteration during pre-construction activities and implement efficient water management practices to prevent over-extraction and ensure equitable water distribution during the operational phase of the project. - Develop and implement a waste management plan: To ensure the safe disposal of hazardous and non-hazardous waste generated during the project - Engage with local communities and authorities: To understand and address

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
	reservoirs during construction.				concerns about potential impacts on natural resources, ensuring that project design and implementation minimizes disruption to existing livelihoods. This should also include awareness campaigns to inform workers about the importance of protecting natural resources and respecting local customs and traditions. - Develop and implement a plan to manage the influx of workers: This plan should include providing workers with information about local resources, rules, and regulations, monitoring worker activities to ensure compliance, and providing alternative options for water and other essential resources.
CROSS-CUTTING					
• **Social inequality:** Risk of being unequally engaged and treated, during the design phase and construction. The vulnerable are likely to be limitedly consulted and having limited access to available irrigation water.	• Engagement and consultations during system design and construction	• Vulnerable groups **Moderate**	The focus group discussions confirmed that the landowners of project areas in all command areas are mainly local communities, giving similar access capacity to the consultation process. However, the field survey reported that the vulnerable are generally those who have no farmland, giving them limited access to benefit from the rehabilitated system. There are arguments at provincial and district level regarding the effort given to the poor which may end up limited efficiency and effectiveness due to lack of various resources and capacity in making the support reach	Direct and indirect, and short and long term	- Conduct participatory planning and regular consultations with local communities, particularly marginalized groups (e.g., women, smallholder farmers, indigenous communities). - Prioritize hiring local labor, with special provisions for disadvantaged groups (e.g., youth, women, minorities) in both skilled and unskilled positions. - Develop and enforce water allocation plans that ensure fair access to water resources for all users, including small-scale and subsistence farmers, during and after construction. - Implement fair and transparent compensation or resettlement plans for those displaced or affected by construction

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			its full potential. The scale of the impact is minimal due to the proportion of the poor is quite small at the command area. However, the poor may benefit from the system as some of them own a small piece of land at home for gardening.		activities, especially vulnerable households. - Establish accessible and responsive grievance redress mechanisms, ensuring all community members can raise concerns or complaints during construction. - Conduct regular social impact assessments, with a focus on identifying inequality trends, and adjust project strategies to mitigate negative effects. - Provide support and training for affected communities to diversify their livelihoods, especially for those whose livelihoods may be disrupted by construction (e.g., farmers, traders). - Ensure transparency in the contracting process, including the selection of subcontractors and suppliers, with opportunities for local businesses, especially those run by marginalized groups.
• **Elite capture** The rich have the resources to grab both available land and water resources, creating greater social disparities	• Engagement and consultations during system design and construction	• Vulnerable groups **Moderate**	Since the landowners within the command areas are primarily from the local community, it is unlikely that elite land capture will occur. Additionally, the current high land prices make it unaffordable compared to the investment cost, reducing the incentive for such practices. However, there is a possibility that the wealthy may attempt to encroach upon protected areas, using their power, networks, or resources to seize land. While this is unlikely given the government's current commitment in its new mandate, if it does happen,	Direct and indirect, and short and long term	- Consultation will be conducted farmers in potential command area, focusing on vulnerable/disadvantaged groups - Alternative livelihoods for vulnerable group are identified based on their needs vis-à-vis project's investment eligibility - Conduct consultation at community level (in the command area) to achieve a consensus on how water needs are balanced between different groups in one command area. - During subproject design, water availability, storage capacity, and water needs of upstream and downstream population are calculated to inform design, and water use

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			the impact could extend to the regional level.		coordination during project operation. - Water user groups should be established for upstream and downstream population and should be coordinated by a higher-level committee/group to negotiate and optimize water coordination - Guidelines/Manual should be developed to provide guideline for upstream and downstream communities at subprojects to meet, discuss, and achieve consensus on how water is distributed for equal use between upstream and downstream population
• **Loss access to land and other assets:** - Construction activities, particularly land acquisition for canals and roads, can displace communities or restrict their access to land, homes, and other assets. - Temporary restriction of irrigation access during construction may occur in some areas, potentially impacting livelihoods, even though the project area is mainly rainfed.	• Temporary land acquisition for construction of: • New irrigation canals (tertiary and quaternary canals) • Roads (widening of existing roads) • Hydraulic structures (dams, reservoirs) • Temporary restriction of irrigation	• Farmers • Fishers • Households along road sections • Vulnerable groups • **Moderate**	The project's construction phase presents a significant risk of temporary or permanent loss of access to land and assets for local communities. Even in cases where physical resettlement is minimal, the acquisition of land, particularly along construction road, and main canals, can disrupt farming activities, restrict access to water resources, and business impacting the livelihoods of those affected. Temporary restriction of irrigation access during construction is anticipated, particularly from farming activities along Ou Ta Paong River, feeder canals, main canal existing reservoirs. This will affect income generation for farmers reliant on irrigation, and business along the canals.	Direct	- The project will prioritize avoiding physical resettlement and minimizing land acquisition. Design adjustments will be made to avoid or reduce land requirements, especially on private land. Public land will be prioritized for any necessary acquisition. - Where land acquisition is unavoidable, the project will employ a negotiated settlement process with affected households. This process, guided by the RGC's Standard Operating Procedures on Land Acquisition and Involuntary Resettlement (SOP-LAR), aims to ensure that affected households receive fair and adequate compensation for their losses and maintain or improve their income and livelihood status. - All individuals with assets within the Corridor of Impact (COI) before the Cut-Off-Date (COD) will be eligible for compensation, regardless of their legal status. Compensation will be provided for various

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
	access from existing reservoirs during construction				losses, including land, structures, crops, trees, and income-generating activities. - Recognizing the potential disruption of income streams during relocation or construction, the project will provide transitional allowances to affected households. These allowances will help cover living expenses and bridge the gap until they can resume their livelihoods. - A multi-tiered GRM will be established to address grievances from any project-affected person. The GRM will operate based on the principles of the Green Climate Fund (GCF) and be accessible at no cost to the complainant.
• **Loss access to natural resources** - Construction activities and project operations can restrict communities' access to forests, fishing grounds, water sources, or other natural resources they depend on for livelihoods	• Upgrading of existing reservoirs. • Construction of new dams. • Implementation of river training measures. • Temporary restriction of water access from existing reservoirs during construction.	• Farmers • Fishers • Downstream communities **Moderate**	Farmers along main streams of Ou Ta Paong and Lum Hach and feeder canals in Ou Ta Paong will face the issues. Additionally, the influx of construction workers and the establishment of temporary facilities like worker camps could put pressure on local resources, including water sources and forest products, potentially leading to exploitation and environmental degradation.		- Implement efficient water management practices during construction and operation to prevent over-extraction of water resources from reservoirs and rivers and ensure equitable distribution for downstream communities and ecosystems. - Establish construction exclusion zones around sensitive habitats, such as wetlands and forests, to prevent disturbance and minimize impacts on fishing grounds and biodiversity. Implement habitat restoration programs in areas where construction has occurred. - Use environmentally friendly construction materials and techniques to reduce the risk of pollution. Properly manage construction chemicals, fuels, and waste to prevent water pollution and contamination of natural resources. Prepare and implement a waste

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					management plan to handle waste generated from construction activities and worker camps. - Optimize construction material use and recycle when possible, to minimize the extraction of new resources. Implement energy-efficient construction practices and use renewable energy sources where possible. - Maintain ongoing communication with affected communities, including farmers, fishers, and downstream communities, to address concerns about natural resource access. Provide information and education to construction workers about responsible use of local resources and respect for community access rights. This suggestion is informed by the sources but is not directly stated in them. - Ensure the GRM is accessible to all community members to address complaints related to natural resource access.
DURING OPERATION					
COMMUNITY HEALTH AND SAFETY					
- Farmers and other labour directly involved in using chemicals inputs for crop production may be affected in terms of health (long-term) due to potential a) increased use of chemical inputs (e.g. pesticide) which affects them directly through inhalation, and through secondary sources such as contaminated	• Intensifying farming activities • Irrigation system operation	• Farmers • Local community **Moderate**	According to the field survey of ESCIA, it is reported that the proportion of safe practices for farmers in their pesticide application is still a concern, given only 48%, 48%, 19%, and 61% of them wear close-toed shoes, long clothes which cover skin, goggle, and gloves, respectively. The figure indicated	Direct, indirect, cumulative	- Implement Simplified IPM Plan

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
surface/ underground water and produced crop. - People who consume water provided by water supply stations extracting water sources contaminated with chemical agricultural inputs may also be affected in the long run. - People who extract surface water, and underground water (through wells) that are infested with pesticide may also be affected in terms of health in the long run. - Consumers of farm produce with pesticide residue may also be affected consumers' health in the long run.			limited understanding of pesticide affecting their health condition. Since the availability of the irrigation water and the promotion of intensification of agriculture, the application of chemical fertilizers and pesticides are likely to increase over time and will directly affect the community health as well as water quality along the stream carrying them to downstream water users and the agricultural produce users.		
CROSS-CUTTING					
Gender inequality - The risk during the operational phase of the project is that women may be excluded from the benefits and opportunities, despite the project's intention to promote gender equality.	• Limited access for women to training, resources, and decision-making processes related to irrigation and agriculture.	• Women farmers and laborers	The risk is rooted in pre-existing gender inequalities in Cambodia, where women have less access to resources, technology, and decision-making power. The assessment has shown that women are less resilient to climate change than men, and they face specific vulnerabilities in terms of income, housing, and access to information and support systems. Socially determined gender roles can also impact the adoption of climate-smart technologies. Consequently, these factors could lead to unequal access to water resources, limited	Direct and Indirect	- The project should actively encourage women's participation in the formation of FWUCs, empowering them through critical decision-making roles and equipping them with the necessary skills and resources to amplify their voices. - The project should ensure that women have equal access to training programs and resources, such as land, credit, and technology. - The project should monitor gender equality indicators and should make adjustments as needed to ensure that women are benefiting from the project.

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
			participation in FWUCs, and a disproportionate burden of negative impacts on women's livelihoods.		
• **Social inequality** Risk of being unequally engaged and treated, during the design phase and construction. The vulnerable are likely to be limitedly consulted and having limited access to available irrigation water at the operation stage.	• Competition for water resources among different user groups (farmers, communities, industries). • Potential displacement or restricted access to land due to irrigation infrastructure expansion. • Engagement and consultations during system design and construction	• Farming communities • Indigenous populations (if present). • Landless or land-poor households. • Vulnerable groups/ . **Minor**	The focus group discussions confirmed that the landowners of project areas in all command areas are mainly local communities, giving similar access capacity to the consultation process. However, the field survey reported that the vulnerable are generally those who have no farmland, giving them limited access to benefit from the rehabilitated system. There are arguments at provincial and district level regarding the effort given to the poor which may end up limited efficiency and effectiveness due to lack of various resources and capacity in making the support reach its full potential. The scale of the impact is minimal due to the proportion of the poor is quite small at the command area. However, the poor may benefit from the system as some of them own a small piece of land at home for gardening.	Direct and indirect, and short and long term	- Ensure Equitable Water Access: Mechanisms should be in place to support vulnerable and marginalized communities in accessing water resources. - FWUCs will manage the irrigation systems and ensure sustainability through fee collection. The project will invest in establishing and training FWUCs, emphasizing inclusivity and capacity building for vulnerable groups. - Implement a Simplified Integrated Pest Management (IPM) Plan.
• **Elite capture** • The rich have the resources to grab both available land and water resources, creating greater social disparities	• Unequal distribution of project benefits, favoring powerful individuals or	• Smallholder farmers • Marginalized communities • Vulnerable groups/ • **Minor**	Since the landowners within the command areas are primarily from the local community, it is unlikely that elite land capture will occur. Additionally, the current high land prices make it unaffordable compared to the investment cost, reducing the	Direct and indirect, and short and long term	- Transparent and accountable FWUC management: Clear guidelines, diverse representation, and grievance redress mechanisms are essential to prevent manipulation and ensure equitable water distribution. - Regular monitoring and evaluation:

Potential and Causes of Risks and Impacts	Activities	Receptor/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
	groups at the expense of the intended beneficiaries. • Engagement and consultations during system design and construction		incentive for such practices. However, there is a possibility that the wealthy may attempt to encroach upon protected areas, using their power, networks, or resources to seize land. While this is unlikely given the government's current commitment in its new mandate, if it does happen, the impact could extend to the regional level.		Continuous monitoring of project impact, especially on vulnerable groups, can identify and address elite capture. - Strengthened land tenure security: Clarifying land rights can protect smallholder farmers and marginalized communities from land grabbing. - Community engagement: Active community participation, especially from vulnerable groups, empowers them and ensures their needs are met.

9.2.3 Environmental Monitoring Program

Table 9.3: Environmental monitoring plan

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	During construction phase				
	ENVIRONMENTAL				
Noise	• Avoid working during night-time from 21:00 hours to 06:00 hours • Provide ear sets for workers to prevent noise if the noise level exceeds the standard • Check and maintain construction machinery regularly to avoid noisy and high vibration • Restrict use of vibrating rollers and operation of heavy equipment near sensitive structures	Construction site Nearby sensitive structures	Site inspection Visual observation	Daily	SEO E&S specialist consultants PMU
	Measuring noise and vibration level	Construction site, there are 8 locations for noise and vibration level sampling. ANV1 X: 356908 Y: 1395649 ANV2 X: 355879 Y: 1404046 ANV 3 X: 444325 Y: 1355032 ANV 4 X: 450811 Y: 1357200 ANV 5 X: 47381 Y: 1311192 ANV 6 X: 470186 Y: 1305388 ANV 7 X: 465547 Y: 1304414	Measuring equipment and/or appropriate monitoring methods	Every 06 months	SEO E&S specialist consultants PMU

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
		ANV 8 X: 443191 Y: 1297797			
Air quality	• Spray or sprinkle water on the work surfaces and other piled materials to minimize dust at least 3-6 times per day in windy and dry weather and/or based on the weather condition • Solid waste or construction waste activities • Construction machinery operation and maintenance • Distance of sitting concrete mixing plants, crushing • plants, quarries and other facilities to settle and other sensitive receptors • Transportation of construction materials	Construction site	Site inspection Visual observation Monitoring equipment and/or appropriate monitoring methods	Daily	SEO E&S specialist consultants PMU
	Testing air quality (NO2, SO2, CO, TSP, PM10, PM2.5)	There are 8 locations for air quality sampling. ANV1 X: 356908 Y: 1395649 ANV2 X: 355879 Y: 1404046 ANV 3 X: 444325 Y: 1355032 ANV 4 X: 450811 Y: 1357200 ANV 5 X: 47381 Y: 1311192 ANV 6 X: 470186 Y: 1305388 ANV 7 X: 465547 Y: 1304414 ANV 8 X: 443191 Y: 1297797	Air quality monitoring equipment	Every 06 months	
Water Quality	• Wastewater management • Design and capacity of septic tank	Construction site	Site inspection Visual observation	Daily	SEO E&S specialist

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	• Digging of side drain at campsite • Construction of retaining structures				consultants PMU
	• Testing surface water quality (Depth, pH, EC, AS, Cd, Pb, TN, TP, TDS, TSS, DO, and Total Coliform) and pesticide residues in water (to be conducted overseas)	There are 8 locations for surface water quality sampling. SW1 X:356706 Y:1396198 SW2 X:355668 Y:1404018 SW3 X:352153 Y:1414410 SW4 X:440785 Y:1356041 SW5 X:474697 Y:1308844 SW6 X:469642 Y:1306016 SW7 X:465456 Y:1307467 SW8 X:442600 Y:1296842	Water quality monitoring equipment	Every 06 months	SEO E&S specialist consultants PMU
Soil quality/ quality reduction	• Avoid construction activities in the rainy season and/or days of heavy rains. • Management activities of fuel, oils, and chemical substances. • Cover all restored areas with topsoil and re-vegetate	Construction site	Site inspection Visual observation	Daily	SEO E&S specialist consultants PMU
	• Testing of soil quality is going to be analyzed in the agriculture context: - Soil classification or particle size, - Soil moisture, - Nitrogen (N), Phosphorus (P), Potassium (K), Magnesium (Mg), Sodium (Na), - Organic Metter - Ratio of the mass of carbon to the mass of nitrogen in organic	There are 5 locations for soil quality sampling. SS1 X:355662 Y:1399063 SS2 X: 354509 Y:1406852 SS3 X: 441471 Y:1355655	Soil quality monitoring equipment	Every 06 months	SEO E&S specialist consultants PMU

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	residues (C/N Ratio), - Total phosphorus (P), - Cation exchange capacity (CEC), - pH, - Electrode Conductivity.	SS4 X: 465450 Y:1304887 SS5 X: 469602 Y: 1306117			
Solid waste/wastewater	• Solid and liquid waste management plan in the project construction sites. • Install septic tanks at the construction camp to prevent the discharge of polluted sewage into the outside. • Implement waste segregation of reusable construction materials, biodegradable, and non- biodegradable wastes. • Orient workers on the solid waste segregation system and prohibit them from indiscriminate throwing wastes outside of waste bins in the construction sites. • Provide sufficient waste bin and proper storage before transportation to dispose at an authorized landfill.	Construction site	Site inspection Visual observation	Daily	SEO E&S specialist consultants PMU
Hazardous and non-hazardous waste	• Hazardous and Non-hazardous waste management strategies • Sludge management • Fuel storage tank will be provided with retention areas to contain accidental spills.	Construction site	Site inspection Visual observation	Daily	SEO E&S specialist consultants PMU
	BIODIVERSITY				
Habitat Loss and Fragmentation	• Area of habitat lost or fragmented. • Changes in vegetation cover. Number of isolated habitat patches • Presence of wildlife corridors.	Construction site	Site inspection Visual observation GIS analysis (if available) Drone surveys (if available)	Daily/Weekly	SEO E&S specialist consultants PMU
Loss of biodiversity and ecosystem services	• Changes in species abundance and diversity • Decline in water quality • Changes in soil fertility	Construction site	Site inspection Visual observation	Daily/Weekly	SEO E&S specialist consultants

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	• Reduced pollination services • Alterations in hydrological processes		Biodiversity surveys		PMU
Hunting and trading, and consumption of wildlife	• Avoid cutting of trees or destruction of vegetation • No hunting, fishing, or collection of animal and plant materials • Revegetation success will be monitored, particularly surrounding riparian vegetation along area where levee is installed for flood protection and for increased water retention.	Construction site	Site inspection Visual observation Community interviews	Daily/Weekly	SEO E&S specialist consultants PMU
Loss of fauna and flora	• Number of individuals of each species observed • Presence of endangered or threatened species • Changes in plant community composition	Construction site	Site inspection Visual observation Biodiversity surveys	Daily/Weekly	SEO E&S specialist consultants PMU
Destruction of farming ecosystem	• Area of farmland affected • Changes in crop yields • Impacts on livestock • Pollution of water sources used for irrigation	Construction site	Site inspection Visual observation Interviews with farmers	Daily/Weekly	SEO E&S specialist consultants PMU
Landscape and biodiversity	• Adopting good housekeeping and good construction practices. • Ensuring proper lining of canals and adequate assembling of pipes • Adopting slope stabilization techniques. • Implementing Biodiversity Action Plan (BAP)	Construction sites	Site inspection Visual observation	Daily	SEO E&S specialist consultants PMU
Protected Areas	• Exclude subproject located in the community forestry, and Zone 3 of the protected area.	Construction sites	Site inspection	Daily	SEO
GHG emission	• Monitor the amount of fuel used by construction vehicles, heavy machinery, and generators. • Track the fuel efficiency of these machines to identify opportunities for improvement. • Assess the effectiveness of measures to control dust emissions from construction sites. • Monitor the types and quantities of waste generated and their disposal methods. • Track the amount of waste recycled or reused to reduce emissions	Construction site Nearby sensitive structures	Site inspection Visual observation Consultation	Daily	SEO E&S specialist consultants PMU

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	associated with landfill disposal. • Monitor the number and types of vehicles entering and leaving the construction site. • Track the efficiency of transportation methods used to deliver materials and equipment.				
	During operation phase				
Water Quality	Testing surface water quality (Depth, pH, EC, AS, Cd, Pb, TN, TP, TDS, TSS, DO, and Total Coliform) and pesticide residues in water (to be conducted overseas)	There are 8 locations for surface water quality sampling. SW1 X:356706 Y:1396198 SW2 X:355668 Y:1404018 SW3 X:352153 Y:1414410 SW4 X:440785 Y:1356041 SW5 X:474697 Y:1308844 SW6 X:469642 Y:1306016 SW7 X:465456 Y:1307467 SW8 X:442600 Y:1296842	Site inspection Visual observation	Annually	SEO E&S specialist consultants PMU
Soil quality/ quality reduction	• Testing of soil quality is going to be analyzed in the agriculture context: - Soil classification or particle size, - Soil moisture, - Nitrogen (N), Phosphorus (P), Potassium (K), Magnesium (Mg), Sodium (Na), - Organic Metter	There are 5 locations for soil quality sampling. SS1 X:355662 Y:1399063 SS2 X: 354509 Y:1406852 SS3 X: 441471	Soil quality monitoring equipment	Annually	SEO E&S specialist consultants PMU

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	- Ratio of the mass of carbon to the mass of nitrogen in organic residues (C/N Ratio), - Total phosphorus (P), - Cation exchange capacity (CEC), - pH, - Electrode Conductivity.	Y:1355655 SS4 X: 465450 Y:1304887 SS5 X: 469602 Y: 1306117			
Biodiversity and Ecosystem Services	• Implementing Biodiversity Action Plan (BAP)	The entire sub-scheme	Site inspection Visual observation	Daily	SEO E&S specialist consultants PMU
Habitat Loss and Fragmentation	• Area of habitat converted for agricultural use • Changes in the size and connectivity of habitat patches • Number of isolated habitat fragments	The entire sub-scheme	Site inspection Visual observation	Annually	SEO E&S specialist consultants PMU
Invasive Species	• Presence and abundance of invasive species • Area affected by invasive species • Effectiveness of control measures	The entire sub-scheme	Site inspection Visual observation Vegetation surveys	Annually	SEO E&S specialist consultants PMU
Hunting, trading, and consumption of animal from the wild	• Incidents of illegal hunting, trapping, or fishing • Presence of wildlife products for sale • Reports of wildlife consumption	The entire sub-scheme	Site inspection Visual observation Community interviews	Annually	SEO E&S specialist consultants PMU Local authorities
GHG emission	• Monitor the Knowledge, Attitude and Practices of farmers in farming activities that cause GHG emission	The entire sub-scheme	Site inspection Visual observation Consultation	Daily	SEO E&S specialist consultants PMU
	ANNUAL CROP MANAGEMENT PLAN				
Water resource efficiency	• Monitor water extraction rates from surface and groundwater sources.	Irrigation intake points Representative fields	Water flow measurements	Daily	PMU FWUC

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	• Assess irrigation efficiency by measuring the amount of water applied versus the amount of water actually used by crops. • Monitor the implementation and effectiveness of water-saving irrigation methods (drip irrigation, sprinkler irrigation, AWD for rice). • Track water consumption per unit of crop yield (e.g., cubic meters of water per ton of rice produced).	within the sub-scheme	Soil moisture monitoring Crop water use assessments		
Soil erosion and soil erosion risk	• Monitor soil erosion rates in different parts of the sub-scheme, particularly in sloping areas. • Assess the effectiveness of erosion control measures (contour planting, terracing, grass barriers). • Monitor soil organic matter content as an indicator of soil health and erosion resistance.	Representative fields Areas with different slopes and soil types	• Visual assessments of erosion features (gullies, rills) • Soil loss measurements using erosion plots or sediment traps • Soil organic matter analysis	After significant rainfall events Annually	PMU Agricultural extension officers
Nutrient application and management	• Monitor the types and amounts of fertilizers applied to different crops. • Conduct regular soil testing to assess nutrient levels and guide fertilizer application rates. • Monitor nutrient runoff from fields, especially near watercourses.	Representative fields Water sampling points near fields	• Fertilizer application records • Soil nutrient analysis • Water quality testing for nutrients (nitrogen, phosphorus)	Before and after fertilizer application Regularly during the growing season	PMU Farmers
Use and effectiveness of pesticides	• Monitor the types and amounts of pesticides used for different crops and pests. • Assess the effectiveness of pest control measures by monitoring pest populations and crop damage. • Track the incidence of pesticide-related health issues among farmers	Representative fields Pesticide storage facilities	• Pesticide application records • Pest scouting and	Regularly during the growing season	PMU Agricultural extension officers

Monitoring Parameters	Monitoring Indicators	Location	Measurements	Frequency	Responsibility
	and workers.		monitoring data • Health records		
Pesticide residues on site soil	• Conduct soil sampling and analysis to measure pesticide residue levels in representative fields.	Representative fields Areas near pesticide storage facilities	• Soil residue analysis	Periodically (e.g., annually or before planting sensitive crops)	PMU Third-party laboratories
Pesticide residues on produce	• Collect and analyze samples of produce to determine pesticide residue levels. • Ensure that produce meets national and international standards for maximum residue limits (MRLs).	Representative fields at harvest time	• Laboratory analysis of produce samples	Before harvest	PMU Third-party laboratories
Energy use	• Monitor fuel consumption for machinery and equipment used in farming operations. • Track electricity usage for irrigation pumps and other energy-consuming activities. • Assess the efficiency of energy use by calculating energy consumption per unit of crop yield.	Fuel storage facilities Irrigation pump stations	• Fuel consumption records • Electricity meter readings	Regularly (e.g., monthly or seasonally)	PMU

9.2.4 Social Monitoring Program

To ensure the effectiveness of social management, the social monitoring program is prepared to monitor social issues. Contractor and/or sub-contractor is responsible for monitoring using appropriate method, equipment and system. Details on monitoring parameters are shown in the table below:

Table 9.4: Social monitoring plan during construction and operational phase

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
During construction phase					
CHILD LABOR & FORCED LABOR					

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
Child Labor/ Forced Labor	• Involvement of child labor/ forced labor in main contractor and subcontractors' workforce • Involvement of child labor/ forced labor among primarily supply workers	• Construction sites • Worksite of primary supplier	• Site inspection • Observation	• Daily • Screening prior to engaging services of primary supplier	• Contractors • Primary supplier PMU
COMMUNITY HEALTH AND SAFETY					
Community Health and Safety	• General disease prevalence within the subproject area and neighboring areas • General health of workers • Communicable diseases among workers and the subproject community • Construction activities that give rise to risks related to traffic accidents and other construction related accidents including fatality, disease outbreaks, and environmental pollution incident	• Construction sites • Camp site and Worker camps • Community and neighboring community	• Site inspection • Observation • Consultation with workers • Consultation with local authorities and commune health center	• Daily • Monthly • Within 48 hours for	• Contractors • PMU
Labor Influx	• Prepare Contractors' Labor Management plan	• Contractors' office • Construction sites	• Labor management plan prepared and submitted to PMU for approval (as part of Contractor's ESMP) • Total workers planned to be mobilized on-site monthly for entire subproject cycle (including managers, skilled workers and unskilled workers) • Total workers planned to mobilize and mobilize monthly (by gender, local vis-à-vis migrant)	• Before construction is proceeded • Updated as needed (subject to PMU's prior review)	• Contractors (including main contractors and subcontractors) • PMU
	• Recruitment of local labor	• Construction sites	• Number of local people engaged monthly (sex disaggregated), and included in Contractors' monthly progress report (to	• Monthly and during subproject cycle	• Contractors • PMU

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
			PMU)		
	• Ensure equity and gender-based job opportunities	• Construction sites	• Total female workers mobilized on-site per month • Number of local female workers mobilized on-site per month • Number of IP workers mobilized if month (if IPs are present in subproject area)	• Monthly and during subproject cycle	• Contractors • PMU
Security and Road and Traffic safety	• Security cautions • General disease prevalence • Worker health • Communicable diseases	• Construction sites • Access roads to construction sites • Newly constructed/rehabilitated roads	• Site inspections • Incident reports • Data collection • Consultation with workers and community members • Review of contractor safety plans	• Daily during construction • Weekly during construction • Monthly during operation	• Contractors • PMU • Local authorities
SEA/SH	• Before mobilizing workers to construction site, conduct orientation/training on SEA/SH (using sample Code of Conduct as a minimum) for all Contractors' managers and workers mobilized to construction site • As part of the above training/orientation, ensure all workers understand SEA/SH risks, disciplines and penalty, and understand project's grievance procedures related to SEA/SH • As part of the workers and manager's work contract, require all workers engaged for project (both workers mobilized to site or work in contractors' office) to peruse	• Construction sites • Relevant local communities	• Number and percentage of workers trained on SEA/SH prior to mobilization to subproject site • Number and percentage of workers signing Code of Conduct as part of Work Contract • Percentage of workers perpetrating SEA/SH and percentage of cases reported to PMU and resolved • Name and contact of ESHS and grievance focal report reported in Contractor's ESMP.	• Monthly and during subproject cycle • Reported to PMU within 48 hours if occurred	• Contractors • PMU

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
	and sign Workers' CoC • Ensure Contractors appoint a focal point in charge of ESHS and grievance reception, processing and resolution • Apply all measures related to management of work camps				
Community Health and diseases	• Incidence of waterborne diseases • Prevalence of vector-borne diseases (e.g., malaria, dengue fever) • Respiratory illnesses related to dust and air pollution • Availability and accessibility of healthcare services • Community awareness of health risks and preventative measures	• Construction sites • Worker camps • Community and neighboring areas	• Health data collection • Site inspections • Health surveys and interviews • Consultation with workers and community members	• Monthly • During outbreaks • Periodic community health awareness campaigns	• PMU • Contractors • Local health authorities
Social Conflicts	• Any actions on the part of Contractors' workers or community member that cause social conflicts (e.g. SEA/SH, the way construction activities are carried out [pollution, restricted access, loss of local income/livelihoods, accidents…)	• Construction sites • Relevant local communities	• Number of social conflicts arising and nature and scope of conflict • Number of social conflicts resolved by contractors within 7 days • Number of social conflicts resolved by local authorities • Number of serious cases that have happened and reported to PMU within 48 hours	• Daily • Monthly	• Contractors • PMU
	• Conflicts between upstream farmers who prioritize water storage for their crops and downstream farmers who require a consistent water supply for their agricultural needs.	• Local communities are living downstream and upstream.			

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
Land acquisition/ Economic displacement	• Track the process of acquiring land for the project, ensuring fair compensation is provided to affected landowners. • Implement programs to help displaced individuals and communities restore their livelihoods. • Establish effective grievance mechanisms to address complaints and concerns related to economic displacement.	• Construction sites	• Monitor the distribution of compensation payments and address any disputes or concerns. • Monitor the effectiveness of these programs, such as job training, income generation opportunities, and access to resources. • Monitor the responsiveness of these mechanisms and ensure timely resolution of issues.	• Daily • Reported to PMU within 48 hours	• Contractors • PMU
OCCUPATIONAL HEALTH AND SAFETY					
Physical Hazards	• Incidence of worker injuries due to physical hazards (e.g., falls, cuts, being struck by objects) • Unsafe working conditions (e.g., inadequate lighting, lack of proper safety equipment, slippery surfaces) • Compliance with safety regulations and use of personal protective equipment (PPE)	• Construction sites • Worker camps • Access roads	• Site inspections: Observe working conditions, worker behavior, and safety equipment usage. • Incident reports: Document all accidents and near misses, including details of the incident, causes, and contributing factors. • Safety audits: Regular inspections to assess compliance with safety regulations.	• Daily during construction • Weekly safety meetings	• Contractors • PMU
Chemical hazards	• Exposure of workers and communities to hazardous chemicals (e.g., pesticides, fuels, solvents) • Improper storage, handling, and disposal of chemicals • Air and water quality monitoring to detect chemical contamination	• Construction sites • Worker camps • Areas surrounding construction sites	• Site inspections: Observe chemical handling practices and storage conditions. • Air and water quality testing: Regular monitoring for chemical contaminants. • Review of material safety data sheets (MSDS): Ensure proper	• Regular inspections of chemical storage and handling areas	• Contractors • PMU

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
			procedures for handling and storing chemicals. • Training for workers: Educate workers on safe chemical handling practices and emergency procedures.		
Underpaid pay and unequal treatment	• Worker wages and benefits compared to legal requirements and industry standards • Instances of discrimination or unfair treatment based on gender, ethnicity, or other factors • Access to grievance mechanisms for workers to report unfair labor practices	• Construction sites • Worker camps	• Payroll records review: Verify worker wages and benefits. • Worker interviews: Confidential interviews to gather feedback on labor conditions and treatment. • Observation of worker interactions: Monitor for signs of discrimination or unfair treatment. • Review of contractor labor policies and practices: Ensure compliance with labor laws and ethical standards.	• Regular payroll audits • Periodic worker satisfaction surveys • Prompt investigation of any reported grievances	• Contractors • PMU
Loss access to land and other assets	• Number of households affected by land acquisition or temporary restrictions on land use • Types of assets affected (e.g., land, houses, crops, trees) • Adequacy of compensation and resettlement measures for affected households	• Project areas where land acquisition is required • Areas affected by temporary restrictions on land use	• Land surveys and asset inventories • Consultations with affected households • Review of compensation and resettlement plans • Monitoring of resettlement implementation	• Before land acquisition • During land • After resettlement	• Contractors • PMU
Loss access to natural resources:	• Impacts on community access to water resources (e.g., for drinking, irrigation, fishing) • Impacts on access to forests and other natural resources • Measures to mitigate impacts and provide	• Areas downstream of irrigation schemes • Areas surrounding project activities that may affect natural resources	• Water quality and quantity monitoring: Assess impacts on water resources downstream of project activities. • Consultations with communities: Gather feedback on impacts on	• Regular water quality and quantity monitoring • During project implementation: Monitor the effectiveness of mitigation measures.	• PMU • Relevant government agencies • Contractors

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
	alternative access to resources		natural resource access and use. • Development and implementation of mitigation plans: Address impacts and provide alternative access to resources.		
Cultural heritage	• Unexpected impacts on heritage resources	• Construction sites	• Site inspection • Observation • Report by local people/local authority	• Daily • Reported to PMU within 48 hours	• PMU • Contractors
Elite capture	• Equitable distribution of project benefits among community members • Transparency and accountability in decision-making processes • Mechanisms for community participation and feedback	• Project implementation areas • Community meetings and consultations	• Monitoring of benefit distribution: Track who is receiving project benefits and ensure fairness. • Observation of decision-making processes: Assess inclusivity and transparency. • Community feedback mechanisms: Establish channels for communities to voice concerns and provide input.	• Throughout project implementation • Regular community meetings and consultations	• PMU • Contractors • Community representatives
GRM	• All grievances shall be recorded (including verbal grievance). Grievance resolution process and resolution result and status will be updated/monitored regularly to ensure grievances are processed/resolved within the timeframe specified for each step in grievance redress procedure (See Annex 8).	• Worker in construction sites • Community and neighboring community	• Site inspection • Observation Consultation with local authorities and local community	• Daily • Monthly	• Contractors • PMU
During operation phase					
Irrigation Operation and Maintenance	• Operation and maintenance for the subproject and irrigation system	• Within target command area	• Inspect and evaluate system dam safety	• Monthly	• PMU (during project life)

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
		• Downstream the target command area	• Prepare before construction completion and adopt during operation	• As soon as the rehabilitated dam and irrigation system is operated again	• PDWRAM (after subproject completion)
COMMUNITY HEALTH AND SAFETY	• Number of accidents and fatalities related to construction activities • Number of disease outbreaks and environmental pollution incidents • Number of reported cases of worker health issues	• Construction sites • Camp site and Worker camps • Nearby community	• Site inspection reports • Accident/Incident reports • Medical records/reports • Consultation minutes/reports	• Daily for site inspections • Monthly for reports and consultations • Within 48 hours for reporting accidents, disease outbreaks.	• PMU • PDWRAM
CROSS-CUTTING					
Gender inequality	• Percentage of female workers in different roles (skilled, unskilled) • Number of reported cases of gender-based violence or discrimination • Participation of women in FWUCs and decision-making processes related to water management.	• Construction sites • FWUC meetings • Community consultations	• Observation of worker roles and interactions. • Records of complaints and their resolution. • Attendance records and meeting minutes.	• Monthly for data collection and reporting	• PMU • PDWRAM
Social inequality	• Employment rates of vulnerable groups (poor, ethnic minorities, people with disabilities) in project activities. • Access to project benefits (training, information, resources) among different social groups.	• Construction sites • Training sessions • Community consultations	• Employment records and beneficiary lists. • Attendance records and feedback surveys. • Consultations with community members and representatives of vulnerable groups.	• Monthly for data collection and reporting	• PMU • PDWRAM
Elite capture	• Participation and representation of different social groups in decision-making bodies (FWUCs, committees). • Transparency and accountability in the allocation of project resources and benefits. • Monitoring of complaints related to	• FWUC meetings • Community consultations • Project implementation records	• Observation of meeting dynamics and representation • Analysis of resource allocation records. • Records of complaints and their resolution.	• Regularly during FWUC meetings and project implementation • Continuously through the GRM.	• PMU • PDWRAM

Monitoring Parameters	Monitoring Indicators	Locations	Measurements	Frequency	Responsibility
	favoritism or exclusion in decision-making.				
Water Use Conflict between upstream and downstream	• Establishment of water user groups for target command area • Development of guidelines/manual for water use coordination within target command area (upstream and downstream) • Policy actions related to water use coordination at sub-basin/basin level • Ensure an effective monitoring mechanism (which is built on water user consensus) is in place, transparent, and information on water use and distribution is regularly recorded to facilitate equitable water use across the entire command area.	• Within target command area • Downstream the target command area	• Number of water user groups to be established for the target command area • Percentage of command area (ha) that are coordinated by established water user group • Percentage of command area (ha) that benefit from water fee (contributed by water user) • Number of waters use conflicts that are reported, recorded, and resolved by affected water user group • Number of waters use conflicts that are reported to, recorded and resolved by provincial Department of Water Resources	• Monthly	• PMU • Established water user groups • PDWRAM

9.2.5 E&S Auditing

Auditing is a critical requirement for Category A projects, necessitating the engagement of an Independent Environmental and Social (ES) Monitoring Agency to ensure compliance during both construction and operation phases, as mandated by the AIIB Environmental and Social Framework (ESF). During the construction phase, audits must be conducted at regular intervals aligned with the lenders' requirements, typically quarterly, to monitor adherence to environmental and social safeguards, including waste management, pollution control, and worker safety. In the operation phase, annual audits are required to assess the long-term impacts on the environment and community, ensuring mitigation measures remain effective and operational standards are upheld. This dual-phase auditing approach ensures comprehensive monitoring and accountability throughout the project lifecycle.

9.3 ROLES AND RESPONSIBILITIES FOR IMPLEMENTATION OF SUB-SCHEME ESCMP

The feasibility study for the CAISAR Project provides key recommendations for implementation, focusing on climate and poverty goals. The project will be managed by the Ministry of Water Resources and Meteorology (MOWRAM) under the oversight of the Ministry of Economy and Finance (MEF) through the country program steering committee. MOWRAM will lead the project's overall management and implementation of Component 2 (Infrastructure), while the National Committee for Sub-National Democratic Development (NCDD) will handle Component 1, which includes farm support, capacity building, and climate-resilient farming practices. The International Fund for Agricultural Development (IFAD) will assist NCDD in leading Component 1 and will manage project communications.

The Project Management Unit (PMU) will include personnel from MOWRAM, the Department of Hydrology and River Works (DHRW), and Provincial Departments of Water Resources and Meteorology (PDWRAM) from four (4) provinces. Key phases include a program for solar pumping to improve infrastructure resilience and climate resilient infrastructure.

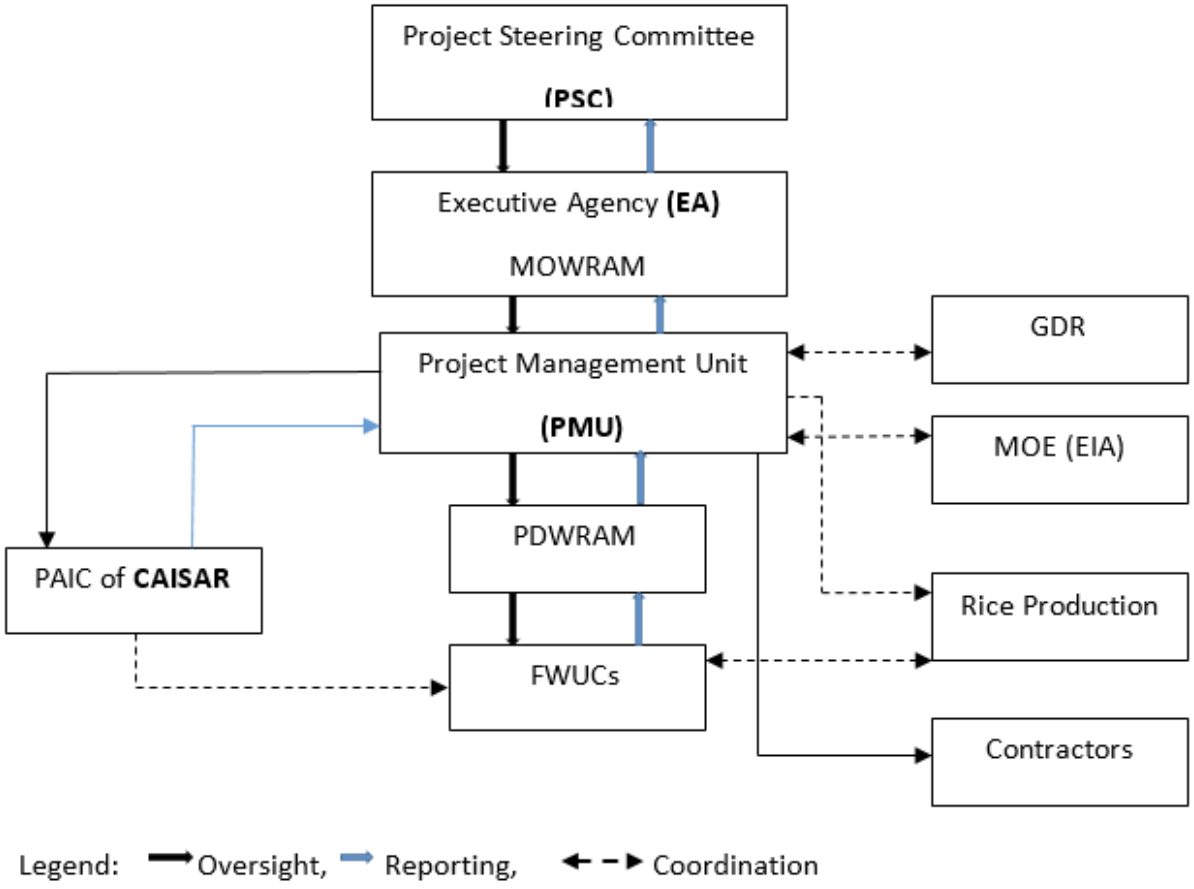
Monitoring and evaluation will focus on increasing capacity at the FWUC level, ensuring the project meets its long-term goals. MOWRAM will oversee project supervision, while PDWRAM and the Ministry of Agriculture, Forestry and Fisheries will handle resettlement and agricultural support. The project steering committee, chaired by the Minister of MOWRAM, will guide policy and implementation, with resettlement managed by an Inter-Ministerial Resettlement Committee led by MEF. Through these arrangements, the CAISAR project aims to enhance water management and agricultural productivity in Cambodia.

9.4 ENVIRONMENTAL AND SOCIAL COMPLIANCE FRAMEWORK

9.4.1 Institutional Arrangement and Capacity Development

MOWRAM is the Executing Agency for implementation of the Project. However, successful implementation of the Project requires the cooperation of several ministries. The project steering committee (PSC) was established to achieve the inter-ministerial coordination and chaired by the Minister of MOWRAM and comprising of senior officials from MOWRAM, MOI (NCDD), MAFF, Ministry of Environment (MOE), Ministry of Economy and Finance (MEF), and the Provincial Governor's Offices of Pursat, Kampong Chhnang, Kandal, and Kampong Speu provinces will oversee project implementation and provide support to the project. Figure below shows the Project organization Structure.

Figure 9.1: CAISAR Project (Component 1) Structure Chart



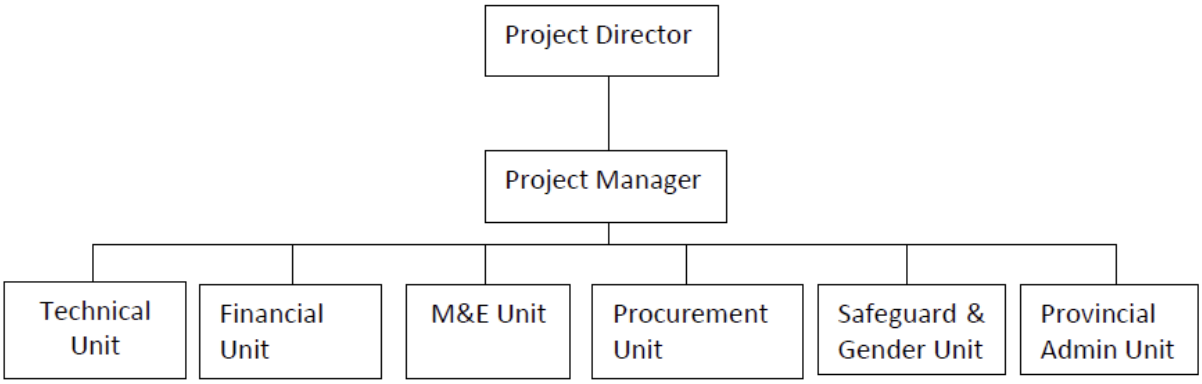
(Source: Feasibility report structure chart)

A project management unit (PMU) has been established establish for the CAISAR project. The PMU will be headed by the Secretary of State of MOWRAM as Project Director, with assistance from the DFWUC Director as Project Manager. The PMU will be fully involved in the preparation and implementation of the project. The PMU is composed of designated personnel from MOWRAM, the Department of Hydrology and River Works (DHRW) of MOWRAM, and the PDWRAMs of Pursat, Kampong Chhnang, Kampong Speu, and Kandal provinces.

The PDWRAMs are responsible for coordinating all field activities with FWUCs and DFWUC and implementing O&M activities.

The PMU is supported by the Project Management Implementation Consulting (PMIC) and consists of Project Director, Project Manager, Technical Unit, M&E Unit, Financial Unit, Procurement Unit, Safeguard & Gender Unit and Provincial Administration Unit as show in Figure below.

Figure 9.2: CAISAR Project PMU structure chart



9.4.2 Environmental and Social Duties of the PMU/Detail Design Consultants

9.4.2.1 MOWRAM'S PMU

MOWRAM's PMU will work closely with PDWRAM in planning and implementing subprojects located within their province. The PDWRAMs will also supervise project officers at the district-level Department of Water Resource and Meteorology, and are responsible for:

- Coordinating effectively with all project stakeholders, including MOWRAM's SEO, consultants, contractors, local authorities, provincial departments, and project communities.
- Supporting provincial and district-level project officers in monitoring and evaluating progress and performance of consultants and contractors.
- Supporting MOWRAM'S SEO to conduct training on labor, gender, SEA, SH, VAC, and HIV/AIDS.
- Supporting MOWRAM'S SEO to disseminate project information and conduct consultation activities, as well as ensuring effective grievance redress resolution within their province.
- Supporting MOWRAM'S SEO to conduct screening and scoping of the subprojects, and identifying environment, social, land acquisition impacts and screening for presence of IPs in the subproject area.

- Liaising with village authorities in subproject area to encourage vulnerable groups to apply for jobs that may be offered by project contractors.
- Collaborating with relevant departments involved in land acquisition and/or other environment or social mitigation measures.

9.4.2.2 NCDD'S PMU

NCDD's PMU will work closely with Provincial Cabinet in planning and implementing subproject located within their province. NCDD PMU will be responsible for day-to-day project implementation, monitoring and evaluation of Project Component 1, 2.1 and 2.2 in collaboration with MAFF. PMU will work under the oversight and guidance of NCDDS and will be responsible for all aspects of environmental and social performance, including E&S monitoring and evaluation, reporting of E&S performance, and relevant incidence during project implementation.

9.4.2.3 Provincial Department of Water Resources and Meteorology

PDWRAM's main responsibility include:

During subproject preparation and construction:

- Support design parties in their surveys and consultation to prepare Feasibility Study and Detailed Design for sub-scheme.
- Oversee construction activities under Component 2, particularly construction of the new irrigation canal in the command area

During operation:

- Collaborate with other relevant technical departments, especially PDAFF at provincial level, farmer water user groups (FWUG) to ensure its regulators (located within the water distribution network) are operated effectively, and in a manner that minimizes water use conflicts among target water user community in the command area.
- Conduct regular maintenance of the reservoir and irrigation canals during subproject operation and maintenance stage.

9.4.2.4 Provincial Department of Agriculture, Forestry and Fisheries

PDAFF is responsible for implementing activities under Component 1, 2.1 & 2.2. Under this subproject, PDAFF is responsible for developing and implementing agricultural techniques that make full use of improved water access (under Component 1) to enable farmers in the command area to produce more food in a sustainable manner which improves farmers' income and livelihoods. PDAFF will focus on the following:

- Promoting crop diversification for farmers in the command area (e.g. crop rotation for rice and horticulture production improves soil conditions whereas enhancing vegetation production for household's better nutrition and income.

- Introducing to farmers new agricultural engineering techniques to promote a) mechanization to increase productivity in crop production (e.g. mechanization in soil preparation using laser land leveling, use of combine harvester to save labor and reduce production costs, b) save water by applying alternate wet and dry (AWD) and drip irrigation for horticultural activities, c) reduce GHG.
- Scaling up Crop Production and engaging Private Sector in value chain development for specific farm product (e.g. rice, bean, and other cash crops such as vegetables…) and relevant agricultural services through agricultural cooperatives, producer groups, etc.

9.4.3 Environmental and Social Duties of the Contractor

The contractor and its subcontractors, if any, shall comply with the ESMP. In particular, the Contractor must prepare a Contractor's ESMP (C-ESMP) to elaborate this ESMP based on a) site condition, b) capacity of the Contractors and their subcontractors (if any), c) national regulations that are active by the time of subproject implementation.

To ensure that necessary action has been undertaken and that steps to avoid adverse impacts and/or reoccurrence have been implemented, the Project Manager, the Safeguard Focal Persons, and/or contractor must report to PMU within 48 hours of any serious incidents of non-compliance that may have serious consequence. In the event of working practices being deemed dangerous either by the subproject, the local authorities, or the other concerned agencies, immediate remedial action must be taken by the contractors. The contractor must keep records of any incidents and any corrective action taken. The records of non-compliance that could be practically addressed (not cause serious impacts) will be reported to the DDIS with a copy to PMU monthly.

The contractor will be responsible for dealing with any reports/grievance forwarded by the local communities, authorities, police or other agencies as soon as practicable, preferably within one (1) hour but always within 48 hours. The Project Manager/Safeguard Focal Persons will monitor and ensure that the contractor has taken appropriate action. Where appropriate, approval of remedial actions may require an agreement from the local authorities and/or other government agencies. Procedures should be put in place to ensure, as far as is reasonably practical, that necessary actions can be undertaken to avoid recurrence and/or serious damage.

9.4.4 Contractor's Environmental and Social Management Plan (C-ESCMP)

The civil works contractor is responsible for implementing the Environmental and Social (E&S) mitigation measures outlined in this ESMP for Component 2, which involves constructing the irrigation canal and related structures like gates and regulators. Based on the ESMP and the project's Labour Management Plan (LMP), the contractor will:

- Prepare and submit a Contractor's Environmental and Social Management Plan (C-ESMP) for each contract, detailing how E&S risks related to construction activities, workers, camps, machinery, and vehicles will be mitigated. The C-ESMP must also include a labor management plan (C-LMP) and be site-specific, addressing risks based on the

contractor's capacity and site conditions.

- If subcontractors are engaged, they must prepare their own E&S plan aligned with the ESMP and LMP, outlining how they will manage identified risks and impacts. Reporting arrangements between the subcontractor and the main contractor must be detailed, with the main contractor consolidating subcontractor reports into monthly E&S performance reports to the PMU, with quarterly reporting potentially required.
- If changes occur to the proposed works and activities during the contract period, the contractor must update the C-ESMP to reflect these changes, including relevant subcontractor plans. The C-ESMP should include:
    - A policy statement outlining the contractor's commitment to the site-specific ESMP.
    - Document details (issue date, revision status, distribution list, and signatures).
    - Applicable laws, regulations, and required permits.
    - Plans to manage E&S risks, including mitigation measures, a Workers' Code of Conduct, and a Contractor's LMP.
    - A list of required environmental and social training for all personnel, including occupational health and safety, SEA/SH/VAC risks, and emergency response.
    - Financial resources and responsibilities for implementing the C-ESMP, including subcontractor responsibilities and training for local workers.
    - Monthly environmental reports, covering accident/incident reporting within 48 hours to MoWRAM, compliance with the C-ESMP, challenges, non-compliance issues, subcontractor activities, and meeting minutes with MoWRAM.

The contractor must ensure timely funding, human resources, and implementation of pre-construction and construction mitigation measures, along with any additional E&S mitigation required.

9.4.5 Safety, Social and Environmental Officer (SSEO)

Under the PMU, the consultant must be competent on-site Safety, Social, and Environment, trained in environmental management, to oversee contractors and subcontractor personnel. The SSEO's responsibilities include:

- Supervising subcontractor compliance with the Contractor's LMP and C-ESMP.
- Submit the LMP and C-ESMP to the PMU/DDIS for approval before mobilizing staff.
- Conducting site inspections and audits to ensure compliance with environmental and social mitigation measures.
- Monitoring and reporting on E&S compliance and preparing audit reports.
- Investigating complaints, recommending corrective actions, and addressing non-compliance.

- Informing the contractor, PMU, and DDIS of any E&S issues, and maintaining detailed records.
- Collaborating on labor issues and preparing the Contractor's LMP and C-ESMP, including OHS regulations.
- Maintaining employment records, verifying minimum working age, and ensuring signed Workers' Codes of Conduct.
- Providing regular training on occupational safety, SEA/SH/VAC, and community relations.
- Ensuring primary suppliers address SEA/SH/VAC, child labor, forced labor, and OHS risks.
- Developing and implementing a grievance mechanism for contracted workers, resolving grievances promptly, and reporting to the PMU.
- Ensuring all workers sign the Code of Conduct and implement measures to prevent SEA/SH.
- Developing and enforcing COVID-19 prevention and mitigation plans.

Incident reporting

The contractors are required to inform DDIS and PMU any incidents listed below within agreed timeframe (e.g. 48 hours):

- Any violations to national laws, regulations, or international agreements.
- Any serious accidents or fatalities,
- Significant impacts that cause losses to personal property such as traffic accidents, damages to local houses/roads and other incidents.
- Serious surface/ground water pollution.
- Failures of embankments at disposal sites that cause serious pollutions to the surroundings,
- Fire related to worker's behaviours,
- Any claims related to SEA/SH/VAC, or any other incidents related to children, and
- Receive a complaint about pollution or damages.

9.4.6 Reporting Arrangements

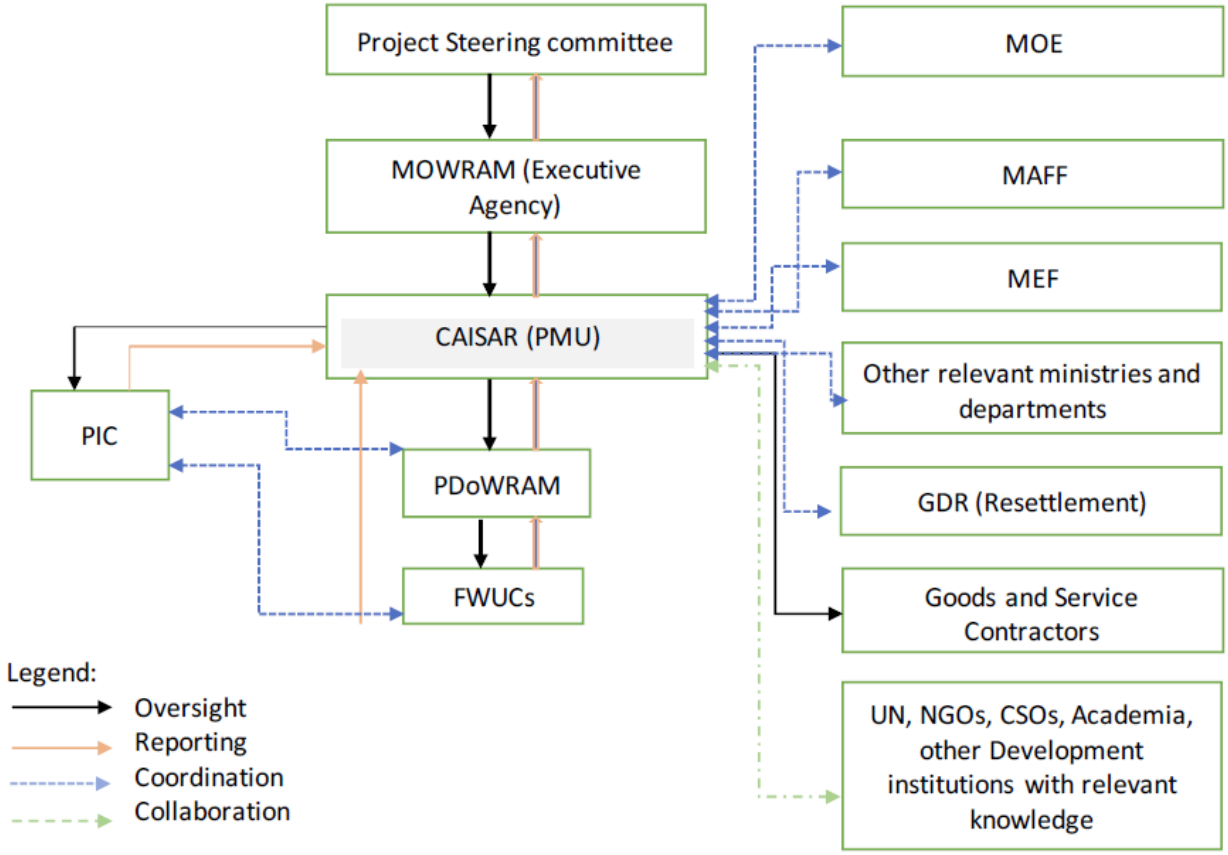
E&S performance will be included in both subproject and overall project progress reports. Safeguard specialists in each PPMU, with support from CSC/field engineers, will monitor and report on E&S performance. These specialists will submit monthly E&S reports at the subproject level to the CPMU. At the central level, the CPMU will prepare biannual E&S monitoring reports for submission to IFAD and the GCF, outlining project progress and compliance with SECAP/GCF safeguards.

The progress report to CPMU must provide sufficient details on subproject implementation and E&S issues related to ESCMF. The overall report from CPMU to IFAD and GCF will include: (i) preparation and disclosure of E&S instruments for subprojects; (ii) progress on ESCMP implementation, including ECOP/COC on SEA requirements in bidding documents; (iii) monitoring of contractor, CSC, and PPMU performance under ESCMP, ECOP, and COC on SEA; and (iv) challenges, solutions, and lessons learned during implementation. Table 9.5 summarizes reporting procedures.

Table 9.5: Report procedure

	Report Prepared by	**Types of Report**	**Project Com.**	**Submitted to**	**Frequency of Reporting**
1	Contractor to the Employer	Progress Report: Progress, issues and challenges, and suggestions	1, 2	PPMUs	Once before construction commences and monthly thereafter
2	Construction Supervision Consultant (CSC)	Monitoring report: Testing, inspection and observation results, status of construction: quality, conflict, compliance.	1, 2	PPMUs	Weekly and monthly
3	Community Monitoring	Monitoring report: Observation, complaints, solutions, challenges, and suggestion	1, 2	PPMUs	When the community has any complaint about the subproject E&S/ESCMF implementation
4	PPMUs	Progress Report: Progress, issues and challenges, and suggestions	1, 2, 3	CPMUs	Monthly
5	CPMUs	Progress Report: Progress, issues and challenges, and suggestions	1,	IFAD and GCF	Once every six (6)-months, in accordance with any signed legal agreements.

Figure 9.3: Stakeholder and flow in reporting of CAISAR project



(Source: Feasibility study report of CAISAR project)

CHAPTER 10 – PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

10.1 INTRODUCTION

This chapter, "Public Consultation and Information Disclosure," focuses on the consultation process and the dissemination of project-related information to ensure transparency and stakeholder engagement. It outlines the steps taken to involve local communities, relevant authorities, and other stakeholders in the consultation process, providing them with opportunities to voice their concerns, feedback, and suggestions. The chapter also details how information was disclosed to the public, ensuring that all parties had access to accurate and timely project data. The consultation involved a diverse group of people, including community members, local leaders, government representatives, and civil society organisations. The results of these consultations are critical in shaping the project's direction, addressing potential impacts, and fostering a more inclusive and collaborative decision-making process.

10.2 SUMMARY OF PUBLIC CONSULTATION PROCESS & RESULTS

10.2.1 The Consultation

10.2.1.1 Periods, Stakeholders and Purposes

Public consultation is a key component of CAISAR, and it was pivotal in preparation of the Environmental, Social, Climate Impact Assessment report (ESCA) Report and the Environmental, Social, Climate Management (ESCM) Plan. The consultations were conducted with relevant institutions, non-governmental organizations, local authorities, and local people during the preparation of ESCIA and ESCMP for CAISAR project. The data collection and consultations were conducted in four (4) periods:

- The first consultation was conducted between 26 and 28 July 2024 to capture information regarding biodiversity and environmental condition in the project area.
- The second consultation was conducted to consult with forestry and fishery communities, local authorities and key informants to understand the situation and concerns related to the presence of the project. The consultation was conducted between 03 and 09 August 2024.

- The third consultation was conducted at household, village, and commune level stakeholders focusing on status, concerns and feedback regarding the project implementation. This consultation was conducted between 10 and 18 August 2024.
- The last consultation was conducted between 21 and 23 August 2024 with the district and provincial stakeholders, mainly focusing on the opinion, and feedback regarding the implementation of the project.

In addition to the stated consultations, there are also continuous consultations being conducted with AIIB, IFAD, and CAISAR PMU including the PMU management, SECAP team, and engineering team to ensure that the disclosed information being aligned with the most updated information of the project.

Table 10.1: Number of participants being consulted for the ESCIA

Levels	**Household survey (Beneficiaries and Potentially Affected)**	**Focus Group Discussions**	**Key Informant Interviews**	**Total**
Village level	272 (134 Females)	309 (180 Females)	32 (3 Females)	613 (317 females)
Commune level			35 (11 Females)	35 (11 Females)
District level			28 (10 Females)	28 (10 Females)
Provincial level			51 (12 Females)	51 (12 Females)
			Total	**727 (350 Females)**

Table 10.2: Types of stakeholders, and topics of the consultations is shown below:

No.	Levels	Key topics	Methods	Timeframe	Participants	Concerns
1	Village	Beneficiary Households	Household Survey	10 - 18 August 2024	A household survey was carried out to gather information from local people living in the 31 villages neighbouring the ESCIA project area.	Refer to concerns and suggestions from consulted people in section 9.2.2.
		Potentially Affected Households				
		Rice farmers	FGDs	10 - 18 August 2024	309 persons (129 male and 180 female)	
		Vegetable producers				
		Chicken raisers				
		Duck raisers				
2	Commune	Commune Committee for Women and Children	Key Informant Interviews	26 - 28 July 2024 03 - 09 August 2024	31 persons (20 male and 11 female)	
		Agricultural Cooperatives				
		Water Farmer User Community				
		Fishermen				
		Community Forestry				

No.	Levels	Key topics	Methods	Timeframe	Participants	Concerns
		Community Fishery				
3	District	Offices of Development and Planning, Agriculture, Environment, Women Affairs,	Key Informant Interviews	21 - 23 August 2024	28 persons (18 male and 10 female)	
4	Province	Provincial Hall, Departments of Land, Water, Agriculture, Environment, Women Affairs, Labour, and Culture	Key Informant Interviews	26 - 28 July 2024 21 - 23 August 2024	51 persons (39 male and 12 female)	
		Non-Governmental Organizations				
		Biodiversity Expert				

10.2.1.2 Consultation Process

The purposes of the consultation were to:

- Inform local people and interested stakeholders of the purpose of the rehabilitation and construction of the irrigation system,
- Share the project information and the design options from the draft engineering design,
- Highlight subproject's key activities that potentially associated with them, and
- Collect their opinion, concern and feedback on the project focusing on background information, project potential impacts (positive and negative), suggestions for impact mitigations, and consultation mechanism.

The consultation agenda with stakeholders included (i) the introduction of the study team, (ii) sharing project information using illustration materials, (iii) discussion and consultation on potential benefits and impacts of the project, (iv) suggestions on the mitigation measures, (v) grievance process and concerns, and (vi) final wrap up for the consultation. The study team were trained to introduce themselves about the purpose of the consultation, followed by the introduction about the project's component and activities expected to be implemented within the area. Materials including leaflet on project information and map of the command area were shared and explained to stakeholder prior to the consultation. Lastly, the consultation began with an overall discussion and specific questions as per the relevant aspect to the stakeholder. Opinions, concerns and suggestions were gathered and confirmed prior to the end of the consultation.

10.2.2 Results of the Consultations

The result of the consultation is presented below summarizing what the consulted stakeholders perceived about the project, their concerns on the risks and impacts, and their feedback and suggestions to which the project should be taken care of. The results of the consultations include

general opinions, concerns and feedback on the project of stakeholders from focus group discussion, village leaders, commune councils, district authorities, provincial line departments, and provincial governments. The results from the consultations were also included in Chapter 06, and Chapter 08 to which they have been responded in the mitigation measures of the project. The synthesized results of the consultation are presented as per the identified VECs below.

10.2.2.1 Ou Ta Paong

10.2.2.1.1 Environment and Biodiversity Component

a. Pollution prevention and resource efficiency

Concerns

- The rehabilitation of irrigation canals and farm roads can disturb environmental effects.
- Large machines can generate noise and vibration pollution, which can disturb nearby residents and wildlife.
- The disposal of solid, liquid, and domestic waste from the workers at the irrigation construction site can negatively impact local air quality and surface water.

Suggestions from the consulted people

- Avoid construction at night.
- Install garbage bins and waste storage areas in the construction sites and conduct orientation workers to put the waste in the garbage bins.
- Government institutions and stakeholders should regularly conduct site inspections to inspect project activities that harm the environment and local community.

b. Biodiversity

Concerns

- CAISAR project may cause negative impacts on the environment, including changes in water quality, dust generation, air pollution, soil erosion, improper waste disposal, and hazardous waste from machinery.
- The project could disrupt the natural flow of water from upstream to Tonle Sap Lake, potentially harming the lake's biodiversity.
- Fish populations in command areas may decrease due to disrupting the natural flow of water and the impact on their habitats from the implementation of the irrigation infrastructure and canal upgrading.

Suggestions from the consulted people

- The contractors and relevant parties should conduct water quality and air quality monitoring during construction.
- Contractors must regularly monitor and inspect the living conditions of the workers, manage waste effectively, and provide adequate housing and sanitation facilities to them.

- Providing comprehensive training to workers on proper waste and oil management procedures.
- Activities such as fishing and hunting should be strictly prohibited to minimize environmental impact.
- The project should avoid construction activities and improve irrigation on fish and aquatic habitats.
- Prevent damage from the construction activities to biodiversity, habitats, and other environmental components.

c. GHG Emission

Concerns

- Climate change is negatively impacting rice production, causing problems such as insect infestations, and extended dry seasons,
- Waste and pollution may contribute to the emission of GHG

Suggestions from the consulted people

- The contractors should ensure that garbage bins are conveniently placed throughout the workers' camp and collaborates with a waste collection company to guarantee regular and efficient removal of waste.
- To minimize emissions, contractors are advised to refrain from using outdated machinery.

10.2.2.1.2 Social Component

a. Labor and Working Conditions

Concerns

- The presence of construction staff and workers at the community may lead to sexual exploitation or affecting women workers and women and children in the community.

Suggestions from the consulted people

- The construction companies should hire local workers to offer them jobs and strictly abide by laws and reduce the concerns about gender-based violence or sexual violence.
- Construction companies and relevant departments should provide training on gender issues, violence, labour laws, and social protections to their staff and workers.
- The project should allocate budget for relevant line departments to conduct relevant trainings to the companies and workers, and to monitor the construction sites

b. Community Health and Safety

Concerns

- Participants remain concerned that the presence of workers could result in sexual abuse of women and children living near the project site,

- Drug trafficking and consuming among workers may cause unsafe environment for both workers and surrounded residents,
- The construction activities may generate dust and slippery road conditions which may lead to traffic incidents,
- Waste generated from worker camps and construction activities during the project could degrade water quality, negatively impacting human health, livestock, and crops.

Suggestions from the consulted people

- The construction companies should regularly place warning signs and water the roads, as well as schedule construction times to minimize noise pollution that could disrupt the community,
- The project should promote gender awareness, enforce stricter punishments for offenders, and prevent drug trafficking in the workplace,
- The construction companies must collaborate with local authorities in all activities to make a proper management, control and monitoring during construction, and
- The project should conduct gender education at the district to prevent and address gender-based violence,

c. Land acquisition, economic and physical displacement

Concerns

- Conflicts between the project and affected families may arise, often driven by external influences rather than the families themselves.
- Land-owning farmers might lose their land for agriculture, which could compel them to migrate.

Suggestions from the consulted people

- The project should conduct a preliminary study on land issues before construction is going to be implemented, addressing specific aspects of land impact and conducting evaluations for each affected property,
- The project/construction company must collaborate with local authorities to resolve land-related issues, and compensation should be provided to landowners affected by the project,
- Farmers who own land may lose it for farming, which could force them to migrate, heightening their vulnerability to exploitation.

d. Cross–cutting risks and impacts

Concerns

- Unequal water distribution among farmers leads to conflicts.

- Institutions or companies responsible for establishing FWUCs are typically based at the national level, resulting in limited quality implementation weakening the FWUCs as PDWRAM is sidelined.
- The FWUCs struggle to generate income, making water management challenging, as there is no budget for repairs, leading to improper system operations.
- Farmers face various challenges such as pests, diseases, labor shortages, lack of capital, limited production techniques, flooding, unstable prices for vegetables and livestock, and high agricultural input costs.
- The provincial department lacks the budget to support the resolution of water user conflicts.
- Some farmers are absent from the rice fields during water distribution periods.
- Tensions between upstream and downstream villages arise when excess water released upstream during the wet season causes downstream flooding, while in the dry season, insufficient upstream water flow impacts downstream areas.
- High agricultural input costs continue to reduce farmers' profitability.
- Farmers do not follow official guidance on the size of rice fields to be cultivated, leading to inadequate water for irrigation.

Suggestions from the consulted people

- PDWRAM should be the leader in formulating the FWUCs with the support from national level,
- Water use and maintenance support should be provided including technical and management training, along with problem-solving techniques, to effectively control and manage water distribution,
- The project should thoroughly examine the water availability, technical and situational aspects of the sub-scheme before construction to prevent water shortages or flooding,
- Ensure transparent water supply to prevent disputes by holding meetings to plan water use and distribution, involving the district governor, commune council, and relevant stakeholders,
- All parties should also participate in the maintenance of the irrigation system and provide training or education on water conservation to farmers.
- Prior to starting irrigation rehabilitation, disseminate project information to people and stakeholders, and announce the construction period in advance.
- The water consumption fee should be gathered from farmers which could be used later to support caretakers and maintain the irrigation system.
- Increase the number of commune agricultural technical officers to provide training and monitor farmers' cultivation techniques.
- Build more water storages, and reservoirs such as ponds or wells and conduct training on water-saving techniques to adapt to actual water availability.

- Installing and upgrading the damaged sluice gates to improve water distribution efficiency and prevent water loss in agricultural production and irrigation systems.
- Facilitate the development of additional agricultural markets.
- Providing modern equipment and new techniques to department officers can enhance agricultural production efficiency and yield.

10.2.2.2 Lum Hach

10.2.2.2.1 Environment and Biodiversity Component

a. Pollution prevention and resource efficiency

Concerns

- During the construction stage, such as the rehabilitation of irrigation canals and farm roads, can have disturbing environmental effects.
- The disposal of liquid waste from the workers at the irrigation construction site will negatively impact local air quality and surface water.

Suggestions from the consulted people

- Government institutions and stakeholders should regularly conduct site inspections to reduce project activities that harm the environment and local community.
- Relevant ministries should conduct a visit to evaluate and address the issue of liquid waste from the construction activities in the commune.

b. Biodiversity

Concerns

- CAISAR project may cause negative impacts on the environment, including changes in water quality, and hazardous waste from machinery.
- The fish populations in command areas may decrease due to disrupting the natural flow of water and the impact on their habitats from the implementation of the irrigation infrastructure and canal upgrading.

Suggestions from consulted people

- To ensure the well-being of workers, contractors must regularly monitor and inspect the living conditions of the workers, manage waste effectively, and provide adequate housing and sanitation facilities to them.
- The contractor is responsible for providing comprehensive training to workers on proper waste management procedures.

c. GHG emission

Concerns

- Climate change is negatively impacting rice production, causing problems such as increased disease, insect infestations, and extended dry seasons,

- Waste and pollution may contribute to the emission of GHG

Suggestions from the consulted people

- Installing solar water pumps in agriculture processing facilities can reduce fuel consumption, which causes greenhouse gas emissions.

10.2.2.2.2 Social Component

a. Labor and Working Conditions

Concerns

- The presence of construction staff and workers at the community may lead to sexual exploitation or affecting women workers and women and children in the community.
- At the construction sites, some men may undervalue women's work. The gender disparities continue to exist, with some men holding the belief that women are not capable or willing to work.

Suggestions from the consulted people

- Construction companies should prioritize hiring local workers, comply strictly with laws, and take steps to mitigate concerns about gender-based and sexual violence.
- Construction companies and relevant departments should provide training on gender issues, violence prevention, labor laws, and social protections to their staff and workers.
- Additional support and monitoring measures should be put in place to prevent abuse, with any incidents being promptly addressed to avoid recurrence.
- Local authorities should regularly inspect construction sites to ensure no children are employed, taking immediate action if any issues are identified.
- The project should allocate funds to support relevant departments in providing training to companies and workers, as well as monitoring construction sites.

b. Community Health and Safety

Concerns

- The presence of workers could lead to the sexual abuse of women and children living near the project site.
- Drug trafficking and use among workers could create an unsafe environment for both workers and nearby residents.
- After construction is completed, there may be risks of people and animals falling into the canals, potentially leading to drowning incidents.
- Waste generated from worker camps and construction activities during the project could degrade water quality, negatively impacting human health, livestock, and crops.

Suggestions from the consulted people

- Construction companies should regularly place warning signs, water the roads, and schedule construction activities to minimize noise pollution that could disrupt the community.
- The project should promote gender awareness, enforce stricter penalties for offenders, and prevent drug trafficking in the workplace.
- Separate accommodations for men and women should be provided.
- Construction companies must collaborate with local authorities to ensure proper management, control, and monitoring throughout the construction phase.
- The project should conduct gender education at the district level to prevent and address gender-based violence.
- The project should establish gender outreach committees at the commune and village levels to monitor gender-related issues within the project areas, particularly during construction.

c. Land acquisition, economic and physical displacement

Concerns

- Landowners along the irrigation system without proper land registration are concerned they may not receive compensation due to the lack of title deeds.
- While the project supports agricultural production, it may not benefit poor families who do not own land for farming.
- Conflicts between the project and affected families may arise, often instigated by external parties rather than the families themselves.
- Land-owning farmers could lose their land, potentially forcing them to migrate, increasing their vulnerability to exploitation and potentially causing their children to drop out of school.

Suggestions from the consulted people

- The project should conduct a preliminary study on land issues before starting construction, addressing specific land impacts and evaluating each affected property.
- The project or construction company must work closely with local authorities to resolve land-related issues, and compensation should be provided to landowners affected by the project.

d. Cross–cutting risks and impacts

Concerns

- Construction companies might disregard concerns raised by local authorities and communities regarding the actual conditions of the area.
- The high cost of agricultural inputs continues to reduce farmers' profits,
- Farmers do not follow the guidance from authorities regarding the size of rice land areas that should be cultivated causing inadequate water for irrigation,

- Manure for fertilizer is declining due to reduced animal raising and lower cattle prices are prompting farmers to reduce livestock raising
- Besides water issues, farmers also struggle with pests, diseases, inadequate labour, lack of capital, limited production technique, flooding, unstable sale price (vegetable and animal) and high agricultural input costs,
- The provincial department lacks budget to support water user conflict resolution,

Suggestions from the consulted people

- A proper handover to local authorities upon project completion should be conducted to avoid quiet handovers,
- Women should be engaged and be promoted as the members of Water User Community to promote water distribution equality regarding water allocation from the system,
- Closed monitoring and support to FWUCs are critical and should be conducted regularly by all levels,
- Water use and maintenance support should be provided including technical and management training, along with problem-solving techniques, to effectively control and manage water distribution,
- Ensure transparent water supply to prevent disputes by holding meetings to plan water use and distribution, involving the district governor, commune council, and relevant stakeholders,
- All parties should also participate in the maintenance of the irrigation system and provide training or education on water conservation to farmers.
- Prior to starting irrigation rehabilitation, organize a public forum to gather feedback from local residents, disseminate project information to people and stakeholders, and announce the construction period in advance.
- The water consumption fee should be gathered from farmers which could be used later to support caretakers and maintain the irrigation system.
- Build more water storages, and reservoirs such as ponds or wells and conduct training on water-saving techniques to adapt to actual water availability.
- Installing and upgrading the damaged sluice gates to improve water distribution efficiency and prevent water loss in agricultural production and irrigation systems.
- Facilitate the development of additional agricultural markets.

