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ENVIRONMENTAL, SOCIAL, AND CLIMATE MANAGEMENT PLAN FOR OU TA PAONG SUB-SCHEME

FINAL DRAFT

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EXECUTIVE SUMMARY

This document is an Environmental, Social, and Climate Management Plan (ESCMP) for the Ou Ta Paong sub-scheme, part of the Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR) project in Cambodia. The project aims to improve farm-level climate adaptation, water use efficiency, and agricultural productivity. The Ou Ta Paong sub-scheme is the largest investment focus of the CAISAR project and will rehabilitate existing irrigation infrastructure and enhance agricultural practices, focusing on the Ou Ta Paong River ecosystem and surrounding communities.

The ESCMP is crucial for ensuring the project's sustainability by addressing potential environmental and social impacts. It outlines measures to mitigate risks associated with water resource management, infrastructure development, and agricultural intensification. The plan recognizes the Ou Ta Paong River's importance for both agriculture and local livelihoods and promotes efficient irrigation practices to optimize water use and minimize the risk of water shortages. The ESCMP ensures that communities are actively engaged in the project's planning and implementation, addressing their concerns through consultations and fair compensation where necessary.

The ESCMP's objectives include:

- Identifying and assessing environmental and social risks and impacts.
- Applying a mitigation hierarchy to avoid, minimize, or mitigate risks and impacts.
- Engaging affected communities and vulnerable groups in the assessment and mitigation process.
- Ensuring compliance with both national and international environmental and social standards.

The project's geographical area is the Bakan District, Pursat Province. The existing sub-scheme is characterized by a complex water supply system drawing from the Pursat River, Ou Ta Paong River, and Svay Don Keo River. This system creates distinct hydraulic zones within the scheme, each with specific water availability levels, impacting agricultural output. The area has faced natural challenges like droughts and floods over the past decade.

The proposed investments include:

- Rehabilitation and improvement of existing irrigation canals.
- Construction of new tertiary canals.
- Installation of solar power systems.
- Training and capacity building for Farmer Water User Communities (FWUCs).
- Agricultural extension services for improved farming practices and value chain development.

The tentative implementation schedule includes detailed design starting in January 2025, followed by procurement and construction. The construction is expected to start after the rainy season in 2026 and be completed by mid-2030.

The ESCMP identifies potential environmental and social risks and impacts during different project stages and proposes mitigation measures.

Before and during construction, potential risks include:

- Unexploded ordnance (UXO): The presence of UXO requires a clearance plan and expert assessment before any construction activity.
- Air and noise pollution: Dust suppression measures, reduced operating hours for machinery, and regular maintenance are proposed to mitigate air pollution and noise.
- Water pollution: Construction diversion control, restrictions on filling canals, and proper waste disposal are crucial to prevent water pollution.
- Solid and hazardous waste: Waste management plans, including designated dump sites, are needed to handle various types of waste generated during construction.
- Wastewater: Proper handling and disposal of hazardous wastewater, such as oil or fuel, are essential.
- Biodiversity impacts: Measures to minimize habitat loss and fragmentation, prevent the spread of invasive species, and raise awareness about wildlife protection are necessary.
- GHG Emissions: Construction and operation of heavy machinery, waste burning, and agricultural burning can increase GHG emissions. Mitigation measures include using low-carbon materials, offsetting emissions, and raising awareness.
- Social impacts: These include labor influx, community health and safety, potential for SEA/SH (Sexual Exploitation, Abuse, and Harassment), and traffic accidents. Mitigation measures involve labor management plans, awareness campaigns, safety training, and grievance redress mechanisms.

During operation, potential risks include:

- Water pollution: The ESCMP emphasizes the need for sustainable agricultural practices, including Integrated Pest Management (IPM), to minimize the risk of water pollution from agricultural runoff.
- Biodiversity impacts: Continued monitoring and management are necessary to address the potential for long-term habitat loss and fragmentation.
- Invasive Species: Changes in land use and water management can introduce invasive plant and animal species.
- Climate change: Promoting energy-efficient irrigation, reducing reliance on fossil fuels, and adopting climate-smart agricultural practices are key to mitigating GHG emissions.
- Social impacts: Continued attention must be paid to elite capture, water use conflict, social inequalities, and potential overuse of pesticides.

The ESCMP outlines a comprehensive stakeholder engagement plan, including consultations with various stakeholders during project preparation and implementation. This plan ensures that local communities and other stakeholders are informed about the project and have opportunities to voice their concerns and suggestions. The ESCMP also includes a grievance redress mechanism to address complaints and grievances from affected people. The mechanism provides a structured process for resolving issues related to land acquisition, labor, SEA/SH, and other project-related concerns.

The plan details implementation arrangements, outlining the roles and responsibilities of various stakeholders, including government agencies, contractors, and consultants, in implementing and monitoring the ESCMP. The monitoring program will include regular monitoring of soil, air, and water quality, and biodiversity.

The financial resources allocated for implementing the ESCMP amount to USD 1,409,000. This budget encompasses a range of expenses, including UXO clearance, assessment for land acquisition and resettlement planning, biodiversity management, community engagement, and essential monitoring activities. However, the estimate cost for the settlement of land and assets and economic displacement are going to be included after the consideration of the final decision regarding the engineering conceptual design which will be conducted by the end of 2024. Transparency and accountability are paramount throughout the project's lifecycle. To this end, the ESCMP will be made publicly available in both English and Khmer, ensuring accessibility and fostering informed participation.

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1. INTRODUCTION

1.1 Rationale of Ou Ta Paong Sub-scheme

Ou Ta Paong sub-scheme is one of the six sub-schemes supported under the CAISAR project, with the largest command area covering over 14,000 hectares. This makes it the largest investment focus of the project, with concentrated activities required. In this context, the preparation of the Environmental, Social, and Climate Management Plan (ESCMP) for Ou Ta Paong is essential to ensure that the project's infrastructure development aligns with sustainable environmental practices. Given the sensitivity of the Ou Ta Paong River ecosystem and its importance to surrounding communities, the ESCMP is designed to identify potential environmental risks early and provide clear guidelines for mitigating them. Without a structured plan, irrigation construction activities could degrade water quality, harm biodiversity, and disrupt the river's natural balance.

Social impacts are also a critical consideration in the preparation of the ESCMP. The Ou Ta Paong River is vital to the livelihoods of local communities, particularly those engaged in farming and fishing. Infrastructure development without proper social safeguards could disrupt these livelihoods, leading to economic challenges and potential social conflict. The ESCMP ensures that communities are actively engaged in the project's planning and implementation, addressing their concerns through consultations and fair compensation where necessary. This inclusive approach minimizes social disruption and fosters stronger community support for the project.

Additionally, the ESCMP is crucial for ensuring that the CAISAR Project meets both national and international environmental and social standards. Compliance with these standards is necessary for securing funding and aligning with global best practices in sustainable development. By preparing a comprehensive ESCMP, the project mitigates both environmental and social risks while promoting long-term sustainability, ensuring that both the natural environment and local communities benefit from the project's outcomes.

1.2 Objectives of the ESCMP

The objectives of the ESCMP for Ou Ta Paong sub-scheme are:

- Identify and assess environmental and social (E&S) risks and impacts that are potentially associated with investment activities proposed under Component 1 and Component 2.
- Ensure the identification and assessment of E&S risks and impacts are in accordance with the requirements of the laws and regulation of the Royal Government of Cambodia, AIIB's Environmental and Social Framework, IFAD's Social, Environmental and Climate Assessment Procedures (SECAP), and GEF's Safeguard Policies.
- Apply a mitigation hierarchy to: (a) anticipate and avoid risks and impacts; (b) where avoidance is not feasible, minimize or reduce risks and impacts to acceptable levels; (c) once risks and impacts have been minimized or reduced, mitigate them; and (d) where

residual risks or impacts remain, compensate for or offset them, where technically and financially feasible.

- As part of the risk and impact identification and assessment, engage a) people potentially affected by project activities (including both project beneficiaries and those potentially affected adversely, and parties interested in project implementation and operations.
- Conduct consultation, particularly with affected people who are disadvantaged/ vulnerable.
- Propose measures to avoid/ minimize/ mitigate E&S risks and impacts and compensate for adverse impacts where residual risks or impacts remain, compensate for impacts that remain, or offset residual risks, where technically and financially feasible.

Coverage of the ESCMP Ou Ta Paong

This site–specific ESCMP cover project activities proposed under Component 1 and Component 2 (See brief description of investment activities in Section 2.3 below).

2. PROJECT DESCIPTION

2.1 Geographical Area of the Sub–scheme

Geographically, Ou Ta Paong command area is located inside a larger Pursat Flood Plain. The flood plain covers a gross area of 63,000 ha, of which 20,500 ha South and 42,500 ha North of National Road No 5. Roughly two thirds (about 10,000 ha) of the OTP scheme area are located North of the road and is part of the flood zone of the Tonle Sap Lake.

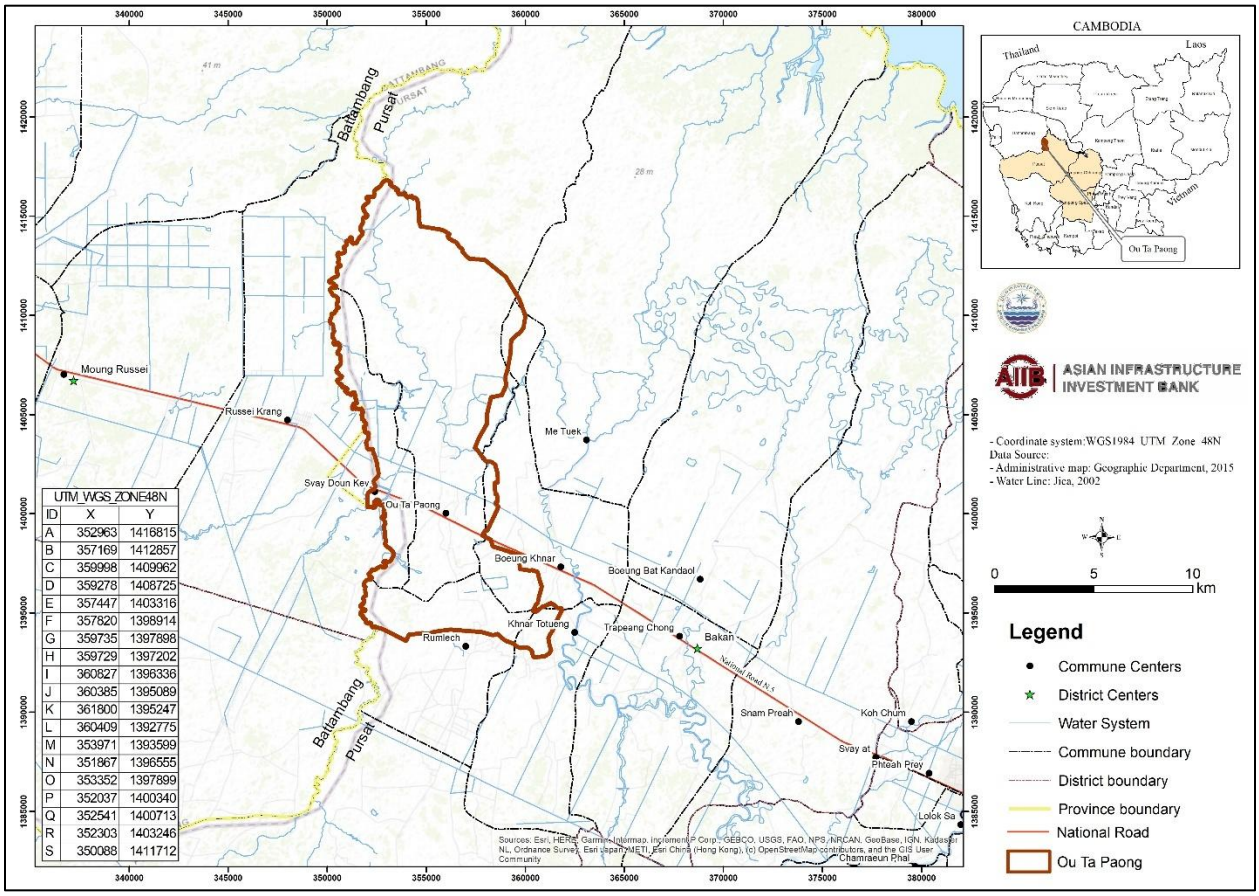
The OTP command area, located in Bakan District, Pursat Province, spans approximately 16,074 hectares and is a crucial rice-producing region. The Ou Ta Paong scheme encompasses five communes within Bakan district, Pursat province: Ou Ta Paong, Boeung Khnar, Svay Duon Kev, Khnar Totueng, and Rulech. Additionally, three 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.

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
	Me Tuek	Bakan	Pursat

Surrounding the scheme	Russei Krang Moung	Russei	Battambang
	Prey Tralach	Rokkiri	Battambang

Figure 1: Administrative map of Ou Ta Paong sub-command area



2.2 Characteristics of the Existing Sub–scheme

2.2.1 Water Availability

The Ou Ta Poang (OTP) irrigation scheme, located in the Bakan District of Pursat Province, Cambodia, depends on a complex network of water sources and infrastructure to support agricultural activities. The primary water sources for the OTP scheme are the Pursat River, Svay Donkeo River, and Ou Ta Paong River, each contributing to distinct hydraulic zones with varying water availability and agricultural productivity.

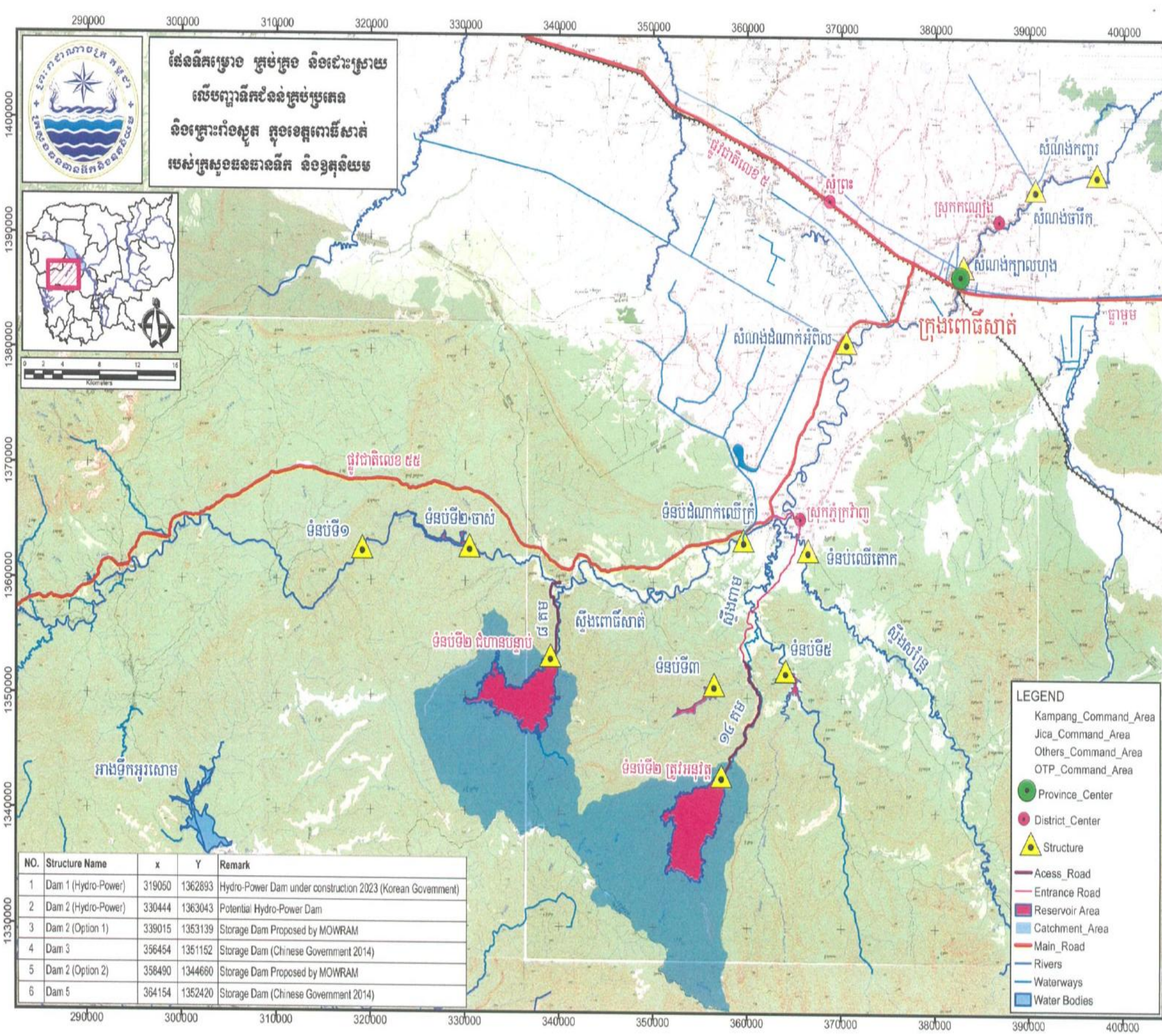
The upper part of the scheme, situated south of National Road 5, relies mainly on the Pursat River, feeding the Damnak Apil Canal and its network of irrigation canals. Gravity-fed irrigation is possible in this area due to the natural slope from south to north, but existing infrastructure requires improvements to optimize water distribution. Enhancements to the canal network and

the construction of additional regulating structures are necessary to enhance water availability in this zone.

The eastern part of the scheme, nestled between the Ou Ta Paong River to the west, the Wat Chre scheme to the east, and National Road 5 to the north, draws water from a mix of sources. These include infrastructure in the south, such as the Damnak Apil and Kbal Hong hydraulic systems, as well as the Wat Loung canal and sections of the Svay Donkeo and Ou Ta Paong rivers. The low hydraulic gradient in this area necessitates one-stage pumping and the development of more efficient distribution networks to ensure adequate water availability for irrigation.

Similarly, the western section of the scheme, situated between the Svay Donkeo River to the west and the Ou Ta Paong River to the east, requires pumping due to the low gradient, with Svay Donkeo serving as the primary water source.

Figure 2: 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 Govemment)
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)

The CAISAR project reported that water availability was adequate at the time Dam No. 1 was completed, provided there was proper coordination among the stated dams. However, at the current stage, Pursat 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 2). 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.

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.

2.2.2 Irrigation Management

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, potentially affecting the water availability downstream to the OTP area.

2.2.3 Cropping Patterns

The OTP sub–scheme has a great agricultural potential, particularly for paddy production. However, currently, the monoculture cultivation of paddy prevails in almost all fields. More than 90% of farmers apply manual direct seeding. Grain kept from the previous harvest is used as seed and the varieties have different maturities. Very few households engage in vegetable production for the market. Small scale horticulture activities take place in the dry season around the homestead, where water can be used from wells and ponds. Such activities were observed in two 'Agriculture Cooperatives (AC): Psar Andeth AC and Chamkar Khluy AC. Also, in neighboring Rumlech Commune, farmers cultivate horticulture crops, such as watermelon on their dry paddies. Ou Ta Paong is traversed by Highway 5 on the northern side with a major road running

eastward towards Tonle Sap Lake. This major road is significant to the farmers since it makes it easy to transport goods and agricultural products to the market shared by the 6 communes.

Farmers grow two early-maturing paddy crops annually: one in the wet season (May-August) and the other in the early dry season (November-February). Where water for irrigation is available in February-April, farmers can grow a third crop, which is harvested in May-June. February-April is the driest period of the year and water is extremely scarce in the Pursat plain. Thus, the size of the third cropping area is inherently minor. In parts of the plain where water is available from local storage ponds/reservoirs, farmers grow horticulture crops in the dry season.

Table 1: OTP - Paddy cultivation areas.

Commune	Cropped area	
	Total in commune (1)	In OTP command area (2)
Beung Khnar	3,966	1,209
Khnar Toteung	2,824	152
Me Tuek	4,332	108
Ou Ta Pong	6,344	5,616
Rom Lech	4,650	578
Svay Dounkeo	2,557	1,702
Total		**9,365**

Notes
[1] As per 2021 Statistics from Bakan District Bureauof Agriculture, Natural Resources and Environment.
(2) As measured on map by CAISAR FS Consultant

In the wet season (WS), when rainfall is generally abundant, all the areas cultivate paddy. Currently, about 40% of the crop area is fully rain-dependent and some 60% is irrigated, namely where water can be accessed (pumped) from adjacent canals of ponds. The varieties used are either early maturing (<100 days) or medium maturing varieties (110-150 days). Land preparation is conducted in early May when rainfall has been enough to soften the soil.

For the common wet season crops, plowing starts in May, the seeding is in May-June, and the harvest falls in in September, yielding 2.0-2.5 t/ha. About 5% of the farmers plant a long duration variety, 150-160 days. They prefer to use these traditional fragrant/aromatic, photo-period sensitive varieties. These crops typically yield 2.5-3 t/ha. Their experience is that the traditional varieties can survive better any dry-spells and explain this from the root systems penetrating deeper into the soil where there is still moisture retained and nutrients reside.

Photo-period sensitive varieties need to be planted in late May and June, in order to be synchronized with the short-day period required for flowering. These varieties include Somaly, Phka Romdoul, and Pkha Malis for the medium maturing varieties, and Sen Kro Ob, OM 5451, and Sra Ngae for the early maturing varieties.

Where at least some irrigation water is available and there is no annual flood, fields can produce two WS crops: an early WS crop planted very early on or even shortly before the rains start, and a late WS crop which is planted during the rainy season but will still have to stand on the field for some weeks after the rains have stopped. For this, varieties with a short growth period (120 days

or less) need to be used. Popular are 'OM varieties. For example, OM 5451 is a high-yielding long-grain cultivar of fragrant rice grown in the Mekong Delta. It has good pests and disease resistance. A DS paddy crop of the same variety may be grown as a third crop, as possible near to natural stream or ponds which usually provide a bit of water.

Some farmers plant a dry season paddy crop, which is typically a short-maturing variety (Sen Kro Ob and OM5451). Some 5% of farmers plant non-rice crops during the dry season including watermelon and sweet corn. Rice yields during dry season are slightly higher than the wet season crop. It has been confirmed from the discussions with the commune representatives that production of non-rice crops may be expanded when irrigation comes. If reliable irrigation water supply becomes available, Ou Ta Pong farmers could grow crops which can be exported to Thailand such as soybeans, mungbean, maize, and sesame in sequence with early-maturing rice crop which can be planted in May.

Where there is no irrigation, the fields can produce just one crop, which is planted when the rains are well on their way. For this, varieties with a medium growth period (120 -150 days) are used. These are commonly photo-sensitive and typically can be harvested in early November. Medium maturity rice has better local marketability and does not face the risk of drought damage, because it flowers in mid-October, when rainwater is still readily available.

Where the area tends to flood to a low level only, farmers may plant just one paddy crop, with preference for a long growth duration paddy (more than 150 days; flowering after mid-November) which can stand flooding better. However, the crop variety used has deep roots, so that they have a better chance of surviving the higher risk of drought damage during the last stage, especially when moisture from preceding rainfall has been retained in the deeper soil layers.

Where the area annually floods to a high level, the farmers still try to grow two crops, but with a higher risk: an early short-duration rain- dependent crop (non- photo-sensitive) can be planted before the flood. These fields may (need to) enjoy some minimum flood protection by a system of low dikes/elevated roads/natural riverbanks, which delays the water during the very early stage of the flood rise from entering the area early, to provide sufficient time to harvest the crop. When the flood has come down sufficiently, they plant - usually in October November - a second short growth duration paddy crop (non- photo-sensitive) "flood recession rice". This crop will run well into the dry season and is indeed classified in the statistics as dry-season paddy (DS rice). When there is no rain or irrigation water, this crop runs a high risk of drought damage. This flood recession rice is widespread in the large tail-end area of the Ou Ta Pong scheme.

2.2.4 Crop Productivity

According to the statistics, WS rice yield in OTP is 4.02 Tons/Ha which is relatively higher than in the other CAISAR schemes (which is possibly related to an increase in soil fertility due to the flooding). DS rice cultivation yielded on average about 7.5 T/Ha (which seems very high for what generally is non- irrigated recession rice; this can be verified from the household survey). Both of these estimates have not accounted for significant crop losses due to droughts in recent years. There has been reported large scale debt incurred by local farmers as a result. Some have even reported family members departing to Thailand to find more secure work. These climate change

induced losses of livelihoods are what the CAISAR scheme is aiming to address. Yields used in further calculations are lower than these figures (especially the dry season yield) to consider these drought crop failures in recent years. This serves as a significant justification for the scheme.

2.2.5 Natural challenges

Droughts and floods are among two major challenges for paddy production in OTP. These ongoing challenges reduce the farmers' interest in investing in their crop and result in average yields being on the low side.

- In terms of drought, the threats are most severe North of the National Road. Droughts, in particular, is a problem because the area is very difficult to reach for irrigation water supply. Infamous is the 'short dry season' that occurs during the wet season. So far, the main route for irrigation water supply throughout the Pursat Flood Plain has been from Damnak Ampil Head Works (DAHW) on Pursat River, via Damnak Ampil Main Canal (DAMC, 23 km length) and its secondary canals. The secondary canals typically end in the Pursat River's former flood-spill route roughly East West, relatively near (4-9 km) to DAMC. The flood route is made up of interconnected creeks/rivers/river sections, of which the main ones are Kambot, Bakan, Boeng Khnar, and ultimately Ou Ta Paong. Pursat River does not overtop its banks anymore and there are no largeflood discharges to be conveyed via this zone of natural drains. All sections have silted up and are dammed off at intervals. The zone forms a formidable obstacle for bringing DAMC water further North. Most water ends up in the river sections, from which much of gets diverted for irrigation.
- As for floods, this problem is particularly in the low terrain North of the road/rail way. Most of the areas there is vulnerable to inundation, be it caused by accumulation of surface run-off or by the upcoming lake flood. Nowadays, farmers plant early maturing paddy crops, and these are not as inundation and heavy-rainfall tolerant as the traditional medium- and late-maturing varieties. Most critical for the crops are the months September - October. To minimize the risk, farmers do not grow crops during that period. Also, on higher terrain where there is no thread of inundation, fields are left fallow, to avoid crop damage by high intensity rainstorms. Farmers are aware of the positive impact of the inundations on soil fertility and there are few if any efforts to improve drainage. Drains are intensively used for collecting and storing water for supplementary irrigation and therefore widely regarded as irrigation canals.

2.3 Analysis of Alternatives

2.3.1 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.

2.3.2 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:

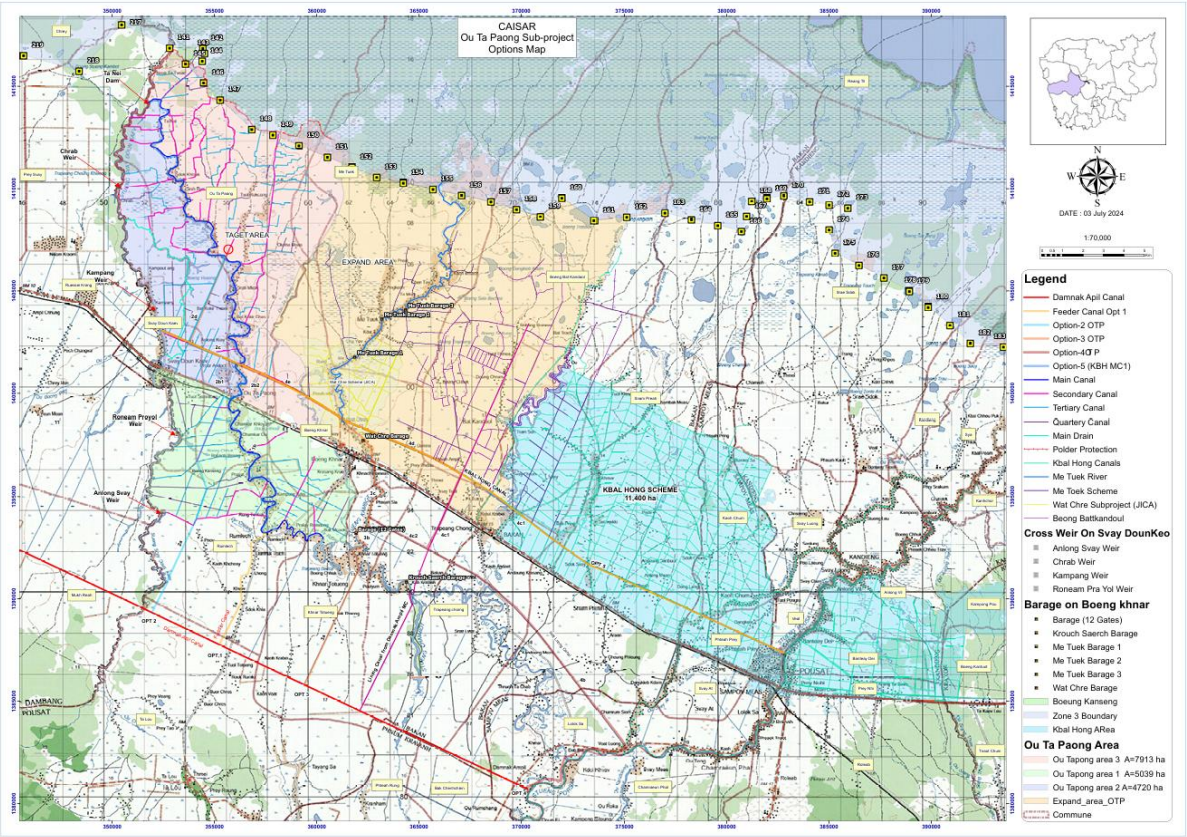
Option 1: Water is extracted from Pursat River through Damnak Ampil Main canal with a length of 6.5 km extended from the main canal feeding into Ou Ta Paong River. The option is one of the best choices, given its shortest length from the main canal to reach command area. However, expanding only the feeder 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.



As per the description provided above, selecting only one option is not feasible as it can generate significant negative impacts. The final decision chooses three options, Option 1, Option 3 and Option 5 as these options will complement each other minimizing the cost, especially relevant to the acquisition of land as well as the water flow into the command area. In addition, all options will feed the water into different blocks of the command area, improving water management efficiency as per the coordination being provided by SCADA.

2.3.3 Project Technology

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

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.

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

2.3.4 Project Scenario Analysis

2.3.4.1 "Without" Project Alternative

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 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.

2.3.4.2 "With" Project Alternatives

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 or three 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.

2.3.5 Prefed Technical Design Option

Five optional supply routes for bringing water to OTP have been identified and were evaluated on their merits. After careful consideration that has been endorsed by MOWRAM, the route that is regarded as the most promising is a combination of three routes, referred to as options 1, 3, and 5 – as summarized below:

Table 2: The most preferred options for canal rehabilitation

Option	Route description
Option 1	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**.

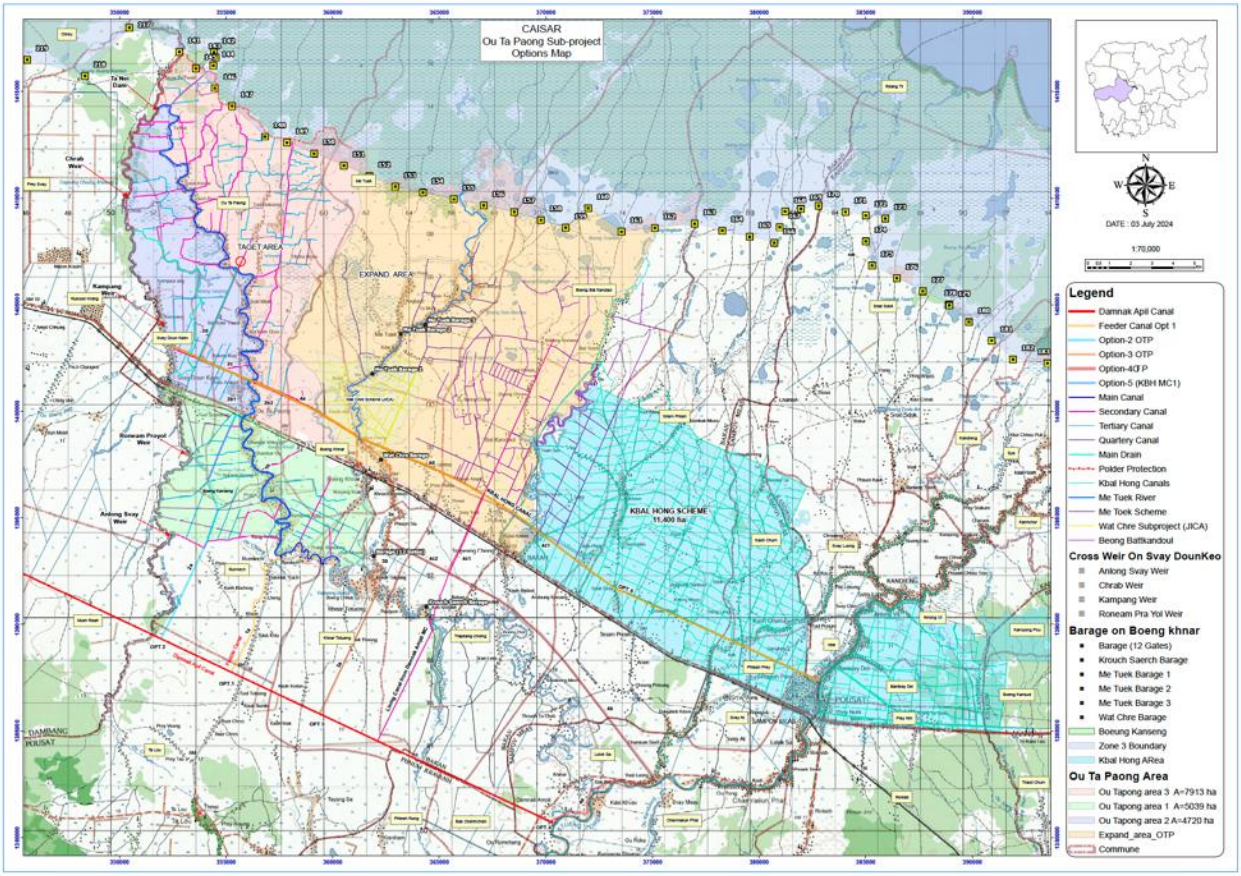
Option 3	From DAHW, via DAMC (16.7 km), via the Secondary Canal at km 16.7 ('Feeder Canal 2', 6.1 km), into Boeng Khnar River's section (9.9 km) South of the National Road to Wat Chrey Head Works, and via link canal (0.5 km) into KHMC, and via KHMC (7.2 km) to the supply point. **Total length of this route is 40.4 km**.
Option 5	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**.

