Subject: Interview to the PDWRAM and Site Visit on Chantrea Irrigation Scheme

Date & Time:	February 21, 2024, 9:00 - 15:00
Location:	Meeting Room at the PDWRAM Svay Rieng, Site Visit at Chantrea reservoir
Attendants:	Refer to the attached Attendance List

The meeting with the PDWRAM and site visit to the target area were conducted to collect information related to the purposes of the survey on the irrigation and flood control in the area.

Table 1. General Information (Chantrea Lake)

Item	Contents
Component	1. Raising embankment of the reservoir by 0.5m 2. Construction of 1 new headwork (spillway), and 2 new intake structures for main canals. 3. Rehabilitation of Prey Mnoas main canal (17km), and Secondary canals (44km) 4. Rehabilitation of Toul Sdei main canal (10km), and Secondary canals (39km) 5. Construction of Branch canals 6. Construction of FWUC building 7. Installation of Automatic Hydro-meteorological Station 8. Establishment & Strengthening of FWUC/FWUGs 9. Strengthening of Agricultural Extension Services
Beneficiary Area	17,000 ha (PDWRAM mentioned 11,791 ha: 9,436 ha in wet season and 2,355 in dry season)
Beneficiary Households	1,458 Households (5,954 farmers)
Capacity of Reservoir *1)	Daun Toay reservoir: 17 MCM Lake Chantre: 3 MCM
Catchment Area*2)	Daun Toay reservoir: 100 km^2 (estimated based on the map)
FWUC Activity	No FWUC

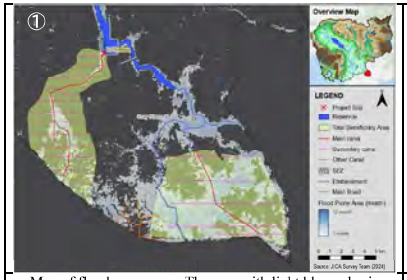
1) JICA Preparatory Survey Report (2012)
2) JICA Survey Team (2024) based on ASTER DEM

After a meeting with PDWRAM Svay Rieng and site visit at Chantrea Flood control, Irrigation and Drainage JST found following:

- Reason for Prioritization
  - Chantrea area is located at the flood plain of delta, so it is known as flood prone area (2 months inundation during wet season). However, there is no drainage system in the area, so most farmers cannot cultivate rice during wet season.
  - During the dry season on the other hand, farmers do not have enough water resource for rice cultivation. The capacity of the Daun Toay reservoir is only 17 MCM for the Daun Toay reservoir located upstream of the Chantrea lake. Therefore, famers who have their farmland near the national boarder unofficially purchase the water by 200,000 riel/ha at the south boarder between Cambodia and Vietnam.
  - Currently, cultivation area during dry season is 2,355 ha, whereas 9,436 ha during wet season. Both cultivation area can be expanded if the irrigation and drainage system is installed.
  - PDWRAM also proposed the raising reservoir's embankment by 0.5m to store more water, which is not mentioned in the paper provided by MOWRAM.
  - In addition, PDWRAM has a plan to supply water to SEZ which is located near the national border, which is to reduce the groundwater usage. It is just a plan and there is no study at all.

- Condition of Irrigation Facility

- A canal from a reservoir (Capacity: 17 MCM) is rehabilitated in 2011. Rehabilitation works for a dam embankment, asphalt pavement, and spillway were funded by IMF. Dikes surrounding the reservoir were rehabilitated by MOWRAM.
- Most of the target main and secondary canals are not rehabilitated after the construction during Por Pot Regime.



Map of flood prone area. The area with light blue color is inundated at least 2 months during wet season. In the case of flood, inundation area seems to expand for 2 weeks.

Spillway rehabilitated in 2011 financed by IMF. The current water level on 21 February 2024 is 3.2m AMSL. The full water level (FWL) is 4.0 AMSL. PDWRAM plans to raise FWL 0.3 – 0.5m to increase the reservoir capacity.

Downstream side of the Spillway of the Daun Toay reservoir. There is no problem in the facility. There are many reservoirs to store the water downstream as well.

A pavement provided in 2012 financed by IMF. If FWL is raised, the top elevation of the dam embankment shall also be raised, and the pavement shall be renewed.

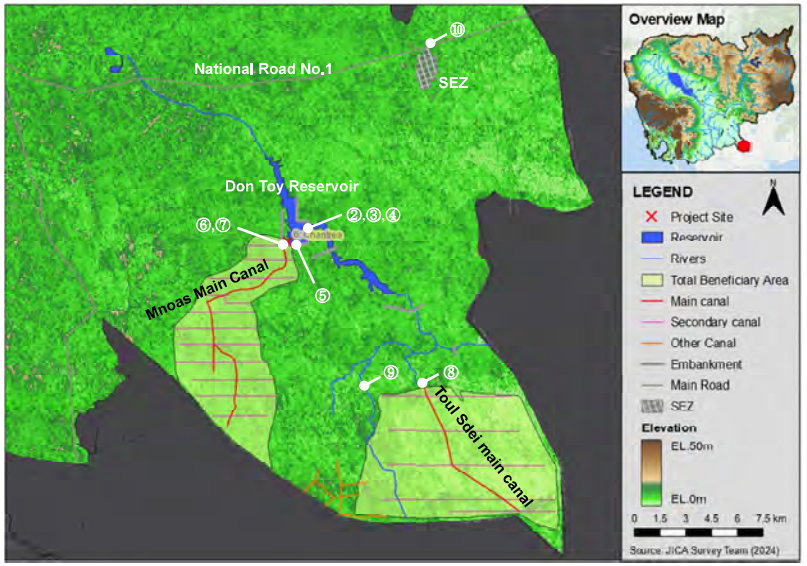
Embankment constructed by MOWRAM, starting in 2012 and completed in 2021. Daun Toay reservoir is surrounded by the embankment.

Intake structure of Mnoas main canal. Rehabilitation was completed in 2012 by MOWRAM. These gates are functioning well.

	
Downstream view of the Intake for the Mnoas main canal., There is no canal connecting to the gates. The area over the concrete lining portion is natural condition.	Upstream of Toul Sdei main canal. There is no facility such as gate except for canals constructed in Por Pot Regime.
	
Eroded portion in the inundation area. When water level rise, soils at the bank slope are saturated, and easily eroded. Soils are mainly composed of silt and sand.	An entrance gate for the Special Economic Zone (SEZ) in Chantrea. PDWRAM concerns the over abstraction of groundwater from the SEZ.

- Others
  - There is no FWUK and PDWRAM officers are responsible for all the gate operation.
  - There is no other donor activity related to this irrigation scheme.

Map of Chantrea Irrigation Scheme



Attachment: Attendance List (PDWRAM Siem Reap)

No.	Name	Position
PDWRAM		
1		Chief of Agricultural Irrigation Officer
2		Officer of Water Resources Management and Conservation
3		Contract Officer
JICA Survey Team		
4		Team Leader (TL)/ Hydrology / Flood Control
5		Co-TL/ Irrigation Development Planning
6		Secretary
7		Survey Assistance
8		Survey Assistance
9		Survey Assistance

Subject: Interview to the PDWRAM and Site Visit on Krosaing Irrigation Scheme

Date & Time:	February 22, 2024, 9:00 - 15:00
Location:	Meeting Room at the PDWRAM Svay Rieng, Site Visit at Krosaing site
Attendants:	Refer to the attached Attendance List

The meeting with the PDWRAM and site visit to the target area were conducted to collect information related to the purposes of the survey on the irrigation and flood control in the area.

Table 1. General Information (Krosaing)

Item	Contents
Component	1. Construction of 1 new headworks 2. Construction of 1 intake structure 3. Construction of upstream flood control embankment with drainage canals 4. Rehabilitation and construction of main/secondary/branch canals with related structures 5. Construction of FWUC building 6. Installation of Automatic Hydro-meteorological Station 7. Establishment & Strengthening of FWUC/FWUGs 8. Strengthening of Agricultural Extension Services
Beneficiary Area	15,000 ha
Beneficiary Households	2,691 Households (13,325 farmers)
Capacity of Reservoir *1)	No reservoir (There used to be a reservoir constructed in Por Pot regime, but now it is in natural condition. In addition, it should be noted that the river connects to the Vaico Irrigation Scheme supported by China through the drainage canal.)
Catchment Area*2)	-
FWUC Activity	No FWUC

1) JICA Preparatory Survey Report (2012)
2) JICA Survey Team (2024) based on ASTER DEM

After a meeting with PDWRAM Kampong Thom and site visit at Samseb Kanha Dam Flood control, Irrigation and Drainage JST found following:

- Reason for Prioritization (Condition of Facility)
  - The water resources are from Kroisan Lake constructed in Por Pot Regime, but there is no rehabilitation work after construction, which makes it almost natural condition. Therefore, PDWRAM proposed a whole irrigation system from the headwork to the branch canals.
  - Farmers utilize the water from Kompong Trech river, but amount of water available is very limited, and most of them must cultivate their farmland by rainfed only.
  - There are two large scale irrigation schemes close to the target irrigation scheme. One of them is located upstream of Kompong Trech river: Bromol Dom Dam Irrigation Scheme, which has 8,000 ha as potential beneficiary area, and another one is located downstream side: Kei Chork Irrigation Scheme, which has 30,000 ha as potential beneficiary area (water level record is available at Kei Chork Canal).
- Impact of Flood and Drought
  - There is no big impact of flood in farmland because the duration of the inundation is less than 10 days. However, water shortage is always suffering farmers (water depth during the flood time is around 1m).

Proposed site of the headworks (Kampong Trach River). Currently there is no facility.

Proposed site of the intake of Main canal. There is no facility except for the canal constructed in Por Pot Regime.

Riverbank around a place where an irrigation intake to be constructed. PDWRAM has not examined a candidate location for the irrigation intake, but it should be near this place according to geographic location of the main canal.

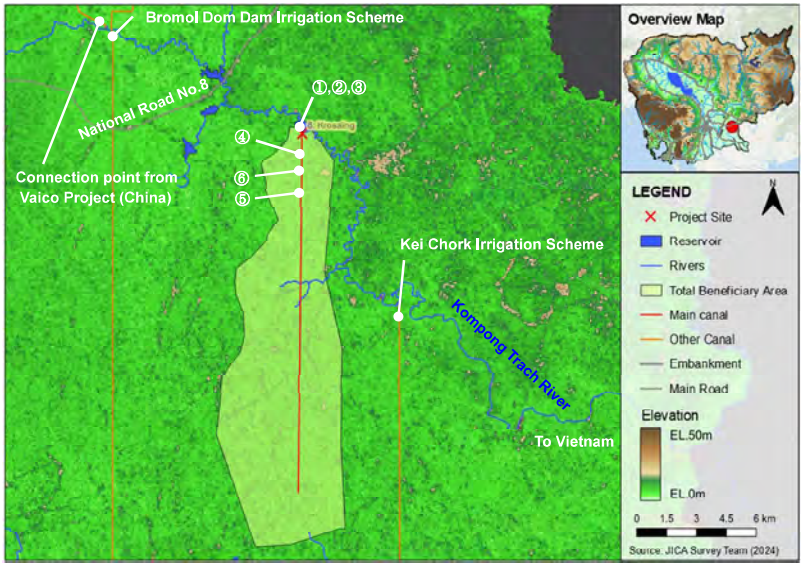
Main canal to be improved by the project. The canal was originally constructed in Por Pot regime, and now it is almost natural condition. The width of the canal is about 25m-30m.

Main canal to be improved by the project. Some of them became a series of small ponds as there is no intake structure.

Small canal in paddy field, which comes from the main canal.

- Others
  - It must be confirmed the water allocation rule between Cambodia and Vietnam because Kompong Trach river is flowing to the Vietnam because the water volume flowing to Vietnam will become significantly reduced after the project. Also, it should be noted that the drainage canal of Vaico Project supported by China is connected to the upstream of the Kompong Trach river.
  - There is no donor activity related on the Krosaing Irrigation Scheme, but there are many irrigation schemes along the Kompong Trach river, which requires higher level of discussions for water allocation (not only inter-provincial discussion but also inter-country discussion).

Map of Krosaing Irrigation Scheme



Attachment: Attendance List (PDWRAM Svay Rieng)

No.	Name	Position
PDWRAM		
1		Chief of Agricultural Irrigation Officer
2		Officer of Water Resources Management and Conservation
3		Contract Officer
JICA Survey Team		
4		Team Leader (TL)/ Hydrology / Flood Control
5		Co-TL/ Irrigation Development Planning
6		Secretary
7		Survey Assistance
8		Survey Assistance
9		Survey Assistance

Subject: Interview to Senior Water Resources Management Specialist, World Bank

Date & Time: January 30, 2024 14:00 - 15:00
Location: Meeting room at World Bank Group Cambodia
Participants: (Senior Water Resources Management Specialist, WB) JICA Survey Team (JST)

The meeting with the World Bank was conducted to collect information about the WB's project such as Cambodia Water Security Improvement Project, and Cambodia Southeast Asia Disaster Risk Management Project as well as the status of the Nature based Solutions in Cambodia.

- Component of Cambodia Water Security Improvement Project (total 145 million USD)

[Project Component]
(1) IWRM
  (a) water storage dam and operation improvement
  (b) integrated flood and drought management

(2) Sustainable Irrigation Service Development
  (a) irrigation system modernization and agricultural water management improvement
  (b) irrigation management reform and capacity building
  (c) private sector engagement to support climate smart agriculture

(3) Institutional Support for Integrated River Basin Management and Project Implementation
  (a) integrated river basin management
  (b) project implementation support

(4) Contingency emergency response component

[Target Area]
Mekong basin and sub-basin of Tonle Sap basin in the province of Kampong Thom, Preah Vihear, Siem Reap, Stung Treng, Kratie, Ratanakiri and Modulkiri.