10.2.2.3 Brambei Mom

10.2.2.3.1 Environment and Biodiversity Component

a. Pollution prevention and resource efficiency

Concerns

- Stakeholders did not express concern about the pollution caused by the rehabilitation and construction of the irrigation system.
- The construction process can release dust, which will disturb the local community and surface water quality.

Suggestions from the consulted people

- Regularly watering on the road transports construction materials and soil to reduce dust that may disturb nearby residents.

b. Biodiversity

Concerns

- Participants did not address the concerns related to the impact of construction activities on local biodiversity; instead, they highlighted the positive effects on fish and aquaculture habitant and movement.

Suggestions from the consulted people

- Prevent damage from the construction activities to biodiversity, habitats, and other environmental components.

c. GHG emission

Concerns

- Climate change is negatively impacting rice production, causing problems such as increased disease, insect infestations, and extended dry seasons,

Suggestions from the consulted people

- Installing solar water pumps in agriculture processing facilities can reduce fuel consumption, which causes greenhouse gas emissions.

10.2.2.3.2 Social Component

a. Labor and Working Conditions

Concerns

- The presence of construction staff and workers at the community may lead to sexual exploitation or affecting women workers and women and children in the community.

Suggestions from the consulted people

- The construction companies should hire local workers to offer them jobs and strictly abide by laws and reduce the concerns about gender-based violence or sexual violence.
- Construction companies and relevant departments should provide training on gender issues, violence, labour laws, and social protections to their staff and workers.
- Additional support and monitoring measures should be implemented to prevent abuse, and any incidents should be promptly addressed to prevent recurrence.

- The project should allocate budget for relevant line departments to conduct relevant trainings to the companies and workers, and to monitor the construction sites

b. Community Health and Safety

Concerns

- Participants remain concerned that the presence of workers could result in sexual abuse of women and children living near the project site,
- Drug trafficking and consuming among workers may cause unsafe environment for both workers and surrounded residents,
- The construction activities may generate dust and slippery road conditions which may lead to traffic incidents,

Suggestions from the consulted people

- The construction companies should regularly place warning signs and water the roads, as well as schedule construction times to minimize noise pollution that could disrupt the community,
- The project should promote gender awareness, enforce stricter punishments for offenders, and prevent drug trafficking in the workplace,
- The construction companies must collaborate with local authorities in all activities to make a proper management, control and monitoring during construction, and
- The project should conduct gender education at the district to prevent and address gender-based violence,
- Separate accommodations for men and women should be provided,
- The project should establish gender outreach committees at the commune and village levels to monitor the gender related issues within the project areas, especially during construction,

c. Land acquisition, economic and physical displacement

Concerns

- Conflicts between the project and affected families could emerge, often fuelled by external instigators rather than the families themselves,

Suggestions from the consulted people

- Preliminary study on land issues before construction is recommended, with each sector addressing specific aspects of land impact and conducting evaluations for each affected property.
- The project/construction company must collaborate with local authorities to resolve land-related issues, and compensation should be provided to landowners affected by the project.

- The government is requested to assist in issuing land titles to farmers with land adjacent to streams and canals.

d. Cross–cutting risks and impacts

Concerns

- Climate change is negatively impacting rice production, causing problems such as increased disease, insect infestations, and extended dry seasons,
- The high cost of agricultural inputs continues to reduce farmers' profits,
- Manure for fertilizer is declining due to reduced animal raising and lower cattle prices are prompting farmers to reduce livestock raising.
- Farmer Water User Group (FWUG) is not well-functioning.

Suggestions from the consulted people

- Providing technical and management training, materials supported to existing Farmer Water User Group (FWUG) to oversee water use and maintenance effectively control and manage water distribution.
- Restore the Brambei Mom dam to its original height to improve water storage capacityand Stueng Krang Ponley with its sub-canal to improve water distribution.
- Improving the Anlong Chrey Reservoir and upgrading the sluice gate can help prevent flooding and better manage water resources.
- Request to produce more water sources, and reservoirs which are able to store more water due to the previous canals and dams are narrow and shallow, limited effective water distribution and set up quickly which can improve agricultural production.
- Utilizing durable concrete for the canal system can improve the efficiency and longevity of the irrigation infrastructure.
- Installing and upgrading damaged sluice gates in both main and secondary canals can improve water distribution efficiency and prevent water loss in agricultural production and irrigation systems.
- Construct both side roads along the canal to enhance transportation for farmers and traders.
- The project should thoroughly examine the technical and situational aspects of the sub-scheme before construction to prevent water shortages or flooding post-construction, and it should be implemented promptly.

10.2.2.4 Krapeu Truom

10.2.2.4.1 Environment and Biodiversity Component

a. Pollution prevention and resource efficiency

Concerns

- The construction process can release dust, which will disturb the local community and surface water quality.
- The disposal of solid, liquid, and domestic waste from the workers at the irrigation construction site will negatively impact local air quality and surface water.

Suggestions from the consulted people

- Regularly watering on the road transports construction materials and soil to reduce dust that may disturb nearby residents.
- Install garbage bins and waste storage areas in the construction sites and conduct orientation workers to put the waste in the garbage bins.

b. Biodiversity

Concerns

- The fish populations in command areas may decrease due to disrupting the natural flow of water and the impact on their habitats from the implementation of the reirrigation infrastructure and canal upgrading.

Suggestions from the consulted people

- The project should avoid construction activities and improve irrigation on fish and aquatic habitats.
- Prevent damage from the construction activities to biodiversity, habitats, and other environmental components.
- Maintain existing large trees along the dam and canal within the sub-schemes during the irrigation and upgrading process.

c. GHG emission

Concerns

- Climate change is negatively impacting rice production, causing problems such as increased disease, insect infestations, and extended dry seasons,

Suggestions from the consulted people

- Installing solar water pumps in agriculture processing facilities can reduce fuel consumption, which causes greenhouse gas emissions.

10.2.2.4.2 Social Component

a. Labor and Working Conditions

Concerns

- The presence of construction staff and workers could lead to gender-based violence affecting women workers, women and children in the community.

Suggestions from the consulted people

- Should offer training to their staff and workers on gender issues, violence, and legal protections.
- Preventive support measures should also be put in place to stop abuse, and any incidents must be swiftly handled to avoid repetition. The training should be conducted by technical officers.

b. Community Health and Safety

Concerns

- Concerns about the presence of workers could cause sexual abuse of women and children living near the project site

Suggestions from the consulted people

- To prevent incidents, construction staff should regularly place warning signs and water the roads, as well as schedule construction times to minimize noise pollution that could disrupt the community and notify authorities upon project completion to avoid quiet handovers.

c. Land acquisition, economic and physical displacement

Concerns

- Landowners along the irrigation system without land registration are concerned they may not receive compensation due to the lack of title deeds.
- Conflicts between the project and affected families could emerge, often fuelled by external instigators rather than the families themselves.

Suggestions from the consulted people

- A preliminary study on land issues before construction is recommended, with each sector addressing specific aspects of land impact and conducting evaluations for each affected property.
- The project/construction company must collaborate with local authorities to resolve land-related issues, and compensation should be provided to landowners affected by the project.
- The construction company should submit quarterly monitoring reports on implementation activities to the provincial department to identify and quickly resolve any issues.
- The government is requested to assist in issuing land titles to farmers with land adjacent to streams and canals.

d. Cross–cutting risks and impacts

Concerns

- Provincial department facing of limited budget to develop and rehabilitate the existing irrigation system

Suggestions from the consulted people

- The project should thoroughly examine the technical and situational aspects of the sub-scheme before construction to prevent water shortages or flooding post-construction, and it should be implemented promptly.
- Establish a Farmer Water User Group (FWUG) to oversee water use and maintenance by providing technical and management training, materials supported to effectively control and manage water distribution.
- The water consumption fee should be gathered from farmers which could be used later to support caretakers and maintain the irrigation system.

e. Agricultural Production

Concerns

- The high cost of agricultural inputs continues to reduce farmers' profits.
- Climate change is negatively impacting rice production, causing problems such as increased disease, insect infestations, and extended dry seasons.
- Manure for fertiliser is declining due to reduced animal raising and lower cattle prices are prompting farmers to reduce livestock raising.

Suggestions from the consulted people

- Build more water storage and reservoir which able to store more water
- The irrigation should be constructed based on technical and water conditions in the area.
- Utilizing durable concrete for the canal system can improve the efficiency and longevity of the irrigation infrastructure.
- Installing and upgrading damaged sluice gates in both main and secondary canals can improve water distribution efficiency and prevent water loss in agricultural production and irrigation systems.
- Construct both side roads along the canal to enhance transportation for farmers and traders.

10.2.2.5 Yutasas

10.2.2.5.1 Environment and Biodiversity Component

a. Pollution prevention and resource efficiency

Concerns

- The construction process can release dust, which will disturb the local community and surface water quality.
- The disposal of solid, liquid, and domestic waste from the workers at the irrigation construction site will negatively impact local air quality and surface water.

Suggestions from the consulted people

- Regularly watering on the road transports construction materials and soil to reduce dust that may disturb nearby residents.

- Relevant ministries should conduct a visit to evaluate and address the issue of liquid waste from the construction activities in the commune.

b. Biodiversity

Concerns

- CAISAR project may cause changes in water quality, dust generation, air pollution, soil erosion, improper waste disposal, and hazardous waste from machinery.
- The fish populations in command areas may decrease due to disrupting the natural flow of water and the impact on their habitats from the implementation of the irrigation infrastructure and canal upgrading.

Suggestions from the consulted people

- Contractors must regularly monitor and inspect the living conditions of the workers, manage waste effectively, and provide adequate housing and sanitation facilities to them.
- The project should avoid construction activities and improve irrigation on fish and aquatic habitats.
- Prevent damage from the construction activities to biodiversity, habitats, and other environmental components.

c. GHG emission

Concerns

- Waste and pollution may contribute to the emission of GHG

Suggestions

- Contractors are advised to refrain from using outdated machinery.

10.2.2.5.2 Social Component

a. Labor and Working Conditions

Concerns

- The presence of construction staff and workers at the community may lead to sexual exploitation or affecting women workers and women and children in the community.
- Under 18 years old workers may be involved for the construction phase as they are eligible to work in factories or other companies that adhere to laws,
- At the construction sites, some men may undervalue women's work. The gender disparities continue to exist, with some men holding the belief that women are not capable or willing to work.

Suggestions from the consulted people

- The construction companies should hire local workers to offer them jobs and strictly abide by laws and reduce the concerns about gender-based violence or sexual violence.

- Construction companies and relevant departments should provide training on gender issues, violence, labour laws, and social protections to their staff and workers.
- Additional support and monitoring measures should be implemented to prevent abuse, and any incidents should be promptly addressed to prevent recurrence.
- Local authorities should regularly monitor and inspect construction sites to ensure no children are working there, taking immediate action if any issues arise.

b. Community Health and Safety

Concerns

- The presence of workers could result in sexual abuse of women and children living near the project site,
- Drug trafficking and consuming among workers may cause unsafe environment for both workers and surrounded residents,
- After the construction complete, there may also be the risks of humans and animals falling into the canals causing drowning,
- Waste generated from worker camps and construction activities during the project could degrade water quality, negatively impacting human health, livestock, and crops.

Suggestions from the consulted people

- The construction companies should regularly place warning signs and water the roads, as well as schedule construction times to minimize noise pollution that could disrupt the community,
- The project should promote gender awareness, enforce stricter punishments for offenders, and prevent drug trafficking in the workplace,
- Separate accommodations for men and women should be provided,
- The construction companies must collaborate with local authorities in all activities to make a proper management, control and monitoring during construction, and
- The project should conduct gender education at the district to prevent and address gender-based violence,
- The project should establish gender outreach committees at the commune and village levels to monitor the gender related issues within the project areas, especially during construction,
- The project should equip the solar lights along the roads to promote the safety of travellers during nighttime,

c. Land acquisition, economic and physical displacement

Concerns

- While the project supports agricultural production, it may not benefit poor families who do not have land for farming,

- Conflicts between the project and affected families could emerge, often fuelled by external instigators rather than the families themselves, and
- Farmers who own land may lose it for farming, which could force them to migrate, heightening their vulnerability to exploitation and potentially causing their children to drop out of school.

Suggestions from the consulted people

- The project should conduct a preliminary study on land issues before construction is going to be implemented, addressing specific aspects of land impact and conducting evaluations for each affected property,
- The project/construction company must collaborate with local authorities to resolve land-related issues, and compensation should be provided to landowners affected by the project,
- If business land is impacted, the government or provincial authorities should provide temporary business premises,
- Advocacy for voluntary land contributions should be encouraged, as the project benefits both the community and individuals, and the restoration of old canals is supported to improve agricultural activities, and
- The construction company should submit quarterly monitoring reports on implementation activities to the provincial department to identify and quickly resolve any issues which affect the livelihood of the community people.

d. Cross–cutting risks and impacts

Concerns

- Unequal water distribution among farmers leads to partisanship and disputes, often because farmers do not adhere to water distribution instructions or announcements from authorities,
- The FWUC could not generate income, causing the management of the water being difficult such as having no budget for repair, resulting in improper operation of the system,
- Besides water issues, farmers also struggle with pests, diseases, inadequate labour, lack of capital, limited production technique, flooding, unstable sale price (vegetable and animal) and high agricultural input costs,
- The provincial department lacks budget to support water user conflict resolution,
- Tensions arise between upstream and downstream villages when water use upstream results in flooding downstream due to excess water being released during the wet season. Conversely, during the dry season, upstream water flow to downstream areas is insufficient.
- Manure for fertiliser is declining due to reduced animal raising and lower cattle prices are prompting farmers to reduce livestock raising.

Suggestions from the consulted people

- A proper handover to local authorities upon project completion should be conducted to avoid quiet handovers,
- Women should be engaged and be promoted as the members of Water User Community to promote water distribution equality regarding water allocation from the system,
- Closed monitoring and support to FWUCs are critical and should be conducted regularly by all levels,
- Water use and maintenance support should be provided including technical and management training, along with problem-solving techniques, to effectively control and manage water distribution,
- Ensure transparent water supply to prevent disputes by holding meetings to plan water use and distribution, involving the district governor, commune council, and relevant stakeholders,
- Prior to starting irrigation rehabilitation, organize a public forum to gather feedback from local residents, disseminate project information to people and stakeholders, and announce the construction period in advance.
- Increase the number of commune agricultural technical officers to provide training and monitor farmers' cultivation techniques.
- Build more water storages, and reservoir such as ponds or wells and conduct training on water-saving techniques to adapt to actual water availability.
- Installing and upgrading the damaged sluice gates to improve water distribution efficiency and prevent water loss in agricultural production and irrigation systems.
- Facilitate the development of additional agricultural markets.

10.2.2.6 Steung Krang Bat

10.2.2.6.1 Environment and Biodiversity Component

a. Pollution prevention and resource efficiency

Concerns

- The construction process may generate dust that could disturb the local community.
- Waste from solid, liquid, and domestic sources produced by workers at the irrigation construction site may have adverse effects on local air quality and surface water.

Suggestions from the consulted people

- Regularly watering roads used for transporting construction materials and soil is recommended to minimize dust disturbance to nearby residents.
- Conduct site visits to assess and address issues related to liquid waste from construction activities within the commune.

b. Biodiversity

Concerns

- The CAISAR project may have negative environmental impacts, such as dust generation and air pollution.
- Construction activities could potentially affect fish habitats and aquaculture.

Suggestions from the consulted people

- Measures should be taken to prevent damage to biodiversity, habitats, and other environmental components due to construction activities.

c. GHG emission

Overall Opinion

- Minor greenhouse gas (GHG) emissions could contribute to global GHG levels due to activities like transportation, agricultural practices, the decomposition of agricultural waste, and its burning.

Concerns

- Waste and pollution may also contribute to GHG emissions.

Suggestions from the consulted people

- Participants did not provide any suggestion for greenhouse gas emissions.

10.2.2.6.2 Social Component

a. Labor and Working Conditions

Concerns

- The presence of construction staff and workers at the community may lead to sexual exploitation or affecting women workers and women and children in the community.
- Under 18 years old workers may be involved for the construction phase as they are illegible to work in factories or other companies that adhere to laws,
- At the construction sites, some men may undervalue women's work. The gender disparities continue to exist, with some men holding the belief that women are not capable or willing to work.

Suggestions from the consulted people

- The construction companies should hire local workers to offer them jobs and strictly abide by laws and reduce the concerns about gender-based violence or sexual violence.
- Construction companies and relevant departments should provide training on gender issues, violence, labour laws, and social protections to their staff and workers.
- Local authorities should regularly monitor and inspect construction sites to ensure no children are working there, taking immediate action if any issues arise.

b. Community Health and Safety

Concerns

- The presence of workers could result in sexual abuse of women and children living near the project site,
- Drug trafficking and consuming among workers may cause unsafe environment for both workers and surrounded residents,

Suggestions from the consulted people

- The project should promote gender awareness, enforce stricter punishments for offenders, and prevent drug trafficking in the workplace,
- Separate accommodations for men and women should be provided,
- The construction companies must collaborate with local authorities in all activities to make a proper management, control and monitoring during construction, and
- The project should conduct gender education at the district to prevent and address gender-based violence.

c. Land acquisition, economic and physical displacement

Concerns

- Conflicts between the project and affected families could emerge, often fuelled by external instigators rather than the families themselves
- Farmers who own land may lose it for farming, which could force them to migrate, heightening their vulnerability to exploitation.

Suggestions from the consulted people

- The project should conduct a preliminary study on land issues before construction is going to be implemented, addressing specific aspects of land impact and conducting evaluations for each affected property,
- The project/construction company must collaborate with local authorities to resolve land-related issues, and compensation should be provided to landowners affected by the project.
- The construction company should submit quarterly monitoring reports on implementation activities to the provincial department to identify and quickly resolve any issues which affect the livelihood of the community people.

d. Cross–cutting risks and impacts

Concerns

- Unequal water distribution among farmers leads to partisanship and disputes, often because farmers do not adhere to water distribution instructions or announcements from authorities,
- The FWUC could not generate income, causing the management of the water being difficult such as having no budget for repair, resulting in improper operation of the system,

- Besides water issues, farmers also struggle with pests, diseases, inadequate labour, lack of capital, limited production technique, flooding, unstable sale price (vegetable and animal) and high agricultural input costs,
- Construction companies might disregard concerns raised by local authorities and communities regarding the actual conditions of the area.
- The construction of the system may cause water shortages downstream of the Stung Krang Ponley area.
- Agricultural production in the Stueng Krang Bat command area is not a potential sector where land is infertile and expensive, and a garment factory is preferable.
- The provincial department lacks budget to support water user conflict resolution,

Suggestions from the consulted people

- A proper handover to local authorities upon project completion should be conducted to avoid quiet handovers,
- Women should be engaged and be promoted as the members of Water User Community to promote water distribution equality regarding water allocation from the system,
- Closed monitoring and support to FWUCs are critical and should be conducted regularly by all levels,
- Water use and maintenance support should be provided including technical and management training, along with problem-solving techniques, to effectively control and manage water distribution,
- Ensure transparent water distribution to prevent disputes by holding meetings to plan water use and distribution, involving the district governor, commune council, and relevant stakeholders,
- Prior to starting irrigation rehabilitation, organize a public forum to gather feedback from residents, disseminate project information to people and stakeholders, and announce the construction period in advance.
- Build more water storages, and reservoirs such as ponds or wells and conduct training on water-saving techniques to adapt to actual water availability.
- Installing and upgrading the damaged sluice gates to improve water distribution efficiency and prevent water loss in agricultural production and irrigation systems.

10.3 INFORMATION DISCLOSURE

The ESCIA Report and ESCMPs are required to be disclosed to the public as per respective requirements of the AIIB, IFAD and GCF. Under CAISAR, the ESCIA Report and ESCMPs will be disclosed in full text in English, and in the form of executive summary in Khmer language. In addition, a Non-Technical Summary will be prepared for the ESCIA in Khmer and will be disclosed in both English and Khmer language. The Non-Technical Summary will present briefly the

meaningful information on the Project. Language will be easy to understand. The NTS may include:

a) A summary of project descriptions (purpose, project components and activities.
b) Key project implementation approach (including use of mitigation hierarchy)
c) E&S baselines;
d) E&E methods and monitoring report;
e) Key E&S risks and impacts (both positive and adverse impacts);
f) Key mitigation measures and recommended actions;
g) A summary of the stakeholder engagement process and results.
h) A summary of key Environmental and Social (E&S) instruments and monitoring reports.

10.4 GRIEVANCE REDRESS MECHANISM (GRM)

The environmental and social policies of AIIB, IFAD, and GCF require the Lead Agency to establish a Grievance Redress Mechanism (GRM) for project-affected parties. The GRM should address concerns regarding environmental and social performance and must include:

- Multiple ways to submit grievances (in person, by phone, email, etc.).
- A system to log grievances and maintain them in a database.
- Clear, publicly available procedures for acknowledging, responding to, and resolving grievances.
- Transparency about the process, decision makers, and an appeals process, including judicial options if needed.
- Mediation may be offered if users are unsatisfied with the resolution.

Contracted workers can also use the GRM for workplace-related concerns, and they will be informed about it during recruitment with assurances of protection from reprisals.

The GRM will be set up by implementing agencies before project activities begin and will provide quick resolutions at the lowest necessary level. Complaints can be lodged verbally, in writing, or electronically, and the process includes detailed logging of complaint details, actions taken, contact points, and final resolution with the complainant's acknowledgment.

The project Stakeholder Engagement Plan has prepared the GRM which will be used as the basis for the project implementation. The following is the adopted mechanism to be applied under the project.

10.4.1 Objectives of the Project GRMs

The objective of the GRM is to provide affected persons with redress procedures that can be conveniently used to raise a project related concern or grievance. The GRM guides how a complaint can be lodged, including forms and channels through which a complaint can be

submitted. To facilitate the grievance resolution process, grievances received will be acknowledged in writing and solved within a specified timeframe. During the resolution process, where necessary, dialogue will be held with aggrieved people for mutual understanding and effective resolution. Once a complaint is resolved, the aggrieved person will be notified of the resolution results.

The GRM has sequential steps that an aggrieved person can use. If the aggrieved person is not satisfied with the grievance resolution result, or if their complaint is not resolved within the timeframe specified for a particular step, the aggrieved person can move on to the next step which is higher in resolution hierarchy. The project has an appeal process where complainants can resort if they are not satisfied with a resolution decision at a particular step, or their complaints are not resolved within a specified timeframe.

10.4.2 Summary of National Legislation Related to Grievance and Complaint

The RGC has various laws and sub-decrees that have been in place to guide the implementation of the complaint resolution process. These documents specify the right of the complainants as well as the responsibilities of concerned governmental agencies as to complaint resolution. Relevant legal documents include:

- Law on Expropriation (dated 26 February 2010)
- Labor Law (dated 13 March 1997, amended on 20 July 2007 and 26 June 2018)
- Law on Prevention of Domestic Violence and Protection of Victims (dated 24 October 2005)
- Sub-decree No. 22 ANK/BK (2018) on Standard Operating Procedures for Land Acquisition and Involuntary Resettlement for Externally Financed Projects in Cambodia. Guidelines for Grievance Redress Mechanism (Appendix 8)
- Law on Administrative Management of Capital, Provinces, Municipalities, Districts and Khans (dated 22 May 2008) – Section 6 on Solution of Local Conflicts
- Sub-decree No. 22 (25 March 2002) on Decentralization of Roles, Functions, and Power to Commune Councils (Article 61: duty to promote the role of conciliating disputes between citizens)
- Sub decree No 47 ANK.BK (31 May 2002) on Organization and Functioning of the Cadastral Commission (Chapter 4 – District/Khan Level Conciliation).

10.4.3 Principles of the Project GRMs

Under CAISAR, the following principles will be applied:

- **Channels.** Different channels are established to enable affected persons to submit their grievances, including submission to village committee, as well as district and provincial levels.
- **Forms.** Grievances can be submitted in writing and verbally, and either directly by the affected households, or by a person delegated by the complainant.
- **Complainant can delegate a representative who acts on their behalf. A** person lodging a grievance can ask assistance from their family or from an individual to act as their representative.
- **Disclosure.** GRM procedures are disclosed in public domain (e.g., websites of PMU, public notice board at village hall, and in front of substation).
- **Documentation.** A grievance logbook will be maintained at substation (subproject level) and at PMU level (through PMU GRM focal point).
- **Transparency.** Grievance procedures include steps, time frame for grievance resolution for each step, notification to affected person, how decision is made.
- **Acknowledgement.** The unit in charge of complaint resolution will notify the complainant upon complaint receipt and will initiate the complaint resolution process.
- **Appeal.** If the agency in charge does not resolve a grievance in a manner that is satisfactory to the affected person, a multi stakeholder committee will be established (ad-hoc) to resolve the dismissed grievance – as an alternative for the affected person going to court.
- **Monitoring.** All grievances received are recorded by PMU and relevant substations, and are processed/resolved in a given timeframe, and are monitored by PMU GRM focal point.
- **Time-limit.** Time-limit is specified for each step in the grievance resolution process.
- **Complainants bear no costs.** Complaint resolution is free of charge to aggrieved persons. However, if the complaints bring their case to court, they will bear the costs associated with their lawsuit.
- Any grievance concerning urgent health and safety issues shall be resolved immediately.

10.4.4 Project's Redress Procedures

The project has in place complaint handling procedures for three (3) types of potential grievances, including grievances related to 1) land acquisition, 2) labour and working conditions, and 3) sexual exploitation and abuse and sexual harassment (SEA/SH/GBV/GBV), and 3) general complaints. These procedures are established based on the above GRM principles and are in accordance with pertinent national legislation. The GRM for complaints related to land acquisition is provided

in the project's Resettlement and Policy Framework (RPF) and that for IPs is provided in the project's IPPF. Summary for the above four (4) procedures is provided below:

10.4.4.1 Redress Procedure for Complaints related to Land Acquisition

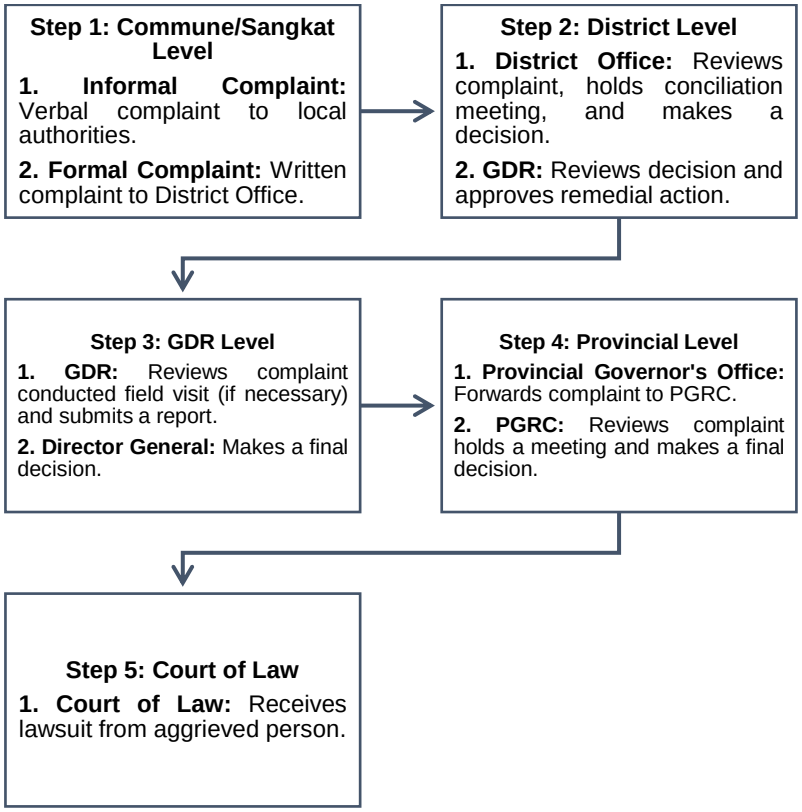
Under this project, to facilitate the grievance redress, the informal and formal steps are combined for convenient use of affected people, as follows:

- **Step 1 – Commune/Sangkat level.** APs will seek assistance from commune/Sangkat chief or community elders who will discuss with the leader of the PRSC-WG to find a solution. Verbal grievances can be provided to the commune/Sangkat chief or community elders. So, no written complaint is required. It is noted that even if the complaint is made verbally, the complaint will be registered in the project's logbook, including resolution process and result for such verbal grievance for monitoring purposes. Upon receipt of the verbal complaint, the PRSC-WG will consult with the IRC-WG to ensure the complaint is addressed timely. If the grievance is not resolved to the satisfaction of the AP, or if the AP prefers, s/he may lodge their complaint through the formal route which includes the steps below.

- **Step 2 – District level.** AH can lodge a written complaint to the Head of the District Office (where the subproject is located). The AH can bring a community elderly or their representative to discuss their grievance at the District Office. A conciliation meeting shall be held, and a decision be made within 15 working days from the date of complaint is received by the District Office. If the complaint is resolved to the satisfaction of the AH, the IRC-WG will inform GDR's Department of Internal Monitoring and Data Management (DIMDM) who will review and seek the approval of the Director General of GDR for appropriate remedial action. GDR will inform the AF of the decision/ remedial action within 15 working days from the receipt of the grievance by the District Office. If the complaint is rejected at this step, the District Office will inform the AH of the rejection in writing. If the complainant is not satisfied with the decision/resolution result, s/he can proceed to step 3 (below).

- **Step 3 – GDR level.** The complainant who is not satisfied with the proposed resolution from Step 2 shall lodge a written complaint to the GDR for resolution. The GDR, through its DIMDM, will carry out a holistic review of the complaint and submit a report on its findings with the relevant recommendations, if any, to the Director General of GDR for review and decision. GDR may conduct a field visit to meet the complaint and the IRC-WG to gather relevant information. The final report must be completed within 30 working days from the date of receipt of the complaint by GDR for submission to the Director General of GDR who will make a final decision within 5 working days of receipt of the final report. In the event that the subject matter requires a policy level intervention, it will be referred to the IRC for a decision which may require that an additional 10 working days be extended from the original deadline for final decision.

Figure 10.1: Redress Procedure for Complaints related to Land Acquisition



- **Step 4 – Provincial level.** AH will submit a written complaint to the PGRC through the Provincial Governor's Office. The complainant or a representative will be given an opportunity to present its case during a meeting and the PGRC may consider any compelling and special circumstances of the AH to inform their decision. The GDR will send a representative, as a non-voting member, to provide an explanation to the rejection of the complaint at Step 3 with the GDR. The decision of the PGRC must be made on a consensus basis and will be final and binding except when the matter relates to the government's policy. Decisions related to government's policy matters on land acquisition and resettlement are decided by the IRC. The PGRC will have 40 working days from the date of receipt of the complaint to reach a final decision. The decision of the PGRC will be sent to the IRC (through the GDR) for endorsement before any remedial action is taken. There are no fees or charges levied on the AH for their lodgement of complaint and for complaint resolution for the above 4 steps.

- **Step 5 – Court of Law.** If the aggrieved person prefers filing a lawsuit at the Provincial/Municipal Courts, as applicable, to seek a resolution, AP can do so but will bear cost related to the lawsuit as per the Expropriation Law. When the case is brought to a Court of Law, there is no involvement of the GDR, PRSC or IRC-WG unless there is a judicial order from the competent courts.

10.4.4.2 Redress Procedure for Complaints Related to Labor and Working Conditions

Project workers can lodge their grievance/complaint as follows:

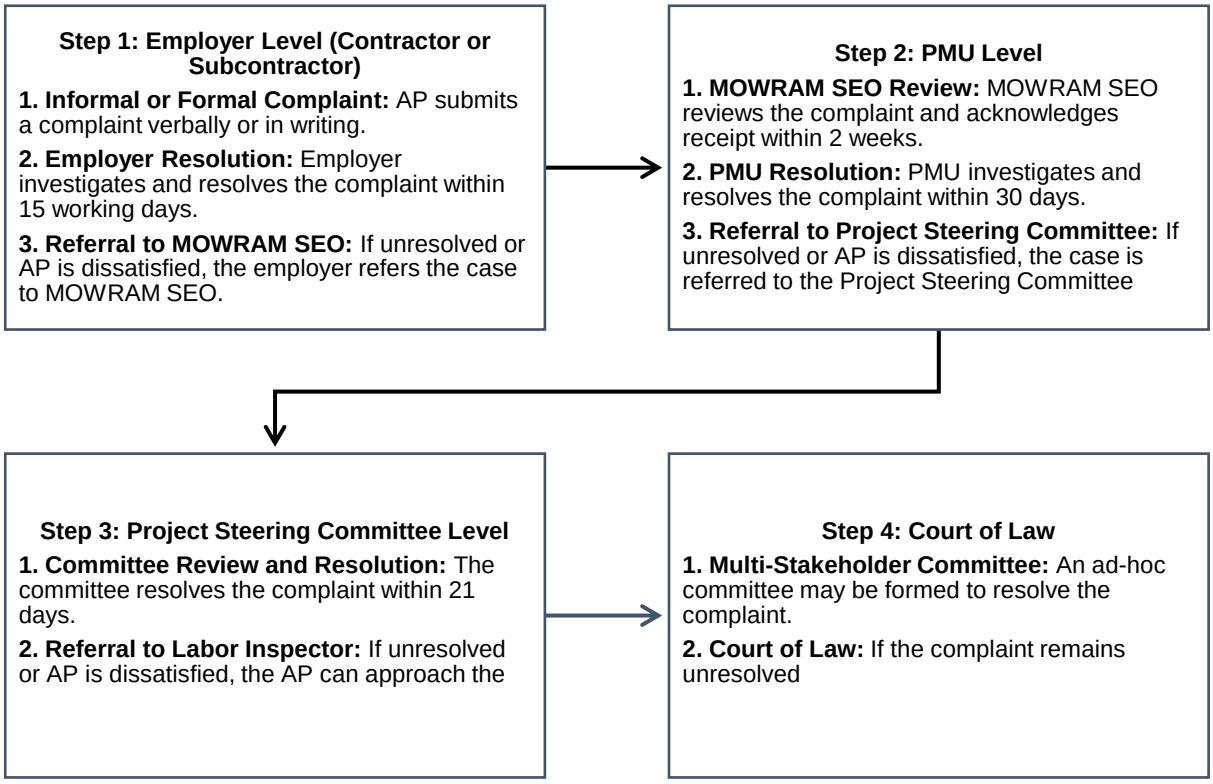
- **Step 1 – Employer Level (Contractor and Subcontractor).** Aggrieved person (AP) can submit their grievance to their Employer who serves as the first focal point for receiving and resolving grievances. Grievance can be lodged verbally or in writing, in person or by phone, text message, mail or email (anonymous complaint is accepted). The Employer involved will resolve the case no later than 15 working days. Once resolved and the AP is satisfactory, the Employer will report the case, including resolution process and results, to the SEO of the MOWRAM for information and record. If the AP is not satisfied with the resolution of their Employer, the Employer will refer the AP to the SEO of MOWRAM, if needed and inform the AP of this referral. It is noted that if a complaint concerns the safety and health of one or several individuals, such a complaint shall be resolved as soon as possible – depending on the nature and urgency of the grievance.

- **Step 2 – PMU level.** MOWRAM SEO will resolve the complaint referred to by the Employer (Step 1) and acknowledge receipt of the AP's complaints within two (2) weeks from the date of complaint receipt. If the SEO of MOWRAM cannot resolve the complaint, the SEO Team will consult with the Project Manager/Director for resolution. The SEO of the MOWRAM will inform the AP (in writing) of the PMU's resolution result within 30 days from the date of complaint receipt. If the AP is not satisfied with the resolution result proposed by PMU, PMU will refer the case to the Project Steering Committee of the project and shall inform the AP (in writing) of this referral.

- **Step 3 – Project Steering Committee level.** At this level, the case will be resolved no later than 21 days. The AP will be informed of the resolution decision in writing. In case the grievance has not been solved within the specified timeframe, or the AP does not agree with the proposed resolution, the AP can approach the Labor Inspector of his/her province or municipality.

- **Step 4 – Court of Law.** If the AP is not satisfied with the resolution proposed above, a multi stakeholder committee will be established (ad-hoc) to resolve the dismissed grievance – as an alternative for the affected person going to court. If the grievance could not be resolved satisfactorily by the multistakeholder committee, the affected person may resort to the court of law. The cost associated with the lawsuit shall be borne by the AP. The decision of the Court will be final.

Figure 10.2: Redress Procedure for Complaints Related to Labor and Working Conditions



10.4.4.3 Redress Procedure for Complaints Related to SEA/SH/GBV

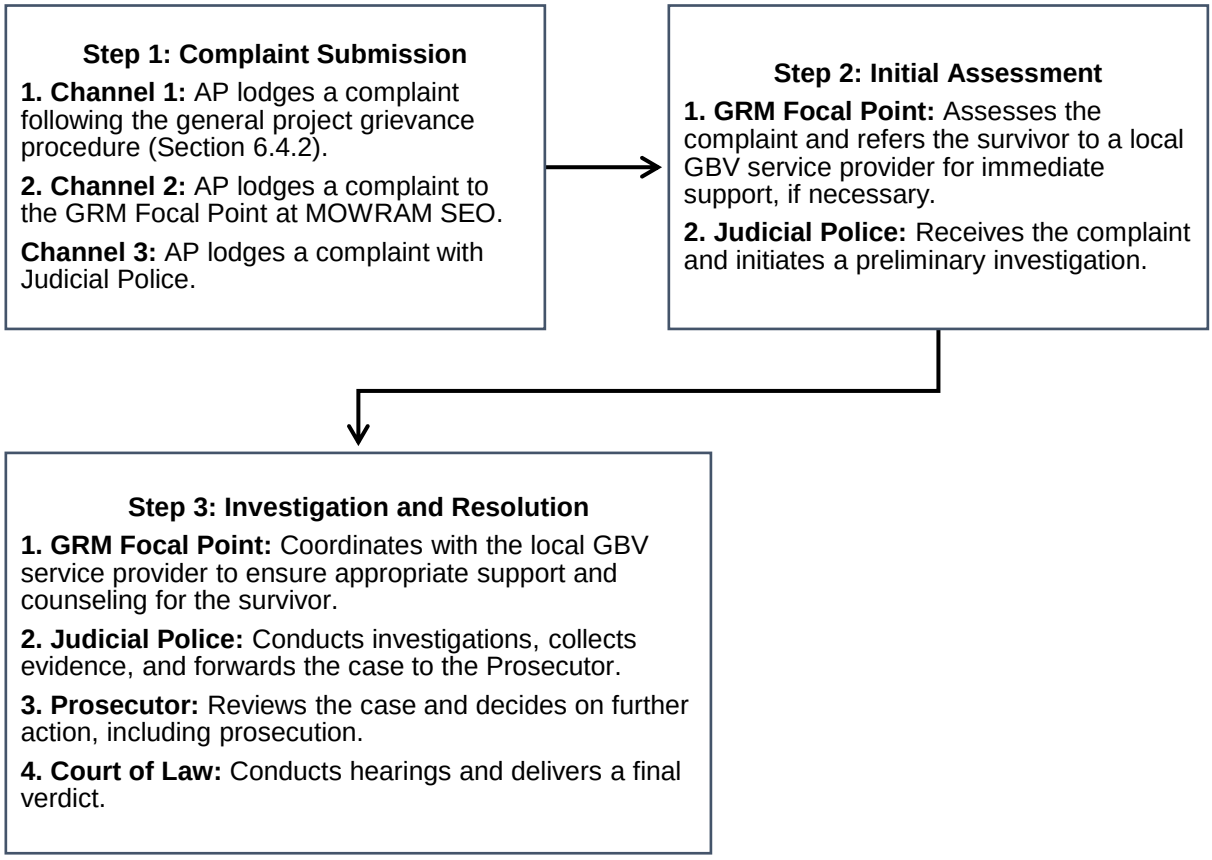
Under the project, the GRM for SEA/SH/GBV mainly serves to: (i) refer complainants to a local GBV service provider; and (ii) record resolution of the complaint. In line with the above, the following principles apply to recognize SEA/SH/GBV victim as principal decision makers in their own care, and treat them with agency, dignity and respect for their needs and wishes:

- **Multiple channels** are in place for easy access and lodge complaints.
- **SEA/SH/GBV survivors will be referred to a local GBV service provider** for immediate support if they make a complaint directly to PMU.
- **Confidentiality of survivors is protected.** GM operators (at PMU and local GBV service providers) will keep confidential for SEA/SH/GBV allegation report.
- **No identifiable information on the survivor shall be collected and stored** in Project Grievance Logbook.
- **Costs of operating the SEA/SH/GBV GRM will be covered by the project.**

It is noted that under this project, GBV service provider will be engaged for subprojects that are rated “High” or “Substantial” for SEA/SH/GBV risks − as part of site-specific ESMP. based on SEA/SH/GBV risk assessment The following channels can be used to submit a grievance related to SEA/SH/GBV:

- **Channel 1 –** AP who believe the SEA/SH/GBV incidence is related to project workers can follow steps outlined in Section 6.4.2 (above) to lodge a SEA/SH/GBV complaint.
- **Channel 2** – Alternatively, AP can lodge their complaint, verbally or in writing, to the GRM's Focal Point within the SEO of MOWRAM for advice and resolution (contact of GRM Focal Point is provided in Section 5.1 (Resources).
- **Channel 3** – If AP wants to bring the case to the Court of Law, AP can follow steps below for prosecution. Prosecution related to SEA/SH/GBV is administered under the Criminal Code and the Code of Criminal Procedure and is as follows:

Figure 10.3: Redress Procedure for Complaints Related to SEA/SH/GBV



- **Step 1 – Judicial Police.** SEA/SH/GBV victim or a representative can submit their grievance to a local Judicial Police (JP) Officer. JPs include a) Commune/ Sangkat Chief, b) Commune/ Sangkat/ District/ Provincial/ National Police, and c) District/ Provincial/ National Military Police. The JP is responsible for receiving, recording complaints, and may conduct preliminary investigations to identify and arrest the perpetrator. The JP will also collect evidence to support the prosecutors. If the SEA/SH/GBV happens at home and/or falls under the domain of domestic violence (as per Law on the Prevention of Domestic Violence and Protection of Victims), the SEA/SH/GBV survivor may seek support from a local qualified Judiciary Police

Officer (appointed by the Ministry of Women's Affairs) who can act as a complaining party on behalf of the SEA/SH/GBV survivor15.

- **Step 2 – Prosecutor.** Upon receiving the completed written record from the JP, the prosecutor can decide on if the prosecutor will hold a file without processing it further or conduct proceedings against the perpetrator. The prosecutor may bring the case to the Court of Law and present the evidence in Court hearings.
- **Step 3 – Investigation by Judge.** During this step, the investigating Judge will conduct interrogation of the charged person and perform other required investigation procedures.
- **Step 4 – Hearing.** After issuing an order of indictment, the investigating Judge will submit the case to the trial court president who shall arrange a date for the trial. The decision of the Court on the SEA/SH/GBV resolution is final.

10.4.4.4 Redress Procedure for General Complaints

In case individuals, households, or communities are affected by any other aspects, for instance, environmental impacts such as increased dust, noise, or lack of safety measures that increase risks of traffic accidents to road users or to local EM, various channels will be established for convenient use by affected parties, including IPs. These include:

- **PMU GRM focal point's telephone (**See Section on Resources) to Local EM leaders (in case affected individual/households are EM)
- **Contractor's hotline:** to report cases that they think contractors can solve timely (contact detail of Contractors will be posted at construction sites, and distributed to IPs (through Subproject Information Booklet) during consultation, and post at public billboard of Commune/Sangkat offices, pagodas, etc.
- Commune/Sangkat offices

10.4.5 Registration of Project Grievance

The SEO, Project 6. Managers within MOWRAM are responsible for establishing and maintaining the project grievance logbook (PGL). The PGL will be established by the SEO to record all concerns/ grievances that are submitted by project stakeholders during project implementation. In case there is a serious complaint, the World Bank should be notified of these complaints within 24 hours of complaint receipt.

The GRM is an integral project management element that intends to seek feedback from beneficiaries and resolve of complaints on project activities and performance. The GRMs for the project are based on AIIB IFAD, UN, and GCF requirements and, most importantly, national requirements for solving potential problems between project owners and residents/persons affected by the subproject(s).

CHAPTER 11 – COSTS AND BUDGET

11.1 INTRODUCTION

The chapter on Cost and Budget of the Environmental and Social Impact Assessment (ESCIA) provides a detailed breakdown of the financial requirements associated with mitigating the environmental and social impacts of the project. It outlines the projected costs for implementing mitigation measures, monitoring activities, capacity-building initiatives, and community engagement programs. The chapter also emphasizes the importance of financial planning in ensuring that resources are efficiently allocated to minimize negative impacts on the environment and affected communities while maximizing the project's long-term benefits. By presenting a clear and transparent budget, this chapter aims to guide stakeholders in understanding the financial commitments necessary to uphold environmental and social safeguards throughout the project lifecycle.

11.2 ESTIMATED COSTS FOR ESCMP IMPLEMENTATION

The costs of implementing the ESCMP listed below are related to PMU costs in addition to the dedicated safeguards PMU personnel budget line item. The main costs of implementing this ESCMP are the additional cost which have not been budgeted within the project. For example, the project component 1 focus on establishment, capacity building and strengthening the FWUCs, therefore the concern regarding water management and water distribution inequality have already covered. Moreover, the sustainable agricultural practices and agricultural value chain is the project actions. In this regard, the concern regarding GHG emission from the farming activities have been already addressed. The proposed budget therefore is the additional cost which are added to the existing (please see in table 11.1).

Table 11.1: Estimated Additional Costs for Environmental Social and Climate Change Monitoring Plan (ESCMP) Implementation

No.	Items	Unit	Instruments	Qty	Cost	Total	Sources
1	Preparation of Resettlement Plans for relevant sub-scheme(s)		Resettlement Plan	1	200,000	**200,000**	GDR
2	ESCMP Implementation		ESCMP			**1,730,000**	MOWRAM
a	UXO clearance		ESCMP	1	250,000	250,000	
b	Consultation outreach	Sub-scheme		6	10,000	60,000	

No.	Items	Unit	Instruments	Qty	Cost	Total	Sources
c	Awareness raising (E&S risks and impacts) (5 times for OTP, the rest 2 times each)			15	3,000	45,000	
d	Implementing Biodiversity Plan		ESCMP			1,375,000	
	• Supporting protected areas in Ou Ta Paong	Year		5	200,000	1,000,000	
	• Supporting protected areas in Lum Hach (3 CFs * 5 years)	Lum-sump		15	15,000	225,000	
	• Supporting biodiversity actions in Stung Krang Ponley (5 years)	Lum-sump		5	30,000	150,000	
3	E&S Monitoring Program	Lum sump		1	390,000	**330,000**	MOWRAM
	• Soil quality monitoring (every six (6) months* 10 locations (3 in OTP, 3 in Lum Hach, 4 in Stung Krang Ponley) * 3 years)			60	1,500	90,000	
	• Air quality, noise and vibration quality monitoring (every six (6) months* 10 locations (3 in OTP, 3 in Lum Hach, 4 in Stung Krang Ponley) * 3 years)			60	2,000	120,000	
	• Water Quality monitoring (every six (6) months* 10 locations (3 in OTP, 3 in Lum Hach, 4 in Stung Krang Ponley) * 3 years)			60	2,000	120,000	
	Total					**2,260,000**	

ANNEX

ANNEX 1: BIODIVESITY ASSESSMENT REPORT

BIODIVESITY ASSESSMENT REPORT

INTRODUCTION

Rationale

The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project in Cambodia is designed to support the Royal Government of Cambodia's National Water Resources Management and Sustainable Irrigation Road Map and Investment Program (2019-2023). The project's primary objective is to enhance the irrigation sector's resilience to climate change while promoting sustainable agricultural practices that also reduce greenhouse gas emissions. CAISAR focuses on improving smart irrigation systems, incorporating renewable energy, and advancing farming techniques to address climate change impacts such as altered rainfall patterns and water-related disasters.

The project's strategy is based on a Theory of Change that posits that upgrading irrigation infrastructure, disseminating knowledge of energy-efficient agricultural technologies, and strengthening agricultural value chains will foster a more resilient and sustainable agricultural sector in Cambodia. This approach is expected to improve crop production, reduce greenhouse gas emissions, enhance climate adaptation, and reinforce the institutional framework for managing these changes.

Financially supported by international organizations such as the Asian Infrastructure Investment Bank (AIIB), the International Fund for Agricultural Development (IFAD), and the Green Climate Fund (GCF), the project targets climate adaptation and livelihood improvement in four Cambodian provinces: Pursat, Kampong Chhnang, Kampong Speu, and Kandal. It is structured around three main components: enhancing farm-level climate resilience, upgrading water infrastructure, and strengthening institutional capacities.

To ensure that environmental, social, and climate considerations are effectively addressed, the Ministry of Water Resources and Meteorology (MOWRAM) will conduct Environmental, Social, and Climate Impact Assessments (ESCIA) and Environmental, Social, and Climate Management Plans (ESCMP), collectively referred to as the “E&S study.” This assessment report focuses primarily on Component 2 of the project and aims to align with relevant standards, contributing to the project's goals of climate resilience and sustainable development.

Furthermore, this study is fully aligned with the International Finance Corporation's Guidance Note 6 (IFC Guidance 6), a comprehensive framework for biodiversity conservation and sustainable management of living natural resources in business operations. IFC Guidance 6 offers guidance on avoiding, minimizing, and mitigating impacts on biodiversity and ecosystems. This biodiversity assessment prioritizes the protection of endangered and critically endangered species and their habitats, promotes

sustainable natural resource management, and ensures that development activities adhere to international conservation standards. It also outlines best practices for preserving ecosystem services and fosters stakeholder engagement and equitable benefit-sharing from natural resource use.

The "area of influence" was defined as the geographical region, encompassing globally threatened species or ecosystems, potentially affected, directly or indirectly, by the proposed project. This initial assessment was crucial for identifying and evaluating potential environmental impacts beyond the immediate project site. The area of influence includes the physical and biological environment that could be affected by the project, such as air quality, water resources, soil quality, flora and fauna, human settlements, and cultural heritage. It also considers potential indirect impacts on surrounding areas, including noise pollution, traffic patterns, and socioeconomic conditions.

Renovation of irrigation systems within the Tonle Sap Floodplains offers significant potential benefits to a wide range of stakeholders. Primarily, farmers who rely on these systems for their livelihoods will experience improved water management, increased crop yields, and reduced water wastage. Additionally, the project can contribute to broader ecological benefits by enhancing water quality, reducing soil erosion, and supporting biodiversity conservation. Furthermore, revitalized irrigation systems can contribute to food security, rural development, and poverty reduction in the region.

Cambodia's Laws Protecting Environment and Biodiversity

Cambodia's government has made significant efforts to protect biodiversity through the establishment of a comprehensive legal framework. Key legislations include the Biodiversity Law (2009), which governs sustainable biodiversity management, and the Environmental Protection Law (1995), which sets broad principles for environmental management. Additionally, the Forest Law (1994) and Wildlife Sanctuary and Protection Law (1993) safeguard critical habitats and species, while the Fisheries Law (1991) ensures sustainable aquatic resource management. The recently introduced Environmental Code (2023) further strengthens regulations on pollution control and biodiversity conservation. Cambodia also participates in international agreements like the Nagoya Protocol, aligning its conservation efforts with global standards. Despite these advancements, effective implementation and enforcement remain essential to achieving long-term biodiversity protection. Below are short sumary of several key national legislations and international agreements:

1. **Biodiversity Law (2009):** This foundational law provides a comprehensive legal structure for the sustainable management of biodiversity resources. It addresses habitat protection, species conservation, genetic resource management, and the sustainable use of biodiversity, outlining the government's responsibilities and promoting public participation.

2. **Environmental Protection Law (1995):** This law sets general principles for environmental protection and outlines the government's role in environmental management, including pollution control, waste management, and natural resource conservation. It complements the Biodiversity Law by providing a broader environmental governance framework.
3. **Forest Law (1994):** Regulating the management, use, protection, and restoration of Cambodia's forests, this law is crucial for balancing economic development with environmental conservation, particularly in biodiversity-rich ecosystems.
4. **Wildlife Sanctuary and Protection Law (1993):** This law establishes wildlife sanctuaries and offers protection to wildlife species by prohibiting hunting, trapping, and other activities that threaten wildlife and their habitats.
5. **Fisheries Law (1991):** This law governs the management of Cambodia's fisheries resources, setting rules for sustainable fishing practices, protecting aquatic habitats, and ensuring the long-term health of aquatic ecosystems.
6. **Environmental Code (2023):** The newly introduced Environmental Code consolidates and updates Cambodia's environmental laws, introducing stricter regulations on pollution control, natural resource management, and biodiversity conservation. It emphasizes climate change adaptation and mitigation and enhances public participation and transparency in environmental decision-making.
7. **Nagoya Protocol (2010):** As a party to the Nagoya Protocol under the Convention on Biological Diversity (CBD), Cambodia commits to the fair and equitable sharing of benefits arising from the utilization of genetic resources. This protocol supports Cambodia's efforts to protect its biodiversity while ensuring that the benefits of its genetic resources are shared with local communities and stakeholders.

Project Objectives, Components, and Activities

The project objective is to increase climate adaptation, mitigate the negative impact of extreme climate events, and improve the livelihoods of smallholder farmers and vulnerable rural communities in four provinces of Cambodia, including Pursat, Kampong Chhnang, Kampong Speu, and Kandal provinces (see map below).

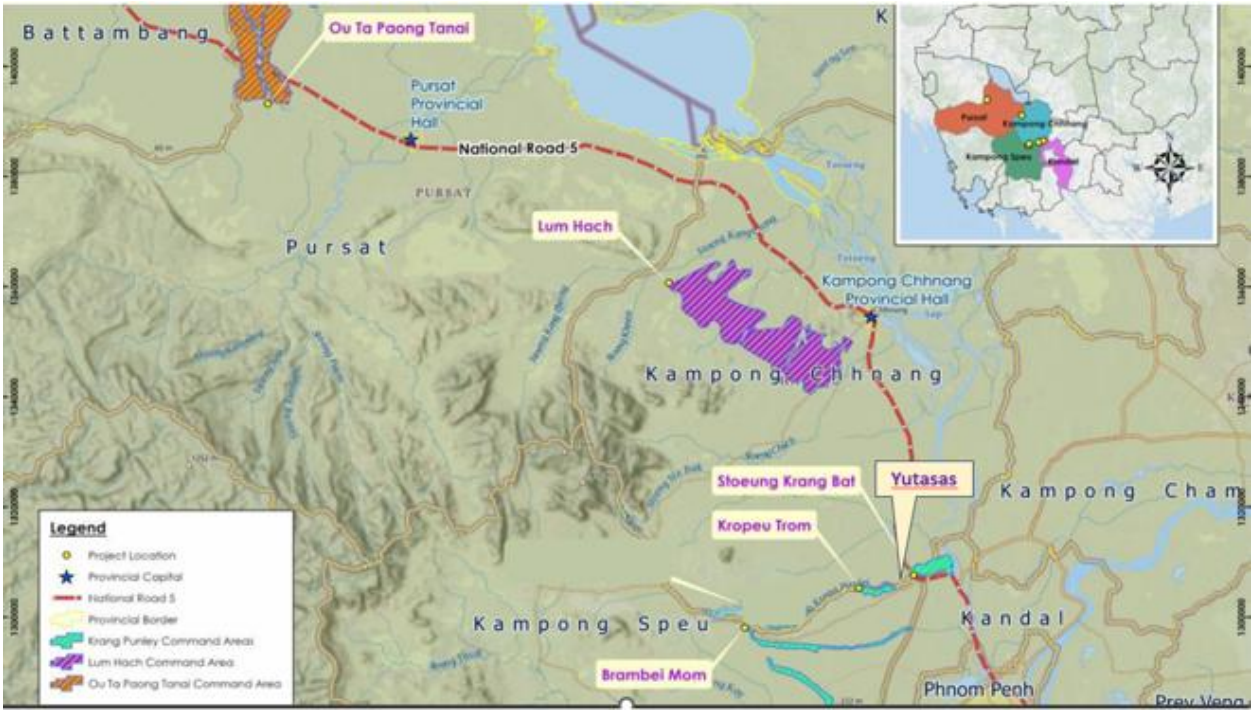


Figure 6 – Locations of six irrigation sub-schemes located in four provinces

The project will be implemented through various activities organized under the following three components:

Component 1. *Improving farm-level climate adaptation, resilience, and water use efficiency*

The objective of this component is to build climate resilience (CR) of smallholder farmers and enhance sustainable production through evidence-based planning and context-relevant climate resilient practices at the farm level. This component is designed to address the lack of knowledge and skills to deploy technologies and practices at the farm level to farmers and the lack of appropriate extension services to propagate them. It will introduce farmers to various climate-resilient technologies and practices for both rice and non-rice activities such as vegetable production, poultry and aquaculture.

Sub-component 1.1 Deployment of farm-level climate adaptation and water use efficiency measures

Output 1.1: Increased capacity of farmers to deploy climate resilient (CR) practices at farm level

This output will focus on developing farmer's capacity to deploy CR technologies and practices to transform the agricultural production system to adapt to the changing climate context. Farmers will be trained to first develop Action Plans (AP) to re-orient farmer behaviour and assist them in transforming the agriculture production system in a manner that is better adapted to factoring in the agroecological context and expected climate change impacts.

1. Activity 1.1.1 Preparation of community-based action plans (AP) to transform agriculture with CR practices.
2. Activity 1.1.2 Preparation of training materials to support implementation of the AP.
3. Activity 1.1.3 Conduct training to create a pool of expertise to demonstrate and propagate the CR technologies and practices.
4. Activity 1.1.4 Train farmers on applying CR technologies using the FFS approach.
5. Activity 1.1.5 Strengthening and fostering tailored mechanization service providers for improved mechanization service delivery.
6. Activity 1.1.6 community-based monitoring and evaluation (CBME) of implementation

Sub-Component 1.2 Climate-adapted, value-added, and market-led agricultural investments

Output 1.2 CR value-added, and market-led agriculture investments secured.

This output involves improving and enhancing some value chains that are key for the project area and include rice, vegetable, chicken and aquaculture value chains, through the use of Public Private Producer Partnerships (4Ps) and increased access to finance, which will improve market access, climate adaptability, and ensure increased income for smallholders in the value chains.

7. Activity 1.2.1 Value chain study and planning
8. Activity 1.2.2 Establish District Multi-Stakeholder Platforms (MSPs)
9. Activity 1.2.3 Public Private Producer Partnership Facility (4PF)

Sub-component 1.3 Improve enabling conditions, capacities and disaster risk management strategies

Output 1.3. Increased access to and use of climate information and advisory services for climate-responsive agriculture planning

This sub-component will strengthen the production and dissemination of tailored agro-meteorological information to inform climate-responsive management and planning of agriculture in the project target areas through ICT technologies. The aim is to ensure that agro-meteorological services are accessible and useful to farmers to manage climate risks, access to and use of water and efficient cropping systems.

10. Activity 1.3.1 Establish an ICT-based multi-disciplinary platform at the provincial level.
11. Activity 1.3.2 Building the capacities of the platform to deliver services.
12. Activity 1.3.3. Establish the agromet information systems and the outreach mechanisms.
13. Activity 1.3.4 Awareness raising and capacity building of farmers and stakeholders in applying the *services.*

Sub-component 1.4 Rural roads

Output 1.4: Increased resilience of farm road infrastructure to climate change

14. Activity 1.4.1 Initial planning and identification
15. Activity 1.4.1 Initial planning and identification
16. Activity 1.4.2 Technical survey and design considerations, preparation of cost estimation

17. Activity 1.4.3 Improve 50 Kilometers of farm roads.
18. Activity 1.4.4 Handing over the completed works.

Component 2: Irrigation Infrastructure for increased resilience

Component 2 is linked with Component 1 such that it facilitates the implementation of CR on-farm crop and water management practices through improved field-level water supply delivery and drainage. It will focus on rehabilitating and modernizing irrigation and flood protection/drainage infrastructure in the six sub-projects, including irrigation and drainage canals, flood control embankments, and ponds, to provide high-efficiency climate-resilient irrigated agriculture systems for adapting to both increasing flood and drought conditions.

Sub-Component 2.1: Modernization of irrigation scheme and ponds

Sub-Component 2.2: Flood-proofing and Drainage improvements

Sub-Component 2.3: Establishments and Training of Farmers Water User Communities (FWUC)

19. Activity 2.3.1 Formation of institutional strengthening of the FWUC
20. Activity 2.3.2 Build technical capacities of FWCU for canal structure O&M
21. Activity 2.3.3 Prepare long-term financing plan for O&M of the systems including the WUAS.

Sub-Component 2.4: Water Information and Management (SCADA)

Component 3. Institutional Strengthening

Sub-Component 3.1 MOWRAM capacity Support.

Output 3.1 Strengthened MOWRAM Capacity

Sub-Component 3.2 Strengthening of NDA and NCDD.

Output 3.2 Improved capacities for climate action monitoring

22. Activity 3.2.1 Preparation of Loss and Damage Strategy
23. Activity 3.2.2 Strengthen national M&E process for climate action
24. Activity 3.2.3 Enhancing Capacity of NDA and other stakeholders.

Environmental Risks and Impacts

Renovation of irrigation systems within the Tonle Sap Floodplains could have significant environmental consequences. Altering water flow patterns can disrupt the delicate ecological balance of the floodplain, affecting fish migration, breeding, and spawning. Increased water extraction for irrigation may lower water levels, impacting aquatic ecosystems and wetland habitats. Additionally, the use of chemical fertilizers and pesticides in agriculture can contaminate water bodies, harming biodiversity. Furthermore, construction activities associated with the renovation can lead to soil erosion, sedimentation, and habitat destruction for both aquatic and terrestrial species.

Social Risks and Impacts

The social implications of renovating irrigation systems in the Tonle Sap Floodplains are complex. While the project aims to improve agricultural productivity, it may also lead to land-use changes and displacement of local communities. Small-scale farmers may face challenges in accessing and competing for water resources, potentially exacerbating socioeconomic inequalities. Moreover, the introduction of new technologies and farming practices may require additional training and support for local communities, which could create new demands on existing resources. Conflict over water rights and access may arise, impacting social cohesion and livelihoods.

OBJECTIVE OF THE ASSESSMENT

Based on a comprehensive biodiversity screening conducted by the E&S screening team, in conjunction with consultations with the ESCIA team, twenty-four potentially present endangered (EN) and critically endangered (CR) species were identified within the project's area of influence. To validate this initial assessment and identify additional species, a thorough literature review was conducted, and consultations were held with key government agencies and civil society organizations, including the Fisheries Administration (FiA), Wildlife Conservation Society (WCS Cambodia), and Punleu Komar Organization (PKO). These organizations specialize in the protection of endangered and critically endangered species, empowering community-based organizations in protecting natural resources and possessing valuable knowledge of their distribution within the project's region.

The specific purpose of the Priority Biodiversity Values is to confirm the status of key wildlife species presenting in the area to ensure the protection and sustainable management of natural resources and livelihood improvement. This includes evaluating current conditions and potential impacts and developing mitigation and compensation measures. The identification and evaluation of Priority Biodiversity Values help prioritise areas with exceptional biodiversity or crucial ecological functions. These include unique habitats, key ecological processes, biodiversity hotspots, endangered species, keystone species, flagship species, cultural significance, and ecosystem services. Identifying these values involves desk-based research, field surveys, and expert consultation, considering global/regional significance, threats, vulnerability, and irreplaceability. Prioritizing conservation actions focuses on threat levels, vulnerability, irreplaceability, and cost-effectiveness to maximize impact

As part of the biodiversity assessment, the following key activities were undertaken:

4.2.6.1 Desk-Based Assessment: Conduct a comprehensive desk-based assessment to identify potential critical habitats and sensitive species

using secondary data, and IFC PS6 criteria. Classify habitats based on ecological characteristics and sensitivity.

4.2.6.2 **Field-Based Surveys: Conduct targeted field surveys to validate desk-based findings, assess species diversity, abundance, and habitat quality, and collect data on environmental parameters.**

4.2.6.3 **Expert consultation: Consult and verify all key findings with relevant national and international experts from key government agency, local NGOs, International NGOs, and researching institutions.**

4.2.6.4 **Critical Habitat Assessment and Mitigation: Conduct detailed assessments of potential critical habitats, develop mitigation measures to minimize impacts, and establish a monitoring program to track effectiveness.**

A comprehensive biodiversity assessment, utilizing the Integrated Biodiversity Assessment Tool (IBAT) and a thorough literature review, identified a total of 25 endangered and critically endangered species across reptiles, mammals, birds, fish, amphibians, plants, and fungi. Sixteen of these species were concentrated in the Ou Tapong (OT) sub-scheme, while five were screened in Lum Hach (LC), two in Prambei Mom (BM) and Krapeu Truom (KT), and five in Yutasas (YT) and Stung Krang Bat (SKB), see Table 1.

Table 2: Second screening list of Endangered and Critically Endangered Birds, Mammals, Reptile and Fishes

No.	Local Name	English Name	Scientific Name	IUCN Category	OTP	LH	CL[58]	BM	KT	Yotasas	SKB
•	**Reptile spices**										
1	អណ្តើកព្រោច	Elongated Tortoise	Indotestudo elongata	CR						Yes	
2	កន្ធាយក្បាលកង្កែប	Asian giant softshell turtle	Pelochelys cantorii	CR			Yes				
3	អណ្តើកក្អែក	Black Marsh Turtle	Siebenrockiella crassicollis	EN	Yes		Yes	Yes			Yes
4	អណ្តើកសោម	Giant Asian Pond Turtle	Heosemys grandis	CR	Yes						
5	អណ្តើកបិទមុខ	Southeast Asian Box Turtle	Cuora amboinensis	EN	Yes						Yes
•	Mammal species										

(58). Chheang Laeung (CL) has been excluded from the project concept design.

6	កេរោមច្រមុះ	Hairy-nosed Otter	Lutra sumatrana	EN	Yes						
7	ស្វាព្រោម	Indochinese Silvered Langur	Trachypithecus germaini	EN	Yes						
8	ស្វាក្តាម	Long-tailed Macaque	Macaca fascicularis	EN	Yes						
9	ឆ្កែព្រៃ	Dhole	Cuon alpinus	EN		Yes					
10	ជ្រីងធំ	Large Flying-fox	Pteropus vampyrus	EN		Yes					
•	Fish species										
11	ត្រីត្រសក់ក្រហម	Jullien's Golden Carp	Probarbus jullieni	CR					Yes	Yes	
12	ត្រីចង្វាស្តើង	Leaping barb/Flying Minnow	Laubuka caeruleostigmata	EN					Yes	Yes	
13	ត្រីប្រាធំ	Striped catfish	Pangasianodon hypophthalmus	EN	Yes			Yes			Yes
14	ត្រីកាហោ /ត្រីគុលរាំង	Mekong giant barb/Giant Carp	Catlocarpio siamensis	CR						Yes	Yes
15	ត្រីកន្ត្រៀប់ខ្លា	Siamese Tiger Perch	Datnioides pulcher	CR	Yes	Yes					Yes
•	Bird species										
16	ក្រដក់ធំ	Greater Adjutant	Leptoptilos dubius	EN	Yes						
17	រនៀលស	Milky Stork	Mycteria cinerea	EN	Yes						
18	ចាបព្រៃវែង	Yellow-breasted Bunting	Emberiza aureola	CR	Yes		Yes				
19	ឪរឹប ឬ ទ្រមាក់អណ្តើក	Bengal Florican	Houbaropsis bengalensi	CR	Yes						
20	ក្ងោក	Green Peafowl	Pavo muticus	EN		Yes					

21	ពពួលទឹក	Masked Finfoot	Heliopais personatus	CR	Yes						
22	ទាព្រៃស្លាបស	White-winged Duck	Asarcornis scutulata	EN	Yes					Yes	
•	Fungi, amphibians, and aquatic plants										
23	ផ្សិតកែវ	Puffball mushrooms	Calostoma insigne	EN		Yes					
24	កញ្ចាញ់ចេកភ្នំក្រវាញ	Cardamon Shrub Frog	Philautus cardamonus	EN	Yes						
25	ស្មៅស្ទឹង / ទន្លេ	River-weed	Terniopsis chanthaburiensis	EN	Yes						

The Southern Tonle Sap Floodplain (STSF), a critical component of Cambodia's biodiversity and socio-economic landscape, is a dynamic wetland ecosystem characterized by seasonal inundation. This intricate interplay of water and land supports a diverse array of flora and fauna (fish, bird, mammal, reptile, fungi, plant), contributing to significant agricultural production. However, the region faces increasing threats from development, climate change, and overexploitation.

The STSF's watershed, encompassing portions of Pursat, Kampong Chhnang, Kandal, and Kampong Speu provinces, is a complex hydrological system influenced by the Tonle Sap River, Mekong River, and their tributaries. This intricate network regulates water flow, nutrient transport, and seasonal fluctuations in water levels. The STSF catchment area, comprising diverse land cover types, directly influences water quality and quantity entering the floodplain. Factors such as topography, soil type, and land use practices within the catchment significantly impact sedimentation, nutrient loading, and overall water quality (Chua et al. 2022).

The interconnectedness of the watershed and catchment is essential for the ecological health of the STSF. The flow of water from the catchment into the floodplain through the river system drives various ecological processes. However, human activities such as deforestation, agriculture, and urbanization within the watershed and catchment pose significant threats to the STSF's biodiversity and ecosystem services. To ensure the long-term sustainability of the STSF, it is imperative to implement sustainable land use practices, prioritize forest conservation, and effectively manage water resources. These measures will help mitigate the impacts of human activities and protect the ecological integrity of this vital ecosystem (MoE; TSA).

METHODOLOGY

Literature review

The literature review was conducted for this assessment at the national, regional, and sub-scheme levels. The national-level review aims to obtain an overall picture of the legal frameworks that govern biodiversity management and conservation in the country, and the current status of biodiversity, management and conservation. The review at the regional level looks at the status quo on biodiversity and management at the Tonle Sap Floodplain because the project area is located upstream of the Tonle Sap Lake. At the sub-scheme level, based on IBAT and eBird data (where relevant), the review focuses on species that fall under the IUCN category as Endangered (EN) and Critically Endangered (CN) and assesses its potential impact due to CAISAR's project activities, and relevant projects that contribute to the cumulative impacts on biodiversity of the project's area of influence in the long run.

This comprehensive review illuminates the precarious state of Cambodia's critically endangered species. It underscores the multifaceted threats these taxa face, including habitat degradation, illegal hunting, pollution, and other anthropogenic pressures. The diversity of taxa represented, spanning animals, birds, fish, plants, and fungi, highlights the intricate tapestry of Cambodia's ecosystems.

Cambodia's biodiversity is under siege, with numerous species teetering on the brink of extinction. This summary focuses on some of the most vulnerable taxa, many of which are critically endangered with dwindling populations.

Field Assessment

Area of Influence: The potential area of influence of the sub-scheme is estimated based on a) the project target's command area (within which most project activities will take place), b) environmental footprints that would potentially caused by project activities such as the rehabilitation of canals (during project construction) and intensified crop production (during project operation). The area of influence is subject to update when more information becomes available to allow reliable assessment. This information may include a detailed E&S assessment of project impact when a) locations of the construction site, its auxiliaries, and logistic operation is confirmed, b) the extent of the project's impacts (indirect, indirect, and cumulative) are firmed up based on the final target of development outcomes (e.g. total cultivation areas subject to crop intensification). It is noted that while direct and indirect impacts are reasonably foreseen – based on prior experience, cumulative impacts, particularly their spatial extent and severity level, need to be supported by scientific evidence which may be gathered appropriately considering the locations and time when data are collected to reconfirm the impact level.

Field works: Based on the potential area of influence estimated based on proposed activities at the sub-scheme level, two field surveys were conducted for the six sub-schmes during July 25-27 and August 3-9, 2024 (which is the wet season). Prior to fieldwork, GIS-based habitat modelling was conducted to identify key hotspots for each of the six sub-schemes. This aims to facilitate the prioritization of locations that should be subject to field observation and data

collection. Key hotspots were also screened based on the potential area of influence initially identified as part of the E&S screening exercise that was conducted for each sub-scheme[59]. Apart from a focus on the potential area of influence, an attempt has been made to visit the potentially vulnerable areas that are located beyond but adjacent to the potential AoI, particularly areas that are vulnerable to potential environmental impact due to environmental footprints (e.g. spreading of pesticide residues) that need sound evidence to support the extent of impact – as cumulative impacts.

Techniques used: Field observation was carried out using drone[60] and transect walks. A drone is particularly used for the areas that are difficult to conduct a transect walk and areas that need a broad aerial view at the boundary between the estimated AoI and beyond. Consultations were conducted with representatives of local authorities and community-based organizations to supplement and validate field observations, particularly information on the potential presence of species that have been screened and identified for the AoI. In the sub-schemes where hotspots such as community forests and community fisheries are found (either inside and outside the area of influence, or both, like the cases of Ou Ta Paoing and Lum Hach), local organizations that manage such community forests and community fisheries hotspots were consulted to gather local ecological knowledge and experience, particularly the historical background about the population change of a particular species in relation to human activities (e.g. related to farming and other income generation activities such as hunting for food, and for trading).

Consulation techniques: Key informant interviews and focus group discussions were used to consult local people. Consultation with local people, particularly those relevant, helped verify the presence and likelihood of occurrence of the species already identified and their habitat locations. The assessment adopts the International Finance Corporation's Performance Standard 6 (PS6) and its associated Guidance Note (GN) as a comprehensive framework for identifying and evaluating critical habitat (CH). Characterized by its irreplaceability and vulnerability, CH is essential for preserving biodiversity and ecological integrity. The three-step process outlined in PS6 and GN6 involves identifying CH through specific criteria, assessing its irreplaceability and vulnerability, and mapping its location. By understanding the distribution of CH, projects can effectively mitigate risks to biodiversity and ensure alignment with environmental sustainability goals.

The assessment was conducted vis-a-vis the environmental and social risks and impacts that were initially identified for each of the six sub-schemes. The assessment, in particular, focuses on the direct, indirect, and cumulative effects of identified E&S risks and impacts. As a result, this process will consider relevant threats to biodiversity and ecosystem services due to a) project activities, and b) activities of relevant projects that constitute the cumulative impact on

[59] Potential area of influence is defined by the respective command areas (which include cultivation area, its supporting utilities such as farm road, technical facilities, and houses…) and areas located adjacent to the above command area that may include paddy fields, natural areas such as forest, pasture, and roads that are potentially used by project's construction contractors in connection with construction material supply site, borrow pits, disposal site, and so forth.

[60] A DJI Mavic 3T, an advanced drone equipped with cutting-edge features, was utilized to gather essential data from key biodiversity hotspots, wildlife habitats, and areas crucial for ecological connectivity and functions. With a remarkable flight range of up to 15 kilometers, the drone's capabilities allowed for comprehensive aerial surveys, even in remote or inaccessible regions.

the identified species, including habitat loss, interference with migratory routes or wildlife movement, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution[61]. It will also account for the diverse values attached to biodiversity and ecosystem services upon which affected communities' livelihoods depend.

The six sub-schemes are located to upstream of the Tonle Sap Lake, constituting the Tonle Sap Floodplain which is a complex ecosystem. This ecosystem and its ecosystem services are characterized with unique hydrology, rich biodiversity, vital livelihood support, and irrigated agricultural production which are located upstream of the Tonle Sap. Given the link between the project's command area and ecosystems located downstream of these sub-schemes, this assessment also evaluate the significance of the risks and impacts due to project activities. This assessment would focus more on areas immediately located outside the command area and to downstream.

Based on the potential risks and impacts, an adaptive management approach is proposed. Under this project, due to a lack of reliable information to confirm the extent and severity of potential impact – over a time dimension, mitigation and management measures proposed would be responsive – based on the changing conditions that were known based on monitoring results conducted periodically throughout the project cycles. Where necessary, adjustments can be made to mitigation and management measures. This iterative process aims to ensure the project follows the hierarchy of mitigation that avoids impacts. Where avoidance is not possible, adverse effects on the ecosystem and local communities will be minimized.

Scope of Work and Key Informant Interviews

IFC Performance Standard 6 (PS6) provides a framework for identifying and assessing critical habitats. The criteria include irreplaceability, vulnerability, biodiversity, ecosystem services, and cultural significance. Field surveys, such as transect surveys, point counts, drone surveys, group discussions, and key informant interviews are employed to gather data on species diversity, abundance, habitat conditions, and environmental parameters. This data, combined with desk-based research and expert consultation, informs the assessment of potential impacts and the development of appropriate mitigation measures.