Table 3: The Supply Route Options and expected land acquisition needs

No	Sections	Expected need for land acquisition	Code
1	Damnak Ampil Main Canal Sections	No need for works on the canal sections. Likely the two offtakes to the respective Secondary Canal/Feeder Canal will need to be enlarged under schedules B, B+ and C but this should be within the existing RoW.	-
2	Kbal Hong Main Canal Sections	No general need for works on the canal sections. Possibly some need at very few minor locations where encroachment has taken place	+/-
3	Ou Ta Paong River Sections u/s of the crossing by KHMC	No need expected. Existing cross-section is wide.	-
4	Boeng Khnar River Sections u/s of Wat Chre Head Works	No need expected. Existing cross-section is wide.	_
5	Link canal between Wat Chre Head Works intake and KHMC	This 460 m canal will need to be somewhat to substantially enlarged under all schedules. Not clear what the current RoW is.	+
6	DAMC Secondary Canal/Feeder Canal 1	The canals currently have the status of distribution canals and are designed as such. WAPCOS design regards Feeder Canal 1 as Main Canal for OTP. Due to design standards, a main canal occupies a much wider RoW than distribution canals. Unsure whether Feeder Canal 2 will also be regarded as main canal.	++
7	DAMC Secondary Canal/Feeder Canal 2		

Codes: ++ = considerable need; + = some need; +/- = possibly needed; - = not needed

Figure 3: Map with Illustration of canal options



The definite needs for land acquisition will be determined after the detailed designs have been completed. Considering that there will only be works on existing canals of the distribution system, the expectation is that there will not be any need for land acquisition.

2.4 Proposed Investment under Ou Ta Paong Sub–scheme

2.4.1 Key activities by Project Component

The project has three Components (summarized below). However, the ESCMP Ou Ta Paong will covers investment activities proposed under only Component 1 and Component 2.

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 farmers' 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 will focus on rehabilitating/creating and modernizing hydraulic infrastructure, including canals, ponds, flood-proof infrastructure (river, drain) and to provide high-efficiency climate-resilient irrigation systems for adapting to both increasing flood and drought conditions. It will include support and capacity building to O&M operators at both, Provincial (PdoWRAM) and scheme (FWUC) level, to ensure the sustainability of the scheme. The output will secure and increase farmer's agricultural production by improving the irrigation supply and protect crops from water-related disasters.

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 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.

2.4.2 Tentative Schedule for Sub–scheme Implementation

By this time, the feasibility study for the Ou Ta Paong is under finalization to allow for the design process, procurement process and approvals. To implementation of the sub–scheme, the following assumptions have been made:

- The detailed design will start in January 2025; it will take two 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 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 dry seasons.

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

Table 4: 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												●	●	●	●	●	●	●	●	●	●	●		

2.5 Project Area of Influence

2.5.1 Definitions

Under Ou Ta Paong sub–scheme, term "Areas of Influence" (AoI) comprise, as appropriate, areas that are likely to be affected by the following:

(i) **Project activities**, including i) project activities and the facilities under Component 1 and Component 1 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**[1] that result from the incremental impacts (direct and indirect) from a) project activities proposed under Ou Ta Paong sub–scheme on the project command area, and b) Ou Ta Paong sub–scheme, and combined cumulative effect from Ou Ta Paong sub–scheme, past and planned projects, on the area downstream the Ou Ta Paong sub–scheme, and other relevant projects; and

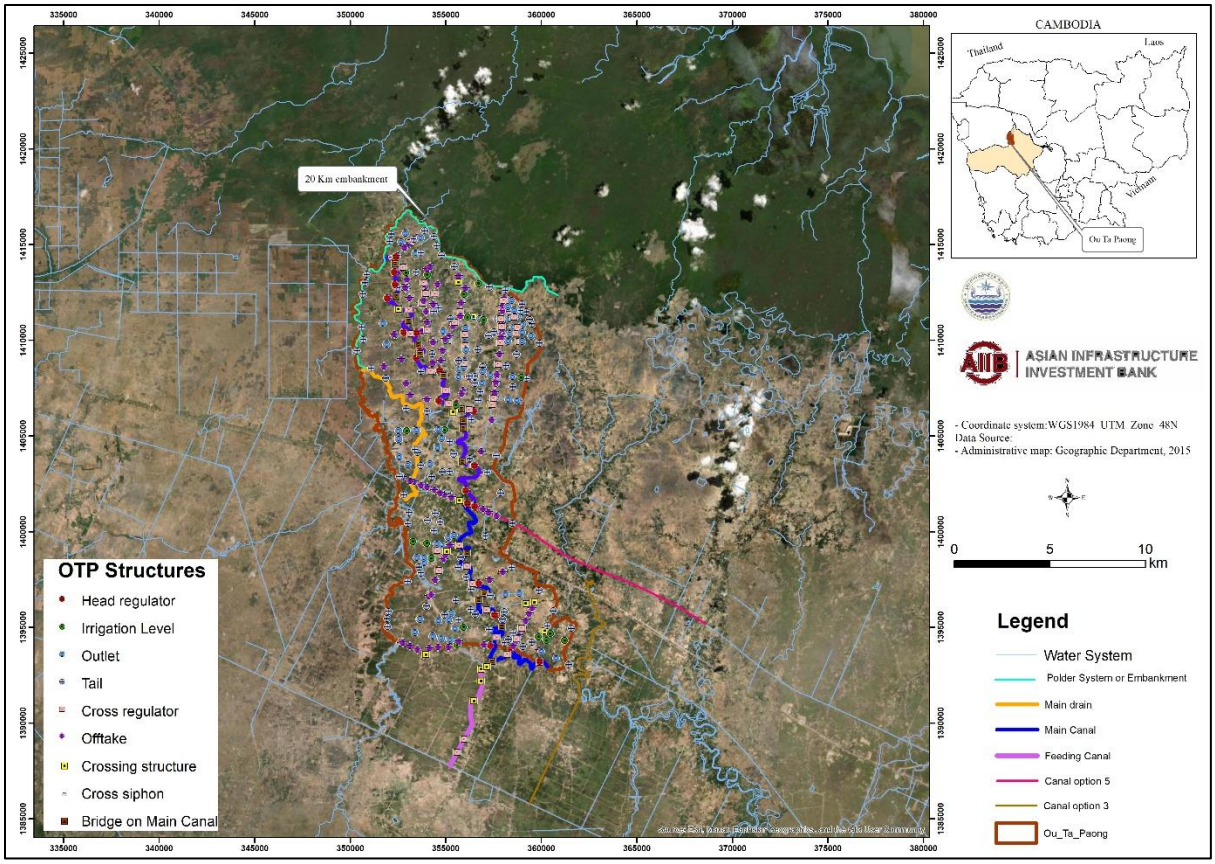
(iii) **Associated facilities** are facilities not included in the Project set out in the Legal Agreements governing the Project, but they are: (a) **directly** and **materially** related to the Project, (b) **carried** out, or **planned to be carried out**, **contemporaneously** with the Project; and **(c) necessary** for the Project to be **viable** and would **not be carried out if the Project did not exist**".

2.5.2 Areas of Influence of Ou Ta Paong Sub–scheme

Under CAISAR, since project design for Ou Ta Paong is still ongoing, the area of influence for Ou Ta Paong 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).

Figure 4: Locations of irrigation structures in Ou Ta Paong

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



Based on investment activities proposed under project component 1 (improved crop production) and component 2 (improved irrigation access), the sub-scheme's area of influence is defined by the following investment activities:

- **Command area:**
  - Areas with increased number of crop per years (under Component 1)
  - Specific location where existing irrigation canals are repaired/improved, extended (at selected location at tertiary level), new small-scaled water gates
- **Construction areas** (mostly inside command areas)
  - Workers' camps
  - Areas where construction materials are stockpiled and machineries and construction vehicles are parked, repaired, operated during construction process.
  - All routes used by contractors and subcontractors for operation of vehicles and machinery for construction (e.g. access roads, communal roads)
- **Road networks**
  - All roads, routes that connect the construction sites and the sites that are used as a) disposal site, b) construction material supply site, c) borrow pits, d) quarries, etc.

- **Disposal site(s), borrow pit(s)**
- **Any area affected by environmental footprint**
    - As defined by the area subject to noise, vibration, air, soil, water pollution due to project activities.
- **Land impacts**
    - Any land area that are acquired for the purpose of expansion of irrigation canals (Compopent 2) and/or farm roads (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 5 – Environmental & Social Risks, Impacts, and Mitigation).

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, 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).

3. LEGAL AND INSTITUTIONAL FRAMEWORK

Following a framework for effective project development as well as environmental sustainability, the project owner shall comply with the national legal framework and protocols ratified by the Kingdom of Cambodia. For CAISAR Project, there are national laws, agreements, guidelines and relevant legal instruments as described below:

3.1 Royal Government of Cambodia's Legal Framework

3.1.1 National legal framework

3.1.1.1 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.

3.1.1.2 Legal Framework related to 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.

3.1.1.3 Legal Framework related to 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.

3.1.1.4 Legal Framework related to 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 people 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.

3.1.2 International Conventions and Treaties

Cambodia has ratified all eight of the ILO's fundamental 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.

3.2 AIIB'S Environmental and Social Framework (ESF)

The Asian Infrastructure Investment Bank's (AIIB) Environmental and Social Framework (ESF) (2022) 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. AIIB's Environmental and Social Framework (ESF) (2022) are summarised here.

- **Environmental and Social Standard 1: Environmental and Social Assessment and Management**: These standard 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 standard 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 standard 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.

3.3 IFADs' SECAP

The International Fund for Agricultural Development's (IFAD) Social, Environmental, and Climate Assessment Procedures (SECAP) provides a framework to ensure that IFAD-financed projects are sustainable, socially inclusive, and environmentally sound. SECAP is composed of several standards that address various environmental and social considerations. Listed in the ToR, here is the summary of the applied standards:

- **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.

3.4 GEF'S Environmental and Social 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.

3.5 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 5.

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.

Table 5: Gap Analysis of National Legal Framework and Policies of AIIB, IFAD and GCF

No.	Standards/ Policies			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 Code and Natural Resource Management (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 Code and Natural Resource Management (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, • 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	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 of poor and vulnerable, entitlements for persons without title or legal rights except for land, information disclosure, payment of compensation and entitlements prior to	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 restoration program are robust and can accurately meet the aim of livelihood restoration in line the AIIB ESS2.

No.	Standards/ Policies			Coverage	RGC's Corresponding Legal Framework	Gap Analysis and suggestions	Proposed measures to address the gaps
	AIIB	IFAD	GCF				
						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.	
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 Code and Natural Resource Management (2023),	The code requires a proper consideration of biodiversity resources and payment of ecosystem services which support the conservation process. There is limited guidance on how to compensate in the ecosystem services once its pristine condition is affected.	This ESCIA include the biodiversity assessment and management plan.
5	ESS1	S2	PS3	Resource efficiency and pollution prevention	• Environmental Code and Natural Resource Management (2023), • Sub-Decree on Environmental Impact Assessment (1999), • Sub-Decree on Air Pollution Control and Sound Disturbance (2000),	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	This ESCIA has included all relevant national laws and regulation as well as the requirement for AIIB ESS1.

No.	Standards/ Policies			Coverage	RGC's Corresponding Legal Framework	Gap Analysis and suggestions	Proposed measures to address the gaps
	AIIB	IFAD	GCF				
					• 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)	resources and avoid or minimize the pollution from sources/project activities.	
6	ESS1	S3	PS8	Cultural heritage	• Environmental Code and Natural Resource Management (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), • Sub-Decree on Establishment of Social Security Scheme "Health Care Scheme" for Persons Defined by the Provisions of the Labor Law (2016)	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, regulation against forced labor and using child labor are not strictly enforced.	The ESCIA provides provisions to monitor compliance by contractor and of their primary suppliers in bidding documents and supervision contracts in order 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.

No.	Standards/ Policies			Coverage	RGC's Corresponding Legal Framework	Gap Analysis and suggestions	Proposed measures to address the gaps
	AIIB	IFAD	GCF				
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.	

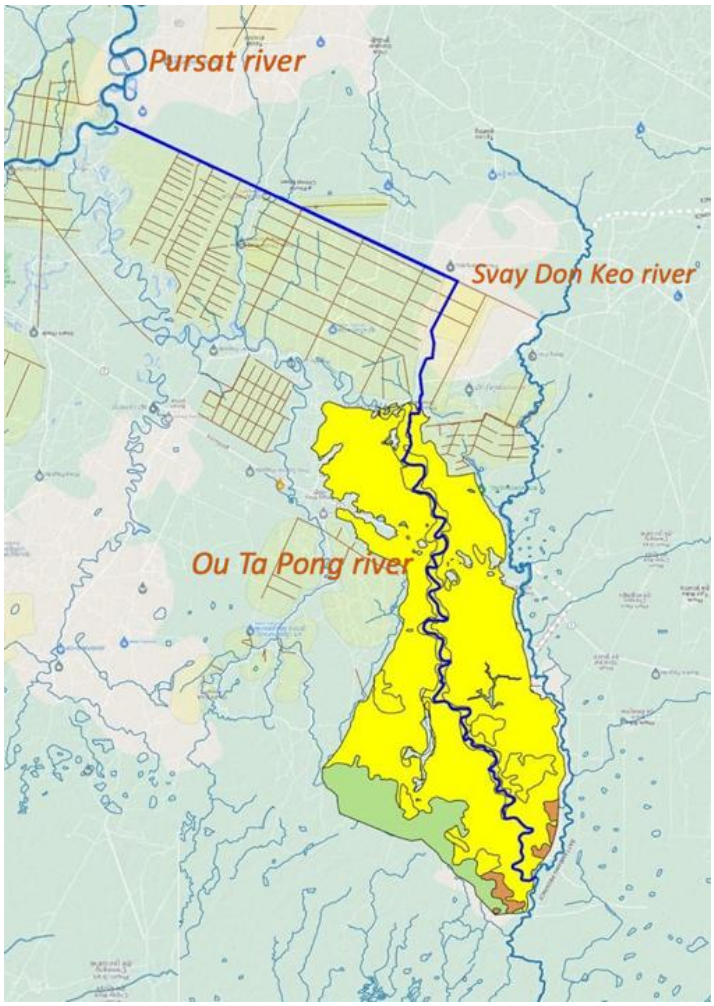
4. BASELINE CONDITIONS

4.1 Physical Conditions

4.1.1 Existing Infrastructure (Irrigation and drainage facilities)

The Ou Ta Paong scheme draws its water supply from various sources. These sources comprise the Pursat River, Svay Donkeov River, and several other rivers that traverse the scheme, including the Ou Ta Paong River itself. This complex 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.

Figure 5: Damnak Ampil Main canal and Ou Ta Paong Sub-scheme



The Pursat river is located on the right side (river flow) while Svay Don Keo river on the left side. Water from Pursat river is diverted into the OTP through the Damnak Apil main canal, then feed into a smaller river called Ou Ta Pong. Both Ou Ta Pong River and Svay Don Keo river run down through the OTP command area in almost parallel until they meet at lower downstream part of the OTP command area (see picture below). A more description of the above rivers is provided below. The OTP is a mixture of

both irrigated and rainfed areas (mostly is irrigated). Areas irrigated obtain water from the current network of 46 km of secondary canals and 27 km of tertiary canals (based on WAPCOS asset survey in 2023).

Water for irrigation is mainly collected from two main rivers: Pursat river and Svay Don Keo river (Figure 5). The Pursat river is located on the right side (river flow) while Svay Don Keo river on the left side. Water from Pursat river is diverted into the OTP through the Damnak Apil main canal, then feed into a smaller river called Ou Ta Pong. Both Ou Ta Pong River and Svay Don Keo river run down through the OTP command area in almost parallel until they meet at lower downstream part of the OTP command area (see picture below). A more description of the above rivers is provided below.

Boeng Khnar River is the principal natural drain for the area under command of the first 17 km of DAMC and an important water source for the area North of the road. The National Road and railway are the second and rather forbidding obstacles for irrigation water from DAMC to reach the Northern areas. Water can only pass to the other side under the bridges. The third problem is that farmers of upstream villages divert as much water as they can manage from the canals, so that little of nothing remains for the downstream villages.

4.1.2 Rivers and Hydrology

For Pursat river, water in this river constituted from three main tributaries — located about 25–35 km to the upstream. Water collected for these attributes are from a combined three catchments area of about 4,245 km^2). Water released downstream from these three tributaries are controlled by three dams: Dam No. 3 and Dam No. 5 (which is under the management of MOWRAM), and Dam No.1 (an 80MW hydropower plant being built by a private company and is under the management of the Ministry of Mines and Energy[2]). The storage capacity of Dam No. 3 and Dam No. 5 is almost similar: 24.5 MCM and 25.5 MCM, respectively. Dam 1 (Hydropower) is expected to store 1,014 MCM (max) once completed but the purpose is for hydropower plant. It is noted the Dam 3 and No.5 have been put into operation since 2013 while Dam 1 is still under construction and is scheduled to operate in 2026. According to the report prepared by WAPCOS for AIIB (dated 8 March 2023), neither of the above reservoirs pose a flood risk to the OTP as it is far from the Pursat river. However, dam failure could decrease water availability to the OTP.

For Ou Ta Pong (OTP) river. OTP river is located within the OTP command area. Originally, the Ou Ta Pong River drained the Pursat River's flood plain. However, currently, this river is mainly a string of ponds. The river has lost its original conveyance function for both water drainage and supply function. The OTP River is estimated to be 38 km, counting from Danmak Apil Headwork to Ta Nai dam – in a straight line. However, the waterway from Damnak Apil Headwork to Ta Nai Dam is as far as 56 km. Water that feed the OTP is mainly from Pursat river which goes into the river through Damnak Apil Headwork.

For Svay Don Keo river, the water is fed by a catchment of 322km^2 located upstream. The river is about 61.7 km long in total. The river makes its way into OTP at the point where (orange dot) where it intersects the Damnak Apil Main Canal (See picture below). The Svay Don Keo river runs roughly

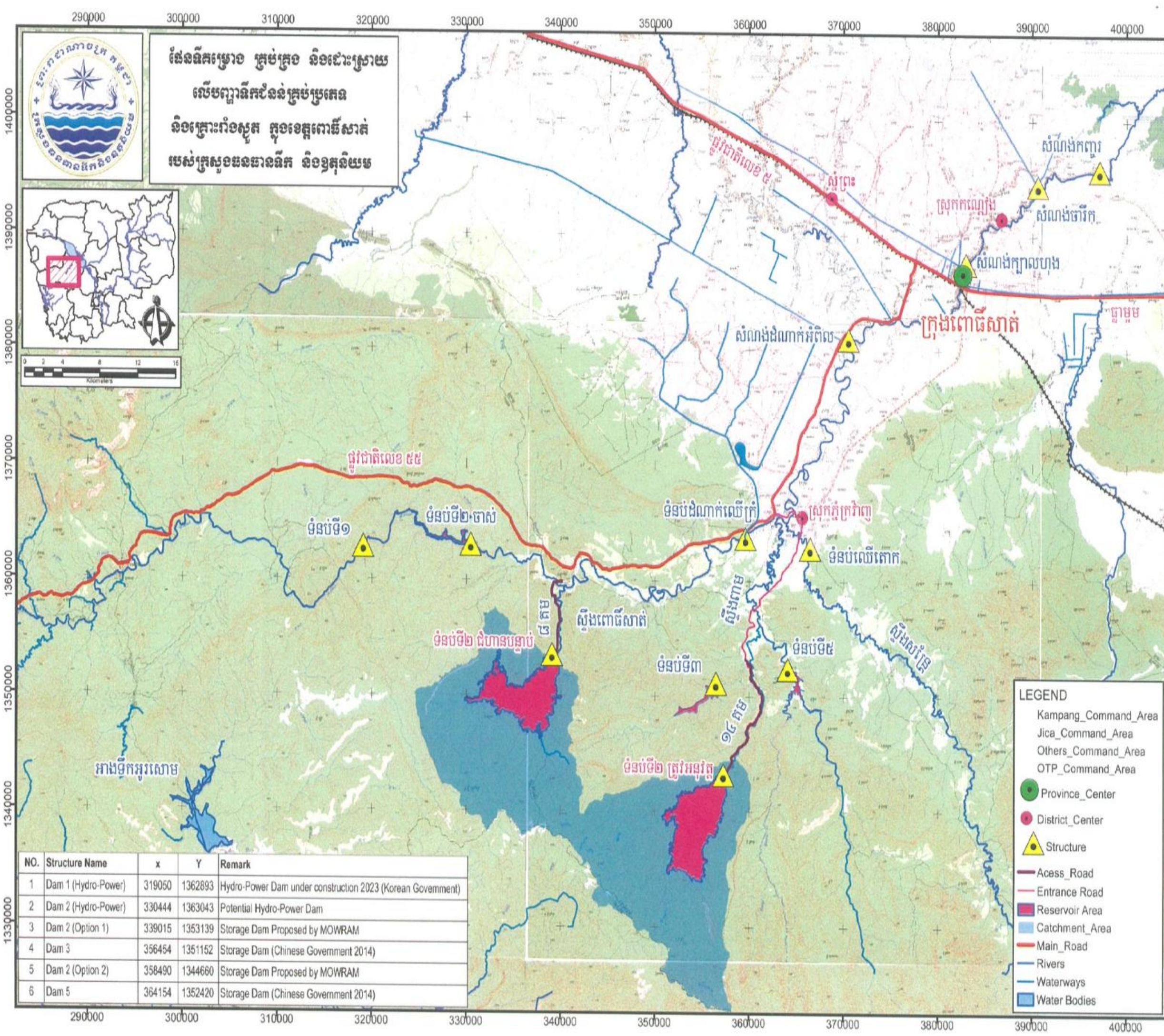
[2] The project is being developed by Asia Energy Power, Erex, ISDN Holdings and SPHP (Cambodia). Erex, Asia Energy Power and ISDN Holdings are currently owning the project having ownership stake of 34%, 33% and 33% respectively.

parallel to OTP river – to the West (See picture below) that depict water flow from Dam 1,3, 5 to form Pursat river.

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 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 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.

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: 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)

4.2 Environmental Conditions

4.2.1 Air Quality and Noise

At provincial level, the air pollution level is considered moderate3. The AQI is 58, which is equivalent to 13.1 µg/m3. 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.

[3] https://www.iqair.com/cambodia/pursat, accessed on 23rd September 2024

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.

4.2.2 Soil Quality

The soil quality study for this sub-scheme was represented by two sites (SS.01 & SS.02). 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.

Soils in Ou Ta Paong can be classified as loam, a texture ideal for agriculture due to its balanced mix of sand, silt, and clay. The relatively high proportion of fine silt and fine sand further enhances water retention and nutrient availability, supporting plant growth. The soils are slightly acidic, with pH levels ranging from 4.12 to 5.36, which may affect nutrient availability. However, this acidity is manageable for crop production with proper soil management. Organic matter content is moderate (3.16% to 3.82%), benefiting soil structure, water retention, and nutrient cycling. This level helps sustain long-term agricultural productivity by improving soil health.

Table 6: Soil analysis results in an agricultural context

No.	Description Parameter		Result	
			SS.01	SS.02
1	Particle Size (Pipette Method)	(<0.002mm), Clay %	9.90	14.01
		(0.002-0.02 mm), Fine Silt, %	37.65	35.55
		(0.02-0.05 mm), Coase Silt, %	21.71	22.69
		(0.05-0.2 mm), Fine Sand, %	30.59	32.75
		(0.2-2 mm), Coase Sand, %	3.22	2.32
2	Ninnu Moisture %, (Oven dry at 105 °C and 24 hours)		1.67	1.73
3	Total Carbon (Black & Walkey Method), C%		2.22	1.84
4	Total Nitrogen (Kjeldal Sulfuric Method),N%		0.19	0.17
5	C/N Ratio (Unit)		12	11
6	Organic Matter (0M) %		3.82	3.16
7	Total Phosphorus (Nitric Digestion) P %		0.051	0.043
8	Available Phosphorus (Bray II), P (ppm)		51	41
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	Exchangeable Cation (meq/100g Soil), (Method, 1 M Ammonium Acetate at H=7)	Calcium (Ca)	3.06	3.77
		Magnesium (Mg)	1.28	1.38
		Sodium (Na)	1.42	0.75
		Potassium (K)	0.77	0.27
	Total Exchangeable Bases (meq/100g soil)		6.53	6.17
11	Bass Saturation %		50	50
12	Exchange Acidity meq/100g Soil, (1 M KCl Method)		20.00	15.00
13	Exchange Al meq/100g Soll, (1 M KCl Method)		0.20	0.12
14	Electrode Conductivity µS/cm, (1:5 Soil: water)		96.80	36.10

No.	Description Parameter	Result	
		SS.01	SS.02
15	pH H2O (1:5 Soil: water)	5.36	5.29
16	pl KCL (1:5 (Soil: IN KCl)	4.21	4.12

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

Nutrient analysis shows low nitrogen content (0.17% to 0.19%), which may limit plant growth. Phosphorus is low in total content (0.043% to 0.051%) but moderately available (41 ppm to 51 ppm), suggesting it's not a limiting factor. Potassium levels range from low to moderate (0.27 to 0.77 meq/100g), indicating that some locations may need supplementation. Calcium, magnesium, and sodium levels are adequate for plant growth. The soils have a moderate Cation Exchange Capacity (CEC) (12.40 to 13.00 meq/100g), indicating good nutrient retention, and the base saturation is balanced at 50%.

Overall, while the soils from all three locations are generally suitable for agriculture, there are areas that need attention, such as the low nitrogen and potassium levels in some samples and the slightly acidic pH. These factors suggest that, with proper nutrient management and soil amendments, the soils can effectively support healthy crop production.

4.2.3 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[4].

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

Table 7: Result of surface water quality

No	Parameter	Unit	Ou Ta Paong			Standard (MoE)	
			SW1	SW2	SW3	River	Lake and reservoir
1	Arsenic	mg/l	0.005	0.005	0.005	<0.01	<0.01
2	Cadmium	mg/l	0.001	0.001	0.001	<0.003	<0.003
3	Lead	mg/l	0.005	0.005	0.005	<0.01	<0.01
4	pH	-	6.32	6.2	6.44	6.5-8.5	6.5-8.5
5	Total dissolved solids	mg/l	30.76	38.07	40.71	<1000	<1000
6	Total suspended solids	mg/l	11	29	39	<100	<100
7	Total Nitrogen	mg/l	4.8	3.8	3.5	<3	<2
8	Total Phosphorus	mg/l	0.8	0.6	0.4	<0.25	<0.15
9	Total coliform	CFU/ 100mL	50,200	38,750	31,650	<1000	<1000
10	Electrical conductivity	µs/cm	61.4	76.12	81.43	500-1500	500-1500

[4] 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

No	Parameter	Unit	Ou Ta Paong			Standard (MoE)	
			SW1	SW2	SW3	River	Lake and reservoir
11	Temperature	^{0}C	31.3	30.8	30.9	<45	<45
12	Dissolved oxygen	mg/l	5.34	5.6	5.7	>3	>4

(Source: Water Innovation Lab, 2024)

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.

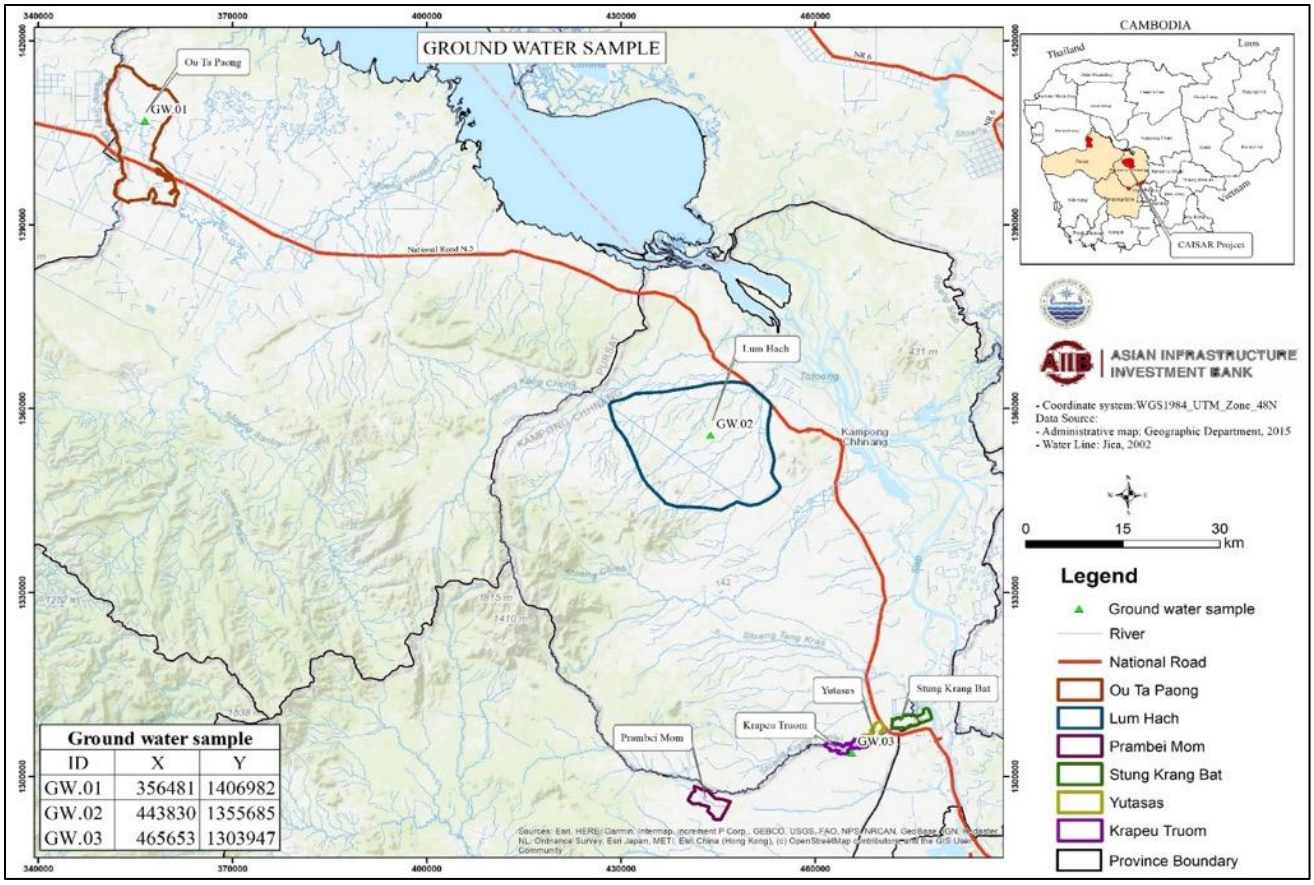
4.2.4 Groundwater Quality

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. The geographical positions and descriptions of the groundwater sampling points are given in Table 9. The results of the groundwater quality analysis are summarized in Table 8.

Table 8: Groundwater sampling locations

No.	Location				UTM	
	Province	District	Commune	Village	X	Y
GW1	Pursat	Bakan	Ou Ta Paong	Oknha Moan	356481	1406982

Figure 7: Map of groundwater sampling locations



The selected samples were analysed and the results of the testing both at the field and at laboratory is provided in Table 9 below.

Table 9: Result of groundwater quality

No	Parameter	Unit	GW1	CDWQS
1	Arsenic	mg/l	0.005	0.05
2	Cadmium	mg/l	0.003	0.003
3	Lead	mg/l	0.0004	0.01
4	pH	-	**6.01**	6.5-8.8
5	Total dissolved solids	mg/l	345.8	800
6	Total suspended solids	mg/l	13	-
7	Total Nitrogen	mg/l	6.4	-
8	Total Phosphorus	mg/l	0.3	-
9	Total coliform	CFU/ 100mL	14,065	0
10	Electrical conductivity	µs/cm	691.4	-
11	Temperature	^{0}C	30.4	-
12	Dissolved oxygen	mg/l	1.92	-

(Source: Water Innovation Lab, 2024)

The groundwater quality test for Ou Ta Paong (GW1) reveals mixed results when compared to the Cambodian Drinking Water Quality Standards (CDWQS). The levels of arsenic, cadmium, lead, and total dissolved solids (TDS) all fall within the acceptable national limits, ensuring that these parameters pose no immediate health risks. However, the slightly acidic pH of 6.01 is below the recommended range (6.5–8.8), indicating that the water is somewhat corrosive, which could affect its taste and the condition of piping systems over time. Though the total suspended solids are not regulated by the CDWQS, their presence might affect water clarity, requiring filtration.

One of the most concerning findings is the high total coliform count, which reaches 14,065 CFU/100 mL, far exceeding the standard of 0 CFU/100 ml. This result indicates significant bacterial contamination, making the groundwater unsafe for direct human consumption without proper treatment. Immediate measures, such as disinfection, are necessary to eliminate pathogens and ensure the water meets health safety standards. Additionally, while there are no specific standards for total nitrogen and phosphorus, the moderate levels recorded could pose a risk if left unchecked, particularly in terms of environmental impacts.