This project costs at 145 million and is expected to start at mid-2024.

The project focuses on improving institutional capacity and planning, reviewing water regulations, and addressing dam safety framework. Currently there is no rule for the payment of water utilization, nor law about the paying system for irrigation water service fee. Therefore, collecting water tariff in Farmer Water User Community (FWUC) is voluntary set, and the rule to define the rate of water tariff varies widely by each FWUC. One objective of this component is to overcome this situation.

Mr. Virak introduced one of the role models in the proper FWUC management by CAVAC (Cambodia Australia Value Chain Program). CAVAC is a six-year program (2010-2015) to accelerate growth in the value of agricultural production and smallholder income in the rice based farming system, and one of the component is "Irrigation and Water Management", one of which activity is setting up community-based water management body (The CAVAC model charges 100$/ha for the whole cropping cycle.)

Mr Virak mentioned that it is no undesirable for farmers to hold more than one job in the operation of FWUC. The government has budget for FWUC members as their earnings, but they have other jobs. Therefore, WB is trying to reframe the existed operational model with MOWRAM.

World Bank focus on the specific areas where the infrastructure is being developed, such as Svay Chrum Reservoir in Kratie province, and O'chba reservoir in Mandokuri province. In these reservoirs

Despite the acknowledged benefits, the implementation of NbS poses challenges, requiring meticulous design and consideration of local conditions. Potential resistance is also noted due to perceived higher costs compared to conventional methods. In Cambodia, the neglect of vegetation/reforestation along the canal is widely observed, attributed to its costliness and a predominant focus on rice production.

Furthermore, in Laos, two successful projects have introduced bamboo-constructed checkpoints in canals ranging from 5m to 20m in width. This not only contributes to slowing down water flow but also provides opportunities for farmers to engage in fishing activities. The hope is to witness similar advancements through JICA's initiatives, promoting sustainable and nature-friendly improvements.

... and upwards

VI-63

VI-45

Subject: Interview to AFD

Date & Time:	March 1, 2024, 9:15 - 10:30
Location:	Project Office in MOWRAM
Attendant list:	(AFD),

Overview of WAT4CAM Activity:

WAT4CAM project is funded by AFD (mostly by European Union funds), and was created demanded by the MOWRAM. It is ongoing for 12 years with the goal of basin knowledge, creating water management committees. Once the water management committee was created, they had to decide what was the stakes within the basin and what will be the priorities problem to solve. And then they made the one action plan, made in 2016 (which will be shared later) that they decided. ADF helps them to find like other NGO.

As for the action plan, the first main activity was to have more access to drinking water. Doing so for this, There are a French programs to have small NGOs to help bringing drinking water from the groundwater in small villages, small communes in Kampong Thom and Preah Vihear. Since 2016, There are eight drinking water supply systems that were built. However, it has a problem in sustainability due to lack of fund for maintenance and functioning. It is too much cost to accommodate by communes. Therefore, WAT4CAM try to make those 8 water supply systems integrate into the water management committee to create fund.

Activities to Create Basin Management Committee:

The first step is to know how a committee can work. Their component in WAT4CAM is to review the activity of Stung Sen because in fact it was a bit difficult to share information with the small budget. So WAT4CAM project decided to help to make communication and share the data on the result of the project that is still ongoing.

Second part is to make a survey on all the IWRM projects that have been implemented in Cambodia (in Tonle Sap, and in upper Mekong). There is the 3S 4P river basin. The objective is to know how the IWRM is working in Cambodia (if it's working or not, what are the problematics and then to make a proposed recommendation to MOWRAM). They ask us recommendation to improve the sub-decree that is framing the IWRM in order to facilitate the implementation and ensure the sustainability. There are a lot of committees created but are not function now due to lack of training and budget to function.

Third part is to make a replication and implement IWRM in Stung Sangker in Battambang, and to create a committee and if possible to integrate the recommendation that we are doing at the scale of Tonle Sap.

Stakeholders of Basin Management Committee:

It consists of representatives from districts, provinces, and state government such as MOWRAM, MOA, MRD, MoISTI (Ministry of Industry, Science, Technology & Innovation), and representative of water users such as FWUCs and fisheries. However, involvement of the state government is not very committed because the sub-decree does not frame the officers outside of the committee. Therefore, WAT4CAM project is asking the other ministry to join the committee.

Situation of the Basin Management Committee:

The committee in Stung Sen and Stung Sangker is now going to be created. The committee is not yet created but they created technical working group to identify what kind of activities they can implement and how it can be funded. In case of both basins (Stung Sen and Stung Sangker), they concern the flood and drought. Now the Stung Sen river basin has a brand new reservoir (Reaksa reservoir constructed by Chinese fund in 2022), so they will update their action plan.

In Stung Sangker basin, there is a multi-purpose dam called the Sek Sak reservoir, and industries (more in specific, two cement industries and one pharmaceutical industry, both of which industries from China) have been releasing blackish water. PDWRAM is responsible for this issue but they are not trained well to treat this problem. They have no experience to manage this scale of reservoir, and they even have not seen the data because hydraulic data is automatically transmitted to the state government. They sometimes miscommunicate about the releasing amount of water to downstream.

He thinks this type of problem (poor management of the dam) is common in Cambodia because the dam construction finishes before the operation and management by MOWRAM/PDWRAM is ready. Stakeholders downstream were not aware of the existence of the new reservoir before IWRM project by WAT4CAM started. WAT4CAM prepares the place to discuss for water management and hold the meeting at least twice a year although it depends on the action plan and there is a budgetary limitation.

Ongoing Studies for the Water Quality Management:

Regarding the water quality, WAT4CAM studies the application of phytoplankton. In addition, they study to use the satellite images (infrared wavelength) to evaluate the water quality, which is free to download for more than 10 years' data with 3 days frequency. In near future, they are also thinking to apply the satellite "SWOT (Surface Water and Ocean Topography)" which is now under the phase of testing.

Others:

Regarding the drinking water source, there are three water sources: rainwater during the wet season which is not safe considering the bacterial growth under the warm weather, bottled water (20L bottle) provided by NGO called 1001 fontaines or other NGOs, and groundwater. As for power supply situation, people tend to use solar panel and generator. As for cooking they usually use wood fuel or gas although there are some accidents of the explosion of gas.

and upwards

Online Meeting Memorandum with Senior Social Safeguards Officer ADB

Date & Time:	June 28th, 2024, 11:00 am to 11:30 am
Location:	No venue due to the online meeting
Participants:	ADB: Senior Social Safeguards Officer
	JICA Team:

Purpose of the Meeting:

To understand the procedures of resettlement and land acquisition for public projects in Cambodia, gap between ADB safeguard policy and laws/regulation in Cambodia, and how to harmonize the gap

Detailed Discussion (a questionnaire in blue color has been sent to ADB and discussion was done following the questions)

1) I understand that the LAR-SOP is applied for projects funded by development partners such as WB, ADB. JICA does not have to refer to "Law on Expropriation (2010)"?

It is needed to refer to Law on Expropriation also, since LAR SOP mentions the law. ADB applies Safeguard policy framework (2009) and high-level dialog between ADB and the government of Cambodia in 2019 was done to discuss gaps related consultation, motoring and reporting. (Mr. Sambath Kim will share it, if possible)

2) Is there a concept of "Land for Land compensation" in case of expropriation in Cambodia?

ADB has the concept of land for land. But in Cambodia, cash compensation is general method, since the provided lands could be very far from the original places, and people prefer cash compensation to land for land compensation.

3) LAR-SOP (Land Acquisition and Resettlement Standard Operational Procedure) introduces a case of full replacement compensation including tax and transaction cost. Is it applicable in Cambodia?

※Article 28 of "Law on expropriation" says, "The amount of compensation shall be calculated as total amount of compensation minus the amount of stamp tax and/or tax on unused land that have not been paid to the State from the total amount of the compensation, and the Expropriation Committee shall deposit the withholding taxes into the State budget in accordance with procedures in force." Does it mean that compensation rate does not included tax for new land purchase? Do affect persons have to pay commission fees when they purchase new lands by using the cash which was gotten by the compensation?

ADB and GDR negotiate the issue several times. PAPs are free from payment of tax and compensation rate does not include tax and transaction cost.

4) Have you identified any gaps related to compensation/measures for land acquisition and resettlement between the ADB safeguard policy and laws/regulation in Cambodia? If so, how have you harmonized them?

Meaningful disclosure, complaint handling mechanism (handling at commune level, semi-annual monitoring report, registration of all complaints in Commune office, district office, project management unit, GDR/MEF, provincial office, finally to court, ADB office, compensation assistance, willingness of buyers/sellers, monitoring & reporting). Also, informal settlers are not compensated in Cambodia, while ADB provides support. In case of farmland within ROW, compensation for crops loss is provided. PMU supported by ADB has experience to receive complaint from PAPs for irrigation project (Canal 15).

5) According to the law, a replacement cost study consultant will evaluate the current market prices of the affected assets. Who shoulders consultant's remuneration? Is it possible for development partners to hire such as consultant for compensation cost estimation?

It is needed to negotiate with GDR. It is tricky. Inflation rates and interest rates (one year later) are added to the proposed compensation rates in case of ADB. GDR never agree the survey to be covered by ADB. Either international/national company or registered company in GDR can work for replacement cost study.

6) According to the LAR-SOP, during the D/D (detailed design) period, compensation cost estimation is to be determined. On the other hand, it is necessary for JICA project to calculate compensation cost and organize consultation meeting to the affected persons. Is it possible to do that in Cambodia?

In project design, government proposed sub-projects. A consultant team for project preparation implements F/S and due diligence for involuntary resettlement and conducted sample survey covering 20% of PAPs and prepare a BRAP (= draft RAP) (based on approximate number of PAPs). In D/D stage, GDR is responsible for all kinds of survey, e.g., DMS (detailed measurement survey) and preparation of a detailed RAP. Replacement cost estimations is done before DMS (D/D stage). It is still under discussion between COG and ADB.

Cadastral map in Cambodia, all of lands have yet to be registered. In irrigation area, cadastral map has not been prepared. Land Management Department owns the data. Payment of compensation is done considering actual situations. In ADB's project, site survey to identify the land use is to be implemented by walking and interview with local people and authorities.

7) Have you prepared a Resettlement Action Plan for a sub-project referring to LAR-SOP and ADB safeguard policy? If so, will you please share it with us?

Yes, it is possible to share it later.

Appendix VII

Meeting Material

Contents

VII-1. Kick-Off Meeting (Online) VII-1

VII-2. Kick-Off Meeting (Face-to-face) VII-6

VII-3. Progress Meeting (JICA) VII-11

VII-4. Progress Meeting (MOWRAM-1) VII-16

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VII-7. ITR Meeting (MOWRAM) VII-33

VII-8. Progress Meeting (Ministry of Economy and Finance) VII-45

VII-9. Progress Meeting (MOWRAM-2) VII-50

VII-10. Progress Meeting (MOWRAM-3) VII-54

VII-11. DFR Meeting VII-56

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

INTRODUCTORY WEB-MEETING

December 19, 2023

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Agenda

1. Objective & Outputs,
2. The Survey Area,
3. Overall Work Schedule,
4. Team Members and Assignment,
5. Plan of Approach,
6. Plan of Operation,
7. Undertakings Requested, and
8. Others

1. Objectives & Outputs,

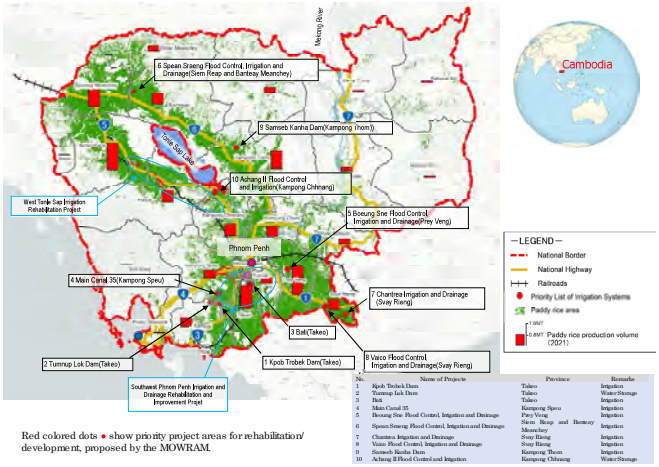
The objectives of this Survey are:

1) To identify the development needs in the irrigation sector in Cambodia and,
2) To identify future candidate irrigation projects for Japanese ODA loans.

In order to achieve above objectives;

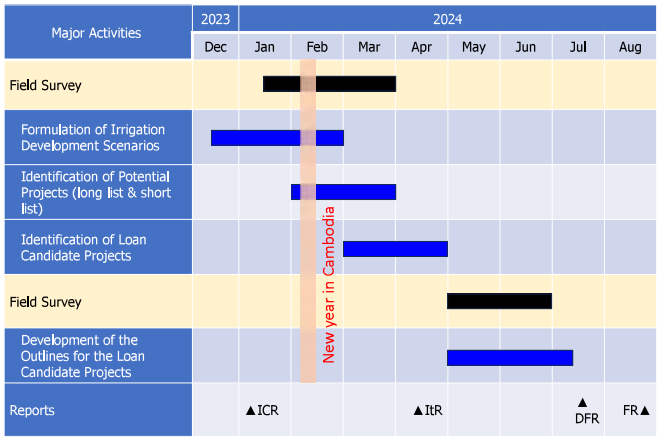
the Survey will collect, confirm and analyze basic information on irrigation development in Cambodia, including the current status and issues of the irrigation sector in Cambodia, as well as the progress and direction of projects planning/ implementation by the Cambodian government and also by other donors.