Key informants were selected based on their knowledge of local wildlife. Approximately 10-12 individuals were chosen from each sub-scheme and interviewed using a semi-structured and structured questionnaire with visual aids (photos). We employed a multi-faceted approach to elicit reliable information, including using all alternative local names and asking questions about species' ecological niches. This allowed us to assess the informants' depth of knowledge.

Forest resources and wildlife

This comprehensive approach will ensure that both the environmental and economic values of forest resources, ecological functions and biodiversity are well framed for protection and

(61). World Bank Performance Standards (OP 4.03), 20220. Environmental and Social Review Summary (ESRS Concept Stage)

safeguarding throughout the project lifecycle. Below are selective key assessment tools that will be used for this study:

- **Biodiversity Mapping:** Create comprehensive biodiversity maps by integrating data from field assessments, interviews, and existing maps from various management and administrative entities (CF, Community Fisheries (Cfi), KBA, protected areas).
- **Species Inclusion Criteria:** Limit the assessment to species sighted within the past 1-5 years to ensure a focus on current and relevant data for developing risk and mitigation strategies. Sighting data older than 5 years is important for predicting future trends based on their habitats and ecological changes.
- **Community Engagement:** Consult with committee members from Community Forests (CF) and Community Fisheries (CFi) to gather their insights on wildlife presence, movement patterns, and potential impacts of the proposed system on their conservation areas.
- **Species Data Verification:** Verify all species sightings and information against existing literature to ensure accuracy and reliability.
- **Detailed Species Assessment:** Conduct in-depth inquiries about confirmed species, focusing on morphological characteristics, behavior, habitat preferences, and reproductive strategies. This will provide valuable data on local ecological knowledge and species distribution for informing conservation efforts.
- **Critical Habitat Identification:** Identify critical habitats for target species based on field data and biodiversity mapping. Highlight areas of significant influence on biodiversity, endangered (EN) and critically endangered (CR) species, and ecological functions to inform mitigation strategies.
- **A3-Sized Color Maps:** Create A3-sized color maps for each scheme, containing key information such as administration boundaries, specific location names, and unique landscape features (streams, lakes, river reservoirs). These maps will be used to determine the distribution of endangered and critically endangered species based on information provided by key informants.

Aquatic Biodiversity and Fisheries

This study aims to assess the status of endangered fish species in each sub-scheme. It involved data review, interviews with local fishers and authorities, and field surveys. The information will inform impact assessments, mitigation measures, and conservation efforts.

We adopted a similar assessment approach used for forest resources and wildlife, focusing on experienced fishermen. This comprehensive approach ensures a thorough understanding of aquatic biodiversity and fisheries.

Recognizing the challenges of identifying fish without direct observation, we will enhance our assessment by examining fish migration connectivity, and species ecological niches, and cross-verifying data with relevant government agencies and research institutions. This rigorous approach will strengthen the reliability of our findings and inform effective management strategies.

Methods used for Critical Habitat Assessment

Critical Habitat. Critical habitats are areas of high biodiversity value that include at least one or more of the five values specified in paragraph 16 of Performance Standard 6 and/or other recognized high biodiversity values. Values that are referred to as “critical habitat criteria” include:

1. Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species
2. Criterion 2: Endemic or restricted-range species
3. Criterion 3: Migratory or congregation species
4. Criterion 4: Highly threatened and/or unique ecosystems
5. Criterion 5: Key evolutionary processes.

In this assessment, the following thresholds are used for the determination of critical habitat status.

1. Thresholds for Criterion 1:

1. Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive unitsGN16 of a CR or EN species.
2. Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a).
3. As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.

4. Thresholds for Criterion 2:

5. The term endemic is defined as a restricted range which refers to a limited extent of occurrence (EOO).
6. Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.
7. For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), the restricted range is defined as having a global

range of less than or equal to a 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).

8. Thresholds for Criterion 3:

1. Areas are known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.
2. Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

3. The thresholds for Criterion 4:

1. Areas representing ≥5% of the global extent of an ecosystem type meet the criteria for IUCN status of CR or EN.
2. Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

Primary and secondary data are required for criterion (1) and (3) to guide the determination about whether a habitat has significant importance for a species. Criterion (4) and (5) need to be assessed on a case-by-case basis. A critical habitat is determined for an area, and a critical habitat Area of Analysis (AoA) needs to be defined for the application of the above criteria. The AoA should be extended beyond the project footprint (area of influence) and should be equivalent to the practical site-based conservation management activities that will be proposed.

The CHA approach adopted involve the following steps:

Step 1 - Generate a List of EN and CN Species, and Restricted Range species.

Criteria (1) and (2) are used based on the IUCN Red List generated using IBAT focusing on EN and CR species. Additional data were collected to supplement, including stakeholder consultation, local knowledge, field observation, secondary data (from previous surveys), and habitat mapping.

Step 2 - Screening based on Likelihood of Occurrence

The list of EN and CR species is screened for the Likelihood of Occurrence (LoO) - based on the ecological state of habitats within the AoA. For this CHA, only species that are confirmed Present, or Possibly Present (based on the result of Step 1) are assessed in Step 3.

Step 3 - Determination of Critical Habitat Status

Reliable data on a species' population size, extent of occurrence, other relevant information and expert opinion are required to assess each species retained after Step 2. The following guidance are used to facilitate the interpretation and analysis of critical habitat.

1. **Recognized areas of high biodiversity value** (such as legally protected areas, Key Biodiversity Areas (KBAs), Important Bird Areas (IBAs), Ramsar Wetlands of International Importance and Natural World Heritage Sites (WHS).
2. CR species face an extremely high risk of extinction and their survival in the wild is in a critical state. As such, **if a surviving population of a CR species is present in the critical habitat Area of Analysis**, the habitat should be considered to have significant importance for the species under PS 6 Criterion 1.
3. **Criteria 4 and 5 are to be assessed on a case-by-case basis** using specialist input and reliable data sources considering the presence of conservation initiatives, legally protected areas and internationally recognized areas of high biodiversity value and the reasons for which they are designated.
4. Critically Endangered (CR) species, by definition, face an extremely high risk of extinction and their continued survival in the wild is in a critical state. Thus, **if a surviving population of a CR species is present in the critical habitat AoA, the habitat should be considered to have significant importance for the species** - under paragraph 16, Item (i).

Step 4 - Identify Critical Habitat Features of Relevance to the Project

Based on PS 6 paragraph 18, the project's mitigation strategy will be described in a Biodiversity Action Plan and will be designed to achieve net gains[62] of those biodiversity values for which the critical habitat was designated.

ASSESSMENT RESULTS

Under this chapter, assessment will be done separately for each of the six sub-schemes under the CAISAR project. The assessment for OTP will be presented first, followed by Lum Hach, Brambei Mon, Krapeau Trom, Yutasass, and Steung Krang Bat. It is noted to ensure the assessment method is consistently applied for each sub-scheme, the presentation of each assessment will be structured around the following sub-sections:

1. Proposed project activities in each sub-scheme and potential risks and impacts;
2. Area of Influence of the sub-scheme;
3. Analysis to prepare for determining Critical Habitat status (Steps 1 & 2);
4. Determining Critical Habitat status (Step 3);
5. Potential Impacts and Feasibility of net gain requirements (Step 4); and
6. Mitigation measures.

Ou Ta Paong

Proposed project activities and potential risks and impacts

[62] PS 6, Footnote 15 writes "Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. Net gains may be achieved through the development of a biodiversity offset and/or, in instances where the client could meet the requirements of paragraph 17 of this Performance Standard without a biodiversity offset, the client should achieve net gains through the implementation of programs that could be implemented in situ (on-the-ground) to enhance habitat, and protect and conserve biodiversity."

Avian species such as the Greater Adjutant, Milky Stork, and Bengal Florican have been documented in the lower section. These birds rely on seasonal wetlands, lakes, waterholes, grasslands, and rice fields for foraging. Additionally, the critically endangered Siamese Tiger Perch and Black Mash Turtle inhabit Boeung Kamsaeng Lake and Svay Daunkav River, respectively, in the upper portion of the command area.

The flooded forest habitat and natural lakes adjacent to the lower section support a diverse array of wildlife, including four critically endangered reptile species: the Black Mash Turtle, Southeast Asian Box Turtle, Giant Asian Pond Turtle, and Elongated Tortoise. These species play crucial roles in the ecosystem, contributing to nutrient cycling, seed dispersal, and maintaining ecological balance. Furthermore, the region is home to two critically endangered mammal species: the Indochinese Silvered Langur and Long-tailed Macaque. These primates are essential for forest regeneration and seed dispersal, helping to maintain the health and resilience of the forest ecosystem. This area, particularly its lower section, serves as a critical habitat for a diverse array of endangered and critically endangered species.

Given the significant ecological value of the Ou Tapaong Command Area, any irrigation system renovations must be carried out with utmost care to minimize negative impacts on biodiversity. This may involve implementing measures such as habitat restoration, creating wildlife corridors, and ensuring that water management practices are sustainable and supportive of biodiversity. By carefully considering the ecological implications of the project, it is possible to balance the needs of agriculture with the conservation of endangered species and their habitats. Under OTP, various activities will be carried out that cause the following E&S risks and impacts:

Table 3: Projection activities that may cause potential impacts on the environment and social aspects at Ou Tapaong sub-scheme

No.	Project activities that cause impacts	E&S Risks & Impacts
1	Construction activities (rehabilication of canal and farm roads), land use changes, and water management practices	**Habitat loss and fragmentation** could lead to habitat loss and fragmentation, affecting species' survival and connectivity. This activity may involve dredging, excavation, or modification of existing water channels and infrastructure. These activities can lead to habitat destruction, disturbance to nesting and foraging sites, disruption of natural water flow patterns, and alteration of hydrological regimes. This can directly impact both terrestrial and aquatic biodiversity.

2	Increased agricultural activities, sedimentation, and pollution	**Water quality degradation** could impact aquatic ecosystems and species that rely on clean water.
3	**Hydrological changes due to m**odifications to water flows and regimes	**Altered habitat** conditions that disrupt ecological processes.
4	**Increased human activities**	**Labor influx (during project construction) and Increased** human activities (during project operations pose additional threats to biodiversity. Increased human activity within the command area which could potentially disrupt wildlife behavior (nesting/foraging), increase poaching or predation risks if not properly managed.
5	Dredging of waterways and Alteration of water levels	Changes in water levels within the command area due to irrigation system renovation may negatively impact wildlife dependent on specific habitats for breeding or foraging purposes. For example, changes in seasonal wetlands or lakes' floodplains can disrupt breeding patterns for avian. Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats.
6	Use of chemicals and nutrient loading	**If pesticides/fertilizers are used during agricultural practices within the command area as part of irrigation system renovation projects, it could lead to contamination of soil and water resources affecting both terrestrial and aquatic biodiversity.**
7	Species displacement and disruption of foraging and breeding habits	Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats. Additionally, alterations to the irrigation system

		could disrupt the foraging and breeding habits of endangered birds and other wildlife.
8	**Land Use Changes**	The changes in land use that may occur as a result of the project, such as agricultural expansion or deforestation.
9	**Biodiversity**	The potential impacts of the project on water flow, water quality, and sedimentation patterns.
10	Introduction of invasive species through irrigation canals	Irrigation canals may facilitate the introduction of invasive plant or animal species into native aquatic ecosystems like Water Hyacinth, Mimosa Pigra, Tilapia etc. These invasives can outcompete native species for resources such as food and habitat space

Areas of Influence

The Ou Tapaong Irrigation Sub-scheme's estimated area of influence encompasses a) the entire command area (some 14,000 hectares, including the upper, middle, and lower parts), and b) any other areas outside the command area where project activities leave an environmental footprint during project implementation and sub-scheme operations. While the first is clear in terms of the boundary, the latter needs additional information based on the final project engineering design and environment monitoring data to establish the additional area of influence that is outside of the command area (due to the project's environmental footprint).

In line with the methods set forth under Section 3.2 (above), a detailed assessment was conducted for the OTP command area (as Modified Habitat) while a preliminary assessment was carried out for the area located immediately outside and to downstream of the OTP command area. It is noted within the OTP command area, that there is a lake called Boeng Kanseang or Kanseang Lake which is home to fish and birds. Analysis to determine critical habitat (Steps 1 and 2 of the CHA method)

Analysis to prepare for determining CH status

1. Critical Habitat Area of Analysis

Critical habitat is defined as an Area of Analysis (AoA), and the project's command area is used as an AoA.

2. Species with Potential Occurrence within the AoA

A list of threatened species with potential occurrence was generated for OTP. The coordinates of OTP (via KMZ file) are used to inform the IBAT radius of screening. Since the default radius of IBAT screening is 50km, steps were taken to narrow down to the sub-scheme's area of

influence to identify only EN and CR species that are potentially present in the sub-scheme area of influence. The narrowing-down aims to practically identify EN and CR species that could be found in the sub-scheme area of influence and to determine the Critical Habitat status of the identified species. After three rounds of screening focusing on EN and CR species, 11 EN and CR species are found as potentially present in the sub-scheme area of influence. These species include 4 reptile species, 2 mammals, 2 fishes, and 3 birds (See list of 11 EN and CR species in Table 3 below).

Description of screening for narrowing down

For Ou Ta Paong, three rounds of screening have been conducted. The first screening (Round 1) was conducted in December 2023. Round 2 was carried out in April 2024, and Round 3 in August 2025. The purpose of repeated screening is to validate the screening results (for the same area) with a wide range of local stakeholders. The screening aims to identify only EN and CR species that are potentially present in the OTP area of influence, covering reptiles, mammals, fish, birds, amphibians, and aquatic plants. Screening was done based on the IBAT report generated and provided by the AIIB.

In the first two rounds of screening, 17 EN and CR species were identified in the OTP area of influence (See Table below). In the 3rd round of screening (in August 2024), however, 11 (out of a total of 17 species) were confirmed as “potentially present” in the OTP’s area of influence.

So, the assessment for Ou Ta Paong focuses on the confirmed list of **11 species** that are categorized by IUCN as EN and CR species, including 4 reptile species (Black Marsh Turtle, Giant Asian Pond Turtle, Southeast Asian Box Turtle, and Elongated Tortoise), 2 mammals (Indochinese Silvered Langur and Long-tailed Macaque), and 2 fishes (Striped catfish and Siamese Tiger Perch), and 3 birds (Greater Adjutant, Milky Stork, and Bengal Florican) (See Table below for the list of confirmed species and see Figure 1 for potential locations of these species in the project’s area of influence).

Table 4: Confirmed List of endangered and critically endangered species for the Ou Tapaong sub-scheme

No.	Local Name	English Name	Scientific Name	IUCN Cat	Screened Species from Round 1&2 (Total=17)	Confirmed Species in Round 3 (Total = 11)
	I. Reptile spices					
1	អណ្តើកក្អែក	Black Marsh Turtle	*Siebenrockiella crassicollis*	EN	Yes	Yes
2	អណ្តើកសោម	Giant Asian Pond Turtle	*Heosemys grandis*	CR	Yes	Yes
3	អណ្តើកបិទមុខ	Southeast Asian Box Turtle	*Cuora amboinensis*	EN	Yes	Yes

4	អណ្តើកព្រៃ	Elongated Tortoise	*Indotestudo elongata*	CR	No	Yes
	II. Mammal species					
5	ភេរោមច្រមុះ	Hairy-nosed Otter	*Lutra sumatrana*	EN	Yes	No
6	ស្វាព្រាម	Indochinese Silvered Langur	*Trachypithecus germaini*	EN	Yes	Yes
7	ស្វាក្តាម	Long-tailed Macaque	*Macaca fascicularis*	EN	Yes	Yes
	III. Fish species					
8	ក្រីជ្រោង	Striped catfish	*Pangasianodon hypophthalmus*	EN	Yes	Yes
9	ក្រីកន្ត្រៀបខ្លា	Siamese Tiger Perch	*Datnioides pulcher*	CR	Yes	Yes
	IV. Bird species					
10	ត្រដក់ធំ	Greater Adjutant	*Leptoptilos dubius*	EN	Yes	Yes
11	រនៀលស	Milky Stork	*Mycteria cinerea*	EN	Yes	Yes
12	ចាបព្រៃវែង	Yellow-breasted Bunting	*Emberiza aureola*	CR	Yes	No
13	ឪរ៉ឹប ឬ ទ្រមាក់អណ្តើក	Bengal Florican	*Houbaropsis bengalensis*	CR	Yes	Yes
14	ពពូលទឹក	Masked Finfoot	*Heliopais personatus*	CR	Yes	No
15	ទាព្រៃស្លាបស	White-winged Duck	*Asarcornis scutulata*	EN	Yes	No
	V. Amphibians, and aquatic plants					
16	កញ្ជ្រោងចេកភ្នំក្រវាញ	Cardamon Shrub Frog	*Philautus cardamonus*	EN	Yes	No
17	ស្មៅស្ទឹង / ទន្លេ	River-weed	*Terniopsis chanthaburiensis*	EN	Yes	No

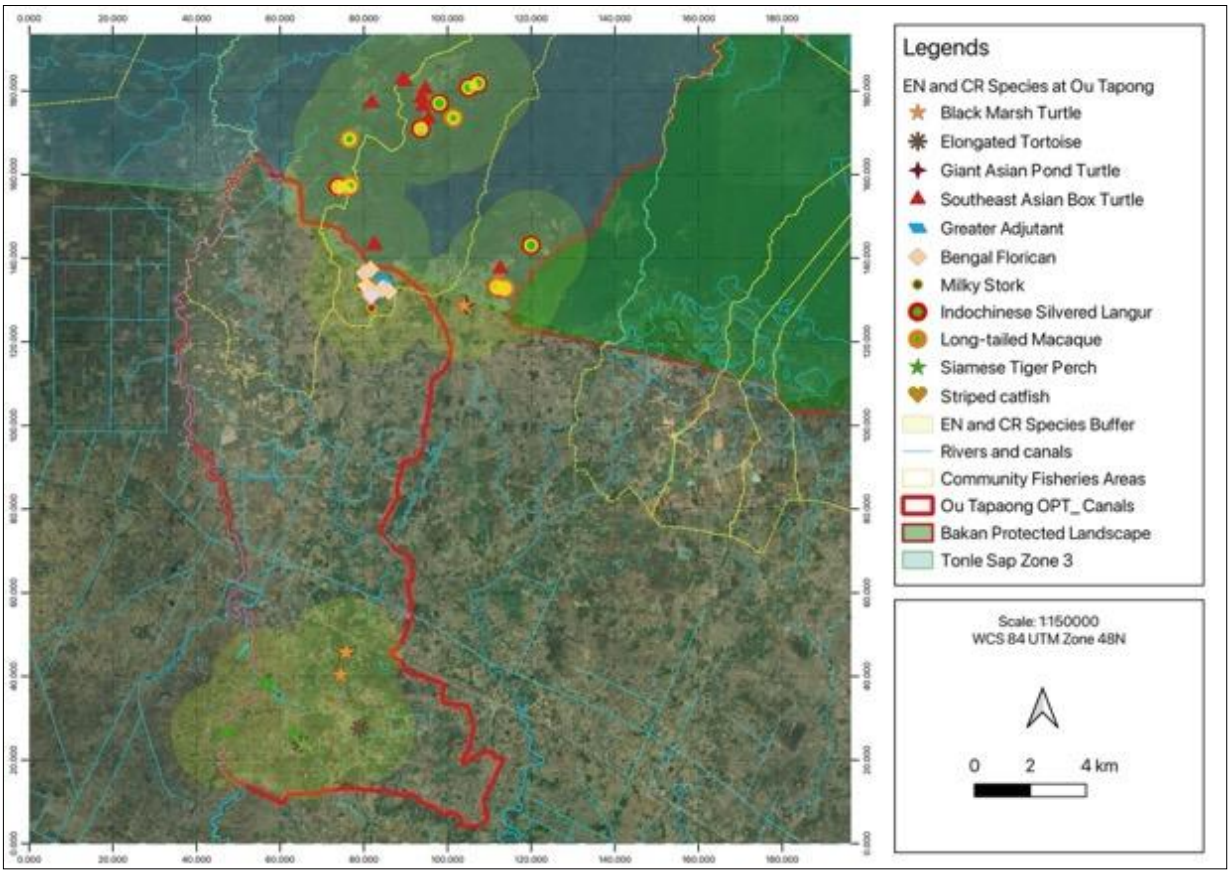


Figure 7: Map showing the observed distribution of identified EN and CR species (with the potential movement of 1-2 km within and around suitable habitats (2020 to 2024)

3. Ecological State of Habitats within the AoA

Understanding of the ecological state of habitats is necessary to assess the Likelihood of occurrence (LoO) of the above 11 screened species - as part of the CHA. For this CHA, species were classified into four LoO categories: Present, Possible, Unlikely and Not Present. Species known to be Present or with a Possible LoO are further assessed in Step 3. This understanding takes into account the classification of habitats as either modified or natural based on levels of human-induced disturbance to species composition and ecological functions. In this session, a brief assessment of the 11 confirmed species are presented. The assessment discusses historical range, distribution, habitat conditions, current status, and potential threats identified by key informants[63].

The OTP command area has been in existence since the 1970s. The OTP is a mixture of paddy fields, farm roads, and residential areas. Natural rivers, such as the OTP river, have been changed and various sections by local people to support living and farming activities. The OTP

[63] Community councils and committees, including community fisheries (CFi) and farmer water user community (FWUC), were convened on July 25 and August 4, 2024. These meetings aimed to identify potential field assessment areas and select individuals with deep local ecological knowledge and experience for interviews. A total of 13 key informants were interviewed in Ou Topaong. Five of these individuals were from the upper command area, while seven were from the lower command area. Additionally, one representative from Punleu Komar Organization, which supports the Samraong Muk Yeik Community Forest Initiative, was included. Notably, the Samraong Muk Yeik and Sdok Khlouk Community Fisheries locations overlaps with portions of the Lower Ou Tapaong Command Area.

command area, therefore, the ecosystem within the OTP command area has been subject to human-induced changes over the past several decades. As such, the OTP command area is a modified habitat.

Reptiles (4 species)

The Black Mash Turtle was observed in both upper and lower sections of the command area, as well as along the main Ou Tapaong River (which is being used as a key canal feeding irrigation water for the command area). Conversely, the Elongated Tortoise was only found in the upper reaches while the Giant Asian Pond Turtle and Southeast Asian Box Turtle were found only in the lower section within Tonle Sap Zone 3 (figure 2 above). Details are below:

- **The Black Mashed Turtle *(Cuora galbinifrons)*** was confirmed to be present in the area of influence based on the accounts of four local informants. Residents from the upper reaches of Ou Tapaong reported historical sightings of this species within the past 10-20 years although recent spotting has been scarce. Key informants who live in the lower part of the command area and had livelihoods closely intertwined with the Tonle Sap Management Zone indicated that there have been ongoing efforts to bring the **Black Mashed Turtle back** to the region albeit its rarity. One informant successfully captured a Black Mashed Turtle just before the interview. This species is highly valued in the local market, particularly among middlemen, and is often used for traditional medicinal purposes. The Black Mashed Turtle is listed as Critically Endangered by the IUCN Red List, and its presence in the area of influence indicates that the habitat is essential for its survival and reproduction. Therefore, the habitat meets the criterion of being significant for a Critically Endangered species of criteria 1a of IFC PS6.
- **Elongated Tortoise:** This species wasn't initially screened for the interview, but it was identified and spotted by two key informants at the upper section of the Ou Tapaong based on the turtle images that were shown to facilitate the identification of species. No such sightings have been documented in the lower portions of the command area. One informant, a local resident near Ou Tapaong, provided a firsthand account of capturing this species. After a thorough examination of the accompanying photographs and a comparison with verified identifying features, this species is confirmed present as reported by the local informant. The Elongated Tortoise is listed as Critically Endangered by the IUCN Red List. The presence of this species within the project area indicates that the habitat is essential for its survival and reproduction, meeting the requirements of Criterion 1a.
- **Giant Asian Pond Turtle:** Three local informants who were interviewed in the lower Ou Tapaong River region confirmed the presence of the Giant Asian Pond Turtle. One informant reported spotting this species in Boeung Kum Traeng, a wetland within Tonle Sap Zone 3 while the other two informants indicated their encounters with this species in the mountainous regions of Kravanh District. Asian Pond Turtle is listed as Critically Endangered by the IUCN Red List. The reported sightings in Boeung Kum Traeng and the mountainous regions of Kravanh District indicate that these areas may be important habitats for the survival and reproduction of this species, meeting the requirements of Criterion 1a.

- **Southeast Asian Box Turtle:** During our survey in the lower section of the Ou Tapaong, we obtained valuable information about the Southeast Asian Box Turtle. All seven informants in this area confirmed the presence of this species in nearby wetlands and flooded forest areas within Tonle Sap Zone 3, which is close to the command area boundary. While three informants reported recent encounters with this species, the remaining four mentioned that they had encountered it 10 to 20 years ago. They explained that the turtle was once abundant but has become very rare in recent years. Similarly, all turtle species, including the Southeast Asian Box Turtle, are threatened by ongoing illegal hunting for trading purposes. Some people were hesitant to share recent information about these species.
  Mr. Pheoun Moeun, Deputy Chief of Samraong Muk Yeik Community Fishery (SMY-CFi) is exceptionally knowledgeable about wildlife species in his Cfi area. He has been actively participating in forest patrols and community activities. He mentioned that some people who go fishing in the forest occasionally bring back one or two turtles with them but he preferred not to disclose this information.
  One key informant admitted that they captured a turtle from a nearby forest and sold it for income. Income was shared among the four individuals. While informants were willing to share their past incidents, they were reluctant to provide details about the recent events because these activities are illegal.
  the Southeast Asian Box Turtle, a Critically Endangered species, is present in the lower section of the Ou Tapaong and nearby wetlands. These unique ecosystems are highly threatened. Therefore, Criteria 1a and 4 of IFC PS6. Additionally, Criteria 1b may also apply due to the high threat level and declining population. are potentially met.

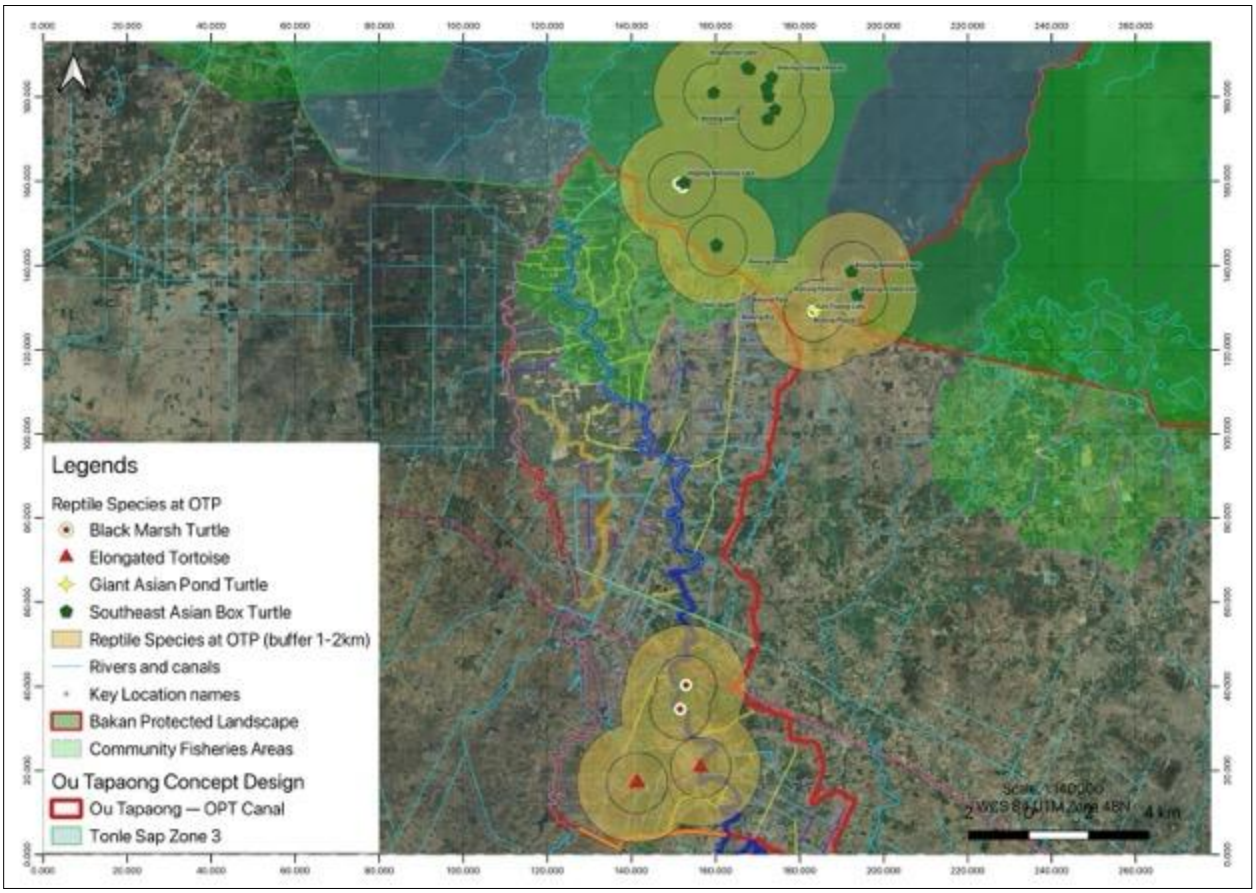


Figure 8: Distribution of identified turtle and tortoise species in and outside the OTP Command Area

Birds (3 species)

Despite extensive interviews with key informants residing in the upper reaches of Ou Tapaong, numerous endangered or critically endangered bird species were reported within their community. Conversely, only three of six bird species were confirmed by both key informants and CFi committees in the lower section. The following paragraphs summarize the primary findings and justifications for each species' presence, along with the associated level of confidence. These conclusions are based on in-depth interviews, technical expertise, and consultations with relevant units, which provided valuable assistance in verifying species of high conservation significance. Several species were initially identified by local residents.

a. **Bengal Florican:** Five informants confirmed the presence of the Bengal Florican in the area of influence. Two individuals reported sightings within the past 10-20 years while three others have observed the species within the last five years and in the past. Notably, one informant witnessed a pair (male and female) as recently as March 2024 (see Figure 3). The lower reaches of Ou Tapaong exhibit a diverse mosaic of habitats, including open wetlands, grasslands, flooded forests, and minimally intensified paddy fields, creating a relatively undisturbed environment that is potentially conducive to Bengal Florican populations. Notably, the Ou Tapaong Command Area is situated only 1

kilometre from the Bakan Protected Landscape (BPL), a region characterized by similar ecological conditions (figure 3).

Established in July 2023 through a joint effort by the Ministry of Environment and the Wildlife Conservation Society (WCS), the BPL aims to safeguard the southernmost Bengal Florican subpopulation within the Tonle Sap Great Floodplain. Moreover, the BPL serves as a critical wintering habitat for the Yellow-breasted Bunting, Manchurian Reed-warbler, and Cambodia's unique population of the Chinese Grassbird, along with other globally threatened avian and wildlife species (WCS 2023).

The project area likely meets Criterion 1a (habitat of significant importance to Critically Endangered species) due to the presence of the Bengal Florican. Additionally, it may meet Criterion 4 (highly threatened and/or unique ecosystems) given the diverse habitat mosaic. However, a detailed ecological assessment is crucial to confirm these findings and identify any other relevant criteria.

b. **Greater Adjutant:** During field assessments within the study area, multiple informants reported sightings of Greater Adjutants. While most individuals were unable to definitively distinguish between the Greater Adjutant and the similar-looking bird, which is Lesser Adjutant), one informant positively identified a Greater Adjutant within the Ou Tapaong Command area. This sighting occurred in recent years (figure 3). Unfortunately, due to the time of the observation, the Greater Adjutant had likely already migrated to its breeding grounds at Prek Toal Ramsar Site, a protected wetland area situated in Koh Chiveang community, Ek Phnom District, Battambang province (MoE 2012).

   Prek Toal Ramsar Site is the sole known breeding habitat for the greater adjutant in Southeast Asia and is recognized as the second-largest breeding colony for this species globally, following Assam, India. In December 2015, the Royal Government of Cambodia and the Ramsar Convention Secretariat designated the Prek Toal Core Area as a Wetland of International Importance due to its exceptional biological, social, and economic value. This designation solidified Prek Toal's status as Cambodia's fourth Ramsar Site (WCS 2016). Following the breeding season, greater adjutants migrate across the Tonle Sap Floodplain to their foraging habitats, with the lower section of Ou Tapaong serving as a critical foraging ground.

   Despite the challenges faced during the field observation due to the time of year, the confirmed sighting of a Greater Adjutant in the study area is a significant finding. It suggests that the species may still be present in the region and that a suitable habitat may exist for its continued survival.

   The findings indicate that the project area meets IFC PS6 Criteria 1a and 3. This is due to the presence of the Critically Endangered Greater Adjutant, a migratory species that utilizes the area as a critical foraging habitat, particularly during the non-breeding season.

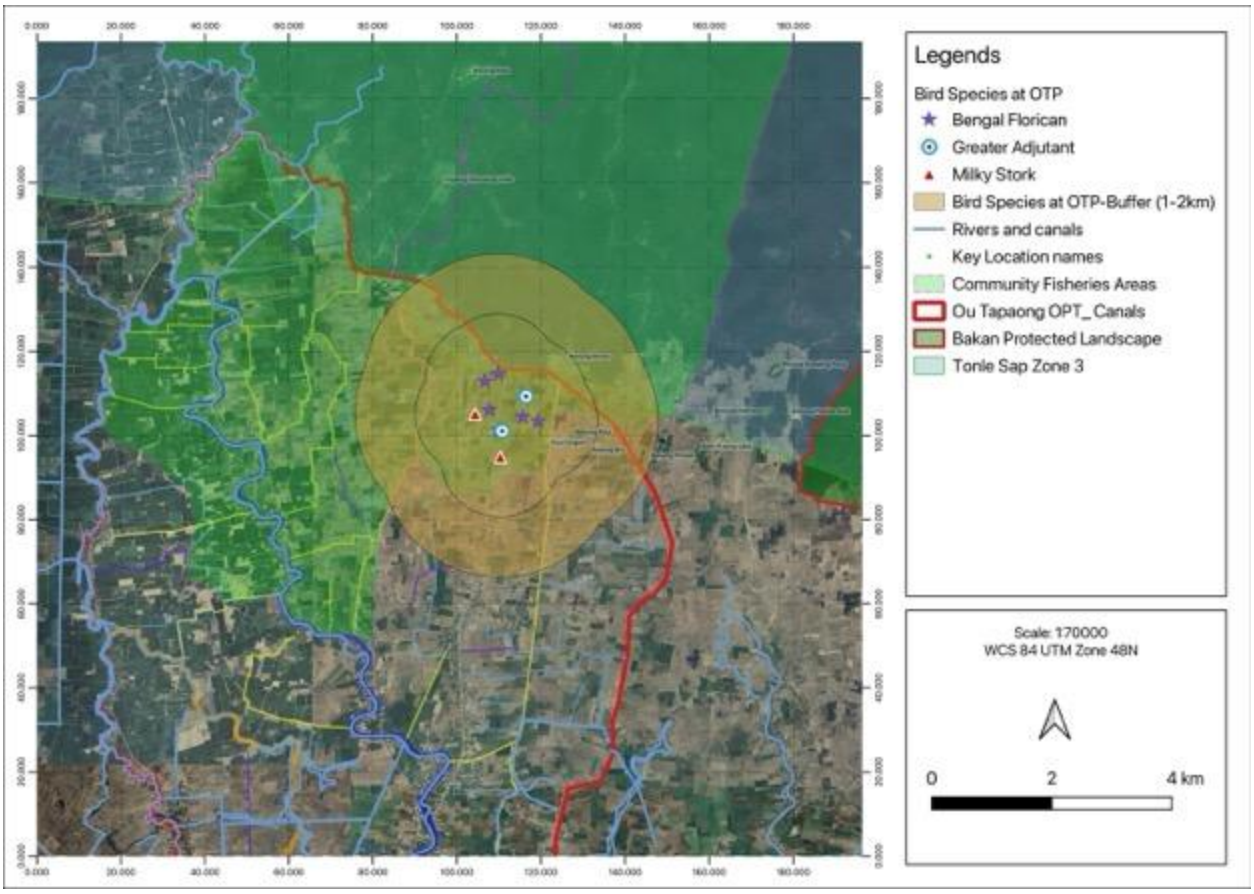


Figure 9: A spatial distribution map was generated for three bird species—the Bengal Florican, Greater Adjutant, and Milky Stork—within the lower Ou Tapaong Command Area. 1-2 km buffer zones were included to approximate their minimum movement range around suitable habitats.

c. **Milky Stork:** Despite repeated attempts to elicit accurate information, many key informants were unable to distinguish between the Painted Stork and the Milky Stork, two similar-looking bird species. This confusion is a common challenge in bird identification, especially for non-experts. While the Milky Stork is considered extremely rare in Cambodia, with sightings typically limited to 1-3 individuals, some informants claimed to have encountered larger groups. This discrepancy can be attributed to misidentification and the difficulty of accurately counting birds in the field.

   Based on my experience in bird identification and conservation, I was able to evaluate the credibility of the information provided. Two informants offered the most reliable accounts, describing sightings of 2-3 Milky Storks feeding alongside numerous Painted Storks in seasonal wetland areas near flooded forests (figure #3). These observations align with the limited available data on Milky Stork distribution and behavior in Cambodia. When the flooding season arrives, they migrate to degraded forest areas in the uplands. Milky Stork and Great Adjutant are migratory birds that move both locally and across international borders. The Prek Toal Ramsar Site serves as the only known breeding ground for Milky Stork

and Greater Adjutant in Southeast Asia; after breeding, they migrate to other wetland areas throughout the country.

The Milky Stork's situation appears to align with several IFC PS6 criteria:

Species Level:

Endangered Species (Criterion 1a): The Milky Stork's rarity and the challenges in accurately assessing its population make it a strong candidate for this criterion. Its limited distribution and potential threats further emphasize its vulnerability.

Migratory Species (Criterion 3): The migratory nature of the Milky Stork, particularly its reliance on the Prek Toal Ramsar Site as a breeding ground and its movements to other wetland areas, highlights its dependence on various habitats throughout its range.

Ecosystem Level:

Highly Threatened and/or Unique Ecosystems (Criterion 4): The wetland habitats used by the Milky Stork, especially the flooded forests and seasonal wetlands, are often threatened by human activities like deforestation, agriculture, and pollution. These ecosystems are essential for the survival of the species and other biodiversity.

Figure 10: Photograph of a Milky Stork foraging alongside a flock of Painted Storks (credit: Sang Mony, Sam Veasna Conservation Tour), and a map illustrating the distribution of Milky Stork sightings in Cambodia from 2020 to 2024, extracted from eBird data.

- **Yellow-breasted Bunting**: The Yellow-breasted Bunting is a small, migratory songbird found in Southeast Asia, including Cambodia. It is characterized by its bright yellow breast and throat, contrasting with its olive-green upperparts. The Yellow-breasted Bunting is a winter visitor and spring passage migrant in Cambodia, often found in rice fields, scrub, grasslands, and marshes in the lowlands. In Cambodia November to May,

the species has been recorded in the Tonle Sap Floodplain and the Lower Mekong Delta. Yellow-breasted Buntings are typically observed in rice fields, scrublands, grasslands, and marshes in the lowlands of Cambodia (Ly et al. 2022).
The local population often mistakenly identifies this species as a sparrow or a weaver due to their similar size, appearance, and shared habitats. After conducting inquiries, none of the locals could confirm whether they had observed this species in the area. This highlights a common gap in local ecological knowledge regarding small bird species like this one. Identifying such species typically requires individuals with advanced birdwatching experience, who can locate them in the appropriate habitat at the right time.
Based on an overall assessment of the habitat conditions in the lower part of Ou Tapaong, we can confirm that this area has the potential to serve as a wintering habitat for this species. Additionally, the boundary of the Ou Tapaong Command Area is just 1 km away from the Bakan Protected Landscape.
The Yellow-breasted Bunting's Critically Endangered status and the Ou Tapaong area's potential as a wintering habitat potentially meet IFC PS6 Criteria 1a. Additionally, the species' restricted range and migratory behavior align with Criteria 2 and 3. The Yellow-breasted Bunting, a CR species, is known to inhabit such areas during its winter migration.

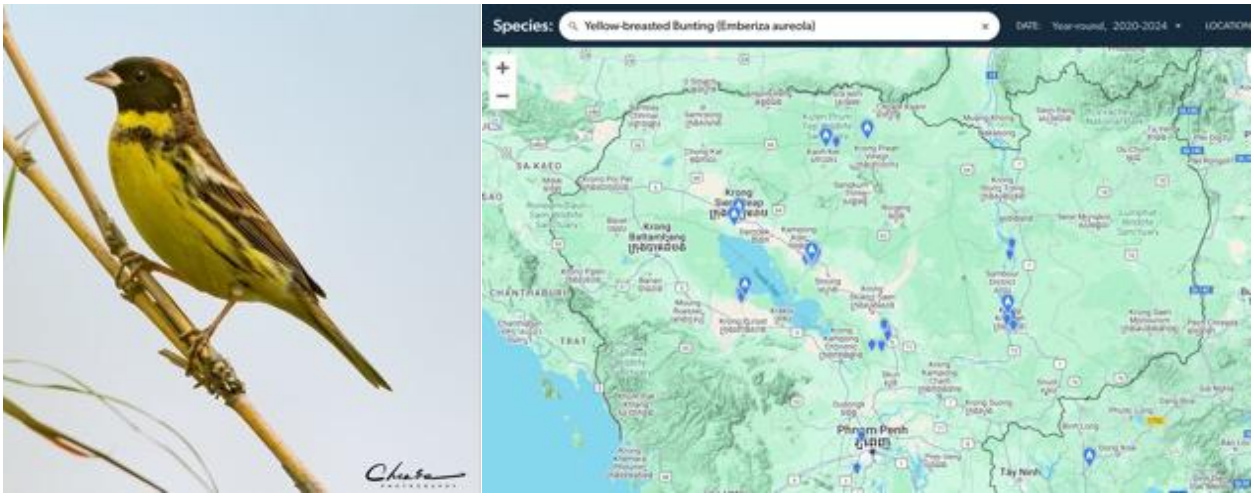


Figure 11. *Photo of Yellow-breasted Bunting (Emberiza aureola) and its distribution map from eBird data (2020-2024)recorded by birdwatcher and wildlife overserves.*

- **Wild-winged Duck:** Regarding the Wild-winged Duck, there was some confusion among informants who mistakenly identified it as the Knob-billed Duck (Sarkidiornis melanotos). However, after discussing key identification features and ecological characteristics, such as breeding and nesting habitats, we determined that none of them had actually encountered the Wild-winged Duck before. Due to it’s tiny population, Wild-winged Duck is very sensitive, and live in the forest close to the lake, wetland, river and waterhold with less disturbance. Due to its limited population, the Wild-winged Duck is particularly sensitive to disturbances and prefers to reside in relatively undisturbed

forests adjacent to lakes, wetlands, rivers, and watering holes. This preference for quieter, less populated areas helps to ensure the survival of this vulnerable species.

Mammals/ primates (2 species)

No suitable habitats or sightings of three mammal species were identified in the upper section of Ou Tapaong. Two primate species (Indochinese Silvered Langur and Long-tail Macaque) were confirmed at the lower section in the Flooded Forest habitat of the Tonle Sap Zone 3 and CFi Areas. Additionally, multiple reports indicated the presence of Hiary-nosed Otters in the region, particularly in the deep waters of the flooded forest near the Tonle Sap Great Lake's mouth. The following paragraphs summarize the key findings and justifications for the presence of these two primate species, along with their associated confidence levels. These conclusions are based on comprehensive interviews, technical expertise, and consultations with relevant units, which contributed to the verification of species with high conservation importance.

- **Indochinese Silvered Langur:** Six local informants (86%) reported frequent encounters with Indochinese Silvered Langurs within the flooded forests of Tonle Sap Zone 3 which is outside of the OTP command area. These sightings, primarily near natural lakes, have been confirmed by multiple individuals engaged in livelihood activities within these areas. While the population of Indochinese Silvered Langur was once plentiful, informants noted a significant decline in recent decades, with only smaller troops now being observed. The species is known to inhabit areas near rivers and large bodies of water.

  Mr. Chem Sophal from Punleu Komar Organization highlighted that his organization provides support for the Samraong Muk Yeik Community Fishery (SMY-CFi) and Sdok Khlouk Community Fishery (SK-CFi) in managing and protecting fisheries resources and flooded forests within their Community Fishery Area (figure 6). Portions of these CFi Areas overlap with the Lower section of Ou Tapaong Command Area. This effort is part of the EU “Our Tonle Sap” Project, led by the Wildlife Conservation Society and funded by the European Union. Mr Sophal emphasized the presence of numerous endangered and critically endangered species, including the Indochinese Silvered Langur, within this CFi Area. To confirm the presence of any Community Fisheries (CFIs) within the specified area, we interviewed the Chief of Pursat Fishery Administration Cantonment. Our inquiry revealed that two CFi areas overlap with the designated region, as illustrated in the accompanying map (see map below).

  Based on the provided information, the following IFC PS6 criteria are potentially met regarding the Indochinese Silvered Langur and the flooded forests of Tonle Sap Zone 3:

  Species Level:

  Criterion 1: Critically Endangered and Endangered Species: The Indochinese Silvered Langur is an endangered species, making its habitat a potential candidate for this criterion.

  Criterion 2: Highly Threatened Species: Given the observed decline in the population and potential threats to its habitat, the species could be considered highly threatened.

  Ecosystem Level:

Criterion 5: Highly Threatened and Unique Ecosystems: The flooded forests of Tonle Sap Zone 3 represent a unique and threatened ecosystem, particularly due to factors such as habitat loss and degradation.

- **Long-tailed Macaque:** Indochinese Silvered Langurs and Long-tailed Macaques were commonly reported by key informants residing within the Tonle Sap Zone 3. These informants, who frequently engaged in fishing activities in the surrounding forests, encountered Long-tailed Macaques regularly. They added that these primates, known for their social nature, live in troops and communicate vocally to alert their group members of potential threats or discoveries. Some troops inhabit flooded forests situated close near the command area.

  However, informants expressed deep concern over the significant decline in the population of Long-tailed Macaques over the past several years. This alarming trend has prompted urgent action from conservation organizations. In response to the deteriorating situation, the primate specialist group upgraded the conservation status of this species from Vulnerable to Endangered in March 2022. This elevated status underscores the urgent need for increased protection measures to mitigate the species' decline, which is primarily driven by the high demand for these primates in the illegal pet trade (*Primate Conservation Alliance. 2022)*

  The provided information strongly suggests that the Tonle Sap Zone 3 adjacent to the OTP meets multiple IFC PS6 criteria related to the Critically Endangered Long-tailed Macaque:

  1. Criteria 1a: The recent uplisting of the Long-tailed Macaque to Endangered status by the IUCN Red List underscores the habitat's critical importance for the species' survival and reproduction. The frequent sightings of these primates by local informants, especially in the flooded forests, highlight the area's significance as a key habitat.
  2. Criteria 4: The flooded forests of the Tonle Sap Zone 3 represent a highly threatened and unique ecosystem. They face significant threats from habitat loss, pollution, and climate change. These forests provide a crucial habitat for the Long-tailed Macaque and other potentially threatened species.

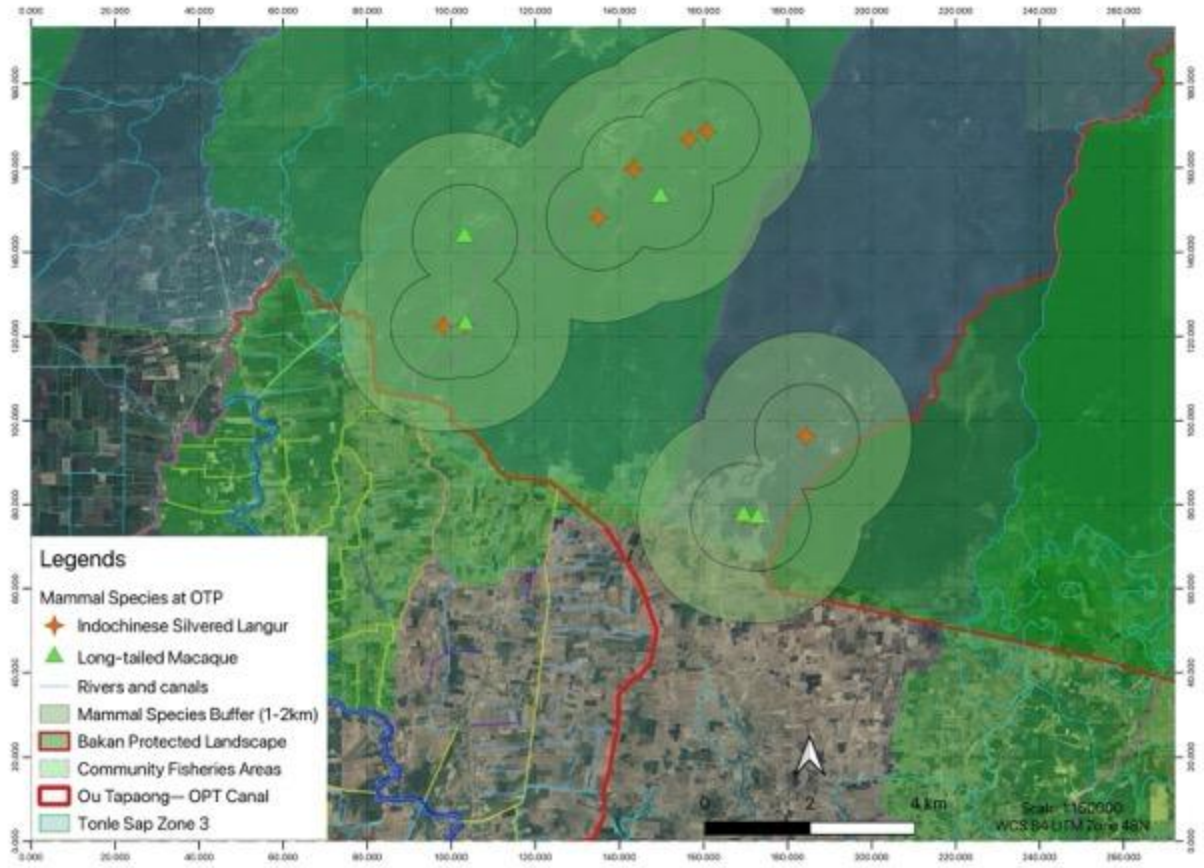


Figure 12: A spatial distribution map was generated for two primate species—the Indochinese Silvered Langur and Long-tailed Macaque—within the lower Ou Tapaong Command Area. 1-2 km buffer zones were included to approximate their minimum movement range around suitable habitats.

Fishes (2 species)

Overall, these statements provide valuable insights into sightings and knowledge about Siamese Tiger Perch and Striped Catfish within different sections of the Ou Tapaong Command area. The following paragraphs summarize the key findings and justifications for the presence of these two fish species confirmed by key informants, along with their associated confidence levels and their ecological knowledge of fish diversity and migration.

- **Siamese Tiger Perch:** According to four key informants in the upper section of the Ou Tapaong Command area, Siamese Tiger Perch has been consistently observed in Boeng Kansaeng Lake, located in the southwest part of the Ou Tapaong Command Area. Three of them reported encountering a few individuals of this fish species in 2023 and 2024 (figure #7), while another informant saw them about 20 years ago during the fully flooded period. This particular informant stopped fishing for many years after becoming older.
  The Siamese Tiger Perch is believed to migrate from Tonle Sap Great Lake to the upstream through Svay Daun Kav River (along the western boundary of command area) and then move into Boeng Kansaeng through its tributary canal during flooding periods.

Common fishing gear used includes line nets, cast nets, and small fish traps. The informants mentioned that catching this species is extremely rare, with only one to two individuals caught per season using line nets. They possess extensive knowledge about fish and make a living through fishing.

On the other hand, two key informants from the lower Ou Tapaong section stated that although they are familiar with Siamese Tiger Perch, they have never seen them in their area. One informant mentioned having seen this species in 1979 but not recently. Similarly, Mr. Chem Sophal from Punleu Komar Organization confirmed his awareness of this species but stated that it is not present in the lower Ou Tapaong Area.

The Criterion 1a of IFC Performance Standard 6 (PS6) is potentially met. The Siamese Tiger Perch, a Critically Endangered species, has been observed in Boeng Kansaeng Lake, a habitat within the Ou Tapaong Command Area. However, the frequency of sightings is low and historical, suggesting that further investigation is necessary to definitively establish the habitat's significance for the species' survival and reproduction.

- **Striped catfish**: One informant recalled seeing the Striped Catfish approximately 7 years ago in a small wetland area during the peak of flooding. This species is exceptionally rare, and it is known to migrate to this specific area when the entire region becomes submerged in floodwater.

  Based on what we know, the habitat for the Critically Endangered Striped Catfish likely meets two of the IFC PS6 criteria:

1. Criterion 1a: This habitat is super important for the survival of this super rare fish. It's like their special breeding ground during floods.
2. Criterion 3: The fish migrates to this specific area when it floods, making it a key spot for this travelling species.

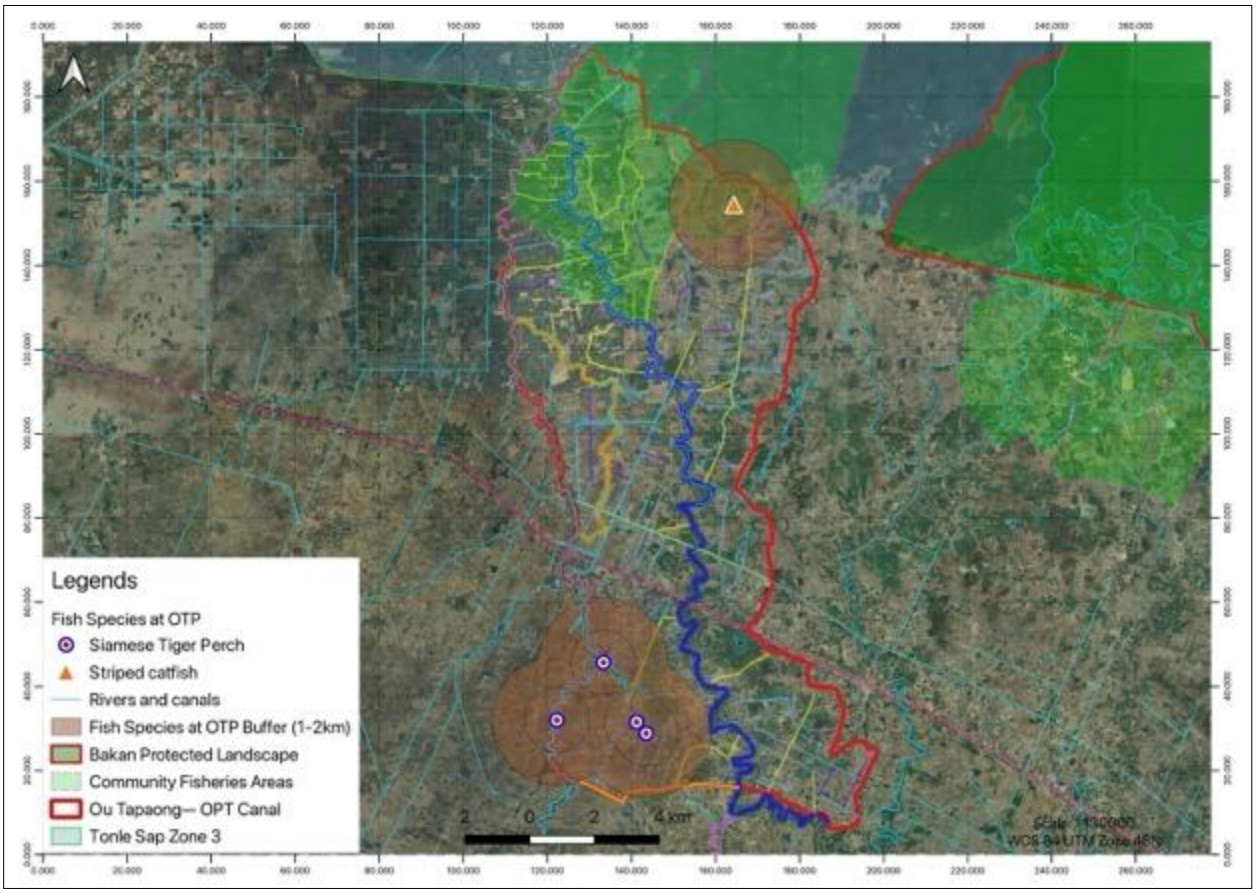


Figure 13: A spatial distribution map was generated for two fish species—the Siamese Tiger Perch, and Striped Catfish (old record-7 years ago)—within the lower Ou Tapaong Command Area. 1-2 km buffer zones were included to approximate their minimum movement range around suitable habitats.

4. Occurrence of Protected Areas near the Sub-scheme Area

A review of protected areas in the vicinity of the sub-scheme has been conducted as a preparatory step before proceeding with Step 3 of the CHA. There are four areas located near and downstream of the OTP sub-scheme (See Table below). The preliminary assessment focuses on the two that are closest to the OTB: Flood Forest Conservation, b) Bakan Grassland Protected Area[64].

No.	Name of Protected Area	Designated by	Main target and requirement	Distance (km) to OTP sub-scheme
1	Flooded Forest Conservation	Royal Government of Cambodia: Sub-decree No. 197	The Tonle Sap's flooded forests are a vital part of its unique ecosystem. During the wet season, the Mekong River's	0 (share the border)

[64] Bakan grassland is a protected area for birds designated by sub-decree No. 144 in 2023.

No.	Name of Protected Area	Designated by	Main target and requirement	Distance (km) to OTP sub-scheme
		dated 29 August 2011	waters back up into the Tonle Sap, flooding vast areas and creating a rich habitat for diverse wildlife. This dynamic ecosystem supports a multitude of fish species, waterbirds, and other wildlife. However, it faces threats like deforestation, overfishing, and pollution, necessitating conservation efforts to protect this vital resource.	
2	Bakan Grassland protected area	Royal Government of Cambodia: Sub-decree No. 144, dated 04 July 2023	Bakan Grassland, a 38,430-hectare protected area in Cambodia, is a vital part of the Tonle Sap ecosystem. It's home to endangered bird species like the Bengal Florican and Chinese Grassbird. The Wildlife Conservation Society (WCS) and local communities are working together to protect this unique habitat.	2
3	Dei Roneat Important Bird Area (IBA)	BirdLife Internation	The IBA supports breeding colonies of important birds like the Darter, Lesser Adjutant, and Greater Adjutant. Its diverse habitat supports various bird species, but faces threats from human activities. Conservation efforts include monitoring, community engagement, habitat restoration, and policy advocacy to protect this crucial site.	12
4	Tonle Sap Biosphere Reserve (TSBR)	Royal Government of Cambodia: Royal Decree in 2001[65]	The Tonlé Sap Biosphere Reserve is a distinctive ecological region encompassing the Tonlé Sap, or Great Lake of Cambodia. The reserve was successfully designated a UNESCO Biosphere Reserve in	16

[65] https://www.unesco.org/en/articles/national-conference-tonle-sap-biosphere-reserve-brings-together-stakeholders-discuss-sustainable

No.	Name of Protected Area	Designated by	Main target and requirement	Distance (km) to OTP sub-scheme
			1997 and subsequently enshrined in the Cambodian Royal Decree in 2001.	
5	Prek Toal Important Bird and Biodiversity Area (IBA), then designated at the core area of TSBR in 2001, and then promoted Prek Toal Ramsar Site in 2015	BirdLife Internation Royal Government of Cambodia: Royal Decree in 2001[66] Sub-decree in 2015	The area is well known as the largest waterbird breeding colonies in Southeast Asia, support a congregation of may globally threatened birds, fish and other wildlife specicis. It's the second world largest breeding habiatat for Greater Adjutant, and the only breeding habitat for Spot-billed Pelican, and Milky Stork in Southeast Asia. Prek Toal is only inland breeding population for Milky Stork in the world.	24

[66] https://www.unesco.org/en/articles/national-conference-tonle-sap-biosphere-reserve-brings-together-stakeholders-discuss-sustainable

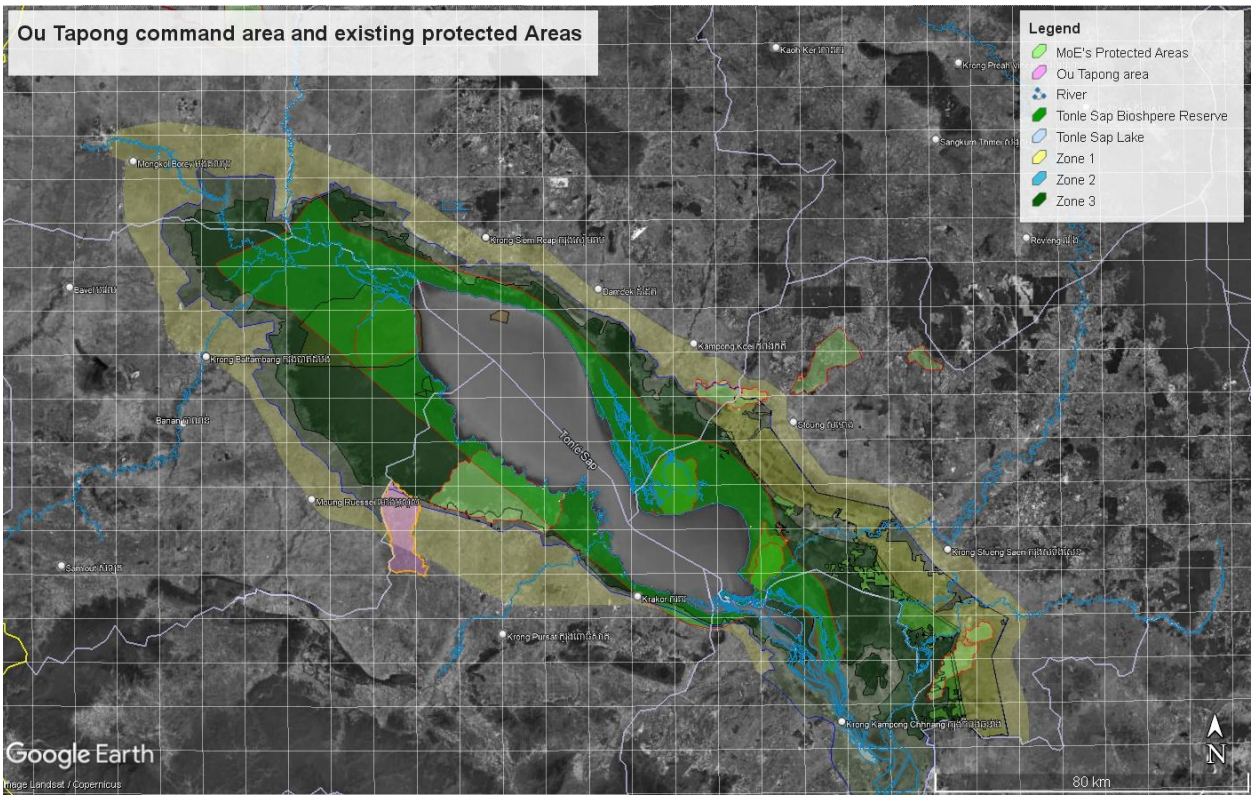


Figure 14: Map of Ou Tapong Command Area and other existing protected areas under administered of the Ministry of Environment, Ministry of Agriculture, Forestry, and Fisheries, and Ministries of Water Resources and Meteorology

Determination of Critical Habitat Status (Step 3)

This section assesses the information (obtained from the above sub-section) vis-a-vis the criteria (presented in Section 3.4 - CH assessment method). This assessment aims to determine whether any species (identified in the list of 11 EN and CR species) qualify for Critical Habitat features.

All information presented in this study report has been meticulously verified against reliable sources, including key government research institutes, national and international organizations, and expert consultations.

To ensure accuracy, fish species identification for Brambei Mom, Kraeu Trom, and Yottasass was confirmed through consultations with Dr. Ea Chitra, Head of the Aquaculture Faculty at the Kampong Speu Institute of Technologies. Furthermore, information on fish and reptiles across all sub-schemes was corroborated with Mr. Tach Sovannara, Head of the Fisheries Lab at the Inland Freshwater Research and Development Institute of the Fisheries Administration, and Mr. Khim Sokha, a senior officer from the Fisheries Conservation Department and a key expert from Punleu Komar Organization and Wildlife Conservation Society (WCS).

Finally, information related to reptiles and amphibians was validated through consultations with Mr. Neang Ty and his team from Wild Earth Allies, renowned experts who have made significant

contributions to the discovery of new reptile and amphibian species in Cambodia, including the Cardamon Shrub Frog (*Philautus cardamonus*).

All information concerning avian and other key wildlife species, including their behavioral patterns, was corroborated through sighting data verified by relevant experts from the Wildlife Conservation Society (WCS), a long-standing partner of the Ministry of Environment (MoE), Fisheries Administration, and Forestry Administration in conservation efforts spanning over 25 years. Additionally, consultations were held with Mr. Hong Chamnan, Director of the Freshwater Wetland Conservation Department, and Mr. Sun Visal, his Deputy Director and the head of the Tonle Sap Biosphere Reserve. Both individuals possess extensive experience, ranging from 20 to 30 years, in avian ecology and protected area management within the Tonle Sap Lake region.

Overview of the current land use and land cover at OPT

The map below features the current land and use and land cover at Ou Tapaong Command Area based on the satellite image captured by Sentinel 2 with 10m resolution in late 2023. The color bands failed to distinguish between rice fields, grassland and shrubland areas. However, based on field assessment, the command area is dominated by existing rice fields and some modified habitats. There are some small and fragmented natural habitats like shrubland, and grassland along the natural streams, seasonal ponds and wetland habitat creating a mosaic habitat for many wildlife species to strive as the area is situated within the Tonle Sap Floodplain close to many protected areas and IBBAs. Residential areas are situated along the main roads, rivers, and streams.

The northern portion of the OTP Command Area is a dynamic landscape characterized by a varied mosaic of habitats. Here, agricultural lands coexist with modified habitats, wetlands, shrublands, and remnants of grassland, seamlessly transitioning into the vast expanse of the Tonle Sap Zone 3 flooded forest.

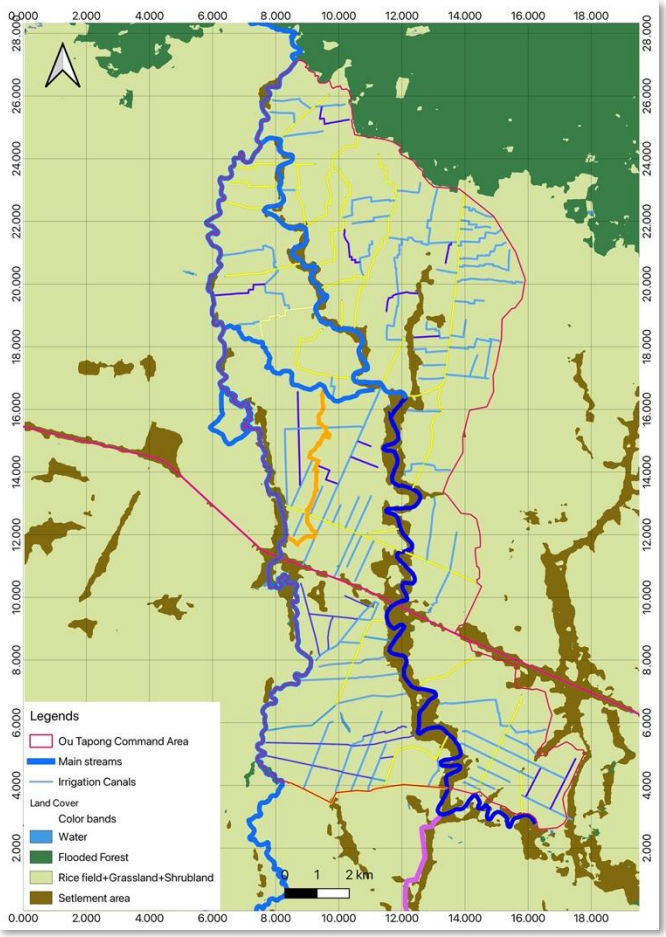


Figure 15: Land use and land cover map based on

This diverse ecological mosaic plays a crucial role in supporting a rich array of biodiversity. The area serves as a vital foraging ground for numerous migratory bird species, providing them with abundant food resources. Additionally, it functions as a critical refuge and breeding ground for fish during the wet season, when the flooded forests and wetlands offer ideal conditions for spawning and juvenile development.

The intricate interplay of these habitats sustains a diverse community of wildlife, including birds, mammals, fish, and reptiles. These species rely on the unique characteristics of the flooded forest and wetland ecosystems for essential life cycle activities such as breeding, nesting, and foraging. The area's significance as a biodiversity hotspot is underscored by its role in supporting a wide range of ecological functions and processes.

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on 3 screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
Reptiles								
Black Marsh Turtle	*Siebenrockiella crassicollis*	EN	No	Yes	Yes	Present	Strongly and accurately confirmed by key informants	Consultation with local people indicated that the Black Marsh Turtle is present in the project area.
Giant Asian Pond Turtle	*Heosemys grandis*	CR	No	Yes	Yes	Present	Strongly and accurately confirmed by key informants	Consultation with local people indicated that the species is present in the project area.
Southeast Asian Box Turtle	*Cuora amboinensis*	EN	No	Yes	Yes	Possible	Strongly and accurately confirmed by key informants	Consultation with local people indicated that the species is present in the project area.
Elongated Tortoise	*Indotestudo elongata*	CR	No	Yes	Yes	Possible	Strongly and accurately confirmed by key informants	Consultation with local people indicated that the species is present in the project area.
Mammals								
Hairy-nosed Otter	*Lutra sumatrana*	EN		Yes	No	Not present		

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on 3 screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
Indochinese Silvered Langur	*Trachypithecus germaini*	EN	No	Yes	Yes	Unlikely	Strongly and accurately confirmed by key informants	Consultation with local people and relevant NGOs working in that area indicated that this species present in the flooded forest within Tonle Sap Zone in adjacent to the command area boundary.
Long-tailed Macaque	*Macaca fascicularis*	EN	No	Yes	Yes	Not present	Strongly and accurately confirmed by key informants	Consultation with local people and relevant NGOs working in that area indicated that this species present in the flooded forest within Tonle Sap Zone in adjacent to the command area boundary.
Fishes								
Striped catfish	*Pangasianodon hypophthalmus*	EN	No	Yes	Yes	Unlikely	Strongly and accurately confirmed by key informants	Consultation with local people indicated that the species is present in the project area but very rare. They encountered them only during high flooding year.
Siamese Tiger Perch	*Datnioides pulcher*	CR	No	Yes	Yes	Present		Consultation with local people indicated that the species is present in the project area especially in Boeung Kansaeng Lake.

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on 3 screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
Birds								
Greater Adjutant	*Leptoptilos dubius*	EN	No	Yes	Yes	Possible		Consultation with local people indicated that the species is present in the project area.
Milky Stork	*Mycteria cinerea*	EN	No	Yes	Yes	Possible		Consultation with local people indicated that the species is present in the project area.
Yellow-breasted Bunting	*Emberiza aureola*	CR		Yes	No			
Bengal Florican	*Houbaropsis bengalensi*	CR	No	Yes	Yes	Present		Consultation with local people and conservation NGO indicated that the species is present in the project area.
Masked Finfoot	*Heliopais personatus*	CR		Yes	No			
White-winged Duck	*Asarcornis scutulata*	EN		Yes	No			
Amphibians, and aquatic plants								

English Common Name	**Scientific name**	**IUCN Red List Status**	**Restricted Range**	**IBAT listing**	**Confirmed based on 3 screenings**	**Likelihood of Occurrence with AoI** (Present, Possible, Unlikely and Not Present)	**Reasons for Exclusion and data sources**	**Critical Habitat Determination of Species**
Cardamon Shrub Frog	*Philautus cardamonus*	EN			Yes	No		
River-weed	*Terniopsis chanthaburiensis*	EN		Yes	Yes	No		

Habitat of significant importance to CE and EN species

As presented in Section 4.1.3.3 (Ecological State), species that qualify as critical habitat features include:

- **Reptile** (4 species): Black Marsh Turtle, Giant Asian Pond Turtle, Southeast Asian Box Turtle, and Elongated Tortoise,
- **Mammals** (2 species): Indochinese Silvered Langur and Long-tailed Macaque),
- **Fishes** (2 species): Striped catfish and Siamese Tiger Perch, and
- **Birds** (3 species): Greater Adjutant, Milky Stork, and Bengal Florican.

First of all, the Ou Tapaong command area was assessed as a modified habitat because the command area which is around 14,000 hectares is a mixture of paddy fields, rivers, shrubland, seasonal ponds, farmers, and houses. Rivers such as Ou Ta Paong River and Svay Donkeo River have been substantially modified at various locations of the river for water collection, storage, as well as for other living and farming purposes.

In this assessment, we divided Ou Tapaong Command Area into three parts: 1) the upper part to the south, 2) the middle part along National Road 5, and 3) the lower part to the north which is situated within the floodplain of Tonle Sap Zones 2 and adjacent to Tonle Sap Zone 3 for key informant interview and habitat assessment purposes as this command area is large and maintain different demographic and natural habitat conditions. On August 7, 2024, the Cambodian government discussed the decision to register two zones (Zone 2 and Zone 3) of the Tonle Sap Lake Basin as state land to protect the natural resources of the lake. This decision will prohibit any further requests for land concessions in these zones. The Ministry of Land Management, Urban Planning and Construction hopes that this will help to preserve the biodiversity of the lake[67]. The assessment focused on the upper and lower parts because these areas are known to have a diverse biodiversity landscape. While the survey revealed variations in knowledge about wildlife among local communities, it also highlighted the need for increased awareness and understanding across all areas.

[67] Land Management, Urban Planning and Construction, Cambodia (2024). Zones 2 and 3 of the Tonle Sap Lake will be registered as state land to preserve this precious natural resource for inheritance for all generations.

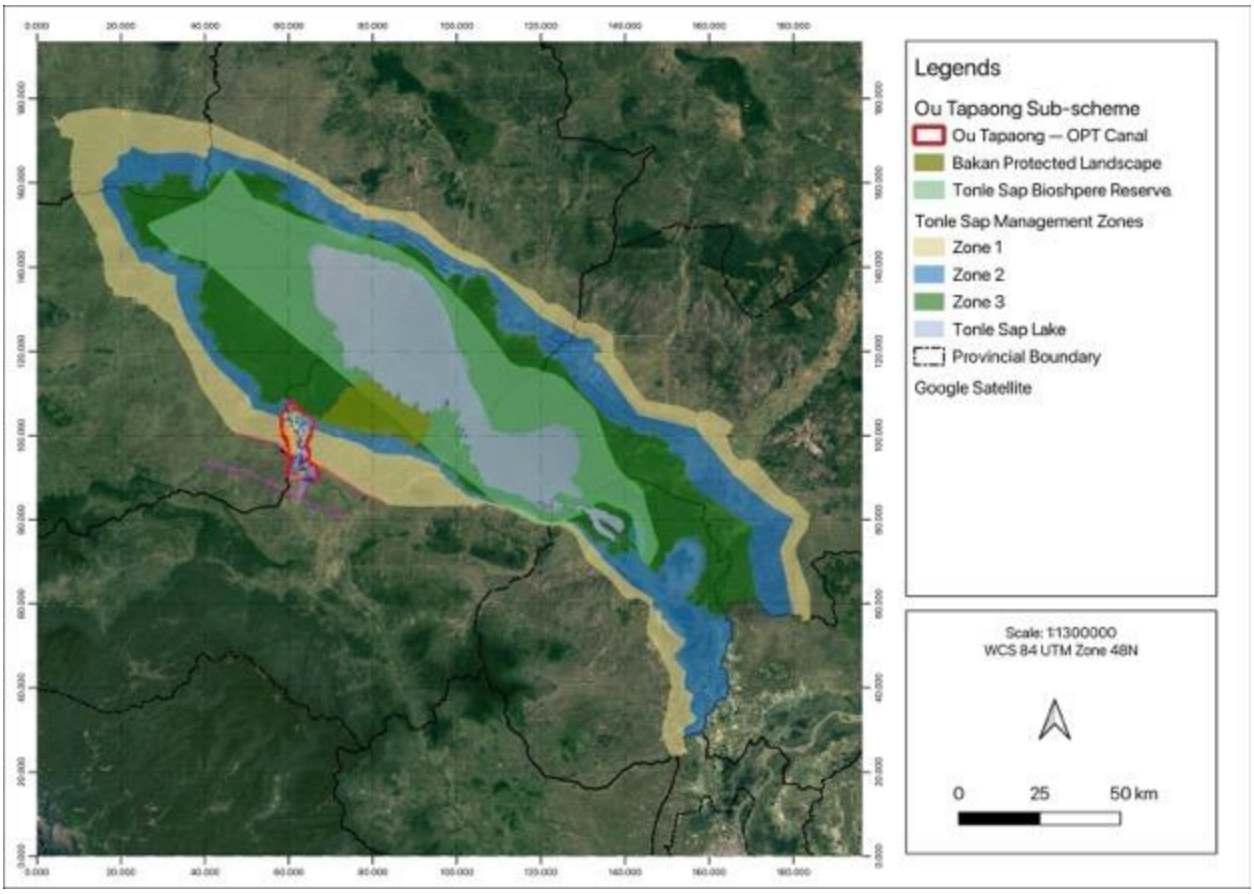


Figure 16: Map of Ou Tapaong command area and other existing protected area within the Tonle Sap Basin

The southern part of the command area is predominantly agricultural, with limited remaining natural habitats. Boeng Kansaeng, the largest seasonal wetland, faces challenges in water retention during the dry season. While the command area mostly gets water for irrigation from the Svay Daunkaev and Pursat rivers, the water volume is insufficient to maintain natural flows (e.g. Ou Tapaung River). Additionally, human interventions such as earth dams and conversion of waterways into fish ponds have fragmented the natural habitats and as such hindered the movement of aquatic species (Figures 8 and 9).