Other parameters, such as electrical conductivity, temperature, and dissolved oxygen, though not regulated by CDWQS, also provide insights into water quality. The electrical conductivity and moderate temperature suggest the presence of dissolved ions and potential microbial growth. The low dissolved oxygen level may further indicate organic contamination, suggesting the need for continued monitoring. Overall, while certain aspects of the groundwater quality are within safe limits, significant attention is required to address bacterial contamination and pH levels to make the water suitable for human use.

Figure 8: Groundwater sampling activities

4.3 Biological Resources

4.3.1 Presence of EN and CR Species

The biodiversity assessment at Ou Ta Paong focused on confirming 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 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 mammal species were confirmed in the upper section of Ou Ta Paong, but two 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 informant having last seen the species 20 years ago. *Striped Catfish* were reported by one informant, who recalled seeing them during a major flood seven 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 10: 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

No.	Local Name	English Name	Scientific Name	IUCN Cate	Screened Species	Confirmed Species
3	អណ្តើកបិទមុខ	Southeast Asian Box Turtle	*Cuora amboinensis*	EN	Yes	Yes
4	អណ្តើកព្រេច	Elongated Tortoise	*Indotestudo elongata*	CR	No	Yes
	II. Mammal species					
5	កេរោមច្រមុះ	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	ក្រីក្រាជំ	Striped catfish	*Pangasianodon hypophthalmus*	EN	Yes	No
9	ក្រីកន្ត្រៃប៉ខ្លា	Siamese Tiger Perch	*Datnioides pulcher*	CR	Yes	No
	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	ឌ្បិប 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					
16	កញ្ជាញ់ចេកភ្នំក្រវាញ	Cardamon Shrub Frog	*Philautus cardamonus*	EN	Yes	No
17	ស្មៅស្ទឹង / ទន្លេ	River-weed	*Terniopsis chanthaburiensis*	EN	Yes	No

Please see Annex 6 – Biodiversity Assessment and Action Plan for details.

4.4 Socio-Economic and Cultural Conditions

4.4.1 Demographic and Facilities

According to the commune database in 2023, the total number of households who are residing within and nearby Ou Ta Paong command area is 8,310 HH (out of which 1,397 HHs (17%) are female headed), giving the total population of 34,189 people (17,602 females). Moreover, the population are young with 62% of them are aging below 34 years old. More than half of the people (45%) completed education at primary school and below whereas those with secondary, high school, and higher

education is only 22%, 16%, and 6%, respectively. It is noticeable that illiterate people have still existed at 10%.

Table 11: 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)

Overall, it is apparent that the Ou Ta Paong sub-schemes contain young population indicating its high potential in future development activities. However, it is a concern as the population have very limited higher education.

Table 12: Demographic information of the HH living within and the vicinity of the command areas

Parameters	Percentage	Parameters	Percentage
Overall		**Educational Level**	
Total HH	8,130	Kindergarten	23%
Female HH Head	1,397 (17%)	Primary school	22%
Total Population	34,189	Secondary school	22%
Female	17,602	High School	16%
Age		College/University	6%
<18 years old	37%	TVET	2%
18 – 34 years old	25%	Illiterate	10%
35 – 60 years old	26%		
> 60 years old	12%		

(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 99.8% access to electricity and only a minority of them continue using battery (0.1%), and biogas (0.1%). However, the sources of water for domestic consumption were low with only 19% of them having access to water supply system while the rest continue using pump well, tube-well, opened-well, pond, 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 30%, filtered water 61%, and boiled water 9%). There is a concern, however, regarding the reliability of the tape water quality which may create a significant impact on 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.

Table 13: Access to energy and water and sanitation facilities

Parameters	Percentage	Parameters	Percentage
Source of Energy		**Drinking Water**	
Electricity	99.8%	Tape water	30%
Battery	0.1%	Filtration	61%
Solar	0%	Boiled	9%
Biogas	0.1%		
Water Source for HH consumption		**Toilet**	
Tape water	19%	Pour Toilet	99%
Pump well	13%	Flush toilet	1%
Wells	4%	Total toilet	100%
Opened Well	3%		
Pond	27%		
Rainwater	22%		
River	11%		

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

4.4.2 Socio–economic Conditions of the Beneficiaries

Agriculture is reported as the primary occupation for the population within the command areas, with full-time private sector employment accounting for the second largest proportion (10%). As for secondary occupations, rice and crop production remains the most common, followed by full-time private sector work.

Table 14: Occupation of the HHs living within and the vicinity of the Ou Ta Paong

Parameters	Percentage	Parameters	Percentage
Main Occupation		**Secondary Occupation**	
Rice and crop production	37.82%	Rice and crop production	22.42%
Animal production	0.30%	Animal production	5.08%
Fishing/aquaculture	0.30%	Fishing/aquaculture	0.75%
Trade	4.48%	Trade	3.89%
Service	1.94%	Service	3.29%
Government staff	2.24%	Handicrafts	0.45%
Workers (full-time, private sector)	10.01%	Government staff	1.79%
Workers, (seasonal, private sector)	1.35%	Workers (full-time, private sector)	9.87%
Housewife	2.39%	Workers, (seasonal, private sector)	3.14%
Student	24.36%	Housewife	3.14%
Other	1.20%	Student	24.36%
No job	13.60%	Other	2.24%

(Source: ESCIA Field Survey, 2024)

A significant proportion of the population with poor 1 & 2 is reported at 9%, indicating the level of economic condition of the areas while the proportion of the people with disability (PWD) is at 1.1%. People are migrated to both inside and outside the country with the highest one is within the country (16%) while 13% migrated to abroad. This makes the total migration of 29%.

Table 15: Migration and vulnerability of the people within the sub-schemes

Parameters	Percentage	Parameters	Percentage
Vulnerability		**Migration**	
Poor 1	1%	Inside the country	16%
Poor 2	9%	Out of the country	13%
Total	**9%**	**Total**	**29%**
Disable person	1.1%		
Old people	0.2%		
Orphan	0.2%		
Total	**1.5%**		

(Source: ESCIA Field Survey, 2024, Ministry of Planning, Commune Database, 2023)

Wooden houses are the most dominated shelter of the people comprising of 57% of the total settlement. Semi-permanent is the second most popular (30%) while the rest belong to one floor or more brick walls, temporary houses and others. Interestingly, about 4% of them live in temporary houses. The assets that people own the most are Television (80%), followed by motorbike (59%), and bicycle (51%), and power tiller (25%) while the rest are in small proportion.

Table 16: Houses and Assets of the HHs within Ou Ta Paong

Parameters	Percentage	Parameters	Percentage
Assets		**Type of Houses**	
HH with Tractor	1.4%	One floor or more/brick wall	8.6%
Power Tiller	25.4%	Semi-permanent	30%
HH with Rice Harvester	0.8%	Wooden house, thatched	57%
Threshing Machine	0.0%	Temporary houses	3.6%
Harvest and Threshing Machine	0.2%	Other	0.7%
Mobile rice mill	0.0%		
Car	6.2%		
Other Machinery	0.3%		
Motorbike	59.2%		
Tricycle	0.2%		
Bike cycle	51.0%		
Boat	7.0%		
TV	80%		

(Source: ESCIA Field Survey, 2024, Ministry of Planning, Commune Database, 2023)

The data highlights family violence (0.71%) and drug use (0.36%) as the most pressing issues, followed by land disputes (0.28%). In contrast, sexual harassment, human trafficking, and crime report no cases, suggesting potential areas for further investigation into reporting mechanisms or community dynamics.

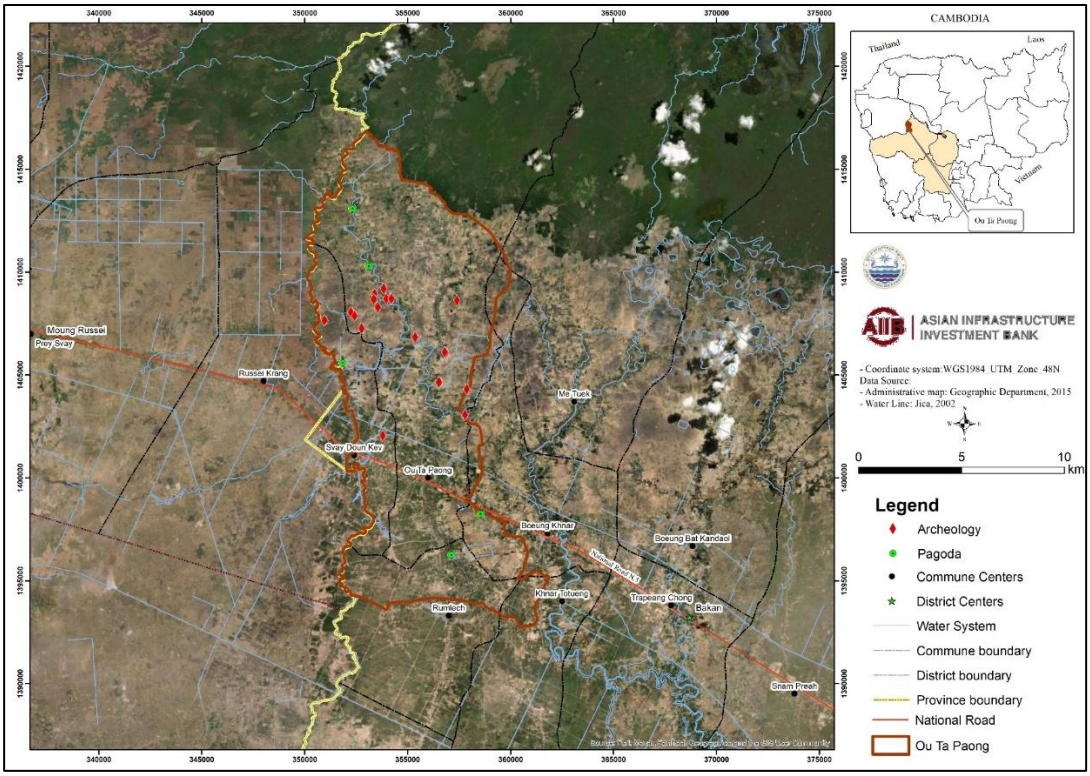
Table 17: Issues in the project communities

Parameters	Ou Ta Paong	Total
Sexual Harassment	0.00%	0.0%
Human Trafficking	0.00%	0.0%
Violence in the family	0.71%	0.71%
Drug using	0.36%	0.36%
Crime	0.00%	0.0%
Stolen Cases	0.02%	0.2%
Land Issues	0.28%	0.28%

4.4.3 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 Ou Ta Paong command areas shall be not affected during or after the irrigation system design and construction phases.

Figure 9: Maps of archaeological and cultural sites in and near Ou Ta Paong Sub-scheme



4.4.4 Gender

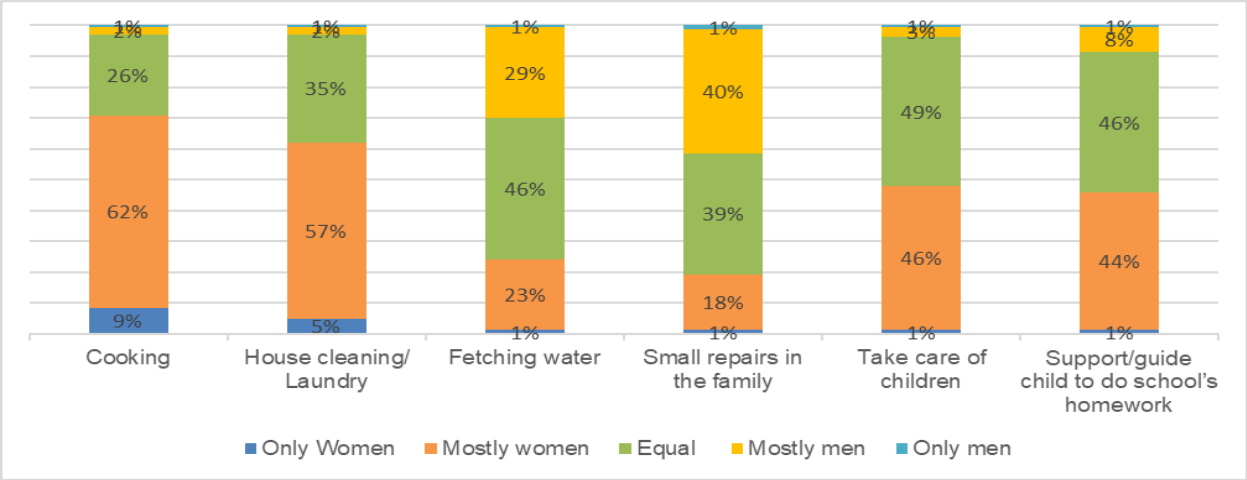
4.4.4.1 Labor Division

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.[5]

Coming 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. [6]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 11).

Figure 10: Division of Roles in Household Chores (n=140)

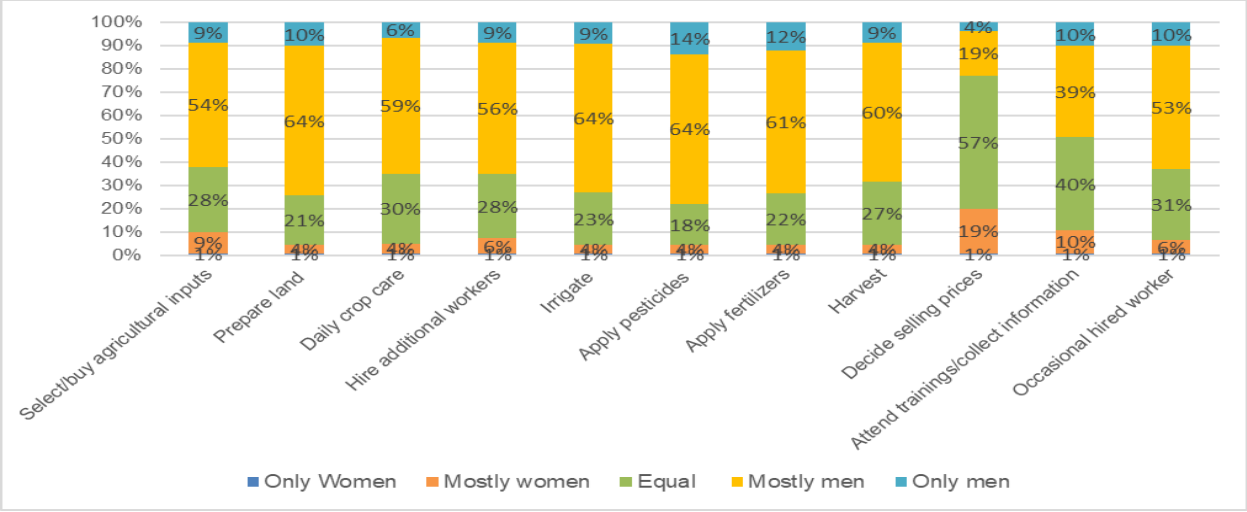
[5] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.
[6] CAISARP (2024). Gender Assessment and Gender Action & Social Inclusion Plan. CAISAR Project. MoWRAM.



(Source: ESCIA Field Survey, 2024)

In crop production, the majority of tasks, particularly during the production phase, were found to be dominated by men. However, men and women were more equally involved in attending trainings and deciding the selling price of their produce. Interesting, women only are less participation in the cultivation at all stage. This reduced participation of women in agricultural production may be attributed to their employment in factories (Figure 11).

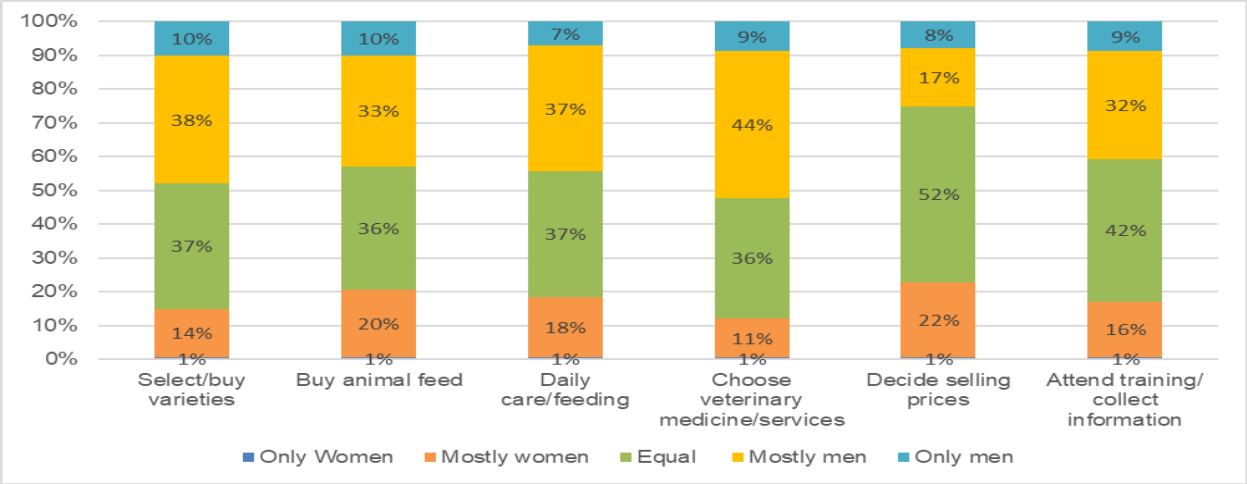
Figure 11: Share of Roles in Crop Cultivation (n=140)



(Source: ESCIA Field Survey, 2024)

In animal production, labor distribution is relatively balanced between mostly men and equally shared. However, tasks such as selecting animal breeds and choosing treatments for curing are predominantly handled by men, while the rest of the production tasks are done collaboratively. Women were found to have a slight dominance in animal raising, likely due to the same reason mentioned earlier_their greater involvement in factory employment (Figure 12).

Figure 12: Share of roles in Animal Husbandry (n=140)



(Source: ESCIA Field Survey, 2024)

4.4.4.2 Income

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.[7]

4.4.4.3 Decision Making

Regarding decision-making, the matters related to children, such as education, childcare, and marriage, are typically decided by both husband and wife. However, a significant number of households have women as the sole decision-makers on child-related issues. When it comes to daily livelihoods, decisions such as household expenses, sales of home-produced goods, and visiting friends or family are usually made jointly. Still, a notable portion of respondents indicated that women alone make decisions regarding their own livelihoods, family expenses, attending trainings, and similar matters. While women tend to take the lead on child and livelihood issues, decisions concerning agricultural activities, like cultivation and animal husbandry, are mostly handled by men. This is largely due to the physically demanding and sometimes hazardous nature of agricultural work, such as pesticide application.[8]

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

4.4.5 Agricultural Production

4.4.5.1 Rice Production

A significant portion of the Ou Ta Paong is flooded by waters from the Tonle Sap Lake for about three months each year, requiring farmers to adapt their agricultural activities to this seasonal flooding. In areas prone to shallow flooding, farmers often plant long-duration varieties that can withstand flooding better, relying on deep-rooted crops to survive potential droughts. In areas experiencing more severe flooding, farmers may still attempt to two crops, but with higher risk. An early, short-duration, rain-fed crop is planted before the flood, with fields benefiting from minimal flood protection, such as low dikes or natural riverbanks, to delay floodwater and allow harvest. When rainfall is abundant, all areas are used for paddy cultivation. After the flood recedes, typically in October or November, a second, short-duration crop (non-photo-sensitive) is planted. This "flood recession rice" grows into the dry season, but without irrigation, it is vulnerable to drought. Flood recession rice cultivation is common in the tail-end areas of the Ou Ta Paong scheme.

Monoculture rice cultivation dominates almost all fields with an average production area of about 2.15 hectares per household. Typically, farmers grow one short-duration rice variety before the floods arrive and another after the waters recede, using grain from the previous harvest as seed while some households also reported buying seed from other farmers. Currently, about 40% of the area relies entirely on rain, while 60% benefits from irrigation, with water sourced from adjacent canals or ponds. Varieties planted are either early maturing approximately 90 days or medium maturing (110–150 days), with land preparation starting in early May once the soil softens with the rain.

Farmers in Ou Ta Paong typically plow in May, seed between May and June, and harvest in September. The FGD confirmed that wet season rice yield per hectare is between 4 and 5.5 tons per hectare a slightly higher than dry season which yield between 4 and 5 tons per hectare. However, some parts of the command area reported the yield of dry season around 4 tons per hectare whereas wet season yielded around 3.5 tons per hectare.

About 5% of farmers plant long-duration varieties (150–160 days), favoring traditional fragrant and aromatic rice types that are photo-period sensitive, yielding around 2.5 to 3 tons per hectare. These traditional varieties are more drought-tolerant, with deeper root systems that tap into residual moisture and nutrients. Photo-period sensitive varieties, such as Somaly, Phka Romdoul, and Pkha Malis for medium maturing rice, and Sen Kro Ob, OM50-54, OM 5451, and Sra Ngae for early maturing rice, must be planted in late May or June to match the short-day flowering period.

In areas with irrigation access and no annual flooding, farmers can produce two wet-season crops. An early WS crop is planted just before or at the start of the rainy season, followed by a late WS crop that remains in the field for a few weeks after the rain stops. For this, short-growth varieties like OM 5451 are popular. OM 5451, a high-yielding fragrant rice variety with strong pest and disease resistance, is also cultivated in the dry season (DS), particularly in areas near streams or ponds. Some farmers also grow dry-season paddy crops, usually short-maturing varieties like Sen Kro Ob and OM 5451. As farmers apply direct seeding, the volume of seeds being used is relatively high, giving the amount between 200 to 300 kg per hectare. The sources of seeds that farmers practice is both from keeping from the previous harvesting and buying from external sources.

The focus group discussion with rice farmers reported that the rate of fertilizer application for wet season rice is slightly below the dry season rice giving the rate of fertilizer application is between 100 and 150 kg/ha whereas the pesticide application is provided around 3 to 4 times based on pest and disease condition. The application of fertilizer and pesticides during dry season is slightly higher as the rate of fertilizer is between 180 and 250 kg/ha while the application of pesticide is around 3 to 5 times. According to the AF screening report of CAISAR, the common fertilizers include urea and di-ammonium phosphate (DAP, 16-48-0), applied at rates of 100 kg/ha and 50 kg/ha, respectively. Although muriate of potash (KCl) is unavailable locally, farmers understand the need for occasional potassium supplementation. In non-irrigated areas, only one crop is grown, with medium-growth rice varieties (120–150 days), which are photo-sensitive and typically harvested in early November. These varieties have a better local market value and are less prone to drought damage, as they flower in mid-October when rainwater is still abundant.

The main challenges that farmers reported are lack of water during dry season where the irrigation water cannot meet the demand of rice production. In addition, the riverbed became very shallow and could not facilitate water flow at some sections of the river. Water conflicts were also reported as the demand rose. In addition, high input costs including fertilizers, seeds and pesticides were also reported while labor shortage has also been an issue for them. Generally, farmers use the labor within their household but there are still households that hired people to help in seeding, pesticide spraying while soil preparation, harvesting and threshing, and transporting rice to home depending on the services of machinery. The total expenditure of rice production was reported to be approximately 615$ per hectare. The remaining straw is left in the field while some farmers take animal feed. Some farmers continue to burn the straw as it helps reduce the strength that is required during the ploughing. Farmers reported receiving limited agricultural extension and technical services.

In addition to paddy rice, around 5% of farmers diversify into non-rice crops such as watermelon and sweet corn during the dry season, with plans to expand non-rice crop production once irrigation systems improve. Ou Ta Paong farmers have the potential to grow exportable crops such as soybeans, mung beans, maize, and sesame, planted sequentially with early maturing rice in May, provided that reliable irrigation becomes in place.

Table 18: Rice production during wet and dry season

Parameters	Number	Parameters	Number
Wet season		**Dry season**	
Land size (m^2)	29,529	Land size (m^2)	32,945
Yield (kg/year)	11,517	Yield (kg/year)	14,304
Income (USD/year)	3,233	Income (USD/year)	3,467

(Source: ESCIA Field Survey, 2024)

4.4.5.2 Vegetable Production

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 '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.

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 USD 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.

Table 19: Rice production during wet and dry season

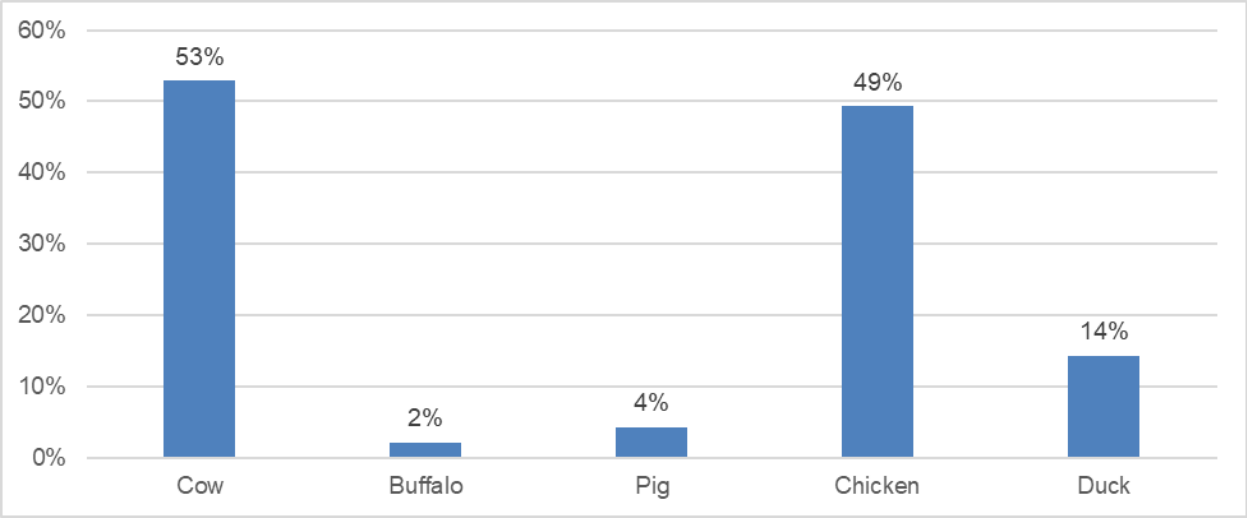
Parameters	Number	Parameters	Number
Wet season		**Dry season**	
Land size (m^2)	948	Land size (m^2)	1,617
Yield (kg/year)	473	Yield (kg/year)	497
Income (USD/year)	247	Income (USD/year)	174

(Source: ESCIA Field Survey, 2024)

4.4.5.3 Animal Production

In Ou Ta Paong, animal production is common among local households, with over half raising cows (53%), followed by chickens (49%) and ducks (14%). Buffaloes and pigs are raised in smaller numbers. This distribution reflects the diversity of livestock practices in the area, with a particular focus on cattle and poultry (Figure 13).

Figure 13: Type of animal in Ou Ta Paong command area



(Source: ESCIA Field Survey, 2024)

Please see Annex 6 – Biodiversity Assessment and Management Plan for details.

5. ENVIRONMENTAL & SOCIAL RISKS, IMPACTS, AND MITIGATION

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 September 2024)
- IBAT reports for Ou Ta Pong.

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)

External technical reports

- Statistical reports/database.
- Publications and Technical Reports from national and internation institutions.

Table 20: Environmental Risks, Impacts, and proposed Mitigation Measures

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
BEFORE CONSTRUCTION						
UNEXPLODED ORDNANCES		**Comp 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.	**Nature & Duration:** short term **Extent:** Direct **Scale:** local **Magnitude:** Minor **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Negligible	• In case of finding the suspected objects during any work, UXOs must be followed • A UXO clearance plan should be developed as part of site-specific ESCMP and is implemented before commencing project activity. • Conduct assessment of UXO risks before site clearance. UXO screening/assessment will 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 subproject prior to commencing any subproject activities • As part of site-specific ESMP, conduct training and awareness activities for local community with regards to UXO risks and chance finds.
DURING CONSTRUCTION						
ENVIRONMENTAL POLLUTION		**Comp 1,2**				
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	Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Nearby residents Construction workers **Minor**	There are limited large scale and heavy infrastructure construction being planned under the project within the areas, except the construction of small-scale hydraulic structures of the irrigation system. In addition, the larger ones are normally	**Nature & Duration:** Temporary **Extent:** Direct **Scale:** local **Magnitude:** Minor **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	• 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
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.				located outside the residential areas whereas some small cross check structures are located within residential area. In this regard, they are unlikely to affect community people as the duration is short while the people along the national road scheme will be possibly heard the traffic noise along the road instead.		• Ensure proper maintenance and proper operation of construction machinery to minimize noise 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 other sensitive receptors. • Noisy construction activities will be avoided 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. • 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						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	• 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. 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.	**Nature & Duration:** Short and long term **Extent:** Direct **Scale:** local **Magnitude:** Minor **Likelihood:** Unlikely **Inherent Risk**: Moderate **Residual risk:** Minor	• 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 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						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	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Nearby residents Construction workers **Minor**	The dredging and excavation activities 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 from workers' camps and the leakage of hazardous materials such as oil and diesel into water bodies, further contributing to water pollution.	**Nature & Duration:** Short term **Extent:** Direct & indirect **Scale:** Local & regional **Magnitude:** Minor **Likelihood:** Unlikely **Likelihood:** Unlikely **Inherent Risk:** Moderate **Residual risk:** Minor	• 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 filling of local drainage system is necessary, consultation with local authorities shall be undertaken and their permission obtained beforehand. An alternative drainage shall be 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						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.
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.	**Nature & Duration**: Short term **Extent:** Direct **Scale:** Local **Magnitude:** Moderate **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	• During Construction • 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,		• 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 of waste. Solid waste generated during construction may include	**Nature & Duration:** Short and long term **Extent:** Direct **Scale:** Local **Magnitude:** Moderate **Likelihood:** Unlikely **Inherent Risk:** Moderate **Residual risk:** Minor	**For hazardous waste in agricultural production** • Crop residue: straw and stub should be collected for use as animal feed or for other purpose 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
structures, construction debris, and so forth.				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.		• 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. **For non-hazardous waste** • Reduce, recycle, and reuse waste [e.g. plastic wastes, 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
Domestic waste: Food waste (bone, and meat waste and vegetables), paper, glass, metals, plastics, textiles, etc. being		• Activity 1.4.3 • Activity 2.1.2	Nearby residents Construction workers Water body along		**Nature & Duration:** Short and long term **Extent:** Direct **Scale:** Local **Magnitude:** Moderate	• Implement waste management plan with appropriate dump sites

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
disposed by in-migrant labourers.		• Activity 2.2.2	construction site **Moderate**		**Likelihood:** Unlikely **Inherent Risk**: Moderate **Residual risk:** Minor	
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.			Nearby residents Construction workers Water body along construction site **Moderate**		**Nature & Duration:** Short and long term **Extent:** Direct **Scale:** local **Magnitude:** Moderate **Likelihood:** Likely **Inherent Risk**: Moderate **Residual risk:** Minor	• Segregate waste (e.g. hazardous and non-hazardous), collect, store and transport waste to designated waste disposal sites. **For hazardous waste in construction** • 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 being stored.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						• Segregate hazardous wastes (oily 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, refuelling will be carried out at a fuel storage area. • Refuelling 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 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 refuelling will be confined to designated areas in construction sites designed to contain spilled lubricants and fuel.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						• 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		*Comp 1,2*				
Habitat Loss and Fragmentation: Conversion of micro-forests or vegetations in wetlands at micro or large may be needed for canal construction can lead 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.	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, canals, and access road. Other activities such as river dredging and rehabilitation activities, as well as dam construction and upgrading which 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	**Nature & Duration:** Short and long term **Extent:** Direct & indirect **Scale:** Local and regional **Magnitude:** High **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	• Implement Biodiversity Action Plan

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				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 high due to biodiversity assessment, in that there is rich of biodiversity hot spot even the surrounding area is mostly paddy fields.		
Loss of Biodiversity 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 **Moderate**	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	**Nature & Duration:** Short and long term **Extent:** Direct & indirect **Scale:** local and regional **Magnitude:** Major **Likelihood:** Possibly **Inherent Risk:** Moderate **Residual risk:** Minor	• Implement Biodiversity Action Plan • Apply Find Chance Procedure

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				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 reaching downstream of the river adjacent to zone 3, there would be likely a significant change for wildlife in the areas as people may expand agricultural land into the protected area.		
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	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Aquatic and terrestrial species **High**	The risks can be quite severe when 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 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.	**Nature & Duration:** Short and long term **Extent:** Induced **Scale:** local **Magnitude:** Moderate **Likelihood:** Possibly **Inherent Risk:** Moderate **Residual risk:** Minor	• Implement Biodiversity Action Plan

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
• **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	• Activity 2.1.2 Activity 2.2.2	Various species, particularly those dependent on forests and wetlands. **High**	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.	**Nature & Duration:** long term **Extent:** Direct **Scale:** local **Magnitude:** Moderate **Likelihood:** likely **Inherent Risk:** High **Residual risk:** Minor	• 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** - Heavy machinery and construction activities can compact the soil, reducing its porosity and ability to retain water and nutrients, ultimately	• Construction activities • Alteration of water regimes due to irrigation infrastructure	• 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	**Nature & Duration:** long term **Extent:** Indirect **Scale:** Local **Magnitude:** Moderate **Likelihood:** Possibly **Inherent Risk:** Moderate	• Restrict the movement of heavy machinery to designated areas and use appropriate construction 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
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.	(dams, levees) Pollution from agricultural runoff			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.	**Residual risk:** Minor	• 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 construction works can result in increased carbon emissions Another source of GHG emission is waste burning from worker camp site. In addition, at the time of construction, there are	Rehabilitation of irrigation canal and farm roads and burning of straw of farmers at the rice field	• 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.	**Nature & Duration:** Short and long term **Extent:** Direct, indirect, and cumulative **Scale:** Regional **Magnitude:** Moderate **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	• 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 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
possibility of smoke generated by burning of straw in the rice field.						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		Comp 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 1.2Output 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.	**Nature & Duration:** Short and long term **Extent:** Direct & indirect **Scale:** local and regional **Magnitude:** Minor **Likelihood:** likely **Inherent Risk**: Moderate **Residual risk:** Minor	• 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 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
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 levels: impact on surface water as immediate effect and underground water as long-term impact. **Soil pollution/ quality reduction:** Overuse of Agri-chemicals (e.g., chemical pesticides, fertilizers, etc.)	Intensification of agricultural production	• Output 1.1 • Output 1.2	Nearby residents Famers **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 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.	**Nature & Duration:** Short and long term **Extent:** Direct & indirect, cumulative **Scale:** local and regional **Magnitude:** Minor to Moderate **Likelihood:** Very likely **Inherent Risk**: Moderate **Residual risk:** Minor	• Implement Simplified Pesticide Management Plan • Conduct regular soil and 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	Intensifying farming	• Output 1.1 • Output 1.2	Aquatic and terrestrial species **High**	At the micro, local, and regional levels, habitat loss is likely to occur due to land clearance during the construction phase, with	**Nature & Duration:** Short and long term **Extent:** Direct, indirect & cumulative	• Implement Simplified Pesticide Management Plan

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
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.				further possible expansion into the protected areas nearby. 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.	**Scale:** local and regional **Magnitude:** Moderate **Likelihood:** Very likely **Scale:** local and regional **Inherent Risk:** High **Residual risk:** Moderate	
Invasive Species: Introduction of Non-Native Species due to 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**	The project may cause changes in water flow and flooding patterns due to irrigation infrastructure which can create favourable conditions for invasive/e 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. 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	**Nature & Duration:** Short and long term **Extent:** Indirect **Scale:** local and regional **Magnitude:** Minor **Likelihood:** Likely **Inherent Risk**: Moderate **Residual risk:** Minor	• Implement Simplified Pesticide Management Plan

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				for areas like Ou Ta Paong where there are water flows in both directions from and to the Tonle Sap Lake. The scale at Ou Ta Paong is large and the impact can be moderate. However, considering the construction will involve only with the existing canals and system, we would consider the impact caused by the project is minor.		
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 and activities within the sub-scheme	• Output 1.1 • Output 1.2	Aquatic and terrestrial species **Minor**	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.	**Nature & Duration:** Long term **Extent:** Induced **Scale:** local and regional **Magnitude:** Moderate **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	• Implement Simplified Pesticide Management 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	• 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, flood control systems, and other infrastructure elements can contribute to increased carbon emissions if not managed efficiently. These factors collectively highlight the potential for	**Extent:** Direct & indirect Nature & **Duration:** Short and long term **Magnitude:** Minor **Likelihood:** Likely **Scale:** local and regional	• Encourage sustainable practices like crop rotation and agroforestry to reduce energy consumption and improve soil health. • Introduce renewable energy sources such as solar-powered irrigation to lower the carbon footprint of rice production. • Train farmers to use alternatives to straw burning, such as mulching or biomass energy generation, to reduce air pollution. • Utilize efficient irrigation methods like alternate wetting and drying (AWD) to conserve water and minimize methane emissions. • Advocate for policies that discourage straw burning and provide incentives

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				the project to have a significant impact on GHG emissions.		for adopting sustainable agricultural practices.
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.	**Extent:** Direct & indirect Nature & **Duration:** long term **Magnitude:** Minor **Likelihood:** Likely **Scale:** local and regional	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.	• 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.	**Extent:** Potentially major Nature & **Duration:** Short and long term **Magnitude:** Minor **Likelihood:** Likely **Scale:** local	• 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. • 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						• 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.	• Output 1.1	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.	**Extent:** Potentially major Nature & **Duration:** Short and long term **Magnitude:** Minor **Likelihood:** Likely **Scale:** local	• 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.	• 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.	**Extent:** Potentially major Nature & **Duration:** Short and long term **Magnitude:** Minor **Likelihood:** Likely **Scale:** local	• 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 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.	**Extent:** Potentially major Nature & **Duration:** Short and long term **Magnitude:** Minor to Moderate **Likelihood:** Unlikely **Scale:** Local and Regional	• Promote the use of pesticides with low persistence and mobility in the environment. • 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						• 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.	• Output 1.1	Consumers, human health.	Pesticide residues on produce can pose a risk to consumer health. **Moderate**	**Extent:** Potentially major Nature & **Duration:** Short and long term **Magnitude:** Minor to Moderate **Likelihood:** Likely **Scale:** Local and Regional	• 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 emissions and impacts operating costs.	Operation of machinery and equipment for various farming activities (tillage, irrigation, harvesting, transportation) and the use of energy for processing and storage.	• 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 pollution and greenhouse gas emissions. **High**	**Extent:** Potentially significant Nature & **Duration:** long term **Magnitude:** Moderate **Likelihood:** Likely **Scale:** Local and Regional	The project needs to: • Promote the use of energy-efficient machinery and equipment. • 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.