2. The Survey Area: Basically Whole Cambodia



Red colored dots ● show priority project areas for rehabilitation/ development, proposed by the MOWRAM.

3. Overall Work Schedule



4. Team Members and Assignment

- Team Leader (TL)
- Irrigation Development Planning
- Facility Planning
- Design
- Cost Estimation
- Co-TL
- Hydrology
- Flood Control
- Environmental and Social Considerations
- Agriculture
- GIS
- Irrigation Development Planning (2)

4. Team Members and Assignment

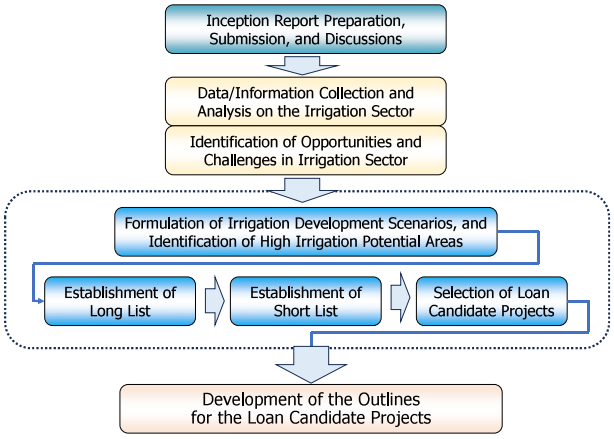
Expertise/ Members	2023	2024						
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Team Leader/ Irrigation Development Planning									
Co-TL/ Hydrology/ Flood Control									
Agriculture									
Facility Planning/ Design/ Cost Estimation									
Environmental and Social Consideration									
GIS/Irrigation Development Planning (2)									
Reports		▲ICR			▲ItR			▲DFR	FR▲

New year in Cambodia

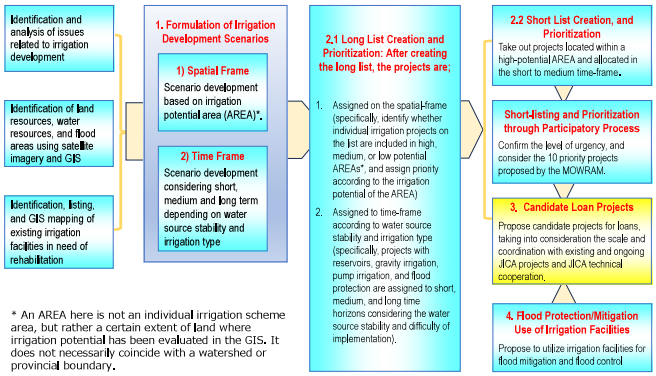
Works in Japan (as required basis) Works in Cambodia

5. Plan of Approach & Operation

5. Plan of Approach: Overall Flow



5. Plan of Approach: Process of Reaching the Highest Priority Projects



* An AREA here is not an individual irrigation scheme area, but rather a certain extent of land where irrigation potential has been evaluated in the GIS. It does not necessarily coincide with a watershed or provincial boundary.

5. Plan of Approach: An Idea of Identifying Irrigation Potential Area

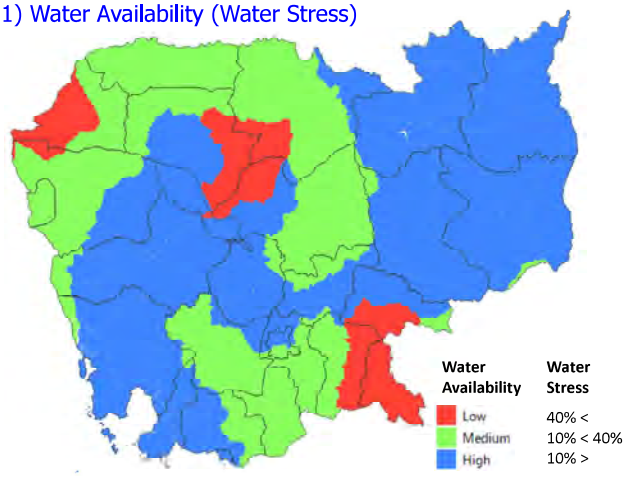
Natural Conditions

	Criteria	Example of Required Info.
1)	Water Availability	Water Supply: monthly RF, monthly discharge of rivers, dams/reservoirs, cross section of rivers Water Demand: demand in each sector (agriculture, domestic, industry, aquaculture, livestock, and water conflicts among them), crop calendar, cropping intensity, etc.
2)	Land Use with Slope	Identification of paddy field, irrigated area, and water utilization facilities. topography and soil condition.
3)	Flood Risk	Frequency, damages, flood affected area map, flood condition (water level, discharge, etc.)
4)	Drought Risk	Frequency, damages, affected population

Social Conditions

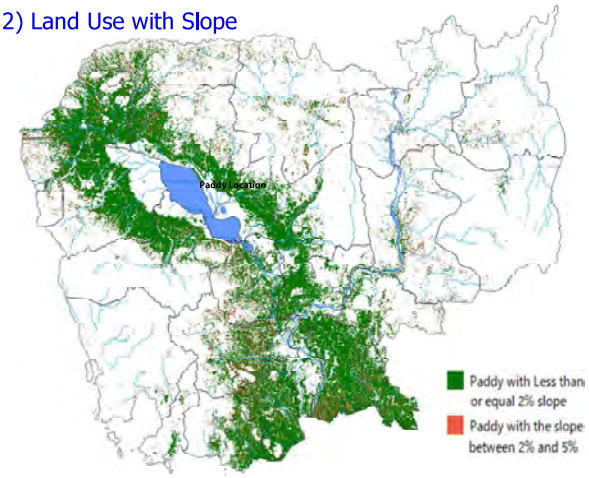
	Criteria	Example of Required Info.
5)	Market Accessibility	Data for Road and Railway with their reliability
6)	Poverty Ratio, etc.	Poverty level, population, education, literacy rate, etc.

1) Water Availability (Water Stress)



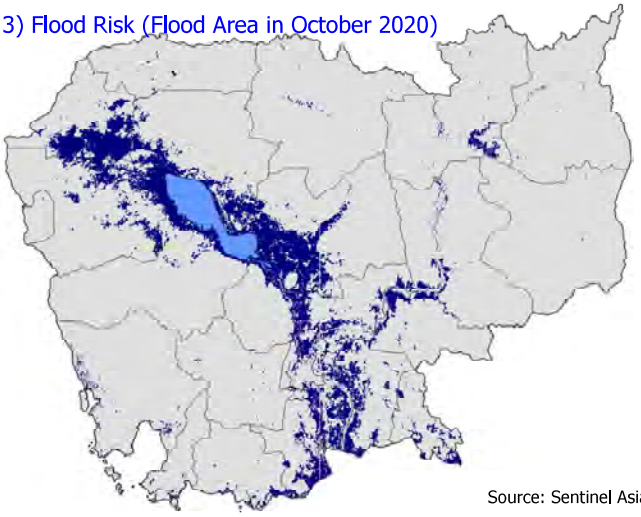
Source: Aqueduct 4.0 (2023)

2) Land Use with Slope



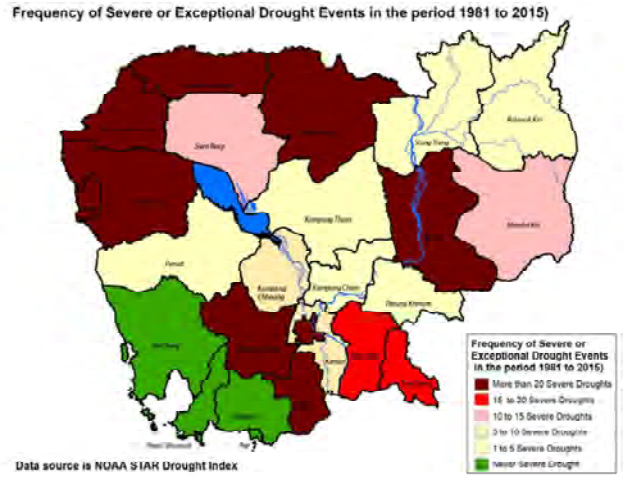
Source: USAID (2020) and SRTM

3) Flood Risk (Flood Area in October 2020)



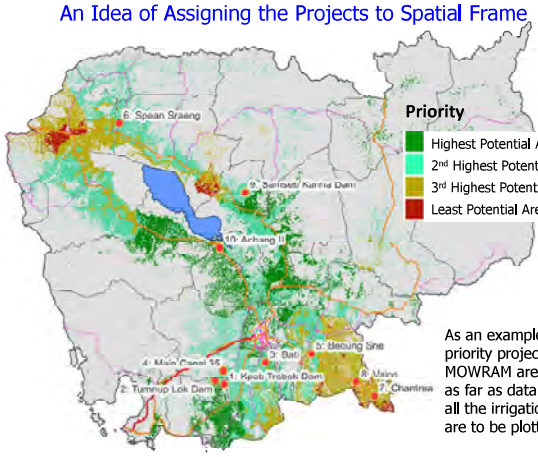
Source: Sentinel Asia

4) Drought Risk



5. Plan of Approach:

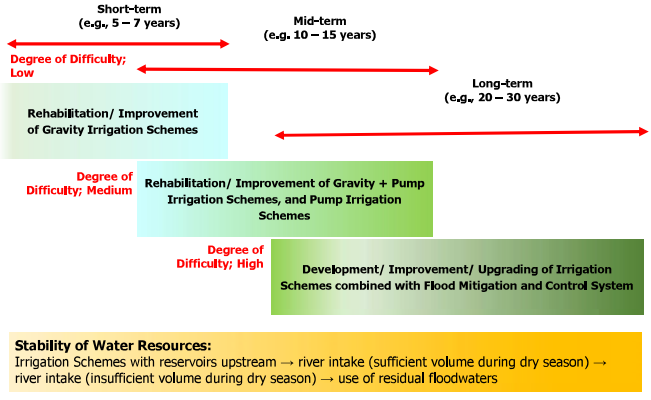
By putting all into one, we can generate irrigation potential map, and An Idea of Assigning the Projects to Spatial Frame



As an example, only 10 priority projects given by MOWRAM are shown, but as far as data are available, all the irrigation schemes are to be plotted.

5. Plan of Approach:

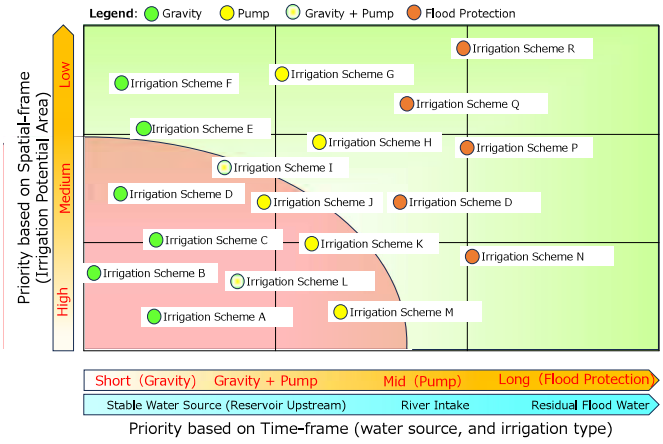
An Idea of Assigning the Projects to Time-frame



Stability of Water Resources:
Irrigation Schemes with reservoirs upstream → river intake (sufficient volume during dry season) → river intake (insufficient volume during dry season) → use of residual floodwaters

5. Plan of Approach:

An Idea of Assigning Priority from Spatial and Time Frames Viewpoints



Priority based on Time-frame (water source, and irrigation type)

6.1 Plan of Operation:

An Examples of Allocating Weights on the Shortlisted Projects in order to Select Candidate Loan Projects

No.	Indicators	Weights
1	Rationale of the Project: Necessity of Irrigation Rehabilitation/ Improvement/ Development	Pre-condition
2	Relevance to the Government National Policies, Strategies, Plans and Programs in Irrigation/ Agriculture Sector	
3	Overlapped Projects by the Government and/or Other Donors Fund	Exclude if overlapped
4	Degree of Emergency to Implement the Project	High
5	Impacts of Economic Benefits (Scale of Beneficiary Area/ No. of Beneficiaries, etc.)	Mid-high to High
6	Synergy/ Ripple Effects with Other ODA and Government Projects (agriculture projects, irrigation projects, and road improvement projects, etc.)	Middle
7	Adaptation Degree to Climate Change	Middle
8	O & M Capacity of Farmer Water User Community (FWUC)	Middle
9	Degree of Poverty Reduction	Middle
10	Land Acquisition and Resettlement	Consultation with MOWRAM/ JICA
11	Risks in the Project Implementation	Consultation with MOWRAM/ JICA

6.2 Plan of Operation:

An Example of Outlines of Candidate Loan Projects

1. Rational of the Project, Relevance to and Synergy with Other Projects
2. General Status of the Project Area (Beneficial Area, Population, etc.)
3. Agriculture Current Status and Farming Plan with Irrigation
4. Major Components, Those Dimensions, Specifications, and Quantities
5. Project Cost, Project Benefit, Project Evaluation from Investment View
6. Construction and Project Implementation Schedule (Preliminary)
7. Consultant Services Required (Preliminary)
8. Procurement Plan (Preliminary)
9. Environmental and Social Consideration including Resettlement
10. Farmer Water User Community
11. Operation and Maintenance Plan of the Irrigation Scheme
12. Poverty Reduction, Gender Consideration, etc.
13. Issues towards next Step

Note: Only preliminary FS level study will be undertaken in this Data Collection Survey, and therefore, Feasibility Study/Preparatory Study for Loan Arrangement should be conducted thereafter upon the request by MOWRAM and acceptance by JICA.