The northeastern part of the command area, though dominated by agriculture, includes a significant area of flooded forests. This diverse habitat supports a range of endangered and critically endangered species. However, the entire water system faces challenges that limit its suitability for species requiring extensive, interconnected habitats. The lowest part of this area is connected to a very healthy flooded forest habitat, consisting of many small and large waterholes, and wetland areas, creating a mosaic habitat that provides suitable ecological niches for many endangered and critical species in the area. This huge flooded forest habitat is part of the Tonle Sap Multiple Use Area, Tonle Sap Biosphere Reserve under the Ministry of Environment, and Tonle

Sap Management Zone under the administration mandate of the Tonle Sap Authority, and Flooded Forest Protected Area under the Fisheries Administration. Additionally, a portion of Ou Tapaong's lower command area overlaps with two Community Fisheries (CFIs) areas.

The critical habitat for these bird species within the Ou Tapaong Irrigation sub-scheme includes flooded forests, wetlands, lakes, rivers, grassland, abandoned and fellow rice fields, and waterways. The flooded forests in Tonle Sap Zone 3 serve as crucial habitats for several endangered and critically endangered primate species like the Indochinese Silvered Langur and Long-tailed Macaque and are charaterised with lakes and wetlands inside that are crucial foraging habitats for birds. Based ont this key finding we can identify and cacharaterise critical habitats of various EN and CR species presence within and close thie command area as below:

1. Flooded forests, particularly those in Tonle Sap Zone 3, are particularly significant for biodiversity. These forests provide crucial habitat for endangered primates such as the Indochinese Silvered Langur and Long-tailed Macaque. Additionally, the lakes and wetlands within these forested areas offer essential foraging grounds for various bird species including Greater Adjutant and Milky Stork.
2. Wetlands, such as Boeung Kansaeng, play a vital role in supporting aquatic and terrestrial biodiversity. These areas provide essential food, shelter, and breeding grounds for a variety of species including birds, reptiles, and fish.
3. Rivers and waterways, like the Svay Daun Kav River, serve as important corridors for fish migration and connectivity between different habitats. This can indirectly benefit birds by providing a healthy aquatic ecosystem.
4. Grasslands and open areas, while less diverse than forested habitats, can still support certain Bengal Florican, Yellow-breasted Bunting and other bird species. Abandoned and fallow rice fields may also offer temporary refuge for many bird birds including the Florican. The Bengal Florican utilizes this habitat for nesting and feeding during the dry season. The Yellow-breasted Bunting winters in this region before returning to its breeding ground in Siberia, Russia, from May to November

Based on the biodiversity assessment conducted at Ou Tapaong Irrigation Sub-scheme, several critical habitats have been identified, and described below. These habitats support a range of endangered and critically endangered species, highlighting their ecological significance. **The critical habitat assessment activities that should be taken for the Ou Tapaong Command area, considering IFC PS 6 guidance on biodiversity conservation and sustainable management of living natural resources, are as follows:**

1. **Baseline Studies: Conduct comprehensive baseline studies to identify and understand the biodiversity values in the area. This should include a literature review, stakeholder engagement and consultation, field surveys, and other relevant assessments. The focus should be on identifying key species (such as Greater Adjutant, Milky Stork, Bengal Florican), fish (Siamese Tiger Perch and Striped Catfish), reptiles (Black Marsh Turtle, Southeast Asian Box Turtle, Giant Asian Pond Turtle, Elongated Tortoise),**

mammals (Indochinese Silvered Langur and Long-tailed Macaque), and their habitats.

2. **Habitat Mapping: Map out the different habitats present within the Ou Tapaong Command area. This should include flooded forests, lakes (such as Boeung Kamsaeng Lake), rivers (Svay Daunkav River), waterholes, grasslands, and fellowed rice fields used by bird species for foraging.**
3. **Threat Assessment: Assess potential threats to critical habitats identified in step 2. Consider factors such as habitat loss due to infrastructure development or land-use changes related to irrigation system renovation.**
4. **Stakeholder Engagement: Engage with relevant stakeholders including local communities living in or around critical habitats to gather their knowledge about biodiversity values in the area.**
5. **Mitigation Measures: Develop mitigation measures specific to each identified critical habitat that aligns with IFC PS 6 guidance on avoidance of impacts whenever possible; implementation of measures to minimize habitat fragmentation; restoration activities during operations or after project completion; implementation of set-asides for protection; consideration of biodiversity offsets where appropriate based on no net loss principle.**
6. **Environmental and Social Impact Assessment (ESIA): Conduct an ESIA that considers all potential impacts on critical habitats identified through steps 1-5 above.**
7. **Monitoring Plan: Develop a comprehensive monitoring plan that includes regular monitoring of key species populations within critical habitats identified in step 2 above.**

Figure 17: *Boeung Kansaeng located in Ou Tampaong's upper reaches, offers sighted records of Siamese Tiger Parch. The area's upper part in this photo is a settlement along the Svay Daunkav River.*

Figure 18: Overview of Boeung Kansaeng, located upstream of Ou Tapaong Command Area. A canal connects to Stueng Svay Daunkav River (left) and Ou Tapaong (right), a potential fish migration route during floods.

Figure 19: Aerial photograph depicting the Ou Tapaong Stream/canal fragmented by earth dams, roads, and ponds, illustrating its diversion for non-intended purposes.

Figure 20: Aerial photograph of intake flooded forest habitat within Tonle Sap Zone 3 and the continuous land encroachment, converting forest land for rice cultivation.

Habitat of significant importance to endemic or restricted-range species

None of the species under EN and CR classification are restricted-range species (based on IBAT report for Ou Ta Paong).

Habitat supporting globally or nationally significant concentrations of migratory or congregation species

None of the IBA that are recognized for significant concentrations of migratory birds or other species are found within the vicinity of the sub-scheme. No other evidence of significant concentrations of migratory or congregatory species is available. The AoA for OTP, therefore is expected to qualify as critical habitats under this criterion.

Highly threatened or unique ecosystems

Each of the reservoirs are modified habitat and is associated with numerous rice paddies. There is no evidence that these areas are highly threatened or unique ecosystems, and no critical habitats are recognized under this criterion.

Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

Boeung Kansaeng Lake still maintains hydrological connectivity for fish migration from Stueng Svay Daunkav River through its canals, where the Siamese Tiger Perch was confirmed. Some small wetland areas at the lower part of the OTP command area support ecological functions and connectivity for confirmed birds, reptiles and fish species for their local movement, nesting, and foraging ground. So, that is necessary to support biodiversity values that require applying biodiversity mitigation measures and protection efforts (described under the above criteria) have been identified. Pumping, drainage, and discharge of chemical inputs into that wetland can have a significant impact on the biodiversity and survival rate of EN and CR species present in that area.

Potential Impacts & Feasibility of Net Gain Requirements (Step 4)

Step 4 (as described in the above CHA method) requires a high-level assessment of the potential for critical habitat features to be affected by the investment activities of the sub-scheme (both construction and operation). This step is necessary to determine if Net Gain measures need to be demonstrated and whether the necessary measures are feasible.

In the section below, species that are assessed as “Present” or “Possible” in sub-scheme AoI (as shown in the above table) are included in the impact assessment. These include the following 8 species: 1) Four reptiles (Black Marsh Turtle, Giant Asian Pond Turtle, Southeast Asian Box Turtle, Elongated Tortoise), 2) Three birds (Greater Adjutant, Milky Stork, and Bengal Florican), and 3) One fish (Siamese Tiger Perch).

1. *Potential impacts*
   - **Reptiles** (Substantial risk)

All four species of reptiles are found in the upper and lower part of the OTP command area, particularly in areas near natural water courses (rivers and streams). During construction, these reptiles are potentially affected directly due to a) disturbances from noise and vibration due to increased vehicle activity and human presence, b) being hit by vehicles, equipment from increased traffic movement and river dredging/training at Ou Ta Paong river, excavating of the extended canal of Kbal Hong and other relevant canals, c) caught by workers, local people, and

hunters. During project operation, these reptiles may be directly affected, including a) being caught by local people and hunters, and b) pesticide residues from intensified crop production.

- **Birds** (Moderate risk)

Greater Adjutant, Milky Stork, and Bengal Florican are found seasonally in the command area, mainly in the lower/downstream part which is subject to annual flooding. These birds are migratory and as such are rare. Local people don't catch these birds for food. However, since these birds feed on aquatic species available from the command area, they may be affected by the feeds that are contaminated with pesticide residues.

2. Net gain assessment

Additionally, during construction activities, these birds may be indirectly affected through disturbance and habitat loss caused by increased human activity and changes in water levels. It is important to note that the Ou Tapaong Command Area serves as a critical habitat for these endangered bird species, making it crucial to minimize any potential negative impacts.

Based on the potential impacts identified above, it is evident that measures need to be implemented to achieve a net gain in biodiversity within the Ou Tapaong Command Area. These measures should focus on minimizing direct disturbances and habitat loss during construction activities, as well as implementing sustainable agricultural practices to prevent pesticide contamination of food sources for these bird species.

In conclusion, based on the assessment results, it is recommended that comprehensive actions be taken to protect critical habitats for species such as reptiles (Black Marsh Turtle, Giant Asian Pond Turtle, Southeast Asian Box Turtle Elongated Tortoise), birds (Greater Adjutant, Milky Stork, Bengal Florican), ensuring their survival alongside irrigation system renovation projects.

Mitigation measures

To minimize the above risks, the following measures need to be implemented.

1. During design

Given the rich biodiversity in the OTP command area and the adjacent area (downstream), during the design phase, ecological considerations need to be prioritized:

- **Avoidance or Minimization:** Avoid/ minimize the project's footprint and impacts by exploring and selecting engineering options that balance the need for irrigation use and the potential impact on identified EN and CR species. Engineering design considers the selection of designs that avoid/ minimize the need for clearing and grubbing. Existing vegetation should be protected by adopting a design that avoids vegetation clearance. Areas prone to erosion should be protected.
- Riparian buffer zones along Ou Ta Paong and other rivers and stream needs to be protected to minimize run-off pollution.

2. During construction

Rehabilitation of farmers and irrigation systems (including river training, dredging, and canal deepening/widening…) may cause adverse impacts to wildlife present in and near the construction areas. The following measures are proposed to avoid/minimize the risk to wildlife present in the command area:

1. **Minimizing Habitat Loss:** Avoid clearing vegetation outside the project area and implement measures to protect existing trees and vegetation.
2. Implementing strict environmental management plans that include guidelines for minimizing noise and vibration disturbances during construction activities.
3. Implementing effective traffic management systems to minimize the risk of vehicle collisions with reptiles and other wildlife.
4. **Erosion and Sediment Control:** Employ erosion control measures to prevent sedimentation in water bodies and downstream impacts.
5. **Waste Management:** Proper construction measures need to be taken for pollution prevention (for soil and water).
6. **Wildlife Protection:** Where needed, install fencing to prevent wildlife animals to enter construction sites, and minimize physical construction activities in areas known as being home to EN and CR species such as rivers and streams for turtles.
7. **Chance Find Procedure: Train and ensure contractor's workers know how to apply chance find procedures to avoid affecting animals that could be encountered during construction.**
8. **Best practices:** Adopt environmentally friendly construction practices, such as minimizing soil disturbance and preventing pollution.
9. Training **and Education for Project workers**: To ensure that construction site labor staff are aware of biodiversity concerns and understand their role in protecting habitats and species, the following training and education initiatives should be implemented:
    a. **Environmental Awareness Training:** Provide comprehensive training on the biodiversity values of the project area, including the importance of critical habitats and the potential impacts of construction activities.
    b. **Identification of EN and CR Species in the project area:** Train staff to recognize endangered or critically endangered species that may be present in the area, enabling them to avoid harming these species.
    c. **Habitat Protection:** Educate staff on the importance of protecting habitats, such as avoiding clearing vegetation unnecessarily, minimizing soil disturbance, avoid eating local wildlife animal.
    d. **Waste Management:** Train staff on proper waste management practices to prevent pollution and habitat degradation.
    e. **Emergency Response:** Prepare staff to respond to environmental emergencies, such as oil spills or accidental habitat damage.

10. The Project's Code of Conduct needs to be implemented (perused and signed by contractors) to prohibit staff and construction workers from hunting, wildlife harvest, or committing any form of trade in wildlife products from the area.

3. During operation

During the operation phase, crop production will be upscaled thanks to increased irrigation water access. The number of crops per production area will be increased. Increased agricultural production will potential increase the scope and scale of water and soil contamination, primarily due to increased use of agricultural chemicals (e.g. pesticide and fertilizers). The following measures are proposed to minimize this risk.

1. **Introduction and adoption of Good Agriculture Practice: Environmental-friendly crop production techniques will be introduced to farmers and adoption of such techniques will be promoted, linking with market demand for premium farm produce.**
2. **Monitoring Water Quality:** Water quality will be monitored regularly to ensure water is not contaminated to the level that affects wildlife in the long term.
3. **Biodiversity Monitoring:** Establish a long-term biodiversity monitoring program to assess the project's impacts on EN and CR species found in the project area, and other relevant flora and fauna.
4. **Community Engagement:** Raise awareness of the community about the need to protect wildlife in the project area and take actions towards to changing attitudes on the consumption of threatened wildlife. Support community-based conservation initiatives to protect biodiversity and promote sustainable livelihoods.
5. **Collaboration: Explore and collaborate with another ongoing and future wildlife program.**
6. **Adaptive Management:** Adjust water management practices based on monitoring results and changing conditions within and outside the command area of OTP where other ongoing projects are likely to induce a cumulative impact on the biodiversity in the command area, and the larger production area in Ou Ta Pong.
7. Promoting sustainable farming practices that reduce reliance on pesticides while maintaining crop yields.
8. **Biodiversity offsets**: Consider implementation in case the significant residual impact is expected despite avoidance and minimization measures.
9. **Maintaining ecological flows in rivers and streams:** It is crucial to maintain natural flow regimes in rivers and streams to support the ecological functions of these habitats. This can be achieved by setting minimum flow requirements during critical periods for fish migration or reproduction. Water allocation plans should consider the needs of both human water use and environmental flows.

Biodiversity Action Plan (OTP), (if relevant, to achieve net gain)

A comprehensive Biodiversity Action Plan (BAP) should be developed to achieve net gain in biodiversity with a clear outline below:

Biodiversity Action Plan for Ou Tapaong Irrigation Sub-scheme

Executive Summary

1. This conservation action plan outlines strategies to mitigate potential negative impacts on biodiversity within the Ou Tapaong irrigation scheme. The plan is based on a critical habitat assessment that identified significant biodiversity values in the area, particularly for endangered and critically endangered species. The proposed actions align with the International Finance Corporation's Performance Standard 6 (PS6) on biodiversity conservation and sustainable management of living natural resources.

Key Objectives

4.2.6.5 Protect critical habitats: Identify and conserve areas crucial for biodiversity, such as flooded forests, wetlands, and rivers.

4.2.6.6 Minimize negative impacts: Implement measures to reduce the adverse effects of irrigation scheme development on wildlife and their habitats.

4.2.6.7 Enhance biodiversity: Promote habitat restoration and conservation activities to support species recovery.

4.2.6.8 Engage with stakeholders: Foster collaboration with local communities and relevant government agencies to ensure effective conservation efforts.

Habitat Mapping

4.2.6.9 Map out the different habitats present within the Ou Tapaong Command area. This should include flooded forests, lakes, rivers, waterholes, grasslands, fellows rice fields used by bird species for foraging.

4.2.6.10 Threat Assessment

4.2.6.11 Assess potential threats to critical habitats identified in step 2. Consider factors such as habitat loss due to infrastructure development or land-use changes related to irrigation system renovation.

Mitigation Measures

4.2.6.12 Develop mitigation measures specific to each identified critical habitat that align with IFC PS 6 guidance on avoidance of impacts whenever possible; implementation of measures to minimize habitat fragmentation; restoration

activities during operations or after project completion; implementation of set-asides for protection; consideration of biodiversity offsets where appropriate based on no net loss principle.

4.2.6.13 Carefully design project activities to avoid direct impacts on critical habitats.

4.2.6.14 Identify alternative project locations or routes that avoid sensitive areas.

4.2.6.15 Modify project designs to minimize the footprint and disturbance of critical habitats.

4.2.6.16 Implement temporary measures to protect critical habitats during construction.

Minimization:

4.2.6.17 Implement responsible construction practices to minimize adverse effects on critical habitats, such as avoiding unnecessary clearing of vegetation and minimizing soil disturbance.

4.2.6.18 Establish effective waste management systems to prevent pollution.

4.2.6.19 Implement erosion control measures to prevent sedimentation in aquatic habitats.

4.2.6.20 Develop pollution prevention strategies to reduce water and air pollution.

4.2.6.21 Habitat Protection and Restoration:

4.2.6.22 Establish measures to protect and restore flooded forests, wetlands, and other natural habitats within and around the command area.

4.2.6.23 Promote sustainable land use practices like agroforestry, conservation agriculture, and sustainable forest management.

Species Conservation:

4.2.6.24 Develop species-specific conservation plans for endangered and threatened species identified in the area.

4.2.6.25 Monitor populations of these species regularly and assess their habitat needs

4.2.6.26 Consider implementing captive breeding programs or reintroduction efforts if necessary

4.2.6.27 Implement habitat management measures that improve the quality and suitability of their habitats

Carbon Sequestration:

4.2.6.28 Carbon Sequestration is the process of capturing and storing atmospheric carbon dioxide (CO2). It's a crucial strategy in mitigating climate change by reducing the amount of greenhouse gas in the atmosphere.

4.2.6.29 Forest and wetland restoration: Re-establishing or enhancing forest and wetland areas can significantly increase carbon sequestration. These ecosystems act as carbon sinks, absorbing carbon dioxide from the atmosphere.

4.2.6.30 Soil carbon enhancement: Implementing agricultural practices that improve soil organic matter content can increase carbon storage in the soil.

4.2.6.31 Blue carbon: Protecting and restoring wetland and flooded forest ecosystem, can contribute to carbon sequestration

Community Engagement:

4.2.6.32 Involve local communities in biodiversity conservation efforts through participatory planning, monitoring, and implementation

4.2.6.33 Educate communities about the importance of biodiversity i nthe sub-scheme area

4.2.6.34 Foster community awareness about endangered species present within their vicinity

4.2.6.35 Promote sustainable livelihoods that support conservation,such as community-based ecotourism,sustainable agriculture, and fisheries management

4.2.6.36 Research and Monitoring:

4.2.6.37 Conduct further research assessing biodiversity and ecological processes within Ou Tapaong Irrigation Sub-Scheme

4.2.6.38 Establish long-term monitoring programs to track changes in biodiversity and habitat conditions which will provide valuable data for evaluating the effectiveness of ongoing conservation efforts

Sustainable Water Management:

4.2.6.39 Ensure irrigation systems and water use practices do not harm critcal haibitats. Optimise irrigation efficiency, *reducing* water pollution and protecting water sources.

Biodiversity Offsets:

4.2.6.40 If significant residual impacts are expected despite avoidance and minimisation measures, biodiversity.

Table 5: Results of the prioritisation exercise to support BAP planning: priority biodiversity for BAP actions for Ou Tapong

Action Category (AC)	Group	Priority Biodiversity	Mitigation and monitoring approach
AC 1 High Priority for habitat mitigation and/or species-specific measures	Mammal	Indochinese Silvered Langur and Long-tailed Macaque	The highest priority for achieving net gain (offset targets) lies in the implementation of both species-specific and habitat-focused mitigation and offset actions.
	Reptiles	Black Marsh Turtle, Elongated Tortoise	
	Birds	Bengal Florican	
	Natural Habitats	Riverine habitat along the main canal where turtles present	
	Protected Areas and Internationally Recognized Areas	Tonle Sap Zone 3, Bakan Protected Landscape	
AC 2 Contingency planning	Birds	Greater Adjutant, Milky Stork, Yellow-breasted Bunting	While the likelihood of significant impacts is considered low, the potential consequences are substantial. Proactive mitigation measures should be implemented across the board as a matter of best practice. If impacts are observed, the situation should be escalated to the highest level of concern (Category 1) and species-specific mitigation strategies should be developed and implemented
	Reptiles	Black Marsh Turtle, Giant Asian Pond Turtle, Southeast Asian Box Turtle	
	Natural Habitat	Somraong Muk-yiek Community Fisheries and Sdok Khloak Community Fisheries	
	Freshwater fish	Siamese Tiger-perch	

	Mammal	Indochinese Silvered Langur and Long-tailed Macaque	
AC 3 General habitat mitigation measures	Freshwater fishes	Siamese Tiger Perch	To minimize anticipated impacts, implement best practices for habitat mitigation. Monitor habitat (or species-specific factors if necessary) to assess the actual impact scale. If monitoring indicates a high likelihood of significant impacts, reclassify the project to Category 1.
	Reptiles		
	Mammals	Hairy-nosed Otter,	
AC 4 Remain aware	Aquatic plant	River-weed *Terniopsis chanthaburiensis*	Potential impacts are anticipated to be minimal. Proactive mitigation measures should be implemented across the project area. Habitat monitoring can serve as an effective indicator to assess the project's actual impact scale.
	Birds	Masked Finfoot, White-winged Duck	

Lum Hach

Proposed project activities and potential risks and impacts

Green Peafowl have been observed year-round in all three community forests; both their offspring and adults were sighted by community patrol teams there. However, they face heightened vulnerability due to habitat degradation, fragmentation issues, land encroachment concerns, and hunting pressures from human activities. By carefully considering the ecological implications of the project, it is possible to balance the needs of agriculture with the conservation of endangered species and their habitats. Under Lum Hach, various activities will be carried out that cause the following E&S risks and impacts:

Table 6: Projection activities that may cause potential impacts on the environment and social at the Lum Hach sub-scheme

No.	Project activities that cause impacts	E&S Risks & Impacts
1	Construction activities (rehabilication of canal and farm roads), land use changes, and water management practices	**Habitat loss and fragmentation** could lead to habitat loss and fragmentation, affecting species' survival and connectivity. This activity may involve dredging, excavation, or modification of existing water channels and infrastructure. These activities can lead to habitat destruction, disturbance to nesting and foraging sites, disruption of natural water flow patterns, and alteration of hydrological regimes. This can directly impact both terrestrial and aquatic biodiversity.
2	Increased agricultural activities, sedimentation, and pollution	**Water quality degradation** could impact aquatic ecosystems and species that rely on clean water.
4	**Increased human activities**	**Labor influx (during project construction) and Increased** human activities (during project operations pose additional threats to biodiversity. Increased human activity within the command area which could potentially disrupt wildlife behavior (nesting/foraging), increase poaching or predation risks if not properly managed.
5	Dredging of waterways and Alteration of water levels	Changes in water levels within the command area due to irrigation system renovation may negatively impact wildlife dependent on specific habitats for breeding or foraging purposes. For

		example, changes in seasonal wetlands or lakes' floodplains can disrupt breeding patterns for avian. Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats.
6	Use of chemical inputs and nutrient loading	**If pesticides/fertilizers are used during agricultural practices within the command area as part of irrigation system renovation projects, it could lead to contamination of soil and water resources affecting both terrestrial and aquatic biodiversity.**
7	Species displacement and disruption of foraging and breeding habits	Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats. Additionally, alterations to the irrigation system could disrupt the foraging and breeding habits of endangered birds and other wildlife.
8	**Land Use Changes**	The changes in land use that may occur as a result of the project, such as agricultural expansion or deforestation and habitat fragmentation.
9	**Biodiversity degradation, edge eddects, and soil erosion**	The potential impacts of the project on water flow, water quality, and sedimentation patterns. The changes in microclimate and increased disturbance at forest edges can negatively impact forest ecosystems and wildlife species.

Areas of Influence

The Lum Hach Irrigation Sub-scheme has a limited area of influence due to its small size and the surrounding farmland. The critical habitats identified within the area include Toul Samraong, Phnom Banon, and Chan Trak Community Forests. These areas are characterized by small, fragmented, and degraded dry deciduous forests (DDFs). However, these forests are crucial for the conservation of Green Peafowl, which have been confirmed to be present in these areas. The protection and restoration of these community forests should be a priority in the biodiversity action plan.

Analysis to prepare for determining CH status

Critical Habitat Area of Analysis

Critical habitat is defined as an Area of Analysis (AoA), and the project's command area is used as an AoA.

1. Species with Potential Occurrence within the AoA

A list of threatened species with potential occurrence was generated for the LH Command Area. The coordinates of this command area (via KMZ file) are used to inform the IBAT radius of screening. Since the default radius of IBAT screening is 50km, steps were taken to narrow down to the sub-scheme's area of influence to identify only EN and CR species that are potentially present in the sub-scheme area of influence. The narrowing-down aims to practically identify EN and CR species that could be found in the sub-scheme area of influence and to determine the Critical Habitat status of the identified species. After three rounds of screening focusing on EN and CR, only one endangered bird species of Green Peafowl was confirmed see table 5 below.

Description of screening for narrowing down

For Lum Hach, three rounds of screening have been conducted. The first screening (Round 1) was conducted in December 2023. Round 2 was carried out in April 2024, and Round 3 in August 2024. The purpose of repeated screening is to validate the screening results (for the same area) with a wide range of local stakeholders. The screening aims to identify only EN and CR species that are potentially present in the Lum Hach area of influence, covering reptiles, mammals, fish, birds, and mushrooms. Screening was done based on the IBAT report generated and provided by the AIIB.

In the first two rounds of screening, 5 EN and CR species were identified in this area of influence (see Table below). In the 3rd round of screening (in August 2024), however, one of five species was confirmed as "potentially present" in the LH's area of influence. So, the assessment for Lum Hach focuses on the confirmed list of **1 species** that are categorized by IUCN as Endangered species.

Table 7: Confirmed List of endangered and critically endangered species for the Lum Hach sub-scheme

No.	Local Name	English Name	Scientific Name	IUCN Cat	Screened Species from Round 1&2 (Total=5)	Confirmed Species in Round 3 (Total = 1)
I. Mammal species						
1	ឆ្កែព្រៃ	Dhole	Cuon alpinus	EN	Yes	No
2	ជ្រីងធំ	Large Flying-fox	Pteropus vampyrus	EN	Yes	No
II. Fish species						

3	ត្រីកន្ទ្រប់ខ្លា	Siamese Tiger Perch	*Datnioides pulcher*	CR	Yes	No
III. Bird species						
4	ក្ងោក	Green Peafowl	Pavo muticus	EN	Yes	Yes
IV. Mashroom						
5	ផ្សិតកែរ	Puffball mushrooms	Calostoma insigne	EN	Yes	No

2. Ecological State of Habitats within the AoA

Understanding of the ecological state of habitats is necessary to assess the likelihood of occurrence (LoO) of Green Peafowl - as part of the CHA. For this CHA, species was classified into four LoO categories: Present, Possible, Unlikely and Not Present. Species known to be Present or with a Possible LoO are further assessed in Step 3. This understanding takes into account the classification of habitats as either modified or natural based on levels of human-induced disturbance to species composition and ecological functions. In this session, a brief assessment of the one confirmed species is presented. The assessment discusses historical range, distribution, habitat conditions, current status, and potential threats identified by key informants.

The remaining forest patches within the Lum Hach Irrigation Sub-scheme are characterized by small size, fragmentation, and degradation. They are classified as very open and degraded Dry deciduous forests (DDFs), which are not suitable for many species, including Long-tailed Macaques, Large Flying-fox, and Puffball mushrooms. The limited availability of suitable habitats is a significant factor contributing to the scarcity of biodiversity in the area.

The biodiversity assessment at Lum Hach Irrigation Sub-scheme initially identified several potential endangered (EN) or critically endangered (CR) species using the Integrated Biodiversity Assessment (IBAT) and key informant interviews. However, further investigation revealed that only Green Peafowl was confirmed to be present within the Toul Samraong, Phnom Banon, and Chan Trak Community Forests (see map in Figure 14 below).

Species Distribution:

4.1.6.1 **Green Peafowl:** Found in all three community forests, indicating their adaptability to the local environment and the importance of these habitats for their conservation.

4.1.6.2 **Dhole:** Despite initial screenings, no confirmed sightings were made within the study area. This may be attributed to factors such as habitat fragmentation, human disturbance, or low population densities.

4.1.6.3 **Flying-fox:** The survey result is similar to the dhole, no flying-fox was confirmed within the study area. This could be due to habitat loss, hunting pressure, or other factors affecting their survival.

4.1.6.4 **Siamese Tiger Perch:** This species was not found within the study area, likely due to its preference for larger water bodies like the Tonle Sap Great Lake. Three KII reportd that they countered this specie when they went for fishing at Tonle Sap every year but they had never seen this species within this area (Lum Hach).

4.1.6.5 **Puffball mushrooms:** Although not confirmed within the study area, there is potential for their presence in higher elevations of the Cardamom Mountains.

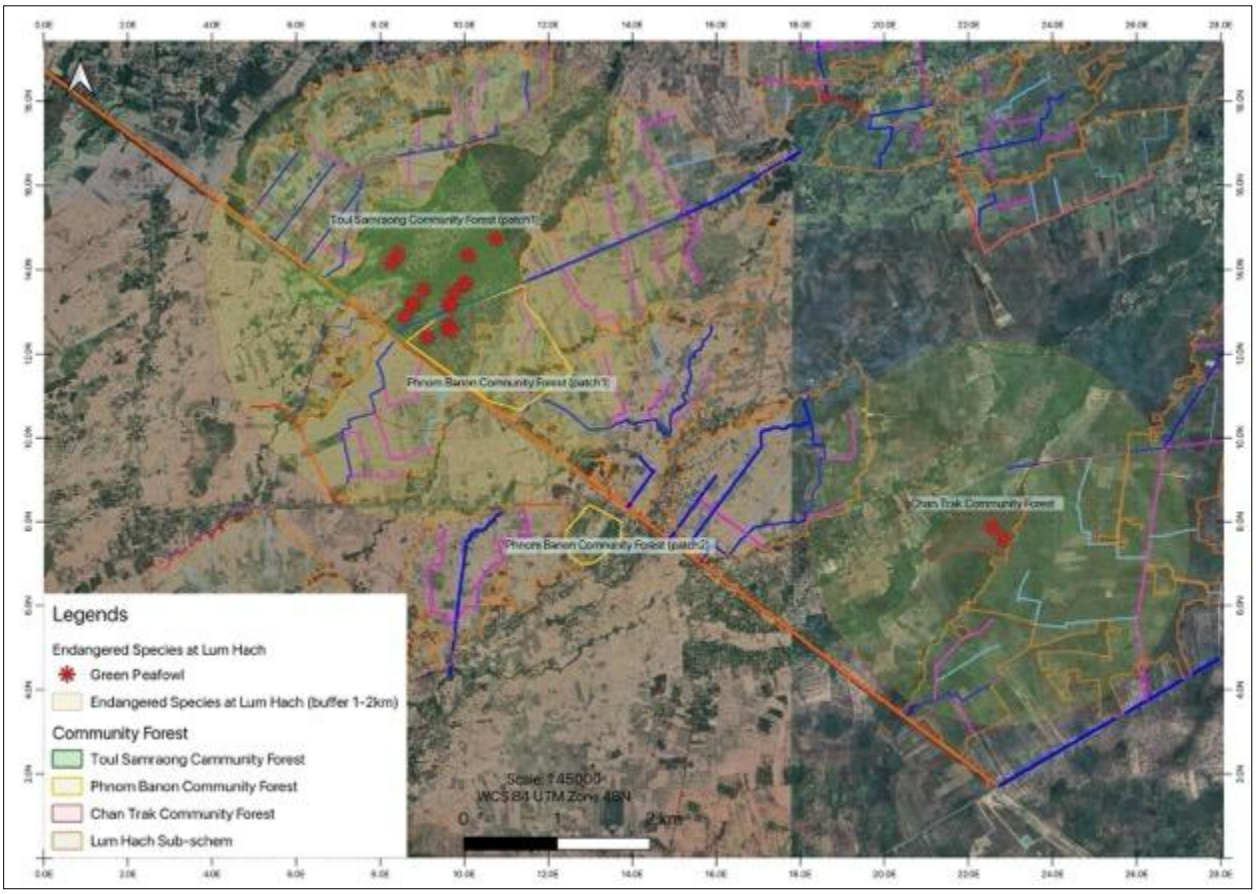


Figure 21: Green Peafowl distribution in Toul Samraong, Phnom Banon, and Chan Trak Community Forests, as confirmed by local sources from 2020 to 204.

Determination of Critical Habitat Status (Step 3)

A habitat assessment was conducted in key areas known for endangered species within the region. Interviews with local authorities, community committees, and key informants confirmed the presence of Green Peafowl in three community forest areas.

Two of these forests, Toul Samraong and Phnom Banon (a large patch), share a boundary and are primarily composed of dry, open dipterocarp forests with some closed dipterocarp areas along the natural canal. These three community forests are small, fragmented, and surrounded

by farmland, with some remaining degraded forest land nearby. Despite their poor ecological connectivity, they are crucial for supporting the small remaining Green Peafowl population.

During a meeting, it was discovered that two community forest boundaries had been revised, and one had changed its name from Trapeang Mlu to Phnom Banon. All forest representatives confirmed that their areas were undergoing registration with the Ministry of Land Management, Urban Planning, and Construction (PLMUPC). However, some key informants expressed concerns about ongoing land encroachment into their community areas. Despite previous complaints, the offenders continue to use and sell the land without any repercussions.

Figure 22: The upperpart of Hum Hack next to Boribou river catchment area

Figure 23: Overview from the above of the general condition of Toul Samroang and Phnom Banon Community Forests

Figure 24: Overview from the above of the general condition of Chan Trak Community Forest

Figure 25: An expert consulted with the Toul Samraong CF management committee to verify the identification of a canine species, ensuring it was correctly identified as either a dhole or a jackal.

1. Habitat of significant importance to CE and EN species

As presented in Section 4.2.3.3 (Ecological State), species that qualify as critical habitat features for Green Peafowl is listed as Endangered Species in the IUCN RedList. The natural dry forest habitats within the community forests of the Lum Hach Irrigation Sub-Scheme are critical for the survival of the Green Peafowl population. These forests provide essential resources for Green Peafowl, including food, shelter, and breeding sites. However, the quality and extent of these habitats can vary significantly, affecting their suitability for the species (Figures 16 and 17).

2. Habitat of significant importance to endemic or restricted-range species

None of the species under EN and CR classification are restricted-range species (based on IBAT report for Ou Ta Paoing).

3. Habitat supporting globally or nationally significant concentrations of migratory or congregatory species

None of the IBA that are recognized for significant concentrations of migratory birds or other species are found within the vicinity of the sub-scheme. No other evidence of significant concentrations of migratory or congregatory species is available. The AoA for LH, therefore is expected to qualify as critical habitats under this criterion.

4. Highly threatened or unique ecosystems

Each of the reservoirs are modified habitat and is associated with numerous rice paddies of there the three community forest areas are trimmed out from the command area. There is no evidence that these areas are highly threatened or unique ecosystems, and no critical habitats are recognized under this criterion. However, the concern of illegal agriculture expansion into the community forest areas was questioned by some key informants (management committee and patrol members of community forests).

5. Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

No ecological functions that are necessary to support biodiversity values (described under the above criteria) have been identified.

Potential Impacts & Feasibility of Net Gain Requirements (Step 4)

Step 4 (as described in the above CHA method) requires a high-level assessment of the potential for critical habitat features to be affected by the investment activities of the sub-scheme (both construction and operation). This step is necessary to determine if Net Gain measures need to be demonstrated and whether the necessary measures are feasible. In the section below, species that are assessed as “Present” or “Possible” in sub-scheme AoI (as shown in the above table) are included in the impact assessment on one bird (Green Peafowl).

1. Potential impacts on Green Peaflow (Substantial risk)

The Green Peafowl is found in three community forest areas located within the vicinity of Lum Hach command area. During construction, these species is potentially affected directly due to a) disturbances from noise and vibration due to increased vehicle activity and human presence, b) caught by workers, local people, and hunters.

2. Net gain assessment

Based on the assessment conducted for the Lum Hach Irrigation Sub-scheme, it has been determined that there is a net loss of biodiversity and ecological value within its area of influence. The critical habitat analysis identified only one endangered species, the Green Peafowl, with a confirmed presence in the sub-scheme's area of influence. The ecological state

of habitats within this area is classified as very open and highly susceptible to human disturbances, posing potential threats to the Green Peafowl population.

It is evident that despite efforts to balance agricultural needs with conservation, there are significant risks and impacts on biodiversity within this project. Therefore, measures must be taken to mitigate these risks and minimize further loss of ecological value in order to achieve a net gain for biodiversity in the long term. This may include prioritizing protection and restoration efforts for critical habitats such as Toul Samraong, Phnom Banon, and Chan Trak Community Forests within the sub-scheme's area of influence.

Mitigation measures

To mitigate these potential impacts, the following measures should be implemented.

1. During design
   - Identify and avoid sensitive areas, such as known habitats for Green Peafowl or other endangered species.
   - Minimize the footprint of construction activities to reduce habitat disturbance.

   4.2.5.1 Develop plans for habitat restoration and compensation in case of unavoidable impacts..
2. During construction

   4.4.5.1 Implement an environmental management plan to minimize impacts on biodiversity.

   4.4.5.2 Use appropriate measures to prevent soil erosion and sedimentation in water bodies.

   4.4.5.3 Properly manage construction waste to prevent pollution.

   4.4.5.4 Habitat Protection: Set up buffer zones around critical habitats during construction activities to minimize disturbances; Implement measures such as temporary fencing or signage to prevent unauthorized access into protected areas.

   4.4.5.5 Waste Management: Establish proper waste management systems onsite; and Provide training for workers on waste disposal procedures

   4.4.5.6 **Training and Education for Labor Staff**: To ensure that construction site labor staff are aware of biodiversity concerns and understand their role in protecting habitats and species, the following training and education initiatives should be implemented:

   a. **Environmental Awareness Training:** Provide comprehensive training on the biodiversity values of the project area, including the importance of critical habitats and the potential impacts of construction activities.

   b. **Species Identification:** Train staff to recognize endangered or critically endangered species that may be present in the area, enabling them to avoid harming these species.

   c. **Habitat Protection:** Educate staff on the importance of protecting habitats, such as avoiding clearing vegetation unnecessarily and minimizing soil disturbance.

   d. **Waste Management:** Train staff on proper waste management practices to prevent pollution and habitat degradation.

e. **Emergency Response:** Prepare staff to respond to environmental emergencies, such as oil spills or accidental habitat damage.

3. During operation

Sustainable Agricultural Practices:

Promote sustainable farming practices among local farmers surrounding the irrigation sub-scheme.

Provide training on agroforestry techniques that integrate tree planting with crops to enhance habitat connectivity.

4.4.5.7 **Water Management:** Ensure that irrigation practices do not harm biodiversity.

4.4.5.8 **Monitoring and Evaluation:** Continuously monitor biodiversity impacts and adjust project activities as needed.

Biodiversity Action Plan

Below is an outline of a biodiversity action plan for this sub-scheme.

Biodiversity Action Plan for Lum Hach Command Area

1. Habitat Restoration and Conservation

4.3.5.1 Reforestation: Plant native tree species to restore degraded forest areas, focusing on areas with high ecological value and potential for species recovery.

4.3.5.2 Habitat Connectivity: Create corridors or buffer zones between fragmented forest patches to facilitate species movement and gene flow.

4.3.5.3 Land Use Planning: Develop and implement sustainable land use plans that prioritize biodiversity conservation and minimize negative impacts on habitats.

2. Species Conservation

4.4.3.1 Green Peafowl:

a. Develop a specific conservation plan for Green Peafowl, including habitat management, population monitoring, and community-based conservation initiatives.

b. Implement measures to reduce human-wildlife conflict, such as habitat modification and education programs.

c. Consider establishing a captive breeding program as a last resort.

4.4.3.2 Other Species:

a. Conduct surveys to determine the presence of other potential endangered or critically endangered species.

b. Develop species-specific conservation plans based on survey results.

3. Community Engagement

4.4.3.1 Capacity Building: Provide training and education to local communities on biodiversity conservation and sustainable practices.

4.4.3.2 Community-Based Conservation: Support community-led initiatives, such as community forestry and wildlife monitoring.

4.4.3.3 Sustainable Livelihoods: Promote sustainable livelihoods that support biodiversity conservation, such as ecotourism, sustainable agriculture, or community-based enterprises.

4. Research and Monitoring

4.4.4.1 Biodiversity Surveys: Conduct regular biodiversity surveys to monitor species distribution, abundance, and population trends.

4.4.4.2 Ecological Monitoring: Establish long-term monitoring programs to track changes in ecosystems and species populations.

Table 8: Results of the prioritisation exercise to support BAP planning: priority biodiversity for BAP actions for Lum Hach

Action Category (AC)	Group	Priority Biodiversity	Mitigation and monitoring approach
AC 1 High Priority for habitat mitigation and/or species-specific measures	Birds	Green Peafowl	The highest priority for achieving net gain (offset targets) lies in the implementation of both species-specific and habitat-focused mitigation and offset actions.
	Protected Areas and Internationally Recognized Areas	Chan Trak Community Forest, Toul Samraong Community Forest, and Phnom Banon Community Forest	
AC 2 Contingency planning	Mammal	Dhole	While the likelihood of significant impacts is considered low, the potential consequences are substantial. Proactive mitigation measures should be implemented across the board as a matter of best practice. If impacts are observed, the situation should be escalated to the highest level of concern (Category 1) and species-specific mitigation strategies should be developed and implemented
	Freshwater fish	Siamese Tiger-perch	
AC 3 General habitat mitigation measures	N/A	N/A	
AC 4 Remain aware	Mammal	Large Flying-fox	Potential impacts are anticipated to be minimal. Proactive mitigation measures should be implemented across the project area. Habitat monitoring can serve as an effective indicator to assess the project's actual impact scale.
	Mushroom	Puffball mushrooms *Calostoma insigne*	

Brambei Mom

Proposed project activities and potential risks and impacts

By carefully considering the ecological implications of the project, it is possible to balance the needs of agriculture with the environment and ecosystem functions. Under Brambei Mom, various activities will be carried out that cause the following E&S risks and impacts:

Table 9: Projection activities that may cause potential impacts on the environment and social aspects at Brambei Mom sub-scheme

No.	Project activities that cause impacts	E&S Risks & Impacts
1	Construction activities (rehabilication of canal and farm roads), land use changes, and water management practices	**Habitat loss and fragmentation** could lead to habitat loss and fragmentation, affecting species' survival and connectivity. This activity may involve dredging, excavation, or modification of existing water channels and infrastructure. These activities can lead to habitat destruction, disturbance to nesting and foraging sites, disruption of natural water flow patterns, and alteration of hydrological regimes. This can directly impact both terrestrial and aquatic biodiversity.
2	Increased agricultural activities, sedimentation, and pollution	Water quality degradation could impact aquatic ecosystems and species that rely on clean water.
3	Dredging of waterways and Alteration of water levels	Changes in water levels within the command area due to irrigation system renovation may negatively impact wildlife dependent on specific habitats for breeding or foraging purposes. Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats.
4	Use of chemicals and nutrient loading	If pesticides/fertilizers are used during agricultural practices within the command area as part of irrigation system renovation projects, it could lead to contamination of soil and water

		resources affecting both terrestrial and aquatic biodiversity.
5	**Biodiversity degradation, edge effects, and soil erosion**	The potential impacts of the project on water flow, water quality, and sedimentation patterns. The changes in microclimate and increased disturbance at forest edges can negatively impact forest ecosystems and wildlife species.
6	Blockage of migration routes by dams or other structures	Dams or other structures can block migratory pathways used by fishes during specific seasons or life stages, preventing them from accessing their preferred habitats or breeding grounds.

Areas of Influence

The Brambei Mom Irrigation Innovation sub-scheme has an extensive area of influence that includes adjacent communities and ecosystems dependent on its water resources. The areas directly affected by the project's activities include agricultural lands within a certain radius from irrigation canals or reservoirs.

Analysis to prepare for determining CH status

1. Critical Habitat Area of Analysis

Critical habitat is defined as an Area of Analysis (AoA), and the project's command area is used as an AoA.

2. Species with Potential Occurrence within the AoA

A list of threatened species with potential occurrence was generated for Brambei Mom. The coordinates of BM (via KMZ file) are used to inform the IBAT radius of screening. Since the default radius of IBAT screening is 50km, steps were taken to narrow down to the sub-scheme's area of influence to identify only EN and CR species that are potentially present in the sub-scheme area of influence. The narrowing-down aims to practically identify EN and CR species that could be found in the sub-scheme area of influence and to determine the Critical Habitat status of the identified species. After three rounds of screening, there's on EN and CR species confirmed.

Description of screening for narrowing down

For Brambei Mom, three rounds of screening have been conducted. The first screening (Round 1) was conducted in December 2023. Round 2 was carried out in April 2024, and Round 3 in August 2024. The purpose of repeated screening is to validate the screening results (for the same area) with a wide range of local stakeholders. The screening aims to identify only EN and CR species that are potentially present in the Brambei Mom area of influence, covering reptiles,

mammals, fish, birds, and mushrooms. Screening was done based on the IBAT report generated and provided by the AIIB.

The four sub-schemes (Brambei Mom, Krapeu Truom, Yotasas, and Stueng Kang Bat) are integral components of the Stoeung Krang Ponley River catchment system, a tributary of the Tonle Sap. These areas share geographic connectivity and ecological functions. Semi-structured and structured interviews were conducted to collect data on species information, distribution, and fisheries ecosystems. In the first two rounds of screening, 2 EN and CR species including 1) one reptile (Black Marsh Turtle), and 2) one fish species (Striped Catfish) were identified in this area of influence. In the 3rd round of screening (in August 2024), however, none of these species was confirmed" in the Brambei Mom's area of influence.

3. Ecological State of Habitats within the AoA

Understanding of the ecological state of habitats is necessary to assess the likelihood of occurrence (LoO) of the above 2 screened species - as part of the CHA. For this CHA, species were classified into four LoO categories: Present, Possible, Unlikely and Not Present. Species known to be Present or with a Possible LoO are further assessed in Step 3. This understanding takes into account the classification of habitats as either modified or natural based on levels of human-induced disturbance to species composition and ecological functions. In this session, a brief assessment of the 11 confirmed species are presented. The assessment discusses historical range, distribution, habitat conditions, current status, and potential threats identified by key informants.

The four sub-schemes (Brambei Mom, Krapeu Truom, Yotasas, and Stueng Kang Bat) are integral components of the Stoeung Krang Ponley River catchment system, a tributary of the Tonle Sap. These areas share geographic connectivity and ecological functions. Semi-structured and structured interviews were conducted to collect data on species information, distribution, and fisheries ecosystems. Two National Fisheries Day ceremonies were held at Kbol and Anlong Chrey Reservoirs, during which millions of fish were released by the former prime minister. The aquaculture department of the Technology Institute of Kampong Speu also releases fish into these reservoirs. Investigations with relevant government departments confirmed that no endangered or critically endangered species were released during these events.

Habitat Assessment

Brambei Mom Command Area is located within the Stoeung Krang Ponley River catchment system, a tributary of the Tonle Sap. These areas are geographically and ecologically interconnected. The habitat is characterized by three large reservoirs (Anlong Chrey, Brambei Mom, and Kdol) in the upper reaches, while the lower areas consist of riverine, wetland, and agricultural landscapes. The water quality, vegetation density, and soil composition vary across these habitats. However, the hydrological functions of the system are disrupted by numerous dams and spillways along the main canal and irrigation canals, hindering fish migration from downstream to upstream. This may be one factor contributing to the absence of the targeted species in the area.

Semi-structured interviews were conducted with multiple fishermen at Anlong Chrey and Brambei

Mom reservoirs. Many claimed to have seen or caught Striped Catfish, Mekong Giant Barb, and Isok barb/Jullien's Golden Carp. To verify their claims, we sent photographs of the fish to Thach Panara, head of the Inland Fisheries Research and Development Institute. It was determined that all of the fishermen had mistakenly identified Mekong Giant Barb as Rohu (Labeo rohita). Additionally, none of the fishermen reported encountering any turtles or tortoises in their fishing area. Despite consulting visual aids, we were unable to confirm the reported sightings of Jullien's Golden Carp and Striped Catfish due to a lack of clear identification evidence.

Ten key informants were interviewed with the support of commune councils. None reported encountering the targeted species within the command area. Discussions with the Chief of Brambei Mom commune revealed a history of large-scale fish farming in the area, including Pangasianodon sp. and Hypsibarbu sp. A flood event years ago led to the release of these fish into the Anlong Chrey reservoir, resulting in increased catches by local fishermen. However, it remains uncertain whether the Pangasianodon sp. was indeed Striped Catfish.

Figure 26: Interviewing and verifying Mekong Giant Barb with similar look of other fish species and their ecological niches

Figure 27: Local fishermen in Brabei Mom mistakenly identified their catch of Rohu (Labeo rohita) as Mekong Giant Barb.

Determination of Critical Habitat Status (Step 3)

This section assesses the information (obtained from the above sub-section) vis-a-vis the criteria (presented in Section 3.4 - CH assessment method). Based on the assessment result there are no EN and CR with their critical habitat confirmed for this sub-scheme.

1. Habitat of significant importance to CE and EN species

As presented in Section 4.3.3.2 (Ecological State), no EN and CR species confirmed.

2. Habitat of significant importance to endemic or restricted-range species

None of the species under EN and CR classification are restricted-range species (based on IBAT report for for Brambei Mom).

3. Habitat supporting globally or nationally significant concentrations of migratory or congregation species

None of the IBA that are recognized for significant concentrations of migratory birds or other species are found within the vicinity of the sub-scheme. No other evidence of significant concentrations of migratory or congregatory species is available. The AoA for Brambei Mom, therefore is expected to qualify as critical habitats under this criterion.

4. Highly threatened or unique ecosystems

Each of the reservoirs are modified habitat and is associated with numerous rice paddies. There is no evidence that these areas are highly threatened or unique ecosystems, and no critical habitats are recognized under this criterion.

5. Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

No ecological functions that are necessary to support biodiversity values (described under the above criteria) have been identified.

Mitigation measures

1. During design

During the design phase of construction activities, it is important to consider measures that minimize impacts on biodiversity to protect natural habitats nearby. Key mitigation measures during this stage may include:

a. Avoidance of Critical Habitats: Identify critical habitats within the construction area and adjust project design accordingly to avoid direct impacts on these areas.
b. Buffer Zones: Establish buffer zones around critical habitats where construction activities are limited or restricted to minimize disturbances.

2. During construction

During the actual construction phase of the project, effective mitigation measures should be implemented to further minimize impacts on biodiversity:

4.5.5.1 Dust Control Measures: Implement dust control measures such as dampening surfaces or covering materials during earthwork activities to prevent sedimentation in nearby water bodies.

4.5.5.2 Waste Management Practices: Properly manage waste generated from construction activities by implementing recycling programs, segregating waste types, and ensuring proper disposal procedures are followed.

3. During operation

After completion of construction, ongoing operation activities should also incorporate mitigation measures:

4.5.5.3 Habitat Monitoring Program: Establish a habitat monitoring program that regularly assesses changes in biodiversity within impacted areas throughout operations.

4.5.5.4 Water Quality Management: Implement proper water quality management practices such as minimizing pollution discharge into surrounding ecosystems through regular maintenance checks of irrigation infrastructure.

Krapeu Trom

Proposed project activities and potential risks and impacts

By carefully considering the ecological implications of the project, it is possible to balance the needs of agriculture with the environment and ecosystem functions. Under Krapeu Trom, various activities will be carried out that cause the following E&S risks and impacts:

Table 10: Projection activities that may cause potential impacts on the environment and social aspects at Krapeu Trom sub-scheme

No.	Project activities that cause impacts	E&S Risks & Impacts
1	Construction activities (rehabilication of canal and farm roads), land use changes, and water management practices	**Habitat loss and fragmentation** could lead to habitat loss and fragmentation, affecting species' survival and connectivity. This activity may involve dredging, excavation, or modification of existing water channels and infrastructure. These activities can lead to habitat destruction, disturbance to nesting and foraging sites, disruption of natural water flow patterns, and alteration of hydrological regimes. This can directly impact both terrestrial and aquatic biodiversity.
2	Increased agricultural activities, sedimentation, and pollution	**Water quality degradation** could impact aquatic ecosystems and species that rely on clean water.
3	Dredging of waterways and Alteration of water levels	Changes in water levels within the command area due to irrigation system renovation may negatively impact wildlife dependent on specific habitats for breeding or foraging purposes. Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats.
4	Use of chemicals and nutrient loading	**If pesticides/fertilizers are used during agricultural practices within the command area as part of irrigation system renovation projects,**

		it could lead to contamination of soil and water resources affecting both terrestrial and aquatic biodiversity.
5	**Biodiversity degradation, and soil erosion**	The **potential** impacts of the project on water flow, water quality, and sedimentation patterns. The changes in microclimate.
6	Blockage of migration routes by dams or other structures	Irrigation structures, such as dams and weirs, can create physical barriers that prevent fish from migrating upstream or downstream. This can disrupt their reproductive cycles and reduce their survival rates.

Areas of Influence

Potential areas of influence might include:

- **Downstream areas:** The lower reaches of the Stoeung Krang Ponley River and the Tonle Sap Lake, may be affected by water quality, sediment loads, and fish migration from Krapeu Trom.
- **Upstream areas:** The upper reaches of the Stoeung Krang Ponley River and its tributaries, which may be influenced by water flow regulation and sediment transport from Krapeu Trom.
- **Adjacent ecosystems:** Forests, wetlands, and agricultural areas that are connected to Krapeu Trom through hydrological or ecological processes.

Analysis to prepare for determining CH status

1. Critical Habitat Area of Analysis

Critical habitat is defined as an Area of Analysis (AoA), and the project's command area is used as an AoA.

2. Species with Potential Occurrence within the AoA

A list of threatened species with potential occurrence was generated for Krapeu Trom (KT). The coordinates of KT (via KMZ file) are used to inform the IBAT radius of screening. Since the default radius of IBAT screening is 50km, steps were taken to narrow down to the sub-scheme's area of influence to identify only EN and CR species that are potentially present in the sub-scheme area of influence. The narrowing-down aims to practically identify EN and CR species that could be found in the sub-scheme area of influence and to determine the Critical Habitat status of the identified species.

Description of screening for narrowing down

For Krapeu Trom, three rounds of screening have been conducted. The first screening (Round 1) was conducted in December 2023. Round 2 was carried out in April 2024, and Round 3 in August 2024. The purpose of repeated screening is to validate the screening results (for the same area) with a wide range of local stakeholders. The screening aims to identify only EN and CR species that are potentially present in the OTP area of influence, covering reptiles, mammals, fish, birds, amphibians, and aquatic plants. Screening was done based on the IBAT report generated and provided by the AIIB.

In the first two rounds of screening, there were two fish species (Isok barb/Jullien's Golden Carp and Leaping barb/Flying Minnow) were screened for the first two rounds. After three rounds of screening focusing on EN and CR species, only Flying Minnow is confirmed as potentially present in the sub-scheme area of influence.

3. Ecological State of Habitats within the AoA

Understanding of the ecological state of habitats is necessary to assess the Likelihood of occurrence (LoO) of the above 11 screened species - as part of the CHA. For this CHA, species were classified into four LoO categories: Present, Possible, Unlikely and Not Present. Species known to be Present or with a Possible LoO are further assessed in Step 3. This understanding takes into account the classification of habitats as either modified or natural based on levels of human-induced disturbance to species composition and ecological functions. In this session, a brief assessment of the one confirmed species is presented. The assessment discusses historical range, distribution, habitat conditions, current status, and potential threats identified by key informants.

The Krapeu Trom command area has been in existence since the 1970s. The KT is a mixture of paddy fields, farm roads, and residential areas. Natural rivers, such as the Stueng Krang Ponlai serve as the sole ecological and hydrological connection between its upstream watershed and the Tonle Sap River basin downstream. This river is crucial for fish migration during the flooding season. However, reservoirs, spillways, and drought conditions have disrupted these essential ecological functions.

Fish (1 species)

Krapeu Trom, like Brambei Mom, is situated within the same river catchment area in the lower reaches, near the Tonle Sap's annual floodplain. Two fish species, the Isok barb/Jullien's Golden Carp (Probarbus jullieni) and Leaping barb/Flying Minnow (Laubuka caeruleostigmata), were targeted for interviews in this command area. Among ten key informants interviewed, only one reported encountering the Jullien's Golden Carp once in 2022, approximately 500 meters downstream of the reservoir facility during a flooding event (see map below). This individual stated that the species migrated upstream from the Tonle Sap during the flood season but became trapped in spillways. They added that if flooding is insufficient, fish populations decline, and rare species may no longer be present in the area.

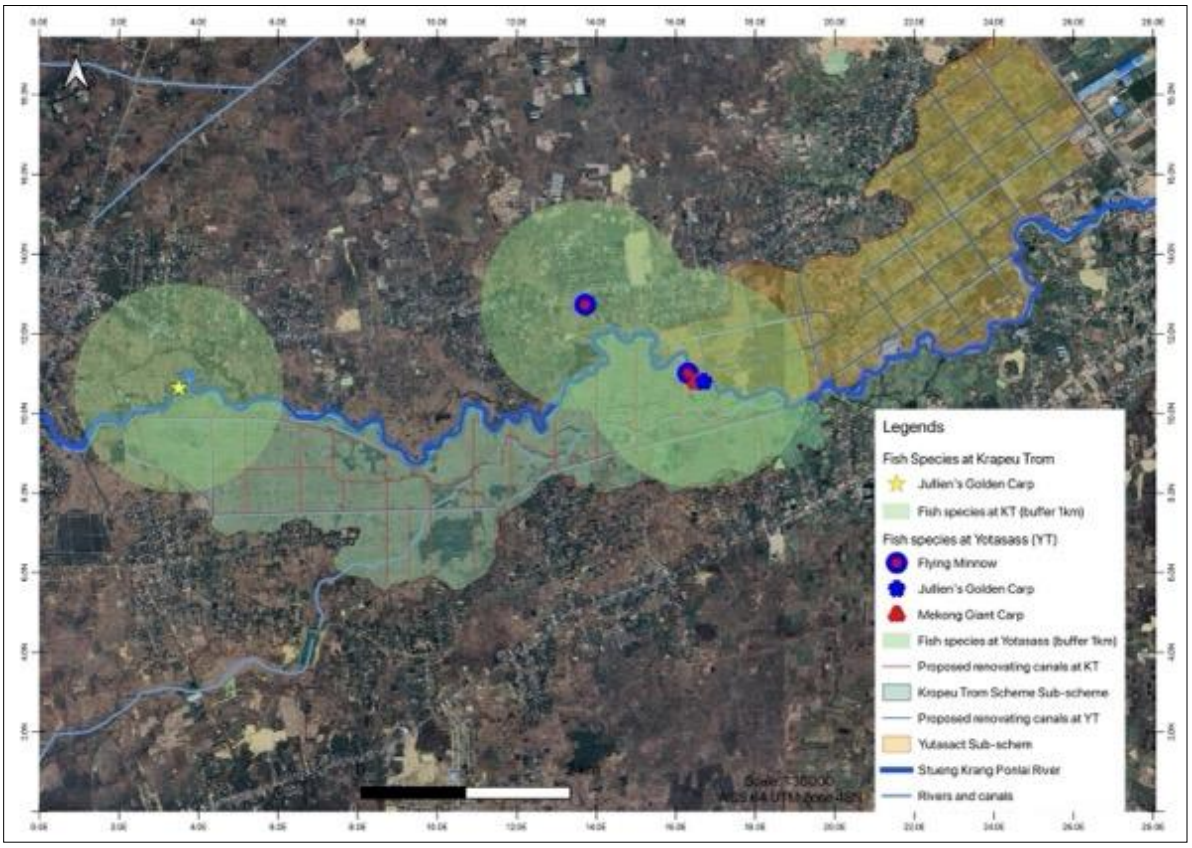


Figure 28: A spatial distribution map was generated for four fish species at Krapeu Trom and Yotasas Command Area. 1 km buffer zones were included to approximate their minimum movement range around suitable habitats.

Determination of Critical Habitat Status (Step 3)

This section assesses the information (obtained from the above sub-section) vis-a-vis the criteria (presented in Section 3.4 - CH assessment method). This assessment aims to determine whether any species qualify for Critical Habitat features.

1. Habitat of significant importance to CE and EN species

As presented in Section 4.4.3.3 (Ecological State), the species that qualifies as a critical habitat feature is the Flying Minnow. Krapeu Trom Command Area is part of Stueng Krang Ponlai River system (Tonle Sap's tributary) and situated approximately 11 km from Tonle Sap River. The area was influenced by flood-plus water from Stueng Krang Ponlai upstream and the push-up of flood water from Tonle Sap River Basic allowing fish to short distance migration for food and breeding.

Although climate change has caused dry and drought more frequently, this area still receives a good amount of flood from its upstream and downstream making a good connectivity and providing ecological function for migratory fish.

2. Habitat of significant importance to endemic or restricted-range species

None of the species under EN and CR classification are restricted-range species (based on IBAT report for sub-scheme).

3. Habitat supporting globally or nationally significant concentrations of migratory or congregation species

None of the IBA that are recognized for significant concentrations of migratory birds or other species are found within the vicinity of the sub-scheme. No other evidence of significant concentrations of migratory or congregatory species is available. The AoA for KT, therefore is expected to qualify as critical habitats under this criterion.

4. Highly threatened or unique ecosystems

Each of the reservoirs are modified habitat and is associated with numerous rice paddies. There is no evidence that these areas are highly threatened or unique ecosystems, and no critical habitats are recognized under this criterion.

5. Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

No ecological functions that are necessary to support biodiversity values (described under the above criteria) have been identified.

Mitigation measures

1. During design

During the design phase of construction activities, it is important to consider measures that minimize impacts on biodiversity to protect natural habitats nearby. Key mitigation measures during this stage may include:

c. Avoidance of important habitats: Identify important habitats within the construction area and adjust project design accordingly to avoid direct impacts on these areas.
d. Buffer Zones: Establish buffer zones around important habitats where construction activities are limited or restricted to minimize disturbances.

2. During construction

During the actual construction phase of the project, effective mitigation measures should be implemented to further minimize impacts on biodiversity:

4.5.5.5 Dust Control Measures: Implement dust control measures such as dampening surfaces or covering materials during earthwork activities to prevent sedimentation in nearby water bodies.

4.5.5.6 Waste Management Practices: Properly manage waste generated from construction activities by implementing recycling programs, segregating waste types, and ensuring proper disposal procedures are followed.

3. During operation

After completion of construction, ongoing operation activities should also incorporate mitigation measures:

4.5.5.7 Habitat Monitoring Program: Establish a habitat monitoring program that regularly assesses changes in biodiversity within impacted areas throughout operations.

4.5.5.8 Water Quality Management: Implement proper water quality management practices such as minimizing pollution discharge into surrounding ecosystems through regular maintenance checks of irrigation infrastructure.

- Water Quality Monitoring: Implement a water quality monitoring program to track changes in water quality and identify potential pollution sources.
- Fish Population Monitoring: Monitor fish populations to assess the effectiveness of mitigation measures and identify any declines or threats.
- Public Awareness and Education: Conduct public awareness campaigns to educate local communities about the importance of habitat conservation and sustainable resource management.

Yutasas

Proposed project activities and potential risks and impacts

Given the presence of endangered and critically endangered species and the sensitive habitat in the Yotasas Yotasas command area, the proposed irrigation renovation scheme must be implemented with careful consideration to minimize negative impacts on biodiversity. By carefully considering the ecological implications of the project, it is possible to balance the needs of agriculture with the conservation of endangered species and their habitats. Under Yutasas, various activities will be carried out that cause the following E&S risks and impacts:

Table 11: Projection activities that may cause potential impacts on the environment and social aspects at Yutasas sub-scheme

No.	Project activities that cause impacts	E&S Risks & Impacts
1	Construction activities (rehabilication of canal and	**Habitat loss and fragmentation** could lead to habitat loss and fragmentation, affecting species'

	farm roads), land use changes, and water management practices	survival and connectivity. This activity may involve dredging, excavation, or modification of existing water channels and infrastructure. These activities can lead to habitat destruction, disturbance to nesting and foraging sites, disruption of natural water flow patterns, and alteration of hydrological regimes. This can directly impact both terrestrial and aquatic biodiversity.
2	Increased agricultural activities, sedimentation, and pollution	**Water quality degradation** could impact aquatic ecosystems and species that rely on clean water.
3	Dredging of waterways and Alteration of water levels	Changes in water levels within the command area due to irrigation system renovation may negatively impact wildlife dependent on specific habitats for breeding or foraging purposes. Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats.
4	Use of chemicals and nutrient loading	**If pesticides/fertilizers are used during agricultural practices within the command area as part of irrigation system renovation projects, it could lead to contamination of soil and water resources affecting both terrestrial and aquatic biodiversity.**
5	**Biodiversity degradation, and soil erosion**	The **potential** impacts of the project on water flow, water quality, and sedimentation patterns. The changes in microclimate.
6	Barriers to fish migration routs	Irrigation structures, such as dams and weirs, can obstruct fish migration, preventing them from accessing critical spawning grounds or nursery areas. This disruption of their natural life cycles can lead to reduced populations and species decline. To mitigate these negative impacts, it's essential to design and operate irrigation systems with fish-friendly considerations.

		Addressing this issue may includes incorporating measures like fish passage facilities[68], such as fish ladders or fish lifts, to enable safe movement upstream and downstream. Additionally, implementing effective water quality management practices and raising public awareness about the importance of protecting fish populations, particularly near fish passage areas, can contribute to the conservation of aquatic ecosystems.

Areas of Influence

The area of influence for the Yatasas Yotasas irrigation renovation scheme encompasses the direct and indirect impacts of the project. This includes:

4 **Direct Impacts:** The immediate area where the irrigation infrastructure will be constructed and operated, including canals, pumping stations, and reservoirs.

5 **Indirect Impacts:** The surrounding areas that may be affected by changes in water flow, land use, or other project-related activities. This includes the Stueng Krang Ponlai River, the Tonle River, and the habitats of endangered species within the Yotasas Yotasas command area.

Analysis to prepare for determining CH status

1. Critical Habitat Area of Analysis

Critical habitat is defined as an Area of Analysis (AoA), and the project's command area is used as an AoA.

2. Species with Potential Occurrence within the AoA

A list of threatened species with potential occurrence was generated for Yutasas. The coordinates of Yutasas (via KMZ file) are used to inform the IBAT radius of screening. Since the default radius of IBAT screening is 50km, steps were taken to narrow down to the sub-scheme's area of influence to identify only EN and CR species that are potentially present in the sub-scheme area of influence. The narrowing-down aims to practically identify EN and CR species that could be found in the sub-scheme area of influence and to determine the Critical Habitat status of the identified species. After three rounds of screening focusing on EN and CR species, 6 EN and CR species are found as potentially present in the sub-scheme area of influence. These species include 3 reptile species, and 3 fishes (See list of 11 EN and CR species in Table below).

Description of screening for narrowing down

[68] Fish passage is essential for fish to navigate water systems and access diverse habitats. Fish passage technologies, like fish ladders, help preserve fish populations and aquatic ecosystems. Fish need to migrate 10 miles or 1,000 miles to access different habitats, food, and environments that support their life cycles.

For Yutasas, three rounds of screening have been conducted. The first screening (Round 1) was conducted in December 2023. Round 2 was carried out in April 2024, and Round 3 in August 2024. The purpose of repeated screening is to validate the screening results (for the same area) with a wide range of local stakeholders. The screening aims to identify only EN and CR species that are potentially present in the Yutasas area of influence, covering reptiles and fish. Screening was done based on the IBAT report generated and provided by the AIIB.

In the first two rounds of screening, 5 EN and CR species were identified in the Yutasas area of influence (See Table 9 below). In the 3rd round of screening (in August 2024), however, 3 (out of a total of 5 species) were confirmed as “potentially present” in the Yutasas’s area of influence.

So, the assessment for Yutasas focuses on the confirmed list of **3 species of fish** that are categorized by IUCN as EN and CR species (see map in Krapeu Trom section above).

Table 12: Confirmed List of endangered and critically endangered species for the Yutasas sub-scheme

No.	Local Name	English Name	Scientific Name	IUCN Cat	Screened Species from Round 1&2 (Total=5)	Confirmed Species in Round 3 (Total = 3)
I. Reptile spices						
1	អណ្តើកព្រេច	Elongated Tortoise	Indotestudo elongata	CR	Yes	Yes
II. Fish species						
2	ត្រីក្រសក់ក្រហម	Jullien's Golden Carp	Probarbus jullieni	CR	Yes	Yes
3	ត្រីចង្វាស្នឹង	Leaping barb/Flying Minnow	Laubuka caeruleostigmata	EN	Yes	Yes
4	ត្រីកាហោ /ត្រីកុលរ៉ាង	Mekong giant barb/Giant Carp	Catlocarpio siamensis	CR	Yes	Yes
II. Bird species						
5	ទាព្រៃស្លាបស	White-winged Duck	Asarcornis scutulata	EN	Yes	No

3. Ecological State of Habitats within the AoA

Understanding of the ecological state of habitats is necessary to assess the Likelihood of occurrence (LoO) of the above 3 screened species - as part of the CHA. For this CHA, species were classified into four LoO categories: Present, Possible, Unlikely and Not Present. Species known to be Present or with a Possible LoO are further assessed in Step 3. This understanding takes into account the classification of habitats as either modified or natural based on levels of human-induced disturbance to species composition and ecological functions. In this session, a

brief assessment of the 3 confirmed species are presented. The assessment discusses historical range, distribution, habitat conditions, current status, and potential threats identified by key informants.

The Yutasas command area has been in existence since the 1970s. This command area is a mixture of paddy fields, farm roads, and residential areas. Natural rivers, such as the Stueng Krang Ponlai, are the sole ecological and hydrological connection between its upstream watershed and the downstream Tonle Sap River basin. This river is crucial for fish migration during the flooding season. However, reservoirs, spillways, and drought conditions have disrupted these essential ecological functions.

Determination of Critical Habitat Status (Step 3)

This section assesses the information (obtained from the above sub-section) vis-a-vis the criteria (presented in Section 3.4 - CH assessment method). This assessment aims to determine whether any species (identified in the list of 3 EN and CR species) qualify for Critical Habitat features.

Table 13: Critical Habitat Status of each conformed species in Yutasas command Area

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on 3 screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
Bird species								
White-winged Duck	*Asarcornis scutulata*	EN	No	Yes	No			
Fish speices								
Jullien's Golden Carp	Probarbus jullieni	CR	No	Yes	Yes	Present (rare)	Strongly and accurately confirmed by key informants	Stueng Krang Ponlai, at the lower part of the reservors of this sub-scheme.
Leaping barb/Flying Minnow	Laubuka caeruleostigmata	EN	No	Yes	Yes	Present (rare)	Strongly and accurately confirmed by key informants	Stueng Krang Ponlai, at the lower part of the reservors of this sub-scheme.
Mekong giant barb/Giant Carp	Catlocarpio siamensis	CR	No	Yes	Yes	Present (rare)	Strongly and accurately confirmed by key informants	Stueng Krang Ponlai, at the lower part of the reservors of this sub-scheme.
Reptile Species								
Elongated Tortoise	Indotestudo elongata	CR	Np	Yes	No			

1. Habitat of significant importance to CE and EN species

As presented in Section 4.1.3.3 (Ecological State), species that qualify as critical habitat features include:

Based on the interviews and habitat assessments, three of the five endangered species were confirmed to be present in the Krapeu Trom section: Jullien's Golden Carp, Flying Minnow, and Mekong Giant Barb (see map above in Krapeu Trom section).

- **Jullien's Golden Carp:** A female fisher reported encountering this rare species in the lower part of the reservoir during a flood in 2022. She caught five individuals using a fishing net. The other informants had not seen this species in several years. After careful verification, it was determined that the fishers were familiar with the species and had not mistaken it for another.
- **Flying Minnow:** Two informants reported encountering this small fish species in 2022 and 2023. One caught them in the lower part of the Yotasass reservoir, where they had migrated from a downstream area. The other found them in her natural fish pond after pumping it. Both informants were confirmed to be familiar with the species.
- **Mekong giant Barb**: A key informant reported catching five individuals of this species in July 2022 after heavy rains. The fish were small, approximately 1.5 kilograms each, and were found in the lower part of the reservoir. The informant was familiar with the species and believed that they were attempting to migrate upstream but were trapped by the reservoir..

2. Habitat of significant importance to endemic or restricted-range species

None of the species under EN and CR classification are restricted-range species (based on IBAT report for Yutasas).

3. Habitat supporting globally or nationally significant concentrations of migratory or congregation species

None of the IBA that are recognized for significant concentrations of migratory birds or other species are found within the vicinity of the sub-scheme. No other evidence of significant concentrations of migratory or congregatory species is available. The AoA for Yutasas, therefore is expected to qualify as critical habitats under this criterion.

4. Highly threatened or unique ecosystems

Each of the reservoirs are modified habitat and is associated with numerous rice paddies. There is no evidence that these areas are highly threatened or unique ecosystems, and no critical habitats are recognized under this criterion.

5. Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

No ecological functions that are necessary to support biodiversity values (described under the above criteria) have been identified.

Mitigation measures

To minimize the negative impacts of the irrigation renovation scheme on biodiversity, the following mitigation measures should be implemented:

1. During design

During the design phase of construction activities, it is important to consider measures that minimize impacts on biodiversity in order to protect natural habitats nearby. Key mitigation measures during this stage may include:

6 Avoidance and Minimization: Plan the project to avoid these sensitive areas whenever possible. If avoidance is not feasible, minimize impacts through careful design and engineering.

7 Sustainable Design: Incorporate sustainable design principles to reduce the project's environmental footprint, such as minimizing water consumption and energy use.

8 Fish Passageways: If necessary, construct fish passageways to facilitate fish migration and maintain connectivity between aquatic habitats.

2. During construction

During the actual construction phase of the project, effective mitigation measures should be implemented to further minimize impacts on biodiversity:

9 Minimizing Disturbance: Use low-impact construction techniques to minimize disturbance to habitats and wildlife.

10 Erosion Control: Implement measures to prevent soil erosion, such as temporary erosion control structures and revegetation.

11 Wildlife Protection: Take precautions to protect wildlife during construction, such as fencing off sensitive areas and avoiding construction activities during breeding seasons.

12 Train and educate labor staff to avoid harming biodiversity during construction.

3. During operation

After completion of construction, ongoing operation activities should also incorporate mitigation measures:

13 Water Management: Implement efficient water management practices to minimize water wastage and reduce the impact on aquatic ecosystems.

14 Monitoring and Adaptive Management: Establish a monitoring program to track the project's impacts on biodiversity and adjust operations as needed to address any negative effects.

15 Community-Based Conservation: Involve local communities in conservation efforts, such as habitat restoration, monitoring, and enforcement of regulations.

16 Mitigation of Pollution: Implement measures to prevent pollution from the project, such as proper disposal of waste and maintenance of equipment.

17 Awareness raising: Raising public awareness about endangered fish species and educating people about the importance of not catching fish at fish passage areas is crucial for their conservation.

Biodiversity Action Plan for three sub-schemes (Brambei Mom, Krapeu Trom, and Yutasas)

Protect and restore biodiversity **within the Brambei Mom, Krapeu Trom, and Yutasas sub-schemes.**

Overall, these Conservation Action Plans aim to minimize habitat loss, reduce pollution, promote sustainable water management practices, protect endangered species' habitats, raise public awareness about conservation issues, and monitor biodiversity changes over time. By implementing these measures effectively, it is possible to achieve a net gain in ecological value for these sub-schemes while balancing agricultural needs with environmental conservation.

Objectives:

1. Habitat Preservation: Maintain and restore the ecological integrity of natural habitats, including wetlands, forests, and waterways.
2. Species Conservation: Protect endangered and critically endangered species and their populations.
3. Sustainable Resource Management: Promote sustainable agricultural practices that minimize negative impacts on biodiversity.
4. Community Engagement: Foster local community involvement in conservation efforts.

Strategies:

5. Habitat Restoration:
    1. Restore degraded habitats through reforestation, wetland restoration, and erosion control measures.
    2. Create wildlife corridors to connect fragmented habitats.
6. Species Conservation:
    1. Develop and implement species-specific conservation plans for endangered and critically endangered species.
    2. Establish protected areas or reserves to safeguard critical habitats.
    3. Monitor populations and track their recovery.
7. Sustainable Agriculture:
    1. Promote sustainable agricultural practices, such as organic farming and integrated pest management.