Table 21: Social Risks, Impacts, and proposed Mitigation Measures

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
BEFORE CONSTRUCTION						
Land acquisition and resettlement	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 the OTP. Based on the initial concept design, there is possibility regarding the acquisition of land for the construction.	Nature & Duration: Short and long term Extent: Direct and indirect Scale: local Likelihood: Likely Inherent Risk: Minor to Moderate	• The actual estimate of the land acquisition and land acquisition impacts has been on the process. The ESCIA team is working with the PMU, local authorities and communities to identify the scope of land acquisition and resettlement impacts of each sub-scheme. The information on the scope and cost estimate including the potentially affected households and persons, affected lands affected assets and affected income and livelihoods will be made available at the end of December 2024 as per the available information of the final concept design and decision making on the options of construction in each sub-scheme. However, the figure may be changed after the availability of the DED.
Economic displacement	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	Nature & Duration: Short and long term Extent: Direct and indirect Scale: local Likelihood: Likely Inherent Risk: Minor to Moderate	• The actual estimate of the economic displacement has been on the process. The ESCIA team is working with the PMU, local authorities and communities to identify the scope of economic displacement of each sub-scheme. The information on the scope and cost estimate including the potentially affected households and persons, affected lands affected assets and affected income and livelihoods will be made available at the end of December 2024 as per the available information of the final concept design and decision making on the options of construction in each sub-scheme.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				economic displacement is still early to conclude.		However, the figure may be changed after the availability of the DED.
Facility Design	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.	**Nature & Duration: Short and long term** **Extent:** Direct and indirect **Scale:** local **Likelihood:** Likely **Inherent Risk:** High	• Ensure designs comply with recognized engineering standards and best practices for irrigation systems. • Use materials and designs that can withstand extreme weather conditions such as heavy rainfall, flooding, and drought. • Engage independent experts to review designs and construction plans to ensure quality and durability. • Conduct detailed hydrological studies to appropriately size culverts, canals, and structures to prevent water flow obstruction and ensure efficient irrigation. • Use adjustable gates and control structures to regulate flow during variable water conditions. • Plan for ongoing inspection and maintenance to address obstructions or sediment buildup that might impede water flow. • Include riprap, geotextiles, and vegetation around banks and structures to reduce erosion and stabilize land. • Install weirs, sediment barriers, or retention ponds to control sediment movement and accumulation. • Monitor and mitigate sedimentation or erosion impacts on adjacent areas, including upstream and downstream locations. • Involve local communities, water user groups, and stakeholders in the planning and design process to address their concerns and incorporate local knowledge.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						• Provide training to local operators and stakeholders on system maintenance and sediment management practices. • Strengthen local authorities' capacity to oversee construction and monitor irrigation system performance.
DURING CONSTRUCTION						
Child Labor	Construction of the irrigation systems		Unskilled workers (mostly local people)	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.	**Nature & Duration:** Temporary **Extent:** Direct **Scale:** local and regional **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Negligible	• Apply LMP for age check prior to engagement of labour
Forced Labor	Construction of the irrigation systems		Unskilled workers (mostly local people)	Risk of workers being forced to work (e.g. young people) to earn income for their family, and/or to pay debt. 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.	**Nature & Duration:** Temporary **Extent:** Direct **Scale:** local and regional **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Negligible	• Strict Code of Conduct for workers with no tolerance for physical or verbal abuse of women or children • 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 contractor's workers.
COMMUNITY HEALTH AND SAFETY						
Disease transmission	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	• Spreading and contracting of communicable diseases of labour forces having direct and indirect contact among themselves. • Risk of contracting non–communicable diseases	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local and regional **Likelihood:** Likely	• 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				of workers due to working behaviours and pressures at the time of working away from home.	**Inherent Risk** Moderate **Residual risk:** Minor	• In the event of a disease outbreak (e.g. COVID-19), provide immediate training/awareness raising to the risk groups. • Contractor's workers will be trained 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: • Ensure the water is visibly clean and free from sand and silt. Filter the water to get rid of visible dirt. • Drink only clean and safe water – either portable water or water filtered through water purifiers. • Get water purifying devices like filters, RO units, etc., regularly serviced and maintained. • Ensure stored water is germ-free. • Add antiseptic liquid, such as Dettol, in dubious-looking bathing water. • Hand hygiene – regularly wash hands with soap after returning home, after using the toilet, before and after preparing food, before eating or drinking anything. • Teach hand hygiene to children. Children should make it a habit to always wash their hands when returning home after playing games. • Ensure food is washed and thoroughly cooked. • Use disposable glass and plates whenever possible when eating outside food, particularly street food. • Avoid eating stale cooked food, unrefrigerated food kept exposed outside for long hours.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						• Take vaccinations for immunization against preventable diseases like Typhoid, Hepatitis A, Polio, etc.
Sexual Exploitation and Abuse, Sexual Harassment (due to labour influx)	Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Project workers Local peoples, primarily vulnerable individuals (including female and children)	• The influx labour forces) 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.	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local and regional **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Minor	• 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 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 prohibited from construction sites and worker's camp. • Ensure access to grievance redress mechanisms. • 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						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.
Road and Traffic safety	Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Project workers and local people traveling near construction sites and on transportation routes.	• Increased risk of road accidents, particularly for people living in the vicinity of the civil works and those traveling near the construction areas 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.	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local and regional **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Minor	• Conduct public awareness raising activities (IEC) to ensure local people and road users are aware of road safety regulations and risks and act accordingly while using the road. • Monitor and observe speed limit;
Community Health	• 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	• 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	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local and regional **Likelihood:** Likely **Inherent Risk** Moderate	• 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
					Residual risk: Minor	• 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. • 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	Construction or Rehabilitation of		Nearby residents Construction workers			

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
Chemical hazards	irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2		• OHS risks identified under the project include physical hazards and chemical hazards. • Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or physical activities. • 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.	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local and regional **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Minor	• 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 centres 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 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, diarrhoea, and other related diseases, as well as Code of Conduct (including discussion of SEA/SH/VAC). • 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
Personal Protective Equipment						

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						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 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)

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						• 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.
Underpaid pay and unequal treatment			Unskilled workers (possibly local people and construction workers)	Unskilled workers may be recruited and 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 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.	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local and regional **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Minor	• Implement a grievance mechanism 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 labour regulations and address any 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
						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. • Regularly engage with labour rights organizations or third-party auditors to evaluate labour conditions and make improvements where necessary.
CULTURAL HERITAGE	Rehabilitation of irrigation canal and farm roads	• Activity 1.4.3 • Activity 2.1.2 • Activity 2.2.2	Underground cultural sites/ **Minor**	Presence of cultural sites are reported. Although the construction occurs only at the existing canals and rivers, there is still possibility that these sites will be damaged by the construction's activities, especially the sacred site of local communities	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local **Magnitude:** Minor **Likelihood:** Likely **Inherent Risk** Minor **Residual risk:** Negligible	• Conduct archaeological surveys before construction in culturally sensitive areas. • Develop mitigation strategies to protect cultural heritage sites and involve local communities in preservation efforts. • Apply Chance Find Procedures.
Loss access to land and other assets:	• 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 access from existing reservoirs during construction	• 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	**Nature & Duration:** Short term **Extent:** Direct **Scale:** local **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	• 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 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				River, feeder canals, main canal existing reservoirs. This will affect income generation for farmers reliant on irrigation, and business along the canals.		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	• 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 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.	**Nature & Duration:** Short term **Extent:** Direct **Scale:** local **Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	• 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. • Engage with local communities and authorities: To understand and address 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						

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
Social inequality	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	Risk of being unequally engaged and treated, during the design phase, construction and after completion of the system	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local **Magnitude:** Minor **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Minor	• Conduct participatory planning and regular consultations with local communities, particularly marginalized groups (e.g., women, smallholder farmers, indigenous communities). • Prioritize hiring local labour, 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 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.

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
Elite capture	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	The rich grabs both available land and water resources, creating greater social disparities	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local **Magnitude:** Minor **Likelihood:** Likely **Inherent Risk** Moderate **Residual risk:** Minor	• 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 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
DURING OPERATION						
Community Health and safety	• Intensifying farming activities • Irrigation system operation	• Activity 1.4.3 • Activity 2.1.2 Activity 2.2.2	Laborers Community people	• 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	**Nature & Duration:** Temporary **Extent:** Direct & indirect **Scale:** local	• Promote sustainable agriculture practices • Implement Simplified IPM Plan

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
				of chemical inputs (e.g. pesticide) • Overuse of pesticide causing harmful residue within agricultural produce which affect consumers' health in the long run.	**Likelihood:** Likely **Inherent Risk:** Moderate **Residual risk:** Minor	
CROSS-CUTTING						
Gender inequality	Limited access for women to training, resources, and decision-making processes related to irrigation and agriculture.	• 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 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.	**Nature & Duration:** Short term and long term **Extent:** Direct, indirect, cumulative **Scale:** local **Likelihood:** Likely **Inherent Risk:** Moderate	• 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.
Social inequality	• Competition for water resources among different user groups (farmers, communities, industries). • Potential displacement or restricted access to land due to irrigation	• 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	**Nature & Duration:** Short term and long term **Extent:** Direct, indirect **Scale:** local and regional **Likelihood:** Likely	• 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

Risks and Impacts	Key activities that cause risks and impacts	Project component	Receptors/ Sensitivity	Assessment of Risks and Impacts	Extent	Proposed Mitigation Measures
	infrastructure expansion. Engagement and consultations during system design and construction			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.	**Inherent Risk:** Minor	inclusivity and capacity building for vulnerable groups. • Implement a Simplified Integrated Pest Management (IPM) Plan.
Elite capture	• 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.	**Nature & Duration:** Short term and long term **Extent:** Direct, indirect **Scale:** local and regional **Likelihood:** Likely **Inherent Risk:** Minor	• 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: 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.

6. STAKEHOLDER ENGAGEMENT AND INFORMATION DISCLOSURE

6.1 Purpose and Process of Stakeholder Engagement

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 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.

During project preparation, various stakeholders have been consulted in July and August 2024. Table below summarizes the number of people consulted by consultation techniques:

Table 22: Number of participants being consulted for Ou Ta Paong Sub-scheme

Levels	Household survey (Beneficiaries and Potentially Affected)	Focus Group Discussions	Key Informant Interviews	Total
Village level	140	61	9	210
Commune level			9	9
District level			5	5
Provincial level			21	21
			Total	**245**

6.2 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 are 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 to 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 stakeholders 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.

6.3 Stakeholder Engagement during Sub–Scheme Preparation

6.3.1 Environment, Biodiversity and Climate Change Impact

6.3.1.1 Pollution prevention and resource efficiency

Under the physical and environment aspects, the consultations discussed to gather opinion of stakeholders regarding the air quality, noise and vibration, surface and ground water quality, soil pollution, solid waste, domestic waste, wastewater. The consultations showed that stakeholders showed some opinions, concerns, and suggestions regarding the risks and impacts that CAISAR project may cause as below:

Overall Opinion

- There seems to be no concern regarding the quality of air or other disturbing factors as the community people and relevant stakeholders indicated the impacts are far below the other risks and impacts which they used to face. For example, the one caused by local factories and enterprises which shown to be at a higher level.
- The surface water quality seems to be impacted by various sources of pollution, including agricultural runoff from fertilizers and pesticides, factory waste, livestock waste, and human activities such as domestic waste and solid waste. While the project's activities are planned to conduct construction in the dry season and include their waste management plan, there's likely less impact on the water quality.

Concerns

- During the construction stage, such as the rehabilitation of irrigation canals and farm roads, can have disturbing environmental effects.
- Large machines used in the irrigation system construction 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 will negatively impact local air quality and surface water.

Suggestions from the consulted people

- Avoid canal rehabilitation and upgrading of the canal being conducted 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 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.

6.3.1.2 Biodiversity

Regarding biodiversity, consultations have been conducted with local people, local authorities, and relevant institutions, focusing on habitat loss and fragmentation, alteration of water regimes, and loss of biodiversity in the command areas. The summary of the results is provided here:

Overall Opinion

- The CAISAR project's construction activities will have a minimal impact on biodiversity within the sub-schemes. By improving irrigation infrastructure, farmers can cultivate their land more frequently, and during the project operation, this may lead to increased biodiversity and ecological benefits.
- Improved irrigation systems will enable farmers to supplement their income by engaging in aquaculture, such as fish farming.
- Fish and other aquaculture will increase due to expanding habitat and space for moving, and farmers will be able to fish for household consumption and income.
- Less impact to biodiversity, however it has more benefit to biodiversity itself and farmers in the community.
- The project will significantly enhance the landscape by generating a livelier farming activities and water availability.

Concerns

- CAISAR project may cause negative impact on the environment, including changes in water quality, dust generation, air pollution, soil erosion, improper waste disposal, and hazardous waste from machinery.
- Additionally, the project's construction could disrupt the natural flow of water from upstream to Tonle Sap Lake, potentially harming the lake's biodiversity.
- 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 contractors and relevant parties should conduct on water quality and air quality monitoring during construction.
- To ensure the well-being of workers, contractors must regularly monitor and inspect of 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 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.

6.3.1.3 GHG Emission

There seems to be limited awareness and knowledge regarding the construction and farming activities which will contribute to the GHG emission. Only a few stakeholders reported the opinions were recorded which are mainly the line departments.

Overall Opinion

- The contribution of the project in terms of GHG emission may add into the global GHD emission due to activities like transportation, agricultural practices, the decomposition of agricultural waste, and the burning of agricultural waste.
- The use of trucks and heavy machinery during the construction process will inevitably release greenhouse gases into the atmosphere.

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, and
- The impact maybe small such as waste burning at the construction sites and the increased use of machinery

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.
- Installing solar water pumps in agriculture processing facilities can reduce fuel consumption, which causes greenhouse gas emissions.

6.3.2 Social Aspects

6.3.2.1 Labor and Working Conditions

Overall Opinion

Common impacts of labour and working condition, provided by relevant stakeholder during the consultation including:

- The project’s benefits outweigh the negative impacts, as it is anticipated to improve the availability of workspaces for both men and women and enabling farmers to boost agricultural production.
- People without land may find labour opportunities, potentially reducing migration.

- Even though women may be occupied with factory work, they can still engage in agricultural activities.

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

In response to the common issues outlined above, participants have also offered suggestions to address these concerns as the following:

- The construction companies should hire local workers to offer them jobs and strictly abide to laws and reducing the concerns about gender-based violence or sexual violent.
- 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

6.3.2.2 Community Health and Safety

Overall Opinion

- The construction and rehabilitation of the irrigation system is unlikely to generate any significant impact on community health, as no harmful chemicals are used, aside from some noise and vibrations.

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,
- The project should equip the solar lights along the roads to promote the safety of travellers during nighttime,

6.3.2.3 Land acquisition, economic and physical displacement

Overall Opinion

Perspective on land acquisition, economic and physical displacement impact from all the sub-scheme organizations is stated below:

- The rehabilitation or restoration of the irrigation system does not appear to directly impact rice farming, but it is crucial for enhancing rice and agricultural production and improving transportation infrastructure for agricultural products,
- Currently, farmers face water shortages for rice cultivation during the dry season and excess water during the wet season, due to insufficient sub-canals, reservoirs, and water sources,
- The irrigation system contributes to improving livelihoods for both general and vulnerable groups by boosting rice production, increasing local businesses and vendors, supporting water-related enterprises (such as water filtration), facilitating labor sales, and promoting local tourism. However, the irrigation system alone will not reduce migration unless there is a market for agricultural products,
- The project is believed to have minimal impact on farmers' land and private companies as it is planned to mainly rehabilitate the existing system,
- People tend to have positive views and welcome such a kind of project and normally they are willing to voluntary contribute the land,
- The provincial, district, and relevant institutions are capable solving the issues well and people are willing to cooperate,
- The roles and structure of the relevant authorities in dealing with the land acquisition and resettlement are well-prepared and ready to address the concern,
- Law on expropriation will be complied and compensation will be made as per the legislation of the country, so it is not generally a big problem for such a project,

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, increasing their risk of exploitation and potentially leading to their children dropping 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,
- 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.

6.3.2.4 Cross–cutting risks and impacts

Regarding to cross-cutting risks and impact focus on social inequalities, and elite capture which influenced by the project, all the participants illustrate their perspectives, concerns and provide some idea and feedback as per their location as the following:

Overall Opinion

- The management of the system is quite challenging which is based on the actual situation of the system,
- The back-and-forth arguments may cause the delay of the construction of the irrigation system,
- The rising price of rice has led farmers to produce more rice than the available water supply can support, despite warnings from PDWRAM,

Concerns

- Unequal water distribution among farmers leads to favoritism and conflicts, often because farmers do not follow water distribution guidelines or announcements from authorities.
- Institutions or companies responsible for establishing FWUCs are typically based at the national level, resulting in limited quality of implementation, which weakens the FWUCs, while PDWRAM is sidelined, leading to wasted resources.
- The FWUCs struggle to generate income, making water management challenging, as there is no budget for repairs, leading to improper system operations.
- In addition to water issues, farmers face 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.
- Manure availability for fertilizer is declining due to reduced livestock raising, and falling cattle prices are prompting farmers to further decrease livestock production.

Suggestions from the consulted people

- 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,
- PDWRAM should be the leader in formulating the FWUCs with the support from national level,
- 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,
- 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 farmer.
- The Environment Department should allow dam or canal restoration activities of private companies, as these activities benefit both the community and agricultural production.
- 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 farmer which could be used later to support caretaker and maintenance the irrigation system.
- 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.
- Provide crop seeds to farmer and implement crop rotation techniques to improve yields.
- Providing modern equipment and new techniques to department officers can enhance agricultural production efficiency and yield.

6.4 Stakeholder Engagement during Sub–Scheme Implementation

During the implementation of the sub–scheme, particularly prior to construction, when locations of contractor's office, workers' camp, disposal sites for construction debris and construction waste, and labor management plan, etc. are identified – based on Contractor's ESMP, environmental and social risks and impacts associated with Contractor's specific construction methods and measures will be updated in C-ESMP and disclosed for continued consultation with local people and local authorities to avoid/minimize E&S risks and impacts.

6.5 Information disclosure

This ESCMP will be disclosed to the public in both English and Khmer language. The English version will be disclosed in full version whereas the Khmer version will be disclosed as Executive Summary. The documents will be disclosed on the website of MOWRAM (as Project

Implementation Unit), and on the website of AIIB, IFAD and GCF before project appraisal and project approval – as per disclosure guidelines required by each donors.

7. GRIEVANCE REDRESS PROCEDURES

7.1 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 aggrieved person can use. If the aggrieved person is not satisfactory with the grievance resolution result, or if their complaint is not resolved within the timeframe specified for a particular step, 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.

7.2 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).

7.3 Principles of the Project GRMs

Under CAISAR, the following principles will be applied:

- Channels. Different channels are established to enable affected person 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 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 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 multistakeholder committee will be established (ad-hoc) to resolve the dismissed grievance – as an alternative for 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 person. 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.

7.4 Project's Redress Procedures

The project has in place complaint handling procedures for three 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 procedures is provided below:

7.4.1 Redress Procedure for Complaints related to Land Acquisition

Under this project, to facilitate the grievance redress (Figure 17), 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 elderlies who will discuss with the leader of the PRSC-WG to find a solution. Verbal grievance can be provided to the commune/Sangkat chief or community elderlies. So, no written complaint is required. It is noted that even if the complaint is made verbally, the complaint will be registered in project's logbook, including resolution process and result for such verbal grievance for monitoring purpose. 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.

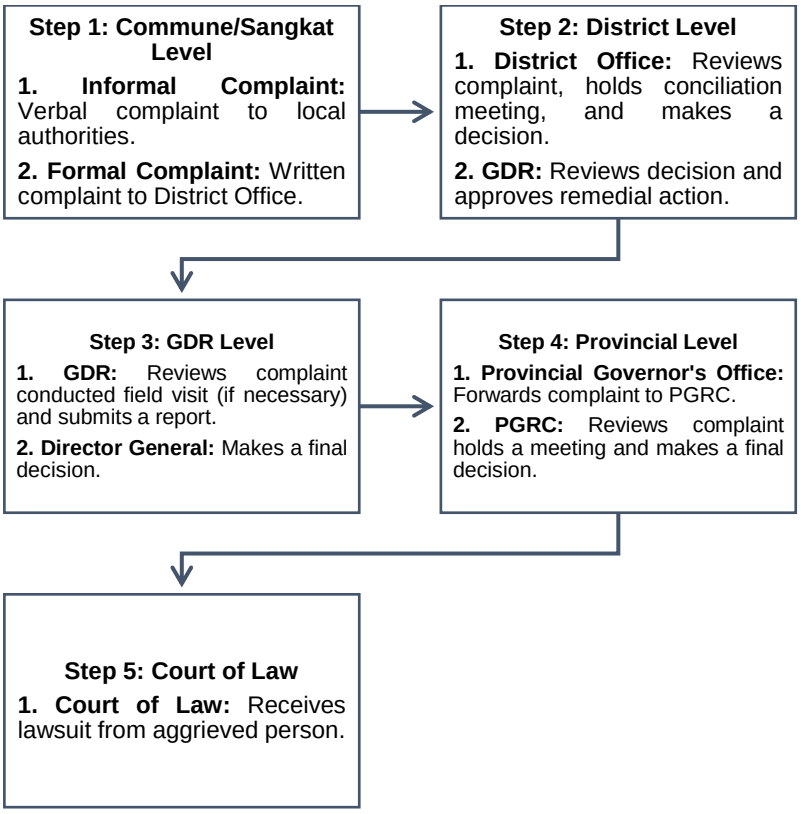
- Step 2 − District level. AH can lodge a written complaint to the Head of the District Office (where the subproject is located). The AH can bring a community elderly or their representative to discuss their grievance at the District Office. A conciliation meeting shall be held, and a decision be made 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, 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 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.

- 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 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 lodgment 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.

Figure 14. Redress Procedure for Complaints related to Land Acquisition



7.4.2 Redress Procedure for Complaints Related to Labor and Working Conditions

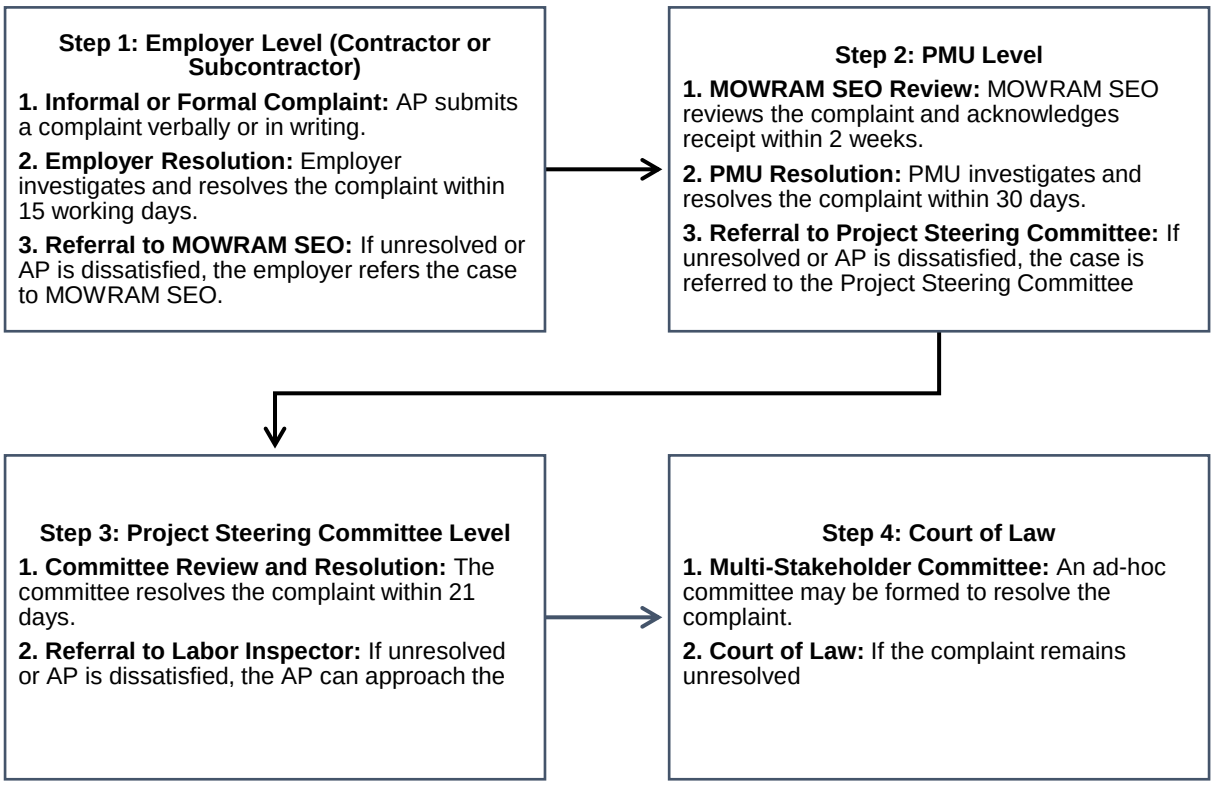
Project workers can lodge their grievance/complaint as follows:

- 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 grievance. 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 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 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 multistakeholder committee will be established (ad-hoc) to resolve the dismissed grievance – as an alternative for 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 15. Redress Procedure for Complaints Related to Labor and Working Conditions



7.4.3 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

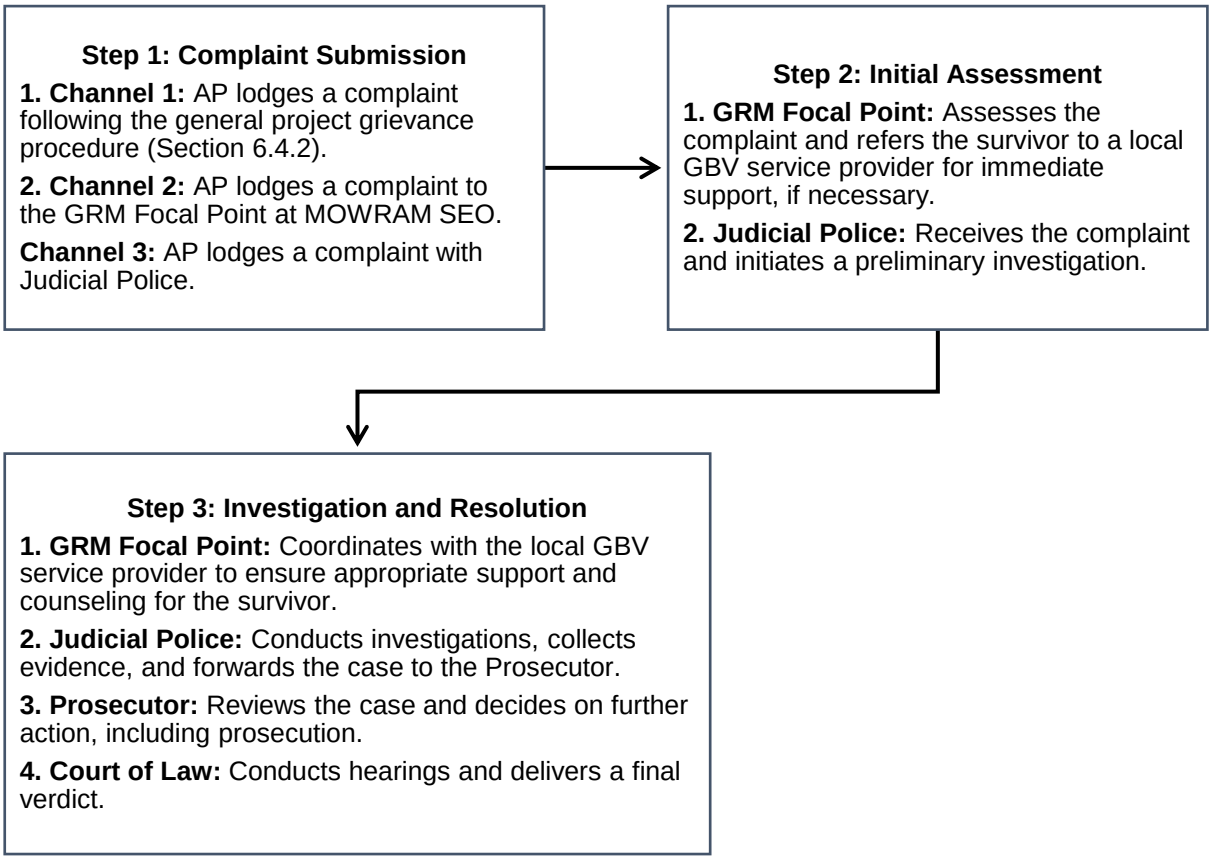
following principles apply so as to recognize SEA/SH/GBV victim as principal decision makers in their own care, and treat them with agency, dignity and respect for their needs and wishes: § Multiple channels are in place for easy access and lodge complaints.

- 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 operator (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 16. 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 procedure.
- 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 SEA/SH/GBV resolution is final.