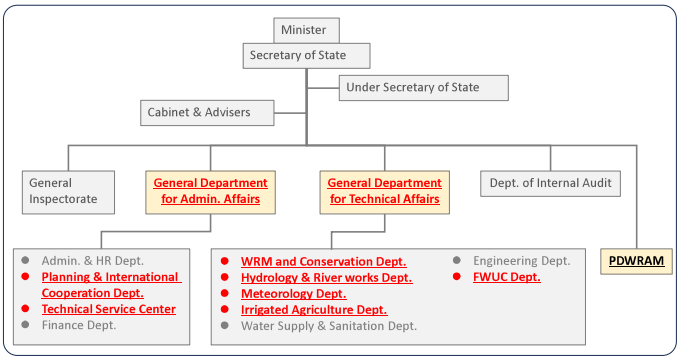
7. Undertakings Requested

No.	Requested Undertakings	Remarks
1.	Nomination and Assignment of Contact Person(s) (Please within this week, through e-mail)	Not necessary for Full Time
2.	Assistance in obtaining GIS spatial data implemented through donor supports: 1. Water Resources Information System (WRIS) in National Water Recourses Data Management Center established under Irrigation Agriculture Improvement Project *1, funded by ABD 2. Cambodia Information System on Irrigation Schemes (CISIS), database of irrigation schemes in Cambodia, assisted by AFD	We like to obtain the GIS spatial data within this year, so that irrigation potential map will be available by the time of team's first arrival (mid Jan). Through e-mail.
3.	Assistance in obtaining permits and making appointments for site field surveys	Field surveys to be made in February, except new year period

*1: Irrigated Agriculture Improvement Project (https://www.adb.org/projects/51159-002/main)

8.1 Others: Confirmation of the CP Department

MOWRAM



*PDWRAM: Provincial Department of Water Resources and Meteorology

National Water Resources Data Management Center (NWRDMC) ?

8.2 Others: Confirmation of Latest Policies/ Plans

Most of the national policies/ strategies/ plans are up to year 2023, so we like to know the update of those if already available and published or under preparation (e.g. Rectangular Strategy was already updated to the Pentagonal Strategy).

No.	National Development Policies and Plans, and Strategic Papers	Remarks
1.	The Rectangular Strategy Phase 4 (2018–2023) Pentagonal Strategy-Phase I (5 years),	5 phases x 5 years
2.	National Strategic Development Plan (2019–2023)	Available from 2024 ?
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4.	Agricultural Sector Strategic Development Plan (2019-2023)	Available from 2024 ?
5.	Any other Important National Policies and Strategies ?	

In cases new policies/ strategies/ plans are already available, please share the URL or the PDF file through e-mail.

8.3 Others: Government Priority Projects

Originally Requested 10 top Priority Project for Japan ODA Loan

No.	Name of Projects	Province	Remarks
1	**KPOB TROBEK** Dam	Takeo	Irrigation
2	**TUMNUB LOK** Dam	Takeo	Water Storage
3	**BATI**	Takeo	Irrigation
4	MAIN CANAL 35	Kampong Speu	Irrigation
5	**BOEUNG SNE** Flood Control, Irrigation and Drainage	Prey Veng	Irrigation
6	**SPEAN SRAENG** Flood Control, Irrigation and Drainage	Siem Reap and Banteay Meanchey	Irrigation
7	**CHANTREA** Irrigation and Drainage	Svay Rieng	Irrigation
8	**VAICO** Flood Control, Irrigation and Drainage	Svay Rieng	Irrigation
9	**SAMSEB** Kanha Dam	Kampong Thom	Irrigation
10	**ACHANG** II Flood Control and Irrigation	Kampong Chhnang	Water Storage

Updated in August 2023 (Pipeline Project for Japan ODA Loan on Flood Control, I&D, Rehab. and Improv. Prj.)

No.	Name of Projects	Province	1st P.	2nd P.
1	**KPOB TROBEK AND TUMNUB LOK DAMS** Flood C., I & D	Takeo	✔	
2	**BATI** Flood Control, Irrigation and Drainage	Takeo	✔	
3	**KHPOB KROUS RESERVOIR** Flood Control, Irrigation and Drainage	Kampong Speu	✔	
4	**BOEUNG SNE** Flood Control, Irrigation and Drainage	Kampong Speu		✔
5	**SPEAN SRAENG** Flood Control, Irrigation and Drainage	Siem Reap, Banteay Meanchey	✔	
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8	**KROSAING** Flood Control, Irrigation and Drainage	Svay Rieng	✔	
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10	**ACHANG** II Flood Control and Irrigation	Kampong Chhnang		✔
11	**PLAING** Flood Control, Irrigation and Drainage	Siem Reap	✔	

8.3 Others: Government 11 Priority Projects

For the Government Priority Projects for Japan ODA Loan, we are now preparing a questionnaire sheet covering the following major items, so, could you please provide us with the following information by 10th Jan. (questionnaire through e-mail):

No.	Item	No.	Item
1	Name of the Irrigation Scheme	11	Necessity of Resettlement and the Scale (families)
2	Expected Works & Volume by Components	12	Existence of Unofficial Settlers within the Project Area
3	Reasons of Rehabilitation/ Improvement	13	Basic Dimensions/ Specification of the Works
4	Expected Benefit with the Project	14	Beneficiary Area (ha)
5	Expected Project Cost	15	Existence of Head Works, or River Intake Only
6	Flood and Inundation Experiences in the Past	16	Scale/ Dimension of the Main Canal
7	Water Shortage and Drought in the Past	17	Length of the Main Canal (m)
8	Water Users Association Available, and Degree of Functionality	18	No. of Total Length of Distribution Canals
9	What Happens in Case without project	19	Status of Drainage Networks
10	Necessity of Land Acquisition and the Scale (ha)	20	PDWRAM in Charge, and Contact Person

MANY THANKS

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

KICK-OFF MEETING

January 18, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Agenda

1. Objective & Outputs,
2. The Survey Area,
3. Overall Work Schedule,
4. Team Members and Assignment,
5. Plan of Approach,
6. Plan of Operation,
7. Undertakings Requested, and
8. Others

1. Objectives & Outputs,

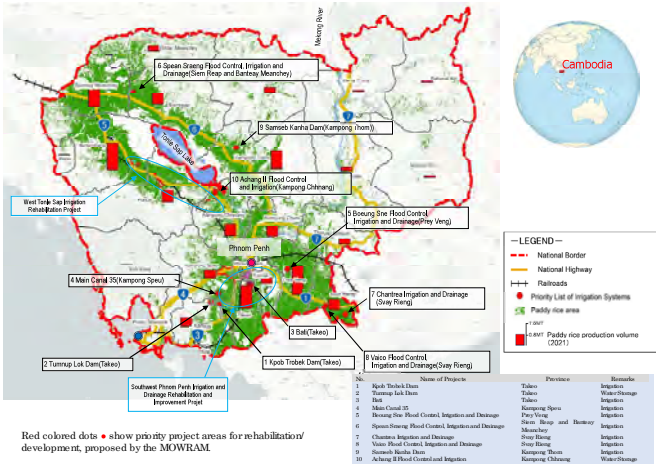
The objectives of this Survey are:

1) To identify the development needs in the irrigation sector in Cambodia and,
2) To identify future candidate irrigation projects for Japanese ODA loans.

In order to achieve above objectives;

the Survey will collect, confirm and analyze basic information on irrigation development in Cambodia, including the current status and issues of the irrigation sector in Cambodia, as well as the progress and direction of projects planning/ implementation by the Cambodian government and also by other donors.

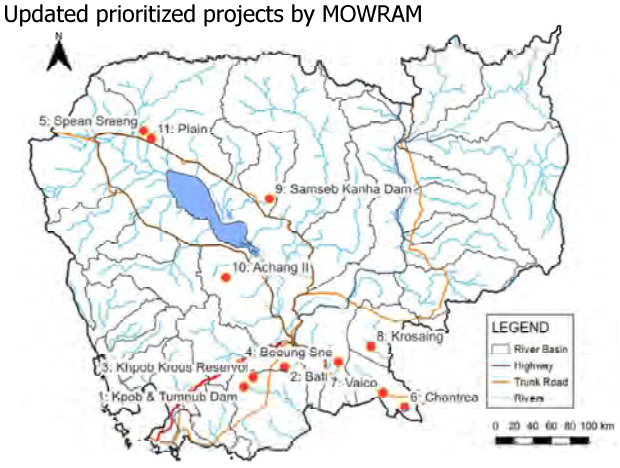
2. The Survey Area: Basically Whole Cambodia



Red colored dots ● show priority project areas for rehabilitation/ development, proposed by the MOWRAM

2. The Survey Area: Basically Whole Cambodia

Updated prioritized projects by MOWRAM



3. Overall Work Schedule

Major Activities	2023	2024							
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1st Field Survey									
Formulation of Irrigation Development Scenarios									
Identification of Potential Projects (long list & short list)									
Identification of Loan Candidate Projects									
2nd Field Survey									
Development of the Outlines for the Loan Candidate Projects									
Reports		▲ICR			▲ItR			▲DFR	FR▲

Chinese New Year

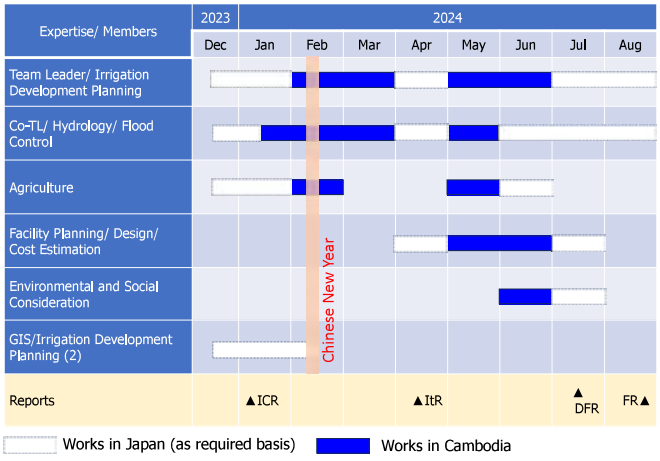
4. Team Members and Assignment

- Team Leader (TL)
- Irrigation Development Planning
- Facility Planning
- Design
- Cost Estimation
- Co-TL
- Hydrology
- Flood Control

TEL: +855 8634-5303

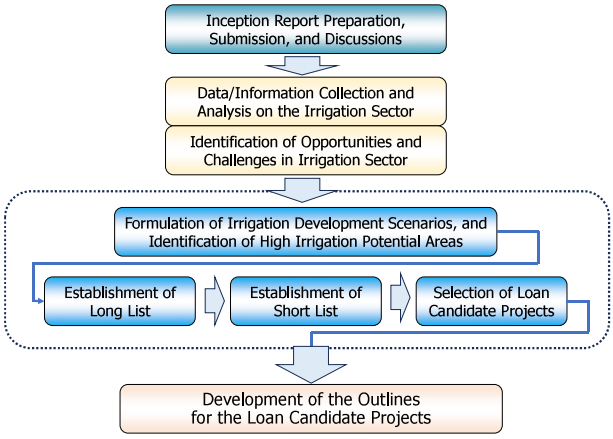
- Environmental and Social Considerations
- Agriculture
- GIS
- Irrigation Development Planning (2)

4. Team Members and Assignment

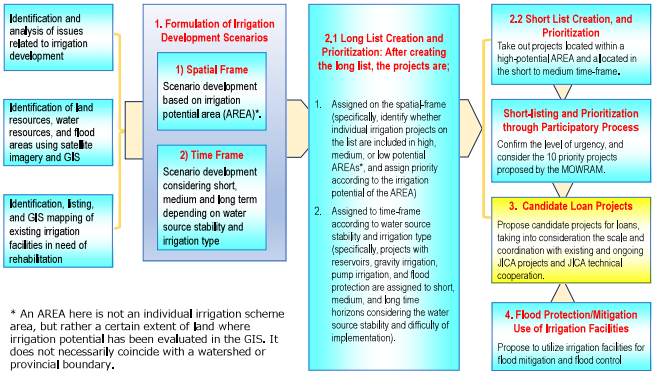


5. Plan of Approach & Operation

5. Plan of Approach: Overall Flow



5. Plan of Approach: Process of Reaching the Highest Priority Projects



* An AREA here is not an individual irrigation scheme area, but rather a certain extent of land where irrigation potential has been evaluated in the GIS. It does not necessarily coincide with a watershed or provincial boundary.