2. Provide incentives for farmers to adopt environmentally friendly methods.

8. Water Management:
    1. Improve water management practices to minimize water pollution and maintain healthy water flows.
    2. Implement measures to reduce sedimentation and erosion.
    3. Community Engagement:
    4. Educate local communities about the importance of biodiversity conservation.
    5. Involve communities in conservation efforts through participatory planning and monitoring.

Implementation:

9. Partnerships: Collaborate with government agencies, NGOs, local communities, and other stakeholders to implement conservation measures.
10. Monitoring and Evaluation: Establish a monitoring and evaluation framework to track progress and assess the effectiveness of conservation actions.
11. Resource Allocation: Secure adequate funding and resources to support conservation activities.
12. Policy Development: Advocate for policies that promote biodiversity conservation and sustainable development.

Specific Actions for Each Sub-Scheme: **Based on the study's findings, specific actions could include:**

13. Brambei Mom:
    1. Prioritize habitat restoration in areas affected by construction activities.
    2. Implement measures to improve water quality and reduce pollution.
    3. Monitor fish populations to assess the impact of irrigation practices.
14. Krapeu Trom:
    1. Focus on protecting the habitats of endangered fish species, such as the Flying Minnow.
    2. Improve water flow connectivity to facilitate fish migration.
    3. Implement measures to reduce sedimentation and erosion in the Stueng Krang Ponlai River.
    4. For Krapeu Trom sub-scheme specifically, incorporate fish passage facilities such as fish ladders or fish lifts to enable safe movement upstream and downstream for migratory fish specie

15. Yutasas:

1. Develop a comprehensive conservation plan for the endangered species identified in the area.
2. Protect and restore wetlands and forests within the command area.
3. Implement measures to reduce the impact of agricultural activities on biodiversity.

Additional Considerations:

16. Climate Change: Incorporate climate change adaptation measures into the conservation plan.
17. Monitoring and Evaluation: Develop a robust monitoring and evaluation system to track progress and adapt strategies as needed.
18. Community Involvement: Ensure that local communities are actively involved in the planning, implementation, and monitoring of conservation efforts.

Stueng Krang Bat

Proposed project activities and potential risks and impacts

Many endangered and critically endangered species of fish and reptiles inhabit the Inandared area, a vital fish migration habitat within the Tonle Sap River Basin. The proposed Stueng Krang Bat irrigation sub-scheme aims to balance agricultural development with biodiversity conservation. Key components include the construction of irrigation canals, water storage facilities, and drainage systems to enhance water management. These infrastructure improvements will support increased agricultural productivity while minimizing negative impacts on the area's rich biodiversity.

Given the ecological significance of the Stueng Krang Bat irrigation sub-scheme and the presence of endangered and critically endangered species, any proposed project activities must be carefully planned and implemented to minimize negative impacts on biodiversity. Under Stueng Krang Bat, various activities will be carried out that cause the following E&S risks and impacts:

Table 14: Projection activities that may cause potential impacts on the environment and social aspects at Stueng Krang Bat sub-scheme

No.	Project activities that cause impacts	E&S Risks & Impacts
1	Construction activities (rehabilitation of canal and farm roads), land use changes,	**Habitat loss and fragmentation** could lead to habitat loss and fragmentation, affecting species' survival and connectivity. This activity may involve dredging, excavation, or modification of existing

	and water management practices	water channels and infrastructure. These activities can lead to habitat destruction, disturbance to nesting and foraging sites, disruption of natural water flow patterns, and alteration of hydrological regimes. This can directly impact both terrestrial and aquatic biodiversity.
2	Increased agricultural activities, sedimentation, and pollution	**Water quality degradation** could impact aquatic ecosystems and species that rely on clean water.
3	Dredging of waterways and Alteration of water levels	Changes in water levels within the command area due to irrigation system renovation may negatively impact wildlife dependent on specific habitats for breeding or foraging purposes. Changes in water levels and habitat quality could force endangered species to relocate, potentially leading to competition with other species or exposure to new threats.
4	Use of chemicals and nutrient loading	**If pesticides/fertilizers are used during agricultural practices within the command area as part of irrigation system renovation projects, it could lead to contamination of soil and water resources affecting both terrestrial and aquatic biodiversity.**
5	**Biodiversity degradation, and soil erosion**	The **potential** impacts of the project on water flow, water quality, and sedimentation patterns. The changes in microclimate.
6	Blockage of migration routes by dams or other structures	Irrigation structures, such as dams and weirs, can obstruct fish migration, preventing them from accessing critical spawning grounds or nursery areas. This disruption of their natural life cycles can lead to reduced populations and species decline. To mitigate these negative impacts, it's essential to design and operate irrigation systems with fish-friendly considerations. Addressing this issue may includes incorporating measures like fish passage facilities, such as fish ladders or fish lifts, to enable safe movement

		upstream and downstream. Additionally, implementing effective water quality management practices and raising public awareness about the importance of protecting fish populations, particularly near fish passage areas, can contribute to the conservation of aquatic ecosystems.
7	**Biodiversity**	The potential impacts of the project on water flow, water quality, and sedimentation patterns.
8	Introduction of invasive species through irrigation canals	Irrigation canals may facilitate the introduction of invasive plant or animal species into native aquatic ecosystems like Water Hyacinth, Mimosa Pigra, Tilapia etc. These invasives can outcompete native species for resources such as food and habitat space.
9	Habitat loss or degradation due to land use changes	Land use changes associated with agricultural expansion or infrastructure development can lead to habitat loss or degradation of critical areas such as wetlands or floodplain ecosystems that support diverse fish populations.

Areas of Influence

The area of influence for the Stueng Krang Bat irrigation sub-scheme encompasses both modified and natural habitats within its command area. It extends along the Tonle Sap River, encompassing floodplains, wetlands, and associated ecosystems. The project activities have the potential to directly or indirectly impact biodiversity within this region.

The area of influence for the Stueng Krang Bat irrigation sub-scheme includes both direct and indirect impacts. Direct impacts may occur within the project area itself, such as construction sites and irrigation canals. Indirect impacts may extend to surrounding areas, including the Tonle Sap River, wetlands, and adjacent ecosystems.

Analysis to prepare for determining CH status

1. Critical Habitat Area of Analysis

Critical habitat is defined as an Area of Analysis (AoA), and the project's command area is used as an AoA.

2. Species with Potential Occurrence within the AoA

A list of threatened species with potential occurrence was generated for Stueng Krang Bat (SKB). The coordinates of SKB (via KMZ file) are used to inform the IBAT radius of screening. Since the default radius of IBAT screening is 50km, steps were taken to narrow down to the sub-scheme's area of influence to identify only EN and CR species that are potentially present in the sub-scheme area of influence. The narrowing-down aims to practically identify EN and CR

species that could be found in the sub-scheme area of influence and to determine the Critical Habitat status of the identified species. After three rounds of screening focusing on EN and CR species, 5 EN and CR species are found as potentially present in the sub-scheme area of influence. These species include 3 reptile species, and 2 fishes (see a list of 6 EN and CR species in Table 13 below).

Description of screening for narrowing down

For Ou Ta Paong, three rounds of screening have been conducted. The first screening (Round 1) was conducted in December 2023. Round 2 was carried out in April 2024, and Round 3 in August 2024. The purpose of repeated screening is to validate the screening results (for the same area) with a wide range of local stakeholders. The screening aims to identify only EN and CR species that are potentially present in the SKB area of influence, covering reptiles, mammals, fish, birds, amphibians, and aquatic plants. Screening was done based on the IBAT report generated and provided by the AIIB.

In the first two rounds of screening, 5 EN and CR species were identified in the SKB area of influence (See Table below). In the 3rd round of screening (in August 2024), however, 6 (one additional critically endangered species) were confirmed as “potentially present” in the OTP’s area of influence.

So, the assessment for SKB focuses on the confirmed list of 6 species that are categorized by IUCN as EN and CR species including 3 reptile species (Asian giant softshell turtle, Black Marsh Turtle and Southeast Asian Box Turtle) and 3 fish species (Striped catfish, Mekong Giant Barb and Siamese Tiger Perch). See Table below for the list of confirmed species and see Figure 1 for potential locations of these species in the project’s area of influence.

Table 15: List of endangered and critically endangered species based on the IBAT Screening result vs. key informant interview at Stueng Krang Bat Sub-scheme

No.	Local Name	English Name	Scientific Name	IUCN Cat	Screened Species from Round 1&2 (Total=5)	Confirmed Species in Round 3 (Total = 3)
I.	**Reptile spices**					
1	កន្ធាយក្បាលកង្កែប	Asian giant softshell turtle	Pelochelys cantorii	CR	No	Yes
2	អណ្តើកក្អែក	Black Marsh Turtle	Siebenrockiella crassicollis	EN	Yes	Yes
3	អណ្តើកបិទមុខ	Southeast Asian Box Turtle	Cuora amboinensis	EN	Yes	Yes
III.	**Fish species**					

4	ត្រីជ្រោង	Striped catfish	Pangasianodon hypophthalmus	EN	Yes	Yes
5	ត្រីកាហោ /ត្រីគុលរ៉ាង	Mekong Giant Barb	Catlocarpio siamensis	CR	Yes	Yes
6	ត្រីកន្ត្រៃប់ខ្លា	Siamese Tiger Perch	Datnioides pulcher	CR	Yes	Yes

Ecological State of Habitats within the AoA

Understanding of the ecological state of habitats is necessary to assess the Likelihood of occurrence (LoO) of the above 11 screened species - as part of the CHA. For this CHA, species were classified into four LoO categories: Present, Possible, Unlikely and Not Present. Species known to be Present or with a Possible LoO are further assessed in Step 3. This understanding takes into account the classification of habitats as either modified or natural based on levels of human-induced disturbance to species composition and ecological functions. In this session, a brief assessment of the 11 confirmed species are presented. The assessment discusses historical range, distribution, habitat conditions, current status, and potential threats identified by key informants.

The SKB command area has been in existence since the 1970s. The SKB is a mixture of paddy fields, farm roads, and residential areas. The Stueng Krang Bat (SKB) irrigation sub-scheme was initially screened for a biodiversity assessment, utilizing the Integrated Biodiversity Assessment (IBAT) approach and key informant interviews. Located on the edge of the Tonle Sap River and annual floodplains of the Tonle Sap and Mekong Rivers, this area holds significant ecological importance. The initial screening identified six EN and CR of reptiles and fish species for this command area. These included the Black Marsh Turtle, Southeast Asia Box Turtle, Striped catfish, Mekong giant barb/Giant Carp, and Siamese Tiger Perch.

Upon conducting key informant interviews (KII), it was confirmed that several endangered (EN) and critically endangered (CR) species inhabit SKB. These included reptiles such as the Black Marsh Turtle, Southeast Asia Box Turtle, and Asian giant softshell turtle along with fish species like Striped catfish, Mekong giant barb/Giant Carp, and Siamese Tiger Perch. The confirmation of these vulnerable species underscores the ecological significance of SKB's command area (see map below).

This information emphasizes the importance of further biodiversity surveys in this region to comprehensively document all wildlife present. Furthermore, these findings highlight potential conservation efforts needed to protect these threatened or endangered species identified through initial screening at SKB.

Ten key informants were selected in collaboration with the commune council and village chiefs for interviews. These individuals were chosen based on their extensive local ecological knowledge and experience in fishing within their communities. The

following paragraphs summarize the key information gathered from interviews regarding each confirmed species.

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Reptiles (3 species)

Asian giant softshell turtle: This species was not initially screened for interviews at this sub-scheme but was confirmed during the interview process. Only one informant reported encountering the Asian Giant Softshell Turtle in 2024 at Boeung Thom. This extremely rare species was last sighted by this informant many years ago. It prefers large lakes and river systems with abundant vegetation and flooded forests. The remaining key informants had not seen this species in many years, and some had never encountered it in their lifetimes.

Black Marsh Turtle: Two key informants confirmed their familiarity with this species. One informant reported encountering the Black Marsh Turtle in the area over a decade ago but has not seen it since then. A second informant also recalled encountering the species more than ten years ago, but not within the specific command area.

Southeast Asian Box Turtle: Five key informants confirmed their familiarity with the Southeast Asian Box Turtle. Two of these informants reported encountering the species in the Boeung Thom and Rek Trors areas in 2022. Another two informants encountered the turtle 7 years ago near the spillway close to the village and in Reahny Longvaek, which has since been converted into a real estate development project. One informant reported seeing the species in the same location for over a decade but has not observed it recently.

Fish Species

Striped Catfish: The local fishermen in the Stueng Kran Bat Command Area have consistently encountered the Striped Catfish species during the flooding season for several years. However, they have noticed a rapid decline in population size, with individuals being caught at much smaller sizes. The estimated catch by comparison to previous years is only around 30%. The fishermen report encountering these fish annually during full flooding and receding periods, with sightings randomly occurring within approximately 900m distance surrounding the village area. These fish typically migrate from the Tonle Sap Lake to the Stueng Kraing Ponlai River in August or September, depending on flood levels. Once in the Stueng Kraing Ponlai River, they disperse throughout the floodplain during the flooding season. All key informants reported consistently catching this species in the following areas for all reported fish species: Veal Braing (the floodplain area around the village), Trek Tor, Boeung Kralor Meach, Boeung Braing, Stueng Krang Ponlay River, Boeung Thom, and Boeung Toek La-ork.

Mekong Giant Barb: Local fishermen in the Stueng Kran Bat Command Area have consistently encountered the Mekong Giant Barb species during the flooding season for several years. However, they have noticed a rapid decline in population size, with individuals being caught at much smaller sizes. The fishermen do not intentionally target these fish species they are at the fingerling stage, but they often become trapped in line nets. Two of the fishermen mentioned that they had encountered this species around a decade ago but stopped going out for fishing for many years. Seven fishermen reported encountering them every year during flooding and early receding periods near the village and within the floodplain area.

The catch sizes are small during flooding season but grow significantly (2 to 3 km per individual) during receding periods. Another fisherman noted that there has been a decrease in both catch amounts and size of these fish over time, with fewer being caught with nets each year. They also mentioned that some of these fish get stuck in large lakes near the Tonle Sap River when floods occur. Overall, it is estimated that there has been a significant decline of more than 70% in catch amounts, and today's Mekong Giant Barb are much smaller compared to previous years at this time of year due to their rarity and the delay and not enough floods.

Striped Catfish: The information provided by the local fishermen regarding the Striped Catfish species in the command area is varied. Two of them reported recent sightings in 2022 and 2023 between 3 to 5 individuals per catch, while one informant mentioned their last encounter was 7 years ago, and two others stated that they haven't seen this species in over a decade. The encounters typically occurred during flooding and receding periods. The number of individuals caught has been very low, and the size of the fish has been decreasing year by year. One fisherman mentioned that he encountered this species in the Tonle Sap River but not around the village area.

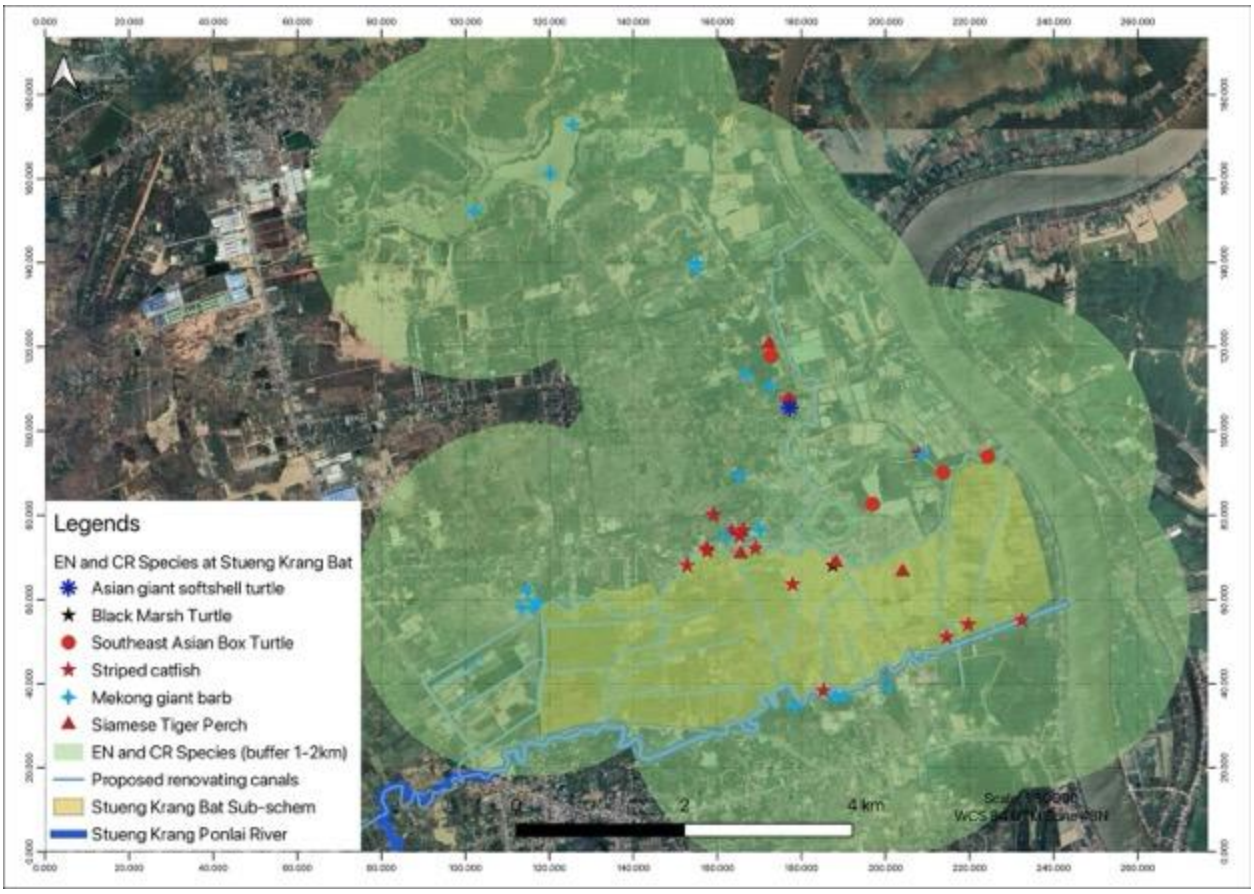

Figure 29: *Map showing the distribution of endangered (EN) and critically endangered (CR) species, with 1-2 km buffers indicating their potential movement ran ge within and around suitable habitats as identified by key informants sighted from 2020 to 2024.*

Determination of Critical Habitat Status (Step 3)

This section assesses the information (obtained from the above sub-section) vis-a-vis the criteria (presented in Section 3.4 - CH assessment method). This assessment aims to determine whether any species (identified in the list of 11 EN and CR species) qualify for Critical Habitat features.

Table 16: Critical Habitat Status of each conformed species in SKB Command Area

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on 3 screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
Fish speices								
Striped catfish	Pangasianodon hypophthalmus	EN	No	Yes	Yes	Present (rare)	Strongly and accurately confirmed by key informants	Tonle Sap Floodplain and Stueng Krang Ponlai.
Mekong Giant Barb	Catlocarpio siamensis	CR	No	Yes	Yes	Present (rare)	Strongly and accurately confirmed by key informants	Tonle Sap Floodplain and Stueng Krang Ponlai.
Siamese Tiger Perch	Datnioides pulcher	CR	No	Yes	Yes	Present (rare)	Strongly and accurately confirmed by key informants	Tonle Sap Floodplain and Stueng Krang Ponlai.
Reptile Species								
Asian giant softshell turtle	Pelochelys cantorii	CR	No	No	Yes	Unlikely	Strongly and accurately confirmed by key informants	Tonle Sap Floodplain and Stueng Krang Ponlai.
Black Marsh Turtle	Siebenrockiella crassicollis	EN	No	Yes	Yes	Present (rare)	Strongly and accurately confirmed by key informants	Tonle Sap Floodplain and Stueng Krang Ponlai.

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on 3 screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
Southeast Asian Box Turtle	Cuora amboinensis	EN	No	Yes	Yes	Possible (rare)	Strongly and accurately confirmed by key informants	Tonle Sap Floodplain and Stueng Krang Ponlai.

1. Habitat of significant importance to CE and EN species

As presented in Section 4.6.3.3 (Ecological State), species that qualify as critical habitat features include:

The habitat assessment identified both modified and natural habitats within the command area. Modified habitats include areas substantially altered by human activity, such as agricultural land, natural lakes, wetlands, and river systems. Natural habitats consist of viable assemblages of native plants and animals, where primary ecological functions and species composition remain largely intact. Identifying critical habitats is essential for understanding the ecological requirements of different fish species within the project areas. The critical habitats identified in the assessment are diverse and support a range of endangered and critically endangered species. These habitats include:

1. **Floodplains:** The floodplains, particularly those connected to the Tonle Sap Lake and Mekong River, provide important habitats for fish species during the flooding season. These areas are periodically inundated, creating a dynamic ecosystem that supports fish migration, spawning, and feeding.
2. **Rivers and Streams:** The rivers and streams within the sub-schemes serve as crucial habitats for fish migration and spawning. The Stueng Krang Ponlai River in Krapeu Trom sub-scheme plays a vital role in connecting upstream watersheds to the Tonle Sap River basin.
3. **Wetlands:** Wetlands such as marshes, swamps, lakes, and ponds are critical for supporting aquatic biodiversity. They provide breeding grounds for fish species and serve as important habitats for reptiles like Black Marsh Turtle and Southeast Asia Box Turtle.
4. **Aquatic Vegetation:** Aquatic plants play a key role in providing food, shelter, and spawning sites for various fish species. They contribute to the overall health of aquatic ecosystems by improving water quality through nutrient uptake.

5. Habitat of significant importance to endemic or restricted-range species

None of the species under EN and CR classification are restricted-range species (based on IBAT report for SKB).

6. Habitat supporting globally or nationally significant concentrations of migratory or congregation species

This command area lies on the heart of Tonle Sap River Basin (TSRB) receiving annual flooding and submerging under the water seasonally. The whole floodplain area provides a signification congregation under the water during the wet season from August or September to January or February (depending on the flood situation) creating significant habitat for migratory fish, congregating downstream to upstream and vice versa..

7. Highly threatened or unique ecosystems

The Stueng Krang Bat irrigation sub-scheme is located in an area of high ecological importance within the Tonle Sap River system. The area is characterized by its proximity to the Tonle Sap Lake, the Mekong River, and their connecting channels, which provide a diverse range of

habitats for fish species. This complex network of waterways supports a diverse range of fish species, making it a global hotspot for aquatic life. The confirmed presence of endangered and critically endangered species in the sub-scheme area highlights its ecological significance..

8. Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d)

Stueng Kang Ponlai or Krang Bat and its floodplain area serve as critical habitat for EN and CR species of fish and reptiles. These ecological functions are necessary to support biodiversity values (described under the above criteria). Protecting flooded forest habitats and maintaining hydrological functions and connectivity are key to securing the free movement of these rare species.

Mitigation measures

To minimize the negative impacts of the irrigation sub-scheme on biodiversity, the following mitigation measures should be implemented:

1. During design

During the design phase of the Stueng Krang Bat irrigation sub-scheme, careful consideration should be given to incorporating measures that minimize potential impacts on biodiversity. This includes:

1. Designing fish-friendly structures for water diversions and crossings: To ensure the continuity of fish migration and minimize habitat fragmentation, it is important to design infrastructure such as weirs, dams, and culverts with features that allow fish passage. Fish ladders, bypass channels, or nature-like fishways can be incorporated into these structures to facilitate the upstream and downstream movement of fish.
2. Corridor Design: Incorporate biological corridors into the design, connecting fragmented habitats to promote species movement and enhance ecological connectivity.
3. Ecosystem Restoration: Implement strategies for ecosystem restoration, such as reestablishing native vegetation or reintroducing locally extinct species in degraded areas.
4. Avoidance and Minimization: Plan the project to avoid these sensitive areas whenever possible. If avoidance is not feasible, minimize impacts through careful design and engineering.
5. Sustainable Design: Incorporate sustainable design principles to reduce the project's environmental footprint, such as minimizing water consumption and energy use.
6. Fish Passageways: Construct fish passageways to facilitate fish migration and maintain connectivity between aquatic habitats.

7. During construction

During the construction phase of the sub-scheme, it is essential to implement mitigation measures that minimize disturbances and protect biodiversity:

8. Maintaining ecological flows in rivers and streams: It is crucial to maintain natural flow regimes in rivers and streams to support the ecological functions of these habitats. This

can be achieved by setting minimum flow requirements during critical periods for fish migration or reproduction. Water allocation plans should consider the needs of both human water use and environmental flows.

9. Preventing the introduction of invasive species: Measures should be taken to prevent the introduction of invasive plant or animal species into native aquatic ecosystems through irrigation canals or other means. This can include regular cleaning and maintenance of irrigation infrastructure to remove potential invasive species propagules, as well as implementing biosecurity measures at canal entrances.
10. Environmental Management Plan: Develop and implement an Environmental Management Plan (EMP) that includes specific measures to prevent habitat destruction, minimize sedimentation, control erosion, manage construction waste properly, and prevent water bodies.
11. Buffer Zones: Establish buffer zones around sensitive habitats or critical ecosystems to protect them from direct impacts associated with construction activities.
12. Habitat Protection Measures: Implement measures to protect nesting grounds, breeding sites, or other critical habitats during construction activities by implementing exclusion zones or temporary relocation strategies.
13. Minimizing Disturbance: Use low-impact construction techniques to minimize disturbance to habitats and wildlife.
14. Erosion Control: Implement measures to prevent soil erosion, such as temporary erosion control structures and revegetation.
15. Wildlife Protection: Take precautions to protect wildlife during construction, such as fencing off sensitive areas and avoiding construction activities during breeding seasons.
16. Train and educate labor staff to avoid harming biodiversity during construction.
17. During operation

Once the sub-scheme is operational:

18. Monitoring Programs: Establish long-term monitoring programs to assess any ongoing impact on biodiversity during operation and ensure early detection of any adverse effects.
19. Adaptive Management Approach: Adopt an adaptive management approach that allows for adjustments in operational practices based on monitoring results and changing environmental conditions.
20. Ecological Education Programs: Develop educational programs for local communities about environmental conservation practices related to agriculture activities within affected communities
21. Water Management: Implement efficient water management practices to minimize water wastage and reduce the impact on aquatic ecosystems.
22. Community-Based Conservation: Involve local communities in conservation efforts, such as habitat restoration, monitoring, and enforcement of regulations.
23. Mitigation of Pollution: Implement measures to prevent pollution from the project, such as proper disposal of waste and maintenance of equipment.

24. Monitoring fish populations and water quality to assess the effectiveness of mitigation measures: Regular monitoring programs should be established to assess changes in fish populations over time, including abundance, distribution, size structure, and diversity. Monitoring should also include assessing water quality parameters such as temperature, dissolved oxygen levels, nutrient concentrations, and pollutant levels.
25. Habitat rehabilitation initiatives - restore degraded habitats by removing obstructions (e.g., dams), improving water quality through erosion control measures (e.g., reforestation), promoting riparian vegetation planting along river banks etc

Conservation action for Stueng Krang Bat Sub-scheme

A comprehensive Biodiversity Action Plan (BAP) should be developed to achieve net gain in biodiversity with clear outline below:

Proposed Conservation Action Plan for Stueng Krang Bat Irrigation Sub-Scheme

Executive Summary

This conservation action plan outlines strategies to mitigate potential negative impacts on biodiversity within the Stueng Krang Bat irrigation sub-scheme. The plan is based on a thorough assessment of the area's biodiversity, including the identification of endangered and critically endangered species. The proposed actions align with the International Finance Corporation's Performance Standard 6 (PS6) on biodiversity conservation and sustainable management of living natural resources.

Key Objectives

Protect endangered species: Implement measures to conserve the Black Marsh Turtle, Southeast Asian Box Turtle, Striped Catfish, Mekong Giant Barb, and Siamese Tiger Perch.

Maintain habitat quality: Preserve and restore critical habitats, including floodplains, rivers, wetlands, and aquatic vegetation.

Minimize negative impacts: Reduce the adverse effects of irrigation activities on biodiversity through careful planning and implementation.

Engage with stakeholders: Foster collaboration with local communities, government agencies, and other stakeholders to ensure effective conservation efforts.

Action Plan

1. Biodiversity Assessment and Monitoring

1. Conduct comprehensive biodiversity surveys: Regularly assess the distribution and abundance of endangered and critically endangered species within the sub-scheme.
2. Monitor habitat conditions: Track changes in water quality, sedimentation patterns, and habitat fragmentation.
3. Evaluate the effectiveness of mitigation measures: Assess the impact of conservation actions on biodiversity and adjust strategies as needed.

2. Habitat Protection and Restoration

1. Identify and protect critical habitats: Delineate and conserve areas of high ecological significance, such as floodplains, wetlands, and river systems.
2. Restore degraded habitats: Implement habitat restoration measures, including reforestation, wetland restoration, and removal of invasive species.
3. Maintain ecological flows: Ensure that irrigation practices do not compromise the natural flow regimes of rivers and streams.
4. Protect fish passage: Incorporate fish-friendly structures and practices to facilitate fish migration and connectivity.

3. Mitigation Measures

1. Avoidance and minimization: During project planning and design, prioritize avoidance of sensitive habitats and minimize impacts through careful site selection and engineering.
2. Habitat protection: Implement measures to protect critical habitats during construction and operation, such as establishing buffer zones and avoiding disturbance of nesting sites.
3. Water quality management: Control pollution and sedimentation to maintain water quality for aquatic species.
4. Invasive species control: Prevent the introduction and spread of invasive species through appropriate management practices.
5. Community-based conservation: Engage local communities in conservation efforts, such as habitat restoration and monitoring.

4. Stakeholder Engagement

1. Involve local communities: Collaborate with residents and stakeholders to understand their concerns and knowledge about biodiversity.
2. Establish participatory platforms: Create mechanisms for ongoing dialogue and decision-making.
3. Promote awareness: Raise public awareness about the importance of biodiversity conservation and the potential impacts of irrigation schemes.

5. Collaboration with Conservation Organizations:

1. Collaborate with recognized conservation organizations or academic institutions specializing in reptile/fish research for technical support in monitoring activities and best practices for habitat management.

6. Environmental Education Programs:

2. Implement environmental education programs targeting local communities aimed at raising awareness about the importance of protecting critical habitats and promoting sustainable agricultural practices that minimize negative impacts on wildlife.

7. Fish-friendly Infrastructure Design:

3. Ensure that all infrastructure development (such as canals, weirs) is designed with fish-friendly features like fish ladders or bypass channels to allow safe fish migration upstream/downstream during different seasons.

8. Invasive Species Control Measures:

4. Develop invasive species control measures specific to irrigation canals to prevent the introduction/spread of invasive plant or animal species into native aquatic ecosystems like water hyacinth or tilapia fish.

Conclusion

This conservation action plan provides a framework for protecting biodiversity within the Stueng Krang Bat irrigation sub-scheme. By implementing these strategies, the plan aims to contribute to the long-term conservation of endangered species and the maintenance of healthy ecosystems in the Tonle Sap River Basin.

Table 17: Results of the prioritisation exercise to support BAP planning: priority biodiversity for BAP action for Stueng Krang Bat

Action Category (AC)	Group	Priority Biodiversity	Mitigation and monitoring approach
AC 1 High Priority for habitat mitigation and/or species-specific measures	Freshwater Fishes	Striped catfish, Mekong Giant Barb, Siamese Tiger Perch	The highest priority for achieving net gain (offset targets) lies in the implementation of both species-specific and habitat-focused mitigation and offset actions.
	Reptiles	Asian giant softshell turtle, Black Marsh Turtle, Southeast Asian Box Turtle	
	Natural Habitats	Remaining flooded forest, and natural ponds/lakes	
AC 2 Contingency planning			
AC 3 General habitat mitigation measures			
AC 4 Remain aware			

KEY CONSIDERATIONS

The low section of this area is rich in biodiversity. By the way, some endangered and critically endangered bird species like Greater Adjutant, Milky Stork, and Bengal Florican are confirmed at the lower section of this area, and critically endangered fish of Siamese Tiger Perch and Critically Endangered Black Mash Turtle are confirmed at the upper part of this area at Boeung Kamsaeng Lake and Svay Daunkav River. Furthermore, four other EN and CR species of reptile including the Black Mash Turtle, Southeast Asian Box Turtle, Giant Asian Pond Turtle, and Elongated tortoise and two CR mammal species including the Indochinese Silvered Langur and Long-tailed Macaque are confirmed in the flooded forest habitat and natural lack in adjacent to the lower section of this command area's boundary. Those bird species are using seasonal wetlands, lakes, waterholes, grasslands, and fellow rice fields as their foraging habitat. Lum Hach is especially important for Green Peafowl. These species have small populations and are highly dependent on their habitats.

The fish surveys conducted in Krapeu Trom and Stueng Krang Bat irrigation sub-schemes have revealed the presence of various fish species, including endangered and critically endangered ones. The information gathered from key informant interviews provides insights into the abundance and distribution of these species within the project areas. Based on assessment results for Krapeu Trom sub-scheme at least two rare fish species have been confirmed present from 2020 to 2024 - Isok barb/Jullien's Golden Carp (Probarbus jullieni) and Leaping barb/Flying Minnow (Laubuka caeruleostigmata). On Yotasas Irrigation subscheme at least three endangered species had been confirmed present - Jullien's Golden Carp; Flying Minnow; and Mekong Giant Barb. And finally, at Stueng Krang Bat Subscheme three EN/CR fish species –the Striped catfish; Mekong Giant barb; Siamese Tiger Perch

The key considerations from these findings are the importance of prioritizing ecological considerations during the design phase, implementing strict environmental safeguards during construction, and engaging in ongoing monitoring and adaptive management during the operation phase. Additionally, educating staff on biodiversity concerns, involving local communities in conservation efforts, promoting sustainable land use practices, establishing habitat protection measures, considering biodiversity offsets for significant residual impact, cultivating community-based conservation initiatives should also be prioritized. These actions are essential for mitigating potential impacts on biodiversity and maximizing the benefits of both OTP, LH and ather 4 sub-schems. Bellow are key interventions should consider and adopted for sustainable development an protection for biodivesity and ecosytem.

Habitat Conservation and Restoration:

1. **Critical Habitats:** Identify and protect critical habitats, such as flooded forests, wetlands, and areas important for endangered species.
1. **Habitat Restoration:** Implement measures to restore degraded habitats and improve their suitability for biodiversity.

Sustainable Resource Management:

1. Fishing Practices: Promote sustainable fishing practices to prevent overfishing and protect fish populations.
2. Agriculture: Encourage sustainable agricultural practices that minimize negative impacts on biodiversity and water quality.
3. Water Management: Implement sustainable water management practices to ensure adequate water availability for both human needs and ecological functions.

Community Engagement and Participation:

1. **Involvement:** Involve local communities in decision-making, monitoring, and conservation efforts to build ownership and support.
2. **Sustainable Livelihoods:** Promote sustainable livelihoods that are compatible with biodiversity conservation.

Monitoring and Evaluation

1. **Regular Monitoring:** Establish a long-term monitoring program to track changes in habitat quality, species populations, and the effectiveness of mitigation measures.
2. **Adaptive Management:** Be prepared to adjust conservation strategies based on monitoring results and changing conditions.

Policy and Governance

1. **Strengthened Policies:** Ensure that existing policies and regulations are adequate for protecting biodiversity and promoting sustainable resource management.
2. **Enforcement:** Enforce environmental laws and regulations to prevent illegal activities that harm biodiversity.
3. **Institutional Capacity:** Strengthen the capacity of government agencies and NGOs to effectively implement conservation measures.

A quick conclusion from this first assessment and observation, these healthy flooded forest and wetland ecosystem are exposed to high risk to more land encroachment and conversion for agricultural expansion when the water are available in the area. The expansion of irrigation and agricultural intensification can pose significant threats to flooded forest habitats, wetlands, and critically endangered species. Here are some of the major threats associated with these activities: anticipated

- **Habitat Loss and Fragmentation**
- **Conversion of Land:** Flooded forests and wetlands may be drained or filled to create more arable land for agriculture, leading to significant loss of habitat.
- **Fragmentation:** Remaining natural habitats may become isolated patches, making it difficult for species to migrate, find mates, and maintain healthy populations.
- **Alteration of Water Regimes**
- **Water Extraction:** Increased irrigation often involves the extraction of large volumes of water from rivers and aquifers, altering natural water flows and drying out wetlands.

- **Flood Control Measures:** The construction of dams and levees for irrigation can disrupt the natural flooding cycles that many species depend on for breeding and feeding.
    - **Pollution**
- **Nutrient Runoff:** Fertilizers used in agriculture can run off into water bodies, causing eutrophication, which leads to algal blooms and decreased oxygen levels that can harm aquatic life.
- **Pesticides and Herbicides:** These chemicals can contaminate water sources, posing risks to aquatic species and entering the food chain, affecting predators.
    - **Invasive Species**
- **Introduction of Non-Native Species:** Changes in land use and water management can introduce invasive plant and animal species that outcompete native species and alter ecosystem dynamics.
    - **Loss of Biodiversity**
- **Species Decline:** Habitat loss and degradation can lead to declines in species populations, particularly those already classified as critically endangered.

    Disruption of Ecosystem Services: The loss of biodiversity can disrupt ecosystem services such as water purification, flood control, and carbon storage.

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ANNEX 2: SUMMARY OF HOUSEHOLD SURVEY RESULTS

Parameters	Ou Ta Paong		Krapeu Trom		Yutasas		Total	
	#	%	#	%	#	%	#	%
Main Occupation								
Rice and crop production	253	37.82%	81	25.08%	63	22.34%	397	31%
Animal production	2	0.30%	2	0.62%	0	0.00%	4	0%
Fishing/aquaculture	2	0.30%	0	0.00%	0	0.00%	2	0%
Forest	0	0.00%	0	0.00%	0	0.00%	-	0%
Trade	30	4.48%	12	3.72%	6	2.13%	48	4%
Service	13	1.94%	5	1.55%	10	3.55%	28	2%
Handicrafts	0	0.00%	2	0.62%	2	0.71%	4	0%
Government staff	15	2.24%	13	4.02%	14	4.96%	42	3%
Workers (full-time, private sector)	67	10.01%	75	23.22%	65	23.05%	207	16%
Workers, (seasonal, private sector)	9	1.35%	7	2.17%	10	3.55%	26	2%
Housewife	16	2.39%	6	1.86%	9	3.19%	31	2%
Student	163	24.36%	63	19.50%	54	19.15%	280	22%
Other (specify)	8	1.20%	10	3.10%	10	3.55%	28	2%
No job	91	13.60%	47	14.55%	39	13.83%	177	14%
Secondary Occupation								
Rice and crop production	150	22.42%	46	14.24%	36	12.77%	232	18%
Animal production	34	5.08%	13	4.02%	19	6.74%	66	5%
Fishing/aquaculture	5	0.75%	0	0.00%	0	0.00%	5	0%
Forest	0	0.00%	0	0.00%	0	0.00%	-	0%
Trade	26	3.89%	10	3.10%	5	1.77%	41	3%
Service	22	3.29%	6	1.86%	6	2.13%	34	3%
Handicrafts	3	0.45%	1	0.31%	2	0.71%	6	0%
Government staff	12	1.79%	12	3.72%	10	3.55%	34	3%
Workers (full-time, private sector)	66	9.87%	76	23.53%	62	21.99%	204	16%
Workers, (seasonal, private sector)	21	3.14%	7	2.17%	10	3.55%	38	3%
Housewife	21	3.14%	12	3.72%	11	3.90%	44	3%
Student	163	24.36%	63	19.50%	54	19.15%	280	22%
Other (specify)	15	2.24%	9	2.79%	8	2.84%	32	3%
No job	131	19.58%	68	21.05%	59	20.92%	258	20%
Total annual income								
Less than 2,500	20	3%	10	3%	7	2%	37	14%
2,500 - 5,000	22	3%	15	5%	19	7%	56	21%
5001 - 7,500	20	3%	12	4%	19	7%	51	19%
7,501 - 10,000	13	2%	6	2%	8	3%	27	10%
Higher than 10,000	65	10%	24	7%	12	4%	101	37%
Total annual expense								
Less than 2,500	30	21%	16	24%	27	42%	73	27%
2,500 - 5,000	63	45%	35	52%	26	40%	124	46%
5001 - 7,500	30	21%	10	15%	8	12%	48	18%
7,501 - 10,000	9	6%	4	6%	1	2%	14	5%
Higher than 10,000	8	6%	2	3%	3	5%	13	5%
Migration								
Inside the country	22	16%	9	13%	5	7.69%	36	13%
Out of the country	18	13%	0	0%	1	1.54%	19	7%
Type of House								
House built of 1 floor or more/brick wall, reinforced concrete roof	12	8.57%	8	11.94%	5	7.69%	25	9.19%
Semi-permanent	42	30.00%	33	49.25%	32	49.23%	107	39.34%
Wooden house, thatched	80	57.14%	24	35.82%	28	43.08%	132	48.53%
Temporary houses	5	3.57%	2	2.99%	0	0.00%	7	2.57%
Type of Land								
Residential land	139	99%	66	99%	65	100%	270	99%

Parameters	Ou Ta Paong		Krapeu Trom		Yutasas		Total	
	#	%	#	%	#	%	#	%
Riceland	134	96%	62	93%	60	92%	256	94%
Garden land	19	14%	15	22%	18	28%	52	19%
Other land	1	1%	1	1%	0	0%	2	1%
Land size (m^2)								
Residential land		1,539		1,342		740		1,298
Riceland		22,107		6,167		5,002		14,237
Garden land		6,849		4,239		2,842		4,709
Other land		70,000		5,000		0		37,500
Production								
Wet season								
Rice	121	86%	67	100%	60	92%	248	91%
Cash Crop	6	4%	4	6%	6	9%	16	6%
Vegetable	9	6%	1	1%	13	20%	23	8%
Industrial crop	0	0%	0	0%	0	0%	0	0%
Other	0	0%	0	0%	0	0%	0	0%
Dry season								
Rice	118	84%	2	3%	7	11%	127	47%
Cash Crop	1	1%	1	1%	3	5%	5	2%
Vegetable	7	5%	2	3%	6	9%	15	6%
Industrial crop	0	0%	0	0%	0	0%	0	0%
Other	0	0%	0	0%	0	0%	0	0%
Land size for Production (m^2)								
Wet season								
Rice		29,529		6,816		5,691		17,626
Cash Crop		2,875		3,173		1,650		2,490
Vegetable		948		150		1,039		965
Dry season								
Rice		32,945		17,000		4,157		31,122
Cash Crop		200		3,000		2,567		2,180
Vegetable		1,617		575		995		1,229
Yield (kg/year)								
Wet season								
Rice		11,517		1,838		1,478		6,453
Cash Crop		2,132		1,434		925		1,505
Vegetable		473		750		385		436
Dry season								
Rice		14,304		6,500		1,197		13,452
Cash Crop		500		15,000		1,167		3,800
Vegetable		497		10,806		477		1,864
Type of animal								
Cow	74	53%	28	42%	28	43%	130	48%
Buffalo	3	2%	0	0%	0	0%	3	1%
Pig	6	4%	1	1%	0	0%	7	3%
Chicken	69	49%	38	57%	29	45%	136	50%
Duck	20	14%	6	9%	1	2%	27	10%
Goat	0	0%	0	0%	0	0%	0	0%
Other	0	0%	1	1%	0	0%	1	0%
Water source for rice production								
Wet season								
Rainwater	116	82.86%	63	94.03%	58	89.23%	237	87.13%
Canal	94	67.14%	51	76.12%	52	80.00%	197	72.43%
River	41	29.29%	21	31.34%	11	16.92%	73	26.84%
Lake	3	2.14%	1	1.49%	0	0.00%	4	1.47%
Reservoir	12	8.57%	7	10.45%	5	7.69%	24	8.82%
Well	4	2.86%	0	0.00%	0	0.00%	4	1.47%
Other	1	0.71%	0	0.00%	0	0.00%	1	0.37%
Dry Season								

Parameters	Ou Ta Paong		Krapeu Trom		Yutasas		Total	
	#	%	#	%	#	%	#	%
Rainwater	37	26.43%	0	0.00%	0	0.00%	37	13.60%
Canal	101	72.14%	1	1.49%	6	9.23%	108	39.71%
River	32	22.86%	2	2.99%	1	1.54%	35	12.87%
Lake	5	3.57%	0	0.00%	0	0.00%	5	1.84%
Reservoir	23	16.43%	0	0.00%	0	0.00%	23	8.46%
Well	9	6.43%	0	0.00%	0	0.00%	9	3.31%
Other	2	1.43%	0	0.00%	1	1.54%	3	1.10%
Agricultural Input Using								
Wet season								
Time of using pesticide	3		0		1		2	
Time of using fertilizer	2		2		2		2	
Quantity of fertilizer per hectare (kg)	282		146		213		228	
Dry season								
Time of using pesticide	4		3		2		4	
Time for using fertilizer	3		2		2		3	
Quantity of fertilizer per hectare (kg)	403		219		416		398	

(Source: ESCIA Field survey data at household level 2024)

ANNEX 3: SUMMARY OF SURVEY DATA WITH VILLAGE CHIEFS

Parameters	Ou Ta Paong		Lum Hach		Krapeu Trom		Yutasas		Stueng Krang Bat		Brambei Mom		Krang Ponley		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Available of noise/vibration																
Yes	6	75%	5	56%	1	25%	3	100%	1	50%	4	80%	9	64%	20	65%
No	2	25%	4	44%	3	75%	0	0%	1	50%	1	20%	5	36%	11	35%
Level of noise/vibration																
Less annoying	1	17%	1	20%	1	100%	1	33%	1	100%	3	75%	6	43%	8	40%
Medium annoying	5	83%	2	40%	0	0%	2	67%	0	0%	1	25%	3	21%	10	50%
Very annoying	0	0%	2	40%	0	0%	0	0%	0	0%	0	0%	0	0%	2	10%
Loudest noise time																
Morning	0	0%	0	0%	0	0%	1	33%	0	0%	0	0%	1	7%	1	5%
Afternoon	2	33%	1	20%	0	0%	0	0%	0	0%	0	0%	0	0%	3	15%
Evening	3	50%	2	40%	1	100%	1	33%	1	100%	3	75%	6	43%	11	55%
Night	1	17%	2	40%	0	0%	1	33%	0	0%	1	25%	2	14%	5	25%
Causes of noise/vibration																
Traffic	3	50%	1	20%	0	0%	2	67%	0	0%	1	25%	3	21%	7	35%
Construction	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Neighbors	4	67%	4	80%	0	0%	1	33%	1	100%	3	75%	5	36%	13	65%
Other	1	17%	0	0%	1	100%	0	0%	0	0%	0	0%	1	7%	2	10%
Air quality around house																
Not good	1	13%	0	0%	1	25%	0	0%	0	0%	0	0%	1	7%	2	6%
Good	7	88%	9	100%	3	75%	3	100%	2	100%	5	100%	13	93%	29	94%
The reasons for air quality																
Burned trash/plastic	0	0%	0	0%	1	25%	0	0%	0	0%	0	0%	1	7%	1	3%
Soil dusty	1	13%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
Level of air quality																
Low	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Medium	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	50%
Strong	0	0%	0	0%	1	100%	0	0%	0	0%	0	0%	1	7%	1	50%
The most polluted period																
Morning	0	0%	0	0%	1	100%	0	0%	0	0%	0	0%	1	7%	1	50%
Afternoon	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	50%
Evening	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Night	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Water quality around in the village																
Not good	3	38%	5	56%	1	25%	0	0%	1	50%	2	40%	4	29%	12	39%
Good	5	63%	4	44%	3	75%	3	100%	1	50%	3	60%	10	71%	19	61%
Reason for water quality																
Chemical fertilizer and pesticide residue	1	13%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
Animal and its manure	1	13%	0	0%	0	0%	0	0%	0	0%	1	20%	1	7%	2	6%
Erosion	0	0%	1	11%	1	25%	0	0%	0	0%	0	0%	1	7%	2	6%

Parameters	Ou Ta Paong		Lum Hach		Krapeu Trom		Yutasas		Stueng Krang Bat		Brambei Mom		Krang Ponley		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Heavy mental and rusty	1	13%	1	11%	0	0%	0	0%	0	0%	0	0%	0	0%	2	6%
Groundwater is rich in lime	1	13%	3	33%	0	0%	0	0%	0	0%	0	0%	0	0%	4	13%
Trashes along the canal	1	13%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
Waste water from factory	0	0%	0	0%	0	0%	0	0%	1	50%	0	0%	1	7%	1	3%
Others	0	0%	0	0%	0	0%	0	0%	0	0%	1	20%	1	7%	1	3%
Level of water quality																
Low	0	0%	1	20%	1	100%	0	0%	0	0%	1	50%	2	14%	3	25%
Medium	3	100%	4	80%	0	0%	0	0%	0	0%	1	50%	1	7%	8	67%
Strong	0	0%	0	0%	0	0%	0	0%	1	100%	0	0%	1	7%	1	8%
Availability of environment issue																
Yes	1	13%	1	11%	0	0%	0	0%	1	50%	2	40%	3	21%	5	16%
No	2	25%	4	44%	1	25%	0	0%	0	0%	0	0%	1	7%	7	23%
Type of environment issue																
Water pollution	0	0%	0	0%	0	0%	0	0%	1	100%	0	0%	1	7%	1	20%
Air pollution	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Soil pollution	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Odor problem	0	0%	1	100%	0	0%	0	0%	1	100%	0	0%	1	7%	2	40%
Solid waste problem	1	100%	0	0%	0	0%	0	0%	1	100%	2	100%	3	21%	4	80%
Others	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Problem may cause by construction																
Land impact	1	13%	6	67%	2	50%	1	33%	1	50%	3	60%	7	50%	14	45%
Noise and vibration	0	0%	0	0%	1	25%	0	0%	0	0%	0	0%	1	7%	1	3%
Damaged road in wet season	0	0%	0	0%	1	25%	0	0%	0	0%	0	0%	1	7%	1	3%
Suggestions																
Construct the irrigation soon as possible	3	38%	3	33%	2	50%	0	0%	0	0%	1	20%	3	21%	9	29%
Provide technical on agricultural production	2	25%	1	11%	0	0%	0	0%	0	0%	0	0%	0	0%	3	10%
Restore existing main and secondary canals and make it deep with high quality	6	75%	6	67%	1	25%	1	33%	1	50%	3	60%	6	43%	18	58%
Request to have enough water for cultivation	1	13%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
Request to have better road in community	1	13%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
Request to restore the back of canal and dam	0	0%	0	0%	0	0%	1	33%	0	0%	0	0%	1	7%	1	3%
Request to produce sluice	2	25%	0	0%	1	25%	2	67%	0	0%	0	0%	3	21%	5	16%
Request for solar installation along the way to canal	0	0%	0	0%	0	0%	1	33%	0	0%	0	0%	1	7%	1	3%
Provide compensate to affected household	0	0%	1	11%	0	0%	0	0%	1	50%	1	20%	2	14%	3	10%
Request a study on placing rock in reservoirs which can flow into the fields by gravity	0	0%	1	11%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%

(Source: ESCIA Field survey data with village chiefs, 2024)

ANNEX 4: SUMMARY OF SUB-SCHEME COMMUNE DATA

Parameters	Ou Ta Paong		Lum Hach		Brambei Mom		Krapeu Trom		Stueng Krang Bat		Yutasas		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Population														
Total HH	8,130	-	7,958	-	1,914	-	2,430	-	1,020	-	1,339	-	22,791	
Female HH Head	1,397	17%	1,422	18%	317	17%	379	16%	179	18%	247	18%	3,941	17%
Total Population	34,189	-	30,844	-	8,237		10,535	-	4,061	-	5,330	-	93,196	
Female	17,602	-	16,019	-	4,252		5,483	-	2,104	-	2,773	-	48,233	
Age													-	
<18 years old	12,644	37%	11,200	36%	3,297	40%	3,816	36%	1,287	32%	1,962	37%	34,206	37%
18 – 35 years old	8,646	25%	8,721	28%	2,419	29%	2,830	27%	1,128	28%	1,725	32%	25,469	27%
36 – 60 years old	8,749	26%	7,777	25%	1,962	24%	2,585	25%	1,051	26%	1,284	24%	23,408	25%
> 60 years old	4,150	12%	3,146	10%	559	7%	1,304	12%	595	15%	359	7%	10,113	11%
Vulnerability														
Poor 1	770	9.5%	479	6.0%	122	6%	37	1.5%	31	3.0%	15	1%	1,454	6%
Poor 2	437	5.4%	158	2.0%	9	0%	10	0.4%	8	1%	-	0%	622	3%
Total	1,207	15%	637	8%	131	7%	47	2%	39	4%	15	1%	2,076	9%
Vulnerable group	-				-		-		-					
Disable person	393	1%	354	1.1%	76	1%	108	1%	96	2%	19	0.4%	1,046	1%
Old people	54	0%	72	0.2%	7	0%	6	0.1%	5	0%	7	0.1%	151	0%
Orphan	78	0%	49	0.2%	5	0%	19	0.2%	1	0%	3	0.06%	155	0%
Total	525	1.5%	475	1.5%	88	1%	133	1.3%	102	3%	29	1%	1,352	1%
Migration	-				-		-		-					
In the country	3,262	10%	1,845	6%	497	6.0%	156	1.5%	118	3%	50	1%	5,928	6%
Out of the country	1,843	5%	561	2%	39	0.5%	43	0.4%	27	1%	17	0%	2,530	3%
Total	5,105	15%	2,406	8%	536	6.5%	199	2%	145	4%	67	1%	8,458	9%
Education	-		-		-		-		-					
Kindergarten	1,952	23%	1,259	14%	348	16%	378	13%	145	10%	167	21%	4,249	17%
Primary school	1,884	22%	4,335	49%	1,144	51%	1,495	52%	218	15%	85	11%	9,161	37%
Secondary school	1,872	22%	1,849	21%	520	23%	710	25%	314	22%	336	42%	5,601	23%
High School	1,361	16%	1,099	12%	161	7%	231	8%	367	26%	170	21%	3,389	14%
College/University	514	6%	223	2.5%	32	1%	37	1%	214	15%	14	2%	1,034	4%
TVET	184	2%	70	0.8%	8	0%	-	0%	131	9%	2	0%	395	2%
Illiterate	850	10%	24	0.3%	9	0%	16	1%	35	2%	34	4%	968	4%
Occupation														
Main Occupation														
Rice and crop production	10,629	57%	12,769	67%	2,578	42%	2,887	36.6%	546	19%	1,222	30%	30,631	52%
Fishing	466	2%	-	0%	-	0%	-	0.0%	55	2%	-	0%	521	1%
Animal raising	478	3%	506	3%	13	0%	195	2.5%	162	6%	38	1%	1,392	2%

Parameters	Ou Ta Paong		Lum Hach		Brambei Mom		Krapeu Trom		Stueng Krang Bat		Yutasas		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Non-Timber	-	0%	37	0%	-	0%	1	0.01%	-	0%	-	0%	38	0%
Handcraft	62	0%	39	0%	-	0%	1	0.01%	2	0%	3	0%	107	0%
Business and trade	579	3%	379	2%	104	2%	85	1.1%	124	4%	20	0%	1,291	2%
Repair	118	1%	54	0%	33	1%	19	0.2%	7	0%	8	0%	239	0%
Transportation	303	2%	37	0%	5	0%	14	0.2%	14	0%	8	0%	381	1%
Labor sale	1,698	9%	923	5%	168	3%	321	4.1%	144	5%	122	3%	3,376	6%
Workers (full-time, private sector)	636	3%	1,104	6%	1,437	23%	1,876	23.8%	590	20%	1,199	29%	6,842	12%
Government officer	273	1%	312	2%	45	1%	90	1.1%	211	7%	79	2%	1,010	2%
Service	3,512	19%	2,809	15%	1,792	29%	2,405	30%	1,090	37%	1,436	35%	13,044	22%
Secondary Occupation														
Rice and crop production	3,971	45%	5,812	47%	486	61%	2,689	55%	305	31%	935	77%	14,198	49%
Fishing	185	2%	161	1%	-	0%	-	0%	35	4%	-	0%	381	1%
Animal raising	603	7%	2,827	23%	10	1%	671	14%	199	20%	100	8%	4,410	15%
Non-Timber	-	0%	142	1%	-	0%	-	0%	-	0%	-	0%	142	0%
Handcraft	46	1%	464	4%	-	0%	1	0%	2	0%	2	0.2%	515	2%
Business and trade	273	3%	445	4%	8	1%	100	2%	69	7%	4	0.3%	899	3%
Repair	26	0%	41	0%	1	0.1%	8	0.2%	1	0%	3	0.2%	80	0%
Transportation	83	1%	15	0%	-	0%	28	1%	10	1%	-	0%	136	0%
Labor sale	1,639	19%	815	7%	68	9%	229	5%	114	12%	33	3%	2,898	10%
Workers (full-time, private sector)	834	10%	203	2%	75	9%	385	8%	24	2%	45	4%	1,566	5%
Service	1,091	12%	1,519	12%	152	19%	750	15%	218	22%	85	7%	3,815	13%
Type of House														
Wooden house, thatched	5,445	68%	3,684	51%	757	41%	989	41%	677	72%	831	64%	12,383	57%
Semi-permanent	481	6%	150	2%	12	1%	109	5%	10	1%	24	2%	786	4%
House built of 1 floor or more/brick wall	1,879	23%	2,897	40%	1,059	57%	1,012	42%	169	18%	365	28%	7,381	34%
Apartment	210	3%	357	5%	26	1%	278	12%	46	5%	76	6%	993	5%
Villa	22	0%	99	1%	2	0%	6	0%	32	3%	1	0%	162	1%
Temporary house	64	1%	379	5%	2	0%	40	2%	1	0%	-	0%	486	2%
Source of electricity use in household														
Electricity	8,031	100%	5,862	83%	1,733	93%	2,378	98%	700	100%	1,297	100%	20,001	93%
Battery	11	0%	904	13%	11	1%	-	0%	-	0%	-	0%	926	4%
Solar	-	0%	333	5%	114	6%	47	2%	-	0%	-	0%	494	2%
Biogas	7	0%	6	0%	-	0%	-	0%	-	0%	-	0%	13	0%
Water Source														
Tape water	1,522	19%	517	7%	252	14%	2,027	83%	935	92%	859	64%	6,112	27%

Parameters	Ou Ta Paong		Lum Hach		Brambei Mom		Krapeu Trom		Stueng Krang Bat		Yutasas		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Pump well	1,055	13%	4,914	62%	426	23%	122	5%	56	5%	251	19%	6,824	30%
Wells	347	4%	1,014	13%	-	0%	56	2%	29	3%	26	2%	1,472	6%
Opened Well	274	3%	1,467	19%	-	0%	-	0%	-	0%	-	0%	1,741	8%
Pond	2,222	27%	2	0%	777	42%	53	2%	-	0%	48	4%	3,102	14%
Rain water	1,814	22%	-	0%	22	1%	133	5%	-	0%	153	11%	2,122	9%
River	896	11%	-	0%			39	2%	-	0%	2	0%	1,318	6%
Drinking Water														
Tape water	1,450	30%	26	0.3%	313	24%	763	53%	529	53%	490	39%	3,571	21%
Filtration	2,945	61%	6,204	83%	403	26%	289	20%	129	13%	499	40%	10,469	61%
Boiled	452	9%	1,218	16%	584	37%	378	26%	348	35%	261	21%	3,241	19%
Toilet Usage														
Pure Toilet	6,464	99%	4,856	99%	1,568	100%	2,132	100%	930	100%	1,246	100%	17,196	99%
Modern toilet	56	1%	61	1%	7	0%	-	0%	-	0%	-	0%	124	1%
Rice production														
Commune area	86,523	86522.5	66,233	66,233	14,925	14,925	15,854	15,854	6,832	6,832	3,440	3440	193,806	
House Land	33,274	38%	5,629	8%	3,026	20%	1,755	11%	2,110	31%	347	10%	46,141	24%
Rice land	27,905	32%	20,613	31%	3,750	25%	6,036	38%	2,781	41%	1,732	50%	62,816	32%
Orchard Land	463	1%	2,699	4%	546	4%	2,306	15%	705	10%	34	1%	6,753	3%
Other land	24,881	29%	37,293	56%	7,603	51%	5,758	36%	1,237	18%	1,327	39%	78,098	40%
Rice Land in Dry Season (ha)	10,585	38%	660	3%	-	0%	-	0%	1,281	46%	-	0%	12,526	20%
Rice Land in Wet Season (ha)	17,320	62%	19,953	97%	3,750	100%	6,036	100%	1,500	54%	1,732	100%	50,290	80%
Rice land received water from IS in dry season	8,182	77%	570	86%	-	#DIV/0!	-	0%	500	39%	-	-	9,252	74%
Rice land received water from IS in wet season	5,625	32%	2,380	12%	45	1%	1,698	28%	1,500	100%	911	53%	12,159	97%
Actual rice land in dry season (ha)	10,385	37%	570	86%	-	-	-	-	474	37%	-		11,429	91%
Actual rice land in wet season (ha)	13,952	50%	17,707	89%	3,750	100%	6,035	100%	1,500	100%	1,547	89%	44,491	88%
Yield in wet season (t/ha)	3	-	2	-	2	-	6		2	-	2	-	3	
Yield in dry season (t/ha)	4	-	2	-	-	-	-	-	3	-	-	-	3	
Highest Price (kg)	959	-	966	-	1,059	-	1,069	-	875	-	1,000	-	5,928	
Lowest Price (kg)	761	-	788	-	880	-	795	-	700	-	780	-	4,705	
Asset														
HH with Tractor	117	1.4%	46	1%	12	1%	3	0.1%	2	0.2%	-	0%	180	1%
Walking tractor	2,065	25.4%	4,504	57%	759	40%	275	11%	71	7%	109	8%	7,783	34%
HH with Rice Harvester	66	0.8%	12	0.2%	3	0%	1	0.0%	1	0.1%	-	0%	83	0%
Threshing Machine	2	0.0%	93	1%	15	1%	6	0.2%	-	0%	1	0%	117	1%
Harvest and Threshing Machine	17	0.2%	6	0.1%	8	0.4%	-	0%	-	0%	-	0%	31	0%
Mobile rice mill	4	0.0%	4	0.1%	-	0%	6	0.2%	-	0%	-	0%	14	0%

Parameters	Ou Ta Paong		Lum Hach		Brambei Mom		Krapeu Trom		Stueng Krang Bat		Yutasas		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Car	508	6.2 %	261	3%	169	9%	150	6%	62	6 %	112	8%	1,262	6 %
Other Machinery	25	0.3 %	10	0.1 %	2	0%	-	0%	-	0 %	-	0%	37	0 %
Motorbike	4,809	59.2 %	5,862	74 %	1,647	86 %	1,720	71 %	919	90 %	977	73 %	15,934	70 %
Tricycle	16	0.2 %	27	0.3 %	10	1%	18	1%	23	2 %	9	1%	103	0 %
Bike cycle	4,145	51.0 %	6,006	75 %	962	50 %	948	39 %	495	49 %	655	49 %	13,211	58 %
Boat	568	7.0 %	8	0.1 %	-	0%	-	0%	76	7 %	-	0%	652	3 %
TV	6,530	80.3 %	4,698	59 %	1,362	71 %	1,960	81 %	906	89 %	1,275	95 %	16,731	73 %
Animal Production														
HH cow raising	2,870	35%	3,714	47 %	693	36 %	387	16 %	427	42 %	551	41 %	8,642	38 %
HH buffalo raising	602	7%	1,351	17 %	-	0%	-	0%	-	0 %	-	0%	1,953	9 %
HH pig raising	483	6%	1,412	18 %	56	3%	13	1%	1	0.1 %	10	1%	1,975	9 %
HH chicken raising	5,287	65%	6,041	76 %	1,421	74 %	562	23 %	610	60 %	1,011	76 %	14,932	66 %
HH duck raising	326	4%	423	5%	46	2%	3	0.1 %	48	5 %	9	1%	855	4 %
HH sheep/goat raising	2	0.0 %	2	0%	-	0%	-	0%	-	0 %	-	0%	4	0 %
HH Crocodile	-	0.0 %	1	0%	-	0%	-	0%	-	0 %	-	0%	1	0 %
HH of fish raising	6	0.1 %	23	0%	1	0.1 %	-	0%	1	0.1 %	-	0%	31	0 %
HH of prawn	-	0.0 %	2	0.0 3%	-	0%	-	0%	-		-	0%	2	0 %

(Source: Commune Database 2023, Ministry of Planning)

ANNEX 5: LABORATORY TESTING RESULT

Groundwater Quality Testing Result

ក្រុមហ៊ុន វ៉ាធើរ អ៊ិនណូវេសិន លេប
WATER INNOVATION LAB
ផ្លូវជាតិលេខ៧ ភូមិអំពិលក្រោម ឃុំអំពិល ស្រុកកំពង់សៀម ខេត្តកំពង់ចាម
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E-mail: lab@wil-kh.com; Tel: +855-16-668 900

Date: 19 August 2024
Reference No: 240005

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	GW1	Water Source:	Well Pump
Client:	PPIC	Province:	Pursat
Date received:	11-Aug-24	District:	Bakan
Collection date:	10-Aug-24	Commune:	Ou Ta Paong
Preservation:	HNO3/Ice box	Village:	Oknha Moan

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.003	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.0004	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.01		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	345.8	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	13		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	6.4	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.3	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	14,065	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	691.4	0.0	
11	Temperature	Electrode	°C	10-Aug-24	30.4	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	1.92	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004
DL = Detection Limit

Kampong Cham, 19 August 2024
Verified by
Lab Director

WATER INNOVATION LAB
KINGDOM OF CAMBODIA

Samrach Phan

ក្រុមហ៊ុន វ៉ាធើរ អ៊ិនណូវេសិន លេប

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Date: 19 August 2024
Reference No: 240006

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	GW2	Water Source:	Well
Client:	PPIC	Province:	Kampong Chhnang
Date received:	11-Aug-24	District:	Rolea Bíer
Collection date:	10-Aug-24	Commune:	Prasneb
Preservation:	HNO3/Ice box	Village:	Prey Sampov

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.5		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	58.12	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	5		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	3.5	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.29	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	1,600	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	116.1	0.0	
11	Temperature	Electrode	°C	10-Aug-24	30.3	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	1.45	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

DL = Detection Limit

Kampong Cham, 19 August 2024

Verified by

Lab Director

WATER INNOVATION LAB KINGDOM OF CAMBODIA

Samrach Phan

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Date: 19 August 2024
Reference No: 240007

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LAB WATER ANALYTICAL RESULTS

Sample ID:	GW3	Water Source:	Well
Client:	PPIC	Province:	Kampong Speu
Date received:	11-Aug-24	District:	Odongk
Collection date:	10-Aug-24	Commune:	Veal Pung
Preservation:	HNO3/Ice box	Village:	Khnaor Ampil

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.48		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	325.5	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	3		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	21.5	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	2.2	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	1,200	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	651.6	0.0	
11	Temperature	Electrode	°C	10-Aug-24	30.5	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	1.25	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

DL = Detection Limit

Kampong Cham, 19 August 2024

Verified by

Lab Director

Samrach Phan

Surface Water Quality Testing Result

ក្រុមហ៊ុន ទ័ធើរ អ៊ិនណើវេសិន លេប
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Date: 19 August 2024
Reference No: 240008

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW1	Water Source:	River
Client:	PPIC	Province:	Pursat
Date received:	11-Aug-24	District:	Bakan
Collection date:	10-Aug-24	Commune:	Rumlech
Preservation:	HNO3/Ice box	Village:	Prasat

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.32		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	30.76	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	11		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	4.8	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.8	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	50,200	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	61.4	0.0	
11	Temperature	Electrode	°C	10-Aug-24	31.3	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	5.34	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004
DL = Detection Limit

Kampong Cham, 19 August 2024
Verified by
Lab Director

WATER INNOVATION LAB
KINGDOM OF CAMBODIA

Samrach Phan

ក្រុមហ៊ុន វ៉ាធើរ អ៊ិនណូវេសិន លេប

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E-mail: lab@wil-kh.com; Tel: +855-16-668 900

Date: 19 August 2024
Reference No: 240009

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW2	Water Source:	Canal
Client:	PPIC	Province:	Pursat
Date received:	11-Aug-24	District:	Bakan
Collection date:	10-Aug-24	Commune:	Ou Ta Paong
Preservation:	HNO3/Ice box	Village:	Bat KoKir Thmei

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.2		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	38.07	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	29		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	3.8	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.6	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	38,750	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	76.12	0.0	
11	Temperature	Electrode	°C	10-Aug-24	30.8	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	5.6	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

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Kampong Cham, 19 August 2024

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Lab Director

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Date: 19 August 2024
Reference No: 240010

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW3	Water Source:	River
Client:	PPIC	Province:	Pursat
Date received:	11-Aug-24	District:	Bakan
Collection date:	10-Aug-24	Commune:	Ou Ta Paong
Preservation:	HNO3/Ice box	Village:	Ta Nai

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.44		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	40.71	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	39		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	3.5	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.4	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	31,650	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	81.43	0.0	
11	Temperature	Electrode	°C	10-Aug-24	30.9	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	5.7	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

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Kampong Cham, 19 August 2024

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Date: 19 August 2024
Reference No: 240011

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW4	Water Source:	River
Client:	PPIC	Province:	Kampong Chhnang
Date received:	11-Aug-24	District:	Rolea Bier
Collection date:	10-Aug-24	Commune:	Prasneb
Preservation:	HNO3/Ice box	Village:	Chonleav

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.42		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	14.95	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	5		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	6.8	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.6	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	19,100	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	29.91	0.0	
11	Temperature	Electrode	°C	10-Aug-24	31.7	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	5.21	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

DL = Detection Limit

Kampong Cham, 19 August 2024

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Date: 19 August 2024
Reference No: 240012

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW5	Water Source:	Lake
Client:	PPIC	Province:	Kampong Chhnang
Date received:	11-Aug-24	District:	Kampong Tralach
Collection date:	10-Aug-24	Commune:	Longvek
Preservation:	HNO3/Ice box	Village:	Wat

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.78		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	71.07	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	17		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	18.1	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.3	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	85,000	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	138.7	0.0	
11	Temperature	Electrode	°C	10-Aug-24	32.8	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	5.62	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

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Kampong Cham, 19 August 2024

Verified by

Lab Director

WATER INNOVATION LAB KINGDOM OF CAMBODIA

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Date: 19 August 2024
Reference No: 240013

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW6	Water Source:	River
Client:	PPIC	Province:	Kampong Speu
Date received:	11-Aug-24	District:	Odongk
Collection date:	10-Aug-24	Commune:	Preah Sre
Preservation:	HNO3/Ice box	Village:	Ta Cheal

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.91		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	91.58	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	43		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	17.7	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.9	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	157,500	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	183.4	0.0	
11	Temperature	Electrode	°C	10-Aug-24	33.4	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	5.65	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

DL = Detection Limit

Kampong Cham, 19 August 2024

Verified by

Lab Director

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Date: 19 August 2024
Reference No: 240014

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW7	Water Source:	Canal
Client:	PPIC	Province:	Kampong Speu
Date received:	11-Aug-24	District:	Odongk
Collection date:	10-Aug-24	Commune:	Veal Pung
Preservation:	HNO3/Ice box	Village:	Phkor

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.001	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	6.53		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	83.43	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	93		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	4.7	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.7	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	92,500	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	167.1	0.0	
11	Temperature	Electrode	°C	10-Aug-24	33.7	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	6.84	0.01	

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Kampong Cham, 19 August 2024

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Date: 19 August 2024

Reference No: 240015

លទ្ធផលវិភាគទឹក

LAB WATER ANALYTICAL RESULTS

Sample ID:	SW8	Water Source:	Dam
Client:	PPIC	Province:	Kampong Speu
Date received:	11-Aug-24	District:	Thpong
Collection date:	10-Aug-24	Commune:	Prambei Mom
Preservation:	HNO3/Ice box	Village:	Tang Pou

No	Parameters	Method	Units	Date Analyzed	Results	D.L	CDWQS
1	Arsenic	Spectrophotometry	mg/L	12-Aug-24	0.005	0.01	0.05
2	Cadmium	Spectrophotometry	mg/L	15-Aug-24	0.009	0.003	0.003
3	Lead	Spectrophotometry	mg/L	13-Aug-24	0.005	0.01	0.01
4	pH	Electrometric		10-Aug-24	7.49		6.5-8.5
5	Total dissolved solids	Electrode	mg/L	10-Aug-24	99.21	0.0	800
6	Total suspended solid	USEPA METHOD #: 160.2	mg/L	12-Aug-24	21		-
7	Total Nitrogen	Spectrophotometry	mg/L	12-Aug-24	5.1	0.5	-
8	Total Phosphorus	Spectrophotometry	mg/L	13-Aug-24	0.3	0.06	-
9	Total coliform	Membrane Filtration	CFU/ 100mL	11-Aug-24	82,850	0	0
10	Electrical Conductivity	Electrode	µS/cm	10-Aug-24	197.1	0.0	
11	Temperature	Electrode	°C	10-Aug-24	38.7	0.0	
12	Dissolved Oxygen	Electrode	mg/L	10-Aug-24	5.4	0.01	

CDWQS = Cambodian Drinking Water Quality Standard, 2004

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Kampong Cham, 19 August 2024

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Results of Soil Laboratory Testing

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងកសិកម្ម រុក្ខាប្រមាញ់ និងនេសាទ
អគ្គនាយកដ្ឋានកសិកម្ម

លេខ......អ.ន.ក

ថ្ងៃ......ខែ......ឆ្នាំ......ព.ស.២៥៦៨
រាជធានីភ្នំពេញ ថ្ងៃទី......ខែ......ឆ្នាំ២០២៤

លទ្ធផលវិភាគដី

Soil Analysis Results

ឈ្មោះក្រុមហ៊ុន(Company Name): **PPIC Co.,Ltd**
អាសយដ្ឋានAddress:
ថ្ងៃខែទទួលសំណាក: 14/8/24 , NAL :...574-256...