7.4.4 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 accident 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 5.1 – Resources). o 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

7.5 Registration of Project Grievance

The SEO, Project 6. Managers within MOWRAM is responsible to establishing and maintaining the project grievance logbook (PGL). The PGL will be established by the SEO to record all concerns/ grievance that are submitted by project stakeholders during project implementation. In case there is serious complaint, the World Bank should be notified of these complaints within 24 hours of complaint receipt (See Annex 3 for Guidance for establishing and maintaining Project Grievance Logbook).

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 IAAB, 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).

8. IMPLEMENTATION ARRANGEMENTS

8.1 Environmental and Social Duties of the PMU/Detail Design Consultants

8.1.1 MOWRAM'S PMU

The 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's contractors.
- Collaborating with relevant departments involved in land acquisition and/or other environment or social mitigation measures.

8.1.2 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.

8.1.3 Provincial Department of Water Resources and Meteorology

PDWRAM's main responsibility includes:

During subproject preparation:

- Support design parties in their surveys and consultation to prepare Feasibility Study and Detailed Design for sub-scheme.

During construction:

- 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.

8.1.4 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.

8.2 Contractor's Environmental and Social Management Plan (C-ESMP)

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.

8.3 Contractor's Safety, Social and Environmental Officer (SSEO)

The contractor must appoint a competent on-site Safety, Social, and Environment Officer (SSEO), 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.

8.4 Contractor's obligation as to contractual requirements

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 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. ENVIRONMENTAL AND SOCIAL MONITORING PROGRAM

9.1 Environmental Monitoring Program

To ensure the effectiveness of environmental management, the environmental monitoring program is prepared to monitor the environmental quality. The 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 23: Environmental monitoring plan during construction phase

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
Soil quality	• 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
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)	Construction site	• Air quality monitoring equipment	Every 06 months	
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 noise 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	• Measuring equipment and/or appropriate monitoring methods	Every 06 months	SEO E&S specialist consultants PMU

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
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 residues (C/N Ratio), - Total phosphorus (P), - Cation exchange capacity (CEC), - pH, • Electrode Conductivity.	There are 2 locations for soil quality sampling. SS1 X:355662 Y:1399063 SS2 X: 354509 Y:1406852	• Soil quality monitoring equipment	Every 06 months	SEO E&S specialist consultants PMU
Water Quality	• Wastewater management • Design and capacity of septic tank • Digging of side drain at campsite • Construction of retaining structures	Construction site	• Site inspection • Visual observation	Daily	SEO E&S specialist consultants PMU
	Parameters for surface water quality test: • Depth • pH • Electrode Conductivity (EC) • Arsenic (AS) • Cadmium (Cd) • Lead (Pb) • Total Nitrogen (TN)	There are 3 locations for surface water quality sampling: SW1 X: 356706 Y:1396198 SW2 X: 355668 Y:1404018 SW3 X: 352153 Y:1414410	• Water quality monitoring equipment		

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
	• Total Phosphorus (TP) • Total Dissolved Solid (TDS) • Total Suspended Solid (TSS) • Dissolved Oxygen (DO) • Total Coliform				
	• Testing wastewater quality and pesticide residues in water (to be conducted overseas)	Final outlet from Septic Tank	Water quality monitoring equipment	Every 06 months	SEO E&S specialist consultants PMU
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	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	Daily/Weekly	SEO E&S specialist consultants PMU

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
			(if available)		
Loss of biodiversity and ecosystem services	• Changes in species abundance and diversity • Decline in water quality • Changes in soil fertility • Reduced pollination services • Alterations in hydrological processes	Construction site	Site inspection Visual observation Biodiversity surveys •	Daily/Weekly	SEO E&S specialist consultants 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
Flora and Fauna	• Avoid cutting down trees or destruction of vegetation • No hunting, fishing, or collection of animal and plant materials • Construction of fish ladder passage • 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	Daily	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 • Avoid extraction of gravel from watercourses. • Adopting of slop stabilization techniques.	Construction sites	• Site inspection • Visual observation	Daily	SEO E&S specialist consultants PMU
Protected Areas	• Exclude a subproject located in 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	Construction site Nearby sensitive structures	• Site inspection Visual observation	Daily	SEO E&S specialist consultants

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
	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 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.		Consultation		PMU
	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 3 locations for surface water quality sampling. SW1 X:356706 Y:1396198 SW2 X:355668 Y:1404018 SW3 X:352153 Y:1414410	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 - Ratio of the mass of carbon to the mass of nitrogen in organic residues (C/N Ratio), - Total phosphorus (P),	There are 2 locations for soil quality sampling. SS1 X:355662 Y:1399063 SS2 X: 354509 Y:1406852	Soil quality monitoring equipment	Annually	SEO E&S specialist consultants PMU

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
	- Cation exchange capacity (CEC), - pH, - Electrode Conductivity.				
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. • 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).	Irrigation intake points Representative fields within the sub-scheme	Water flow measurements Soil moisture monitoring Crop water use assessments	Daily	PMU FWUC

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
	• Track water consumption per unit of crop yield (e.g., cubic meters of water per ton of rice produced).				
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 and workers.	Representative fields Pesticide storage facilities	• Pesticide application records • Pest scouting and monitoring data • Health records	Regularly during the growing season	PMU Agricultural extension officers
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.	Representative fields at harvest time	• Laboratory analysis of	Before harvest	PMU Third-party

Monitoring Parameters	Monitoring Activities	Location	Measurements	Frequency	Responsibility
	• Ensure that produce meets national and international standards for maximum residue limits (MRLs).		produce samples		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 Social Monitoring Program

To ensure the effectiveness of social management, the social monitoring program is prepared to monitor social issues. The contractor and/or sub-contractor are responsible for monitoring using appropriate methods, equipment and system. Details on monitoring parameters are shown on the table below:

Table 24: Social monitoring plan during construction and operational phase

Monitoring Parameters	Activities Subject to Monitoring	Locations	Measurements/ Indicators	Frequency	Responsibility
During construction phase					
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-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 PMU)	• Monthly and during subproject cycle	• Contractors • 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	• Monthly and during subproject cycle	• Contractors • PMU

Monitoring Parameters	Activities Subject to Monitoring	Locations	Measurements/ Indicators	Frequency	Responsibility
			present in subproject area)		
Security and Road and Traffic safety	• Security cautions • General disease prevalence • Worker health • Communicable diseases	• Construction sites • Access roads to construction sites • Newly constructed/re habilitated 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 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	• 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
Community Health and diseases	• Incidence of waterborne diseases • Prevalence of vector-borne diseases (e.g., malaria, dengue fever) • Respiratory illnesses related to dust	• Construction sites • Worker camps	• Health data collection • Site inspections • Health surveys and interviews • Consultation with workers and community members	• Monthly • During outbreaks • Periodic	• PMU • Contractors • Local health authorities

Monitoring Parameters	Activities Subject to Monitoring	Locations	Measurements/ Indicators	Frequency	Responsibility
	and air pollution • Availability and accessibility of healthcare services • Community awareness of health risks and preventative measures	• Community and neighboring areas		community health awareness campaigns	
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
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 • Fatality • Disease outbreaks • Environmental pollution incident • Dam failure (during construction)	• 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
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
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	
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	• Worker in construction sites Community	• Site inspection • Observation Consultation with local authorities and local community	• Daily Monthly	• Contractors PMU

Monitoring Parameters	Activities Subject to Monitoring	Locations	Measurements/ Indicators	Frequency	Responsibility
	processed/resolved within the timeframe specified for each step in grievance redress procedure.	and neighboring community			
During operation phase					
Irrigation Operation and Maintenance	• Operation and maintenance for the subproject and irrigation system	• Within target command area • Downstream the target command area	• Inspect and evaluate system dam safety	• Monthly	• PMU (during project life) • PDWRAM (after subproject completion)
			• Prepare before construction completion and adopt during operation	• As soon as the rehabilitated dam and irrigation system is operated again	
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	• Construction sites • Training sessions • Community	• 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

Monitoring Parameters	Activities Subject to Monitoring	Locations	Measurements/ Indicators	Frequency	Responsibility
	social groups.	consultations			
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 favoritism or exclusion in decision-making.	• 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
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

10. ESTIMATED COSTS

10.1 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, exclusive of the actual budget for the land resettlement and land acquisition which will be estimated by the end of the year as per the newly approval on the final conceptual design. 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 one 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 one.

Table 25: Estimated cost for ESCMP implementation

No.	Items	Qty	Unit	Cost (USD)	Total (USD)
1	UXO clearance	1	Lum-sump	150,000	150,000
2	Land Acquisition and Land Impact Assessment and the preparation of the Land Acquisition and Land Resettlement Plan	1	Lum-sump	120,000	120,000
3	Implementing Biodiversity Management Plan	5	Year	200,000	1,000,000
4	ESMP awareness raising and sensitization with key stakeholders and communities (5 times)	5	Times	3,000	15,000
5	Community outreach at the project area	1	Sub-scheme	15,000	15,000
6	Consultation facilitation	1	Sub-scheme	10,000	10,000
7	E&S monitoring activities	1	Lum-sump	99,000	99,000
	Total				**1,409,000**

10.2 Estimated Costs for ESMCP Monitoring Program

The monitoring cost will be budgeted only for the activities which are supposed to be additional expenditure which are not included in the social and safeguard consultant. The cost for monitoring is mainly focused on the monitoring cost for soil, water, and air quality.

Table 26: Estimated cost for ESCMP monitoring program

No.	Items	Unit	Qty	Cost	Total
1	Soil quality monitoring (every six months* 3 locations * 3 years)	Times	18	1,500	27,000
2	Air quality, noise and vibration quality monitoring (every six months* 3 locations * 3 years)	Times	18	2,000	36,000
3	Water Quality monitoring (every six months* 3 locations * 3 years)	Times	18	2,000	36,000
	Total				**99,000**

Annex

Annex 1. Screening checklist for E&S impacts for Ou Ta Paong Sub-scheme

Circle screening conclusion:

- If the answers to the checklist questions are "No", there is no need for further action.
- If the answers to the questions are "Yes", then consult the relevant procedures /guidelines for assistance in addressing issues of concerns.

A	Environmental and Social Impacts	No	Yes	Notes
Location				
1	Are there environmentally sensitive areas (forests, pastures, rivers, and wetlands) or threatened species that could be adversely affected by the sub-project?		√	
2	Does the sub-project area (or components of the project) occur within or adjacent to any protected areas designated by government (national park, national reserve, world heritage site, etc.)?		√	
3	If the sub-projects are outside of, but close to, any protected area, is it likely to adversely affect the ecology within the protected areas (e.g., interference with the migration routes of mammals, fish, or birds)?		√	
4	Will the sub-projects reduce people's access to pasture, water, public services, or other resources that they depend on?	√		
5	Might the sub-projects alter any historical, archaeological, or cultural heritage site or require excavation near such a site?	√		
Physical and biological environment				
6	Will projects require large volumes of construction materials (e.g. gravel, stones, water, timber, firewood)?	√		
7	Might the projects lead to soil degradation or erosion in the area?		√	
8	Might the projects affect soil salinity?		√	
9	Will the projects create solid or liquid waste that could adversely affect local soil,	√		

	vegetation, rivers, streams, or groundwater?			
10	Might river or stream ecology be adversely and remarkably affected due to the installation of structures such as weirs, etc.?	√		
11	Will the projects have adverse impacts on natural habitats that will not have acceptable mitigation measures?	√		
12	Do the projects have human health and safety risks, during construction or later?		√	OHS safety and Dam safety
13	Might the projects lead to migration into the area?		√	
Alternatives				
14	Is it possible to achieve the objectives above in a different way, with fewer environmental and social impacts?	√		
B	**Land Acquisition and Social Issues**			
1	Have all groups within the community been consulted about the proposed project?		√	
2.	Which groups have not been consulted?	√		
3	Will the projects require acquisition of land (public or private) and/or other assets for its development?		√	Need to re-assess when the final design being made available
4	Will anyone be prevented from using economic resources (e.g. pasture, community places, forests etc.) to which they have had regular access?		√	Need to re-assess when the final design being made available
5	Will the projects result in the involuntary resettlement of individuals or families?		√	Need to re-assess when the final design being made available
6	Will the projects result in temporary or permanent loss of crops, fruit trees and household infrastructure such as granaries, toilets, kitchens etc.?		√	Need to re-assess when the final design being made available
7	Will the projects affect the livelihoods of particular groups within the communities, especially vulnerable groups such as the landless?	√		
8	Will the projects affect the well-being and livelihoods of women, particularly female-headed households?		√	Need to re-assess when the final design being made available
9.	Will the projects benefit all groups within the community equally?		√	
10.	Are there ongoing land or water disputes within the community/with neighboring communities?		√	

C	Pesticides and Waste Materials			
1	Will the project result in the introduction of pesticides or an increase in pesticide use if the use of such products exists?		√	
2	Will the project result in the production of solid or liquid waste (e.g. water, domestic or construction waste), or will it result in an increase in waste production during construction or operation?		√	Need to reassess when the final design and needs in construction being made available
D	**Is there a probability of the presence of unexploded ordinance (UXO) at or near the proposed sub-project area?**		√	

Annex 2: Layout of Ou Ta Pong sub-scheme

Figure 1. Administrative map of Ou Ta Paong sub-command area 128
Figure 2. Three blocks (sub-scheme) of Ou Ta Pong sub-project 128
Figure 3. Concept design of Block A of Ou Ta Pa Ong Scheme 129
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Figure 1. Administrative map of Ou Ta Paong sub-command area

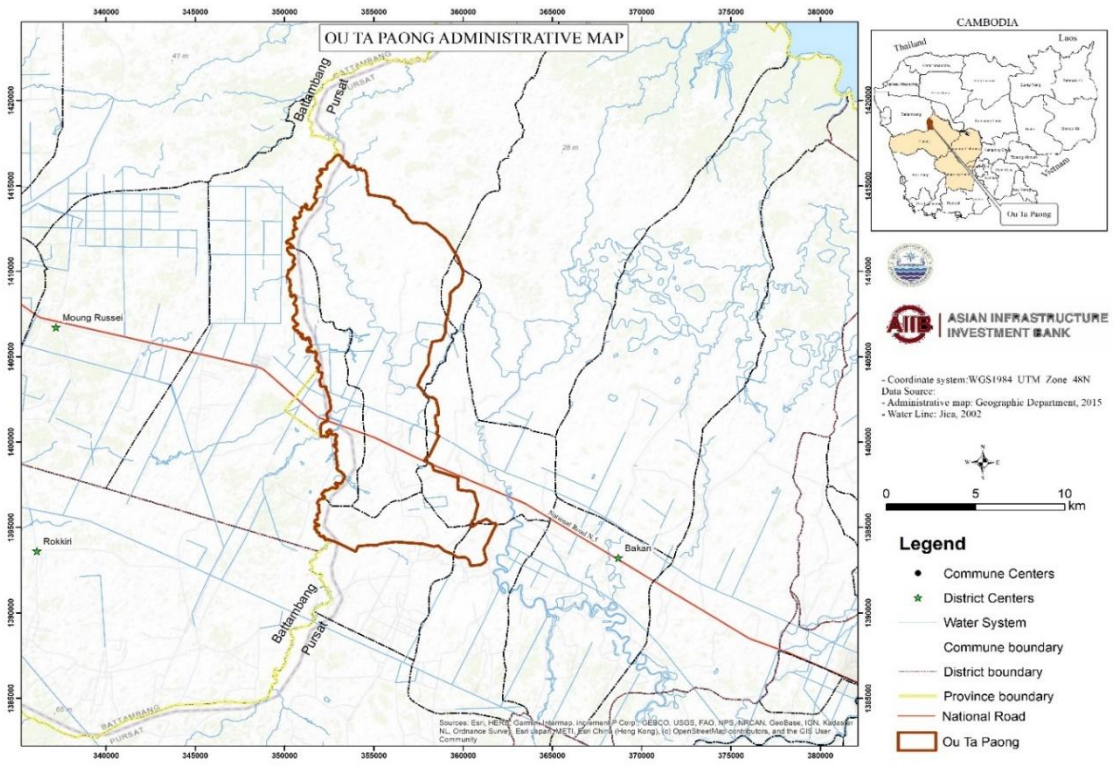


Figure 2. Three blocks (sub-scheme) of Ou Ta Pong sub-project

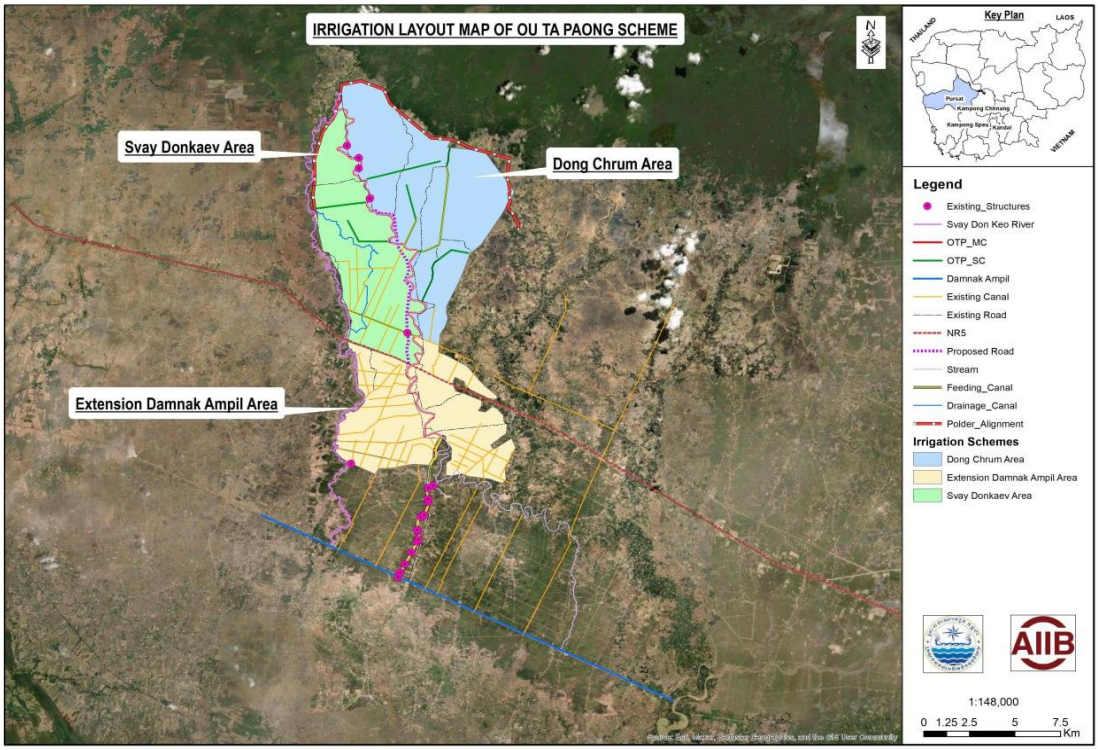


Figure 3. Concept design of Block A of Ou Ta Pa Ong Scheme

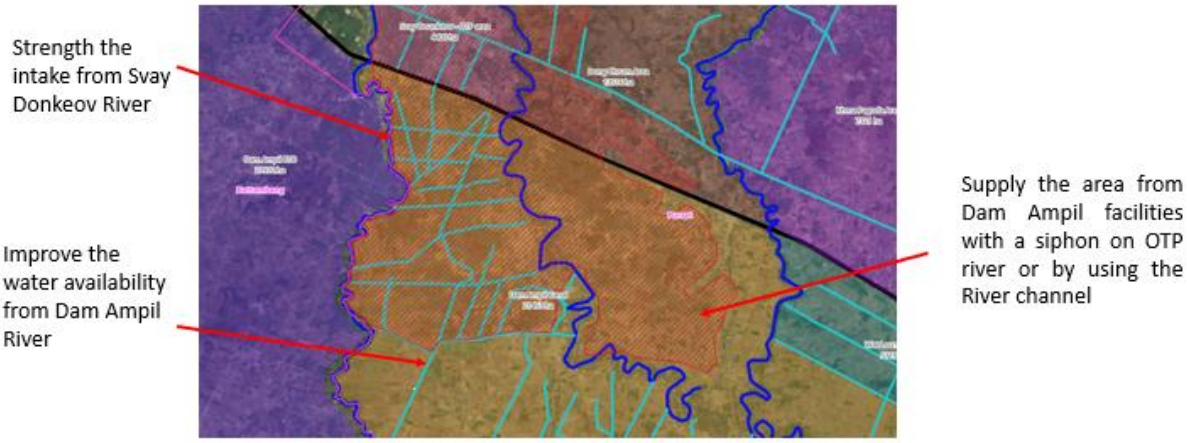


Figure 4. Concept design of Block B of Ou Ta Pa Ong Scheme

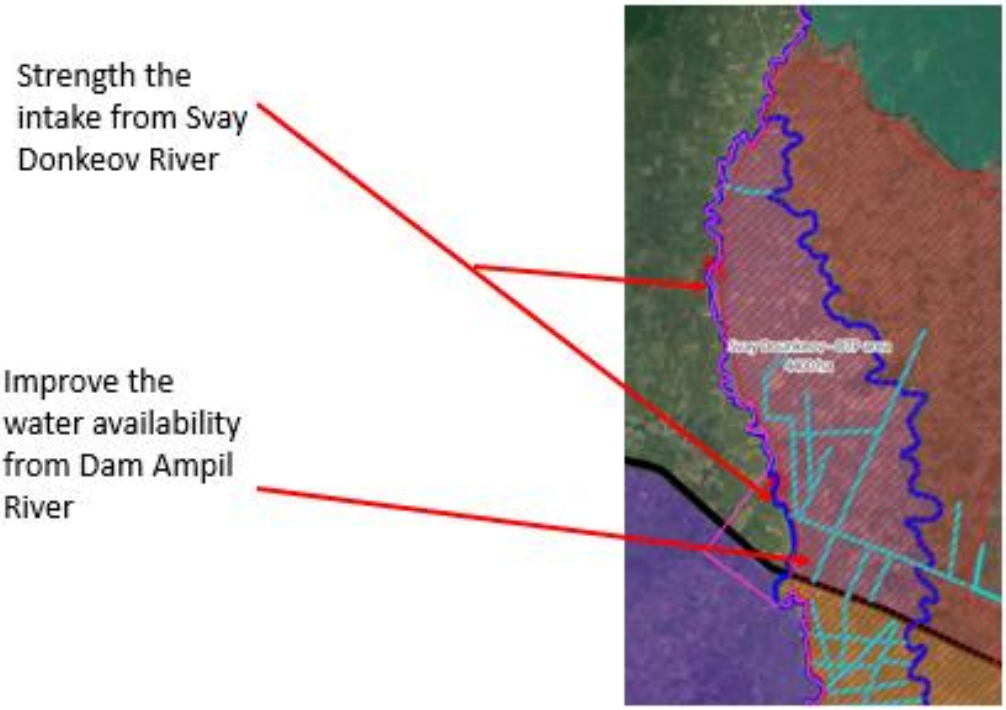


Figure 5. Concept design of Block C of Ou Ta Pa Ong Scheme

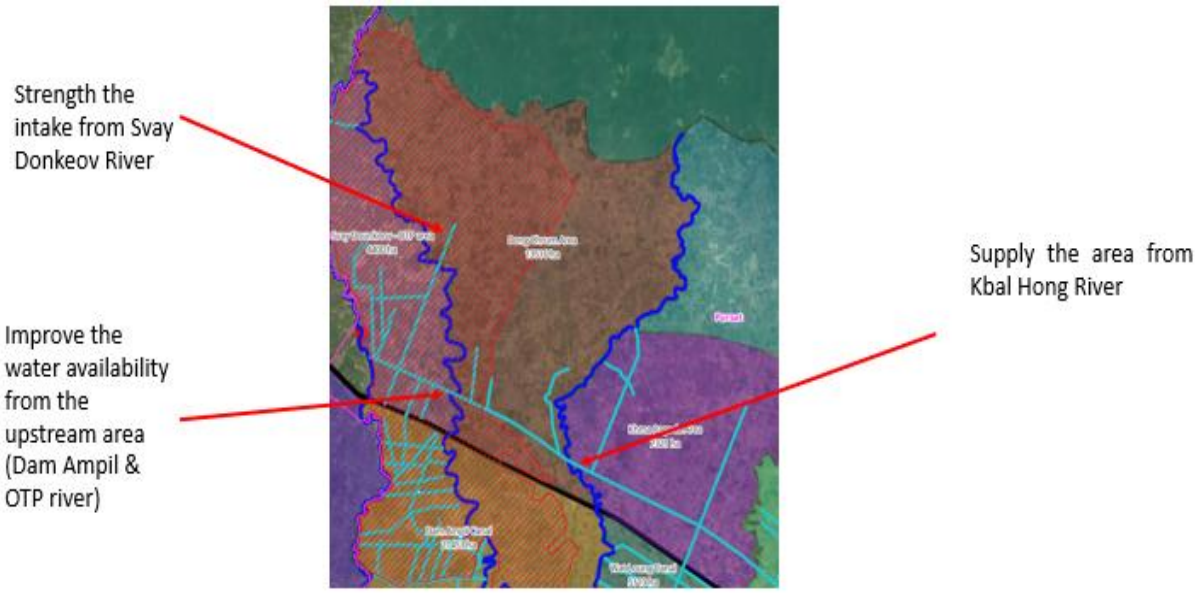


Figure 6. The illustration of the engineering design in Ou Ta Paong sub-scheme

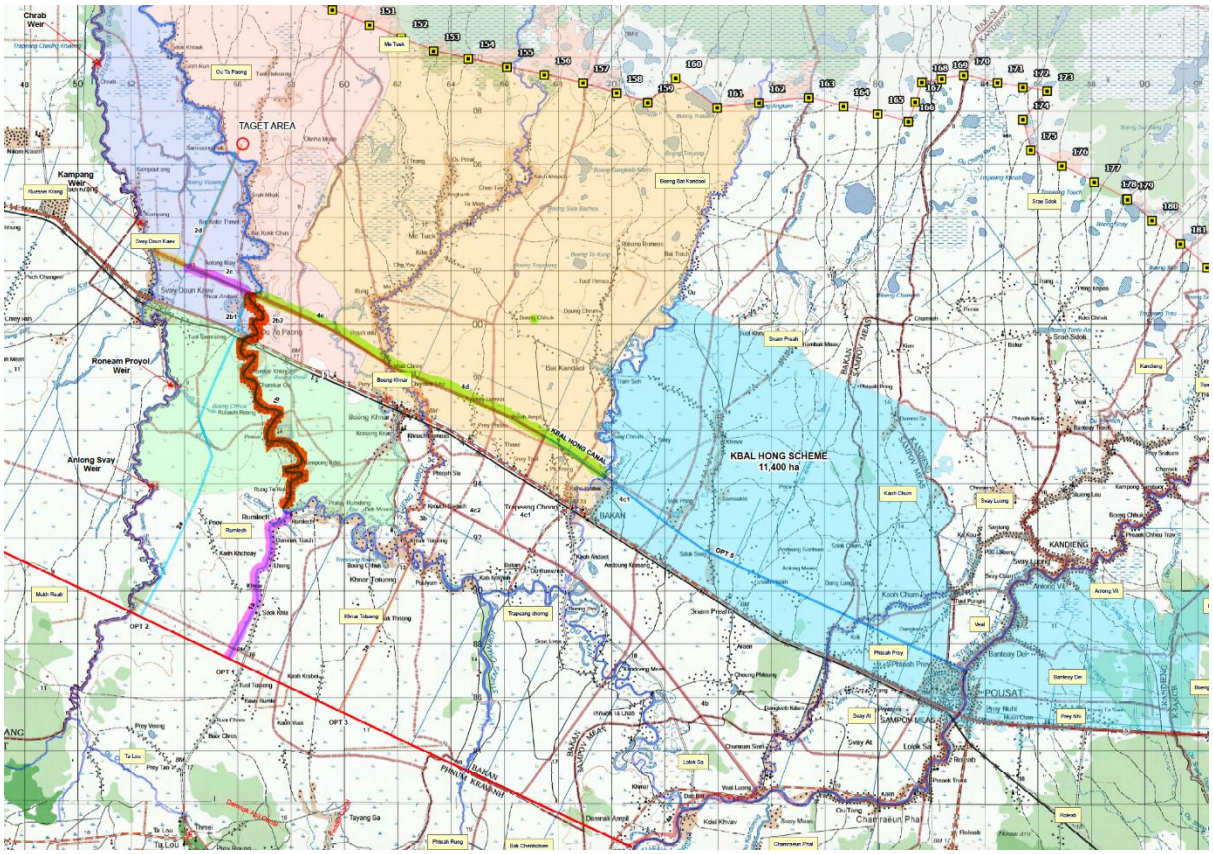


Figure 7. Map of Construction Sites and Residential Area in Ou Ta Paong

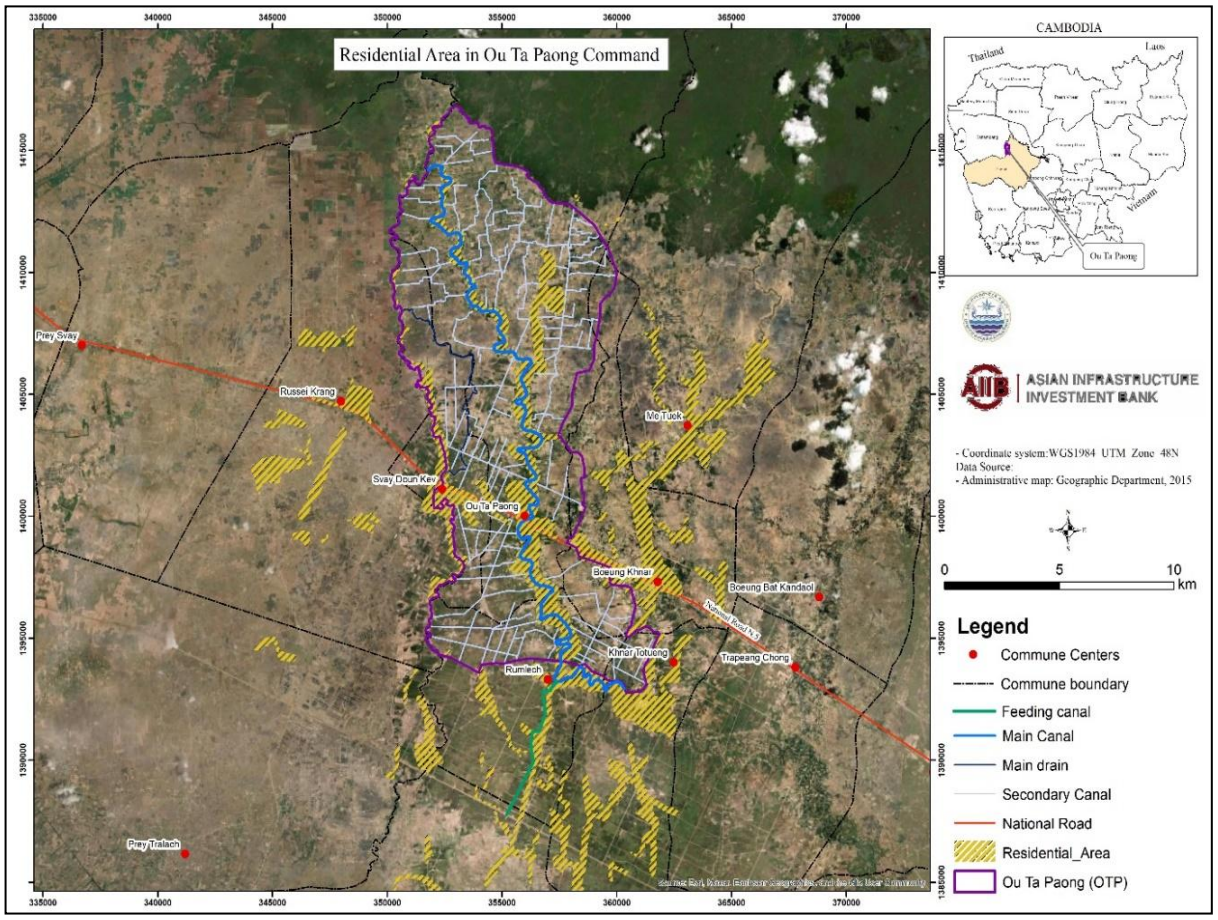
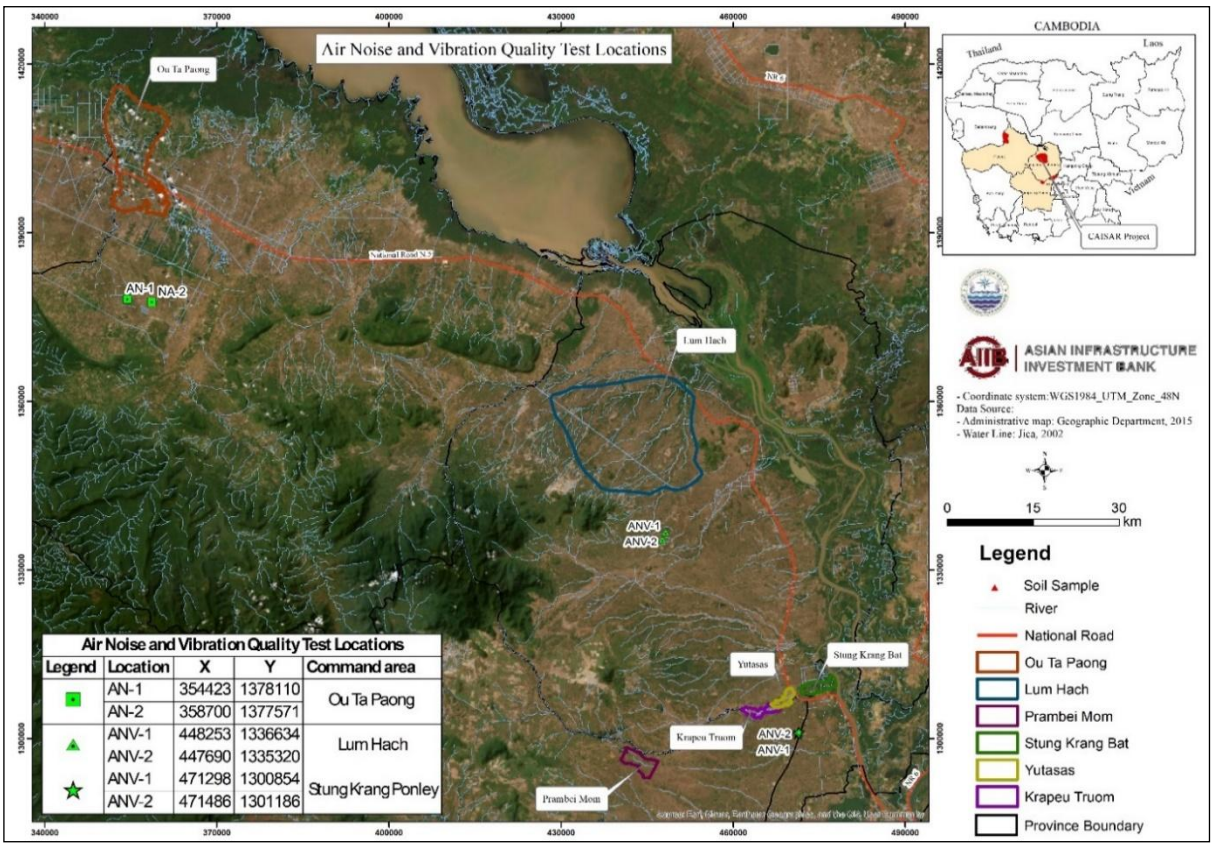