5. Plan of Approach: An Idea of Identifying Irrigation Potential Area

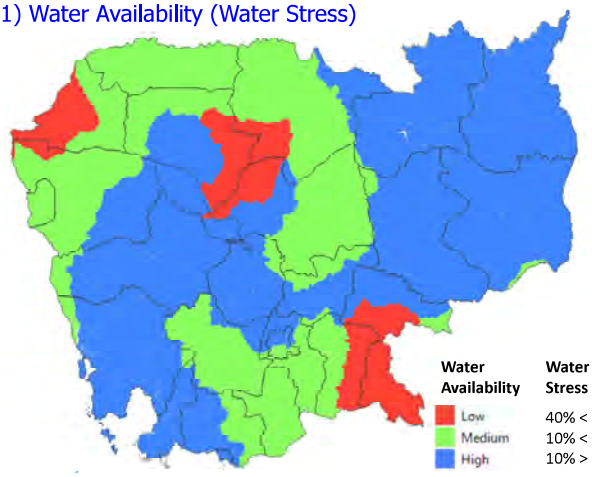
Natural Conditions

	Criteria	Example of Required Info.
1)	Water Availability	Water Supply: monthly RF, monthly discharge of rivers, dams/reservoirs, cross section of rivers Water Demand: demand in each sector (agriculture, domestic, industry, aquaculture, livestock, and water conflicts among them), crop calendar, cropping intensity, etc.
2)	Land Use with Slope	Identification of paddy field, irrigated area, and water utilization facilities. topography and soil condition.
3)	Flood Risk	Frequency, damages, flood affected area map, flood condition (water level, discharge, etc.)
4)	Drought Risk	Frequency, damages, affected population

Social Conditions

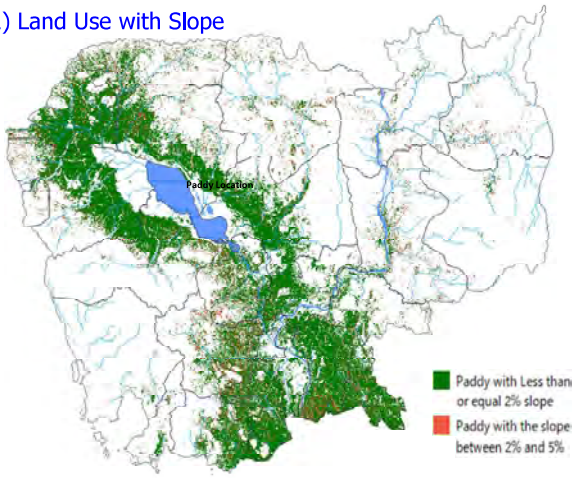
	Criteria	Example of Required Info.
5)	Market Accessibility	Data for Road and Railway with their reliability
6)	Poverty Ratio, etc.	Poverty level, population, education, literacy rate, etc.

1) Water Availability (Water Stress)



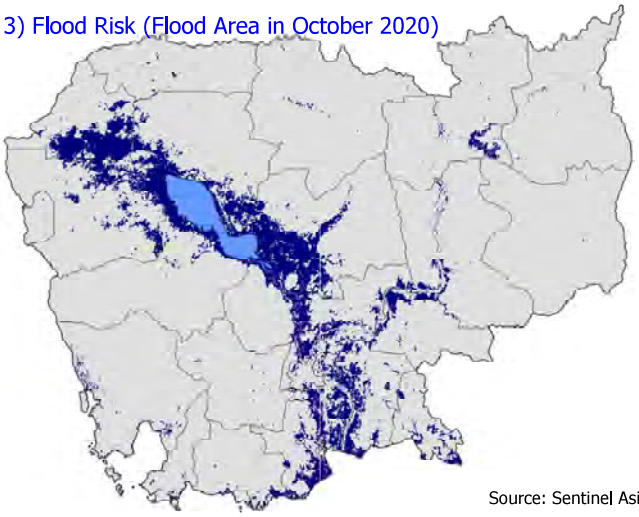
Source: Aqueduct 4.0 (2023)

2) Land Use with Slope



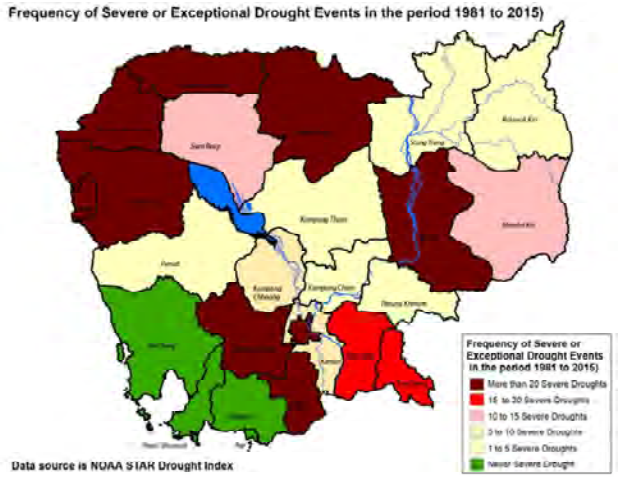
Source: USAID (2020) and SRTM

3) Flood Risk (Flood Area in October 2020)



Source: Sentinel Asia

4) Drought Risk



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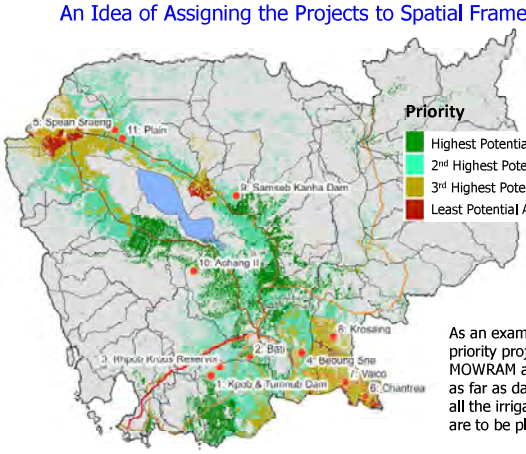
By putting all into one, we can generate irrigation potential map, and An Idea of Assigning the Projects to Spatial Frame



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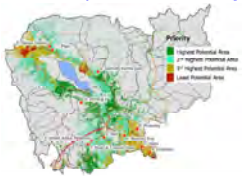
5. Plan of Approach:

Example result of Irrigation Potential for 11 prioritized projects



Potential analysis needs to be updated through this first field survey (e.g. additional important data such as geospatial data of irrigation schemes, beneficiary area, importance in flood/drought measures, etc)

No.	Name of Projects	Province	1st	2nd	Temp. Result
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2	BATI Flood Control, Irrigation and Drainage	Takeo	✔		1 ~ 2
3	KHPOB KROUS RESERVOIR Flood Control, Irrigation and Drainage	Kampong Speu	✔		2
4	BOEUNG SNE Flood Control, Irrigation and Drainage	Kampong Speu		✔	3
5	SPEAN SRAENG Flood Control, Irrigation and Drainage	Siem Reap, Banteay Meanchey	✔		2 ~ 3
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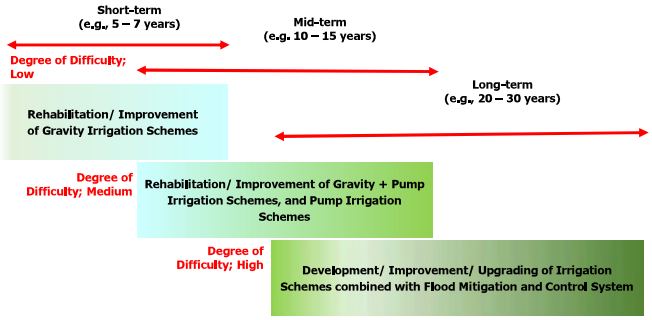
5. Plan of Approach:
An Idea of Assigning the Projects to Time-frame



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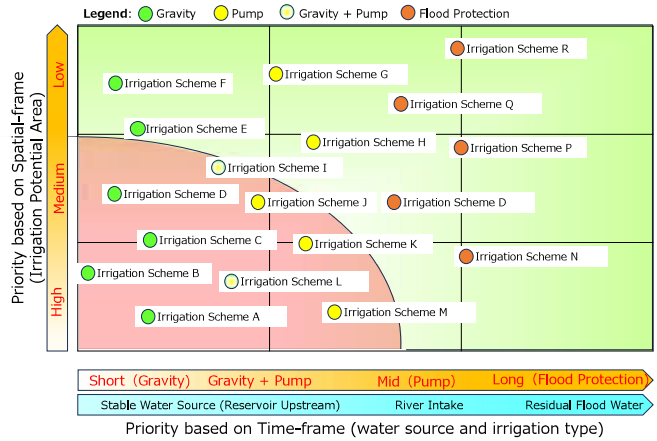

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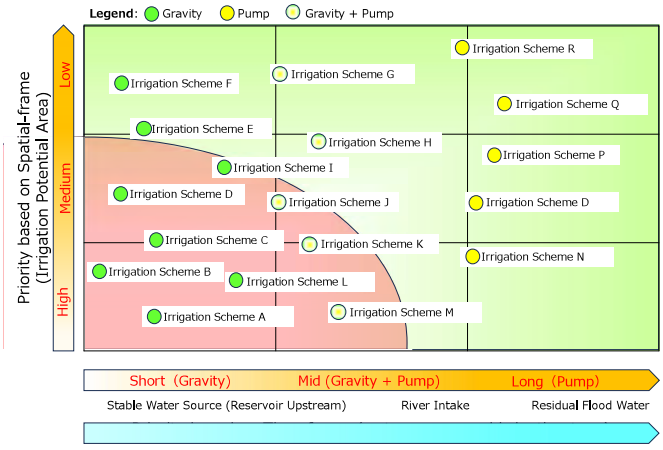

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An Example of Outlines of Candidate Loan Projects

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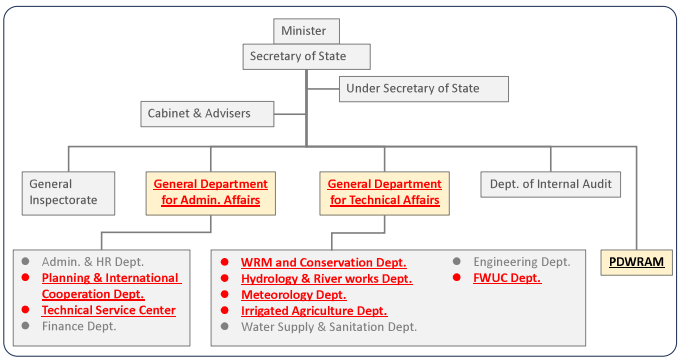

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9	**SAMSEB KANHA** Flood Control, Irrigation and Drainage	Kampong Thom	✔	
10	**ACHANG** II Flood Control and Irrigation	Kampong Chhnang		✔
11	**PLAING** Flood Control, Irrigation and Drainage	Siem Reap	✔	

8.3 Others: Government 11 Priority Projects

For the Government Priority Projects for Japan ODA Loan, we are now preparing a questionnaire sheet covering the following major items, so, could you please provide us with the following information:

No.	Item	No.	Item
1	Name of the Irrigation Scheme	11	Necessity of Resettlement and the Scale (families)
2	Expected Works & Volume by Components	12	Existence of Unofficial Settlers within the Project Area
3	Reasons of Rehabilitation/ Improvement	13	Basic Dimensions/ Specification of the Works
4	Expected Benefit with the Project	14	Beneficiary Area (ha)
5	Expected Project Cost	15	Existence of Head Works, or River Intake Only
6	Flood and Inundation Experiences in the Past	16	Scale/ Dimension of the Main Canal
7	Water Shortage and Drought in the Past	17	Length of the Main Canal (m)
8	Water Users Association Available, and Degree of Functionality	18	No. of Total Length of Distribution Canals
9	What Happens in Case without project	19	Status of Drainage Networks
10	Necessity of Land Acquisition and the Scale (ha)	20	PDWRAM in Charge, and Contact Person

MANY THANKS

DATA COLLECTION SURVEY
ON IRRIGATION AND FLOOD PROTECTION

MEETING with JICA HQ

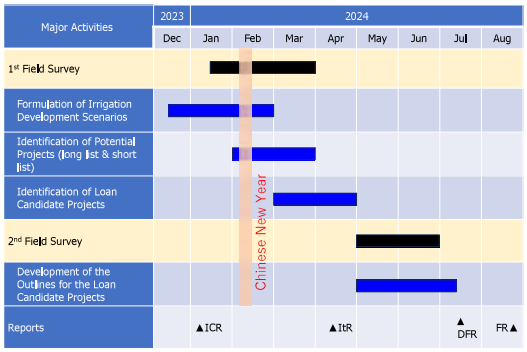
February 20, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Agenda

1. Progress of the Survey, (Status on the Study of Irrigation Development Scenario)
2. Further Schedule

1. Progress of the Survey



Current National Development Plans

Sector(s)	Title
Whole National (Core strategy)	Pentagonal Strategy-Phase I
Agriculture Sector (1)	National Development Plan on Agriculture Sector 2022-2030
Agriculture Sector (2)	Strategic Development Plan for Cambodian Agro-industories 2019-2030
Irrigation	National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

Pentagonal Strategy-Phase I

Items	Contents
Past and Current Strategies	Triangle Strategy (1998 - 2003): 6 years Rectangular Strategy Phase I (2004 - 2007): 4 years Rectangular Strategy Phase II (2008 - 2012): 5 years Rectangular Strategy Phase III (2013 - 2017): 5 years Rectangular Strategy Phase IV (2018 - 2022): 5 years Pentagonal Strategy Phase I (2023 - 2028): 6 years
Objectives	Sustain peace, economic growth, and development
Key Priorities	People, Road, Water, Electricity, and Technology.
Five Strategic Pentagons	1. Human Capital Development 2. Economic Diversification 3. Private Sector Development 4. Sustainable and Inclusive Development 5. Digital Economy and Society.
Agriculture Sector Plans described in the strategy	1. National Development Plan on Agriculture Sector 2022-2030 2. Strategic Development Plan for Cambodian Agro-industories 2019-2030