Lab. ID: 61 /24		LabNo. :	1
Description Parameter		Field ID:	SS 01
			X= 355662, Y= 1399063
Particle Size	(< 0.002mm)ឥដ្ឋ, Clay %		9.90
	(0.002-0.02 mm)ល្បាប់ ម៉ត់, Fine Silt , %		37.65
	(0.02- 0.05 mm)ល្បាប់ គ្រើម, Coase Silt , %		21.71
	(0.05- 0.2 mm) ខ្សាច់ម៉ត់, Fine Sand,%		30.59
(Pipette Method)	(0.2 - 2 mm) ខ្សាច់គ្រើម, Coase Sand,%		3.22
សំណើម Moisture % , (Oven dry at 105 °C and 24 hours)			1.67
កាបូន Total Carbon (Black & Walkey Method) , C %			2.22
អាសូត Total Nitrogen (Kjeldal Sulfuric Method) ,N %			0.19
អនុបាត C/N Ratio (Unit)			12
សារធាតុសរីរាង្គ Organic Matter (OM) %			3.82
ផូស្វ័រសរុប Total Phosphorus (Nitric Digestion) P %			0.051
ផូស្វ័ររលាយ Available Phosphorus (Bray II) , P (ppm)			51
សមត្ថភាពដោះដូរកាចុង Cation Exchange Capacity C.E.C meq/100g Soil (Method ,1M Ammonium Acetate at pH = 7 & Leach with 10 % NaCl)			13.00
កាចុងដោះដូរ ,Exchangeable Cation (meq/100g Soil), (Method, 1M Ammonium Acetateat pH =7)	កាល់ស្យូម, Calcium Ca		3.06
	ម៉ាញ៉េស្យូម,Magnesium Mg		1.28
	សូដ្យូម,Sodium Na		1.42
	ប៉ូតាស្យូម,Potasium K		0.77
កាចុងដោះដូរសរុប , Total Exchangeable Bases (meq/100g soil)			6.53
អត្រាចំអែតនៃកាចុង, Bass Saturation %			50
អាស៊ីតដោះដូរ Exchange Acidity meq/100g Soil , (1 M KCl Method)			20.00
អាលុយមីញ៉ូមដោះដូរ Exchange Al meq/100g Soil , (1 M KCl Method)			0.20
ចរន្ត.អ.និចលជាតិប្រៃ Electrode Conductivity µS/cm , (1:5 Soil: water)			96.80
ប៉េហាស់ទឹក, pH H2O , (1:5 Soil: water)			5.36
ប៉េហាស់អំបិល , pH KCL , (1:5 (Soil : 1N KCL)			4.21

អាសយដ្ឋានលេខ: ៥៤ប/៤៩អេហ្វ ផ្លូវលេខ ៣៩៥-៦៥៦ សង្កាត់ទឹកល្អក់៣ ខណ្ឌទួលគោក រាជធានីភ្នំពេញ ទូរស័ព្ទលេខ:(០២៣) ៨៨៣ ៤២៧ ទូរសារលេខ:(០២៣) ៨៨៣ ៤២៧
Address# 54B/49F, Street 395-656, Sangkat Toeuk Laak3, Khan Tuol Kok, Phnom Penh. Cambodia, Phone : (023) 883 427, Fax : (023) 883 427

Lab. ID: 61 /24		LabNo. :	2
Description Parameter		Field ID:	SS 02
			X= 354509, Y= 1406852
Particle Size (Pipette Method)	(< 0.002mm)ឥដ្ឋ, Clay %		14.01
	(0.002-0.02 mm)ល្បាប់ ម៉ត់, Fine Silt , %		35.55
	(0.02- 0.05 mm)ល្បាប់ គ្រើម, Coase Silt , %		22.69
	(0.05- 0.2 mm) ខ្សាច់ម៉ត់, Fine Sand,%		32.75
	(0.2 - 2 mm) ខ្សាច់គ្រើម, Coase Sand,%		2.32
សំណើម Moisture % , (Oven dry at 105 °C and 24 hours)			1.73
កាបូន Total Carbon (Black & Walkey Method) , C %			1.84
អាសូត Total Nitrogen (Kjeldal Sulfuric Method) ,N %			0.17
អនុបាត C/N Ratio (Unit)			11
សារធាតុសរីរាង្គ Organic Matter (OM) %			3.16
ផូស្វ័រសរុប Total Phosphorus (Nitric Digestion) P %			0.043
ផូស្វ័រលាយ Available Phosphorus (Bray II) , P (ppm)			41
សមត្ថភាពដោះដូរកាថុង Cation Exchange Capacity C.E.C meq/100g Soil			12.40
(Method ,1M Ammonium Acetate at pH = 7 & Leach with 10 % NaCl)			
កាថុងដោះដូរ ,Exchangeable Cation (meq/100g Soil), (Method, 1M Ammonium Acetateat pH =7)	កាល់ស្យូម, Calcium Ca		3.77
	ម៉ាញ៉េស្យូម,Magnesium Mg		1.38
	សូដ្យូម,Sodium Na		0.75
	ប៉ូតាស្យូម,Potasium K		0.27
កាថុងដោះដូរសរុប , Total Exchangeable Bases (meq/100g soil)			6.17
អត្រាចំអែតនៃកាថុង, Bass Saturation %			50
អាស៊ីតដោះដូរ Exchange Acidity meq/100g Soil , (1 M KCl Method)			15.00
អាលុយមីញ៉ូមដោះដូរ Exchange Al meq/100g Soil , (1 M KCl Method)			0.12
បណ្តាន.អ.នីមើលជាតិប្រៃដី Electrode Conductivity µS/cm , (1:5 Soil: water)			36.10
ប៉េហាសនីក, pH H2O , (1:5 Soil: water)			5.29
ប៉េហាសអំបិល , pH KCL , (1:5 (Soil : 1N KCL)			4.12

Lab. ID: 61 /24		LabNo. :	3
Description Parameter		Field ID:	SS 03
			X=441471, Y=1355655
Particle Size (Pipette Method)	(< 0.002mm)ឥដ្ឋ, Clay %		1.23
	(0.002-0.02 mm)ល្បាប់ ម៉ត់, Fine Silt , %		3.40
	(0.02- 0.05 mm)ល្បាប់ គ្រឹម, Coase Silt , %		5.23
	(0.05- 0.2 mm) ខ្សាច់ម៉ត់, Fine Sand,%		33.52
	(0.2 - 2 mm) ខ្សាច់គ្រឹម, Coase Sand,%		55.72
សំណើម Moisture % , (Oven dry at 105 °C and 24 hours)			0.20
កាបូន Total Carbon (Black & Walkey Method) , C %			1.80
អាសូត Total Nitrogen (Kjeldal Sulfuric Method) ,N %			0.17
អនុបាត C/N Ratio (Unit)			11
សារធាតុសរីរាង្គ Organic Matter (OM) %			3.10
ផូស្វ័រសរុប Total Phosphorus (Nitric Digestion) P %			0.046
ផូស្វ័រលាយ Available Phosphorus (Bray II) , P (ppm)			46
សមត្ថភាពដោះដូរកាចុង Cation Exchange Capacity C.E.C meq/100g Soil			10.00
(Method ,1M Ammonium Acetate at pH = 7 & Leach with 10 % NaCl)			
កាចុងដោះដូរ ,Exchangeable Cation (meq/100g Soil), (Method, 1M Ammonium Acetateat pH =7)	កាល់ស្យូម, Calcium Ca		3.56
	ម៉ាញ៉េស្យូម,Magnesium Mg		1.58
	សូដ្យូម,Sodium Na		0.30
	ប៉ូតាស្យូម,Potasium K		0.13
កាចុងដោះដូរសរុប , Total Exchangeable Bases (meq/100g soil)			5.57
អត្រាចំអែតនៃកាចុង, Bass Saturation %			56
អាស៊ីតដោះដូរ Exchange Acidity meq/100g Soil , (1 M KCl Method)			5.00
អាលុយមីញ៉ូមដោះដូរ Exchange Al meq/100g Soil , (1 M KCl Method)			0.04
បញ្ជូន.អ.ឌីមើលជាតិប្រៃដី Electrode Conductivity µS/cm , (1:5 Soil: water)			99.30
ប៉េហាសនីក, pH H2O , (1:5 Soil: water)			7.67
ប៉េហាសអំបិល , pH KCL , (1:5 (Soil : 1N KCL)			6.51

Lab. ID: 61 /24		LabNo. :	4
Description Parameter		Field ID:	SS 04
			X=465450, Y=1304887
Particle Size (Pipette Method)	(< 0.002mm)ឥដ្ឋ, Clay %		14.95
	(0.002-0.02 mm)ល្បាប់ ម៉ដ្ត, Fine Silt , %		30.00
	(0.02- 0.05 mm)ល្បាប់ គ្រើម, Coase Silt , %		19.81
	(0.05- 0.2 mm) ខ្សាច់ម៉ដ្ត, Fine Sand,%		31.12
	(0.2 - 2 mm) ខ្សាច់គ្រើម, Coase Sand,%		5.92
សំណើម Moisture % , (Oven dry at 105 °C and 24 hours)			2.64
កាបូន Total Carbon (Black & Walkey Method) , C %			1.63
អាសូត Total Nitrogen (Kjeldal Sulfuric Method) ,N %			0.14
អនុបាត C/N Ratio (Unit)			12
សារធាតុសរីរាង្គ Organic Matter (OM) %			2.80
ផូស្វ័រសរុប Total Phosphorus (Nitric Digestion) P %			0.044
ផូស្វ័រអាឡាយ Available Phosphorus (Bray II) , P (ppm)			29
សមត្ថភាពដោះដូរកាចុង Cation Exchange Capacity C.E.C meq/100g Soil			16.50
(Method ,1M Ammonium Acetate at pH = 7 & Leach with 10 % NaCl)			
កាចុងដោះដូរ ,Exchangeable Cation (meq/100g Soil), (Method, 1M Ammonium Acetateat pH =7)		កាល់ស្យូម, Calcium Ca	8.30
		ម៉ាញ៉េស្យូម,Magnesium Mg	2.37
		សូដ្យូម,Sodium Na	2.57
		ប៉ូតាស្យូម,Potasium K	0.36
កាចុងដោះដូរសរុប , Total Exchangeable Bases (meq/100g soil)			13.60
អត្រាចំរែតនៃកាចុង, Bass Saturation %			70
អាស៊ីតដោះដូរ Exchange Acidity meq/100g Soil , (1 M KCl Method)			10.00
អាលុយមីញ៉ូមដោះដូរ Exchange Al meq/100g Soil , (1 M KCl Method)			0.12
បណ្តាន.អ.ទឹមើលជាតិប្រៃដី Electrode Conductivity µS/cm , (1:5 Soil: water)			108.40
ប៉ែហាស់ទឹក, pH H2O , (1:5 Soil: water)			7.41
ប៉ែហាស់អំបិល , pH KCL , (1:5 (Soil : 1N KCL)			6.23

4

Lab. ID: 61 /24		LabNo. :	5
Description Parameter		Field ID:	SS 05
			X=469604 , Y=1306117
Particle Size (Pipette Method)	(< 0.002mm)ឥដ្ឋ, Clay %		7.30
	(0.002-0.02 mm)ល្បាប់ ម៉ដ, Fine Silt , %		21.10
	(0.02- 0.05 mm)ល្បាប់ គ្រឹម, Coase Silt , %		11.70
	(0.05- 0.2 mm) ខ្សាច់ម៉ដ, Fine Sand,%		30.29
	(0.2 - 2 mm) ខ្សាច់គ្រឹម, Coase Sand,%		28.78
សំណើម Moisture % , (Oven dry at 105 °C and 24 hours)			2.62
កាបូន Total Carbon (Black & Walkey Method) , C %			1.87
អាសូត Total Nitrogen (Kjeldal Sulfuric Method) ,N %			0.17
អនុបាត C/N Ratio (Unit)			11
សារធាតុសរីរាង្គ Organic Matter (OM) %			3.22
ផូស្វ័រសរុប Total Phosphorus (Nitric Digestion) P %			0.094
ផូស្វ័រលាយ Available Phosphorus (Bray II) , P (ppm)			37
សមត្ថភាពដោះដូរកាចុង Cation Exchange Capacity C.E.C meq/100g Soil (Method ,1M Ammonium Acetate at pH = 7 & Leach with 10 % NaCl)			16.30
កាចុងដោះដូរ ,Exchangeable Cation (meq/100g Soil), (Method, 1M Ammonium Acetateat pH =7)		កាល់ស្យូម, Calcium Ca	5.43
		ម៉ាញ៉េស្យូម,Magnesium Mg	1.48
		សូដ្យូម,Sodium Na	1.50
		ប៉ូតាស្យូម,Potasium K	0.35
កាចុងដោះដូរសរុប , Total Exchangeable Bases (meq/100g soil)			8.76
អត្រាចំអែតនៃកាចុង, Bass Saturation %			54
អាស៊ីតដោះដូរ Exchange Acidity meq/100g Soil , (1 M KCl Method)			10.00
អាលុយមីញ៉ូមដោះដូរ Exchange Al meq/100g Soil , (1 M KCl Method)			0.12
បញ្ជូនអ.ន៏មើលជាតិប្រៃដី Electrode Conductivity µS/cm , (1:5 Soil: water)			63.00
ប៉េហាសិទឹក, pH H2O , (1:5 Soil: water)			5.66
ប៉េហាសិអំបិល , pH KCL , (1:5 (Soil : 1N KCL)			4.47

ចំណាំ:លទ្ធផលនៃការវិភាគមានតម្លៃតែលើសំណាកដែលបានបញ្ជូនមកវិភាគតែប៉ុណ្ណោះ(Note:Analysis result refers to the sumitted sample only).

ប្រធានមន្ទីរពិសោធន៍ជាតិកសិកម្ម

បានឃើញ និងឯកភាព
ប្រតិភូរាជរដ្ឋាភិបាលកម្ពុជាទទួលបន្ទុកជាអគ្គនាយក
នៃអគ្គនាយកដ្ឋានកសិកម្ម

ហ៊ូ ពុទ្ធា

ANNEX 6: CHANCE FIND PROCEDURE

The following *"chance find"* procedures must be included in all third-party contracts (e.g. Letters of Agreement) in instances where the contracted party is assisting with project implementation and/or construction activities.

Provincial PMUs will ensure that the bidding documents and work contracts for civil works contractors include clauses on chance find procedures. Specifically, the clause will stipulate that if the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during project implementation, the Contractor shall:

- Stop the activities in the area of the chance find.
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local or provincial authorities take over.
- Notify the supervisory Safeguards Specialist within the PMU who, in turn, will notify the responsible local and provincial authorities immediately (within 24 hours or less);
- Responsible local and/or provincial authorities would oversee protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by government approved archeologists. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values.
- Decisions on how to handle the finding shall be taken by the responsible local and provincial authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage.
- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities; and
- Project activities could resume only after permission is given from the responsible local or provincial authorities concerning safeguard of the heritage.

Note that the reporting of chance finds only occurs when an item/area/etc. of cultural significance is found and is only carried out insofar as what is detailed above (i.e. reporting the find, reporting how the item/area will be treated moving forward). Reporting begins with the local level implementer (e.g. staff tasked to the implement the project within a village) notifying the Safeguards Specialist, after which, the Safeguards Specialist guides the process according to the instructions above (e.g. notifying the relevant government authorities).

ANNEX 7: LIST OF ARCHEOLOGICAL AND CULTURAL SITES

The following are the list of the archeological and cultural sites within the command areas as per the statistics given by Provincial Department of Culture and Fine Arts in 2024.

No.	Sub-Scheme	Name Khmer	Name English	Type	Village	Commune	District	Province	X	Y
1	Lum Hach	ចេតិយលោកបាដេស	Bardez Stupa	Stupa	Krang Leav	Krang Leav	Rolea Bier	Kampong Chhnang	451815	1352511
2	Lum Hach	ទួលប្រាសាទ	Tuol Prasat	Archeology	Khvet	Pongro	Rolea Bier	Kampong Chhnang	456939	1355359
3	Lum Hach	វត្តក្រឡាញ់រង្សី	Kralanh Rangsei	Pagoda	Srangam Ter	Prasneb	Rolea Bier	Kampong Chhnang	448434	1361251
4	Lum Hach	វត្តត្រពាំងអំពិល	Trapang Ampil	Pagoda	Trapang Ampil	Prasneb	Rolea Bier	Kampong Chhnang	443581	1363490
5	Lum Hach	វត្តអណ្តូងព្រេង	Ondong Preng	Pagoda	Andoung Preng	Krang Leav	Rolea Bier	Kampong Chhnang	448414	1346725
6	Lum Hach	វត្តតាសុត	Ta Sout	Pagoda	Krang Leav	Krang Leav	Rolea Bier	Kampong Chhnang	451323	1353213
7	Lum Hach	វត្តនុទីពូធរាម	Noty Pocha Ram	Pagoda	Chor	Prasneb	Rolea Bier	Kampong Chhnang	435927	1356091
8	Lum Hach	វត្តចំបក់ប្រាសាទ	Chambak Prasath	Pagoda	Chambak Prasath	Krang Skear	Tuek Phos	Kampong Chhnang	435418	1351279
9	Lum Hach	វត្តក្រាំងស្គារ	Krang Skear	Pagoda	Lum Harch	Krang Skear	Tuek Phos	Kampong Chhnang	441163	1350893
10	Lum Hach	វត្តគិរីរុក្ខារាម	Kirirukharam	Pagoda	Phnum Ta Sam	Krang Skear	Tuek Phos	Kampong Chhnang	439315	1345397
11	Lum Hach	វត្តស្ទឹង	Stueng	Pagoda	Ou Leach	Banteay Preal	Rolea Bier	Kampong Chhnang	451345	1356445
12	Lum Hach	វត្តភ្នំខ្លា	Phnom Khla	Pagoda	ou Roung	Chrey Bak	Rolea Bier	Kampong Chhnang	455819	1348500
13	Lum Hach	វត្តព្រះរាម	Preah Ream	Pagoda	Preah Ream Reangsei	Chrey Bak	Rolea Bier	Kampong Chhnang	456242	1346839
14	Lum Hach	វត្តបង្គ័ល្ខ	Balang	Pagoda	Prambei Chhaom	Pongro	Rolea Bier	Kampong Chhnang	455213	1356241
15	Lum Hach	វត្តអាឡែង	Alaeng	Pagoda	Aleng	Chrey Bak	Rolea Bier	Kampong Chhnang	458921	1345407
16	Lum Hach	វត្តចាស់	Wat Chas	Pagoda	Prachak	Prey Mlu	Rolea Bier	Kampong Chhnang	458524	1344578

No.	Sub-Scheme	Name Khmer	Name English	Type	Village	Commune	District	Province	X	Y
17	Lum Hach	វត្តថ្មកែវ	Thmor Keo	Pagoda	Thmor Keo	Svay Chrum	Rolea Bier	Kampong Chhnang	453515	1361941
18	Lum Hach	វត្តអង្គមេត្រី	Angmetrei	Pagoda	Trea	Svay Chrum	Rolea Bier	Kampong Chhnang	458911	1357975
19	Lum Hach	វត្តគោល	Koul	Pagoda	Selang	Svay Chrum	Rolea Bier	Kampong Chhnang	458026	1358349
20	Lum Hach	ត្រពាំងឈូក	Trapang Chhouk	Shrine	srah kev	Melum	Baribour	Kampong Chhnang	450354	1365102
21	Lum Hach	ត្រពាំងលាងជាវ	Trapang Leangdav	Shrine	srah kev	Melum	Baribour	Kampong Chhnang	450023	1365675
22	Lum Hach	ត្រពាំងដើមពោធិ៍	Trapang Derm Por	Shrine	Tuol Thlok	Melum	Baribour	Kampong Chhnang	448732	1366465
23	Lum Hach	វត្តស្រះកែវ	Srah Kaev	Pagoda	Srah Kaev	Melum	Baribour	Kampong Chhnang	449337	1365583
24	Lum Hach	វត្តរវាំងចោម	Roveang Chum	Pagoda	Andoung Rovieng	Anhchanh Rung	Baribour	Kampong Chhnang	440010	1367419
25	Lum Hach	វត្តក្រពុំឈូក	Kra Pum Chhouk	Pagoda	Anhchanh Rung	Anhchanh Rung	Baribour	Kampong Chhnang	437065	1365784
26	Lum Hach	វត្តត្រពាំងប្រាសាទ	Tra Peng Brasat	Pagoda	Tang Trapeang	Pech Chongvar	Baribour	Kampong Chhnang	434115	1367224
27	Lum Hach	វត្តអូររលុះ	O Rolus	Pagoda	Krang Skear	Krang Skear	Tuek Phos	Kampong Chhnang	428812	1364716
28	Lum Hach	វត្តកែវសុវណ្ណគិរីសេនជ័យសុខារាម	Keo Sovankirisenchey Sokharam	Pagoda	Kdol	Krang Skear	Tuek Phos	Kampong Chhnang	428861	1358537
29	Lum Hach	វត្តចន្ទរង្សី (ត្រពាំម្លូរ)	Chan Rainsy (Trapeam Mlou)	Pagoda	Trapeang Mlu	Krang Skear	Tuek Phos	Kampong Chhnang	441163	1350893
30	Lum Hach	វត្តគង្គា	Kongkea	Pagoda	Tang Krasang	Tang Krasang	Tuek Phos	Kampong Chhnang	455817	1339324
31	Lum Hach	វត្តព្រាល	Preal	Pagoda	Preal	Banteay Preal	Rolea Bier	Kampong Chhnang	452189	1357714
32	Ou Ta Paong	ទួលបន្លាស្អិត	Tuol banlea saet	Archeology	Roung	Beong Khna	Bakan	Pursat	361785	1400642
33	Ou Ta Paong	ទួលគរ១	Tuol Kor 1	Archeology	Roung	Beong Khna	Bakan	Pursat	359524	14044333
34	Ou Ta Paong	ទួលថ្ងាន់ខាងលិច	Tuol Thnang Lech	Archeology	Roung	Beong Khna	Bakan	Pursat	359594	1404389

No.	Sub-Scheme	Name Khmer	Name English	Type	Village	Commune	District	Province	X	Y
35	Ou Ta Paong	ទួលសំរោង	Tuol Samrong	Archeology	Roung	Beong Khna	Bakan	Pursat	359685	1405010
36	Ou Ta Paong	ទួលម៉	Tuol Mor	Archeology	Roung	Beong Khna	Bakan	Pursat	359816	1405388
37	Ou Ta Paong	ទួលតាផាន	Tuol Taphan	Archeology	Roung	Beong Khna	Bakan	Pursat	359674	1404051
38	Ou Ta Paong	ទួលអំពិល	Tuol Ampil	Archeology	Roung	Beong Khna	Bakan	Pursat	359940	1404042
39	Ou Ta Paong	ទួលល្វា	Tuol Lvea	Archeology	Roung	Beong Khna	Bakan	Pursat	359974	1404132
40	Ou Ta Paong	ទួលតាកិល១	Tuol Takil 1	Archeology	Roung	Beong Khna	Bakan	Pursat	359856	1404091
41	Ou Ta Paong	ទួលថ្នាន់ខាងកើត	Tuol Thnang Kaeut	Archeology	Roung	Beong Khna	Bakan	Pursat	359733	1404138
42	Ou Ta Paong	ទួលតាកិល២	Tuol Takil 2	Archeology	Roung	Beong Khna	Bakan	Pursat	360102	1404229
43	Ou Ta Paong	ទួលតាគៀត	Tuol Ta Keat	Archeology	Roung	Beong Khna	Bakan	Pursat	361926	1400522
44	Ou Ta Paong	ទួលខ្ពស់	Tuol Khpuos	Archeology	Roung	Beong Khna	Bakan	Pursat	361714	1400746
45	Ou Ta Paong	ទួលអូរវល្លិប្រេង	Tuol O Va Breng	Archeology	Roung	Beong Khna	Bakan	Pursat	361882	1399835
46	Ou Ta Paong	ទួលតាវ៉ាន	Tuol Tavan	Archeology	Roung	Beong Khna	Bakan	Pursat	361680	1400196
47	Ou Ta Paong	ទួលគរ២	Tuol Kor 2	Archeology	Trach Krol	Beong Khna	Bakan	Pursat	359492	1404044
48	Ou Ta Paong	ទួលគរ៣	Tuol Kor 3	Archeology	Trach Krol	Beong Khna	Bakan	Pursat	359245	1404005
49	Ou Ta Paong	ទួលគរ៤	Tuol Kor 4	Archeology	Trach Krol	Beong Khna	Bakan	Pursat	359470	14044139
50	Ou Ta Paong	ទួលគរ៥	Tuol Kor 5	Archeology	Trach Krol	Beong Khna	Bakan	Pursat	359306	1404189
51	Ou Ta Paong	ទួលតាមុំ	Tuol Ta Mom	Archeology	Bat Kokir Chas	Ou Ta Paong	Bakan	Pursat	357802	1403082
52	Ou Ta Paong	ទួលភ្នៅ	Tuol Phnov	Archeology	Bat Kokir Chas	Ou Ta Paong	Bakan	Pursat	359306	1404189
53	Ou Ta Paong	ទួលពង្រួញ	Tuol Proung	Archeology	Bat Kokir Chas	Ou Ta Paong	Bakan	Pursat	357886	1404335

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54	Ou Ta Paong	ទួលអ្នកតាឧកញ៉ាមាន់	Tuol Neak Ta Oknha Moan	Archeology	Oknha Moan	Ou Ta Paong	Bakan	Pursat	356855	1406103
55	Ou Ta Paong	ទួលតាស៊ុក	Tuol Ta Suk	Archeology	Oknha Moan	Ou Ta Paong	Bakan	Pursat	356817	1406136
56	Ou Ta Paong	ទួលវត្តចាស់	Tuol Wat Chas	Archeology	Ou Bat	Ou Ta Paong	Bakan	Pursat	355370	1406864
57	Ou Ta Paong	ទួលស្រះម្កាក់	Tuol Srah Mkak	Archeology	Srah Mkak	Ou Ta Paong	Bakan	Pursat	356525	1404675
58	Ou Ta Paong	ទួលស្រះរុន	Tuol Srah Run	Archeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353855	1409227
59	Ou Ta Paong	ទួលរាជ	Tuol Reach	Archeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353565	1408310
60	Ou Ta Paong	ទួលអំពិល២	Tuol Ampil 2	Archeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353408	1408957
61	Ou Ta Paong	ទួលអំពិល១	Tuol Ampil 1	Archeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353364	1408699
62	Ou Ta Paong	ទួលតាទុយ	Tuol Ta Tuy	Archeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353980	1408730
63	Ou Ta Paong	ទួលអំពិល	Tuol Ampil	Archeology	Srah Run	Ou Ta Paong	Bakan	Pursat	354218	1408735
64	Ou Ta Paong	ទួលគោឯង	Tuol Rokeang	Archeology	Tuol Rokeang	Ou Ta Paong	Bakan	Pursat	357407	1408650
65	Ou Ta Paong	ទួលវិហា (ថ្មគ្រែ)	Tuol Vihea (Thmo Krae)	Archeology	Chrob	Svay Don Kev	Bakan	Pursat	350967	1407679
66	Ou Ta Paong	ទួលគុក	Tuol Kuk	Archeology	Chrob	Svay Don Kev	Bakan	Pursat	352252	1408072
67	Ou Ta Paong	ទួលកំពោតអាង	Tuol Kampot Ang	Archeology	Kampout ang	Svay Don Kev	Bakan	Pursat	352770	1407290
68	Ou Ta Paong	ទួលតាកោ	Tuol Takor	Archeology	Kampout ang	Svay Don Kev	Bakan	Pursat	352433	1407902
69	Ou Ta Paong	ទួលប្រត្រាញ់	Tuol Pratranh	Archeology	Svay Don Kev	Svay Don Kev	Bakan	Pursat	353801	1402072
70	Ou Ta Paong	ទួលវែង	Tuol Veng	Archeology	Tuol Samraong	Svay Don Kev	Bakan	Pursat	352115	1400412
71	Ou Ta Paong	វត្តចន្ទគន្ធរាម	Chan Khutaram	Pagoda	Ta Nai	Ou Ta Paong	Bakan	Pursat	352341	1413104
72	Ou Ta Paong	វត្តស្តុកឃ្លោក	Stok Khlok	Pagoda	Sdok Khlouk	Ou Ta Paong	Bakan	Pursat	353133	1410316

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73	Ou Ta Paong	វត្តកំប៉ាង	Kampang	Pagoda	Kampout	Svay Don Kev	Bakan	Pursat	351865	1405613
74	Ou Ta Paong	វត្តទួលអ្នកគ្រូ	Toul Neak Kru	Pagoda	Nikom Leu	Svay Don Kev	Bakan	Pursat	350902	1402270
75	Ou Ta Paong	វត្តចន្ទរង្សី រំលេច	Chan Rainsy Romlech	Pagoda	Rumlech	Rumlech	Bakan	Pursat	358428	1393346
76	Ou Ta Paong	វត្តរស្មីឈូកស	Raksmey Chhouk Sar	Pagoda	Boeng Chhuk	Khnar Totoeng	Bakan	Pursat	361370	1392685
77	Ou Ta Paong	វត្ត(មង្គលវនៃវាសី) ហៅ(វត្តបឹងគល់)	Mongkul One Veasey (Wat Boeung Koul)	Pagoda	Sakar	Boeung Khnar	Bakan	Pursat	359747	1399031
78	Ou Ta Paong	វត្តប្រាសាទដូនអន	Prasat Wat Don Orn	Pagoda	Prasat	Rumlech	Bakan	Pursat	357137	1396275
79	Ou Ta Paong	វត្តបឹងខ្នា	Boeng Khna	Pagoda	Prey Svay	Boeung Khnar	Bakan	Pursat	358563	1398259
80	Ou Ta Paong	វត្តត្រាង	Trang	Pagoda	Trang	Me Tuek	Bakan	Pursat	361654	1407561
81	Ou Ta Paong	វត្តនន្ទូណារាម (វត្តកោះខ្សាច់)	Noun Thonaram (Koh Khsach)	Pagoda	Koh Khsach	Me Tuek	Bakan	Pursat	366350	1405804
82	Ou Ta Paong	វត្តព្រៃដំរី	Prey Domrei	Pagoda	Prey Phdua	Boeung Khnar	Bakan	Pursat	364443	1395900
83	Ou Ta Paong	វត្តពូសិរីវង្ស	Pou Serei Vong	Pagoda	Kruo	Boeung Khnar	Bakan	Pursat	362889	1396697
84	Ou Ta Paong	វត្តសុវណ្ណជល្លសាខ្នាអណ្តែត ហៅវត្តទន្សាយអើត	Sovanchul Sakhnar Andet (Tonsay Eth)	Pagoda	Krasang	Boeung Khnar	Bakan	Pursat	361791	1396360
85	Ou Ta Paong	វត្តកូនត្នោត	Kon Thnot	Pagoda	Kon Thnot	Rumlech	Bakan	Pursat	356619	1393584
86	Ou Ta Paong	វត្តវេឡុវ័នតំណាក់ត្រាច	Velovan Tamnak Trach	Pagoda	Tamnak Trach	Rumlech	Bakan	Pursat	357044	1392516
87	Ou Ta Paong	ប្រាសាទវត្តបាកាន	Prasat Wat Bakan	Pagoda	Bakan	Trapeang Chong	Bakan	Pursat	365943	1390522
88	Ou Ta Paong	វត្តដូងជ្រុំ	Doung Chrum	Pagoda	Doung Chrum	Boeung Bat Kandaol	Bakan	Pursat	369173	1401120
89	Ou Ta Paong	វត្តអ្នកតាទ្វារ	Neak Ta Thvear	Pagoda	Neak Ta Thvear	Ou Ta Paong	Bakan	Pursat	351859	1415913
90	Stung Krang Bat	ទួលតាខឹម	Tuol Ta Khem	Archeology	Tropeang Chambok	Longvek	Kampong Tralach	Kampong Chhnang	472155	1311719

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91	Stung Krang Bat	ទួលវិហារបាក់ក (បាត់កង)	Toul Vihear Bak Kor (Bat Kong)	Archeology	Tropeang Chambok	Longvek	Kampong Tralach	Kampong Chhnang	472653	1312071
92	Stung Krang Bat	ទួលវិហារតុក	Tuol Vihear Tok	Archeology	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474677	1311029
93	Stung Krang Bat	ទួលតាយូ	Tuol Tayu	Vihear	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474156	1311730
94	Stung Krang Bat	ទួលវិហារបរយុក	Tuol Vihear Bor Youk	Vihear	Wat	Longvek	Kampong Tralach	Kampong Chhnang	473982	1311839
95	Stung Krang Bat	ទួលប្រាសាទរាជា	Tuol Prasat Reachea	Temple	Wat	Longvek	Kampong Tralach	Kampong Chhnang	473775	1312183
96	Stung Krang Bat	ទួលក្រពើណេនធន់	Toul Krapeu Nen Thorn	Archeology	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474855	1311948
97	Stung Krang Bat	ទួលប្រាសាទកាន់ណេកកត់	Tuol Prasat Kan Neak Kot	Temple	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474723	1311592
98	Stung Krang Bat	ទួលនាងសក់ក្រអូប	Tuol Neang Sok Kra Aoub	Temple Foundation	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474262	1310739
99	Stung Krang Bat	ទួលតាអុក	Toul Ta Ok	Archeology	Wat	Longvek	Kampong Tralach	Kampong Chhnang	473771	1310352
100	Stung Krang Bat	ទួលតាប្រាក់ (តាព្រាក)	Toul Ta Brakk (Ta Prak)	Archeology	Wat	Longvek	Kampong Tralach	Kampong Chhnang	472905	1310211
101	Stung Krang Bat	ទួលតាឈឺន (លួងឈឹង)	Toul Ta Chhin (Luong Chhing)	Archeology	Wat	Longvek	Kampong Tralach	Kampong Chhnang	473550	1312197
102	Stung Krang Bat	ទួលតាប៉ាវ	Tuol Tapao	Archeology	Wat	Longvek	Kampong Tralach	Kampong Chhnang	473286	1311780
103	Stung Krang Bat	វត្តត្រឡែងកែង	Tralaeng Kaeng	Pagoda	Wat	Longvek	Kampong Tralach	Kampong Chhnang	473896	1311731
104	Stung Krang Bat	វត្តប្រាំបីជុំ	Brambei Chhom	Pagoda	Peam Chumnik	KampongLuong	Ponhea Lueu	Kandal	477972	1310163
105	Stung Krang Bat	វត្តដងទង់	Dangtong	Pagoda	Peam Chumnik	KampongLuong	Ponhea Lueu	Kandal	478032	1309643
106	Stung Krang Bat	វត្តពាមជំនីក	Peam Chumnik	Pagoda	Peam Chumnik	KampongLuong	Ponhea Lueu	Kandal	477781	1309221
107	Stung Krang Bat	វត្តសង្វារ	Sangvor	Pagoda	Sangvar	KampongLuong	Ponhea Lueu	Kandal	478110	1308715
108	Stung Krang Bat	ប្រាសាទយាយទាវ	Yeay Tey	Temple	Sangvar	KampongLuong	Ponhea Lueu	Kandal	476870	1308902
109	Stung Krang Bat	លោកយាយជំទាវម៉ៅ	LokYeay Chumteav Mao	Shrine	Peam Chumnik	KampongLuong	Ponhea Lueu	Kandal	477386	1311208

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110	Stung Krang Bat	វត្តពោធិ៍កំបោរ	PoKomBoar	Pagoda	PoKomBoar	Vihear Luong	Ponhea Lueu	Kandal	475831	1307970
111	Stung Krang Bat	វត្តវិហារសំណរ	Wat Vihear Samnor	Pagoda	Sala Kat Sak	Vihear Luong	Ponhea Lueu	Kandal	474341	1307690
112	Stung Krang Bat	ប្រាសាទនាងកែវណាម៉ា	Neang Keo Nama	Temple	Sala Kat Sak	Vihear Luong	Ponhea Lueu	Kandal	474305	1307602
113	Stung Krang Bat	វត្តសាលាគូ	Sala Kou	Pagoda	Malu Meun	Phsar Dek	Ponhea Lueu	Kandal	473527	1306754
114	Stung Krang Bat	វត្តព្រះវិហារហ្លួង	Preah Vihear Luong	Pagoda	Thnak	Vihear Luong	Ponhea Lueu	Kandal	474956	1306685
115	Stung Krang Bat	វត្តប្រក់ក្តារ	Prok Kdar (Wooden Roof Pagoda)	Pagoda	Prok Kda	Vihear Luong	Ponhea Lueu	Kandal	472332	1307676
146	Stung Krang Bat	ប្រាសាទ តុលាការ	PrasatTolaka	Shrine	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474730	1311895
131	Stung Krang Bat	វត្តព្រះអង្គទេព	Prah En Tep	Pagoda	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474564	1311155
132	Stung Krang Bat	វត្តសសរ ១២០	Sorsor moi roi mapei	Pagoda	Wat	Longvek	Kampong Tralach	Kampong Chhnang	474742	1311775
133	Stung Krang Bat	វត្តសុភីរង្សី	Sophy Raingsei	Pagoda	Srah Chak	Longvek	Kampong Tralach	Kampong Chhnang	474142	1312485
134	Stung Krang Bat	វត្តទួលបាយក្តែក	Toul Bay K'aek	Pagoda	Peam Longvek	Vihear Luong	Ponhea Lueu	Kandal	475333	1311372
135	Stung Krang Bat	វត្តសង្គមមានជ័យបុរីមានរិទ្ធ	Sangkum Meanchey, Borey Mean Rith	Pagoda	Tropeang Chambok	Longvek	Kampong Tralach	Kampong Chhnang	472318	1311158
130	Krapeu Truom	វត្តប្រាជុំខ្ពស់	Brachum Kpous	Pagoda	Voat Sedthei	Svay	Sameakki Meanchey	Kampong Chhnang	465424	1309984
117	Krapeu Truom	វត្តវិហារខ្ពស់	Vihear Kpos	Pagoda	Vihear Kpos	Veang Chas	Odongk	Kampong Speu	471628	1305730
120	Krapeu Truom	វត្តទេពសុវណ្ណ	Tep Sovann	Pagoda	Phdor	Veal Pung	Odongk	Kampong Speu	465704	1304524
121	Krapeu Truom	វត្តខ្សាច់ពូន	Khsach Poun	Pagoda	Khsach Puon	Veal Pung	Odongk	Kampong Speu	464355	1303193
122	Krapeu Truom	វត្តធ្លាចាស់	Thleachas	Pagoda	Thleachas	Veal Pung	Odongk	Kampong Speu	463631	1304247
123	Krapeu Truom	វត្តព្រះនរាយណ៍	Preah Noreay	Pagoda	Kngaok Pong	Svay Chuk	Sameakki Meanchey	Kampong Chhnang	458790	1305619

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124	Krapeu Truom	វត្តក្តីបុរីរម្យ	Kdei Borey Rom	Pagoda	Boureirom	Veal Pung	Odongk	Kampong Speu	460699	1304686
125	Krapeu Truom	វត្តត្បែងខ្ពស់	Tbaeng Khpos	Pagoda	Tbaeng Khpos	Tbaeng Khpos	Sameakki Meanchey	Kampong Chhnang	461089	1306547
138	Krapeu Truom	វត្តត្រពាំងម្ទេស	Tra Peang Mor Tes Monastery	Pagoda	Trapeang Mtes	Svay Chuk	Sameakki Meanchey	Kampong Chhnang	455362	1304172
126	Krapeu Truom	វត្តហង្សឈូក	Hang Chhouk	Pagoda	Hangs Chhuk	Svay	Sameakki Meanchey	Kampong Chhnang	464938	1305996
127	Yutasas	វត្តទន្លាប់	Tonlab	Pagoda	Khyang Cheung	Svay	Sameakki Meanchey	Kampong Chhnang	468243	1307222
128	Yutasas	វត្តខ្យាង	Khyang	Pagoda	Khyang Tbuong	Svay	Sameakki Meanchey	Kampong Chhnang	468275	1307412
116	Yutasas	វត្តវាំងចាស់	Vaing Chas	Pagoda	Knong Veang	Veang Chas	Odongk	Kampong Speu	472311	1306273
118	Yutasas	វត្តព្រៃច្រាប	Prey Chrab	Pagoda	Prey Chrab Lech	Veal Pung	Odongk	Kampong Speu	467805	1304487
119	Yutasas	វត្តអង្គសណ្តាន់	Ang Sandan	Pagoda	Angk Sandan	Preah Sre	Odongk	Kampong Speu	468585	1304611
129	Yutasas	វត្តវិហារចាមសាមគ្គី	Vihear Cham Samaki	Pagoda	Thmei	Svay	Sameakki Meanchey	Kampong Chhnang	468475	1309425
136	Brambei Mom	វត្តអង្គទន្លេស្ងួត	Aug Tonlea Sngout	Pagoda	Boeng Va	Trach Tong	Odongk	Kampong Speu	457039	1295585
137	Brambei Mom	វត្តអង្គក្រាំងក្តឹប	Ang Krang Kdeb	Pagoda	Sdok	Mean Chey	Odongk	Kampong Speu	455611	1294336
139	Brambei Mom	វត្តស្រះទាល់	Srah Thul	Pagoda	Trapeang Thum	Yuth Sameakki	Odongk	Kampong Speu	451001	1290590
140	Brambei Mom	វត្តទឹកលង	Toek Lorng	Pagoda	Tuek Long Ti Pir	Rung Roeang	Tpong	Kampong Speu	445408	1291996
141	Brambei Mom	វត្តសុវណ្ណគីរី	Sovankiri	Pagoda	Trapeang Kraeun	Prambei Mom	Tpong	Kampong Speu	437228	1294353
142	Brambei Mom	វត្តជុតិវន្ត	Chotivoan	Pagoda	Chambak Sa	Rung Roeang	Tpong	Kampong Speu	447065	1296838
143	Brambei Mom	វត្តច្រកស្តេច	Chrak Sdach	Pagoda	Chrak Sdach	Peam	Sameakki Meanchey	Kampong Chhnang	447157	1304159
144	Brambei Mom	វត្តភ្នំព្រះធាតុ	Phnom Preah Theat	Pagoda	Chrak Kov	Peam	Sameakki Meanchey	Kampong Chhnang	441487	1306834
145	Brambei Mom	វត្តឧត្តមគីរីព្រឹក្សា	Utdomkiri Proeksa	Pagoda	Trapeang Kraeun	Prambei Mom	Tpong	Kampong Speu	433367	1293210

(Source: Pursat, Kampong Chhnang and Kampong Speu Provincial Department of Culture, and Fine Arts, 2024).

Figure 1: Maps of archeological and cultural sites in and near Ou Ta Paong Sub-scheme

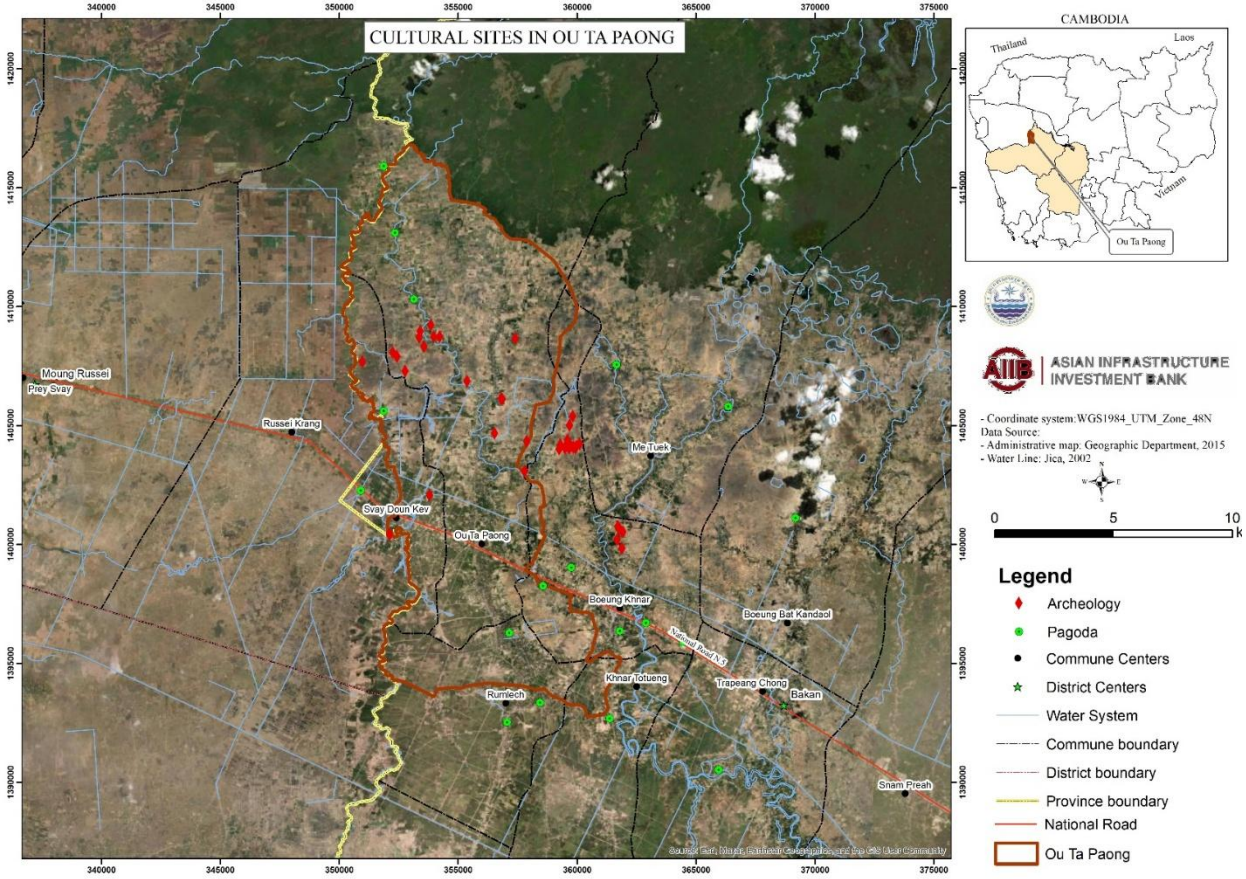


Figure 2: Maps of archeological and cultural sites in and near Lum Hach Sub-scheme

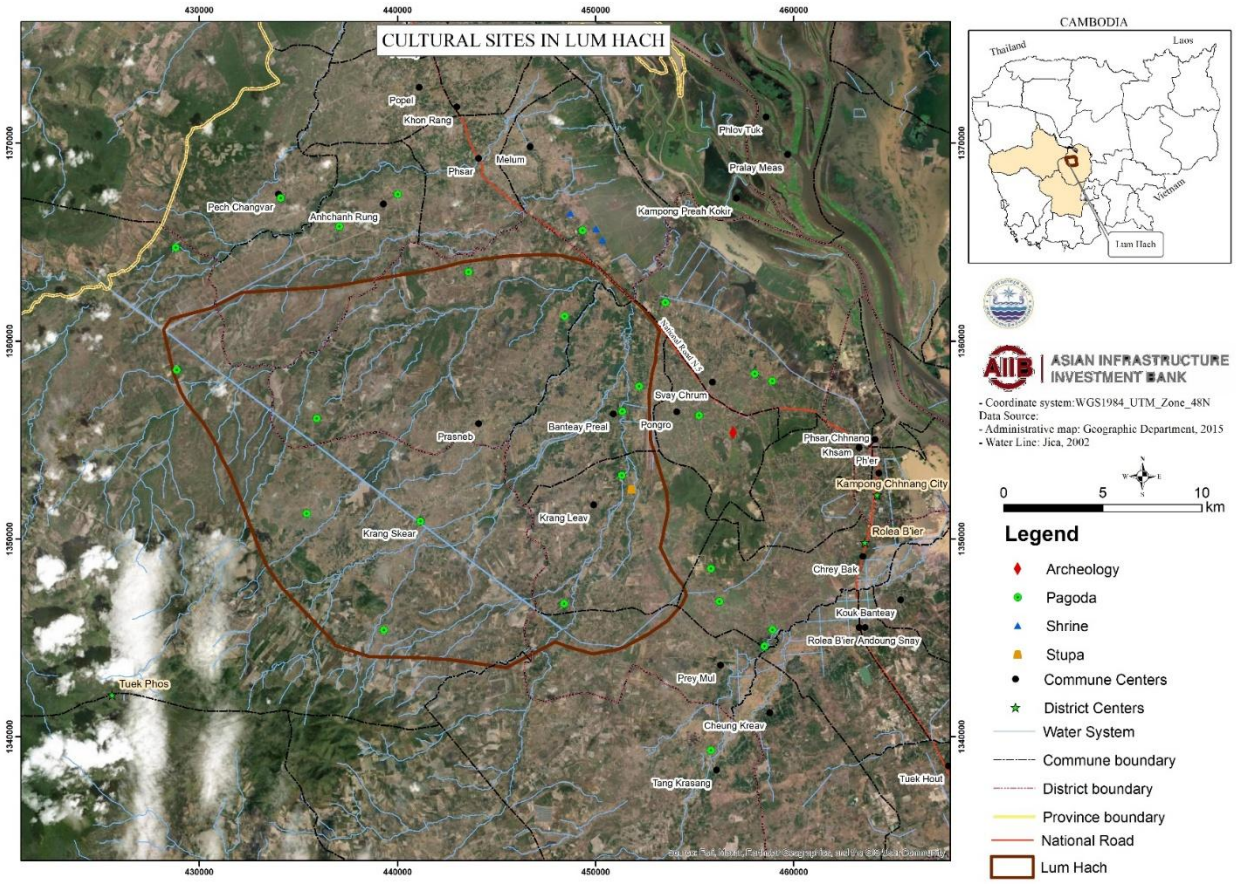
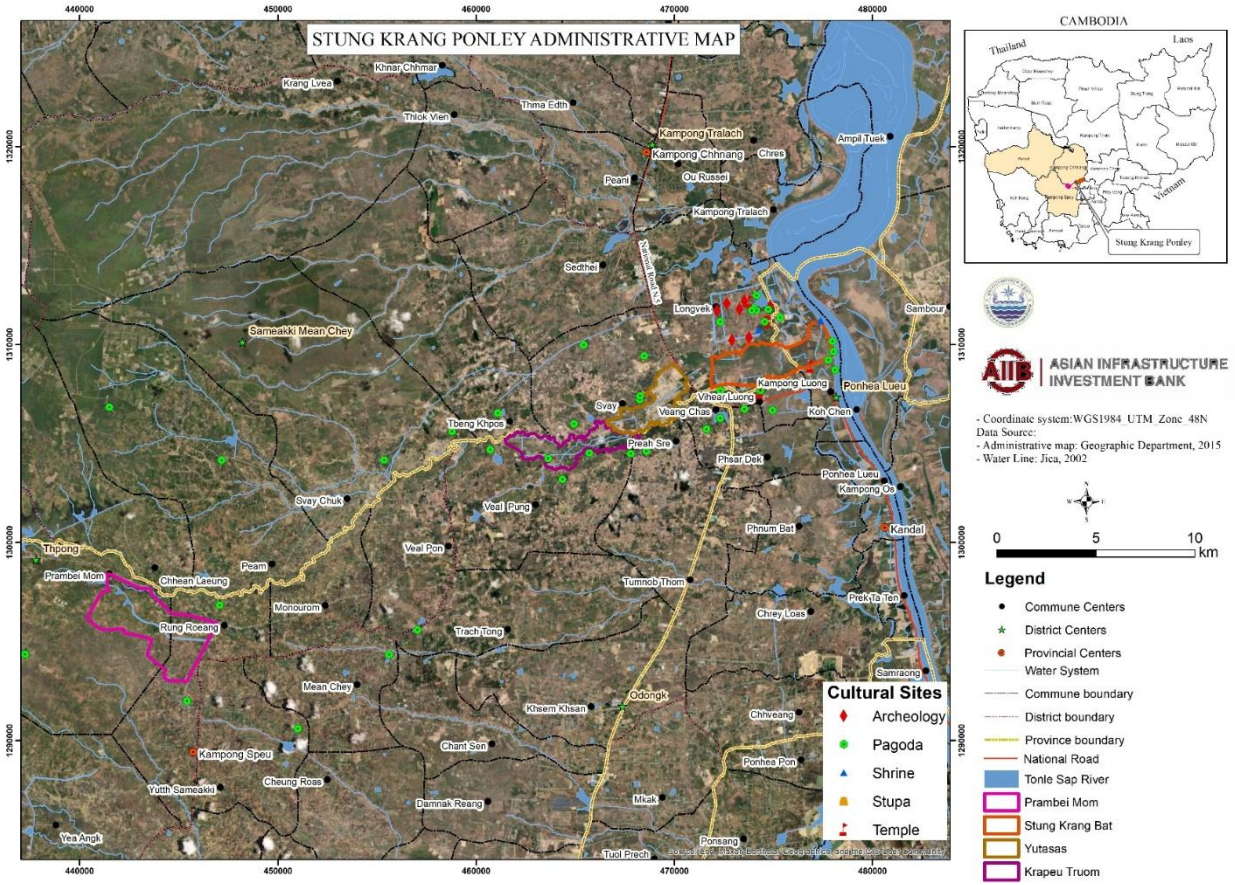

CULTURAL SITES IN LUM HACH
430000
440000
450000
460000
1370000
1360000
1350000
1340000
Popel
Khon Rang
Melum
Phsar
Pech Changvar
Anhchanh Rung
Philov Tuk
Pralay Meas
Kampong Preah Kokir
Svay Chrum
Banteay Preal
Pongro
Prasneb
Phsar Chhnang
Khsam
Ph'er
Kampong Chhnang City
Krang Leav
Krang Skear
Rolea B'ier
Chrey Bak
Kouk Banteay
Rolea B'ier Andoung Snay
Prey Mul
Tuek Phos
Cheung Kreav
Tang Krasang
Tuek Hout
CAMBODIA
Thailand
Laos
Vietnam
Lum Hach
ASIAN INFRASTRUCTURE INVESTMENT BANK
- Coordinate system: WGS1984_UTM_Zone_48N
Data Source:
- Administrative map: Geographic Department, 2015
- Water Line: Jica, 2002
0
5
10
km
Legend
Archeology
Pagoda
Shrine
Stupa
Commune Centers
District Centers
Water System
Commune boundary
District boundary
Province boundary
National Road
Lum Hach

Figure 3: Maps of archeological and cultural sites in Stung Krang Ponley Sub-scheme



ANNEX 8.1: RESULTS OF THE CONSULTATIONS IN PURSAT PROVINCE

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Pursat Provincial Hall
Participants	Mr. Lay Viseth
Moderator	1. Mr. Chun Nimul 2. Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The sectors with potential for development in the province include agriculture (rice, cassava, corn, and oranges) and mining (stone and sand). Notably, reservoirs No. 1, No. 3, and No. 5 are supplying the province, while Reservoir No. 2 is under construction. - In the agricultural sector, 78% of the province's population are farmers, which emphasizes the importance of agriculture in development plans. - Challenges in implementing the CAISAR project include difficulties in sourcing water from Dam Ampeul due to its distance from O Ta Pong and its potential impact on the population. Conversely, sourcing water from Kbal Hong, which is closer and has existing canals, would avoid population displacement. - The environmental and biodiversity impacts in the area are minimal. Regarding the livelihoods of residents, the project benefits farmers by providing irrigation during the dry season, creating agricultural jobs, and addressing poverty in priority areas 1, 2, and 3, though these areas still require significant attention. - There are no major issues with resettlement in the province due to the existence of clear policies and active participation from relevant institutions, including departments, communes, and villages, along with scheduled compensation from the government. - The General Department responsible for mitigating impacts is working to secure land for project implementation by coordinating meetings with affected residents, officials, and banks to collectively resolve disputes. -
Requests	- Strengthen livelihood capacities - The project should be implemented quickly - Prepare to participate in project work, cooperate, and implement - Work together to face and resolve challenges -

Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Department of Agriculture Forestry and Fisheries, Pursat province
Participants	1. Mr. Hun Sovan 2. Mr. Meas Set
Moderator	Mr. Keo Sony
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Each household owns an average of 3 hectares of farmland. - Farmers use an average of 250 kg of seeds per hectare during the dry season and 300 kg per hectare during the wet season. - Seeds are purchased from companies (OM seeds from Vietnam and local varieties) and saved for 2–3 generations. Seeds for mung beans and cucumbers are also purchased. - Fertilizer is applied to rice twice per season and to other crops three times. - Insecticides are applied to rice five times per season and to other crops 5–6 times per season. - Farmers hire labor for plowing, harvesting, and spraying pesticides. - Rice is sold directly in the fields, while other crops are sold at home. - Challenging of farming are flooding, water shortages, and climate change (currently facing water scarcity). - Farmers purchase seeds and also save their own. - Chemical fertilizers are currently suitable for the area. - Pesticide: While not ideal, there are no better options.

	- Insufficient water availability due to poor water management and lack of infrastructure. - There are no fees as there is no community-based water management system. - Rice is harvested by machine, and other crops are harvested manually. - Production Cost: Include plowing, fertilizers, pesticides, seeds, harvesting, and transportation. - Quick-harvesting crops like mung beans, cucumbers, and cabbages are grown popularity in the area. - Along the Ou Ta Pong stream is suitable areas for vegetable cultivation. - Vegetable Crop Benefits: Quick harvest time and broad market opportunities. - The Department organizes meetings between buyers and farmers to secure markets. - Fish Species Recommended: Catfish, silver barb, and tilapia. - Fish Farming Areas: Along the O Ta Pong stream near households. - Market Opportunities for Fish: Expected to thrive quickly, with the Department facilitating market access for farmers. - Challenges in Fish Farming: Insufficient water availability. - Training Provided: The Department conducts 20 training sessions per year for rice farmers (twice annually in the O Ta Pong area) on cultivation techniques and awareness. - 2023 Training Topics: Focused on rice production and the promotion of other crops. - Average Rice Cultivation: Farmers cultivate rice twice per year on average. - Additional Training Sources: Farmers receive training from partner organizations and fertilizer and pesticide companies. - Support from the Department: Committed to supporting projects by providing training, technical guidance on water conservation, and promoting solar-powered systems. - Water Availability and Management: Improved water accessibility enhances agricultural productivity, mitigates natural disasters (floods and droughts), and ensures water availability when needed. - Areas for Improvement: Establish agricultural technical officers at the commune level to train farmers, address challenges, find markets for agricultural products, and provide training on seed selection.
Requests	- Study technical methods for constructing irrigation systems properly to avoid water shortages or flooding in nearby areas. - Canals must have a consistent water supply. - Ensure stable water distribution and avoid conflicts over water usage.

	- Raise awareness among the population and stakeholders about the existence and benefits of the project. - Solutions: Adjust planting schedules and adopt intercropping methods; build reservoirs, ponds, and wells; educate and train people on water conservation; and encourage farming practices that do not exceed the area's available water resources.
Photo	 

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Department of Water Resources and Meteorology, Pursat province
Participants	1. Mr. Kit Phal 2. Mr. Lao Sokha 3. Mr. Ra Sovanret 4. Mr. Mao Mina
Moderator	Miss Sek Liny
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The current water sources are sufficient for the rainy season but inadequate for the dry season. This is because the agricultural land spans 110,000 hectares, while water can only supply 20,000 hectares. Presently, farmers cultivate 70,000 hectares, with a water shortage affecting about 10%. (Farmers use water reserved for livestock for their fields, leaving no water in ponds or other reservoirs.) Farmers exceed recommended cultivation levels due to the high market value of rice and observing others doing the same. - The rainy season's water supply is generally sufficient for rice farming, making water shortages uncommon. However, the dry season still faces water scarcity issues.

	- Developing water resources in the province presents challenges and obstacles that impact farmland and residents' settlements, though the impact is minimal if development occurs using existing systems. - In the Ou Ta Paong area, there is a water users' community with a committee, but it is nonfunctional due to insufficient water supply for farmers. - The CAISAR Project aims to improve water access for farmers, establish efficient community operations, provide technical knowledge, and train communities on conflict resolution since many residents do not follow instructions or announcements from authorities. - Other challenges in water management include: • Providing inaccurate data on cultivation areas (underreporting actual numbers). • Water shortages due to farmers cultivating more fields than recommended (ignoring guidelines and the water department's supply limitations). • Insufficient water sources for rice farming. • Conflicts in water allocation caused by noncompliance with distribution rules. • Farmers neglecting field maintenance and not participating in water distribution or monitoring. • Farmers leaving water gates open, causing water loss (with insufficient community representatives monitoring usage). • Unauthorized water usage during off-hours by individuals while community representatives are unavailable (e.g., stealing water between 10 p.m. and midnight). - The state of water resources and management in target areas involves discussions on water allocation. However, cases of water theft persist, and some residents refuse to adhere to recommended water levels (reluctant to share with downstream users). Water is sourced from key areas, such as the Stung Thom (Promaoy), Stung Areng (Dams #3 and #5), and Stung Prek Khlong (via Stung Pursat). - Management: Contract officers manage water sources upstream, while local authorities oversee water usage at the village, commune, and district levels. Annual meetings are held to plan water use and allocation. - Importance of irrigation systems in the livelihoods of citizens: • Provide water for farming (rice fields, vegetable cultivation, and livestock). • Reduce migration by encouraging farmers to increase rice farming. • Maintain a higher population in villages (limiting migration). • Enable more local business activities due to increased buyers and consumers in the area.

	• Boost water-related businesses (e.g., purified water production).
Requests	- Provide additional training on water management and technical skills to the water user communities. - Supply modern equipment and new technologies to the officials within the department. - A farmer in Romlech commune expressed happiness about the establishment of the irrigation system but dissatisfaction with the construction company. The issue stems from uneven land excavation, leaving deep pits that make the remaining land near the canal unusable for farming. (The farmer has also demanded $200 in compensation from the company.)
Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Department of Labour and Vocational Training, Pursat province
Participants	Kol Buntheuorn
Moderator	1. Mr. Chun Nimul 2. Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The employment and vocational training in the project area focus on agriculture, tourism, industry, and agro-industry. - The department's role in managing and monitoring project activities includes providing guidance to workers in the area, collaborating with company owners, and ensuring worker safety. - The department provides vocational skills training to farmers in the community, focusing on crop cultivation and livestock rearing. - Female migration does not significantly impact the labor force needed for rice production, as farming activities are partially automated. - The CAISAR project has minimal impacts on the community and work environment, as it is located downstream, in areas previously prone to seasonal flooding. - Migration occurs mainly after agricultural and household work, contributing to increased household economic stability. - In terms of health, the project has no significant adverse effects since the irrigation system does not involve chemical usage. Minor disturbances include occasional noise or vibrations.
Requests	- Support the project because it is in Zone 2.
Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Department of Women's Affairs, Pursat province
Participants	1. Mr. Morn Kimsoeurn 2. Ms. Teou Sonary 3. Ms. Kruoch Bunly
Moderator	1. Mr. Chun Nimul 2. Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The participation of women in agricultural work has declined due to low market prices for agricultural products (e.g., vegetables), high input costs, limited water availability for irrigation during the dry season, and low participation in community meetings. - Incidents of violence have decreased in both mild and moderate cases. - Mild cases: Victims report to the commune-level officials. - Moderate cases: Complaints are filed with the local police or judiciary, potentially leading to mediation, separation orders, or arrests. - The department collaborates with local authorities at all levels to monitor, identify pro bono lawyers, and report cases to the National Council and Ministry of Women's Affairs. - Resolutions are coordinated with local authorities at the commune and district levels. - Support is provided to help victims find pro bono legal representation. - Reports are prepared and submitted to the National Council and Ministry of Women's Affairs. - Resolutions for minor cases are handled at the village, commune, and district levels through education, mediation, and agreements. Moderate cases may involve separation orders, arrests, divorce petitions, or formal mediation. - Government mechanisms, including the six-point Neary Rattanak Policy and plans for women, are effective. Relevant departments collaborate with the Department of Social Affairs and Women's Affairs to track victims and arrest or detain perpetrators. - There is concern about gender-based violence (GBV) risks linked to the presence of project staff in the area. - Projects aimed at reducing GBV risks must enforce policies, ensure worker discipline, and hold companies accountable for staff conduct.

	- GBV risks in the area depend on individual behavior and interpersonal relationships. - Construction companies must coordinate and implement measures to protect the community from sexual exploitation and abuse/sexual harassment (SEA/SH). - All project staff operating in the area must participate in awareness campaigns, receive guidance, and adhere to strict discipline. Strengthening judicial systems and providing training on legal issues related to complaints are also necessary.
Requests	- The department's staff lacks financial support, relying only on the department's own mission budget. - It is necessary to consider deploying specialists to educate and raise awareness about issues of violence. - Expedite the construction and restoration of this irrigation system project.
Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Department of Environment, Pursat province
Participants	1. Mr. Dang Rady 2. Mr. Lay Vannak
Moderator	Miss Sek Liny
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project

Perceptions and concerns	- The general situation in the province includes areas with multi-use nature conservation zones (Tonle Sap region) and national parks. - The department is responsible for monitoring and inspecting various locations, with some locations requiring daily inspections. - The department's role involves regular project monitoring in three phases: pre-project, operational, and post-completion (managing waste and construction debris). It also raises public awareness about hygiene among the affected population and the general public, although hygiene issues persist. The department will continue its awareness campaigns. - Major challenges include insufficient public participation, requiring regular monitoring. Approximately 40% of urban residents have not yet participated in sanitation efforts (previously, more residents were involved in municipal waste disposal, but participation has declined due to economic issues, as residents must pay monthly waste collection fees). The ministry has a campaign to reduce plastic usage, with factories participating more actively and improving management compared to before. However, there is a lack of technical staff, and a significant portion of the population continues to dump waste indiscriminately rather than using designated bins. - The department has contributed materials to the project but has not yet established other forms of collaboration. - Key biodiversity areas/species/habitats are not affected by the project but have been improved instead. Biodiversity areas are primarily located in the Tonle Sap region, which could face impacts if construction workers improperly dispose of waste. - Positive environmental and biodiversity impacts: The project improves fish habitats, allowing aquatic species to migrate and increasing fish production due to larger waterways. Residents benefit from higher fish catches, reduced costs, expanded agricultural production, and livestock farming. The project also helps clean the environment by reducing unauthorized constructions and indiscriminate waste dumping by the community. - Negative environmental and biodiversity impacts: Construction and project activities may cause water and air pollution, soil erosion, waste from workers and machinery, noise pollution, and impacts on residential and commercial lands. Wastewater and debris could enter conservation zones and multi-use areas (Tonle Sap), polluting water and affecting fish in the Tonle Sap area. - Solutions: o Provide compensation or alternative arrangements for affected families regarding land issues. o Schedule construction to avoid noise pollution during residents' rest times. o Offer temporary business locations for those affected by partial loss of commercial land.

	○ Restrict the use of outdated machinery, allowing them only in rural areas. ○ Promote clean living practices, reduce plastic usage, and improve waste management. ○ Conduct air quality tests to prevent water pollution.
Requests	- Request to conduct water and air quality tests before starting construction in order to compare the conditions during and after construction. - The construction company must regularly monitor the workers' living conditions, waste management, and ensure there are proper sanitation facilities and adequate housing for the workers. - The company provides education and guidance on maintaining cleanliness and hygiene for the workers (such as proper waste disposal and handling of oil) and prohibits activities like fish poaching and hunting.
Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Department of Land Management, Urban Planning and Construction, Pursat province
Participants	Mr. Suong Se
Moderator	1. Mr. Chun Nimul 2. Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project

Perceptions and concerns	- The land use and land ownership registration in the Ou Ta Paong area are fully documented in the system. - The general issues related to land use are that conflicts may arise on an individual basis. - The system's land certificates is existing, but there have been difficulties in issuing certificates for citizens concerning land cultivation. - The impact of the CAISAR project on the community and land use is not a concern, as there is a registered irrigation plan in place. - There are no concerns about the restoration of the irrigation system, as it benefits the local population.
Requests	- Conduct a study on the impacts on the irrigation system. - Request shapefiles to clearly define boundaries and prevent opportunistic individuals from causing issues with land value or exploiting profits through speculation. - Request proper land parcel delineation or ensure that all citizens with land ownership certificates are accounted for.
Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Department of Culture and Fine Arts, Pursat province
Participants	1. Mr. Ut Raksa 2. Mr. Chea Sophea

	3. Mr. Teng Phearum
Moderator	Miss Sek Liny
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- In the province, there are no complete temple structures, only the foundations and ancient mounds that were once inhabited. There are 9 temple foundations, 91 ancient mounds, 15 small mounds, 11 ponds, and 34 other features. - The status and characteristics of the temples in the CAISAR project area are as follows: in Bakan District, there are 6 temple foundations, 50 ancient mounds, 1 pond; in Ou Ta Paong Commune, there is 1 temple foundation and 16 mounds. - The role and activities of the department include the preservation, protection, and promotion of the value of national cultural heritage, organizing conservation, registration of ancient objects to prevent loss, registering the inventory of ancient buildings and historical sites, collaborating with authorities to prevent crimes related to cultural heritage assets, conducting archaeological surveys and determining ancient locations, and promoting the awareness of historical sites. - Potential impacts and changes to the heritage site area due to the project may affect the water channels and the base of the ancient temple, Phnom An.
Requests	- Request that the project be relocated or diverted away from the temple site. - If the project cannot be avoided, request project funding for mitigation efforts and preservation activities to protect the cultural heritage.
Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Sustainable Cambodia Organization, Pursat province
Participants	1. Phang Polin 2. Ok Seab
Moderator	Mr. Nhoeb Phearun
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Involvement with clean water and sanitation for poor households, providing rainwater collection tanks with a capacity of 400 liters. If possible, also provide small portions of help such as digging latrines, building sanitary latrines, teaching vegetable gardening, creating compost, community ponds for animal farming to increase income, and forming groups of 10-15 people per group. Additionally, provide sewing lessons to make souvenirs (bags, phone cases, washable sanitary pads, etc.) and maintain sanitation for women. - Concerns and challenges include high migration rates, and group formation is often influenced by political affiliation, with the village chief selecting members based on their political party alignment.
Requests	- If the project affects citizens' land, please provide them with appropriate compensation. - If possible, preserve large trees.
Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Lutheran Hope Cambodia Organization, Pursat province
Participants	Ms. Ruon Phorn
Moderator	Mr. Nhoeb Phearun
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Activities related to clean water, sanitation, agriculture (vegetable farming, animal husbandry), drip irrigation systems, and greenhouses for vegetable farming, strengthening community activities with committees to promote awareness among youth. - Providing sanitation training to communities and schools, resolving disputes outside the judicial system with the community, and raising awareness about migration. - The project has been progressing well, with enough funds to implement the plan, but the main difficulty is finding money for continued project implementation. This has led to reducing staff, and community participation has been slow due to high migration rates. Many people are in debt and are focused on earning money, leaving no time to participate in the project. - Concerns and challenges include potential impacts on agricultural land around the irrigation systems and disputes between project implementers and beneficiaries, causing delays in farming. - Impact, benefits, and changes from the CAISAR project: After completion, the irrigation system was sufficient, leading to increased production. Migration was reduced as people worked on farms four times a year, and animal husbandry and fish farming were incorporated to create a more sustainable environment. - People with less land may lose their land, and there is a lack of farming land. Children are not able to attend school because they must follow their mothers to work in distant areas.
Requests	- Provide appropriate compensation when construction takes place, or allow them to exchange land where they can farm.

Photo	

Consultation Level	Provincial
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	HEKS - EPER Cambodia Organization, Pursat province
Participants	Ms. Khorn Sokluk
Moderator	Mr. Nhoeb Phearun
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The registered land is limited; the project will assist in improving the living conditions of the people. - The needs of the people have been addressed, and they can participate in the responsibility of maintaining and using water. - Organized discussions with agents to encourage them to be operators. - The relationship between the CAISAR project and organizations can help address household or farming needs and ensure the sustainability of water irrigation for a long time. - Study the necessary requirements to ensure farming can be done in both seasons with adequate water supply. - Concerns and challenges include land affected by construction near irrigation systems or the placement of construction projects, with some areas of land that people are using being close to harvest time and potentially rendered unusable.

	- Reduce migration by strengthening capabilities in farming and livestock management (government should allocate leadership and manage water distribution). - Reduce impacts and conduct more studies; the risks and benefits of water flooding in villages should be shared. - Minimize negative effects and discuss with people whether irrigation restoration is indeed a need. - Establish teams for maintaining irrigation systems and water gates, and add trees when preparing the irrigation areas.
Requests	- Set a specific deadline to prevent negatively affecting the people's increased productivity. - Minimize the impact on both people and the environment as much as possible. - Trees along the irrigation channels should be preserved and not cut down. Irrigation workers should be instructed to love and protect the environment. - Study the needs of the people before making decisions and ensure clarity. - The irrigation system should be capable of storing a large amount of water. - The community level should be small, from 10 to 20 hectares. - The community should own the irrigation systems and not consider them as state property. - Implement a water usage fee model to fund maintenance and further improvements. - Villages or districts should collaborate with the irrigation system or help maintain it. - A village-level management committee should be established to manage water resources, especially for areas with 100 or 80 hectares of land.

Consultation Level	District
Date	August 21st, 2024
Sub-Scheme	Ou Ta Paong
Organization	Bakan District Hall, Pursat province
Participants	1. Ms. Khiev Raning 2. Mr. Chea Heng 3. Ms. Sam Sophun 4. Ms. Vann Sokhon 5. Ms. Him Makara
Moderator	Mr. Keo Sony

Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The sectors with potential and priority for rural development are agriculture and handicrafts (bricks and tiles). - The project will create water storage sites and infrastructure systems. - The impact on wildlife habitats during construction. - Create wildlife habitats and corridors. - Local people have migrated to work in Thailand, South Korea, Japan, and Phnom Penh. - The role of local authorities is to enforce clear policies on water resource management, and the government has already measured and registered land. As a result, the working team has also preserved land near water sources. - Key issues and challenges may arise from land-related problems, but the local population is aware of the project and its presence. - The capacity and human resources of local authorities include a district administrative committee to resolve conflicts outside the judicial system. - The biggest challenge for farmers is the lack of irrigation water, insufficient infrastructure systems, and competition for water resources among migrants. - The solution is that local authorities distribute water from sources (such as wells) to each village, and the people contribute funds for irrigation and water distribution in cooperation with local authorities. - Seeds: In the first year, people buy seeds from the market; in subsequent years, they keep their own seeds (seeds can be kept for only 2-3 years). The types of seeds include OM51, OM54, Cambodian varieties, and Sarang. - Fertilizer: Fertilizers must be used for agriculture (types include urea, granular fertilizer, and DAB fertilizer). - Pesticides: Use herbicides, insecticides, and fungicides. - Infrastructure systems: There is insufficient water for farming due to a lack of infrastructure, water storage ponds, and over-farming during the dry season. - Post-harvest: Harvesting is done using machines. - Production costs: Preparing the land, buying seeds, fertilizers, pesticides, and harvesting. - Government initiatives should be efficient to reduce and address gender-based violence through awareness campaigns on reducing violence at the grassroots level and collaborating with educational organizations on gender issues. - To prevent and respond to gender-based violence, gender education should be integrated into local programs. - Concerns about the risks of gender-based violence due to an increase in the number of workers in the CAISAR project, which may lead to

	violence within workers' families, as well as sexual assault from male workers on women and children living near the project sites. - To reduce the risk of gender-based violence that may arise from the project, the company should collaborate with local authorities to provide gender training for workers. - Risks in the area include traffic accidents and substance abuse. - The company should cooperate with local authorities to provide gender education for workers.
Requests	- The company collaborates with local authorities. - The company informs local authorities and the community about the project's presence. - The project development is requested to proceed as quickly as possible.
Photo	

ANNEX 8.2: RESULTS OF THE CONSULTATIONS WITH COMMUNE COUNCILS IN PURSAT PROVINCE

Consultation Level	Commune
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Organization	Svay Doun Keo Commune Hall, Bakan District, Pursat Province
Participants	1. Mr. Deuk Kimhean 2. Mr. Un Samart 3. Mr. Moung Moeun 4. Mr. Sok Chanthy 5. Mr. Long Tang
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune has developed concrete and dirt roads in each village. About 95% of the population engages in agriculture, with a total of 2,550 hectares of farmland, 60% of which is dedicated to rice cultivation. - Residents practice rice farming, grow vegetables at the household level, and raise livestock, relying on wells as a water source. The commune also has a poultry farm. Other livelihood activities include trading, handicrafts, and small businesses. - Farmers near the Svay Doun Keo stream use water from the reservoir for irrigating rice fields, raising livestock, and fishing. - Drinking Water: Residents use tap water and purified bottled water. However, those living in villages along dirt roads rely on well water, which is filtered using household filtration systems. - Most farmers cultivate rice twice a year, while some do so once annually. Common rice varieties include OM, Somaly, and Sra Ngae. - The wet-season rice is cultivated from June to December, while dry-season rice is planted from January to March. Average yields range from 4 to 5 tons per hectare. - Most households grow vegetables on small plots of land around their homes, primarily cultivating leafy greens and fruiting vegetables. - Family-based livestock farming includes raising chickens, ducks, pigs, cows, and buffaloes. - Two villages, Kampout Ang and Svay Doun Keo, benefit from the restoration of the Ou Ta Pong sub-scheme.

	- The commune coordinates and consults with families affected by land issues, aiming to explain the project's benefits and gain their understanding. - The commune will assist in facilitating and collaborating with the project to address any issues and obstacles that may arise. - The project will provide water for rice farming, household use, and livestock rearing, benefiting approximately 90% of the population. It will also enhance the local aquatic ecosystem, especially increasing fish populations. - There are no cultural heritage sites in the project area that would be affected. - The project will affect land owned by some residents. - The commune also plans to restore the Domnak Ampil Canal, Svay Doun Keo Stream, and Ou Boeng Krapeu in certain areas.
Requests	- Restore secondary irrigation canals, install box culverts to facilitate water flow and drainage. - Repair and reinforce embankments, improve canals and streams, and install water gates. - Compensation should be considered if the irrigation project significantly impacts the land of any farmer.
Photo	

Consultation Level	Commune
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Organization	Rumlech Commune Hall, Bakan District, Pursat Province
Participants	Ms. Chhum Phally
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune has constructed canals, roads, rubber-paved roads, concrete roads, and internal village roads. - Rumlech Commune has a total land area of 6,000 hectares, of which 4,650 hectares are used for agriculture. - Most residents engage in rice farming, vegetable cultivation, and livestock rearing at the household level. The commune also has one poultry farm.

	- Residents living near canals, streams, and rivers use water for household needs, rice farming, livestock rearing, and fishing. - Rice farming and vegetable cultivation rely heavily on water from the canals. However, water is insufficient during the dry season. - Each household uses tap water and well water, which is filtered through individual household filtration systems. - Most farmers cultivate rice three times a year. The common rice varieties grown are OM and light rice varieties. - Most residents grow vegetables on household plots and land surrounding their homes, often planting mixed crops. - Family-based livestock farming includes raising chickens, ducks, pigs, cows, and buffaloes. - The canal restoration benefits two villages include Rumlech and Kampong Kdei. - The commune has informed the population about the benefits and potential impacts of the project. - The commune will cooperate with the project team to resolve issues with affected residents if assistance from the commune is required. - The project will provide water for rice farming, household use, and support diverse crop cultivation, livestock rearing, and fishing. This will increase agricultural productivity, creating more job opportunities and boosting household incomes. Additionally, the aquatic ecosystem will thrive, with an increase in fish populations. - The project does not impact cultural heritage sites but may affect land owned by residents. - The commune plans to restore Rumlech Canal and 107 secondary canals, including: 4 branch canals, 3 drainage canals, 3 water gates, 100 small irrigation canals, and 52 main canals.
Requests	- Please restore and repair shallow canals within the commune to improve water management and accessibility. - Accelerate the construction process to ensure timely completion and minimize disruption to local livelihoods. - Before commencing the irrigation system restoration, the Ministry is requested to organize public forums in collaboration with the commune to gather feedback from the local population, especially from residents who may be affected by the project.