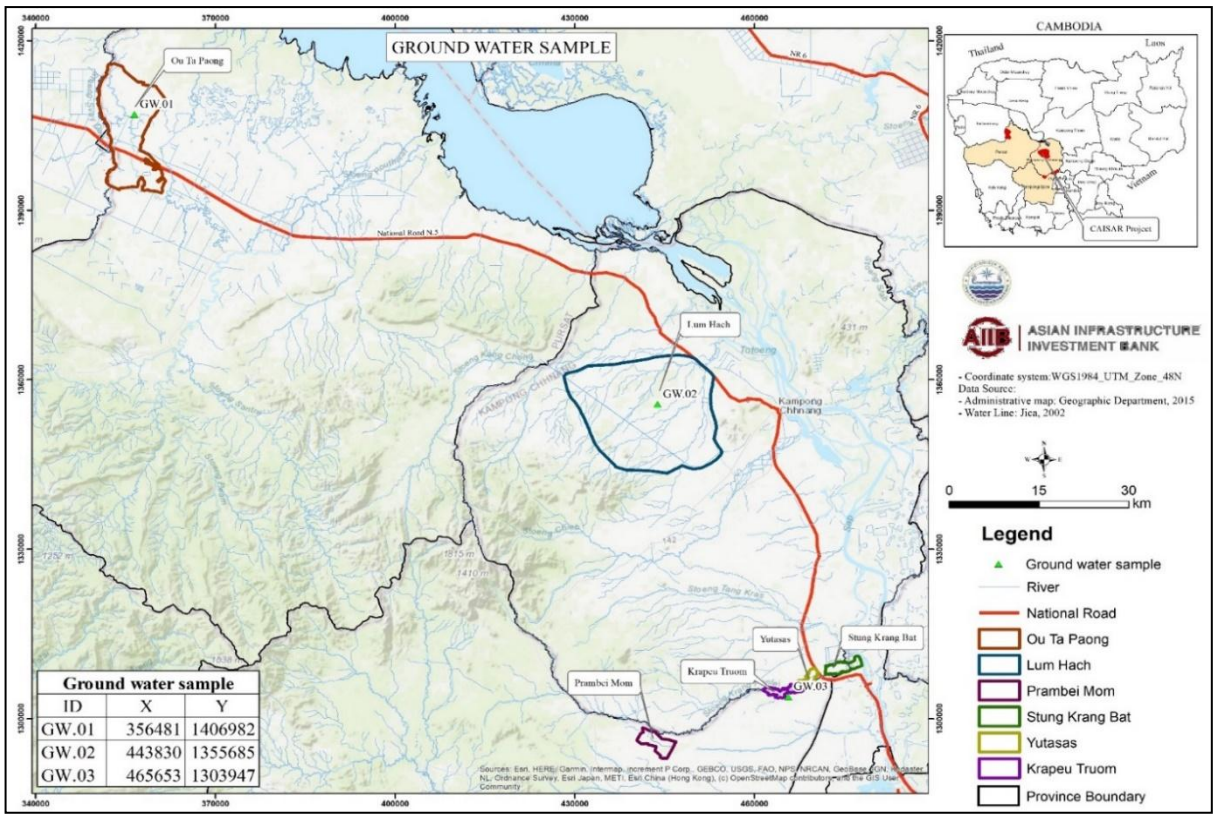
Figure 8. Map of Locations for Air, Noise, and Vibration for Baseline Understanding



Air Noise and Vibration Quality Test Locations

Legend	Location	X	Y	Command area
■	AN-1	354423	1378110	Ou Ta Paong
	AN-2	358700	1377571	
▲	ANV-1	448253	1336634	Lum Hach
	ANV-2	447690	1335320	
★	ANV-1	471298	1300854	Stung Krang Ponley
	ANV-2	471486	1301186	

Figure 9. Map of groundwater sampling locations



Ground water sample

ID	X	Y
GW.01	356481	1406982
GW.02	443830	1355685
GW.03	465653	1303947

Annex 3 – Grievance Monitoring

1.1 Reportable Incidents

The following incident types are to be reported using the environmental and social incident response process.

- **Fatality**: Death of a person(s) that occurs within one year of an accident/incident including from occupational disease/illness (e.g., from exposure to chemicals/toxins).
- **Lost Time Injury**: Injury or occupational disease/illness (e.g., from exposure to chemicals/toxins) that results in a worker requiring 3 or more days off work, or an injury or release of substance (e.g., chemicals/toxins) that results in a member of the community needing medical treatment.
- **Acts of Violence/Protest**: Any intentional use of physical force, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, deprivation to workers or project beneficiaries, or negatively affects the safe operation of a project worksite.
- **Disease Outbreaks**: The occurrence of a disease in excess of normal expectancy of number of cases. Disease may be communicable or may be the result of unknown etiology.
- **Child Labor:** An incident of child labor occurs: (i) when a child under the age of 14 (or a higher age for employment specified by national law) is employed or engaged in connection with a project, and/or (ii) when a child over the minimum age specified in (iii) and under the age of 18 is employed or engaged in connection with a project in a manner that is likely to be hazardous or interfere with the child's education or be harmful to the child's health or physical, mental, spiritual, moral or social development.
- **Forced Labor:** An incident of forced labor occurs when any work or service not voluntarily **performed** is exacted from an individual under threat of force or penalty in connection with a project, including any kind of involuntary or compulsory labor, such as indentured labor, bonded labor, or similar labor- contracting arrangements. This also includes incidents when trafficked persons are employed in connection with a project.
- **Environmental pollution incident:** Exceedances of emission standards to land, water, or air (e.g., from chemicals/toxins) that have persisted for more than 24hrs or have resulted in harm to the environment.
- **Discrimination based on SOGI:** Discrimination means creating a distinction, exclusion, or restriction which has the purpose or effect of impairing or excluding a person based on their real or perceived sexual orientation, gender identity, gender expression, or sex characteristics from being on an equal basis with others.
- **Sexual Exploitation:** Any actual or attempted abuse of position of vulnerability, differential power, or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially, or politically from the sexual exploitation of another. In Bank financed operations/projects, sexual exploitation occurs when access to or benefit from a Bank financed Goods, Works, Non-consulting Services or Consulting Services is used to extract sexual gain.
- **Sexual Abuse:** Actual or threatened physical intrusion of a sexual nature, whether by force or under **unequal** or coercive conditions. In Bank financed operations/projects, sexual abuse

occurs when a project related worker (contractor staff, subcontractor staff, supervising engineer) uses force or unequal power vis a vis a community member or colleague to perpetrate or threat to perpetrate an unwanted sexual act.

- **Sexual Harassment:** Any unwelcome sexual advance, request for sexual favor, verbal or physical conduct or gesture of a sexual nature, or any other behavior of a sexual nature that might reasonably be expected or be perceived to cause offence or humiliation to another, when such conduct interferes with work, is made a condition of employment, or creates an intimidating, hostile or offensive work environment. In Bank financed operations/projects, sexual harassment occurs within the context of a subcontractor or contractor and relates to employees of the company experiencing unwelcome sexual advances or requests for sexual favor or acts of a sexual nature that are offensive and humiliating among the same company's employees.
- **Other**: Any other incident or accident that may have a significant adverse effect on the environment, the affected communities, the public, or the workers, irrespective of whether harm had occurred on that occasion. Any repeated non-compliance or recurrent minor incidents which suggest systematic failures that PMU deems needing the attention of the WB.

1.2 For environmental and social incidents

1.2.1 Form to be completed by PMU within 48 hours

Q1: Incident Details	
1. Date of Incident:	
2. Time:	
3. Date Reported to PMU:	
4. Date Reported to WB:	
5. Reported to PMU by:	
6. Reported to WB by:	
7. Notification Type (Email/'phone call/media notice/other):	
8. Full Name of Main Contractor:	
9. Full Name of Subcontractor:	
Q2: **Type of incident (please check all that apply)**	
1. ☐ Fatality 2. ☐ Lost Time Injury 3. ☐ Displacement Without Due Process 4. ☐ Child Labor 5. ☐ Acts of Violence/Protest 6. ☐ Disease Outbreaks 7. ☐ Forced Labor 8. ☐ Unexpected impacts on heritage resources 9. ☐ Unexpected impactson biodiversity resources 10. ☐ Environmental pollution incident 11. ☐ Dam failure 12. ☐ Other	

Q3: Description/Narrative of Incident
For example: 1. What is the incident? 2. What were the conditions or circumstances under which the incident occurred (if known)? 3. Are the basic facts of the incident clear and uncontested, or are there conflicting versions? What are those versions? 4. Is the incident still ongoing or is it contained? 5. Have any relevant authorities been informed?

Q4: Actions taken to contain the incident			
Short Description of Action	**Responsible Party**	**Expected Date**	**Status**

For incidents involving a contractor:

1. Have the works been suspended under the Contract GCC8.9?
   a) ☐ Yes
   b) ☐ No
2. Name of Contractor: **……**

Q5: What support has been provided to affected people?

1.2.2 Form to be completed by PMU (following investigation)

Q6. Fatality/Lost time Injury information	
Cause of fatality/injury for worker or member of the public (please check all that apply): 1. ☐ Caught in or between objects 2. ☐ Struck by falling objects 3. ☐ Stepping on, striking against, or struck by objects 4. ☐ Drowning 5. ☐ Chemical, biochemical, material exposure 6. ☐ Falls, trips, slips 7. ☐ Fire & explosion 8. ☐ Electrocution 9. ☐ Homicide 10. ☐ Medical Issue 11. ☐ Suicide 12. ☐ Others	*Vehicle Traffic:* 13. ☐ Project Vehicle Work Travel 14. ☐ Non-project Vehicle Work Travel 15. ☐ Project Vehicle Commuting 16. ☐ Non-project Vehicle Commuting 17. ☐ Vehicle Traffic Accident (Members of Public Only)

Name	**Age/DOB**	**Date of Death/injury**	**Gender**	**Nationality**	**Cause of Fatality/Injury**	**Worker (Employer)/Public**

Q7: Financial Support/Compensation Types (To be fully described in Corrective Action Plan template)

1. ☐ Contractor Direct
2. ☐ Contractor Insurance
3. ☐ Workman's Compensation/National Insurance
4. ☐ Court Determined Judicial Process
5. ☐ Others
6. ☐ No Compensation Required

Name	Compensation Type	Amount (US$)	Responsible Party

Q8: Supplementary Narrative:

1.3 For SEA/SH Incident

1.3.1 Incident Form for SEA/SH (to be completed by PMU within 48 hours)

Q9. Incident Details		
Date of incident intake by project/GM:	Date Reported to PMU:	Date Reported to AIIB:
Reported to project/GM by: 1. Survivor 2. Third party 3. Others:	Reported to PMU by: 1. GM operator 2. Directly, by Survivor 3. Directly, by third party 4. Others:	Reported to AIIB by: 1. PMU 2. Directly, by Survivor 3. Directly, by third party 4. Other:

Q10. Is a record of this incident in GM?

a) ☐ Yes
b) ☐ No

Q11: Incident type (please check all that apply) See Appendix 1 for definitions

c) Sexual exploitation
d) Sexual abuse
e) Sexual harassment

Q12: Provide the following details from the GM record.

1. Age of survivor (if recorded in GM):

2. Have the national legislation or mandatory reporting requirements been followed?

f) ☐ Yes
g) ☐ No

3. Sex of survivor (if recorded in GM):

a) ☐ Male
b) ☐ Female
c) ☐ Others

4. Was the survivor referred to service provision?

	a) ☐ Yes b) ☐ No
5.	Is the survivor employed by the project (as indicated by the survivor or complainant and reported in the GM)? a) ☐ Yes b) ☐ No
6.	Is the alleged perpetrator employed by the project (as indicated by the survivor or complainant and reported in the GM)? a) ☐ Yes b) ☐ No
Q13: Basis for further action	
1.	Has the complainant provided informed consent to lodge a formal complaint? a) ☐Yes b) ☐ No
2.	Does the employer have a suitable administrative process and capacity in place to investigate misconduct relating to SEA/SH in a survivor-centered way? a) ☐ Yes b) ☐ No
3.	Has the survivor provided informed consent to be part of an investigation into misconduct? a) ☐ Yes b) ☐ No
4.	Has the complaint been filed anonymously or through a third party? a) ☐ Yes b) ☐ No
5.	If the answer to any of these questions is no, has the GM assessed the risks and benefits of carrying out an investigation into the alleged misconduct, taking into account the survivor's safety and wellbeing? a) ☐ Yes b) ☐ No
6.	Will an investigation into misconduct be undertaken in addition to an investigation into adequacy of project systems, processes or procedures? a) ☐ Yes b) ☐ No

1.4 Incident Form for SEA/SH (to be completed by PMU following SEA/SH investigation)

Q14: Findings of the investigation	
1.	Have sanctions against a perpetrator been recommended as part of an investigation into misconduct? a) ☐ Yes b) ☐ No
2.	Has an investigation into adequacy of project systems, processes or procedures been undertaken? a) ☐ Yes b) ☐ No
Q15: Corrective actions to be implemented (To be fully described in Corrective Action Plan)	

Short Description of Action (SEA/SH examples)	Responsible Party	Timeline for completion/Status
1. Referral of Survivor to holistic care services		
2. Undertake disciplinary investigation in accordance with GM timelines and confirmed process		
3. Disciplinary actions, including sanctions, to be applied following misconduct investigation by employer		
4. Increased training on Codes of Conduct (CoC)		
5. Audit of implementation of SEA/SH safety mitigation		
6. Strengthened awareness training on project-related risks, CoC and how to report incidents for project-affected community		
7. Training for project supervisors on the need to follow guidelines of behavior in CoC and their supervisory responsibilities		
8. Plan to improve coverage/quality of service provision		
9. Any other system strengthening measures or corrections for system failures that are necessary		

3.1 Project's Grievance Logbook

3.1.1 Sample for Local Levels

No	Name of complainant (or anonymous)	Addresses	Sex	Age	Contact information	Date Received	Details of nature of grievance (Environmental impacts, social impacts, labor, health, etc.)	Which of the three GRM that was used?	Actions taken to resolve grievance, by whom	How many steps that have been used in the relevant GRM	Date grievance was finally resolved/closed?	Notes

3.1.2 Sample for PMU Level to be elaborated on Excel spreadsheet with filter function

No	Questions	Response
1	**Date Received:**	
2	**Name of Complaint** (or anonymous):	
3	**Sex:**	
4	**Age:**	
5	**Contact information** (Phone number/email, other channel(s):	
6	**Location of Complainants** (Province, District, commune, village):	
7	**Form of grievance received** (Writing or Verbal (face to face, telephone, online), SMS, MOWRAM and DoWRAM comment box in designated Website/Face book/What's App, etc.	

8	**Channel of Receipt** (Direct to PMU GRM Focal Point, or Relayed from other channels (Provide details)	
9	**Key topics of Grievances** a) Labor and Working Condition Resettlement (incl Voluntary Land Donation) b) SEA/SH c) Environmental impacts d) Community Health and Safety Accidents	
10	**Nature of complaints?** a) Resolution required b) Clarification required c) Suggestion n only (for project improvement) d) General Concerns	
11	**Step 1 of GRM Procedure:**	
	a) Date receipted:	
	b) Date solved/transferred:	
	c) Duration spent (in days):	
12	**Step 2,3,4** (Replicated in Excel spreadsheet):	
13	**Closing of Case** (At which Steps, date of case closing):	
14	**Notes:**	

Annex 4 – Worker's Code of Conducts

The Annex has two Code of Conduct (COC): one is for ESHS and SEA/SH/VAC, and the other is for working with local Ethnic Communities.

1.1 Code of Conduct related to ESHS and SEA/SH/VAC

Instructions:

This Code of Conduct shall be perused and signed by all individual workers who enter direct work contract with a) PMU, b) PMU's consulting firms and service providers, c) contractors who renovate existing HCFs.

I,_____, acknowledge that adhering to environmental, social, health and safety (ESHS) standards, following the project's occupational health and safety (OHS) requirements, and prevention of Sexual Exploitation & Abuse (SEA)/Sexual Harassment (SH), are important.

I understand that that failure to follow ESHS and OHS requirement, or to partake in activities constituting SEA/SH -- be it at the project site, the surrounding area of the project site, workers' camps, or the project communities, including community members and project workers, constitute acts of gross misconduct and are therefore grounds for sanctions, penalties, or potential termination of employment. Prosecution by the Police of those who commit SEA/SH may be proceeded as applicable under relevant Laws.

I agree that while working on the project, I will:

- Carry out my duties competently and diligently.
- Comply with this Worker's Code of Conduct and all applicable laws, regulations, and other requirements, including requirements to protect the health, safety and well-being of other project workers, and any other person and community members.
- Maintain a safe working environment including by:
    - Ensure that workplaces, machinery, equipment, and processes under each person's control are safe and without minimal risk to health and safety of those involved.
    - Use appropriate measures relating to chemical, physical and biological substances, and agents; and
    - Follow applicable emergency response procedures.
- Report works situations that I believe unsafe or unhealthy to either project workers and/or community and remove myself and inform those relevant to remove themselves from a work situation which I reasonably believe imminent and dangerous to safety, life, and health of those involved.

- Consent, if required, to a background check in any place I have worked for more than six months.
- Attend and actively partake in training courses related to ESHS, OHS, SEA/SH and VAC, as requested by my employer.
- Always wear my personal protective equipment (PPE), as required while at work or engaged in project related activities.
- Take all practical steps to implement the environmental and social management plan (ESMP), which may include OHS Management Plan.
- Abide by a zero-tolerance policy as to SEA/SH/VAC and alcohol consumption during work activities, and refrain from use of narcotics or other substances which can impair worker's expected working ability and judgement.
- Respect women, children (persons under 18 years of age), and the elderlies regardless of their ethnic background, language, religion, personal opinions, disability, and/or other socioeconomic status.
- Shall not use language or behavior that are inappropriate to community members and project workers, particularly women, children, and the elderlies,
- Shall not commit any sexual abuse and or exploit, and/or sexual harassment of any kinds to community members in the project area and any project workers.
- Shall not engage in sexual harassment of project personnel and staff — for instance, making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature (looking somebody up and down; kissing, howling or smacking sounds; hanging around somebody; whistling and catcalls; in some instances, giving personal gifts.
- Shall not engage in offering any work-related favors such as making promises of favorable treatment (i.e., promotion), or make threats of unfavorable treatment (i.e., loss of job), or make payments in kind or in cash depending on sexual acts — or other forms of humiliating, degrading or exploitative behavior.
- Shall not engage in using prostitution service -- in any form and at any time during project implementation.
- Shall not participate in sexual contact or activity with children under 18 years of age — including grooming or contact through digital media. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not considered a defense or excuse.
- Consider reporting through the project's GRM, or to my manager, any suspected or actual SEA/SH deed by a fellow worker, whether employed by my company or not, or any breaches of this Code of Conduct.
- Complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation & Abuse, Sexual Harassment, and Violence Against Children (VAC).

- Report violations of this Code of Conduct; and

With respect to children under the age of 18:

- Bring to the attention of my manager the presence of any children on the construction site or engaged in hazardous activities.
- Wherever possible, ensure that another adult is present when working in proximity to children.
- Shall not invite unaccompanied children unrelated to my family into my home unless they are at immediate risk of injury or in physical danger.
- Not use any computers, mobile phones, video, and digital cameras or any other medium to exploit or harass children or to access child pornography (see also “Use of children's images for work related purposes” below).
- Avoid, in all circumstances, any verbale and/or physical punishment or discipline of children.
- No hiring of children (under 18) in any project activity.
- Comply with all relevant local regulations, including labor law in relation to child labor and forced labor.
- Take appropriate caution when photographing or filming children (see also section below). Photos or films of children should not be taken under the project, except for instances showing the benefits or impacts of road works, such as impacts to schools or school safety trainings.

Use of children's images for work related purposes

When photographing or filming a child for work related purposes, I must:

- Before photographing or filming a child, assess and endeavor to comply with local traditions or restrictions for reproducing personal images.
- Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this, I must explain how the photograph or film will be used.
- Ensure photographs, films, videos present children in a dignified and respectful manner and not in a manner that is vulnerable or submissive. Children should be adequately dressed up and not in poses that could be seen as sexually suggestive.
- Ensure images are honest representations of the context and the facts.
- Ensure file labels do not reveal identifying information about a child when sending images electronically.

Raising Concerns

If any person observes behavior that I believe may represent a violation of this Code of Conduct, or that otherwise concerns me, I will raise the issue promptly. This can be done in either of the following ways:

1. Contact [enter name of the Employer's Social Focal Point] to handle these incidences.
2. Call Employer's telephone number (See contact detail at Section 5 of project's Stakeholder Engagement Plan).

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. PMU will take all reports of possible misconduct seriously and will investigate and take appropriate action. In case of SEA/SH, PMU will provide referral to local service provider who will provide support to SEA/SH victims (See also Section 6.4 of project's Stakeholder Engagement Plan).

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

Sanctions

I understand that if I breach this Workers' Code of Conduct, my employer will take disciplinary action which could include:

- Informal warning.
- Formal warning.
- Additional Training.
- Termination of employment.
- Report to the Police if warranted.

I understand that it is my responsibility to:

Ensure that the Environmental, Social, Health and Safety requirements are met. Adhere to the Occupational Health and Safety Management Plan

Avoid actions or behaviors that could be construed as SEA/SH/VAC. Any such action will be a breach of this Workers' Code of Conduct.

I hereby acknowledge that I have perused the foregoing part of this Workers' Code of Conduct, agree to comply fully with the requirements contained therein and understand my roles and responsibilities to prevent and respond to ESHS, OHS, SEA/SH/VAC issues. I understand that any actions that are inconsistent with this Workers' Code of Conduct, or failure to act as mandated by this Workers' Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Signature: _____

Printed Name: _____

Title: _____

Date: _____

1.2 Code of Conduct for Working with Local Ethnic Communities

This Code of Conduct is grounded on the objectives of the WB's ESS7, which are:

- To ensure that the development process fosters full respect for the human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods of Indigenous Peoples.
- To avoid adverse impacts of projects on Indigenous Peoples, or when avoidance is not possible, to minimize, mitigate and/or compensate for such impacts.
- To promote sustainable development benefits and opportunities for Indigenous Peoples in a manner that is accessible, culturally appropriate and inclusive.
- To improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with the Indigenous
- To recognize, respect and preserve the culture, knowledge, and practices of Indigenous Peoples, and to provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.

Annex 5 – Simplified Pest Management Plan

1.1 Rationale

In Cambodia, around 90% of cultivated land is used for rice production. Rice alone accounts for about 70% of the country's total calorie supply. Rice production contributes an estimated 44% of rural household income, making the rice sector an area for strategic development in the country. Despite rice is the major crop in Cambodia, rice production is characterized by widespread misuse of pesticides. This is due to inconsistent enforcement of current regulation and a lack of information on pesticide safety and alternative pest management techniques among rice farmers. Most pesticides are imported and labelled in a foreign language incomprehensible to farmers. It is common that rice farmers mix two to five pesticides by intuition, leading to pesticide poisoning among farmers and adverse impact on environment[9]. Rice farmers tend to apply more pesticide when they see pests on their field[10]. Vegetable farmers also typically mix various types of pesticides per spray which is not good practice[11].

The CAISAR project will 1) improve overall water security for all stakeholders in the targeted basins in the four provinces, 2) exploit the potential of unused water resources and increase agricultural productivity in the targeted basin, and 3) enhance the overall capacity of the water resources management of the central government, concerned local governments, and concerned communities. Through all of the three project components, the project will improve 1) Water Service Delivery, 2) Agricultural Productivity, and 2) Water Resources Management. The project does not involve procurement of pesticides.

Under CAISAR, the project will support target farming population in irrigated areas to improve their use of good agricultural practices, including integrated crop water management, climate-smart agriculture (diversification into high-value crop plantation, public-private-partnership and commercialization), as well as agribusiness and trade development. CAISAR does not involve procurement of chemical fertilizers, pesticides, and/or other toxic agrochemicals nor promote use of chemical agricultural inputs during project implementation. However, rehabilitation /upgrading of existing reservoirs/irrigation system, etc. to be financed under the Project are expected to increase the agricultural command areas, including the number of crops per year. This increased crop may give rise to increased use of fertilizers, pesticides, and/or other toxic agrochemicals in the subproject areas which are unintended impact of the project.

1.2 Key Pesticide Management Outcomes in Cambodia

Pesticide Use and IPM implementation in Project Provinces: The General Directorate of Agriculture (GDA)'s survey in 2014 and nation-wide inspections in 2013 of pesticide and herbicide

[9] https://ipmil.cired.vt.edu/our-work/projects/rice-ipm-for-cambodia/

[10] Matsukawa, M., Ito, K., Kawakita, K. et al. Current status of pesticide use among rice farmers in Cambodia. Appl Entomic Zool51, 571–579 (2016). https://doi.org/10.1007/s13355-016-0432-5.

[11] Sim Skooching, Keo Socheat and Sarom Moldiest. 2021. Pesticide Use Practices in Cambodia's Vegetable Farming. CDRI Working Paper Series No. 128. Phnom Penh: CDRI.

suppliers in provincial capitals and other main distribution hubs, indicate that the most commonly sold products include: abamectin, chlorpyrifos, cypermethrin, glyphosate, imidacloprid. In the Northern provinces, where a large part of the herbicide use is on corn and rubber plantations, the main products sold are the herbicides Glyphosate, Paraquat and Atrazine. Nowadays, on Rice and Maize cultivation farmers don't use pesticide accept some vegetables. These inspections have also shown that the most problematic highly hazardous products, such as monocrotophos, methyl parathion, methamidophos, mevinphos, endosulfan, etc., are no longer found on the market with the exception of the occasional old bottle. The only banned products that still are found regularly are paraquat and methomyl. This is because these products were banned only recently (2010) and are still permitted in the neighboring countries from where they are informally brought in by users or retailers. The banning of highly hazardous pesticides in China does not seem to have led to dumping of old stocks in Cambodia. There are no known large stocks of obsolete pesticides.

Insecticides are used mainly on vegetables (such as Long Yard Bean, Chilly, Cabbage, Chinese Cabbage) marketable high-value crops and plantation crops, notably rubber. Field surveys by the national IPM program and GDA indicate there still is wide-spread abuse of pesticides among farmers. Lack of knowledge among farmers is a major constraint. Abuse includes mixing without justification (just to be sure), use of wrong pesticides, use of wrong dosages, etc. Adequate protective gear is hardly being used. Shops often have gloves and masks for sale, but these tend to be inadequate for protection against hazardous chemicals. Buyers of pesticides rarely also buy protective gear, and shops do not provide it for free. Half used pesticide bottles or packages are often stored within the house or near homesteads, often in easy reach of children. Empty pesticide containers are often discarded at the border of fields or in drainage ditches.

1.3 Government Regulation Related to Pest Management

Pest management practices in Cambodia have been promoted through the expansion of the National Integrated Pest Management (IPM) Program by both the government and NGOs. These agencies have been working together to establish a Pesticide Reduction Network to develop awareness of the risks associated with pesticide use amongst farmers.

As a key function, Ministry of Agricultural and Forestry (MAFF) has been examining and implementing various international legal guidelines and instruments relating to regulating the trade, distribution and use of pesticides in Cambodia. These include adherence to the FAO Code of Conduct on the Distribution and Use of Pesticides, the Stockholm Convention on Persistent Organic Pollutants, and the WTO sanitary and phytosanitary measures.

Following the promulgation of the Law on Management of Pesticides and Fertilizers as Royal Kram Number 0112/005 on 14th January 2012, MAFF had developed five Prakas in relation to Procedures for Registration and Business Operations, as follows:

- Prakas No. 415/MAFF dated 17 August 2012, on Procedures and Standard Requirements for Fertilizer Registrations.
- Prakas No. 456/MAFF dated 19 October 2012, on Procedures and Standard

Requirements for Pesticide Registrations.

- Prakas N. 484/MAFF dated 26 November 2012, on List of Pesticides in the Kingdom of Cambodia.
- Prakas No. 119/MAFF dated 11 April 2013, on Procedures for Management of Fertilizers for Business Operations.
- Prakas No. 120/MAFF dated 11 April 2013, on Procedures for Management of Pesticides for Business Operations.

Within MAFF, the Department of Agriculture Legislation and GDA are mandated to oversee all pesticide regulations and use.

1.4 International Code of Conduct on the Distribution and Use of Pesticides

The following rules are observed for IPM:

- The standards of conduct set forth in this Code: 1.7.6. are designed to promote Integrated Pest Management (IPM) (including integrated vector management for public health pests).
- Concerted efforts should be made by governments to develop and promote the use of IPM. Furthermore, lending institutions, donor agencies and governments should support the development of national IPM policies and improved IPM concepts and practices. These should be based on scientific and other strategies that promote increased participation of farmers (including women's groups), extension agents and on-farm researchers.
- All stakeholders, including farmers and farmer associations, IPM researchers, extension agents, crop consultants, food industry, manufacturers of biological and chemical pesticides and application equipment, environmentalists and representatives of consumer groups should play a proactive role in the development and promotion of IPM.
- Governments, with the support of relevant international and regional organizations, should encourage and promote research on, and the development of, alternatives posing fewer risks: biological control agents and techniques, non- chemical pesticides and pesticides that are, as far as possible or desirable, target-specific, that degrade into innocuous constituent parts or metabolites after use and are of low risk to humans and the environment.
- Governments should provide extension and advisory services and farmers' organizations with adequate information about practical IPM strategies and methods, as well as the range of pesticide products available for use.
- Governments should ensure that any pesticide subsidies or donations do not lead to excessive or unjustified use which may divert interest from more sustainable alternative measures.

1.5 Current Governmental Implementation Arrangements Related to Pest Management

Integrated Pest Management (IPM) refers to all pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.

Under MAFF, Department of Plant Protection, Sanitary and Phytosanitary and their branches in provinces as well as Agricultural Offices at district level are governmental agencies that coordinate and work on Integrated Pest Management Programs. These activities are built on the National IPM program that was initiated with assistance from the FAO, DANIDA and other donors since early 1990s which is largely being maintained using national budget.

IPM activities implemented by these local authorities and technical backstopping by experts from GDA include conducting field surveys, making forecast, monitoring and checking progress of on-field pest development. Using the forecast based on the timing, scale and level of damage that the key pests may cause, provincial plant protection authorities recommend policies, plans, and measures for pest management purposes.

Farmers learn how to implement various integrated measures such as pest identification, pest control, pest analysis, pest surveillance, and apply measure to control pest, such as applying chemical and botanical control agent, promoting application of biological measures for pest management, reducing chemicals and practice sustainable IPM. Farmers are also trained on proper use of chemical pesticide and fertilizers to ensure efficiency in pest management, ensuring safety for human, natural enemy, and the environment. Communication campaigns on plant protections and quarantine legislations and advance IPM technics to the farmers are also carried out depending on budget availability, etc.

GDA's Plant Protection Center, including the national IPM program, has developed training programs intended to raise awareness, develop capacity and help rural communities formulate and implement their own action plans for pesticide risk reduction. As of 2018, some 300,000 Cambodian farmers have participated in IPM courses. Season-long Integrated Pest Management training through Farmers Field Schools (FFS) often includes these short-duration IPM courses. These FFSs allow farmers to learn about and adopt Integrated Pest Management to reduce overuse of pesticides in crop production. Pesticide Risk Reduction and IPM adoption at farm level remains a priority for the Government.

Operational costs of plant protection agencies are allocated from state funds. Their staff also work on projects and programs that are financed by other international funding and conduct additional annual trainings (using international budget) for farmers.

1.6 Objective of Simplified Pest Management Plan

This Simplified Pest Management Plan (S-PMP) aim to see out plan and measures to ensure the project does not unintentionally give rise to increased overuse of chemical agricultural inputs (such as chemical pesticide, fertilizers, and plant growth regulators, etc.). This S-PMP will be integrated into on-going pest management program and effort that provincial DAFF in project provinces have been doing and make sure pest management efforts target areas where water access is improved through project investment activities.

To mitigate this potential impacts as a 'good practice', the subproject owner will prepare and implement a S-PMP aiming to increase famers knowledge on Government regulations, policies, and/or technical guidelines related to safe use (application, storage, and disposal) of pesticides and toxic agrochemicals likely to be used by farmers as well as promote the application of an Integrated Pest Management (IPM) practice that are appropriate for the agriculture productions in the subproject area through training and other capacity building activities.