National Development Plan on Agriculture Sector 2022-2030

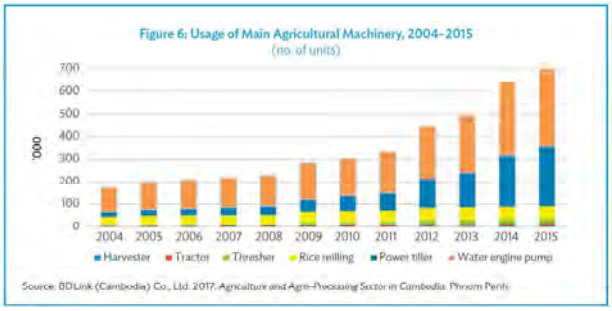
Items	Contents
Objectives	To transform Cambodia's agriculture sector into a more productive, sustainable, and competitive force by 2030. It focuses on enhancing agricultural productivity, promoting diversification, improving market access for agricultural products, and ensuring food security.
Focus point	1. to leverage modern technologies 2. to enhance irrigation systems 3. to improve farmers' skills and knowledge.
Challenges	1. climate change 2. resource management 3. the need for increased investment in research and development
Benefited areas	Aligning with broader national development goals and international commitments, the following will be the achievements. 1. rural development 2. poverty reduction 3. economic growth,

Strategic Development Plan for Cambodian Agro-industories 2019-2030

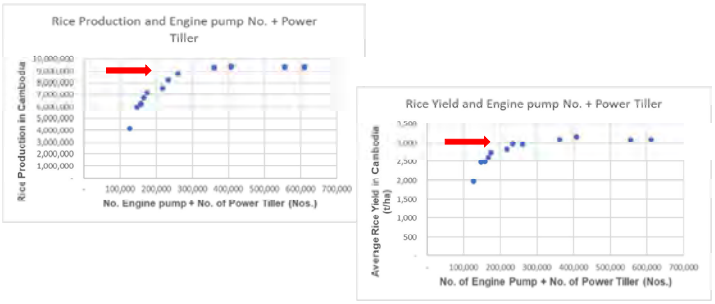
Items	Contents
Objectives	1. To promote processing of market-demanded, safe, and quality agricultural products; and 2. To create quality and inclusive rural employment in Cambodia.
Strategic Stages	1. Improvement and modernization (2019-2022) 2. Diversification and transformation (2023-2026) 3. Reinvention and innovation (2027-2030)
Promotion activities	1. Market-demanded agricultural products 2. Quality rural employment 3. Capacity building across various stages
Rice Production and export	1. Rice Milling Sector: to establish a solid supply chain management, Cambodian fragrant rice has received the World's Best Rice Award 2018 2. Investment: required investment in research and extension services for the rice sector 3. RGC adopted a policy on milled rice export in 2010. Despite insufficient consultations with the related sectors, it developed at large. However, the targeted 1.0 million tons of milled rice export by 2015 was not achieved.

National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

Items	Contents
Objectives	Modernizing water resources management, establishing fully operational irrigation schemes, and improving the efficiency and effectiveness of irrigation systems.
Challenges	Varying quality of reservoirs and irrigation schemes, securing water for dry season crops, and the need for modernizing irrigation schemes to support efficient water delivery and crop diversification
Implementation Framework	1. Establishment of National Standards for Irrigation Design, Construction, and Supervision 2. Implementation of a Manual for O&M of Irrigation Schemes.
Irrigation System Rehabilitation	1. Establishment of farmer water user communities (FWUC) 2. Private sector involvement in O&M of large irrigation schemes 3. Minimizing flooding impacts through improved drainage systems.
Projected Impact	1. Increased agricultural productivity 2. Improved water management 3. Enhanced resilience against climate change (flood and drought)

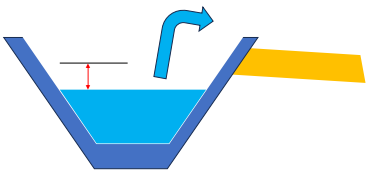


Source: Cambodia Agriculture, Natural Resources, and Rural Development Sector Assessment, Strategy, and Road Map



Source: FAO, National Statistics in Cambodia

Water Level in the main/Secondary canal and Tertiary Canal's Bottom Elevation : an engine pump is required.

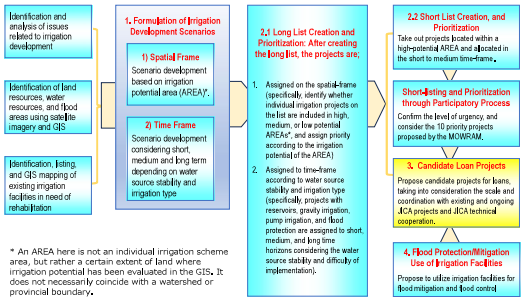


Function

Main/Secondary Canal: Irrigation Supply + Flood Release

Secondary/Tertiary canal: Irrigation

Plan of Approach: Process of Reaching the Highest Priority Projects



Formulation of Irrigation Development Scenarios

1) Spatial Frame

Development Scenario based on Irrigation Potential Area

1. Water Resources (Availability & Variability)
2. Land Resources (Land Use and Fertility)
3. Change in Paddy Area
4. Distance from the Primary Road

2) Time Frame

Development Scenario based on Characteristics of Irrigation Schemes

1. Water Resources (Reliability)
2. Irrigation Type (Gravity, Pump or Mixed)

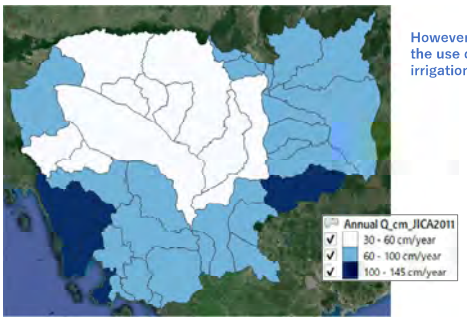
3) Screening Conditions

- Condition should be less than 59% in CISIS data
- Scale of Irrigation Scheme

1) Spatial Frame

- Water Resources (Availability)

Discharge Volume is set from the Nationwide Irrigation Development Report (JICA 2011)

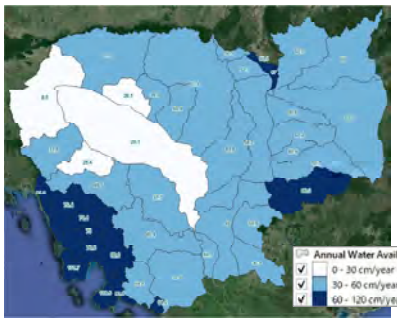


However, this data doesn't reflect the use of water by the recent irrigation development.

1) Spatial Frame

- Water Resources (Availability)

Annual Basin-wise Water Resources are simply estimated based on the Satellite Data

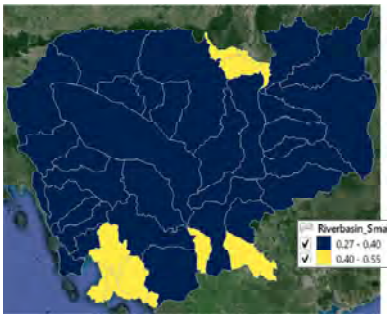


1. Determine Rainfall Amount by Basin with GSMaP data
2. Determine Land Use by Basin with Satellite data from Open Development Cambodia
3. Set Runoff Coefficient based on the Land Use
4. Set Rice Cultivation Area (Irrigated and Rainfed) by the above Land Use and CISIS data
5. Subtract the Water Utilization by Rice Cultivation and Calculate the Rest of Available Water

1) Spatial Frame

- Water Resources (Variability)

Interannual variability of rainfall during small dry season is evaluated by river basin



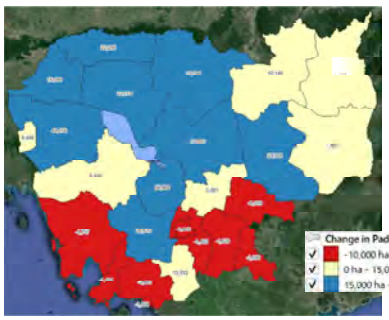
Larger variability

= Less stability of rainfall during small dry season (from April to June)

1) Spatial Frame

- Change in Paddy Area

Increase/Decrease of Paddy Area in 5 years (2015-2020) is estimated by the Land Use data

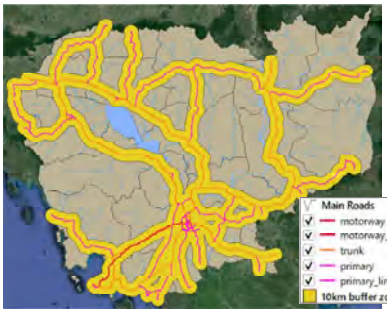


Red area shows the trend of decrease in Paddy Area due to increase in residential and industrial land.

1) Spatial Frame

- Distance from the Primary Road

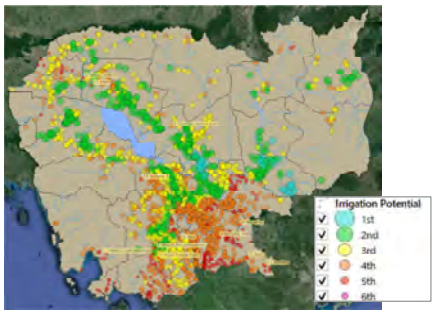
Considering the accessibility from the Main Road, 10km buffer zone is created.



In the Wet season, 10km is assumed to be the distance that cars can reach in 1 hour.

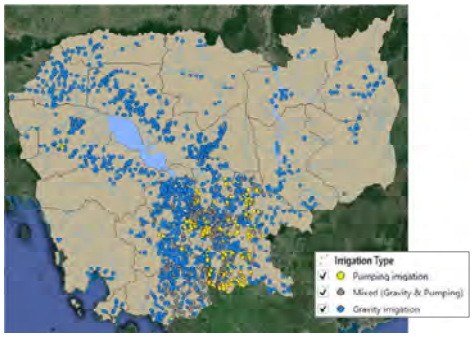
1) Spatial Frame

- Result of Irrigation Potential



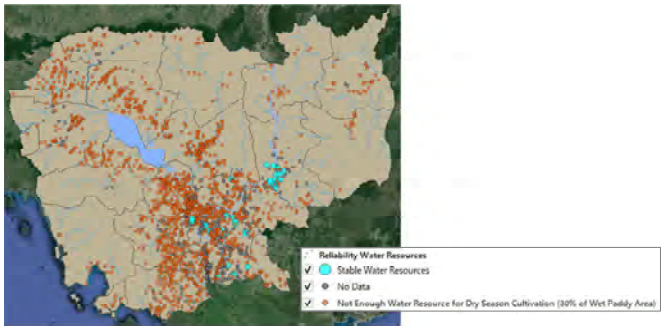
2) Time Frame

- Irrigation Type (Gravity, Pump or Mixed)



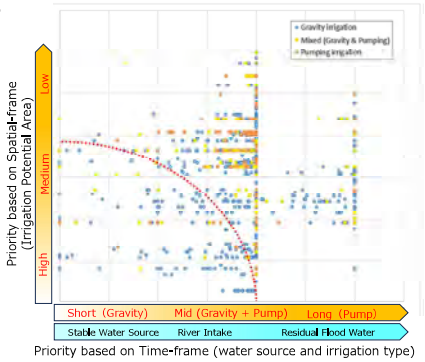
2) Time Frame

- Water Resources (Reliability) based on the CISIS data

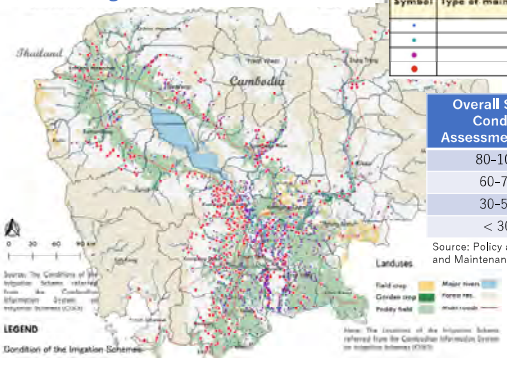


3) Irrigation Potential

- Priority Map



3) Screening Condition (Condition)

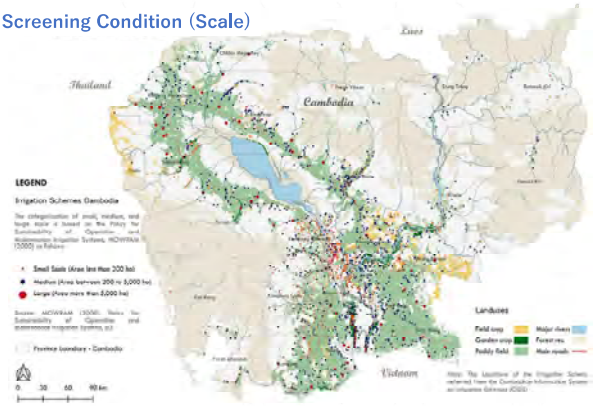


Symbol	Type of maintenance/rehabilitation budget required
•	Routine
•	Periodic
•	Rehabilitation
•	Write off

Overall Scheme Condition Assessment Rating	Number of Schemes (based on CISIS)
80-100 %	447
60-79 %	675
30-59 %	1,060
< 30 %	301