Photo	

Consultation Level	Commune
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Organization	Boeng Khnar Commune Hall, Bakan District, Pursat Province
Participants	Ms. Tang Rebanglay
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune has developed concrete roads and dirt roads in each village, improving connectivity and access. - The commune has constructed drainage channels to manage water flow from canals. Additionally, key infrastructure has been built, including a temple, commune office, hospital, schools, and two community centers. - Most of the population engages in rice farming, vegetable cultivation, and family-based livestock farming, including chickens, ducks, pigs, and cattle. However, large-scale farms are not yet established. - Residents living near rivers use water for household consumption, farming, livestock, and fishing. Farming and vegetable growing depend on rainfall and river water, but during the dry season, water availability is insufficient. - For drinking, the population uses tap water and collects river water for irrigation. Each household has a water storage tank for individual use.

	- Farmers typically cultivate rice three times a year. The favoured rice varieties are OM and lowland rice. In the first two seasons, the average yield is 4-5 tons per hectare, while the third season yields about 1 ton per hectare. - The villages benefiting from the canal restoration project include Srakar, Chamkar Leu, Voat Chreae, and Trach Kraol. - The commune will actively raise awareness among residents about the benefits and impacts of the project. It will collaborate with the project to resolve any issues faced by affected individuals, especially if assistance is needed from the commune. - The commune has a limited capacity to contribute to the project but is committed to providing support where possible. - The project will provide water for agricultural activities, household use, livestock farming, and fishing, contributing to improved public health. It will help diversify crops, improve livelihoods, and increase agricultural employment. With sufficient water access, farmers will spend less and earn more, boosting income. Additionally, aquatic animals, particularly fish, will thrive in the restored water systems. - The project will not affect cultural heritage sites but will have an impact on land owned by local citizens. - The commune currently lacks the technical knowledge and sufficient budget to implement a large-scale restoration project. If restoration occurs, it will be on a smaller scale. - If the project proves feasible, the commune plans to learn from it and, with increased funding, will include such projects in future investment plans for subsequent locations.
Requests	- Please restore and repair Ou in the commune to improve water management and accessibility. - The project should organize training sessions for the commune to help them understand the project's processes, including the size of the infrastructure systems and the standards for excavation and construction. This will ensure that the commune is well-informed about the project. - Before the restoration begins, the Ministry should organize public consultations and work with the commune to gather feedback from the local population, especially those directly affected by the project. This will ensure transparency and community involvement. - In cases where the project disrupts residents living along the waterway, the project should offer compensation to those affected. This will address the impact on their livelihoods and property.
Photo	

Consultation Level	Commune
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Organization	Ou Ta Paong Commune Hall, Bakan District, Pursat Province
Participants	1. Ms. Meng Chhorn 2. Ms. Hul Sereyvathana
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune of Ota Pong consists of 18 villages, with 14 villages being served by the irrigation system. - Villages along National Road 5 primarily engage in business activities, while those located along the secondary roads depend largely on agriculture. These farming households typically cultivate rice once or twice a year, depending on soil conditions and proximity to water sources. - Some farmers plant vegetables after harvesting their rice, while others maintain vegetable gardens around their homes. Common vegetables grown include squash, beans, and cucumbers. - Livestock farming is common across the commune, with most households raising animals such as cattle, pigs, ducks, and chickens. One family, located near the river mouth, raises over 500 ducks for eggs. - Many young people, seeking work, migrate to other provinces or to Thailand for employment opportunities. - Water for rice cultivation comes from the Ota Pong canal and the feeder canals connected to it. - Water for irrigating vegetables and for livestock is sourced from local ponds and the water reservoirs around the homes of farming households. - For households along the main road, drinking water is supplied via a tap water system. However, people living along secondary roads in rural villages rely on water from channels filtered through household water containers. - While crop damage from pests is minimal, water scarcity remains a significant issue for farmers, especially during the dry season.

	- Watermelons are typically grown on rice fields near water sources after the rice has been harvested. - Due to the low market prices for cattle, many farmers in the area have reduced cattle farming. However, they continue to raise smaller numbers of pigs, chickens, and ducks for household consumption. - It is important to educate and raise awareness about the potential impacts of the project and prevent people from encroaching on irrigation land. - There should be public campaigns to prevent pollution in the water systems, including both the Ota Pong canal and the smaller feeder canals. - The project will ensure a sufficient water supply for both rice farming and vegetable cultivation. If farming production increases, it may reduce migration, improve fish stock levels, and boost local fishing activities. - With the project, fish populations will grow, and local farmers will have the opportunity to engage in fishing, providing additional income for their families. - Families will have sufficient food through access to fish, vegetables, and meat, which they can either cultivate or raise themselves. - The project will affect the land ownership of the local community. - This project aligns with the village's development plans. The village regularly submits proposals for investment projects, but due to limited funding and more urgent infrastructure needs, funding has been redirected to road development. - Currently, the village only has a plan for maintaining and protecting the irrigation system.
Requests	- Requesting the ministry's assistance to restore the Ou Ta Pong and side drainage channels to ensure water availability for farmers during the dry season. - Requesting support to restore three Boeng include, Boeng Konseng, Boeng Peak Dong, and Boeng Chouk to serve as water reservoirs for the local population in the surrounding areas. - Requesting the construction of water gates and dams along the irrigation channels and side drains, ensuring precise water level measurements to prevent both flooding and water shortages. - Compensation for Affected Landowners: If any farmland is severely impacted, requesting the ministry to study the possibility of compensation for the affected farmers.

Photo	

ANNEX 8.3: RESULTS OF THE CONSULTATIONS WITH VILLAGE CHEFS IN PURSAT PROVINCE

Consultation Level	Village Chef
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Svay Doun Keo Village, Svay Doun Keo Commune, Bakan District, Pursat Province
Participants	Mr. Chhut Vandy
Moderator	Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent diseases in the village are caused by chemicals in food, consumption of canned beverages, and the use of chemical pesticides. - 30 households receive water from the irrigation system. - The main issue is water scarcity during the dry season and the distance from large water sources. - The commune chief manages the irrigation system in the village. - The water quality in the irrigation system is poor due to chemicals and pesticides flowing in, and livestock farming is commonly done in water ponds. - This project will not impact the farmland of the farmers. - The project will help farmers have water for three growing seasons, which can be used for livestock farming, helping to increase additional income.
Requests	- Request to construct a pond with adequate water storage. - Request to help build proper roads in the village.
Photo	

Consultation Level	Village Chef
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Kampang Village, Svay Doun Keo Commune, Bakan District, Pursat Province
Participants	Mr. Vann Sorng

Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent diseases in the village are due to the dense forests and the abundance of mosquitoes, which lead to malaria. - 223 households receive water from the irrigation system. - The main issue is water scarcity during the dry season. - The sub-district is the manager of the irrigation system in the village. - The water quality in the irrigation system is poor due to waste clogging the mouths of the ponds. - This project will not impact the farmland of the farmers. - The project will help farmers have water for both the dry and rainy seasons, increasing household income and reducing the number of family members who migrate abroad or to distant provinces for work.
Requests	- Assist in restoring water drainage ponds. - Please expedite the implementation of this irrigation system restoration project.
Photo	

Consultation Level	Village Chef
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Prasat Village, Rumlech Commune, Bakan District, Pursat Province
Participants	Mr. Hach Pat
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent diseases in the village are due to - The factors contributing to frequent diseases in the village are due to poor hygiene practices, consumption of food rich in chemicals, and climate change. - 150 households receive water from the irrigation system. - The main issue is the water being too distant, and there is insufficient water during the dry season. - There is currently no manager for the irrigation system in the village. - The water quality in the irrigation system is good for about 50% of the supply. - This project will not impact the farmland of the farmers.

	- The project will help provide water for the entire community.
Requests	- Please help restore the ponds to a deeper level. - Kindly provide technical support for growing rice and vegetables to the farmers, as their knowledge is still at a basic level.
Photo	

Consultation Level	Village Chef
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Voat Chreae Village, Boeng Khnar Commune, Bakan District, Pursat Province
Participants	Mr. Kae Vanna
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent diseases in the village are due to the abundance of mosquitoes during the rainy season, chemicals from pesticide use in agriculture, and dietary factors. - 254 households receive water from the irrigation system. - The main issue is the lack of sufficient water for farming during the dry season, as well as conflicts between the upper and lower villagers over water sources. - The village water resource group plays a role in coordinating water usage for the community during times of water scarcity. - The water quality in the irrigation system is good. - This project will not affect the farmers' land, as the land has been planned and cleared for expanding or restoring the irrigation system. - The project will help farmers grow crops year-round, provide additional water for livestock, and reduce migration.
Requests	- Request to restore the main pond and build secondary ponds in the village. - Help construct water gates to control the water flow from the irrigation system's five-phase ponds.
Photo	

Consultation Level	Village Chef

Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Srah Run Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	Mr. Yaet Horn
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent diseases in the village are due to climate change, poor hygiene in food preparation, and the consumption of food containing chemicals. - 186 households receive water from the irrigation system. - The main issue is that the large irrigation system cannot reach the village due to its distance, and the residents only use pond and irrigation water. - The village chief, sub-chief, and community members play a role in coordinating the use of water. - The water quality in the irrigation system is poor. - This project will not impact the farmers' land. - The project will help farmers have an irrigation system that reaches all farmers in the village, allowing them to fully engage in agriculture. Farmers will be able to grow crops in both the rainy and dry seasons, helping to improve household economies.
Requests	- Request that the Ministry of Agriculture help restore the pond, dig additional ponds, and expand irrigation canals.
Photo	

Consultation Level	Village Chef
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Ou Ta Paong Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	Mr. Voa Saren
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project

Perceptions and concerns	- The factors contributing to frequent diseases in the village are due to climate change. - 253 households receive water from the irrigation system. - The main issue is water scarcity. - The village chief plays a role in coordinating the irrigation system in the village. - The water quality in the irrigation system is good. - This project will impact the farmland of about 35 households living near the mouths of the irrigation canals. - The affected households feel sad about losing their land. - The project will help farmers create livelihoods, such as engaging in fishing to support family needs, and allow them to grow crops in both the dry and rainy seasons, increasing household income and reducing migration to foreign countries or distant provinces for work.
Requests	- Request that the community have sufficient water for use during the rainy season.
Photo	

Consultation Level	Village Chef
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Bat Kokir Chas Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	Mr. Tol Nhib
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent diseases in the village are due to the consumption of food without considering its nutritional value and climate change. - 80% of households in the village receive water from the irrigation system, while 20% work outside the village. - The main issues are the distance to the water source, difficulties in managing water, water scarcity, and conflicts over water use with neighbouring villages along the water stream. - The village chief plays a role in coordinating the irrigation system in the village and ensuring adequate water distribution to the community. - The water quality in the irrigation system is good. - The project will impact some farmers' land, but this is not considered a problem, as farmers understand that expanding the irrigation canals

	benefits agriculture. The affected land has already been planned and cleared for the canals and roads. - The project will ensure sufficient water for the community to increase rice production and provide clean, accessible roads for easy entry and exit.
Requests	- Request the restoration of the main pond and construction of additional secondary ponds in the irrigation system. - Encourage the restoration and construction process to be completed as quickly as possible.
Photo	

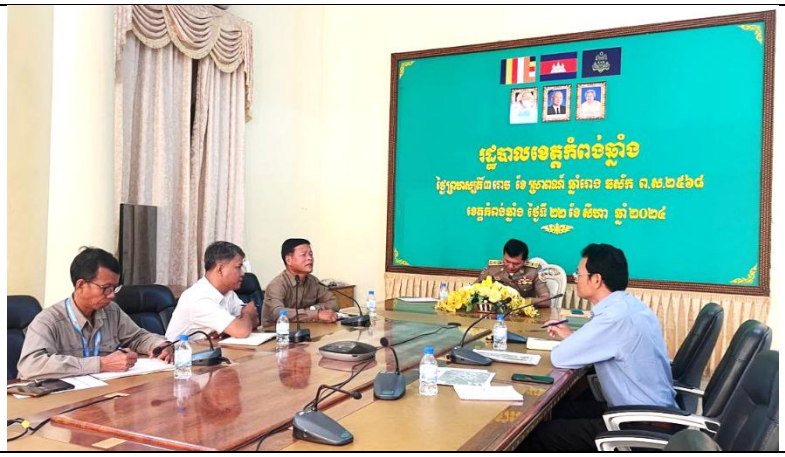
Consultation Level	Village Chef
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Oknha Moan Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	Mr. Doung Savy
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent diseases in the village are due to - The factors contributing to frequent diseases in the village are due to climate change (Flu) and poor hygiene (diarrhea, dysentery). - 251 households receive water from the irrigation system. - The main issues are the lack of irrigation canals, canals being too far from the farmland, and the canals being shallow. - The village authorities and community members are involved in maintaining the irrigation system in the village. - The water in the irrigation system is usable, but the groundwater contains a lot of salt and clay. - The project will affect the farmland of about 7 households, but they are willing because they will have water for vegetable farming. - The project will help the community have sufficient water for irrigation, improve roads within the village, and provide more housing.
Requests	- Request to restore the main irrigation canal and deepen the secondary canals. - It is recommended to construct water gates at the outlet of the irrigation system to control water flow.

Photo	

ANNEX 9.1: RESULT OF CONSULTATION: KAMPONG CHHNANG PROVINCE

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Kampong Chhnang Province Hall
Participants	1. Mr. Pich Keomony 2. Mr. Un Sotha 3. Mr. Kim Vanny
Coordinators	1. Mr. Chun Nimul 2. Ms. Toun Samphorsdavin
Topic	CAISAR
Perception and Concern	- The agricultural sector holds significant development potential in the province, and the project plays a critical role in ensuring water storage during the dry season. - The primary goal of provincial development is to enhance family livelihoods, boost the national economy, and improve the transportation system supporting agriculture. - Risks include insufficient water supplies from existing projects, failure to study abundant river sources, potential water loss, and flooding during the rainy season, which could lead to financial losses. - Negative impacts may involve disruptions to water access and encroachments on private land.

	- Positive impacts include benefits to farming activities, particularly for both wet and dry rice cultivation and mixed crops. - The project should prioritize vulnerable populations, clearly identify beneficiary families, and conduct thorough studies on water usage. - The provincial administration possesses the legal authority to collaborate with the judiciary. - Budget-related challenges need to be addressed by the working group. - The sub-committee is responsible for addressing project impacts and ensuring effective communication with the public. - Experience required includes expertise in land area assessment, land valuation, construction planning, cost estimation, and crop studies. - Challenges may include space constraints, concerns over water distribution, impacts on private land, and non-compliance by companies with local authorities and communities. - The action plan for resolution emphasizes avoiding private land impacts, preparing adequate materials and signage, determining usage boundaries, informing the public beforehand, and setting clear policies and timelines. - Most problems arise from external instigators rather than directly from affected communities.
Request	- Strengthen livelihood skills - The project should be implemented promptly - Prepare to participate in project activities, collaborate, and implement - Work together to face challenges and find solutions

Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	DAFF
Participants	1. Mrs. Heng Kimsreang 2. Mr. Chum Maochandara 3. Mr. Mech Phearom
Coordinators	Mr. Keo Sony
Topic	CAISAR
Perceptions and Concerns	- Farmland owned by farmers typically ranges from 3 to 5 hectares. - Average seed usage is 200kg during the dry season and 500kg during the rainy season. - Most farmers in the region purchase seeds in the first year and use self-produced seeds in the second and third years.

	- Fertilizers are applied 2 to 3 times per growing cycle, using 4 to 6 sacks. - Pesticides are used 1 to 2 times per growing cycle to protect crops. - Farmers generally do not hire labor but instead rely on machinery. - Farmers in the area usually sell their harvested crops directly from the fields. Challenges: - The most common issue is the lack of irrigation systems and insufficient water for farming. Solutions: - Restore and build additional irrigation systems. - Perform land preparation 1 to 2 times per season. - Practice farming during rainy seasons. - Purchase seeds in the first year and select seeds in subsequent years. - - Use fertilizers to enhance productivity (e.g., urea, DAP, 20-20-15). - Apply pesticides to safeguard crops against threats. - Address irrigation shortages by establishing reservoirs and canals. - Post-harvest, farmers use machinery for harvesting. - Production costs include land preparation, fertilizer, water pumping, pesticides, and harvesting. Recommended vegetable crops for sub-systems: - Sugarcane, watermelon, beans, cucumbers. - Suitable areas for cultivation span the district, especially during the dry season.

	- These crops meet market demands. - The department will partner with stakeholders to establish markets for farmers. Challenges in vegetable production: - Low prices and limited markets (often restricted to local sales). Recommended fish species for sub-systems: - Catfish, tilapia, snakehead fish, and carp. - Areas suitable for fish farming include locations near rivers. - There is significant market demand, making fish farming potentially successful. - The department will collaborate with partners and markets to support market access. Challenges in promoting fish farming under CAISAR: - Lack of infrastructure, inadequate locations, limited technical expertise, and restricted market access. - Farmer training initiatives: - Farmers have received training on rice production five times per year. - Key training topics in 2023 focused on climate change and rice production. - On average, farmers cultivate rice twice a year. Training support and collaboration: - - Farmers have been trained on rice production by various service providers, including civil society organizations (VSU, LWD, World Vision, WSP) and pesticide companies. Current agricultural support: - Support is being provided through the construction of irrigation systems and water reservoirs. To improve agricultural productivity:

	- Modernized community projects (e.g., cooperative land use, coordinated production, and marketing). - Training on production planning to prevent crop overlap.
Request	- Construct additional small canals (tributary canals). - Build irrigation systems to ensure a consistent water supply.
Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	WORAM
Participants	Mr. Oeur Samreun
Coordinators	1. Mr. Chun Nimul 2. Ms. Toun Samphorsdavin
Topic	CAISAR
Perceptions and Concerns	- The current water sources for agricultural supply are insufficient, with only 60% availability.

	- The development of water resources in the province faces challenges and obstacles due to limited funding, traditional water usage practices by local communities, and market dependence on private traders. - In the lowland areas, there are farmer communities utilizing water, but these systems are not operational due to a lack of cooperation in paying contributions. - In the lowland regions, soil erosion is prevalent, and rice yields decrease annually due to rising temperatures and water shortages. - The importance of irrigation systems is critical to the livelihoods of the population, providing water for agriculture and enabling multi-season rice cultivation.
Request	- A water user community should be organized prior to construction to participate in identifying key locations and ensure there are caretakers in place.
Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat

Organization	Department of Labor and Vocational Training
Participants	1. Mrs. Yim Nimul 2. Mr. Rim SamAng 3. Mr. Reun Channa
Coordinators	Ms. Sek Liny
Topic	CAISAR
Perceptions and Concerns	- The employment situation and vocational training in the project area benefit from the presence of numerous factories, which help reduce migration. - Common issues in factories and enterprises include air pollution, factory heat, technical problems (electric shocks), personal disputes within factories, and conflicts between workers and employers (related to wages, working hours, health, poor workplace safety, and concerns about child labor under 18 years old, especially in brick kilns). - The role of the provincial department includes disseminating labor laws to factories and workers, assisting in resolving disputes, conducting regular inspections to prevent concentration of violations, and promoting laws prohibiting the use of child labor under 18 years old. - Job training opportunities for farmers are lacking because the department focuses on non-agricultural skills (e.g., auto and motorcycle mechanics). - The department can contribute to providing training and job creation for the CAISAR project in non-agricultural fields (e.g., auto and motorcycle mechanics) and offer training in food processing (e.g., tamarind processing, pickling vegetables). The deputy provincial governor has suggested training in fish farming as well. - Women's migration for work has a minor impact due to the reduced labor force for farming. However, modern farming methods currently require less labor.

	- The employment framework and agriculture in the province and target areas are mainly centered on factory work and farming. - The industrial sector has greater potential than agriculture due to its geographic proximity to urban areas, the availability of labor, and strong relationships between the department and employers. - The agricultural sector requires further strengthening and significant technical support. - The department can help mitigate negative impacts and improve the agricultural sector by providing more agricultural jobs. - Factory workers with social security schemes (NSSF) have benefited from reduced health burdens, though health issues persist frequently.
Request	- Help promote sufficient irrigation systems and water availability for farmers to cultivate their fields.
Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas

	3. Stueng Krang Bat
Organization	Department of Women's Affairs
Participants	1. Mrs. Pich Sophea 2. Mrs. Phin Phalla
Coordinators	Ms. Sek Liny
Topic	CAISAR
Perceptions and Concerns	- There is not complete agreement with the idea, as most women work in factories in the area but still assist with family farming tasks during their days off. Men and women contribute equally to agriculture, with men participating during the initial stages, and women helping with tasks like fertilizer application. - Violence incidents occur at a rate of 1-2 cases per month, and sexual assaults happen every 1-2 months, often linked to media influence, mobile phone use, alcohol, or drug abuse. - Reports of violence have increased as women have become more courageous, confident, and financially independent. - Psychological violence is more prevalent than physical violence. - Some victims remain hesitant and embarrassed, unable to speak out immediately. Counselors recommend employing specific techniques for probing and providing victims with a supportive and compassionate environment. - The role of the Women's Affairs Department includes providing advice for decision-making, assisting with filing complaints to the court, offering temporary shelter and some material and food support to victims during the resolution or litigation process, educating and promoting information on gender equality, attending court sessions when requested by victims, and coordinating with volunteer lawyers for legal representation (for the victims).

	- The department assists in resolving, mediating, and referring cases to relevant institutions. - The department provides minimal financial assistance, temporary shelter, and works to find centers for child victims of violence and sexual assault. - Immediate reports are made to the deputy provincial governor responsible, with daily updates provided. - The department resolves and closes cases by filing them in court, at the provincial office, or preparing documentation for referral to centers and the judiciary. - Government mechanisms include the Ratanak VI Women's Plan, the Legal Protection Office, and collaboration with the police, the Department of Social Affairs, the Department of Health, and the judiciary. - To improve the prevention and response to gender-based violence, efforts focus on promoting and educating about gender equality, punishing offenders, imposing penalties, and reducing drug trafficking. - The increase in personnel under the CAISAR project is not a concern, as there have been no prior issues with site workers, and local communities and companies are attentive to preventing problems. - Risks in the area include violence and sexual assault. - Construction companies should prioritize hiring local workers to provide employment opportunities, reduce concerns about newcomers, and create opportunities for the Women´s Affairs Department to contribute additional recommendations on gender and women´s issues, as well as increasing job opportunities for women capable of working in construction.
Request	- The provincial level provides minimal opportunities for women in construction work.

	- Some men working at the provincial level still undervalue women's contributions in the workplace.
Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Department of Environment
Participants	1. Mr. Leng Sameth 2. Mrs. Meas Sovanna 3. Mr. Khoun Chantheng
Coordinators	Mr. Keo Sony
Topic	CAISAR
Perceptions and Concerns	- The general situation regarding environmental management involves project owners collaborating with the department and being encouraged to comply with legal requirements. - The role of the department includes conducting inspections of project activities twice a year.

	- Major challenges include project owners failing to comply with laws, such as discharging liquid waste, a lack of cooperation from project owners, and shortages of funds and materials for enforcement. - The work of the Environmental Department related to the CAISAR project's environmental management program includes resolving land impact issues with local communities, watering dirt roads to reduce dust, monitoring the transport of soil, ensuring legal compliance, and managing fuel and oil waste to prevent contamination of water sources. - Negative impacts: Changes in biodiversity, loss of habitats, and feeding grounds. - Positive impacts: Access to water is ensured throughout all seasons. - Solutions: Restore degraded reservoirs or canals and preserve areas that serve as feeding grounds for wildlife.
Request	- Minimize environmental impacts from project activities. - Address impacts through peaceful methods. - Collaborate with the Environmental Department.
Photo	

Focus Group Discussion	Provincial Level

Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Department of Land Management Urban Planning & Construction
Participants	Mr. Chhun Sokongpheak
Coordinators	1. Mr. Chun Nimul 2. Ms. Toun Samphordavin
Topic	CAISAR
Perceptions and Concerns	- Areas with registered land systems are already listed. - For land disputes involving registered land, resolution must follow legal procedures through the courts and applicable laws, ensuring fair and just compensation. - For land disputes involving unregistered land, resolutions are to be pursued through collaboration under provincial administration, supported by reports from residents highlighting common reasons for disagreement, such as the complete demolition of homes, refusal to accept compensation, or increased land values. - Technical work involves measuring and delineating land plots, waterways, and property boundaries of residents. - There are no concerns regarding land that has already been systematically registered.
Request	- Pre-study is beneficial for solving land issues. - Supporting the restoration of old irrigation systems is good for agricultural work.

Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Department of Culture & Fine Arts
Participants	Mrs. Oun Yada
Coordinators	1. Mr. Chun Nimul 2. Ms. Toun Samphordavin
Topic	CAISAR
Perceptions and Concerns	- The province has 110 registered locations of ancient sites, including temples, monuments, historical sites, ponds, and ancient reservoirs. - The land system includes one temple mound in Pongro Village, Rolabear District. - The project area does not affect any temples or temple mounds.

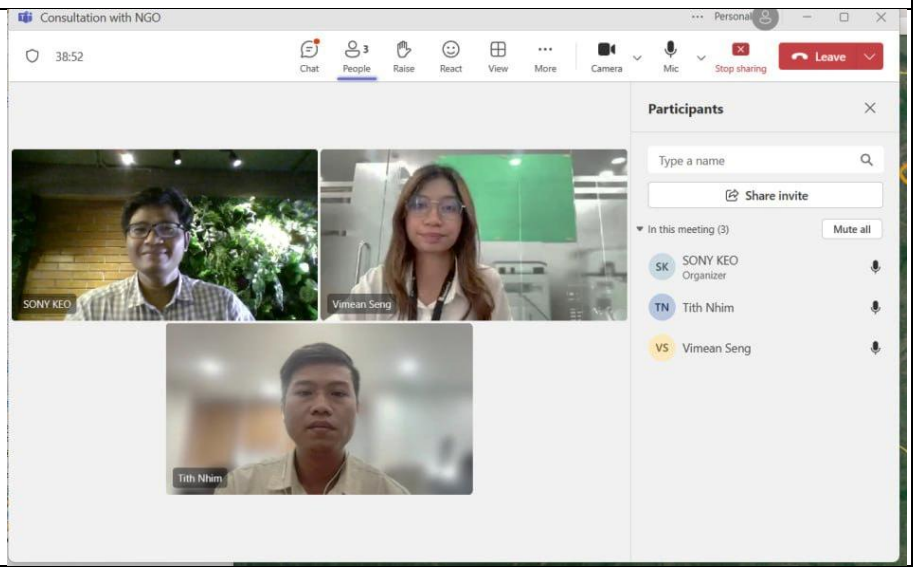
	- The department's role is to protect and maintain these sites, provide information, and report to the Ministry. - There are no indigenous ethnic minorities, distinct cultures, religions, or special areas in the project area, as most of the land consists of old irrigation systems. - There are no temple mounds located within the project area. If any impact occurs, it will be reported to the Ministry of Culture and Fine Arts, which is the decision-making authority.
Request	- Request for set up irrigation system quickly
Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Community Hope Organization
Participants	1. Mr. Rech Panha 2. Mrs. Munh LangHeang

Coordinators	Mr. Nheb Phirun
Topic	CAISAR
Perceptions and Concerns	- The key roles and activities of the organization in the province include mental health, education through the construction of schools, development, installation of solar panels along the roads, sanitation facilities, installation of water wells in villages, teaching sewing and coffee-making (open to anyone interested, without discrimination), covering all 8 districts of the province. - Awareness and perceptions about the project indicate difficulties in reaching the community, especially along water routes. There are high costs for the community to participate in training without fees (such as coffee-making and sewing), and those living near the schools are either unwilling to learn or do not value the training. The community has provided scholarships to 21 students from grades 6 to 12, with amounts ranging from $25 to $35, and one student is receiving $100 per month for studies at a university. - Concerns and potential challenges include the risk of animals or people falling into water and drowning after flooding, loss of farmland, and the destruction of residents' homes. - The impact on aquatic biodiversity may result in the loss or extinction of species, and residents may lose land for farming. If there is an impact, compensation should be addressed properly, including for lost trees. If farmland is lost, people may migrate, making them vulnerable to exploitation, and their children may have to abandon their education.
Request	- Provide appropriate compensation, protect biodiversity and the environment well

Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Rural Water Supply and Sanitation Organization
Participants	1. Mr. Vann Sambath 2. Ms. Seng Vimean 3. Mr. Nhem Tith
Coordinators	Mr. Keo Sony
Topic	CAISAR
- Perceptions and Concerns	- The key roles and activities of the organization in the province include providing clean water and sanitation systems to rural populations and implementing projects that help communities adapt to climate change. - The project will help the population increase agricultural production several times a year. - The relationship between the CAISAR project and the organization ensures that the population receives sufficient water and is resilient to climate change.

	- Concerns and potential challenges include impacts on infrastructure. - The benefits of increasing agricultural production help reduce migration.
Request	- The project should cooperate with local authorities and partner organizations - Educate people's attitudes about using water sparingly - Establish a water management committee for this irrigation system.
Photo	

Focus Group Discussion	Provincial Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	World Vision Cambodia
Participants	Mrs. Lay Lineang
Coordinators	Ms. Sek Liny
Topic	CAISAR
Perceptions and Concerns	- The key roles and activities of the organization in the province include education (primary school), health, nutrition, clean water, sanitation, food security, child protection (youth), Sponsor

	Child, social accounting (in collaboration with partners), and family welfare activities. These efforts include promoting gender awareness in the project and engaging with people with disabilities. The organization has also worked on irrigation systems and roads, and generally, there have been no issues, as everything has been properly planned and cleared. - The implementation of previous projects has not encountered any problems, as all activities adhered to established guidelines. - The organization and authorities consistently participate in child protection and legal age regulations. - Families without land face fewer issues if their needs are not land-related. - The project has helped improve biodiversity, with more livestock farming, increased water availability, more trees planted, reduced costs, water storage facilities, and an increased number of crop planting cycles.
Request	- All sectors must be involved technically - Can not help reduce migration completely until there is a market

Focus Group Discussion	District Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Rolea Bier District Hall, Kampong Chhnang province
Participants	1. Mr. Mey Sophally 2. Ms. Chan Sokly
Coordinators	Mr. Keo Sony
Topic	CAISAR
Perceptions and Concerns	- The sector with potential and a priority for rural development is the agricultural sector.

	- Awareness and perceptions about the project indicate that the local administration of Rolabear District has previously participated in meetings about the watershed system project at the district and provincial levels. - The benefits of the project include the creation of habitats and corridors for biodiversity, and ensuring the population has sufficient water for agricultural production. - The role of the district administration is to collaborate with specialized institutions to identify potential issues and address them. - The main challenges include populations dependent on agricultural resources along waterways or water systems located within the project area. - The district's capacity and human resources include a committee for resolving land disputes outside the judicial system. - The general challenge for farmers is the lack of irrigation water during the dry season and the absence of water infrastructure and reservoirs. - Solutions from the district administration involve restoring irrigation systems and pumping water from sources (watershed areas), constructing systems funded by the district's budget, and involving community participation. - Seedlings: In the first year, people buy seeds from the market, and in the following years, they use their own seeds (seeds can only be saved for 2-3 years). - Fertilizer: Farming requires the use of chemical fertilizers (such as urea and phosphate fertilizers) and compost. - Pesticides: The use of herbicides, insecticides, and fungicides. - Water systems: There is a lack of water for irrigation in agricultural areas due to the absence of infrastructure and water storage reservoirs.

	- Post-harvest: Farmers harvest using machinery. - Production costs: Preparing the land, buying seeds, fertilizer, pesticides, and harvesting. - The situation regarding domestic violence: Domestic violence incidents occur within families. - Victims of violence have filed complaints with village and commune authorities. - The government operates a committee related to violence at the commune and district levels. - To prevent and respond to gender-based violence, awareness campaigns and educational programs on gender are organized at the commune and village levels. - There is concern about the potential for sexual violence against women and children in the area due to the increase in staff for the CAISAR project. - To reduce the risks of gender-based violence potentially caused by the project, project owners must educate and train staff about gender knowledge and rights. - Risks in the area include land disputes and drug use. - Construction companies should prioritize hiring local workers from the area.
Request	- Please ensure the project operates as quickly as possible. - The company collaborates with local authorities. - The project provides significant benefits to the local population in the agricultural sector. - The company is requested to hire local staff and workers for the project.

Photo	

Focus Group Discussion	District Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Teuk Phos District Hall, Kampong Chhnang Province
Participants	1. Mr. Mot Novavi 2. Mrs. Chim Chot 3. Mrs. Ung Sophy 4. Mr. Bit Sary
Coordinators	Ms Sek Liny
Topic	CAISAR
Perceptions and Concerns	- The sectors with potential and priority for local development are agriculture and tourism. - The district is aware of the project to restore and expand the existing irrigation system, which will help provide water for agricultural land.

	- The benefits of the project include enhancing biodiversity due to more water availability, creating a tourism area, allowing farmers to cultivate year-round (2 to 4 times per year), reducing migration, reducing poverty, and offering labor for sale. - The role of the district level is to assist in coordinating the project activities, help resolve issues with affected stakeholders, request solutions from higher levels for the population, ensure affected people receive compensation, and monitor air pollution (informing the company to manage water spray). - There are no more land issues, as the land has already been registered. - The district's human resource capacity is sufficient to address issues according to land law. - The main challenges for farmers in this irrigation system are water shortages during the dry season, market access, pests, and conflicts due to water scarcity. - The causes of these challenges are a lack of water sources and climate change, leading to longer dry seasons. Farmers are losing some irrigation water due to management constraints, and markets are not functioning well because of excessive heat. - Solutions include creating water sources, providing water usage techniques, promoting water conservation, and establishing water resources while helping with coordination. - Seeds: Farmers save 80% of seeds and buy 20%. - Fertilizers: Farmers use chemical fertilizers, organic fertilizers, and natural fertilizers. The use is not ideal yet, and they want regulations or training on fertilizer use according to soil types. - Pesticides: The use of herbicides is considered effective since they kill the grass quickly, and there are only a few pest problems. - Irrigation system: During the dry season, water availability is insufficient. - Post-harvest: 95% of harvesting is done by machine, and 5% is done manually.

	- The situation of domestic violence in families is about 2%, mainly due to alcohol and gambling, but it has decreased significantly, and drug abuse is about 1%. - The victims of violence are not well-known because issues are being resolved at the commune level. The district has not yet participated, as most land-related issues are being resolved at the commune level. - Government actions include laws related to solving violence issues, promoting gender awareness, and ensuring safety in villages and communes. - To prevent and respond to gender-based violence, efforts are being made to involve more men in training programs, as most problems are caused by men. Continued gender awareness campaigns, reducing drug and alcohol abuse, and addressing social media-related issues are also part of the approach. - The increase in personnel in the CAISAR project has not raised concerns about gender-based violence risks, as there have been no incidents involving construction workers in the past. - To reduce the risks of gender-based violence that may arise from the project, relevant parties will conduct site inspections, separate accommodation for men and women, and continue public awareness and gender campaigns. - The risks in this area include violence and drug use. - The company must verify the names, identification numbers, and contact details of workers, inform workers about laws and penalties for wrongdoers, promote gender equality, and ensure that the company has someone responsible for reporting issues to local authorities.
Request	- When construction is taking place, the company or relevant parties must notify the local authorities. - Upon completion of the construction project, notification must be given, and there must be a formal handover, avoiding any secrecy. - Clear work distribution and assignment of responsibilities must be made.

	- Compensation should be provided to the local population, and the company must cooperate with local authorities. - Provide water storage facilities and ensure an adequate water supply for agricultural purposes.
Photo	

Focus Group Discussion	District Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Samaki Meanchey District Hall, Kampong Chhnang Province
Participants	1. Mrs. Se Kem 2. Mrs. Hem Saveth
Coordinators	Mr. Nheb Phirun
Topic	CAISAR
Perceptions and Concerns	- The sectors with potential and priority for rural development are agriculture, the garment industry, seasonal farming, and paddy cultivation. - Awareness and perception of the project include community participation, especially during the dry season, encouraging local

	communities to grow vegetables in rotation. During the rainy season, there is no issue with water, but during the dry season, sufficient water is available to grow crops throughout the year. The village and commune areas have access to irrigation systems. - The impacts and benefits of the project should be studied and minimized, especially when expanding the planting area, dealing with the death of livestock due to irrigation, or contamination of fish and aquatic animals. The community benefits from improved livelihoods due to employment opportunities, which helps vulnerable and indigenous populations without any significant issues. - The role of local authorities is to cooperate with citizens regularly and ensure the protection of the community once the project is operational. - Key challenges in land acquisition for the project include finding ways to balance the benefits to the community, ensuring they can continue to benefit from irrigation activities in the future. - The capacity and human resources at the local level need to be used extensively and persistently, with the district governor playing a key role by being regularly involved in overseeing the project. - The main challenges for farmers in the irrigation system include a lack of rainfall, limited water in some irrigation systems, or excessive water that may flood crops and cause conflicts. - Solutions include better water conservation practices, effective water distribution, and ensuring water is not wasted. - Seed varieties: Farmers purchase seed varieties and also store some of their own seeds as a habit, particularly those for flooding-prone rice strains. - Pest control: Farmers use pesticides as recommended for pest management. - Irrigation systems: The irrigation systems can be used based on their availability and how they were studied in the harvested areas. - Production costs: The cost of buying seed varieties.

	- The situation regarding domestic violence is still a concern, with an occurrence rate of about 3% in the last three years, involving domestic disputes, violence, and economic instability, which leaves victims fearful for their future. - Government interventions include annual action plans to raise awareness among the public, particularly during crises, imposing penalties when necessary, and supporting coordination with organizations to address violence and provide appropriate solutions. - To prevent and address gender-based violence more effectively, efforts should be made to encourage male participation in awareness programs, with perpetrators of violence directly involved in public campaigns. These should be organized at least once a year in 9 communes. - If there is an increase in the number of project personnel, the project should not proceed if there are concerns about gender-based violence. - To reduce the risks of gender-based violence arising from the project, efforts should focus on ensuring proper communication and understanding about the project and fostering family unity. - The risks in this area must be addressed promptly to prevent violence from recurring. - Local leadership in villages and communes must meet to address challenges and resolve issues impacting those directly affected or opposed to the project.
Request	- Help provide crop seeds to families in the community.

Photo	

Focus Group Discussion	District Level
Date	August, 22 2024
Sub-scheme	1. Lum Hach 2. Yutasas 3. Stueng Krang Bat
Organization	Kampong Tralach District Hall, Kampong Chhnang Province
Participants	1. Mr. Ker Mat 2. Mrs. Nuon Hong 3. Mr. Kao Viriya 4. Mrs. Nem Chanthea
Coordinators	Mr. Nheb Phirun
Topic	CAISAR
Perceptions and Concerns	- The sectors with potential and priority for rural development are agriculture (72.2%), handicrafts (0.6%), and factories (27.2%). - The project could enable our population to produce rice two to three times a year. If we can connect the irrigation systems from

	the deep reservoirs, we may have the potential to grow more vegetables. If there is enough water, we can plant rice three times a year, and some farmers may even use the land for industrial crops like chili cultivation. When private individuals restore the area, they must consider the environmental impacts as they rebuild reservoirs and irrigation systems. - Potential impacts may include the loss of fish habitats and environmental degradation, such as soil erosion. - The benefits of the project include reducing rural migration by allowing farmers to cultivate rice two to three times per year. - Land loss due to the project can be minimized by reducing negative impacts through proper boundary demarcation. - The role of local authorities is to facilitate multiple meetings (ideally two or three) to ensure smooth implementation and, if necessary, resolve any conflicts by achieving consensus with at least 70% participation from local stakeholders. - If consensus is not reached, additional meetings should be organized to find common ground. If there are only a few opponents, the project should still proceed. - The local authorities have strong capacity and resources, with district or deputy district governors directly addressing issues. - Challenges include farmers who rely on agriculture but face water shortages for rice cultivation and chili farming. - Solutions include restoring irrigation systems and building reservoirs. - Seeds: Rice seeds are purchased with 90% used for the dry season and 40% for the rainy season. - Fertilizer: The use of organic fertilizers is encouraged, with training on how to use them in local villages, as well as the use of chemical fertilizers such as DAP and Urea.

	- Irrigation system: The current irrigation system is insufficient, as the amount of agricultural land exceeds the available water resources. - Harvesting: A rice harvester machine is used for harvesting. - The situation regarding violence is unclear, but regular meetings are held in the communes, ensuring safety for all participants. - Authorities help facilitate and educate citizens on their rights, encouraging participation through legal and procedural methods. - Government actions include disseminating 13 key points through regular community-based meetings, spreading information directly to local populations through commune councils. - To prevent and respond to gender-based violence, efforts should be made to raise awareness in communes by holding multiple sessions and directly addressing areas where violence is occurring. - Public meetings should be organized three times to ensure appropriate compensation and government authorities should remain engaged with the local stakeholders. - To reduce the risks of gender-based violence arising from the project, authorities should maintain consistent communication with local groups to address concerns. - Communication efforts should include three awareness campaigns, ensuring that the involved individuals participate directly in the process.
Request	- Should not catch the machine when he digs a pond to dry rice - If affected, should move to another place that is not affected or compensate appropriately.

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ANNEX 9.2: RESULTS OF THE CONSULTATIONS WITH COMMUNE COUNCILS IN KAMPONG CHHNANG PROVINCE

Consultation Level	Commune
Date	August 16th, 2024
Sub-Scheme	1. Lum Hach 2. Stoeung Krang Bat 3. Yutasas
Organization	Krang Leav Commune Hall, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Mr. Pho Sok 2. Ms. Kae Hoeurn 3. Ms. Men Chenda
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune has developed key achievements such as roads, bridges, and reservoirs. However, agricultural development has not progressed well due to a lack of water. - Growing rice, cultivating vegetables, and raising livestock are very challenging for farmers in the commune because of water scarcity. They are willing to cultivate, but without water, their agricultural activities rely solely on rainfall. - The commune's role is to help coordinate and manage project activities. - The residents are pleased with the project because, in the future, the entire commune will have sufficient water for cultivation and livestock, enabling them to expand production and improve their livelihoods, which will reduce migration to other areas. - The project also contributes to environmental protection and will create biodiversity, potentially turning the area into a recreational site for residents. - Negative impacts include the displacement of residents affected by land loss, as they previously grew more rice, but now their production has decreased. - This project aligns with the commune's development plan, as the commune had planned to restore the canals but lacked sufficient funding.
Requests	- They want the project to help restore the canals and additional reservoirs.

	- They request to expedite the project implementation to quickly provide water for the residents, enabling them to increase agricultural productivity. - They wish for the ministry to frequently visit, study, and monitor the project closely.
Photo	

Consultation Level	Commune
Date	August 15th, 2024
Sub-Scheme	1. Lum Hach 2. Stoeung Krang Bat 3. Yutasas
Organization	Banteay Preal Commune Hall, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Mr. Prum Thorn 2. Mr. Khoem Chham 3. Mr. Suos Saret
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune has a total agricultural land area of 5,313 hectares, including more than 2,587 hectares of rice fields. Other areas consist of mixed-crop land and forest land that has not yet been allocated to the residents. - Most of the farmers are over 50 years old, while younger, able-bodied individuals have migrated to work in Thailand.

	- Livelihoods in the commune include agriculture, collecting forest products, handicrafts (such as making baskets and mats), trading, and labour work. - Key agricultural activities include rice farming, home gardening of vegetables, and raising chickens, ducks, cattle, buffaloes, and pigs at the household level. There is also one farmer in the commune who raises ducks for egg production on a farm. - Rice farming depends entirely on seasonal rainfall (from June to December). Water flows into the Lum Hach irrigation system and eventually drains into local canals in the village only when it rains. - Vegetable farmers use well water for irrigation. Some farmers living near reservoirs can irrigate their crops using reservoir water, but during the dry season, severe drought can lead to water shortages in the reservoirs. - For drinking water, most farmers rely on well water. Some households have filtration tanks, while others use the water directly. However, the water quality is poor due to arsenic contamination. - A portion of the population living in urbanized areas uses clean water from 20-litter containers, but even this water has limited quality. - Most farmers can only grow rice once a year due to water shortages during the dry season. - Vegetable cultivation is done at the household level on land surrounding their homes, and the produce is sold only within the village. No companies have yet established large-scale purchase contracts. - Livestock farming is still limited and small-scale. - Of the 10 villages, 4 receive water from the irrigation system: Trapeang Phkoam, Toap Srov, and Ou Leach. - The commune will collaborate with the project to assess its impacts and mediate with residents whose land is affected by the project. - The benefits of the project include enabling farmers to cultivate rice 2 to 3 times a year, having sufficient water for vegetable farming, and increasing biodiversity with fish and other aquatic animals. Additionally, it will boost household income through integrated farming. - There are no heritage sites within the commune. - The project may impact agricultural land and pose a risk of drowning for children. - The project aligns with the commune's three-year rolling development plan. Although the commune has submitted a proposal, there has been no response regarding the restoration of the irrigation system. The three-year rolling plan also includes a request to construct check dams

	(water gates) in Ruessei Duoch, Trapeang Phkoamg, and Toap Srov villages.
Requests	- Before implementing the restoration of the irrigation system, the ministry should organize a public forum to gather feedback from residents, especially those directly affected by the project. - The restoration and reconstruction of the Ou Koal should be prioritized. - The irrigation system should be constructed using durable structures (concrete) to prevent soil erosion, canal narrowing, and unauthorized access by the community in the future. - Build check dams along damaged or deteriorated canals and streams, as well as new ones in locations where they are currently lacking. Check dams regulate water levels, allowing excess water to overflow into canals or streams situated at lower elevations.
Photo	

Consultation Level	Commune
Date	August 15th, 2024
Sub-Scheme	1. Lum Hach 2. Stoeung Krang Bat 3. Yutasas
Organization	Krang Skear Commune Hall, Teuk Phos District, Kampong Chhnang Province
Participants	1. Ms. Keo Yan 2. Ms. Phan Sophalla

	3. Mr. Bearn Porn
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune has constructed gravel roads connecting each village, and some village roads have been paved with concrete. - Most of the able-bodied youth have migrated to work in Thailand, in factories across various provinces, or as labourers on plantations. - Krang Skear Commune is a remote rural area, with 99% of the population engaged in agriculture, primarily rice farming and small-scale vegetable gardening at the household level. - There is a growing trend of cultivating fruit trees (such as mangoes, coconuts, and longans) as plantations. - Livestock farming is conducted on a household scale, including cattle, buffaloes, pigs, chickens, and ducks. - Irrigation water comes from reservoirs and rainwater that flows into dug canals (such as Prek 1 Makara, a canal from the Pol Pot era) and streams. However, during the dry season, water is insufficient for rice farming. - In some areas, wells must be dug to support rice farming and vegetable gardening around homes, with depths ranging from 10 to 50 meters. - For domestic use, residents rely on filtered water from shallow wells and tube wells. - Many farmers in Krang Skear Commune cultivate rice once a year, specifically during the wet season, which spans up to six months. - Vegetable cultivation, primarily leafy greens, remains a household-level activity, typically grown on land surrounding homes. - Livestock rearing is still predominantly practiced at the family level, including cattle, buffaloes, pigs, chickens, and ducks. - In addition, the commune has small-scale livestock farms for pigs, chickens, and ducks, which have their own established markets. - Five villages stand to benefit from the canal restoration project: Chan Trak, Trapeang Mlu, Tuol Samraong, Krang Skear, Chambak Prasat. - The project aims to provide: Adequate water for rice cultivation and other crops. Sufficient water for household use. Water resources for livestock farming, particularly for cattle, buffaloes, and pigs. Enhanced aquatic biodiversity, especially fish, in the area. - The project will impact land owned by residents, especially agricultural land. - There are no cultural heritage sites within the commune that will be affected.

	- The commune has proposed plans to restore the Prek Chi and the small canal tributary in specific locations to enhance water distribution. - The commune is ready to assist and collaborate in implementing the irrigation system restoration project. This includes: - Facilitating communication between project stakeholders and affected farmers. - Coordinating with residents to address concerns and ensure smooth project implementation.
Requests	- Before construction, it is necessary to collect data on the land of farmers affected by the project, consult with the residents for their opinions, disseminate information, and notify the community. Coordination with farmers is essential during the project implementation process. - We request the Ministry to urgently assist in raising the dam and restoring the Prek Chi and small canal tributary as soon as possible, to enable farmers to increase rice production for a full year. - Compensation should be considered if the implementation of the irrigation project severely impacts the land of any farmer.
Photo	

Consultation Level	Commune
Date	August 14th, 2024
Sub-Scheme	1. Lum Hach 2. Stoeung Krang Bat

	3. Yutasas
Organization	Longveak Commune Hall, Kompong Tralach District, Kampong Chhnang Province
Participants	1. Mr. Ou Chanmony 2. Mr. Thim Thouern 3. Mr. Srey Saret 4. Mr. Choem Bunthoeurn 5. Mr. Uch Virak 6. Mr. Tok Bunna 7. Miss Sot Tonsreypov 8. Mr. Chhoem Chhoan
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Some of the agricultural land owned by the villagers has been sold to companies. - Most of the working-age population works as factory workers or migrates to Phnom Penh for employment. - The commune has paved roads, and some villages are currently constructing concrete roads as part of the commune's development budget, with additional dirt roads providing access to farmers' fields. - Within the commune, there are textile factories, shoe factories, and beer factories, among others, which discharge wastewater into the streams and canals. - Regarding agricultural potential, all eight villages have 90% of the population engaged in dry-season rice cultivation, which is done only once per year, starting in November when the water recedes, with harvesting in April. - As for vegetable cultivation and livestock raising, these activities are mostly on a household scale, but only a small number of households grow vegetables. They rely on water from wells, ponds, or canals. There are no commercial farms in the commune. - Dry-season rice farming depends on the remaining water in the canals after the river water recedes. - In some villages near the canals that receive wastewater from factories, farmers pump water from the canals for a second cycle of dry-season rice cultivation. - For household use, they rely on clean water from authority. - During the water recession season, farmers begin dry-season rice cultivation. Some farmers grow heavy rice varieties (cultivated only once a year), while others grow light rice varieties to harvest twice a year.

	- Livestock raised at the household level includes cattle, chickens, ducks, and pigs. - The commune will participate in studying, promoting, and facilitating project activities. - The benefits of the project include helping residents increase their income through double cropping per year, growing vegetables for additional income, fishing to sell fish, increasing fish populations, and ensuring sufficient water for agriculture. - There are no cultural heritage sites in the area. - The project may impact small remaining forested areas along the canal banks and result in the loss of some agricultural land. - The commune's development plan highlights the restoration of canals and ponds to support the agricultural sector. In 2024, the commune requested district authorities to restore a pond (Boeng Tuek La'k), but the restoration project was not completed as the company awarded the contract withdrew from the agreement.
Requests	- If the canal restoration is carried out, we request the Ministry to create water gates along the remaining canals to store water for use. - For the Pol Pot-era irrigation system, we ask to maintain its original size and deepen it more than before. - We request that the canal banks be raised to create a two-lane road, approximately 5 meters wide, to allow farmers to drive vehicles to their fields and to provide access for rice buyers. - We request that the Ministry conduct an inspection and address the issue of wastewater discharge from certain factories in the commune. - We request the installation of solar lamps on bridges crossing the canals (such as Krang Punlai Bridge, Ta Hor Bridge, and Kampong Chamlor Bridge) to ensure safety for night travel and to assist residents transporting harvested rice. - We request the construction of a new gate at the Ou-Sleng dam because the old gate is difficult to open and close.

Photo	

Consultation Level	Commune
Date	August 13rd, 2024
Sub-Scheme	1. Lum Hach 2. Stoeung Krang Bat 3. Yutasas
Organization	Svay Commune Hall, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	Mr. Chum Sam Ol
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- People living along the road have shifted to business activities. - Most of the youth with working age leave the village to work in factories or move to Phnom Penh. - Most of the population engages in wet-season rice farming, while dry-season rice farming is done only in small areas near the river or on land with its own water resources. - Regarding livestock farming, nearly all households in the commune raise cattle, chickens, and ducks on a household scale, selling only within the village. There are also agricultural farms cooperating with CP Company, with two farms raising broiler chickens and one farm

	raising pigs. Additionally, there is a private farm raising about 200 to 300 ducks. - The water used for wet-season irrigation comes from the river, while dry-season irrigation uses water from canals and ponds. Household water comes from clean water supplied by the authorities. - In the past, people would thresh rice by hand, but now there is a shortage of local labour, so mechanized methods are used, which leads to a higher need for agricultural inputs. - There are two vegetable farms in the commune, and in addition, vegetable cultivation is carried out on a household level. - Six villages benefit from the project, including Chamkar Village, Ang Chhuk Village, Trapeang Boun Village, Trapeang Thma Village, Tuol Pongro Village, and Svay Pok Village. - The commune will participate in promoting and facilitating the restoration project. Currently, the commune has its own fund to support the maintenance of the dam. - The benefits of the project include providing farmers with sufficient water for irrigation, reducing fuel costs, enabling vegetable cultivation, and supporting the raising of ducks, fish, and crabs. It will also reduce the need to buy water and improve the health of both animals and people, as well as provide food and fish breeding grounds that people can fish from. - The commune does not have any cultural heritage sites. - The potential impact could affect some of the agricultural land. - The commune has a plan for the project, but no funding has been secured for the restoration yet. Currently, there is a development plan for the irrigation infrastructure, but it has not been implemented due to the priority need to construct concrete roads into the village and repair existing dirt roads first.
Requests	- For the irrigation system restoration project, if it impacts agricultural land that is severely affected, please consider appropriate compensation measures to prevent discouragement among the local population. - Please study methods to preserve or store more water during the dry season in each area and expedite the implementation of the project, as the local population is currently facing water shortages. - Please collaborate with agricultural experts if the water distribution project is implemented. - We request the Ministry to assist in constructing a handrail on the side of the water gate dam, as this area is frequently crossed by residents daily.

Photo	

Consultation Level	Commune
Date	August 14th, 2024
Sub-Scheme	1. Lum Hach 2. Stoeung Krang Bat 3. Yutasas
Organization	Kampong Luong Commune Hall, Ponhea Lueu District, Kandal Province
Participants	1. Mr. Nhem Punleur 2. Mr. Chim Chhen 3. Mr. Prak Pao
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune has developed concrete roads and dirt roads to each village. - Most of the agricultural land in this area has already been sold to companies, with only about 20% of the land remaining under the ownership of the local population. This land requires water from the Stoeung Krang Punlei for irrigation, while the rest is located farther from the river mouth. - In terms of agriculture, the population engages in rice farming, vegetable cultivation on a household scale, and raising ducks, cattle, chickens, and ducks. One household also raises fish in their own pond. - Farmers near the Stoeung Krang Punlei use its water for irrigation on their fields. - The clean water system has been extended along the national roads for residents, while those living in villages farther from the roads rely on well water. - For consumption, the population uses purified water (from 20-litter containers), water from hand-dug wells that is filtered with a mesh, and piped water from pumps, which is filtered before consumption. - Most farmers in the area manage to cultivate two rice crops per year, specifically light rice. The first crop is from January to March, and the second crop is from April to June.

	- Some farmers grow only one crop per year, but after harvesting the rice, they plant vegetables on the same land, using well water for irrigation. - Livestock farming requires minimal resources in the area. - To address issues, the commune will collaborate with the Ministry to coordinate the project, communicate updates to the public, and raise awareness about the environmental impact, especially water pollution in the area. - The benefits of the project include providing water for some farmers, allowing drainage for flooded areas during the rainy season, supporting local fisheries, and offering habitats for fish to thrive and reproduce. - The Rajanilongvek Eco-tourism site might benefit from additional views of the river mouth. - Over 500 farming households live along the river mouth and rely on river water for irrigation. - There is potential to cultivate mixed vegetables for additional household income. - The project could affect some farmland, particularly for families with land along the river mouth. - It might also impact some trees growing along the river mouth. - The project would affect the farmland of over 100 farming households and land owned by companies near the river mouth. Notably, it severely impacts the land of one household who built their home right on the river mouth (in Kla Tram village). - The commune has previously requested the Ministry of Water Resources to restore this river. - The commune does not have sufficient budget plans for this project now.
Requests	- A request is made to deepen the river to improve water drainage for areas affected by flooding during the rainy season. - A request is made to repair a water gate at the intersection of Prek Chrov and Lao Khav, as the current gate is too small and cannot adequately release water during the rainy season. - A request is made to study the situation at the Rajani Bridge, located near the Ta Chan dam, because there is a small gap for water flow that needs to be addressed. - A request is made to construct a head dam in the Peam Chinik village to help retain water for agricultural use.

Photo	

ANNEX 9.3: RESULTS OF THE CONSULTATIONS WITH VILLAGE CHEFS IN KAMPONG CHHNANG PROVINCE

Consultation Level	Village Chef
Date	August 13rd, 2024
Sub-Scheme	Yutasas
Farmer Group	Svay Pok Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	Nhem Non
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The villagers face issues with poor-quality animal feed, unhygienic conditions, and food that is overly chemically processed. - Some villagers are struggling with limited access to water and lack the means to buy water pumps. Renting water pumps is expensive, making it difficult for them to meet their needs. - The village has 223 households that rely on the irrigation system for their water supply. - There are community officials managing the water distribution system, such as the dam gatekeeper. - The quality of water in the irrigation area is good. - The construction of the irrigation system has not caused any harm to the people's assets or cultural sites. - The project will provide water for both agricultural work during the rainy and dry seasons, as well as for animal husbandry. It is expected to boost the local economy and could help create a tourism area, providing additional income for villagers.
Requests	- Request assistance from the Ministry of Public Works to repair the dam embankment. - Ask the Ministry to install metal gates for the water dam (Ta Pring) and the embankment (Ta Nang). - Help to repair the embankment (Pou Sim), which is currently at risk of damage. - Request to install solar panels for lighting the road to the Yutasas dam
Photo	

Consultation Level	Village Chef
Date	August 13rd, 2024
Sub-Scheme	Yutasas
Farmer Group	Svay Pok Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	Mr. Dik Hakk
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent illnesses in the village include climate change (extreme heat) and mosquito bites, which cause diseases such as malaria and dengue fever, with higher occurrences during the rainy season. - Approximately 70% of the villagers use water from the irrigation system, while the remaining 30% rely on river water. - There is a shortage of water, especially during the rice reproductive stage, as there is no water supply to the fields, causing crop damage. Farmers must wait for water from Svay Pok, which only flows to them after farmers in that area have sufficient water. - The Water User Community is responsible for managing the irrigation system. - The current canals are shallow, storing only a limited amount of water. - The project will provide sufficient water for agricultural activities, increase water storage capacity, allow for additional rice cultivation during the dry season, and support vegetable farming. - The project may impact the farmland adjacent to the canals. When water is released, it may flood the villagers' fields, damaging crops and affecting approximately 60 households.
Requests	- Compensation will be provided to the affected households for the farmland impacted by the construction. - A water reservoir and gates will be constructed to retain water.
Photo	

Consultation Level	Village Chef
Date	August 13rd, 2024
Sub-Scheme	Yutasas
Farmer Group	Krasang Pul Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	Mr. Chea Sary
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent illnesses in the village include a lack of water for daily use and pollution from factory emissions. - Approximately 310 households in the village rely on water from the irrigation system. - During the dry season, the canals do not have enough water, and villagers must take turns pumping water, which is time-consuming. - There is currently no designated authority managing the irrigation system; instead, everyone in the village has equal access to it. However, those with land adjacent to the irrigation system participate in its maintenance. - The water quality in the irrigation system is poor, characterized by a murky and heavily turbid appearance. - The project will help villagers increase productivity and access water for irrigation beyond rice farming, such as growing vegetables and raising livestock. - Approximately 50 households will be affected by the project. They feel concerned and regretful about losing their farmland, but they acknowledge that the project must proceed, and the land has already been excavated.
Requests	- The project will restore and improve the irrigation system within the village.
Photo	

Consultation Level	Village Chef
Date	August 13rd, 2024
Sub-Scheme	Stoeung Krang Bat
Farmer Group	Oknha Pang Village, Longveak Commune, Kompong Tralach District, Kampong Chhnang Province
Participants	Mr. Chhoem Chhorn
Moderator	Mr. Ly Visoth

Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent illnesses in the village include mosquito bites causing dengue fever among children and dietary habits leading to diseases like diabetes and hypertension. - The canal lacks water during the dry season, and if there is no rainfall at the beginning of the wet season, the canal remains dry. - Villagers with land adjacent to the canal are responsible for maintaining it. - The water quality in the canal is poor due to polluted wastewater discharged from a nearby bag manufacturing factory. - Approximately 50 households in the village rely on water from the irrigation system. - The construction project on this canal will affect approximately 100 plots of land belonging to the villagers. - The villagers will not agree to the restoration of the irrigation system unless appropriate compensation is provided. - The project will help address the water shortage for dry-season rice farming and crop cultivation.
Requests	- The ministry should consider providing fair compensation for the land affected by the project.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Chan Trak Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	Mr. Pon Bunly
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The factors contributing to frequent illnesses in the village include poor sanitation, lack of access to clean water, limited knowledge, and food containing excessive chemicals. - If the irrigation system reaches the village, 90 households will benefit from it. - The main challenge faced by farmers is the lack of water, as the current irrigation system has not yet reached the village. - Villagers will have access to water for irrigating their agricultural fields.

Requests	- They request the department to conduct technical training sessions on agricultural practices. - They also wish for the canal to be deepened and for the construction of branch canals to reach the village.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Trapeang Mlu Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	Ms. Chey Puthy
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The main factor contributing to frequent illnesses in the village is climate change. - Approximately 50 households in the village rely on water from the irrigation system. - A major challenge is the insufficient water supply during the dry season. - The canal in the village currently has no designated management authority; all farmers share the responsibility for its maintenance. - The water quality in the irrigation system is good. - The project will impact the land of around 50 households living near the canal. - Affected households initially feel upset, but the commune has organized outreach sessions to explain the project's benefits. Since they have land within the village for resettlement, they can relocate if necessary. - The project will provide sufficient water for crop cultivation and rice farming in both the dry and wet seasons. It will also enable villagers to engage in fishing, supporting their livelihoods and increasing household income. - The project will help reduce the number of family members migrating to work abroad or in distant provinces.
Requests	- Request the restoration project to be completed as quickly as possible.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Krang Skear Khang Tboung Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	Mr. Soam Sary
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The primary factor causing frequent illnesses in the village is frequent climate change, which affects the health of the population. - Only 7 households in the village rely on water from the irrigation system, while the rest use their own wells and ponds. - A key challenge is the insufficient water supply for pumping, as the water in the stream often runs out after each pump cycle. - The canal in the village currently has no management authority. - The water quality in the canal is poor, as fallen leaves contaminate the stream, making the water muddy and suitable only for livestock consumption. - The project will not affect cultural heritage sites but will impact farmland and plantations near the stream. - Affected households feel disappointed about losing some of their land near the canal and will demand compensation if their land is excavated. - The project will provide the community with a reliable irrigation system, ensuring sufficient water for various needs, including rice field irrigation, vegetable cultivation, and farming. - Additionally, the villagers will be able to fish in the water system, enhancing food security and income.
Requests	- Requests the restoration of the old stream within the village.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Andoung Preng Village, Krang Leav Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	Mr. Keo Heng
Moderator	Miss Yeab Dalin

Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The main factors causing frequent illnesses in the village are poor nutrition, climate change, and an increase in mosquitoes during the rainy season. - Currently, there is no irrigation system in the village. - The quality of the water (from wells) is poor due to the presence of heavy metals. - The project will impact the land of villagers, and affected households are demanding compensation. - Once completed, the project will provide water for household use, support additional livestock farming, and enable rice cultivation in both the wet and dry seasons. - The villagers support the construction of the irrigation system.
Requests	- They request the immediate construction of the irrigation system and the restoration of the canal.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Krang Leav Village, Krang Leav Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	Mr. Hem Sarom
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The primary factor contributing to frequent illnesses in the village is climate change, which often causes flu outbreaks. - Approximately 222 households in the village rely on water from the irrigation system. - The main challenge is the insufficient water supply during both the dry and wet seasons. - Currently, the irrigation system is managed by the abbot of the local pagoda. - The quality of the canal water is suboptimal, while the groundwater contains a high level of minerals, particularly lime. - Regarding land impacts, the commune has already allocated land for canal restoration. - Affected households, around 10 to 15 families, feel regretful about losing their land.

	- The project will provide sufficient water for crop cultivation and rice farming in both the dry and wet seasons, helping to increase household income. - Villagers will also be able to fish, contributing to their family's food security. - The project is expected to reduce the need for family members to migrate for work to other provinces or abroad.
Requests	- The restoration of the irrigation system to be completed as soon as possible.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Srae Veal Village, Krang Leav Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	Ms. Phen Chanthorn
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent illnesses in the village are caused by the consumption of chemically treated vegetables and climate change. - Only 5 households in the village use water from the irrigation system, while others rely on groundwater and rainwater for farming. - The main challenge is the lack of sufficient water to increase crop yields and rice production. - There is no management authority overseeing the village's irrigation system. - The quality of canal water is poor, and the groundwater contains a high level of contaminants. - The project will have minimal impact on the land of households near the irrigation system, and no significant problems are expected when restoring the system. - Affected families have no objections to the construction or restoration of the irrigation system, and they are satisfied with the project. - The project will help provide adequate water for expanding rice cultivation and increasing other crop production.
Requests	- Requests assistance in restoring or constructing the irrigation system.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Preal Village, Banteay Preal Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	Ms. Nim Sarith
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent illnesses in the village are caused by many mosquitoes during the rainy season, leading to an increase in malaria cases, as well as climate change factors. - Only 16 households in the village use water from the irrigation system; the rest rely solely on rainwater for farming. - The main challenge is the lack of sufficient water for irrigation. - There is no management authority overseeing the village's irrigation system. - The quality of canal water is poor, and the groundwater is contaminated with a lot of salts. - The project will impact the land of about 25 households, but it is not expected to cause significant issues. - Affected households are requesting compensation for the loss of land. - The project will help ensure sufficient water for irrigation, enabling multiple cropping seasons and providing more water for better rice yields and crop production. - The community can also fish from the irrigation system.
Requests	- Compensation is requested for the households affected by the land loss. - The project aims to restore and improve the quality of the irrigation canals.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Sdok Kabbas Village, Banteay Preal Commune, Rolea B'ier District, Kampong Chhnang Province

Participants	Ms. Nov Saoky
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The cause of the frequent illnesses in the village is unclear. - Only 4 households in the village use water from the irrigation system, sourced from canals, ponds, and rainwater. Other households do not have land for farming. - The villagers do not engage in dry season (winter) rice cultivation. - The main problem is that the canals are dry during the dry season, and both the pond and stream lack sufficient water. - There is no management authority overseeing the village's irrigation system. - The project will not affect the cultural areas of the village, but it will impact the agricultural land of the villagers. - Affected households are disappointed about losing their land, but they still support the project. - The project will help the villagers by providing a functional irrigation system, allowing them to cultivate crops and irrigate fields during both the rainy and dry seasons.
Requests	- There is a request to restore the pond and canal systems to meet the village's irrigation needs.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Sdok Kabbas Village, Banteay Preal Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	Ms. Nov Saoky
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent illnesses in the village are caused by a lack of sanitation (Diarrhea, fever, stomach diseases), climate change leading to epidemics, and mosquito bites causing malaria. - Only 20 households in the village use water from the irrigation system. - The villagers do not practice dry-season rice farming. - The main issue is the absence of water storage ponds for agricultural use during the dry season.

	- The government manages three large reservoirs (0.35 hectares) and a cattle pond (2 hectares), while farmers manage other smaller ponds. - The water quality from the irrigation system is not good, and the underground water contains many pollutants. - The project will not affect cultural areas or the agricultural land of the villagers. - The project will provide a water storage pond that can support the villagers' fishing activities.
Requests	- A study is requested to examine the possibility of placing water sediment in the streams to allow the water to flow into the fields. - The project will include the restoration of a new irrigation canal from the water sediment storage area. - The construction of the new canal will involve using the land to form an irrigation canal entrance.
Photo	

Consultation Level	Village Chef
Date	August 15th, 2024
Sub-Scheme	Stoeung Krang Bat
Farmer Group	Trapeang Chambak Village, Longveak Commune, Kompong Tralach District, Kampong Chhnang Province
Participants	Ms. Kong Samut
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent illnesses in the village are caused by the lack of proper sleep for the population, and parents do not have time to properly care for their young children. Elderly people often suffer from diabetes due to consuming excessive amounts of sweet foods. - Only 60 households in the village use water from the irrigation system. - The main issue is the inability to grow crops in the dry season due to a lack of rain and insufficient water in the irrigation canals. In addition, fishers in the area have blocked the water gates, preventing water from flowing into the village's irrigation systems. - The village irrigation system does not have any management. - The water quality is poor, as it is polluted by waste runoff from factories, and it can only be used for farming and livestock purposes. - The project will not affect cultural areas but will impact the land of villagers living near the irrigation canals.

	- Families whose land is affected feel disappointed about losing their land and will demand compensation if their land is damaged during construction. - Once the project restores the old canal in the village, it will allow water from the surrounding irrigation systems to flow in, providing enough water for farming and crop cultivation.
Requests	- The project will help restore the irrigation canals in the village, making it easier to receive water and connect the main canal to the village's irrigation systems.
Photo	

ANNEX 10.1: RESULTS OF THE CONSULTATIONS IN KAMPONG SPEU PROVINCE

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	4. Krapeu Truom 5. Brambei Mom
Organization	Kampong Speu Provincial Hall
Participants	1. Mr. Chet Dom 2. Ms. Prak Leakkhina
Moderator	3. Mr. Chun Nimul 4. Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The agricultural sector in both regions has fertile land suitable for growing rice and other crops. - There are no major concerns as the local population is willing to cooperate, though there may be issues with land disputes. - Negative impacts mostly occur during construction (such as difficult terrain and challenging travel) and land impact. - Positive outcomes post-construction includes better roads, water distribution systems, and access to water in the area. - There are no environmental or natural impacts, and biodiversity can improve once the project is completed. - The living conditions of the local population have improved overall, benefiting both landowners involved in agriculture and non-landowners through wage labor, offering jobs to the poor in manual labor roles (wage labor and physical work). - The general situation of resettlement issues and management solutions in the province largely involves conflicts between private land project companies and local populations, with some grassroots movements opposing regional development. - Technical issues arise in various aspects of resolution, and there are financial resource challenges.
Requests	- Request to construct a concrete system for long-term use (with a focus on quality) for both the irrigation channels and the main canal. - Request to improve and enhance the quality of the water reservoirs, drainage ditches, making them more efficient and modern, as well as to repair the current water gates due to flooding issues. - Consideration for the local population during the construction phase and after the completion of the project.

	- Request for the project to proceed quickly.
Photo	

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Department of Agriculture Forestry and Fisheries, Kampong Speu province
Participants	Mr. Chea Hokly
Moderator	1. Mr. Chun Nimul 2. Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The use of medium-sized rice seeds for the dry season (150kg-200kg for male and 20kg-30kg for female) and wet season (150kg-200kg for male and 20kg-30kg for female). - Five communes have rice farming areas: 1860ha for the wet season and 30-50ha for the dry season. - Most farmers in this region purchase rice seeds from companies and community seed producers. Local land beans are saved by the farmers, and vegetable seeds are bought from companies.

	- Fertilizer usage: 70%-80% of farmers use fertilizer twice, and 20%-30% use fertilizer three times. - Most farmers do not use pesticide; they only use herbicides and insecticides. - Labor hiring is rare; most work is done manually or with machines. - Farmers here sell rice depending on the type. For fragrant rice (e.g., jasmine), they sell it immediately at a high price (wet 1100 Riel), while for regular rice, they store it at home until it dries, then sell it at a higher price (wet 800-900 Riel, dry 1500 Riel). - Issues faced include water scarcity, agricultural inputs, and the lack of livestock to produce fertilizer. - Pesticide use is minimal, and bans on usage are not enforced. - Irrigation systems are inadequate; storage reservoirs are limited to upper sections such as the Tasal, Talong dam, and the Tonle Prek river. The province has areas that are flooded or dry. - Harvesting is done using machines. - Production costs: Fertilizers, pesticides, and fuel are expensive. - Vegetable production that should be promoted focuses on the market, depending on farmers and farming communities. - The region is suitable for farming, especially when farmers gather according to community plans. - The vegetable market relies on the community's connection to traders and other local networks. - Fish species are unclear, and farmers often lack time, as most work in factories. - Labor issues include a shortage of workers and irregular income. - There are 31 training courses in 31 communes, equal to 31 villages. - Training topics include vegetable and rice farming techniques. - Farmers typically cultivate rice three times a year. - Besides the ministry, farmers receive training on rice production through some programs from World Vision and government projects.
Requests	- Assist in properly organizing the irrigation system.

Photo	

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Department of Water Resources and Meteorology, Kampong Speu province
Participants	Mr. Huong Eksamnang
Moderator	1. Mr. Chun Nimul 2. Miss Tuon Somphorsdavin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The current water sources are insufficient due to most of the dams in the province being small dams. - The development of water resources in the province faces issues and obstacles, particularly a lack of financial resources. - The 35 communes have farming communities using water, but the systems are not yet operational. There are human resources, but no materials available. - The management of the department is the best coordinator for connecting with the communities. - However, most of the farming communities using water have failed due to the entry of industrial investment companies into the region. - The total irrigated area in the province is 65,000ha for both dry and wet seasons, with 75% of the irrigation systems being in poor condition (most systems are damaged).

	- The importance of irrigation systems in improving living conditions is that they reduce poverty and improve the lives of the people in the region, helping landowners with farming and providing work opportunities for landless individuals.
Requests	- Do not take too long to conduct the study for the project. - Request for the project to proceed quickly.
Photo	

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Department of Women's Affairs, Kampong Speu province
Participants	Ms. Phun Phin
Moderator	Mr. Keo Sony
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Industrial development has led to female family members working in garment factories, resulting in a lack of water for agricultural use. - There is violence within families and cases of sexual assault. - Victims are concerned about personal safety and fear that pursuing legal action could result in retaliation from the perpetrator's family. - The Women's Affairs Department works with institutions and partner organizations to provide legal services and vocational training for victims. - The department has addressed incidents through public awareness programs on gender in collaboration with local authorities and communes, working with partner organizations such as CSC (legal aid

	organization), CWCC (organization helping women in crisis), and LWD (Life with Dignity). - The department provides support to victims through legal and social services. - The department prepares monthly gender reports for submission to the Ministry. - The department resolves cases by preparing complaints for the court and providing psychological and legal counseling. - Government initiatives include the "Rattanak Women's Strategy Plan," the "National Action Plan to Combat Violence Against Women and Children," and collaboration with partner organizations. - To prevent and better respond to gender-based violence, efforts include increasing public awareness of gender issues and legal challenges faced by offenders, creating gender-related community networks at the grassroots level, and ensuring regular gender report collection at local levels (district, commune, village). - The increasing number of personnel in the CAISAR project has raised concerns about company workers engaging in violence against people (sexual assault). - To mitigate the risk of gender-based violence associated with the project, the company must train staff on gender issues and collaborate with local authorities and relevant institutions to provide personnel data. - The primary risk in this area is sexual assault. - Construction companies involved in coordinating and providing living and restroom facilities must separate accommodations and restrooms for men and women. They must also provide gender training to staff and workers, collaborate, and report incidents at project sites, ensuring public awareness of the project's presence to local authorities and the community.
Requests	- The project will reduce migration. - The project will increase agricultural production. - It is requested that women be included in the management committee of the irrigation system.

Photo	

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Department of Environment, Kampong Speu province
Participants	Mr. Koy Sonin
Moderator	1. Mr. Keo Sony 2. Mr. Nhoeb Phirun
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The general situation of environmental management by the Department of Environment for development projects in the province involves coordinating with local authorities and communities to ensure the smooth implementation of the project and encouraging companies to comply with the law. - The role of the Department of Environment includes preparing agreements (for areas under one hectare) and collaborating with ministries. - The work of the Department of Environment related to the environmental management program for the CAISAR project involves preparing the Environmental Impact Assessment (EIA) in collaboration

	with the Ministry of Environment. For any project funded by ADB, World Bank, or similar organizations, an EIA must be prepared. - There are no significant areas of biodiversity resources, only agricultural land. - The project provides benefits to biodiversity resources by providing habitats and relocation opportunities for species. - Solutions include placing hazard signs and water irrigation along transportation routes. The company collaborates with local authorities to address the impacts of project activities on land use.
Requests	- The company implements its own plan. - Collaborates with local authorities. - Prepares a report to monitor project activities every 3 months.
Photo	

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Svay Kravan Disabled People's Federation Organization, Kampong Speu province
Participants	Mr. Vann Sambath
Moderator	Mr. Keo Sony
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project

Perceptions and concerns	- The role and key activities of the organization in the province involve advocating for persons with disabilities, protecting the rights of persons with disabilities, promoting disability rights to private partners, and providing assistance to persons with disabilities. - The project will help the population increase agricultural production multiple times per year. - The relationship between the CAISAR project and the organization is to improve agricultural production. - The impacts, benefits, and changes brought by the CAISAR project include creating shelter and pathways for biodiversity resources, providing opportunities for the population to increase agricultural production or participate in reducing migration.
Requests	- Provides opportunities for farmers to engage in agriculture multiple times per year. - Reduces the risks of floods and droughts.