Key Elements - The elements of the S-PMP include the followings:

- Preventing pest problems.
- Monitoring for the presence of pests and pest damage.
- Establishing the density of pest population, which may be set at zero, that can be tolerated or corrected with a damage level sufficient to warrant treatment of the problem based on health, public safety, economic or aesthetic threshold.
- Treating pest problems to reduce population below those levels established by damage thresholds using strategies that may include biological, cultural, mechanical and pesticidal control methods and that shall consider human health, ecological impact, feasibility and cost effectiveness; and
- Evaluating the effects and efficacy of pest treatments.

Decision Making

Detecting a single pest under the Project will not always mean control is needed. A decision to use pesticides will be taken only as the very last resort and will also be based on conclusions reached from an agroecosystem analysis and trials. The decision will also depend on the number of pests and diseases found in the respective crop and the level of damage they are doing. If it is necessary to spray crops with pesticides, use of selective rather than broad-spectrum pesticides shall be strictly observed.

Pest Monitoring and Surveillance

A process for the reporting and identification of unusual plants, animals and pests will be established to track and document all pest cases, be it minor or major in a pest inventory register. Pest surveys will be conducted on a regular basis to detect new infestations and will include the types, abundance, location of pest plants, date when first spotted or seen, and date when reported. This information will be gathered from surveillance or monitoring systems to be put in place, periodic surveys to be conducted and feedback from farmers/ farm assistants. The data will be managed in a standardized way so that trends can be established. A rapid response

process for the management of new infestations will be established to treat and manage new pest infestations as soon as they are identified.

Table 1. Potential impacts and proposed mitigation for pest

Potential Impacts	Proposed Mitigation
Contamination of ground water resources	Conducting trials on relatively flat land with less than 2% slope reducing the possibility of run off and at more than 500m away from water sources
Effect of pesticides on non-target species	Use pesticides that are systemic and narrow range and specific to sucking insects.
Effect of pesticides on grazing areas, settlements	Spraying in the morning hours when the weather is cool and less windy to reduce spray drifts. Locating trials or plots at distance of between 500-1000m away grazing areas or human settlements
Possibility of increasing resistance of pests to the pesticide	Training of field staff responsible on recommended usage of the pesticide
Harmful effects on staff applying pesticides	Provision and usage of safety clothing and working gear to staff
Harm to people within the homestead where the chemical is stored	Designation of a separate and secured storage room for pesticide Warnings and notices to increase awareness

1.7 Mitigation Measures

It is expected that there will be no procurement of pesticides under the project and that pesticide use, overall, will decline as a result with the introduction of good agricultural practices. To ensure the tendency of increased overuse of pesticide does not happen with subproject where project intervention take place, the project will prohibit procurement of large pesticides using the “negative list” and provide training to key staff and farmers on integrated pest management, safe use of pesticides, and organic farming practices. This will be integrated as part of the safeguard training. This S-PMP will be applied to the project activities that involve:

a) Any rehabilitation/upgrading of weirs/reservoirs/dams/existing irrigation schemes that are likely to prompt farmers to increase their use of pesticides:

b) Change/introduction of best agricultural practices such as integrated crop water management, Climate-smart agriculture, and

c) Promotion of agribusiness and trade related to farm products produced from target command area, and neighboring areas.

The plan is comprised of three parts:

(i) Application of government regulation on pesticide control.

(ii) Training of the integrated pesticides concept and/or other approaches for the safe use of pesticides; and

(iii) Monitoring.

Annex 6 - Biodiversity Assessment Findings for Ou Ta Paong

1. Project Activities and Potential Risks and Impacts

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 Ta Paong 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 2: Projection activities that may cause potential impacts on the environment and social aspects at Ou Ta Paong 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

2. Areas of Influence

The Ou Ta Paong 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 the 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 fishes and birds. Analysis to determine critical habitat (Steps 1 and 2 of the CHA method)

3. Analysis to Prepare for Determining CH Status

3.1 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.

3.2 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 3: Confirmed List of endangered and critically endangered species for the Ou Ta Paong 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	អណ្តើកស្អែក	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	Yes
9	ក្រីកន្ត្រៀប ខ្លា	Siamese Tiger Perch	*Datnioides pulcher*	CR	Yes	Yes
	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					
16	កញ្ជ្រោងចេកភ្នំក្រវាញ	Cardamon Shrub Frog	*Philautus cardamonus*	EN	Yes	No
17	ស្មៅស្ទឹង / ទន្លេ	River-weed	*Terniopsis chanthaburiensis*	EN	Yes	No

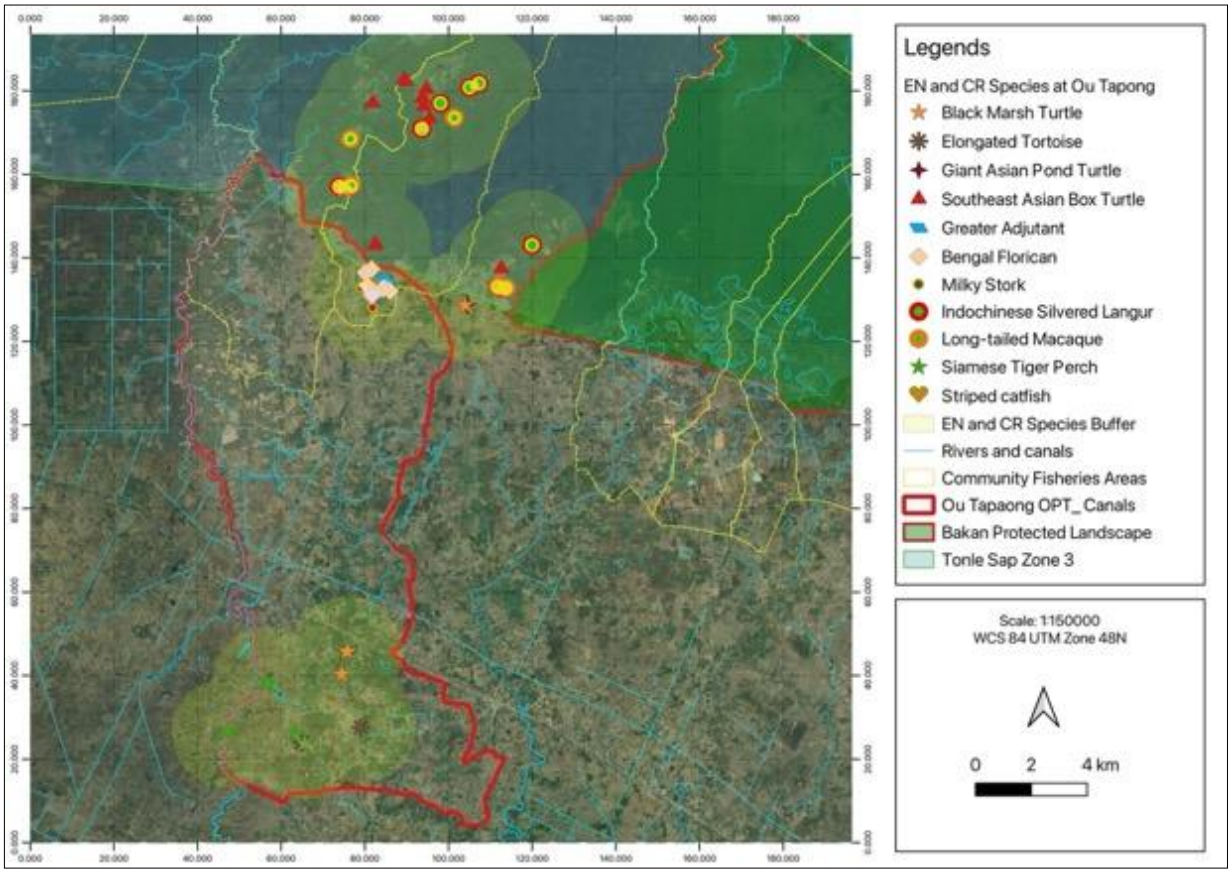


Figure 2: Map showing the observed distribution of identified EN and CR species (with the potential movement of 1-2 km within and around suitable habitats (2020 to 2024)

3.3 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[12].

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 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.

3.4 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 Ta Paong 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 Ta Paong 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.
- **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 Ta Paong based on the turtle images that were shown to facilitate the identification of species. No

[12] 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 Ta Paong Command Area.

such sightings have been documented in the lower portions of the command area. One informant, a local resident near Ou Ta Paong, 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.

- **Giant Asian Pond Turtle:** Three local informants who were interviewed in the lower Ou Ta Paong 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.
- **Southeast Asian Box Turtle:** During our survey in the lower section of the Ou Ta Paong, 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 purpose. 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.

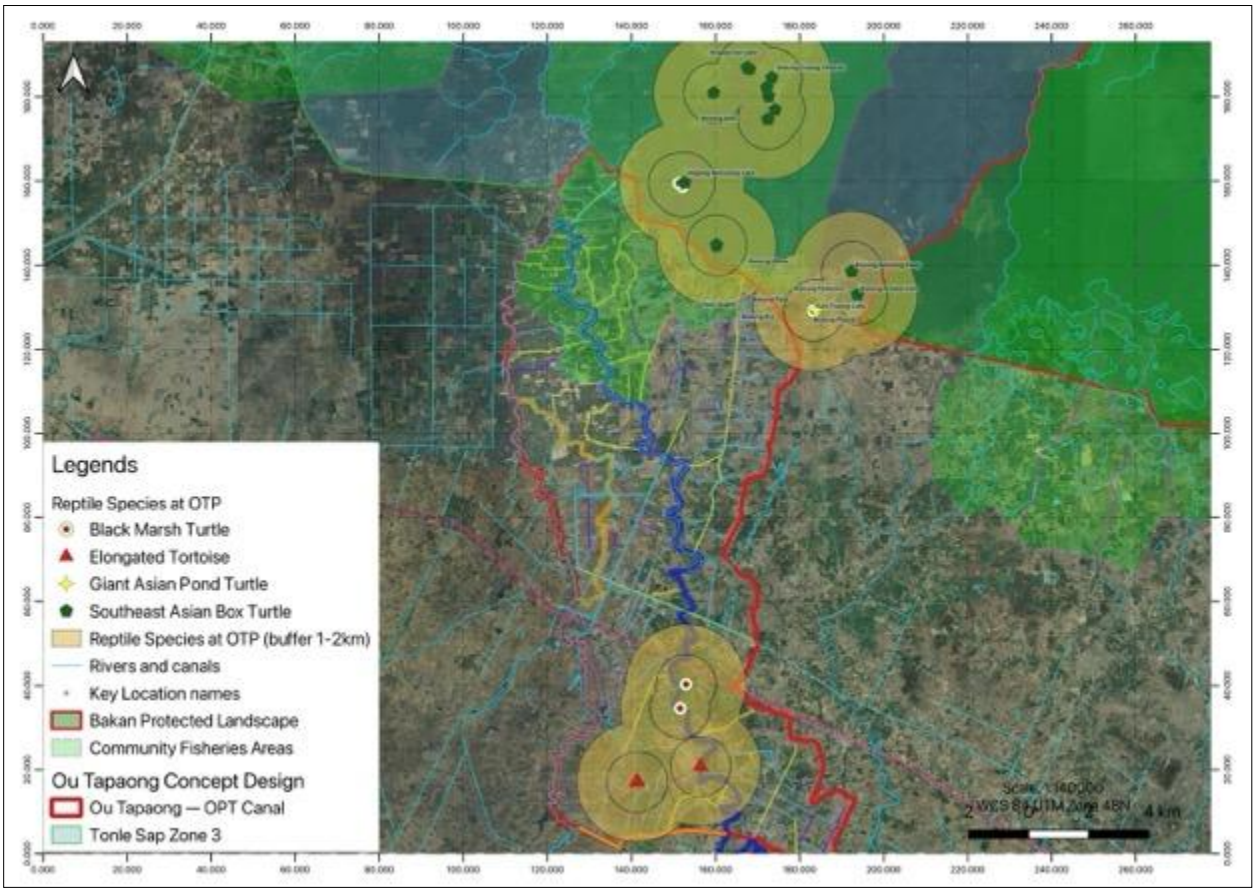


Figure 3: Distribution of identified turtle and tortoise species in and outside the OTP Command Area

3.5 Birds (3 species)

Despite extensive interviews with key informants residing in the upper reaches of Ou Ta Paong, 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 residents.

- **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 Ta Paong 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 Ta Paong Command Area is situated only 1 kilometer 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 Reedwarbler, and Cambodia's unique population of the Chinese Grassbird, along with other globally threatened avian and wildlife species (WCS 2023).

- **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 Ta Paong 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 Ta Paong 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.

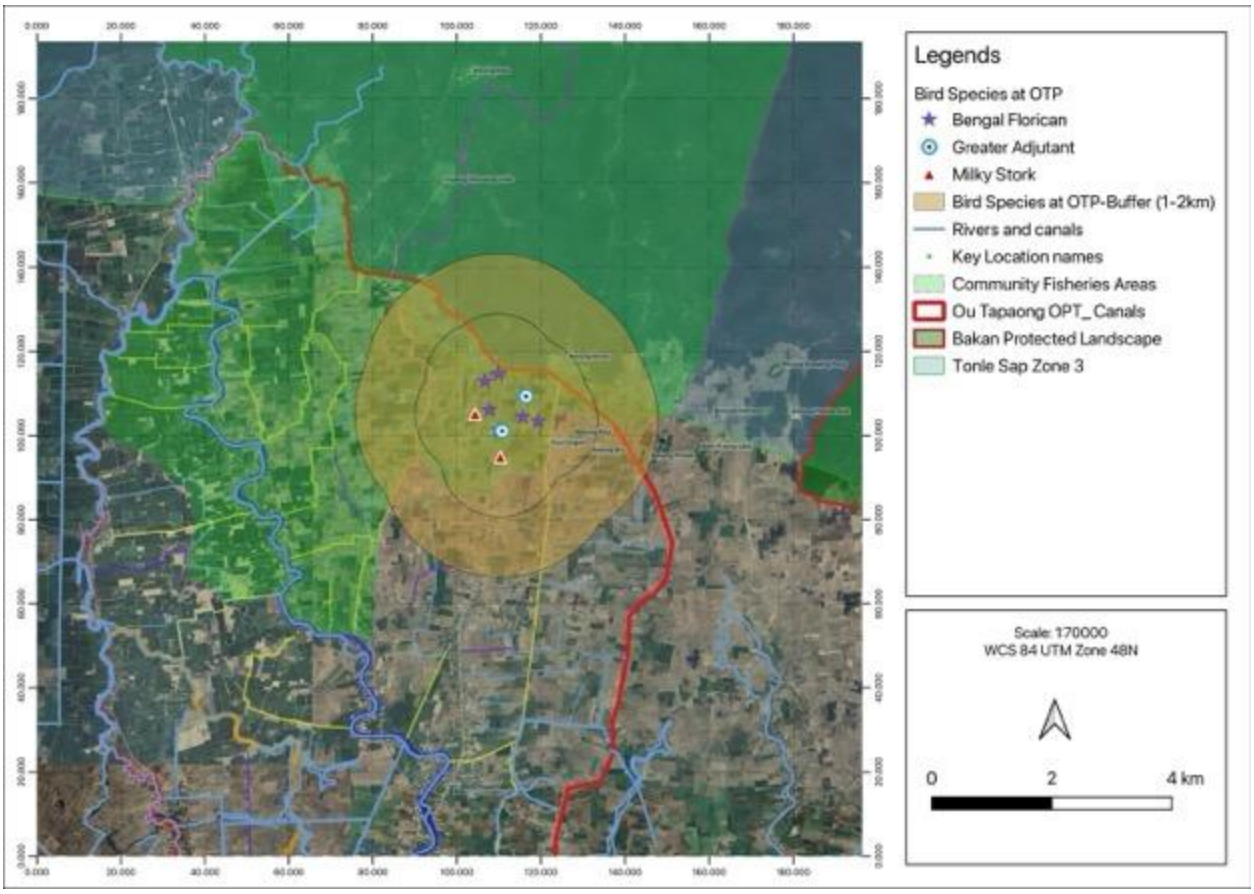


Figure 4: *A spatial distribution map was generated for three bird species—the Bengal Florican, Greater Adjutant, and Milky Stork—within the lower Ou Ta Paong Command Area. 1-2 km buffer zones were included to approximate their minimum movement range around suitable habitats*.

- **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.

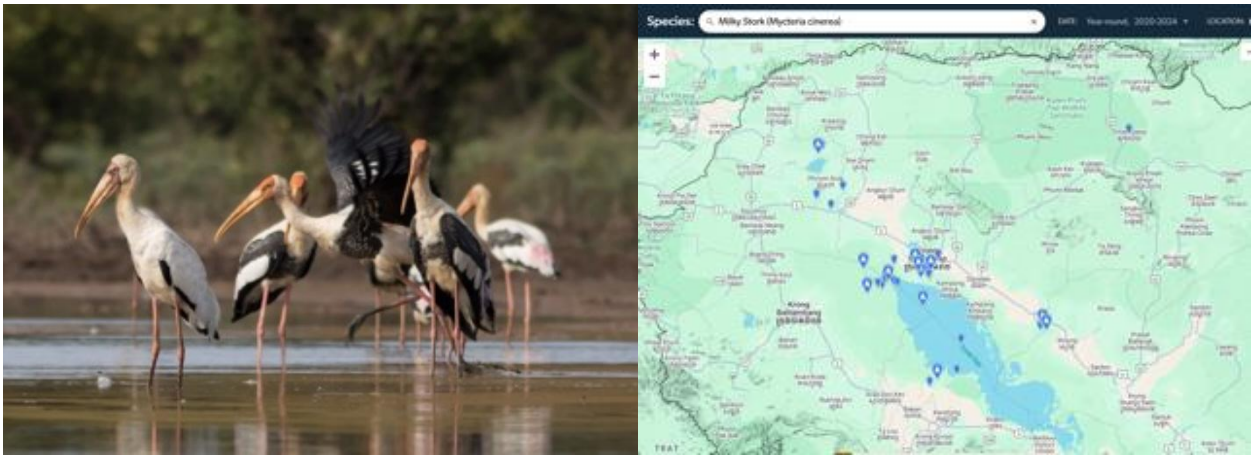


Figure 5: *Photograph of a Milky Stork foraging alongside a flock of Painted Storks (credit: Sang Mony, Sam Veasna Conservation Tour), and a map illustrating the distribution of Milky Stork sightings in Cambodia from 2020 to 2024, extracted from eBird data.*

- **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 Ta Paong, we can confirm that this area has the potential to serve as a wintering habitat for this species. Additionally, the boundary of the Ou Ta Paong Command Area is just 1 km away from the Bakan Protected Landscape.

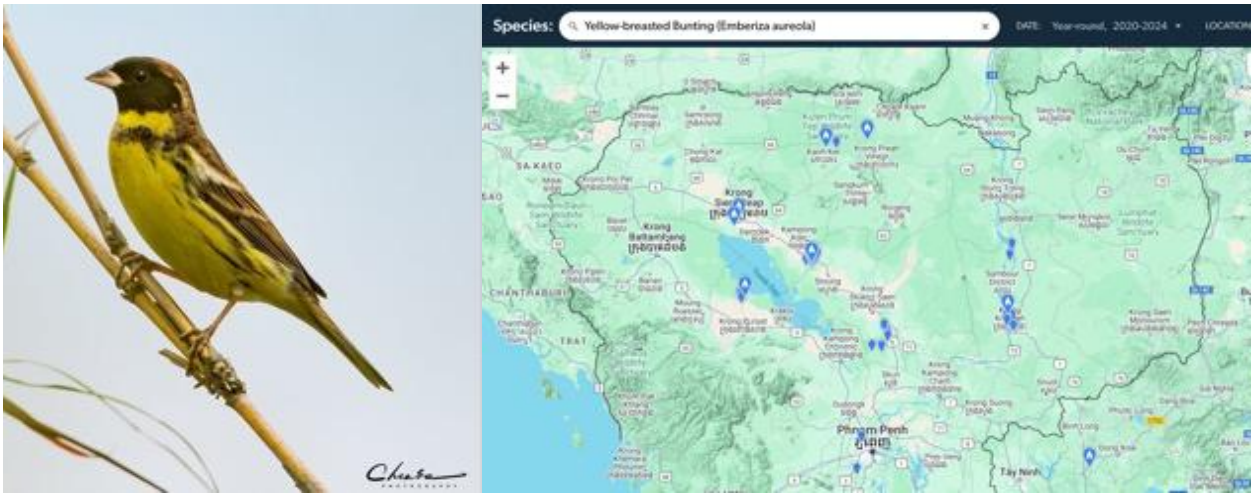


Figure 6. *Photo of Yellow-breasted Bunting (Emberiza aureola) and its distribution map from eBird data (2020-2024) recorded by birdwatchers and wildlife overserves.*

- **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 waterhole 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 help to ensure the survival of this vulnerable species.

3.6 Mammals/ primates (2 species)

No suitable habitats or sightings of three mammal species were identified in the upper section of Ou Ta Paong. 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 Hairy-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 Ta Paong 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).

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)*

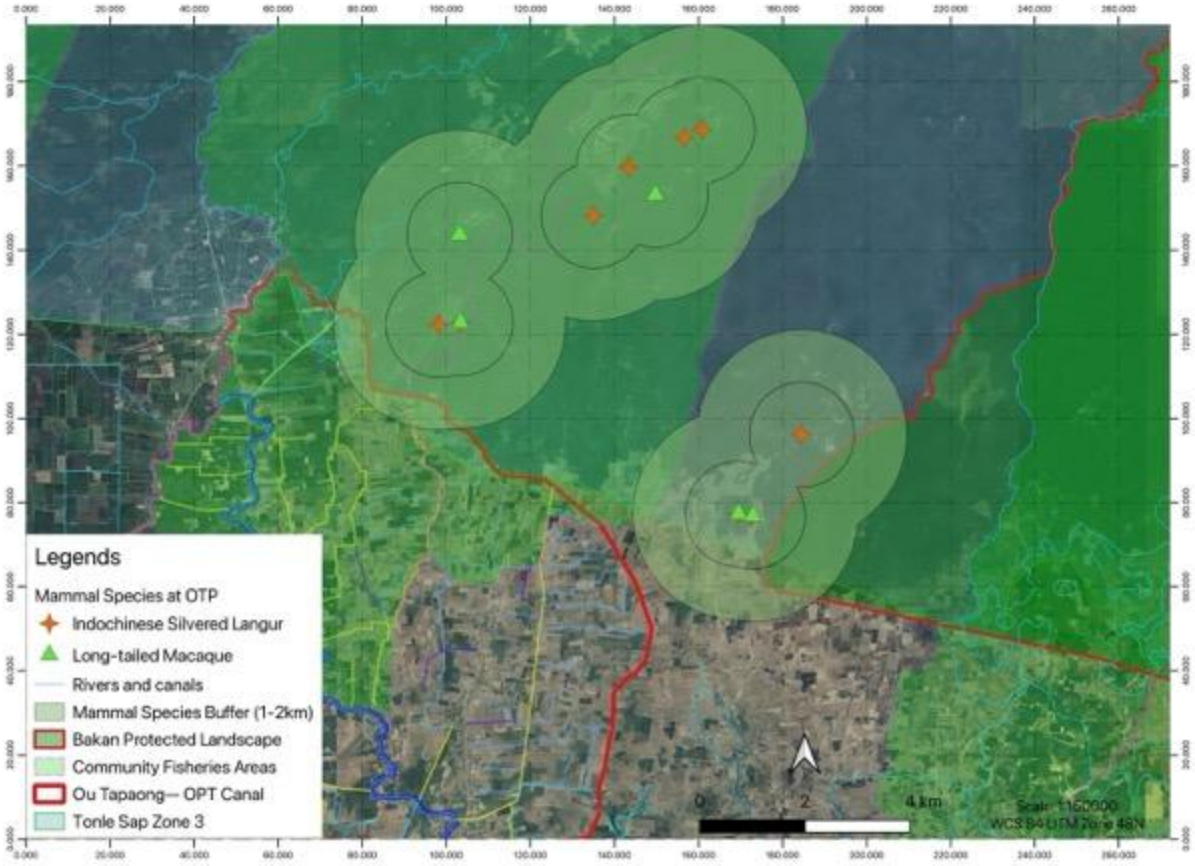


Figure 7: *A spatial distribution map was generated for two primate species—the Indochinese Silvered Langur and Long-tailed Macaque—within the lower Ou Ta Paong Command Area. 1-2 km buffer zones were included to approximate their minimum movement range around suitable habitats*.

3.7 Fish (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 Ta Paong 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 Ta Paong Command area, Siamese Tiger Perch has been consistently observed in Boeng Kansaeng Lake, located in the southwest part of the Ou Ta Paong 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 Ta Paong 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 Ta Paong Area.

- **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.

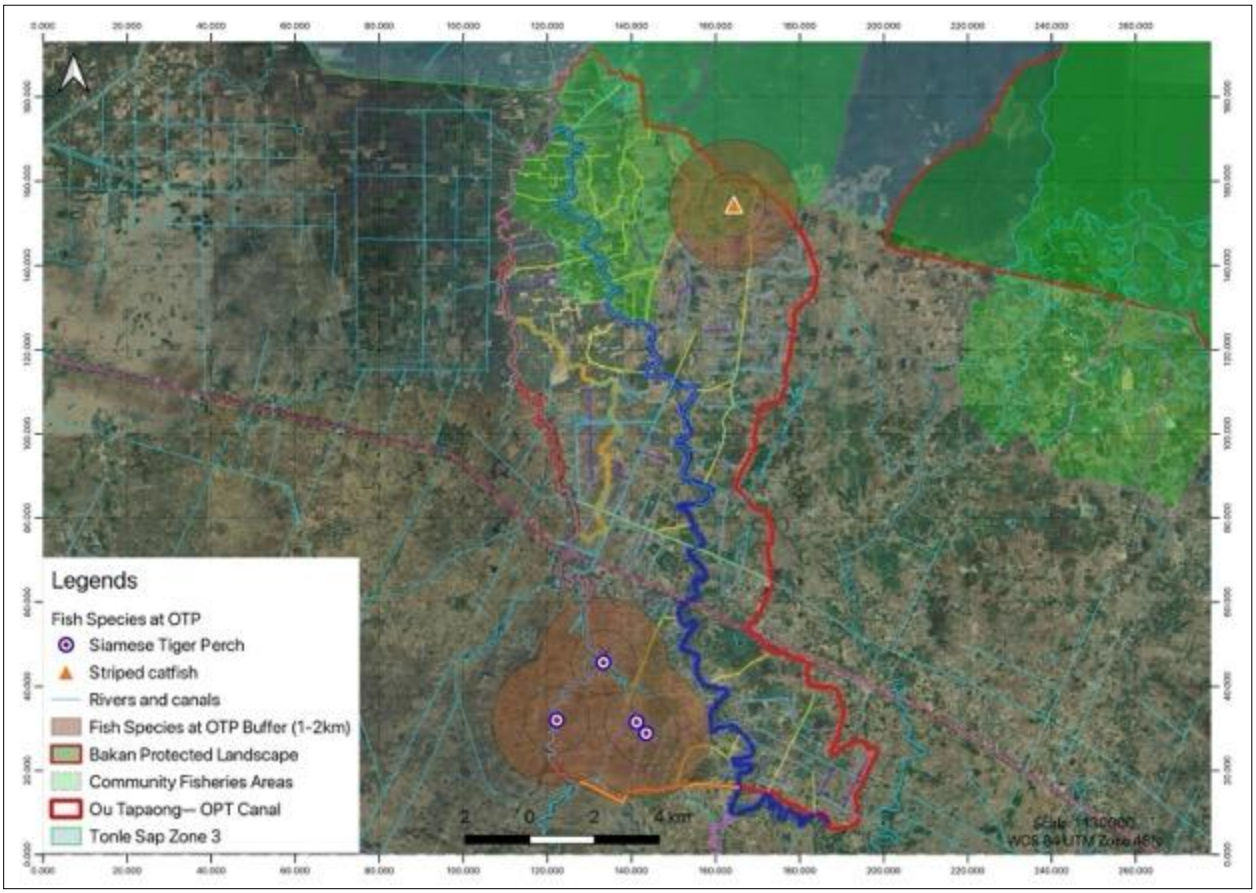


Figure 8: *A spatial distribution map was generated for two fish species, the Siamese Tiger Perch, and Striped Catfish (old record-7 years ago)—within the lower Ou Ta Paong Command Area. 1-2 km buffer zones were included to approximate their minimum movement range around suitable habitats*.

3.8 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[13].

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 dated 29 August 2011	Protect the flooded forest around the Tonle Sap lake for fishery productivity and ecological functions	0 (share the border)
2	Bakan Grassland protected area	Royal Government of Cambodia: Sub-decree No. 144, dated 04 July 2023	Protect the ecosystem in the area and ensure the sustainable use of the area.	2
3	Dei Roneat Important Bird Area (IBA)	Birdlife Internation	The IBA supports breeding colonies of Darter (Anhinga melanogaster), Lesser Adjutant (Leptoptilos javanicus) and Greater Adjutants (L. dubius).	12
4	Tonle Sap Biosphere Reserve (LSBR)	Royal Government of Cambodia: Royal Decree in 2001[14]	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 1997 and subsequently enshrined in the Cambodian Royal Decree in 2001.	16

4. Determination of Critical Habitat Status (Step 3)

This section assess 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 Critical Habitat feasures.

[13] Bakan grassland is a protected area for birds designated by sub-decree No. 144 in 2023.
[14] https://www.unesco.org/en/articles/national-conference-tonle-sap-biosphere-reserve-brings-together-stakeholders-discuss-sustainable

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on 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 (scare)	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 (scare)	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		
Indochinese Silvered Langur	*Trachypithecus germaini*	EN	No	Yes	Yes	Unlikely (scare)	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.

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
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 (scare)	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.
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			

English Common Name	Scientific name	IUCN Red List Status	Restricted Range	IBAT listing	Confirmed based on screenings	Likelihood of Occurrence with AoI (Present, Possible, Unlikely and Not Present)	Reasons for Exclusion and data sources	Critical Habitat Determination of Species
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								
Cardamon Shrub Frog	*Philautus cardamonus*	EN			Yes	No		
River-weed	*Terniopsis chanthaburiensis*	EN		Yes	Yes	No		

4.1 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:

- **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 Ta Paong 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 Ta Paong 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[15]. 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.

[15] 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.

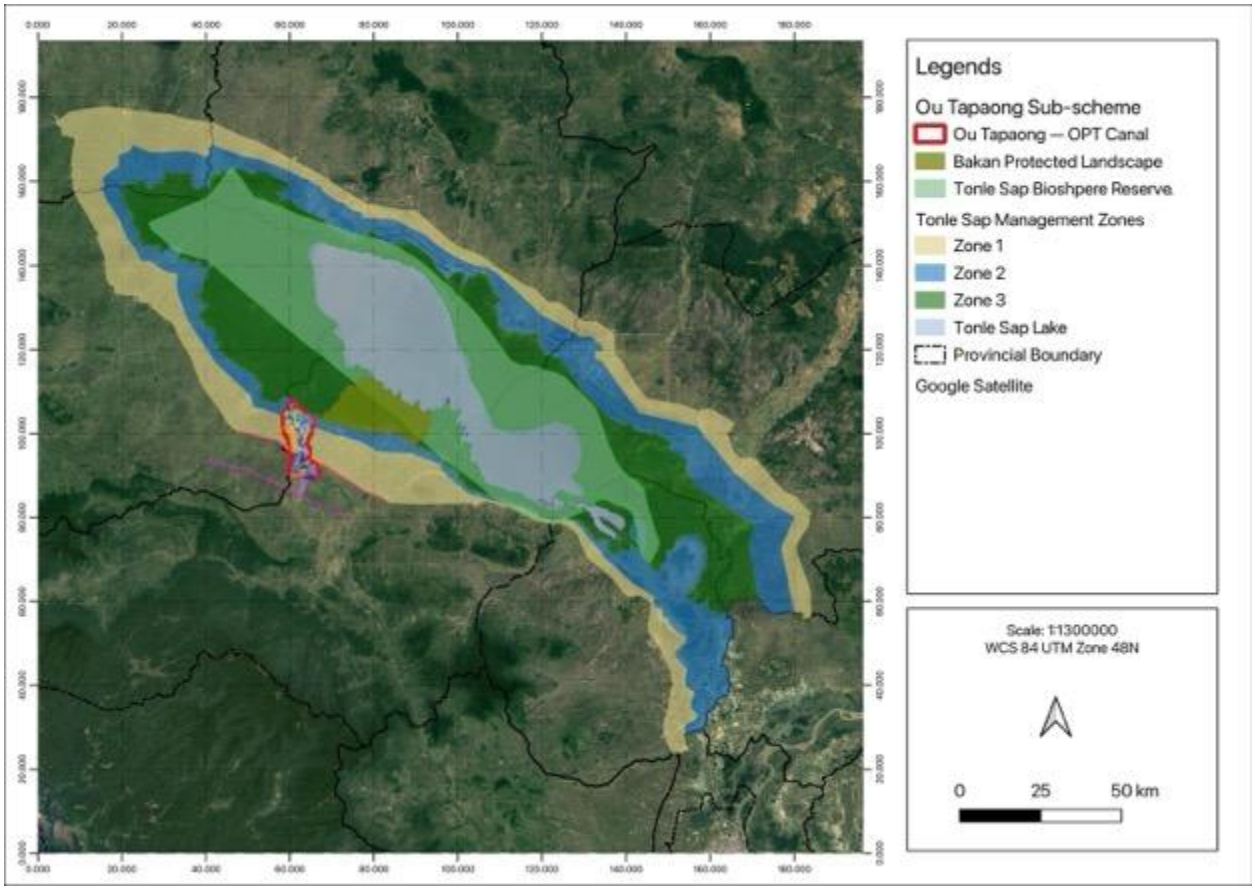


Figure 9: Map of Ou Ta Paong command area and other existing protected area within the Tonle Sap Basin

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 Ta Paong's lower command area overlaps with two Community Fisheries (CFIs) areas.