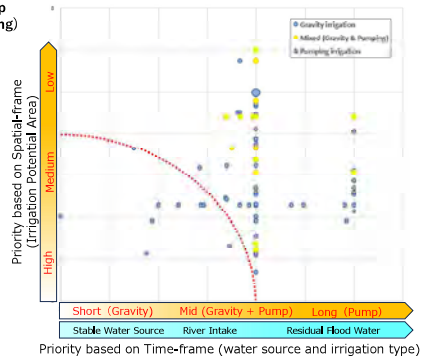
Source: Policy and Implementation Manual for Operations and Maintenance of Irrigation Schemes (MOWRAM 2015)

3) Screening Condition (Scale)



3) Irrigation Potential

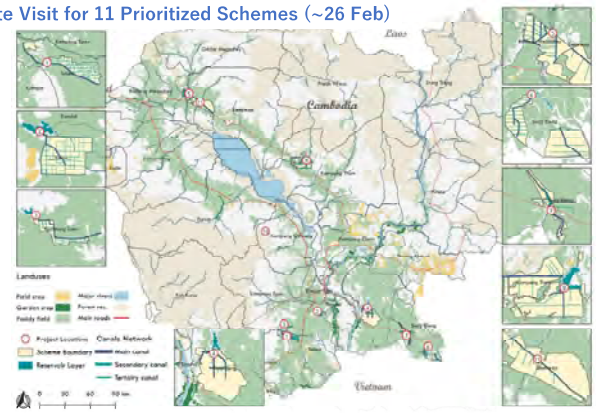
- **Priority Map (After Screening)**



2. Further Schedule

Major Activities	2024			
	Jan	Feb	Mar	Apr
1st Field Survey				
Formulation of Irrigation Development Scenarios			△ Discussion w/JICA	
Identification of Potential Projects (long list & short list)			△ Discussion with MOWRAM	
Identification of Loan Candidate Projects			△ Discussion with MOWRAM	
Reports	▲ICR			▲ItR

Site Visit for 11 Prioritized Schemes (~26 Feb)



MANY THANKS

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

Progress Meeting

February 29, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Agenda

1. Survey Progress
2. Irrigation Development Scenario
3. Prioritized Projects
4. Further Schedule

1. Survey Progress

Data Collection

Core information is almost obtained except for the rainfall data. Following information/data is still necessary for further study.

- Historical Rainfall Data (Daily/Monthly)
  - Now estimation data from the satellite data is used.
- Information about the WRIS and NWRDMC
  - Essential for the installation of Hydro-meteorological Station
- Standard to calculate the Flood Damage
  - Especially for the data after 2020
- Series of Agricultural Data
  - Latest information is necessary to create synergies for the irrigation development & flood protection projects

2. Irrigation Development Scenario

Agriculture in Cambodia

Farmers mainly cultivate 'Temporary crops', and Rice is ranked as the most dominant crop production among them.

About 60% of crop production are mainly used for home consumption, but production for sale slightly increased from 2020 to 2021.

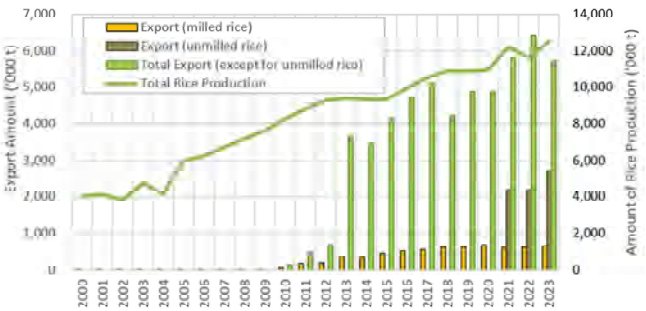
Items	Description
Crop production by farmers[1]	94% households produce crops
Crop: temporary of permanent[1]?	Temporary crop: 92.5%, Permanent + fallow: 7.5%
Crop production (1,000 tons)[3]	1. Cassava: 13,512, 2. Rice: 10,886, 3. Maize: 895, 4. Vegetables: 682, 5. Sugar cane: 618
Home consumption or selling (HH) [1, 2]	Home consumption: 61%, For sale: 39% (CAS2020) Home consumption: 58%, For sale: 42% (CAS2021)
Ownership of farmland (HH) [1]	Owned: 98%, Rent or others: 2%

Source: *1: Cambodia Agriculture Survey 2020 (CAS2020), *2: Cambodia Agriculture Survey 2021 (CAS2021), *3: Statistical Yearbook of Cambodia 2021 (SYC2021)

2. Irrigation Development Scenario

Agriculture in Cambodia

Agriculture sector accounts 25% of total GDP, and lately both production and export of rice are increasing, which made Cambodia one of the world's 10th largest rice exporters (8th in 2022)

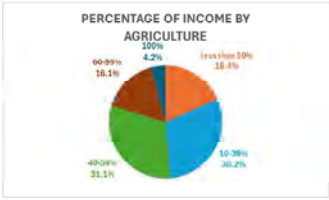


2. Irrigation Development Scenario

Agriculture in Cambodia

The dominant farmland size is less than 1 ha (51%).

Only 4% of farmers rely on 100% of agriculture income, and most farmers have other income sources (Farmers are busy).



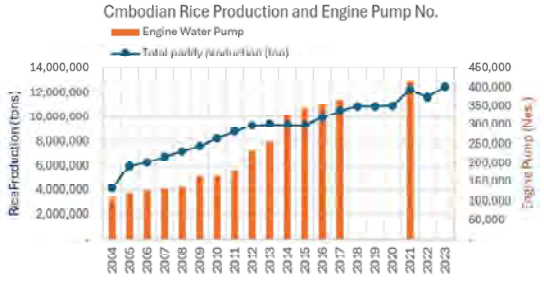
Source: Arranged from the data in the Statistical Yearbook of Cambodia 2021 (SYC2021)

2. Irrigation Development Scenario

Agriculture in Cambodia

Until 2012, urgent rehabilitation of the existing irrigation system was required for self-sufficiency in the country. Around 2010 and after, the rehabilitation policy would be changed from urgent work to a modernized Irrigation system establishment.

In parallel, the irrigation methods in the country also converged into the current ones based on engine pump expansion.



Source: Arranged from the data in the Statistical Yearbook of Cambodia 2021, MAFF Annual Report (2021)

2. Irrigation Development Scenario

Irrigation Development in Cambodia

Period	Activities in Development
The 7th Century [1]	Commencement of Irrigation. Surplus rice production was obtained. Those products were exchanged for cloth and other goods.
The 9th to the 15th century [1] (Angkor Wat period)	Water management systems, including 2 seasons of irrigation, were further developed. West Barai reservoir was developed.
The 15th to 19th century [1] (before French colonial time)	The economy declined, and rice surplus became low because irrigation systems were not properly managed due to wars.
1863 to 1953 [1] (French colonial time)	The economy was not so healthy. Rice was exported with developed road networks. The irrigation system was slowly strengthened.
1975 to 1978 [1] (Democratic Kampuchea regime)	Many irrigation systems were constructed, but the engineering viewpoint was not given importance to design and construction.
1980s – 2000s	Urgent irrigation system rehabilitation was implemented with international donors' assistance. Rice production increased based on mechanization (power tiller, engine pump).
2010s - current	Modernized irrigation systems based on meteorological data have been developing. The existing irrigation systems shall be improved before implementing a new project, which is essential to be done because of cost and investment efficiencies.

*1 Source: Cambodia Development Research Institute (CDRI), 2008, "Water Resource Management in Cambodia: History and Current Challenges", Cambodia Development Review, January – March 2008

2. Irrigation Development Scenario

Pentagonal Strategy Phase I (2023 – 2028)

Pentagon 4: Resilient, Sustainable and Inclusive Development

4-3) Promotion of Agriculture and Rural Development

4-3-3) Strengthening the rationalization of irrigation investments to ensure water security for agriculture and rural development

- 4-3-7) Continuing to enhance domestic market connectivity and export promotion

To the Next 25 Years Towards Realizing the Cambodia Vision 2050

- Cambodia is "a country that enjoys harmony, resilience, and inclusivity of physical and natural environment, and has a good balance between development and environmental conservation" for comfortable living of people, wherein the state emphasizes the importance of energy security; builds an efficient water supply system and management systems for all types of wastes; builds modern and automatic irrigation systems; mitigates and builds adaptation system to climate change; utilizes ecological system sustainably; equips modern technology in the agriculture sector; and manages and consumes natural resources, with environmental balance taken into consideration

2. Irrigation Development Scenario

National Strategic Development Plan 2019-2023

4: Inclusive and sustainable development

4-9) Prioritization of investment in irrigation systems by focusing on linkages with agricultural production areas together with regular maintenance and reinforced management of these systems

FIVE Strategies which MOWRAM focuses on:

- Administration management improvement and human resources development.
- Water resources management and development including irrigation hegemony implementation.
- Water resources and meteorology information management.
- Flood and drought management and meteorology information management.
- Water sustainability and conservation.

2. Irrigation Development Scenario

National Development Plan on Agriculture Sector 2022-2030

Objectives

- To transform Cambodia's agriculture sector into a more productive, sustainable, and competitive force by 2030.

Focusing Point

- Leverage modern technologies
- Enhance irrigation systems
- Improve market access for agricultural products
- Improve farmers' skills and knowledge

Challenges

- Climate change adaption
- Natural resources management
- Investment in research and development

2. Irrigation Development Scenario

Strategic Development Plan for Cambodian Agro-industries 2019 - 2030

Objectives

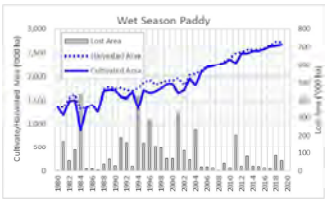
- To promote processing of market-demanded, safe, and quality agricultural products
- To create quality and inclusive rural employment in Cambodia

Rice Production and Export

- Rice Milling Sector: to establish a solid supply chain management, Cambodian fragrant rice has received the World's Best Rice Award 2018
- Investment: required investment in research and extension services for the rice sector
- RGC adopted a policy on milled rice export in 2010. Despite insufficient consultations with the related sectors, it developed at large. However, the targeted 1.0 million tons of milled rice export by 2015 was not achieved.

2. Irrigation Development Scenario

Change in Paddy Cultivated & Harvested Area b/w 1980-2019

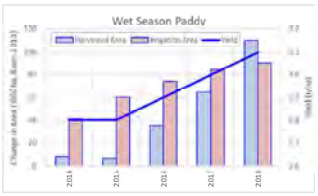


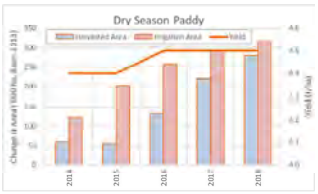
Steady increasing trend is confirmed for both wet and dry season paddy.

Source: Statistical Yearbook Cambodia 2021

2. Irrigation Development Scenario

Change in Irrigation Area, Yield, and Harvested Area b/w 2014-2018



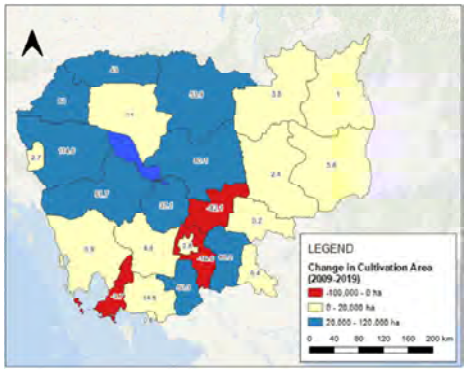


Irrigation development contributes to the increase in yield in wet season and increase in irrigation area in dry season.

Source: Statistical Yearbook Cambodia 2021 & Strategic Development Plan on Water Resources and Meteorology In 5 Years 2019-2023 (MOWRAM)

2. Irrigation Development Scenario

Change in Paddy Cultivation Area



Source: Statistical Yearbook Cambodia 2021 & Cambodia Disaster Damage & Loss Information System (NCDM 2024)

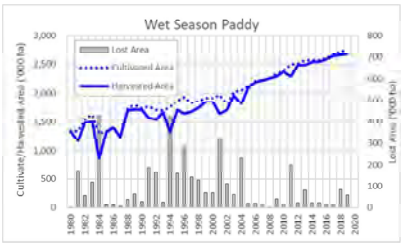
2. Irrigation Development Scenario

Impact of Flood in Agriculture Sector – Impact to Crop

Average Lost Area & Production (1980-2019)

Area Lost: 101,800 ha/year

Production Lost: 190,687 ton/year



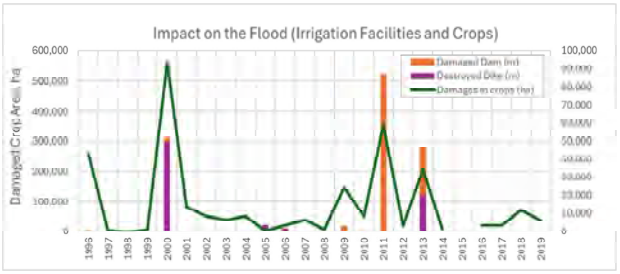
Also, flood protection enables farmers to choose high yield and quality species as well.

Source: Statistical Yearbook Cambodia 2021 & Cambodia Disaster Damage & Loss Information System (NCDM 2024)

2. Irrigation Development Scenario

Impact of Flood in Agriculture Sector – Impact to Crop

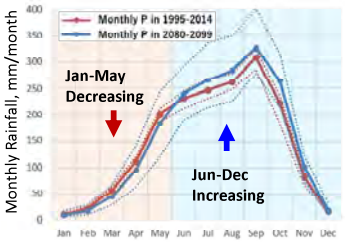
Based on the data of National Committee for Disaster Management (NCDM), serious impact of flood on the irrigation facilities and crops can be seen periodically.