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Kong Pisei Integrated Agricultural Community, Kampong Speu province
Participants	Mr. Chea Ratha
Moderator	Mr. Nhoeb Phirun
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The community has participated in the election process and the declaration of the provincial district council. A training session for the community has been organized, covering livestock farming, fish farming, and vegetable cultivation for all districts throughout Kampong Spue province. - Farmers are knowledgeable about fish farming, livestock farming, and vegetable cultivation, but currently, these projects have been discontinued. - There is limited communication due to the farming-related issues they are involved in. - There are no impacts as long as the project starts quickly; the benefits and environmental improvements will continue to improve. - Living conditions and migration are not an issue if land measurement and planning are carried out correctly. - Vulnerable groups, including women, children, ethnic minorities, and communities with cultural backgrounds, face no issues if the impacts

	have already been addressed or if land exchange has been completed.
Requests	- Accelerate construction to ensure it is completed in time for the planting season of the population. - Establish a community to protect water usage or pay fees for construction and repairs.
Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Oudong Me Chey Town Hall, Kampong Speu province
Participants	1. Mr. Kong Sophannak 2. Mr. Keo Borey 3. Mr. Yoeng Soyen 4. Mr. Mak Samoeurn 5. Mr. Sok Khanit 6. Mr. Um Vann
Moderator	Miss Sek Liny
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The sector with potential and a priority for rural development is agriculture (75%) (rice, vegetables, groundnuts, watermelons, Chinese broccoli, and cabbage), followed by handicrafts (10-20%), tourism, and industry (factories). - The district is aware of the project to restore and expand the existing irrigation system, which helps facilitate water delivery to agricultural land. Once land prices drop, farmers return to farming. - The impact is the dry season causing water shortages. - The benefits of the project include providing water for livestock and fish, reducing migration, improving the livelihoods of the population, increasing agricultural production, providing additional jobs for landless people through selling labor, and starting small businesses because there are many people in the district (reducing migration). - The role of the district is to facilitate project activities and advise the company on how to reduce pollution (water and air pollution). - There are no more land issues because the land has already been registered. - Meetings are held to find solutions and provide compensation to those affected.

	- The district's capacity and human resources for those with land titles: resolve through legal channels; for those without land titles: assist in facilitating solutions. - The main challenges for farmers are water shortages, lack of water storage, pests, crop diseases, lack of capital, lack of labor, and poor crop growth due to climate change and flooding. - Challenges include insufficient irrigation systems (water has to be taken from dikes and reservoirs). The dry season lasts too long, and the water level of dams is too high, preventing the flow of water. In the plan, there is no land allocation for rice cultivation, but farmers have cultivated 20 hectares. When there is heavy rain and high water, they open the dam, which causes water to overflow and damage fields. - Solutions include using chemical and organic pesticides, borrowing money from banks, planting vegetables in small greenhouses, providing agricultural training to farmers, and issuing emergency alerts when water exceeds 3 meters. - Seed retention: keep 90% and buy 10%. - Fertilizer: use chemical fertilizers, which are required annually, and compost (chicken, pig, and duck manure). Some farmers use both, but sometimes only chemical fertilizers. - Pest control: No use of insecticides, only weed killers. - Irrigation system: There is enough water in the rainy season; some years, about 500 hectares of rice land may be flooded for 3-7 days. The dry season does not have enough water, and there is a shortage of water storage. - Service fees for the irrigation system: The community pays 40,000 KHR/ha for water in the village area, 20,000 KHR/ha for drained land, and 10,000 KHR/ha for pumped land. - Harvesting: 90% is machine harvested, and 10% is hand-harvested (for seed selection). - The situation regarding violence includes 2 cases of sexual abuse and 1 case of physical violence. - Victims, particularly women, may still be hesitant to speak out but have become braver in reporting and filing complaints. - Government operations include existing laws for resolving and publicizing gender issues. - To prevent and respond to gender-based violence, efforts include continued gender awareness campaigns, strict punishment for perpetrators, and efforts to reduce the spread of drugs. - The increase in the number of staff in the CAISAR project poses no problems, as no issues have been caused by construction workers so far. - To reduce the risk of gender-based violence, the project involves allocating separate accommodation for men and women, advising

	workers on laws and punishments for violations, and promoting gender equality. - Risks in the area include violence and sexual harassment. - The construction company facilitates and completes work by allocating separate accommodation for men and women, advising workers about laws and punishments for violators, and promoting gender equality.
Requests	- Increase water sources to help reduce migration, which in turn helps reduce sexual violence through living together with family. - Request the water resources department to expedite construction. - Provide water storage facilities and ensure sufficient water for agricultural activities.
Photo	

Consultation Level	Provincial
Date	August 23rd, 2024
Sub-Scheme	1. Krapeu Truom 2. Brambei Mom
Organization	Thpong District Hall, Kampong Speu province
Participants	1. Ms. Say Sean 2. Ms. Seng Samrong 3. Mr. Sao Vat 4. Mr. Sem Chea 5. Mr. Long kakada
Moderator	Miss Sek Liny
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project

Perceptions and concerns	- The sector with the potential and priority for rural development includes agriculture, agro-industry, industries (such as garment factories and sugar factories), and tourism. - It is known that there are plans to restore and expand existing irrigation systems, helping to facilitate water supply to agricultural land. - Areas with high biodiversity, habitats for various species, and a conducive environment help increase fish flow if developed in stages, without negatively impacting the environment, while also creating tourist destinations in the region. - The living conditions of the population and migration could impact some lands, but it can increase yields through the availability of water, and farmers need agricultural techniques and good market access. - Vulnerable groups and indigenous peoples can sell their labor. - The role of the district is to assist in coordinating the project activities, resolving issues with affected populations who are beneficiaries, and promoting participation in water system conservation. - There are no further issues as land titles have already been registered. - The district's capacity and human resources can resolve some issues at the local level through legal land rights and requests for additional support from the provincial level in case of more serious problems. - The main challenges for farmers include flooding, water scarcity (during the dry season), pests, labor shortages, animal diseases, and unstable markets. - The reasons for the issues stem from heavy rains, dam construction, the draining of some ponds, climate change leading to longer dry seasons, water management issues, pest outbreaks due to drought, cross-border movement, increased factory operations, and declining livestock breeding and trust in the population. - Solutions include emergency relief movements, establishing water storage facilities, promoting water usage, collaboration with relevant ministries and agencies to educate on water conservation, and introducing modern agricultural methods. - Seedstock: 90% are kept by farmers (who select seeds for planting) and 10% are purchased. - Fertilizers: 50% chemical fertilizers and 50% organic fertilizers (from poultry, pigs, and ducks), used according to vendor advice. - Irrigation system: Insufficient water during the dry season. - Irrigation service fees: No fees have been collected yet due to insufficient water supply to meet demand, and the infrastructure is not yet adequately organized. - Harvesting: 90% is done by machine, and 10% by hand (for seed selection or when machinery is not available). - Violence situation: Cases of sexual assault and violence.

	- Vulnerable families have filed complaints, and more people are coming forward to file complaints than before. - Government interventions include the Ratanak Women's Book, which provides legal resolutions, public awareness campaigns, and gender education to the public, with a GBV team to assist in resolving issues. The team provides confidential assistance, including counseling, without exposing the identities of victims, and consultation groups are formed to resolve and offer psychological support. - To prevent and respond to gender-based violence, continued awareness campaigns on gender are needed, along with strong penalties for perpetrators, efforts to reduce drug use and alcohol, and addressing social media issues. There should also be campaigns promoting safe communities in rural areas. - There has been no issue with the increased number of staff in the CAISAR project because there have been no issues caused by construction workers in the past. - To reduce the risk of gender-based violence that could arise from the project, related parties should conduct site checks, separate accommodations for men and women, provide legal guidance to workers, and impose penalties for offenders. - Risks include issues related to violence and sexual assault. - Construction companies coordinating and completing their work should provide workers with information on laws, penalties for offenders, and promote gender equality.
Requests	- Request for the construction project to hire workers from the local area. - Accelerate construction. - Provide water storage facilities and ensure there is enough water for agriculture.
Photo	

ANNEX 10.2: RESULTS OF THE CONSULTATIONS WITH COMMUNE COUNCILS IN KAMPONG SPEU PROVINCE

Consultation Level	Commune
Date	August 12th, 2024
Sub-Scheme	1. Brambei Mom 2. Krapeu Truom
Organization	Sangkat Preah Sre Hall, Oudong Me Chey District, Kampong Speu Province
Participants	1. Mr. Tim Sanou 2. Mr. Chhay Aem 3. Mr. In Thy 4. Mr. Huy Seng
Moderator	1. Mr. Chun Nimul 2. Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Most of the development in the district focuses on the construction of road infrastructure. - The district's population mainly consists of farmers, with some individuals along the roads engaged in businesses, and youth migrating for employment. - Agricultural activities mainly involve rice cultivation, vegetable farming, and livestock raising. - For the wet season irrigation, water is sourced from the reservoir and canals connected to it. However, during the dry season, there is a shortage of water, and irrigation for crops is unavailable. Household water use is dependent on tap water. - Farmers typically cultivate rice once a year during the wet season. - Vegetables are grown around homes, utilizing canal or pond water. In some areas, after rice harvesting, melon farming is practiced. There is also one farmer cultivating cucumbers in a well-organized setup with a market in Phnom Penh. - Livestock farming includes raising cattle, chickens, and ducks for household consumption. Additionally, there are two farms for chicken and two for pigs currently operational in the district, with some farmers also raising ducks on farmland after harvesting crops. - There are four villages that benefit from this irrigation system: Angk Sandan, Pou Kaong, Ta Chiel, and Chhuk Sar.

	- The commune will facilitate resolving conflicts related to impacts and cooperate during project implementation. - The benefits of the project include a sufficient water supply for rice farming and vegetable cultivation, a habitat for fish, irrigation for crops, and the potential for integrated vegetable farming to generate additional household income. - There are no heritage sites within this commune. - The potential impact includes affecting some parts of the rice fields. - The restoration of this canal aligns with the commune's implementation plan, but the commune currently lacks sufficient funding to carry it out.
Requests	- Please implement the restoration project according to the system plan. If the restoration deviates from the designated system plan provided by the land surveyor and affects private land, appropriate compensation should be provided to the landowners. - A water gate should be constructed at the stream to divert water into the secondary canals, as the stream level is lower than the canal. - Please conduct a thorough impact assessment and public consultation before implementing the project. - The project will help establish a road along the canal, which will increase the land value in the area after construction is completed.
Photo	

Consultation Level	Commune
Date	August 14th, 2024

Sub-Scheme	4. Brambei Mom 5. Krapeu Truom
Organization	Sangkat Veal Pong Hall, Oudong Me Chey District, Kampong Speu Province
Participants	1. Mao Mon 2. Sorn Sem
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune consists of 16 villages, all of which use water from the irrigation system, which supports farmers in growing rice and vegetables during the rainy season. However, this year, there was a shortage of water during the dry season. - The irrigation system covers three communes, providing water from the lower Krapeu Irrigation System for use in these areas. Water for irrigation and domestic use within the communes is generally sufficient. - If water is available during both the dry and rainy seasons, it will greatly assist farmers in cultivating rice, growing vegetables, and raising livestock (which typically requires adequate water for farming). - The entire community benefits from the Krapeu Truom Irrigation System, supporting rice cultivation and various crops. Migration also contributes to improving livelihoods. - The construction of the irrigation system does not harm the environment. On the contrary, it increases fish diversity, and the local population can fish and enjoy recreational activities on weekends. - During the dry season, the economic situation of the community is challenging due to insufficient water, leading to some residents migrating. - If the irrigation project is implemented but fish are scarce in the canals, it may affect the landscape negatively, which could discourage residents from visiting. - The project is in line with the commune's 5-year plan and a 3-year investment plan, which includes necessary repairs as part of the implementation.
Requests	- Request for the department to assist in repairing the automated water gate that has been damaged, to restore its functionality as before. - Request to help repair the water intake pipes for both the main and secondary canals. - If possible, request assistance in constructing concrete structures in the canals.

Photo	

Consultation Level	Commune
Date	August 14th, 2024
Sub-Scheme	1. Brambei Mom 2. Krapeu Truom
Organization	Brambei Mom Commune Hall, Thpong District, Kampong Speu Province
Participants	Ms. Kao Sokea
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Key developments in the commune include the construction of concrete roads and earthen roads in each village. - Agricultural land in the area, owned by residents, requires water from the Five-Mum dam for irrigation, and some residents also use clean water from the Anlong Chrey reservoir. - In terms of agriculture, people in the commune grow rice and vegetables at a family level, and raise cattle, chickens, and ducks. One family even practice aquaculture in a pond. - Farmers near the Brambei Mom dam use water from the dam for irrigation. Some farmers also grow vegetables near the dam's mouth to conveniently access water for use. - Drinking water is sourced from tap water, well water filtered with a strainer, and machine-filtered water, with a proper cleaning process before consumption. - Most farmers cultivate rice once a year, growing light rice and OM rice varieties, from May to November. They plant vegetables on the same land after harvesting. Most farming relies on rainwater, while livestock farming requires minimal water usage. - To address the issues that arise, the commune will collaborate with the Ministry to coordinate the project activities and disseminate

	information to the public about potential impacts, particularly environmental concerns such as water pollution in the region. - The benefits of constructing the irrigation system include providing water to farmers, helping to mitigate flooding during the rainy season, enabling farmers to cultivate crops year-round, and supporting fishery activities. This will also allow farmers to grow mixed vegetables for additional family income and reduce rural-urban migration. - Over 600 families living along the riverbanks will have access to river water for irrigation. - The project will impact agricultural land owned by farmers, land held by companies, and some trees along the Brambei Mom dam's embankment. - The commune has previously submitted a request to the Ministry of Water Resources to restore the Brambei Mom dam. - Currently, the commune does not have sufficient funds to implement the project, but it will participate in disseminating information to the local population.
Requests	- A request is made to assist in restoring the dam to its original depth to effectively drain the rainwater and alleviate flooding.

Consultation Level	Commune
Date	August 14th, 2024
Sub-Scheme	1. Brambei Mom 2. Krapeu Truom
Organization	Roung Roeang Commune Hall, Thpong District, Kampong Speu Province
Participants	Ms. Soun Sarith
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The commune is crossed by a paved road and is developing various village roads by constructing concrete roads, which are part of the commune's budgeted projects. - Most of the working-age population migrates to work in factories outside the district or in Phnom Penh. - Farmers can only cultivate rice during the rainy season due to the availability of water from community reservoirs or ponds within the commune. The canal located east of the Brambei Mom irrigation system also provides sufficient water, but during the dry season, there is not enough water for agricultural activities. - Farmers engage in small-scale livestock raising, such as cattle, buffaloes, chickens, and ducks. Pig farming is less common.

	- Rice farming relies on rainwater collected in reservoirs, ponds, and canals connected to the Brambei Mom irrigation system. From January to July, water for agriculture is no longer available. - Water usage at the household level varies: rural farmers use water from community reservoirs, ponds, and hand-dug wells, while those in urban areas use clean water (tap water). For drinking water, some residents consume purified water, while others boil or filter water from taps and wells. - Farmers typically grow rice, but only during the rainy season. - Vegetable cultivation is limited to small-scale gardening around households. For larger-scale farming, it is only feasible on land along the banks of Krang Punley Stream during the dry season. - Livestock is raised at the household level, with well water used during the dry season and water from reservoirs and ponds during the rainy season. - The commune will assist in disseminating information about the canal restoration, inspecting and maintaining the restored canal, and coordinating with the ministry during project implementation. - The project will provide water to enhance rice and vegetable production, increasing household income, and boosting the aquatic ecosystem. - The project may negatively impact privately-owned land. - There are no heritage sites within the commune. - The commune had proposed a development plan related to dam restoration, but due to high costs, the budget was redirected to road construction instead. - The commune has plans to restore small canals in the area and install culverts to prevent water from flowing across roads.
Requests	- Restore Krang Punley Stream and the canals connected to the Brambei Mom irrigation dam to provide water for residents during the dry season. - Reconstruct the Brambei Mom dam to its original height, as it has deteriorated and can now only store a limited amount of water. - Improve the irrigation system in the commune by elevating and deepening the Lorng Dam and Lang Dam to increase water storage capacity, ensuring sufficient water supply for residents around both dams during the dry season.

Photo	

ANNEX 10.3: RESULTS OF THE CONSULTATIONS WITH VILLAGE CHEFS IN KAMPONG SPEU PROVINCE

Consultation Level	Village Chef
Date	August 12th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Angk Sandan Village, Preah Srae Commune, Oudong Me Chey District, Kampong Speu Province
Participants	Mr. Kuy Cheun
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by the abundance of forests and heavy rainfall, which create conditions for a large mosquito population. Villagers work hard during their youth, which leads to deteriorating health as they age. - A total of 196 families receive water from the irrigation system. However, the remaining families face water shortages because when others pump water first, the water source runs dry before they can access it. - The main challenges include a lack of water, failed well drilling, and competition among villagers for limited water, especially during the dry season when water is scarce. - The village chief, deputy village chief, and other community members are responsible for managing and regulating the use of the irrigation system. - Air quality in the village is poor due to residents burning waste, resulting in harmful smoke. - The water quality is excellent, suitable for drinking and supporting both human consumption and livestock farming. - The project will not impact cultural heritage sites but may affect approximately 20 families whose farmland is located near streams, rivers, and canals, causing some discontent among the affected residents. - Some villagers who own land near streams, rivers, and canals do not have official land titles, meaning they lack legal ownership of the land. - The project aims to establish an irrigation system for the community, providing sufficient water for various uses such as rice farming, vegetable cultivation, livestock rearing, fish farming, and extending the growing season.

Requests	- Request the government issue land titles for their properties near streams, rivers, and canals. - Propose the construction of water reservoirs and gates within the village to collect and store water from the Krapeu Trom area.
Photo	

Consultation Level	Village Chef
Date	August 13th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Khchas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	Mr. Thoy Voan
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by improper food consumption, leading to diarrhea, and by the abundance of forests, which creates a large mosquito population, resulting in dengue fever. - A total of 24 families receive water from the irrigation system. - The primary challenge is the lack of sufficient water for use. - The village has selected a leader to manage the irrigation system. - The water in the irrigation system is of good quality. - The project will have a minor impact on the farmland of approximately 30-40 families. - The families affected by the loss of their farmland initially felt upset, but the village and commune authorities have worked to communicate and mediate with them. - The project will provide sufficient water for crop cultivation and rice farming during both the dry and rainy seasons, helping to increase household income.
Requests	- There is a desire for the irrigation system to be restored quickly and constructed according to the geographical conditions of the area.
Photo	

Consultation Level	Village Chef

Date	August 14th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Souvongs Leu Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	Mr. Oam Phorn
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by climate change, leading to an increase in cases of the common cold. - A total of 134 families receive water from the irrigation system. - The main challenge is the difficulty in pumping water for use, which requires a significant financial cost. - The village chief and members of the water user community are responsible for managing the irrigation system. - The water quality in the irrigation system is not very good, and the groundwater is also not very clear. - During the construction period, there may be noise disturbances from heavy machinery and road damage during the rainy season. - The project will not impact farmers' rice fields. - The project will help ensure sufficient water for crop cultivation and rice farming during both the dry and rainy seasons, contributing to increased household income.
Requests	- Request to restore the irrigation system as soon as possible to facilitate easier water access for the villagers.
Photo	

Consultation Level	Village Chef
Date	August 14th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Thlea Chas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	Mr. Kroun Thiem
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by poor hygiene in food consumption, children eating unhealthy food, and

	climate change, leading to illnesses such as the common cold and skin diseases. - A total of 133 families, accounting for 100% of the households in the village, receive water from the irrigation system. - The main challenges are water shortages, lack of a water storage system, and difficulties in coordinating with upstream villages to request water when needed. - The village chief, deputy village chief, and the head of the water user group are responsible for maintaining the water gates and coordinating with other villages to provide water for agriculture during shortages. - The water quality in the irrigation system is good. - The construction of the irrigation system does not pose any issues for the community, as the affected landowners have supported the project and prepared the necessary land plans. Twenty families are directly affected by the project. - The project will help store sufficient water to allow rice farming two to three times per year and expand crop cultivation, reducing concerns about water shortages.
Requests	- The project will assist in restoring the irrigation system to increase water storage capacity. - It will also address and restore parts of the system that lack adequate water supply.
Photo	

Consultation Level	Village Chef
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Lar Village, Brambei Mom Commune, Thpong District, Kampong Speu Province
Participants	Mr. Bun Samnang
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by consuming unhygienic food containing chemical substances and by climate change. - A total of 87 families receive water from the irrigation system. - The main challenge is insufficient water, and the irrigation system is not yet operational.

	- Farmers in the village have never used water from the Brambei Mom irrigation system. - The project will have a minor impact on the farmland of approximately 20 families. - The families affected by the loss of farmland are generally indifferent, as their main concern is having sufficient water for use. - The project will help provide water for irrigation during both the rainy and dry seasons, supporting rice farming, crop cultivation, and other agricultural activities.
Requests	- There is a request to expedite the construction of the Brambei Mom irrigation system so that the villagers can benefit from it as soon as possible.
Photo	

Consultation Level	Village Chef
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Prey Veng Village, Brambei Mom Commune, Thpong District, Kampong Speu Province
Participants	Mr. Khoen Sou
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by climate-related factors. - A total of 75 families receive water from the irrigation system. - The main challenge is the lack of sufficient water for use. - The village's irrigation system currently has no designated management. - The water in the irrigation system is of good quality and suitable for use. - The project will have some impact on farmers' rice fields. - The project will help ensure sufficient water for crop cultivation and rice farming during both the dry and rainy seasons, contributing to increased household income.
Requests	- There is a request to construct secondary canals branching from the Brambei Mom irrigation system.
Photo	

Consultation Level	Village Chef
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Tang Pou Village, Brambei Mom Commune, Thpong District, Kampong Speu Province
Participants	Mr. Hun Dara
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by climate-related factors. - A total of 263 families receive water from the irrigation system. - The main challenge is the lack of sufficient water, especially during the dry season when the canals have no water supply. - The village's irrigation system currently has no designated management. - The water quality in the irrigation system is poor due to heavy sedimentation. - There are no impacts on cultural heritage sites; however, approximately 10 families with farmland near the canal will be affected. - The affected families feel some distress but continue to support the project. - The project will ensure sufficient water for crop irrigation, fish farming, livestock rearing, and extended rice farming seasons. For the families affected by the loss of farmland, they will be able to cultivate their crops once the project is completed.
Requests	- There is a request to restore the reservoir. - In case of reservoir excavation, roads should be constructed around the area to facilitate transportation.
Photo	

Consultation Level	Village Chef
Date	August 14th, 2024

Sub-Scheme	Brambei Mom
Farmer Group	Tuek Long Ti Muoy Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	Mr. Touch Yan
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The frequent occurrence of diseases in the village is caused by poor hygiene and mosquito bites, which lead to diseases such as malaria or dengue fever. - A total of 290 families receive water from the irrigation system. - The village has a community pond, but water cannot be pumped into the rice fields because, during the dry season, the pond has a small capacity and stores limited water. - The main challenge is that during the dry season, both the Loleng reservoir and the community pond do not have enough water for agricultural activities, and there is no secondary canal connecting the reservoir to the village. - The village chief is responsible for managing the water in the community pond. - The water quality in the irrigation system is poor. - Construction will impact the farmland of local farmers. In cases of minor impacts, the affected families will be understanding. - The project will help villagers access water for dry-season rice farming, grow vegetables, and improve road access to the fields.
Requests	- Requests the ministry to assist in deepening and expanding the Loleng reservoir, as the surrounding land belongs to the government. - Requests the creation of secondary canals from the Lorng reservoir. - Additionally, there is a request for a canal connection from the Brambei Mom reservoir to the Loleng reservoir.
Photo	

Consultation Level	Village Chef
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Chambak Sar Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	Ms. Koh Phirum
Moderator	Mr. Ly Visoth

Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The primary cause of frequent diseases in the village is mosquito bites, which lead to dengue fever. - A total of 200 families receive water from the irrigation system. - The main challenge is that the canal in the southern part of the village (connected to Anlong Chrey) does not have water and does not flow back into the Brambei Mom reservoir. - The local authorities manage the village's irrigation system. - The water quality in the irrigation system is poor because the upstream stream in a neighbouring village is contaminated by pig farming, with waste discharged into the stream. - Construction will affect approximately 50 families whose farmland is located along the banks of the stream and canal. - Some affected farmers with small plots of land are unwilling to participate in the project. - The project will help villagers access water for dry-season rice farming and vegetable cultivation during the dry season.
Requests	- It is requested that compensation be provided to the families whose farmland is affected by the project.
Photo	

ANNEX 11: RESULTS OF THE CONSULTATIONS WITH RICE FARMERS

Results of the Consultations with Rice Farmer Group in Kampong Chhnang Province

Consultation Level	Rice Farmer Group
Date	August 13th, 2024
Sub-Scheme	Yutasas
Farmer Group	Krasang Teab Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Mr. Iem An 2. Mr. Van Sarun 3. Ms. Aor Sat 4. Ms. Paok Raksmey 5. Ms. Sun Sreypov 6. Ms. Uoch Saren
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Challenges include brown planthopper, invasion of stem borers during the tillering stage, and high production costs. - Farmers in the village have received training on rice cultivation techniques, including land preparation, seed selection, and fertilizer application. - After canal restoration, rice cultivation could be extended to up to three growing seasons per year.
Requests	- Establish a new irrigation system in the village and restore the old canals.
Photo	

Consultation Level	Rice Farmer Group
Date	August 13th, 2024
Sub-Scheme	Yutasas
Farmer Group	Svay Pok Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Ms. Tum Siem 2. Ms. Mao Koeurng 3. Mr. Khut Vorng 4. Mr. Bel Soy

	5. Ms. Sam Phorn 6. Mr. Poul Nhoeb 7. Mr. Phal Pheap
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Challenges include insufficient water in the canals. - The rising cost of fertilizers and pesticides. - Rice cultivation heavily relies on chemical fertilizers, while pesticide usage is minimal. - High expenses for labour, land preparation, and harvesting. - Farmers in the village have never received training specifically on rice cultivation.
Requests	- We request the ministry to increase the height of the strategic water gate by 30 centimetres to ensure sufficient water storage for year-round rice farming. Additionally, please help install water gates at the Ta Pring and Ta Nang dams to store water for the dry season. - Kindly assist in restoring the "Yay Soy" canal from the Ta Pring dam to the mouth of the stream. Also, please help repair the damaged Ta Sim dam. - We request assistance in addressing the cost of agricultural fertilizers and maintaining favourable rice prices. - Please arrange for solar-powered lighting along the embankment roads to improve accessibility for farmers during rice cultivation and sales.
Photo	

Consultation Level	Rice Farmer Group
Date	August 13th, 2024
Sub-Scheme	Yutasas
Farmer Group	Kyang Khang Tboung Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Ms. Prak Bopha 2. Ms. Pak Maly 3. Ms. Chea Thy 4. Ms. Phorn Samley 5. Ms. Phoung Kroem 6. Ms. Seng Chanthy 7. Ms. Dum Korng
Moderator	Miss Sothy Chantana

Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is a shortage of water for rice farming and crop cultivation due to insufficient water in the canals. - There is a high infestation of pests that damage rice, requiring the use of many pesticides to control them. - The cost of production is increasing, especially for land preparation, pesticide application, and harvesting. - In general, farmers use organic manure mixed with chemical fertilizers, and all pest control is done using chemical pesticides. - Farmers have received training on rice cultivation techniques only once a year from agricultural cooperatives.
Requests	- There is a desire to have an adequate irrigation system for rice farming. - Build a central reservoir dam for agricultural use and water storage. - Construct water gates for the canals to facilitate water storage.
Photo	

Consultation Level	Rice Farmer Group
Date	August 13th, 2024
Sub-Scheme	Stoeung Krang Bat
Farmer Group	Oknha Pang Village, Longveak Commune, Kompong Tralach District, Kampong Chhnang Province
Participants	1. Mr. Rith Sarath 2. Ms. Chab Nem 3. Ms. Chab Niem 4. Ms. oun Chanry 5. Mr. Kol Vannak
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Lack of an irrigation system and flooding issues caused by runoff from nearby hills. - The price of fertilizers continues to rise. - High costs for labour, land preparation, and harvesting. - Rice cultivation relies almost entirely on chemical fertilizers, but insecticides are rarely used. - Farmers in the village have never received any training on rice cultivation.

Requests	- It is necessary to construct secondary canals to supply water to the village's rice fields, ensuring at least two cropping seasons and potentially enabling dry-season rice cultivation.
Photo	

Consultation Level	Rice Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Chan Trak Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	1. Ms. Ma Chantha 2. Ms. Nuy Sina 3. Ms. Sem Mao 4. Ms. Sim Sarom 5. Ms. Kai Eang 6. Mr. Prak Heurn 7. Ms. Nhean Sarat 8. Ms. Seng Da
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The main challenge is water scarcity, which limits farmers to cultivating only one rice crop during the rainy season, relying entirely on rainwater. - A lack of capital to purchase inputs forces them to borrow money or buy on credit, which further reduces their profit margins. - Farmers primarily use chemical fertilizers rather than combining them with compost fertilizers, and pest management is mostly done with chemical pesticides. - The costs for labour, land preparation, pesticide application, and harvesting are increasingly high. - Farmers have never received any training on rice cultivation.
Requests	- Please provide training on rice cultivation techniques to the farmers in the village. - Assist in establishing an irrigation system, as the area is currently facing severe water shortages.
Photo	

Consultation Level	Rice Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Krang Skear Khang Tboung Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	1. Ms. Chhum Neang 2. Ms. Ros Chhum 3. Ms. Dul Sophal 4. Mr. Sem Chek 5. Ms. Chann Sopheak
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The village canals have no water because there is no main canal to supply them. - The farmers have never received any training on rice cultivation. - The costs for labour, land preparation, pesticide application, and harvesting are significantly high.
Requests	- Restore the old canals in the village to ensure sufficient water supply for rice production and potentially increase the cropping seasons to up to three per year. - Propose the construction of a community reservoir in the village.
Photo	

Consultation Level	Rice Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Trapeang Mlu Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	1. Mr. Kim Huot 2. Ms. Hem Nary 3. Ms. Lang Mom 4. Ms. Em Sophearath 5. Mr. Pon Thouch 6. Mr. Yim Chea

	7. Mr. Seb Oeurn
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The village canals currently have sufficient water. - Production costs, including land preparation, fertilizers, pesticide application, and harvesting, remain high. - Farmers in the village have never received any training on rice cultivation.
Requests	- Assist in urgently restoring the irrigation system to maintain water availability. - Organize training programs focused on rice cultivation techniques for the farmers.
Photo	

Consultation Level	Rice Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Sdok Kabbas Village, Banteay Preal Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Mr. Satt Thet 2. Ms. Non Noa 3. Mr. Chum Vuthy 4. Mr. Oeur Savry
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The village canals have no water because there is no main canal to supply them, limiting farmers to cultivating rice only during the rainy season, relying solely on rainwater. - The fields face severe weed problems, and the soil has low fertility. - Most farmers in the village grow rice primarily for household consumption. - The costs for labour, land preparation, and harvesting remain high. - Farmers have previously received training on single-seedling rice transplanting techniques.
Requests	- Restore the old canals in the village and develop additional irrigation systems to ensure sufficient water supply for rice production, potentially increasing the cropping seasons to up to three per year.

	- If implemented, the community is likely to provide additional support and participation.
Photo	

Consultation Level	Rice Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Andoung Preng Village, Krang Leav Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Mr. Phoem Sarun 2. Mr. Horn Sambol 3. Ms. Hong Chanthorn 4. Ms. Om Sam 5. Mr. Sok Ratha
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is a water shortage, and an irrigation system is needed to store and manage water for agricultural use. - Farmers face a lack of capital. - Rice cultivation relies on chemical fertilizers and animal manure, but very few farmers use chemical pesticides. - The costs for labour, land preparation, pesticide application, and harvesting are high. - Farmers in the village have never received training on rice cultivation.
Requests	- An irrigation system is essential in the village to increase rice and vegetable production. - Urgent action is needed to build or restore the irrigation system as soon as possible.
Photo	

Consultation Level	Rice Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Krang Leav Village, Krang Leav Commune, Rolea B'ier District, Kampong Chhnang Province

Participants	1. Ms. Chhun Channa 2. Mr. Sao Hong 3. Ms. Soam Youn 4. Ms. Meas Sruoy
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The village canals have sufficient water supply. - There is an issue with weeds affecting rice crops. - Production costs include land preparation, fertilizers, and harvesting. - Farmers in the village have received training on land preparation for rice fields.
Requests	- Request assistance in restoring the irrigation system in the village. - Increase training programs and techniques for vegetable cultivation. - Seek support for acquiring quality seeds.
Photo	

Consultation Level	Rice Farmer Group
Date	August 18th, 2024
Sub-Scheme	Stoeung Krang Bat
Farmer Group	Trapeang Chambak Village, Longveak Commune, Kompong Tralach District, Kampong Chhnang Province
Participants	1. Mr. Kong Sinat 2. Ms. Phen Sony 3. Ms. Phorn Rath 4. Mr. Hin Samart 5. Mr. Sok Chamreun
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is a lack of irrigation water for rice fields and crops. - Production costs include land preparation, fertilizers, pesticides, and harvesting. - Farmers in the village have never received training on rice cultivation.
Requests	- There is a need to restore the irrigation system and build a new secondary canal in the village to ensure a reliable water supply.
Photo	

Results of the Consultations with Rice Farmer Group in Kampong Speu Province

Consultation Level	Rice Farmer Group
Date	August 12th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Angk Sandan Village, Preah Srae Commune, Oudong Me Chey District, Kampong Speu Province
Participants	1. Ms. Youn Pao 2. Ms. Phan Sary 3. Ms. Sin Sophanny 4. Ms. Sieng Chanthol 5. Ms. Chan Orn 6. Ms. Chan Ngorn 7. Ms. Oun Srey 8. Mr. Uong Muon
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The main challenge is the lack of water and the absence of a dam for water storage. - There is a shortage of water pumps, and farmers must rent them from others, but there are not enough pumps available and often not in time. - Farmers have previously received training from the APSARA company on the use of seeds, fertilizers, and pesticides.
Requests	- There is a desire to build a water reservoir to capture water from the runoff, which could help ensure farmers have water for rice cultivation during the dry season.
Photo	

Consultation Level	Rice Farmer Group
Date	August 14th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Thlea Chas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province

Participants	1. Ms. Thiem Lida 2. Ms. Soung Lang 3. Ms. Nom Sarorn 4. Mr. Khut Chou 5. Mr. Mith Rien 6. Mr. Kroun Theam 7. Mr. Soung Som 8. Ms. Soung Sophal
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The issue of water scarcity during the rainy season is caused by damaged gates in the irrigation system, along with climate change affecting the timing of the rainy season. - The community must pay for water usage to pump into the rice fields. - Farmers have previously received training on the use of rice seeds.
Requests	- Request assistance in restoring the irrigation system to a deeper level and constructing water storage structures to ensure sufficient water for rice cultivation during the dry season as well.
Photo	

Consultation Level	Rice Farmer Group
Date	August 14th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Souvongs Leu Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	1. Ms. Phat Rorn 2. Ms. Soy Chandy 3. Ms. Rin Channeang 4. Mr. Soy Ny 5. Ms. Khem Yeun
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The irrigation system is too deep, making it difficult to pump water into the rice fields. - Invasion of stem borers during the tillering stage - Farmers in the village have never received any training.

Requests	- Request assistance to make the canals deeper and more manageable for easier water pumping into the rice fields. - Propose constructing a water storage reservoir to store water for use during both the rainy and dry seasons.
Photo	

Consultation Level	Rice Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Chambak Sar Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	1. Ms. Vann Ry 2. Ms. Soun Leang 3. Ms. Kong Sophal 4. Ms. Soth Kol 5. Ms. Phoung Pet 6. Ms. Ngam Torn
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is no water in the canals during the dry season (February). - The cost of labour for land preparation, fertilizers, and pesticides is increasing. - Farmers have never received any training on rice. - Rebuilding the canals could negatively impact the farmers' land, and they may not agree with the plan.
Requests	- It would be better to restore the old canals from the nearby swamp area that are already in place, rather than constructing new ones.
Photo	

Consultation Level	Rice Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Tuek Long Ti Muoy Village, Roung Roeang Commune, Thpong District, Kampong Speu Province

Participants	1. Ms. Lach Heang 2. Ms. Dul Lean 3. Mr. Sem Rem 4. Mr. Thai Bunthorn 5. Ms. Ma Sok 6. Ms. Kaorm Phal
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is a water shortage, and no irrigation system is in place. - Farmers have never received any training on rice.
Requests	- Request assistance in setting up an irrigation system by creating water channels from the existing reservoir and a new water storage dam, allowing farmers to have sufficient water for dry season rice cultivation.
Photo	

Consultation Level	Rice Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Chambak Thum Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	1. Ms. Taem Na 2. Ms. Tak Saroun 3. Ms. Nov Vorn 4. Mr. Phlaok Vorn 5. Ms. Ouk Sarorn
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is a water shortage for rice cultivation. - Climate change issues are affecting crop production. - Invasion of fall armyworm on rice - Farmers have never received any training on rice.
Requests	- Request assistance in constructing secondary canals from the main irrigation system to ensure farmers have enough water for their crops.
Photo	

Consultation Level	Rice Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Prey Veng Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	1. Mr. Sem Chhum 2. Mr. Loa Tob 3. Mr. Kim Song 4. Mr. Soun Yoeurn 5. Mr. Troeng Choek 6. Mr. Sorn Moy 7. Mr. Young Han
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is a water shortage for rice cultivation; although there are canals, they do not provide sufficient water. - Farmers have never received any training on rice.
Requests	- Request assistance in creating a canal system connected to the main reservoir to supply water to the village, as the village currently has no usable irrigation system.
Photo	

Results of the Consultations with Rice Farmer Group in Pursat Province

Consultation Level	Rice Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Prasat Village, Rumlech Commune, Bakan District, Pursat Province
Participants	1. Ms. Soeurng Soeurn 2. Mr. Boem Hil 3. Ms. Soeurng Seng 4. Mr. Kon Chantha 5. Mr. Kann Noeurn 6. Mr. Sien Hean
Moderator	Miss Chhim Sreytouch

Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- There is a shortage of water for rice cultivation during the dry season due to irrigation issues. - Seeds and fertilizers have become more expensive, and counterfeit pesticides are widespread in the market. - There is a lack of capital. - Famers have previously received many training sessions.
Requests	- Request additional technical training on planting techniques. - Request assistance in restoring irrigation to ensure sufficient water during the dry season. - Ask for help in solving the issue of fluctuating rice prices and how to stabilize them. - Request that the Ministry conducts inspections of fertilizers and pesticides in the market to address counterfeit products.
Photo	

Consultation Level	Rice Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Svay Doun Keo Village, Svay Doun Keo Commune, Bakan District, Pursat Province
Participants	1. Mr. Em Kong 2. Mr. Chhut Bunchhai 3. Mr. Kov Keo 4. Ms. Uk Chenda
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The irrigation channels are dry and there is no water because the gate to the water source from the Svay Doun Keo irrigation system is not opened to allow water to flow into the village's irrigation system. - Famers have never received training on rice cultivation.
Requests	- Reviving the old irrigation system in the village would provide sufficient water for rice production, enabling up to three planting seasons per year.

	- Request the construction of a water gate connecting to the Svay Doun Keo irrigation system to ensure sufficient water for the village.
Photo	

Consultation Level	Rice Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Bat Kokir Thmey Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	1. Mr. Kim Sophal 2. Ms. Tuy Savoeurn 3. Mr. Kim Sak Sakhorn 4. Mr. Khim Soeurn 5. Mr. Net Borey 6. Mr. Meng Chhaoet
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The main issue is the lack of water because the village irrigation system has low water storage, and during the dry season, we must rely on water flowing from the upstream village. - There is a lack of capital, as we must purchase seeds and fertilizers on credit, with repayment made after harvest, including an additional 10% interest, which reduces the profit margins. - I have never received training on rice cultivation.
Requests	- To establish a proper water entry and exit system in the village, restore the main irrigation system, and develop a secondary irrigation system to support rice cultivation.
Photo	

Consultation Level	Rice Farmer Group
Date	August 16th, 2024

Sub-Scheme	Ou Ta Paong
Farmer Group	Voat Chreae Village, Boeng Khnar Commune, Bakan District, Pursat Province
Participants	1. Mr. Em Pa 2. Mr. Nhim Sophal 3. Mr. Kae Sophal
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The issue is the lack of water because the village's irrigation system has shallow water storage that is insufficient. - There is a lack of capital, as we must purchase seeds and fertilizers on credit, with repayment made after harvest along with interest, which reduces profit margins. - Farmers in the village have never received training on rice cultivation.
Requests	- Restore the old irrigation system from the upper region down to the village and to construct a water dam.
Photo	

Consultation Level	Rice Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Kampang Village, Svay Doun Keo Commune, Bakan District, Pursat Province
Participants	1. Mr. Mai Phorn 2. Mr. Sorng Kimsoeurn 3. Mr. Long Phalla
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The issue is the lack of water because the village's irrigation system has shallow water storage. - I have previously received training in agriculture and industry. - Farmers support the restoration of the irrigation system in the village.
Requests	- Request that water channels be established along the irrigation system. - Also request the creation of technical agricultural training programs.

Photo	

Consultation Level	Rice Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Ou Ta Paong Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	1. Ms. Ly Neang 2. Mr. Von Morng 3. Mr. Sieng Sokchea 4. Mr. Men Leang 5. Mr. An Roun
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The issue is the lack of water for rice and crop cultivation due to the shallow water storage in the village's irrigation system. - The price of chemical fertilizers continues to rise. - I have never received training on rice cultivation. - Farmers support the restoration of the irrigation system in the village.
Requests	- To request urgent assistance in restoring the irrigation system and water infrastructure.
Photo	

ANNEX 12: RESULTS OF THE CONSULTATIONS WITH VEGETABLE FARMERS

Results of the Consultations with the Vegetable Farmer Group in Kampong Chhnang Province

Consultation Level	Vegetable Farmer Group
Date	August 13rd, 2024
Sub-Scheme	Yutasas
Farmer Group	Svay Pok Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	7. Ms. Sieng Kunthy 8. Ms. Phorn Sron 9. Ms. Sea Lakk 10. Ms. Sim Kun 11. Ms. Hin Yeurn
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Challenges include insufficient rainfall, fungal diseases affecting vegetables, and various pests. - The soil in the village is low in nutrients because it is sandy loam. - The water quality is average, but the irrigation water supply is insufficient during the dry season. - Farmers have received training on vegetable cultivation techniques and composting from the district agricultural office, while some have also learned from online sources. - If water were available in the canal, farmers could pump it into reservoirs, allowing for more cultivation cycles and enabling them to grow a wider variety of vegetables.
Requests	- Please study the height of the Yutasas dam. If it is raised by an additional 30 centimetres, it could ensure an adequate water supply to the canal. - We request the ministry to install metal water gates along canals AB, such as Ta Pring Canal, Ta Nang Canal, and Svay Commune Canal. - Please assist in repairing the roads along both sides of the dam. - If the project implementation affects privately owned land, we request the ministry to consider appropriate compensation. - We also request training on modern agricultural techniques and assistance in finding markets for farmers.

Photo	

Consultation Level	Vegetable Farmer Group
Date	August 13rd, 2024
Sub-Scheme	Yutasas
Farmer Group	Kyang Tboung Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Ms. Ek Sokhoeurn 2. Ms. Yem Pol 3. Ms. Pon Sok 4. Ms. Seng Soth 5. Ms. Khim Ry 6. Ms. Tob Bopha 7. Ms. Chhim Khon
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Leafy vegetables are significantly affected by diseases, while fruiting vegetables are impacted by pests and climate variability, with diseases spreading from one farm to another. - The soil quality is good, allowing for high yields, as farmers regularly use cow manure to enrich the soil's nutrients. - The producer group is not heavily impacted by water shortages and can manage the situation effectively. - Market information for agricultural products is provided by vegetable-buying communities. - Previously, the village had a community that collected vegetables from farmers and sold them to supermarkets under clear contractual agreements. However, this was discontinued because farmers believed the prices were too low, and supermarkets required only high-quality vegetables. Now, ordinary traders purchase these vegetables instead. - Farmers have received training on vegetable cultivation techniques, the use of pesticides and fertilizers, drip irrigation systems, composting, and the implementation of good agricultural practices (GAP). - Farmers in the village have substantial knowledge of smart agriculture but practice it to a limited extent. - If additional water systems are available, the producer group plans to expand cultivation areas and grow a wider variety of vegetables.

Requests	- Please restore additional canals and construct water gates to retain water for agricultural use.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Chan Trak Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	9. Ms. Ma Chantha 10. Ms. Nuy Sina 11. Ms. Sem Mao 12. Ms. Sim Sarom 13. Ms. Kai Eang 14. Mr. Prak Heurn 15. Ms. Nhean Sarat 8. Ms. Seng Da
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Challenges include insect pests, low market prices, and climate change issues. - Insufficient water for irrigating vegetable fields, as the irrigation system only reaches about 20% of the village. - Lack of access to modern agricultural techniques due to limited participation in training programs. - If sufficient water is available, farmers are willing to expand their vegetable cultivation area.
Requests	- Request for more wells to be dug or ponds to be constructed, as water scarcity is a significant issue, with most vegetable farming relying on rainwater. - Request to restore canals for water storage.
Photo	

Consultation Level	Vegetable Farmer Group

Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Trapeang Phkoam Village, Banteay Preal Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Ms. Doung Net 2. Mr. Chhoem Sambath 3. Ms. Leng Sopha 4. Mr. Lach Tong 5. Ms. Neang Soeurn
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The main challenge is the various worm that damage vegetables. - The quality of well water is acceptable, but the quantity may be insufficient in particularly hot months, especially during May and June. - Farmers have previously participated in training on vegetable cultivation techniques, such as seedling production and crop care. However, they have not received any training on smart agriculture. - If sufficient water is available, it would encourage farmers to grow more vegetables during the dry season and enable year-round cultivation.
Requests	- Request the ministry to restore the canal and conduct a study on how to maintain a consistent water supply in the canal throughout all seasons, as currently, during the dry season, there is no more runoff from the upland areas. - If excavation or construction affects privately owned land, it is requested to consider appropriate compensation for the affected landowners.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Srae Veal Village, Krang Leav Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Ms. Phen Saoroeurng 2. Ms. Sen Sreymom 3. Ms. Phen Vanna 4. Ms. Hun Von

	5. Mr. Hun Kear 6. Mr. Hong Thong 7. Ms. Sao Thon
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The main challenges in cultivation are the presence of fall armyworms and some diseases, but these can be managed using self-made organic pesticides. - Water scarcity during the dry season is a significant issue, and the well water used for irrigation contains high levels of sediment. - The soil in the area is fertile, leading to good crop growth and high yields. - Farmers have never participated in any formal training programs. - The project could help farmers expand vegetable cultivation from a subsistence level to a commercial scale, thereby increasing agricultural activities and reducing migration to work abroad. - If sufficient water is available, farmers plan to grow new types of vegetables that meet market demands and practice year-round crop rotation.
Requests	- Request the construction of a secondary canal extending into the village, connected to the main canal from the upland area, to provide a shared water resource for the community.
Photo	

Results of the Consultations with the Vegetable Farmer Group in Kampong Speu Province

Consultation Level	Vegetable Farmer Group
Date	August 12nd, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Angk Sandan Village, Preah Srae Commune, Oudong Me Chey District, Kampong Speu Province
Participants	9. Ms. Youn Pao 10. Ms. Phan Sary 11. Ms. Sin Sophanny 12. Ms. Sieng Chanthol 13. Ms. Chan Orn 14. Ms. Chan Ngorn 15. Ms. Oun Srey

	16. Mr. Uong Muon
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include insect pests damaging vegetables, low market prices, lack of buyers, and climate change issues. - There is a lack of irrigation water, and water sources are far away. - Farmers have received market information. - The project will help farmers grow vegetables in both the dry and rainy seasons. - If sufficient water is available, they plan to farm during the dry season, as it offers quick yields, higher income, and opportunities to expand vegetable cultivation.
Requests	- Construct a water gate from the Krapeu Truom irrigation system - Offer additional training programs related to agriculture.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 13rd, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Khchas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	1. Ms. Soun Sokny 2. Ms. Muth Chanthoeurn 3. Ms. Khloeng Sophann 4. Ms. Khon Soeurn 5. Ms. Penh Sary
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include insects damaging vegetables and climate change. - Farmers grow a small quantity of vegetables, mostly using organic fertilizers. - There is no issue with irrigation water, as they use clean water from the nearby Krapeu Truom dam. - The government has previously distributed vegetable seeds to famers for cultivation.

	- If the irrigation system is restored and sufficient water is available, farmers in the village currently have no plans to expand vegetable cultivation but prefer to focus on rice farming during both the dry and rainy seasons due to higher income from rice compared to vegetables.
Requests	- There is a request for the construction of a secondary canal connected to the swamp irrigation system to reach their village.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 14th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Thlea Chas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	9. Ms. Thiem Lida 10. Ms. Soung Lang 11. Ms. Nom Sarorn 12. Mr. Khut Chou 13. Mr. Mith Rien 14. Mr. Kroun Theam 15. Mr. Soung Som 6. Ms. Soung Sophal
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include pests, diseases, mealy bugs, extreme heat, lack of farming techniques, and insufficient planting materials. - The soil is generally good, but some areas have poor soil quality due to excessive use of chemical fertilizers. - This year, there is a water shortage during the dry season, whereas in previous years, water was sufficient, and the quality improved when the water level rose. - The provincial department has visited to promote and distribute seeds. - If the Krapeu Truom irrigation system is restored and water is available, farmers may expand vegetable cultivation.
Requests	- A request is made to restore the Krapeu Truom irrigation system and improve the water gate to prevent water leakage.

	- A request for technical support on farming practices and the proper use of chemical fertilizers.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Lar Village, Brambei Mom Commune, Thpong District, Kampong Speu Province
Participants	2. Ms. Ngin Phan 3. Ms. Ek Hoeurng 4. Mr. Chhit Tonh 5. Mr. Samrit Yem 6. Mr. Kry Treang
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include an abundance of pests and diseases, extreme heat, and poor soil quality for cultivation. - Water is scarce both during the rainy and dry seasons, and there is high sediment content in the available water. - Vegetable production in the village has limited potential due to the lack of resources, but if sufficient water is available, farmers will expand their production areas.
Requests	- Request for technical training and the provision of seeds. - Request for the provision of organic fertilizers to the community.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Chambak Thum Village, Brambei Mom Commune, Thpong District, Kampong Speu Province
Participants	2. Mr. Rith Sovan 3. Ms. Sang Sokhim

Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include extreme hot weather, diseases affecting vegetables, especially cucumbers, and pest problems during certain months, which have not been solved. - The soil used for vegetable cultivation in the village is rich in nutrients. - There is no issue with water scarcity because the farmland of the production group is adjacent to an irrigation canal that flows from the main canal. - Information about popular and high-value vegetables is obtained through traders who purchase them. - The production group has previously participated in study tours on various crops in other provinces. They have also received training related to smart agriculture, which is now being widely implemented. - The farmers do not yet have plans for expanding the cultivated land area.
Requests	- Encouragement is needed for the quick restoration of irrigation canals.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Tuek Long Ti Muoy Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	1. Mr. Sorn Chhean 2. Mr. Lach Lounh 3. Ms. Lach Soeurn 4. Ms. Sorn Keanf 5. Mr. Yang Leng 6. Ms. Chheng Na
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include leaf curl disease and pests, and the soil is not very fertile. - The quality of the water used is good, but the amount of irrigation water is insufficient during the dry season, from February to May.

	- Farmers learn techniques from other farmers in the village and nearby villages. Additionally, they have received training in poultry farming and vegetable cultivation four times from the Life with Dignity (LWD) organization several years ago. - If there is sufficient water, farmers can grow more vegetables in multiple cycles, expand the cultivated land during the dry season, and attract other farmers from the village to cultivate as well.
Requests	- Help is needed to establish a water storage system in the region to ensure adequate irrigation water during the dry season.
Photo	

Results of the Consultations with the Vegetable Farmer Group in Pursat Province

Consultation Level	Vegetable Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Srah Run Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	1. Ms. Nhim Roeurn 2. Ms. Vann Sary 3. Ms. Phin Siem 4. Ms. Huy Soy 5. Mr. Nhen Sol 6. Ms. Chum Khorn 7. Ms. Chhean Sang 8. Ms. Soun Sitha
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include hot weather, pest disturbances, and fluctuating market prices depending on the traders. - Water scarcity occurs during the dry season. - The farmers' vegetable cultivation land is fertile. - They have never received agricultural information or training on various topics. - If there is sufficient water, the farmers plan to expand their vegetable cultivation.

Requests	- A request is made for the project to provide training on vegetable cultivation techniques, natural pest control methods, and to supply vegetable seeds. Additionally, they are requesting capital if possible.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Prasat Village, Rumlech Commune, Bakan District, Pursat Province
Participants	1. Ms. Sean Soeurn 2. Ms. Bo Sokban 3. Ms. Lorn thy 4. Mr. Kann Noeurn 5. Ms. Chhin Rou
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include fungal diseases, pests, irregular market prices, and climate change. - Water scarcity occurs during the dry season. - The farmers' vegetable cultivation land is fertile. - The agricultural information they have received includes seedling propagation, crop care, and irrigation techniques. - The farmers have previously received one training session on vegetable cultivation techniques. - If there is sufficient water, the farmers will expand their cultivation during both the rainy and dry seasons.
Requests	- Provide training in cultivation techniques. - A proposal is made for the project to deepen the water channels to store more water for irrigation. - A request is made for the project to help find markets with reasonable prices.
Photo	

Consultation Level	Vegetable Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Voat Chreae Village, Boeng Khnar Commune, Bakan District, Pursat Province
Participants	1. Mr. Moung Touch 2. Ms. Chou Rath
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The challenges include diseases that cannot be treated, causing total crop failure, fluctuating vegetable market prices, and climate change leading to vegetable diseases. - In the dry season, there is insufficient water for irrigating the vegetables. - The soil quality is not very good, and growing crops requires a lot of fertilizer. However, the soil can be improved by using cow manure. - They have received information about using fertilizers, pesticides, and seeds, but have never participated in any training sessions. - If there is sufficient water, the farmers will expand their cultivation, especially during the dry season.
Requests	- Assistance is needed to restore the main canal and build a water reservoir to store water from the headwaters to ensure water availability throughout the year.
Photo	

ANNEX 13: RESULTS OF THE CONSULTATIONS WITH CHICKEN FARMERS

Results of the Consultations with Chicken Farmer Group in

Kampong Chhnang Province

Consultation Level	Chicken Farmer Group
Date	August 13th, 2024
Sub-Scheme	Yutasas
Farmer Group	Krasang Pul Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Mr. Reun Rith 2. Mr. Chan Sothei
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Poultry farming has been successful because it follows proper techniques and has never failed. - Farmers in the village have a reasonable understanding of poultry health care and can mix natural feed on their own. - Farmers are very satisfied with this type of poultry farming because it is easy and there is ample space for raising chickens. Currently, around 100 households in the village are engaged in poultry farming. - Poultry farming contributes approximately 600,000 riels per month to household income, and farmers intend to continue this activity in the future. - Challenges include extreme heat, occasional chicken illnesses, and missing chickens when left free-range. - It is difficult to find and purchase feed, and feed prices are rising. - The market price for chicken meat is low and depends heavily on middlemen.
Requests	- Farmers request the project to provide poultry farming equipment and materials. - They also request additional technical training. - Farmers would like to have access to high-quality chicken breeds.
Photo	

Consultation Level	Chicken Farmer Group
Date	August 13th, 2024
Sub-Scheme	Yutasas
Farmer Group	Svay Pok Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Mr. Im Van 2. Mr. Meng Dara 3. Mr. Tom Nan 4. Mr. Sam Nim 5. Ms. Nim Ro 6. Mr. Pov Kroeurn 7. Ms. Sam Tha 8. Mr. Hin Voeurn
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The reasons for raising chickens are that it is easy to manage, they are disease-resistant, and they grow quickly, making them ready for sale in a short time. - The types of chicken breeds being raised are Sampov and Skouy chicken varieties. - Poultry farming can contribute approximately 1 million riels per month to household income. - Farmers in the village are satisfied with this poultry farming, with 219 households currently engaged in it, and they intend to continue in the future. - The challenges include a lack of technical knowledge in poultry farming. - Extreme heat causes the chickens to scratch the ground excessively and fall ill. - Sometimes it is difficult to find markets, and the price of chickens heavily depends on middlemen.
Requests	- A request is made for the department to conduct more frequent technical training, provide vaccines, poultry farming equipment, and high-quality chicken breeds for raising.
Photo	

Consultation Level	Chicken Farmer Group
Date	August 13th, 2024
Sub-Scheme	Stoeung Krang Bat
Farmer Group	Oknha Pang Village, Longveak Commune, Kompong Tralach District, Kampong Chhnang Province
Participants	1. Mr. Korng Kearn 2. Ms. Chhun Sreythum
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Poultry farming is going well because it is easy to manage, the breeds are readily available, they grow quickly, and the breeds are reasonably priced. - Poultry farming contributes approximately 600,000 to 800,000 riels per month to household income and helps support children's education. - Poultry farming is not very popular among farmers in the village, with only about 10 households currently engaged in it. The main reason for its low popularity is the perception that chickens often get sick and die quickly, the selling price is low, and there is limited market demand, except during festive seasons. - Challenges include frequent illnesses and high mortality rates among chickens, a lack of high-value chicken breeds, and the absence of a poultry farming community in the area.
Requests	- A request is made for the government to help establish a poultry farming community in the region. - They also request training in poultry farming techniques, the provision of farming materials and supplies, and access to high-value chicken breeds for better market opportunities.
Photo	

Consultation Level	Chicken Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Trapeang Mlu Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	1. Mr. Kim Huot 2. Ms. Hem Nary

	3. Ms. Lang Mom 4. Ms. Em Sophearath 5. Mr. Pon Thouch 6. Mr. Yim Chea 7. Mr. Seb Oeurn
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Poultry farming is successful because it is easy to manage, can be done within the household premises, requires minimal labour, and provides both food for the family and an income from sales. - Poultry farming contributes about 30% to household income. - Poultry farming is not very popular among villagers, with only about 10 to 15 households currently engaged in it. - Most villagers are not interested in poultry farming because large-scale farming requires close supervision, and those who raise chickens are mostly elderly people with limited physical capacity. - The main challenge is chicken diseases.
Requests	- They request the CAISAR project to be established to ensure sufficient water supply for rice cultivation and for raising ducks and chickens by the farmers.
Photo	

Consultation Level	Chicken Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lum Hach
Farmer Group	Trapeang Phkoam Village, Banteay Preal Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Ms. Leas Vean 2. Ms. Kaoet Sae 3. Ms. Thuch Sarin 4. Mr. Phann Sarath 5. Mr. Boeur Sinat
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Most of the poultry farming in the village is free-range, with chickens raised both for sale and for household consumption.

	- Poultry farming contributes only a small amount to household income. - Almost all households in the village raise chickens, but the majority do so mainly for their own consumption. - Challenges include chickens catching colds and dying in large numbers during the rainy season, and extreme heat causing illness and mortality as well.
Requests	- A request is made for additional technical training and access to better chicken breeds.
Photo	

Results of the Consultations with Chicken Farmer Group in Kampong Speu Province

Consultation Level	Chicken Farmer Group
Date	August 13th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Khchas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	1. Ms. Roeurn Siem 2. Mr. Khen Sokha 3. Ms. Son Saoly 4. Ms. Kann Tonglim
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The reasons for raising chickens include ease of care, low susceptibility to diseases, minimal maintenance requirements, and convenience in feeding. - Raising chickens can somewhat improve household livelihoods by supporting children's education and providing food. However, villagers are not fully satisfied with the income generated. - Farmers in the village are not keen on raising chickens due to a lack of labour force, as most chicken raisers are elderly. - Challenges include chicken diseases, lack of technical knowledge, and limited market access.
Requests	- Request for technical training programs on chicken raising in the village. - Restore the Krapeu Truom irrigation system to ensure sufficient water supply.

Photo	

Consultation Level	Chicken Farmer Group
Date	August 14th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Thlea Chas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	1. Mr. Phorn Sophal 2. Mr. Sorn Siengly 3. Mr. Dong Duy 4. Mr. Hai Venghong 5. Ms. Chey Say
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Most villagers raise chickens naturally, with minimal care, primarily for consumption and occasional sales. - Income from chicken raising is modest, and there are no clear future for expanding this activity. - Only about 50 households in the village are currently raising chickens. - Challenges include limited market access, low selling prices, and the absence of buyers. Additionally, when raising many chickens, the lack of technical knowledge leads to high mortality rates. - Climate change has caused chickens to become sick and die. - The chicken breeds being raised are slow growing, have low body weight, and are prone to diseases.
Requests	- There is a need for technical training on chicken farming and breeds that are more resilient to climate change. - Reduce water costs from the Krapeu Truom irrigation system.
Photo	

Consultation Level	Chicken Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom

Farmer Group	Chambak Thum Village, Brambei Mom Commune, Thpong District, Kampong Speu Province
Participants	11. Ms. Sorn Sreymom 12. Ms. Hon Davy 13. Ms. Muong Vansorn 14. Ms. Vann Sreymom 15. Ms. Huon Hai
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Raising chickens contributes to the household economy by helping pay for utilities, covering some school expenses for children, and purchasing feed for the chickens. - However, villagers are not satisfied with the income because of low selling prices and a lack of buyers, leading to unclear plans for expanding chicken farming in the future. - Approximately 100 households in the village engage in chicken farming due to its ease of management, with chickens raised for both consumption and sale. - During the dry season, chicken farming faces fewer challenges, but in the rainy season, issues arise such as outbreaks of avian influenza and increased mortality due to heavy rains.
Requests	- Additional technical training on chicken farming is requested.
Photo	

Consultation Level	Chicken Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Lar Village, Brambei Mom Commune, Thpong District, Kampong Speu Province
Participants	10. Mr. Ya Yan 11. Mr. Pin Nak 12. Ms. Ek Hun 13. Mr. Ek Horn 14. Mr. Soeng
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project

Perceptions and concerns	- The reasons for raising chickens include ease of care, non-selective feeding, fast growth for quicker sales, disease resistance, easy access to breeds, and abundant market opportunities. - Chicken farming can significantly improve household livelihoods and occasionally provides food for the family. Farmers plan to continue raising chickens in the future. - The average income from chicken farming is around 200,000 riels per month. - Approximately 150 households in the village engage in chicken farming. - Challenges include a lack of capital to purchase additional chicken breeds, insufficient technical knowledge, and difficulty in sourcing necessary farming materials.
Requests	- The villagers request the relevant department to conduct technical training on chicken farming in the village. - They also seek project support for providing feed, vaccines, quality chicken breeds, coops, and other essential farming materials.
Photo	

Results of the Consultations with Chicken Farmer Group in Pursat Province

Consultation Level	Chicken Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Srah Run Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	9. Ms. Nhim Roeurn 10. Ms. Vann Sary 11. Ms. Phin Siem 12. Ms. Huy Soy 13. Mr. Nhen Sol 14. Ms. Chum Khorn 15. Ms. Chhean Sang 16. Ms. Soun Sitha
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- The reasons for raising chickens include ease of care, fast growth, non-selective feeding, and abundant market opportunities.

	- Chicken farming has contributed to household income, and farmers plan to continue it in the future to improve their livelihoods. - Approximately 150 households in the village are engaged in chicken farming. - Challenges include extreme heat, which causes high chicken mortality. - The market price is unstable, and farmers lack the capital to buy chicken breeds and have limited technical knowledge.
Requests	- Additional technical training on chicken farming is requested. - Support is needed in the form of capital, farming materials, and quality chicken breeds.
Photo	

Consultation Level	Chicken Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Oknha Moan Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	1. Ms. Hun Chan 2. Ms. Voeurn Phal 3. Ms. Thy Channa 4. Ms. Khin Niem 5. Mr. Thoeng Chantha
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Chicken farming in the village follows a family-based, traditional approach, with insufficient feed, no vaccinations, and occasional outbreaks of disease (in December-January and June). - Chicken farming is easy to manage, leads to fast growth, has high demand, requires low initial investment, and minimal maintenance. - Almost every household in the village raises chickens, as it contributes to household income and provides food. - Challenges include chicken diseases, extreme weather (both hot and cold), which cause high mortality rates. - There is a lack of technical knowledge and experience, which discourages farmers from raising larger numbers of chickens. - Farmers face a shortage of capital to expand their poultry farming. - If the Ou Ta Paong irrigation system is implemented and sufficient water is available, farmers could pump water into ponds at home to

	ensure a steady supply of drinking water for chickens and other animals.
Requests	- Assistance is requested to provide more training in chicken farming techniques and to supply quality chicken breeds.
Photo	

ANNEX 14: RESULTS OF THE CONSULTATIONS WITH DUCK FARMERS

Results of the Consultations with Duck Farmer Group in Kampong Chhnang Province

Consultation Level	Duck Farmer Group
Date	August 13th, 2024
Sub-Scheme	Yutasas
Farmer Group	Krasang Pul Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Mr. Vann Chhai 2. Mr. Pou Art 3. Mr. Chann Sothei
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is easy to manage, with ducks eating almost any feed, being resistant to diseases, growing quickly for sale, having a short production cycle, and being easier to raise than chickens. - Farmers are satisfied with duck farming as it helps solve some livelihood issues in the present, and they plan to continue if there is access to better markets with higher prices in the future. - The average monthly income from duck farming is 500,000 riels. - Only 4 households in the village are currently raising ducks. - Challenges include falling market prices, difficulty in receiving payment from buyers, and a lack of capital.
Requests	- Farmers request the project to help find better markets for their products. - The project is also requested to provide additional technical training on duck farming.
Photo	

Consultation Level	Duck Farmer Group
Date	August 18th, 2024
Sub-Scheme	Yutasas
Farmer Group	Svay Pok Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province

Participants	1. Mr. Norn Thoeurn 2. Mr. Norn Kroun
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming operates well and is easy to sell the products. - Duck farming helps address some livelihood issues in the present, and farmers plan to continue raising ducks in the future. - The average monthly income from duck farming is 300,000 riels. - There are not many farmers in the village engaged in duck farming, with only 5 households involved. - Challenges include high mortality rates and a lack of technical knowledge on duck farming. - Farmers face a shortage of capital and lack the means to purchase more ducks for farming. - Market prices are low, and traders set the prices.
Requests	- Provide technical training on duck farming, as the farmers' knowledge is still limited.
Photo	

Consultation Level	Duck Farmer Group
Date	August 13th, 2024
Sub-Scheme	Yutasas
Farmer Group	Kyang Khang Tboung Village, Svay Commune, Sameakki Mean Chey District, Kampong Chhnang Province
Participants	1. Ms. Pak Maly 2. Ms. Ek Yiem
Moderator	Miss Yeab Dalin
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming operates well with low disease incidence, is easy to manage, and produces heavy ducks. It requires fewer vaccinations and low feed costs. - Duck farming helps improve livelihoods to some extent, but in the future, farmers may stop raising ducks due to a lack of labor to care for them. - There are only 9 households in the village raising ducks, as most farmers are busy with crop farming, and some families face a shortage of labour.

	- Challenges include the lack of market access and traders defaulting on payments. - When diseases affect the ducks, they are hard to treat, and the disease spreads quickly, leading to high mortality rates. However, outbreaks are not frequent.
Requests	- Restoration of the main canal connected to the irrigation system is needed. - Restoration the irrigation system as soon as possible.
Photo	

Consultation Level	Duck Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Krang Leav Village, Krang Leav Commune, Rolea B'ier District, Kampong Chhnang Province
Participants	1. Ms. Prak Borany 2. Ms. Um Theary 3. Ms. Ing Thy 4. Ms. Min Siphoan 5. Ms. Soam Youn
Moderator	Miss Chhim Sreytouch
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is easy to manage and sell. - Farmers are satisfied with duck farming as it helps solve some livelihood issues in the present, and they plan to continue in the future. - Only 37 households in the village are raising ducks. - Challenges include a shortage of water sources, limited market prices, lack of technical knowledge, and low levels of expertise. - Ducks are prone to diseases and high mortality rates due to extreme heat. - Efforts to care for ducks are challenging, especially during the rainy season. - Traditional medicines can be used to treat sick ducks.
Requests	- Farmers request the restoration of irrigation ponds to provide water for agriculture and animal husbandry. - They also ask the Ministry to help find markets and increase stable prices.

	- Farmers request technical assistance for duck farming, vaccines, and quality duck breeds.
Photo	

Consultation Level	Duck Farmer Group
Date	August 15th, 2024
Sub-Scheme	Lumhach
Farmer Group	Krang Skear Khang Tboung Village, Krang Skear Commune, Teuk Phos District, Kampong Chhnang Province
Participants	1. Ms. Chann Ngorn 2. Ms. Ul Chanthoeurn 3. Mr. Seng Hak
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming operates well, is easy to manage, and ducks grow quickly, making them easy to sell. - Villagers raise ducks on a family basis, which allows them to earn about 25% of their household income compared to other livelihoods. - Duck farming in the village is considered a supplementary activity. - Most farmers in the village do not prefer raising many ducks due to the need for more breeds, large fields, and daily care. Currently, young people tend to work in factories or other jobs, leaving only women and elderly people to manage farming activities like vegetable cultivation and family-based duck farming. - Challenges include a lack of market access, with buyers taking a long time to purchase, especially during the holiday season. - Ducks are sold at very low prices. - There is a lack of technical knowledge in duck farming.
Requests	- Training on duck disease treatment methods and providing farming materials such as pens, nets, and assistance in finding markets for selling ducks is needed.
Photo	

Consultation Level	Duck Farmer Group

Date	August 18th, 2024
Sub-Scheme	Stoeung Krang Bat
Farmer Group	Trapeang Chambak Village, Longveak Commune, Kompong Tralach District, Kampong Chhnang Province
Participants	1. Mr. Korng Sarin 2. Ms. Soun Sopheap 3. Mr. Hit Sophin 4. Mr. Khoem Savuth
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is successful, easy to manage, and can be done around the household. It requires little labour, is easy to raise, and the ducks eat a variety of food with low expenses. - Villagers raise ducks on a family basis, for both consumption and sale, with about 25% of their household income coming from this activity compared to other livelihoods. - Duck farming in the village is considered a supplementary activity. - Most farmers in the village do not prefer raising many ducks due to the need for large areas of land and intensive care. Nowadays, the younger generation tends to work in factories, while only women and the elderly remain at home for farming and family-based duck farming. - Challenges include the high temperatures causing diseases in ducks and a lack of technical knowledge on duck farming and disease treatment methods.
Requests	- The community hopes that the CAISAR project will be implemented to provide sufficient water for irrigation and duck farming, benefiting farmers in the area.
Photo	

Results of the Consultations with Duck Farmer Group in Kampong Speu Province

Consultation Level	Duck Farmer Group
Date	August 13th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Khchas Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	1. Ms. Loeurn Samhak 2. Mr. Tut Chanthoeurn 3. Mr. Khon Sroeun

	4. Ms. Khloeng Sophan 5. Ms. Penh Sary 6. Ms. Soun Sokny
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is successful with no significant problems, as it is easy to manage and can be done in the backyard with minimal labour. Ducks are resistant to diseases, and feed costs are low because they do not require selective feeding. - Villagers raise ducks on a family basis, for both consumption and sale. They can generate about 15% of their household income from duck farming compared to other livelihoods. - Villagers are satisfied with duck farming because it requires minimal expenditure, and the ducks can be sold for a decent profit. - Duck farming in the village is seen as a supplementary activity for villagers. - Currently, only 10 households in the village raise ducks out of more than 200 farming households. Most villagers prefer to work in factories, and only women and the elderly stay at home to engage in farming and duck raising. - Challenges include heat causing diseases like avian cholera, as well as a lack of technical knowledge in duck farming and disease treatment methods.
Requests	- Provide more training on duck farming techniques in the village to improve knowledge and skills.
Photo	

Consultation Level	Duck Farmer Group
Date	August 14th, 2024
Sub-Scheme	Krapeu Truom
Farmer Group	Souvongs Leu Village, Veal Pong Commune, Oudong Me Chey District, Kampong Speu Province
Participants	1. Ms. Phat Rorn 2. Ms. Soy Chandy 3. Ms. Rin Channeang 4. Mr. Soy Ny

	5. Ms. Khem Yeun
Moderator	Miss Hak Leakhina
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is not very successful due to the lack of a market; it is difficult to sell ducks, and the buying process takes a long time. - Villagers are not satisfied with the income from duck farming because they are not making much profit. - Duck farming is done on a family basis in the village for both consumption and sale, generating about 5% of household income compared to other livelihoods. - Most villagers are not interested in raising ducks because it requires large space, multiple breeds, and daily care. Currently, younger adults work in factories or other jobs, while only elderly people and women stay at home to engage in farming and raising ducks. - Challenges include ducks getting sick (such as avian cholera) and a lack of technical knowledge on duck farming and treatment methods.
Requests	- Provide training on duck farming techniques in the village to improve knowledge and skills.
Photo	

Consultation Level	Duck Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Chambak Sar Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	1. Ms. Yun Savoeurn 2. Mr. Von Sambath 3. Mr. Mom Pov 4. Ms. Soth Korn 5. Mr. Hem So 6. Mr. Phon Soth
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is going well, easy to manage, and can be done in a small space such as a backyard. It requires minimal labour, is disease-resistant, and has low feed costs since ducks are not picky eaters. The ducks are raised both for consumption and sale.

	- Villagers practice small-scale family-based duck farming, keeping some for-home consumption and selling the rest, which contributes around 10% of household income compared to other sources. - However, they are not fully satisfied with the income from duck farming as it provides limited profit. - Most farmers in the village are not interested in large-scale duck farming, as it requires a lot of space, daily care, and is challenging to manage disease outbreaks when they occur. Farmers prefer clean areas for gardening, and they don't want to mix livestock farming with crop cultivation. - Currently, younger adults work in factories, while elderly people and housewives are mainly responsible for farming and duck raising at home. - The challenges include frequent disease outbreaks, especially during hot and rainy seasons, and a lack of technical knowledge on duck farming and treatment methods.
Requests	- A request is made for training on duck farming techniques to help improve skills and manage diseases more effectively.
Photo	

Consultation Level	Duck Farmer Group
Date	August 14th, 2024
Sub-Scheme	Brambei Mom
Farmer Group	Tuek Long Ti Muoy Village, Roung Roeang Commune, Thpong District, Kampong Speu Province
Participants	1. Ms. Sok Sarom 2. Mr. Thai Siem 3. Mr. Soy Lang 4. Mr. Mes Thoeurn
Moderator	Mr. Ly Visoth
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is going well, easy to manage, grows quickly, ducks are not picky eaters, and are disease resistant. Ducks can be sold regularly, and it requires minimal time for care. - There are few villagers interested in raising ducks, with only 6 families doing so. This is mainly because duck farming requires large spaces for them to roam, so farmers with small plots of land do not engage in it.

	- The farmers are not fully satisfied with the income from duck farming, as it still provides limited returns. - The main challenges are the lack of a consistent market and no buyers willing to guarantee purchases. - When disease outbreaks occur, they result in the loss of all ducks. - There is a lack of technical knowledge on duck farming and treatment methods.
Requests	- Provide more training on duck farming techniques to improve knowledge and address disease management.
Photo	

Results of the Consultations with the Duck Farmer Group in Pursat Province

Consultation Level	Duck Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Kampang Village, Svay Doun Keo Commune, Bakan District, Pursat Province
Participants	1. Mr. Pat Pov 2. Ms. Chin Voeurn 3. Ms. Loat Phung
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is going well, it is easy to manage, grows quickly, ducks are not picky eaters, and are disease resistant. It is possible to raise them in the backyard. - However, the income is not satisfying because of high expenses and low selling prices. Duck farming contributes only 5% to the household income. - There are few villagers involved in duck farming, with only 4 families participating. - Most farmers in the village are not interested in raising ducks because it requires a large area of land and daily care. - Currently, most of the young people with strength are working in factories, while only housewives and the elderly stay at home for farming and raising ducks on a family scale. - The main challenge is that diseases arise during the hot months.

	- There is no treatment method, and ducks that fall ill often die. - There is a shortage of funds to buy feed.
Requests	- Provide more additional training on duck farming techniques.
Photo	

Consultation Level	Duck Farmer Group
Date	August 16th, 2024
Sub-Scheme	Ou Ta Paong
Farmer Group	Ou Ta Paong Village, Ou Ta Paong Commune, Bakan District, Pursat Province
Participants	1. Mr. Nhim Nhenh 2. Ms. Chorn Nan 3. Ms. Nhenh Channy 4. Mr. Sao Bunthoeurn
Moderator	Miss Sothy Chantana
Consultation Topics	The Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project
Perceptions and concerns	- Duck farming is going well, it is easy to manage, ducks are not picky eaters, disease-resistant, and can be raised in the backyard with minimal labour. Ducks are raised both for consumption and for sale. - However, the income from duck farming is not satisfactory due to high expenses, low selling prices, and the income only contributing about 15% to the household. - There are not many villagers involved in duck farming, with only 12 families participating. This is because raising more ducks requires a lot of care, and most of those who farm ducks are elderly and do not have much strength. - The main challenges include diseases (such as duck plague) occurring during the hot and rainy months, as well as the ducks' damaging crops in the yard. - There is no treatment method available, and sick ducks often die.
Requests	- The villagers would like the CAISAR project to be implemented to ensure sufficient water for agriculture and duck farming.
Photo	