The critical habitat for these bird species within the Ou Ta Paong 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 characterized with lakes and wetlands inside that are crucial foraging habitats for birds. Based on this key finding we can identify and characterize critical habitats of various EN and CR species presence within and close the command area as below:

- 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.
- 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.
- Rivers and waterways, like the Svay Daun Kao River, serve as important corridors for fish migration and connectivity between different habitats. This can indirectly benefit birds by providing a healthy aquatic ecosystem.
- 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 Ta Paong 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 Ta Paong 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 Ta Paong 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 9: *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 10: Overview of Boeung Kansaeng, located upstream of Ou Ta Paong Command Area. A canal connects to Stueng Svay Daunkav River (left) and Ou Ta Paong (right), a potential fish migration route during floods.

Figure 11: *Aerial photograph depicting the Ou Ta Paong Stream/canal fragmented by earth dams, roads, and ponds, illustrating its diversion for non-intended purposes*.

Figure 12: *Aerial photograph of intake flooded forest habitat within Tonle Sap Zone 3 and the continuous land encroachment, converting forest land for rice cultivation*.

4.2 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 Paong).

4.3 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 OTP, therefore is expected to qualify as critical habitats under this criterion.

4.4 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.

4.5 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.

5. 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).

5.1 Potential impacts

1) **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.

2) **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.

5.2 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 Ta Paong 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 Ta Paong 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.

6. Mitigation Measures

To minimize the above risks, the following measures need to be implemented.

6.1 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.

6.2 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:

- **Minimizing Habitat Loss:** Avoid clearing vegetation outside the project area and implement measures to protect existing trees and vegetation.
- Implementing strict environmental management plans that include guidelines for minimizing noise and vibration disturbances during construction activities.
- Implementing effective traffic management systems to minimize the risk of vehicle collisions with reptiles and other wildlife.
- **Erosion and Sediment Control:** Employ erosion control measures to prevent sedimentation in water bodies and downstream impacts.
- **Waste Management:** Proper construction measures need to be taken for pollution prevention (for soil and water).
- **Wildlife Protection:** Where needed, install fencing to prevent wildlife animals entering 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.
- **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.**
- **Best practices:** Adopt environmentally friendly construction practices, such as minimizing soil disturbance and preventing pollution.
- 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:
    - **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.

- **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.
- **Habitat Protection:** Educate staff on the importance of protecting habitats, such as avoiding unnecessarily clearing vegetation, minimizing soil disturbance, avoid eating local wildlife animal.
- **Waste Management:** Train staff in proper waste management practices to prevent pollution and habitat degradation.
- **Emergency Response:** Prepare staff to respond to environmental emergencies, such as oil spills or accidental habitat damage.

- The Project's Code of Conduct needs to be implemented (perused and signed by contractors) to prohibit staff and construction workers from hunting, harvesting wildlife, or committing any form of trade in wildlife products from the area.

6.3 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.

- **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.**
- **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.
- **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.
- **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.
- **Collaboration: Explore and collaborate with another ongoing and future wildlife program.**
- **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 biodiversity in the command area, and the larger production area in Ou Ta Pong.
- Promoting sustainable farming practices that reduce reliance on pesticides while maintaining crop yields.

- **Biodiversity offsets**: Consider implementation in case the significant residual impact is expected despite avoidance and minimization measures.
- **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 flow.

7. Biodiversity Action Plan (OTP)

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 Ta Paong Irrigation Sub-scheme

Executive Summary

- ***This conservation action plan outlines strategies to mitigate potential negative impacts on biodiversity within the Ou Ta Paong 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

- ***Protect critical habitats: Identify and conserve areas crucial for biodiversity, such as flooded forests, wetlands, and rivers.***
- ***Minimize negative impacts: Implement measures to reduce the adverse effects of irrigation scheme development on wildlife and their habitats.***
- ***Enhance biodiversity: Promote habitat restoration and conservation activities to support species recovery.***
- ***Engage with stakeholders: Foster collaboration with local communities and relevant government agencies to ensure effective conservation efforts.***

Habitat Mapping

- ***Map out the different habitats present within the Ou Ta Paong Command area. This should include flooded forests, lakes, rivers, waterholes, grasslands, fellows rice fields used by bird species for foraging.***
- ***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.***

Mitigation Measures

- ***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.***
- ***Carefully design project activities to avoid direct impacts on critical habitats.***
- ***Identify alternative project locations or routes that avoid sensitive areas.***
- ***Modify project designs to minimize the footprint and disturbance of critical habitats.***
- ***Implement temporary measures to protect critical habitats during construction.***

Minimization:

- ***Implement responsible construction practices to minimize adverse effects on critical habitats, such as avoiding unnecessary clearing of vegetation and minimizing soil disturbance.***
- ***Establish effective waste management systems to prevent pollution.***
- ***Implement erosion control measures to prevent sedimentation in aquatic habitats.***
- ***Develop pollution prevention strategies to reduce water and air pollution.***
- ***Habitat Protection and Restoration:***
- ***Establish measures to protect and restore flooded forests, wetlands, and other natural habitats within and around the command area.***
- ***Promote sustainable land use practices like agroforestry, conservation agriculture, and sustainable forest management.***

Species Conservation:

- ***Develop species-specific conservation plans for endangered and threatened species identified in the area.***
- ***Monitor populations of these species regularly and assess their habitat needs***
- ***Consider implementing captive breeding programs or reintroduction efforts if necessary***
- ***Implement habitat management measures that improve the quality and suitability of their habitats***

Carbon Sequestration:

- ***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.***
- ***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.***
- ***Soil carbon enhancement: Implementing agricultural practices that improve soil organic matter content can increase carbon storage in the soil.***
- ***Blue carbon: Protecting and restoring wetland and flooded forest ecosystem, can contribute to carbon sequestration.***

Community Engagement:

- ***Involve local communities in biodiversity conservation efforts through participatory planning, monitoring, and implementation***
- ***Educating communities about the importance of biodiversity in the sub-scheme area***
- ***Foster community awareness about endangered species present within their vicinity***
- ***Promote sustainable livelihoods that support conservation, such as community-based ecotourism, sustainable agriculture, and fisheries management***
- ***Research and Monitoring:***
- ***Conduct further research assessing biodiversity and ecological processes within Ou Ta Paong Irrigation Sub-Scheme***
- ***Establish long-term monitoring programs track changes in biodiversity and habitat conditions which will provide valuable data for evaluating effectiveness of ongoing conservation efforts***

Sustainable Water Management:

- ***Ensure irrigation systems and water use practices do not harm critical habitat. Optimise irrigation efficiency, reducing water pollution and protecting water sources.***

Biodiversity Offsets:

- ***If significant residual impacts are expected despite avoidance and minimization measures, biodiversity.***

Budget for the Implementation of the Biodiversity Action Plan for Ou Ta Paong

No.	Items	Unit	Qty	Cost	Total
3	Implementing Biodiversity Management Plan	Year			1,000,000
3.1	**Restoration:** Implement the restoration of damaged or degraded critical habitats including reforestation, wetland restoration, habitat connectivity initiatives, and soil remediation measures over 5 years	Times	10	5,000	50,000
3.2	**Habitat Protection**				
3.2.1	Conduct continuous patrolling activities (1 time per months)	Times	60	500	30,000
3.2.2	Demarcation for the boundary of the critical habitats and nearby protected areas and community fisheries boundaries (mapping, pole posting, conflict resolution, etc.)	Poles	200	250	50,000
3.2.3	Support community patrols (2 community fisheries)	Year	5	15,000	75,000
3.2.4	Support ranger join patrol within zone 3	Year	5	18,000	90,000
3.3	**Species Conservation**				
3.3.1	Set up and train community-based biodiversity monitoring teams (1 training/year x 5 years)	Training	5	1,000	5,000
3.3.2	Conduct monthly biodiversity monitoring and protection	Year	5	14,000	70,000
3.3.3	Monitor populations of these species regularly and assess their habitat needs for 5 years	Lum-sump	5	10,000	50,000
3.3.4	Implement captive breeding programs or reintroduction efforts if necessary	Year	5	15,000	75,000
3.3.5	Implement habitat management measures that improve the quality and suitability of their habitats	Lum-sump	5	18,000	90,000
3.4	Implementing Community Based Carbon Sequestration program for community people for 5 years	Lum-sump	5	10,000	50,000
3.5	**Community Engagement**				
3.5.1	Conduct community awareness raising about the importance of biodiversity in the sub-scheme area for 5 years and 10 locations in OTP	Times	50	1,500	75,000
3.5.2	Involve local communities in biodiversity conservation efforts through participatory planning, monitoring, and implementation	Lum-sump	5	10,000	50,000
3.5.3	Promote sustainable livelihoods that support conservation, such as community-based ecotourism, handicraft, and fisheries management for 5 years 1. Train and provide capacity building to farmer on agroforestry, and SMART agriculture pratices 2. Provide training on community-based ecotourism and natural resource protection 3. Promote wildlife friendly products and community market	Lum-sump	5	18,000	90,000

No.	Items	Unit	Qty	Cost	Total
3.6	Establish long-term monitoring programs to track changes in biodiversity and habitat conditions 1. Forest fire monitoring and firefighting 2. Remote sensing analysis-based satellite image data 3. Conduct annual land used and land cover study	Lum-sump	5	15,000	75,000
3.7	Promote biodiversity offsets for conservation activities to community people (5 years) 1. Tree nursery preparation 2. Tree planting, maintaining and monitoring	Lum-sump	5	15,000	75,000
	Total cost for over 5-year period				**1,000,000**

Annex 7. Chance Find Procedure

1. Purpose, Objectives and Scope

Construction of small infrastructure and facilities as well as livelihood supports related activities under the CAISAR project has the potential to alter tangible or intangible cultural heritages, unknown or unrecorded cultural and archaeological sites. The project will develop Chance Finds Procedure to define the steps on how Chance Finds will be managed once they have been discovered. MOWRAM PMU will ensure contractors and livelihood experts to be familiar with the possibility that they may discover unknown finds and know how to manage them.

The objectives of the Chance Finds Procedure are to:

- Define the steps which must be followed to manage the discovery of previously unknown sites, including the preservation and appropriate treatment of these finds, while minimizing any disruption to the construction schedule
- Enable compliance with all relevant national laws and regulations and other requirements.

MOWRAM PMU will make sure that the Chance Finds Procedure will be applied by all CAISAR contractors/ subcontractors at subproject sites.

2. Procedure and Implementation

Consultation. MOWRAM PMU will consult with all relevant parties, including relevant ministries at national level, provincial line technical departments, and district authority, in order to agree to the Chance Finds Procedure.

Laboratory and Other Support. MOWRAM PMU, with technical support from the Ministry of Culture and Fine Art and its provincial departments, will make arrangements for suitable laboratory test and other necessary facilities at provincial level or national level for identifying the find objects.

Training and Awareness. Where necessary, MOWRAM PMU, with support from cultural expert, will develop and implement a Cultural Heritage Training and Awareness. The training and awareness will include basic training in the identification of sites and objects relevant to the subproject sites, including the cultural significance of IC communities. The training and awareness shall be delivered to all relevant project implementation agencies at sub-national level, contractor, and subcontractor prior to their participation in subproject activities.

3. Implementation & Monitoring

Monitoring shall require the appropriately trained personnel to determine the significance of a chance find in accordance with the definitions provided in the CAISAR project's Cultural Heritage Management Framework and follow the Chance Find Flowchart provided in

Attachment 1.

Attachment 1 - Chance Find Flowchart

- Bound copy of Chance Finds Report Forms presented to MOWRAM PMU and provincial representative
- Verification of each Chance Find Report Forms to Chance Finds items completed
- Chance finds appropriately packed and labelled
- Inventory of Chance Finds Items placed inside packed boxes
- Outstanding issues relating to any or all of the above have been resolved
- MOWRAM PMU or provincial representative accepts transfer of Chance Finds items from contractor to relevant provincial department of Culture and Fine Art.

Contractor Representative	MOWRAM PMU Representative	Provincial Representative
Name	Name	Name
Signature	Signature	Signature
Date	Date	Date

4. Stop Work

a) Once cultural heritage objects sites are identified, contractor or sub-contractor shall immediately stop work within an approximate distance of the site.

b) Contractor/sub-contractor shall call MOWRAM PMU and provincial level to the location to make a rapid determination of the significance of the find.

c) Contractor/sub-contractor shall, in the event that a site of potentially high significance is discovered, demarcate, and secure the area.

d) MOWRAM PMU, provincial Department of Culture and Fine Arts and contractor shall evaluate sites or objects in accordance with the procedure required by the Ministry of Culture and Fine Arts.

e) If threated species such as animal and trees are found, these species must be kept intact, protected, and immediately reported to relevant site managers for appropriate handling. Wild animals spotted on the construction sites must not be caught for sale and/or consumption in any way.

5. Management of Chance Finds

In case the chance find site is a highly significant cultural sites, contractor and MOWRAM PMU shall work together to determine any requirements for community engagement accordance to ESS10. The team will seek out and consult with the affected stakeholders and establish the appropriate action.

Management Options. The following management options will be considered:

- **Avoidance** to minimizes the impact to the site through partial or complete project redesign or relocation, should be the preferred option for cultural resource management perspective.
- **In-situ Management** This option includes the application of site protection measures. Appropriate protection measures will be identified and agreed between MOWRAM PMU, contractor, provincial department of culture and fine arts, and the local authority on a site-specific basis.
- **Destruction** If a site is assessed as having limited cultural significance, it may be destroyed once a complete photographic record has been made and the Chance Finds Report Form has been completed.

6. Reporting

All cultural heritage sites will be reported to MOWRAM PMU and provincial level and national level as part of contractor's monthly report, and will include a summary of:

- An update of the Key Performance Indicators
- Incidents of disturbance to known cultural heritage sites
- All cultural heritage sites identified, distinguishing between known and chance finds
- All Chance Finds, etc.

Annex 8 – Summary of Stakeholder Consultation

This section summarizes four consultation rounds carried out during the project preparation phase. These consultations involved discussions with relevant institutions, non-governmental organizations, local authorities, and local communities throughout the preparation process. The data collection and consultations were conducted over four periods:

1. First consultation

- The first consultation was conducted between 26 and 28 July 2024 to capture information regarding biodiversity and environmental condition in the project area.

2. Second consultation

- 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.

3. Result of consultation

- The information gathered from the key informant interviews highlighted several confirmed species present within Ou Ta Paong Irrigation Sub-scheme's command area. These included a variety of reptiles such as Black Marsh Turtle, Giant Asian Pond Turtle, Southeast Asian Box Turtle along with Elongated Tortoise amongst others. Additionally Indochinese Silvered Langur and Long-tailed Macaque were among those mammal speices confirmed to be present by informants while striped catfish and Siamese Tiger Perch stood as confirmed fish species recorded in this area. Furthermore, among bird speices Greater Adjutant, Milky Stork, Bengal Florican were also amongst others that have been successfully verified to be living in this region.
- Proposed project activities: Given the critical habitats identified and the biodiversity assessment results, proposed project activities must prioritize conservation measures.

4. Third consultation

- 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 Ou Ta Paong sub-schemes have a predominantly young population, which suggests strong potential for future development, though higher education levels are low. Agriculture is the main occupation, with 10% engaged in full-time private sector work. For secondary jobs, rice and crop production are most common. About 9% of the population falls under poor categories 1 and 2, indicating economic challenges, while 1.1% are people with disabilities. Migration is notable, with 16% moving within the country and 13% abroad, totaling 29% of the population.
- Moreover, both men and women share together for household chore, agricultural

involvement and decision making.

Table 1. List of participants of KII and FGD in Ou Ta Paong Command area

No	Name	Sex	Position	Commune	District
Key Informant Interview					
1	Chhut Vandy	M	Deputy Village Chief	Svay Doun Keo	Bakan
2	Vann Sorng	M	Deputy Village Chief	Svay Doun Keo	Bakan
3	Hach Pat	M	Village Chief	Rumlech	Bakan
4	Kae Vanna	M	Village Chief	Boeng Khnar	Bakan
5	Yaet Horn	M	Village Chief	Ou Ta Paong	Bakan
6	Voa Saren	M	Village Chief	Ou Ta Paong	Bakan
7	Tol Nhib	M	Village Chief	Ou Ta Paong	Bakan
8	Doung Savy	M	Village Chief	Ou Ta Paong	Bakan
9	Chhut Vandy	M	Deputy Village Chief	Svay Doun Keo	Bakan
10	Deuk Kimhean	M	Commune Council	Svay Doun Keo	Bakan
11	Un Samart	M	Commune Council	Svay Doun Keo	Bakan
12	Moung Moeun	M	Commune Council	Svay Doun Keo	Bakan
13	Sok Chanthy	M	Commune Council	Svay Doun Keo	Bakan
14	Long Tang	M	Commune Council	Svay Doun Keo	Bakan
15	Chhum Phally	F	Commune Council	Rumlech	Bakan
16	Tang Rebanglay	F	Commune Council	Boeng Khnar	Bakan
17	Meng Chhorn	F	Commune Council	Ou Ta Paong	Bakan
18	Hul Sereyvathana	F	Commune Council	Ou Ta Paong	Bakan
Focus Group Discussion					
1	Sean Soeurn	F	Vegetable Farmer	Rumlech	Bakan
2	Bo Sokban	F	Vegetable Farmer	Rumlech	Bakan
3	Kann Noeurn	M	Vegetable Farmer	Rumlech	Bakan
4	Chhin Rou	F	Vegetable Farmer	Rumlech	Bakan
5	Moung Touch	M	Vegetable Farmer	Boeng Khnar	Bakan
6	Chou Rath	F	Vegetable Farmer	Boeng Khnar	Bakan
7	Nhim Roeurn	F	Vegetable Farmer	Ou Ta Paong	Bakan
8	Vann Sary	F	Vegetable Farmer	Ou Ta Paong	Bakan
9	Phin Siem	F	Vegetable Farmer	Ou Ta Paong	Bakan
10	Huy Soy	F	Vegetable Farmer	Ou Ta Paong	Bakan
11	Nhen Sol	M	Vegetable Farmer	Ou Ta Paong	Bakan
12	Chum Khorn	F	Vegetable Farmer	Ou Ta Paong	Bakan
13	Chhean Sang	F	Vegetable Farmer	Ou Ta Paong	Bakan
14	Soun Sitha	F	Vegetable Farmer	Ou Ta Paong	Bakan
15	Soeurng Soeurn	M	Rice Farmer	Rumlech	Bakan
16	Boem Hil	M	Rice Farmer	Rumlech	Bakan
17	Soeurng Seng	M	Rice Farmer	Rumlech	Bakan
18	Kon Chantha	M	Rice Farmer	Rumlech	Bakan
19	Kann Noeurn	M	Rice Farmer	Rumlech	Bakan
20	Sien Hean	M	Rice Farmer	Rumlech	Bakan
21	Em Kong	M	Rice Farmer	Svay Doun Keo	Bakan
22	Chhut Bunchhai	M	Rice Farmer	Svay Doun Keo	Bakan
23	Kov Keo	M	Rice Farmer	Svay Doun Keo	Bakan
24	Uk Chenda	F	Rice Farmer	Svay Doun Keo	Bakan
25	Kim Sophal	M	Rice Farmer	Ou Ta Paong	Bakan

26	Tuy Savoeurn	F	Rice Farmer	Ou Ta Paong	Bakan
27	Kim Sak Sakhorn	M	Rice Farmer	Ou Ta Paong	Bakan
28	Khim Soeurn	M	Rice Farmer	Ou Ta Paong	Bakan
29	Net Borey	M	Rice Farmer	Ou Ta Paong	Bakan
30	Meng Chhaoet	M	Rice Farmer	Ou Ta Paong	Bakan
31	Em Pa	M	Rice Farmer	Boeng Khnar	Bakan
32	Nhim Sophal	M	Rice Farmer	Boeng Khnar	Bakan
33	Kae Sophal	M	Rice Farmer	Boeng Khnar	Bakan
34	Mai Phorn	M	Rice Farmer	Svay Doun Keo	Bakan
35	Sorng Kimsoeurn	M	Rice Farmer	Svay Doun Keo	Bakan
36	Long Phalla	M	Rice Farmer	Svay Doun Keo	Bakan
37	Ly Neang	F	Rice Farmer	Ou Ta Paong	Bakan
38	Von Morng	M	Rice Farmer	Ou Ta Paong	Bakan
39	Sieng Sokchea	M	Rice Farmer	Ou Ta Paong	Bakan
40	Men Leang	M	Rice Farmer	Ou Ta Paong	Bakan
41	An Roun	F	Rice Farmer	Ou Ta Paong	Bakan
42	Nhim Roeurn	F	Chicken Farmer	Ou Ta Paong	Bakan
43	Vann Sary	F	Chicken Farmer	Ou Ta Paong	Bakan
44	Phin Siem	F	Chicken Farmer	Ou Ta Paong	Bakan
45	Huy Soy	F	Chicken Farmer	Ou Ta Paong	Bakan
46	Nhen Sol	M	Chicken Farmer	Ou Ta Paong	Bakan
47	Chum Khorn	F	Chicken Farmer	Ou Ta Paong	Bakan
48	Chhean Sang	F	Chicken Farmer	Ou Ta Paong	Bakan
49	Soun Sitha	F	Chicken Farmer	Ou Ta Paong	Bakan
50	Hun Chan	F	Chicken Farmer	Ou Ta Paong	Bakan
51	Voeurn Phal	F	Chicken Farmer	Ou Ta Paong	Bakan
52	Thy Channa	F	Chicken Farmer	Ou Ta Paong	Bakan
53	Khin Niem	F	Chicken Farmer	Ou Ta Paong	Bakan
54	Thoeng Chantha	M	Chicken Farmer	Ou Ta Paong	Bakan
55	Pat Pov	M	Duck Farmer	Svay Doun Keo	Bakan
56	Chin Voeurn	F	Duck Farmer	Svay Doun Keo	Bakan
57	Loat Phung	F	Duck Farmer	Svay Doun Keo	Bakan
58	Nhim Nhenh	M	Duck Farmer	Ou Ta Paong	Bakan
59	Chorn Nan	F	Duck Farmer	Ou Ta Paong	Bakan
60	Nhenh Channy	F	Duck Farmer	Ou Ta Paong	Bakan
61	Sao Bunthoeurn	M	Duck Farmer	Ou Ta Paong	Bakan

Figure 1: Household survey in Ou Ta Paong commune

5. Fourth Consultation

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.

6. Consultation Results

6.1 Environment and Biodiversity Component

6.1.1 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

- 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 to inspect project activities that harm the environment and local community.

6.1.2 Biodiversity

Concerns

- The CAISAR project may cause negative impact 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 reirrigation infrastructure and canal upgrading.

Suggestions

- 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.

6.1.3 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

- 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.

6.2 Social Component

6.2.1 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

- The construction companies should hire local workers to offer them jobs and strictly abide to laws and reducing the concerns about gender-based violence or sexual violent.
- Construction companies and relevant departments should provide training on gender issues, violence, labour laws, and social protection to their staff and workers.
- The project should allocate the budget for relevant line departments to conduct relevant trainings to the companies and workers, and to monitor the construction sites

6.2.2 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 consumption 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

- 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,

6.2.3 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

- 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.

6.2.4 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

- 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 farmer.
- 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 caretaker and maintenance the irrigation system.
- Increase the number of commune agricultural technical officers to provide training and monitor farmers' cultivation techniques.
- Build more water storage, 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.
- Providing modern equipment and new techniques to department officers can enhance agricultural production efficiency and yield.

Table 2. List of participants during the fourth consultation meeting

No	Name	Sex	Position	Organization
1	Lay Viseth	M	Deputy Provincial Governor	Pursat Provincial Hall
2	Hun Sovan	M	Deputy Director	DAFF
3	Meas Set	M	Head of Office	DAFF
4	Kit Phal	M	Deputy Director	DoWRM
5	Lao Sokha	M	Deputy Director	DoWRM
6	Ra Sovanret	M	Deputy Head of Office	DoWRM
7	Mao Mina	M	Deputy Head of Office	DoWRM
8	Kol Buntheuorn	M	Director	DoLVT
9	Morn Kimsoeurn	M	Deputy Director	DoWA
10	Teou Sonary	F	Head of Health Office	DoWA
11	Kruoch Bunly	M	Officer	DoWA
12	Dang Rady	M	Head of Office	DoE
13	Lay Vannak	M	Deputy Head of Office	DoE
14	Suong Se	M	Deputy Director	DoLMUPC
15	Ut Raksa	M	Deputy Director	DoCFA
16	Chea Sophea	M	Head of Office	DoCFA
17	Teng Phearum	M	Deputy Head of Office	DoCFA
18	Phang Polin	M	CEO	Sustainable Cambodia Organization
19	Ok Seab	M	Manager	Sustainable Cambodia Organization
20	Ruon Phorn	F	Project Staff	Lutheran Hope Cambodia Organization
21	Khorn Sokluk	M	Director	HEKS - EPER Cambodia Organization
22	Khiev Raning	M	Deputy District Governor	Bakan District Hall
23	Chea Heng	M	Deputy District Governor	Bakan District Hall

24	Sam Sophun	M	Chairman of District Council	Bakan District Hall
25	Vann Sokhon	F	Head of Agriculture Office	Bakan District Hall
26	Him Makara	F	Head of Social Office	Bakan District Hall

Figure 2: Consultation with Provincial Department of Women Affaire, Pursat Province

Figure 3: Consultation with Provincial Department of Water Resources and Meteorology, Pursat Province

Figure 4: Consultation with District officer at Bakan District, Pursat Province

Annex 9: Laboratory Testing Result

Groundwater Quality Testing Result **199**
Surface Water Quality Testing Result **200**
Results of Soil Laboratory Testing **203**

Groundwater Quality Testing Result

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WATER INNOVATION LAB

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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

Samrach Phan

Surface Water Quality Testing Result

ក្រុមហ៊ុន វ៉ាធើរ អ៊ិនណូវេសិន ឡេប

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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

Samrach Phan

ក្រុមហ៊ុន វ៉ាធើរ អ៊ិនណូវេសិន លេប

WATER INNOVATION LAB

ផ្លូវជាតិលេខ៧ ភូមិអំពិលក្រោម ឃុំអំពិល ស្រុកកំពង់សៀម ខេត្តកំពង់ចាម

National Road 7, Ampil Krom Village, Ampil Commune, Kampong Siem District, Kampong Cham 030501, Cambodia

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

DL = Detection Limit

Kampong Cham, 19 August 2024

Verified by

Lab Director

WATER INNOVATION LAB KINGDOM OF CAMBODIA

Samrach Phan

ក្រុមហ៊ុន វ៉ាធើរ អ៊ិនណូវេសិន លេប

WATER INNOVATION LAB

ផ្លូវជាតិលេខ៧ ភូមិអំពិលក្រោម ឃុំអំពិល ស្រុកកំពង់សៀម ខេត្តកំពង់ចាម

National Road 7, Ampil Krom Village, Ampil Commune, Kampong Siem District, Kampong Cham 030501, Cambodia

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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

DL = Detection Limit

Kampong Cham, 19 August 2024

Verified by

Lab Director

Samrach Phan

Results of Soil Laboratory Testing

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងកសិកម្ម រុក្ខាប្រមាញ់ និងនេសាទ
អគ្គនាយកដ្ឋានកសិកម្ម

លេខ....០៥៤/២៤....អ.ន.ក

ថ្ងៃ.........................ព.ស.២៥៦៨
រាជធានីភ្នំពេញ ថ្ងៃទី....២០.....ខែ សីហា 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 (Pipette Method)	(< 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
	(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
	ម៉ាញេស្យូម,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.និម៉េលជាតិប្រៃ 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/៤៩ផ 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
ផូស្វ័សសរុប 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 (Method ,1M Ammonium Acetate at pH = 7 & Leach with 10 % NaCl)			12.40
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
បញ្ជូន.អ.នីមើលជាតិប្រៃដី Electrode Conductivity µS/cm , (1:5 Soil: water)			36.10
ប៉េហាសសីក, pH H2O , (1:5 Soil: water)			5.29
ប៉េហាសអំបិល , pH KCL , (1:5 (Soil : 1N KCL)			4.12

2

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 គ្រើម, Coase Silt , %		5.23
	(0.05- 0.2 mm) ខ្សាច់ម៉ត់, Fine Sand,%		33.52
	(0.2 - 2 mm) ខ្សាច់គ្រើម, 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.ន៏មើលជាតិប្រៃដី Electrode Conductivity µS/cm , (1:5 Soil: water)			99.30
ប៉េហាសសំទឹក, pH H2O , (1:5 Soil: water)			7.67
ប៉េហាសសំប៉ិល , 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
បញ្ជូន.អ.ឌីមើលជាតិប្រៃដី 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 ម៉ដ់, Fine Silt , %		21.10
	(0.02- 0.05 mm)ល្បាប់ គ្រើម, Coase Silt , %		11.70
	(0.05- 0.2 mm) ខ្សាច់ម៉ដ់, Fine Sand,%		30.29
	(0.2 - 2 mm) ខ្សាច់គ្រើម, 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
អត្រាចំរែតនៃកាចុង, 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
បញ្ជូន.អ.ន៏មើលជាតិប្រៃដី Electrode Conductivity µS/cm , (1:5 Soil: water)			63.00
រ៉ែហាស់ទឹក, pH H2O , (1:5 Soil: water)			5.66
រ៉ែហាស់អំបិល , 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

អគ្គនាយករង

ហ៊ុ ពុទ្ធា

Annex 10. 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	Ou Ta Paong	ទួលតាមុំ	Tuol Ta Mom	Archaeology	Bat Kokir Chas	Ou Ta Paong	Bakan	Pursat	357802	1403082
2	Ou Ta Paong	ទួលពង្រួញ	Tuol Proung	Archaeology	Bat Kokir Chas	Ou Ta Paong	Bakan	Pursat	357886	1404335
3	Ou Ta Paong	ទួលអ្នកតាឧកញ៉ាមាន់	Tuol Neak Ta Oknha Moan	Archaeology	Oknha Moan	Ou Ta Paong	Bakan	Pursat	356855	1406103
4	Ou Ta Paong	ទួលតាស៊ុក	Tuol Ta Suk	Archaeology	Oknha Moan	Ou Ta Paong	Bakan	Pursat	356817	1406136
5	Ou Ta Paong	ទួលវត្តចាស់	Tuol Wat Chas	Archaeology	Ou Bat	Ou Ta Paong	Bakan	Pursat	355370	1406864
6	Ou Ta Paong	ទួលស្រះម្កាក់	Tuol Srah Mkak	Archaeology	Srah Mkak	Ou Ta Paong	Bakan	Pursat	356525	1404675
7	Ou Ta Paong	ទួលស្រះរុន	Tuol Srah Run	Archaeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353855	1409227
8	Ou Ta Paong	ទួលរាជ	Tuol Reach	Archaeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353565	1408310
9	Ou Ta Paong	ទួលអំពិល២	Tuol Ampil 2	Archaeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353408	1408957
10	Ou Ta Paong	ទួលអំពិល១	Tuol Ampil 1	Archaeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353364	1408699
11	Ou Ta Paong	ទួលតាទុយ	Tuol Ta Tuy	Archaeology	Srah Run	Ou Ta Paong	Bakan	Pursat	353980	1408730
12	Ou Ta Paong	ទួលអំពិល	Tuol Ampil	Archaeology	Srah Run	Ou Ta Paong	Bakan	Pursat	354218	1408735
13	Ou Ta Paong	ទួលរគាំង	Tuol Rokeang	Archaeology	Tuol Rokeang	Ou Ta Paong	Bakan	Pursat	357407	1408650
14	Ou Ta Paong	ទួលវិហា (ថ្មគ្រែ)	Tuol Vihea (Thmo Krae)	Archaeology	Chrob	Svay Don Kev	Bakan	Pursat	350967	1407679
15	Ou Ta Paong	ទួលគុក	Tuol Kuk	Archaeology	Chrob	Svay Don Kev	Bakan	Pursat	352252	1408072

No.	Sub-Scheme	Name Khmer	Name English	Type	Village	Commune	District	Province	X	Y
16	Ou Ta Paong	ទួលកំពោតអាង	Tuol Kampot Ang	Archaeology	Kampout ang	Svay Don Kev	Bakan	Pursat	352770	1407290
17	Ou Ta Paong	ទួលតាកោ	Tuol Takor	Archaeology	Kampout ang	Svay Don Kev	Bakan	Pursat	352433	1407902
18	Ou Ta Paong	ទួលប្រត្រាញ់	Tuol Pratranh	Archaeology	Svay Don Kev	Svay Don Kev	Bakan	Pursat	353801	1402072
19	Ou Ta Paong	វត្តចន្ទគន្ធរាម	Chan Khutaram	Pagoda	Ta Nai	Ou Ta Paong	Bakan	Pursat	352341	1413104
20	Ou Ta Paong	វត្តស្តុកឃ្លោក	Stok Khlok	Pagoda	Sdok Khlouk	Ou Ta Paong	Bakan	Pursat	353133	1410316
21	Ou Ta Paong	វត្តកំប៉ាង	Kampang	Pagoda	Kampout	Svay Don Kev	Bakan	Pursat	351865	1405613
22	Ou Ta Paong	វត្តប្រាសាទដូនអន	Prasat Wat Don Orn	Pagoda	Prasat	Rumlech	Bakan	Pursat	357137	1396275
23	Ou Ta Paong	វត្តបឹងខ្នារ	Boeng Khna	Pagoda	Prey Svay	Boeung Khnar	Bakan	Pursat	358563	1398259

(Source: Pursat Provincial Department of Culture, and Fine Arts, 2024).

Figure 1: Maps of archeological and cultural sites in and near Ou Ta Paong Sub-scheme