Source: Cambodia Disaster Damage & Loss Information System (NCDM 2024)

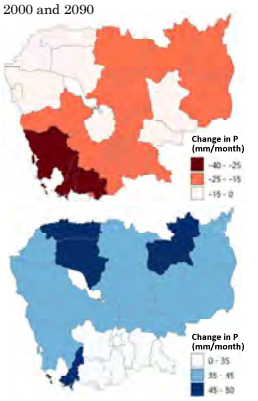
2. Irrigation Development Scenario

Future Projection of the Flood



Source: Climate Change Knowledge Portal (WB 2023)

Change in Monthly Precipitation in May (top) and October (bottom) between 2000 and 2090

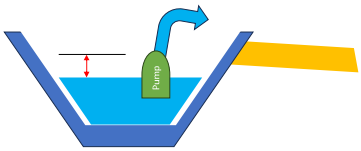


CCKP analysis with CMIP6 predicts extremes in rainfall patterns in future, which makes more frequent and stronger flood and drought events would occur in the future.

2. Irrigation Development Scenario

Challenges

From the Main Canal to the Secondary/Tertiary Canals: an engine pump has been contributed.

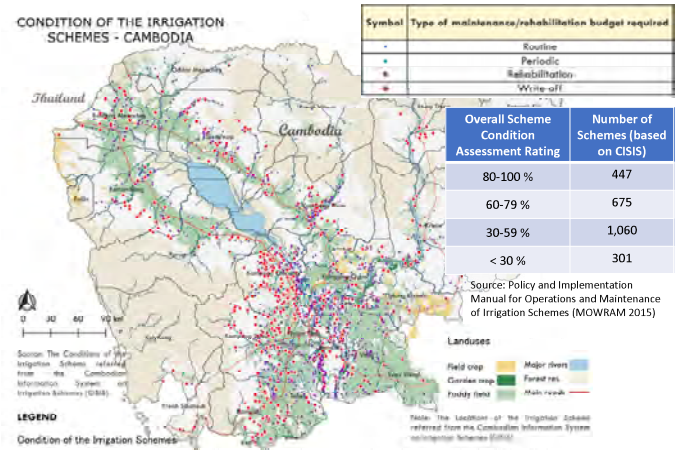


Function

Main/Secondary Canal:
Irrigation Supply + Flood Release

Secondary/Tertiary canal:
Irrigation Supply

2. Irrigation Development Scenario



Overall Scheme Condition Assessment Rating	Number of Schemes (based on CISIS)
80-100 %	447
60-79 %	675
30-59 %	1,060
< 30 %	301

Source: Policy and Implementation Manual for Operations and Maintenance of Irrigation Schemes (MOWRAM 2015)

2. Irrigation Development Scenario

JICA Survey Team proposes the following conditions to determine the development priority:

1) Spatial Frame Conditions

Natural conditions or artificial conditions which seem very hard to change

1. **Water Resources (Availability & Variability)**
2. **Land Resources (Land Use and Fertility)**
3. **Change in Paddy Area**

2) Time Frame Conditions

Artificial conditions which can change but taking time, or type of irrigation applied in each irrigation scheme

1. **Water Resources (Reliability: Capacity of Reservoir)**
2. **Irrigation Type (Gravity, Pump or Mixed)**
3. **Distance from the Primary Road**

3) Screening Conditions

- **"Condition" should be less than 60% in CISIS data**
- **Scale of Irrigation Scheme should be more than 3,000 ha**

2. Irrigation Development Scenario

JICA Survey Team proposes the following conditions to determine the development priority:

4) Other conditions

Natural or social conditions related to the necessity of the project

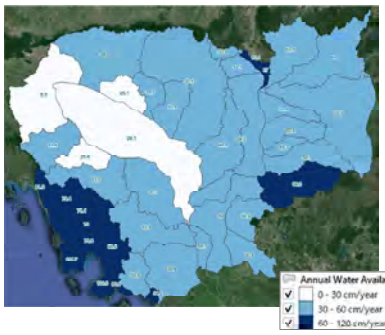
1. **Flood Impact (flood damage to the irrigation facilities and crop damage)**
2. **Poverty ratio**
3. **Overlap of project by MOWRAM or other donors**

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-1) Water Resources (Availability)

Annual Basin-wise Water Resources are simply estimated based on the Satellite Data



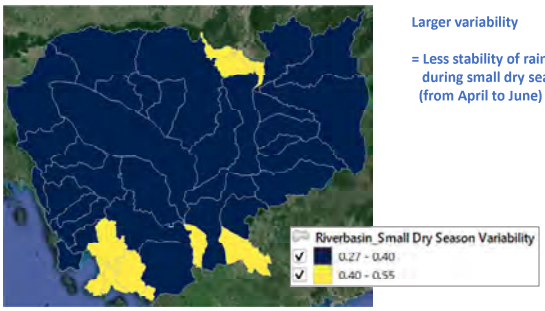
1. Determine Rainfall Amount by Basin with GSMaP data
2. Determine Land Use by Basin with Satellite data from Open Development Cambodia
3. Set Runoff Coefficient based on the Land Use
4. Set Rice Cultivation Area (Irrigated and Rainfed) by the above Land Use and CISIS data
5. Subtract the Water Utilization by Rice Cultivation and Calculate the Rest of Available Water

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-2) Water Resources (Variability)

Interannual variability of rainfall during small dry season is evaluated by river basin



Larger variability

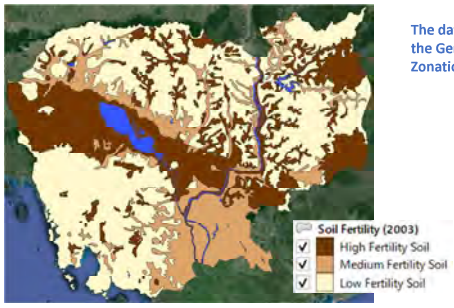
= Less stability of rainfall during small dry season (from April to June)

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-3) Land Resource

"Medium fertile" or "Fertile" soils are selected for high priority area.



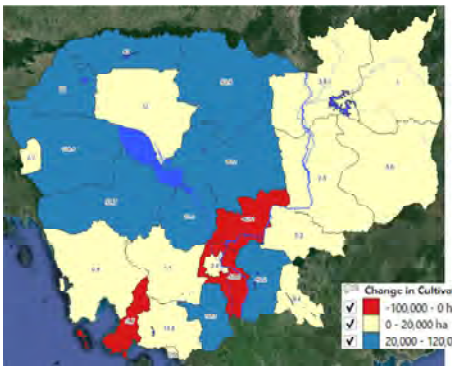
The data is obtained from the Gene-Ecological Zonation of Cambodia.

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-4) Change in Paddy Cultivation Area

The irrigation scheme that has in the province of increasing trend should be prioritized.



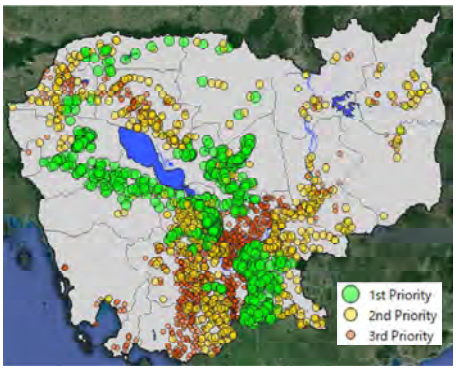
The cultivation area records in 2019 and in 2009 are compared by province.

*Numbers in the map is change of cultivation area ('000 ha)

2. Irrigation Development Scenario

1) Spatial Frame Conditions

Result of the spatial frame analysis

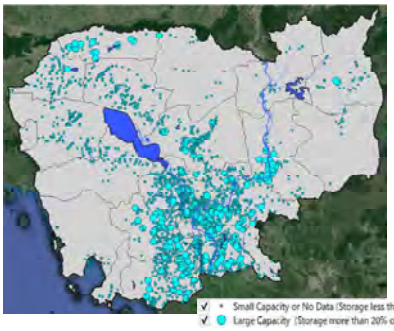


2. Irrigation Development Scenario

2) Time Frame Conditions

2-1) Water Resources (Reliability)

Capacity of the reservoir/dam is evaluated compared to their scale of irrigation scheme.



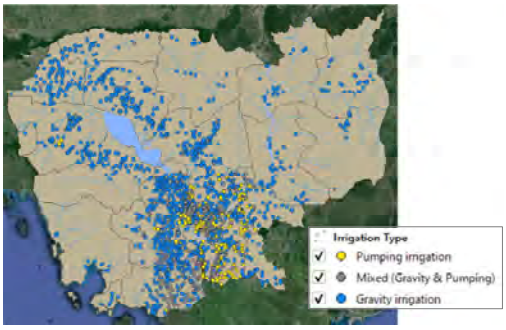
1. Set the required water volume as 20,000 m3/ha for dry season.
2. If more than 20% of potential beneficiary are can be supplied from the reservoir/dam, it is evaluated as "Sufficient water storage"
3. If there is a dam with smaller capacity than above or no information about the capacity, it is evaluated as "Not sufficient"
4. If there is no reservoir/dam info, it will be "No data" as the least priority on this condition.

2. Irrigation Development Scenario

2) Time Frame Conditions

2-2) Irrigation Type

Based on CISIS database, Gravity type, Pump type, or Mixed type are identified.

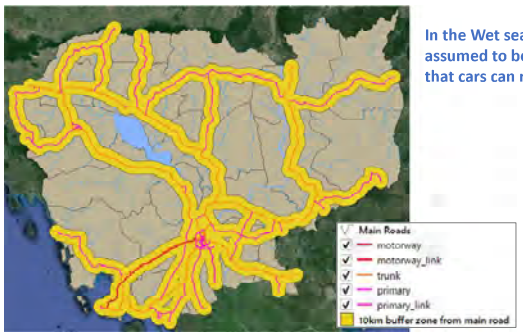


2. Irrigation Development Scenario

2) Time Frame Conditions

2-3) Distance from the Primary Road

Considering the accessibility from the Main Road, 10km buffer zone is created.



In the Wet season, 10km is assumed to be the distance that cars can reach in 1 hour.

3. Prioritized Projects (Draft)

Result of Prioritization Study

Result of the Spatial and Time Frame are plotted on the graph below, categorizing the priority into four.

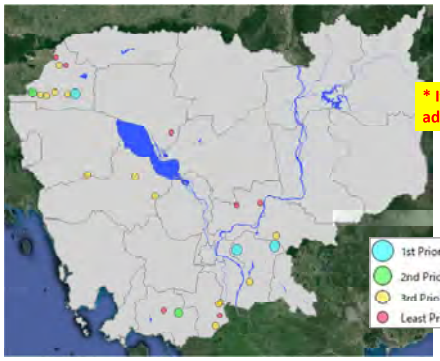
3. Prioritized Projects (Draft)

Result of Prioritization Study (11 Prioritized Projects)

Project No.	Name	Priority: Time Frame	Priority: Spatial Frame	Priority: Total
1	Kpob Trobek & Tumnup Lok	1	1	1
3	Khpob Kraus reservoir	1	2	2
5	Spean Sraeng	1	2	2
6	Chantrea	1	2	2
7	Valco	1	2	2
11	Plaing	1	2	2
2	Dei	2	1	3
4	Boeung Snie	2	1	3
9	Samseb Kanha reservoir	2	1	3
8	Krosaing	2	2	4
10	Achong II	2	2	4

3. Prioritized Projects (Draft)

Result of Prioritization Study (The other Projects)



Irrigation Schemes more than 3,000 ha of Command Area are extracted.

*** It will be updated after additional data is provided.**

4. Further Schedule

Major Activities	2024			
	Jan	Feb	Mar	Apr
1st Field Survey				
Formulation of Irrigation Development Scenarios		△ Discussion w/JICA		
Identification of Potential Projects (long list & short list)		△ Discussion with MOWRAM		
Identification of Loan Candidate Projects			△ Discussion with MOWRAM	
Reports	▲ICR			▲ItR

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

Progress Meeting
(Discussion for Projects on Short List)

March 25, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Agenda

1. Irrigation & Agricultural Development Status in Cambodia
2. Irrigation Development Scenarios
3. Prioritized Projects
4. Further Schedule

1. Irrigation & Agricultural Development Status

Irrigation Development in Cambodia

Period	Activities in Development
The 7th Century [1]	Commencement of Irrigation. Surplus rice production was obtained. Those products were exchanged for cloth and other goods.
The 9th to the 15th century [1] (Angkor Wat period)	Water management systems, including 2 seasons of irrigation, were further developed. West Barai reservoir was developed.
The 15th to 19th century [1] (before French colonial time)	The economy declined, and rice surplus became low because irrigation systems were not properly managed due to wars.
1863 to 1953 [1] (French colonial time)	The economy was not so healthy. Rice was exported with developed road networks. The irrigation system was slowly strengthened.
1975 to 1978 [1] (Democratic Kampuchea regime)	Many irrigation systems were constructed, but the engineering viewpoint was not given importance to design and construction.
1980s – 2000s	Urgent irrigation system rehabilitation was implemented with international donors' assistance. Rice production increased based on mechanization (power tiller, engine pump).
2010s - current	Modernized irrigation systems based on meteorological data have been developing. The existing irrigation systems shall be improved before implementing a new project, which is essential to be done because of cost and investment efficiencies.

*1 Source: Cambodia Development Research Institute (CDRI), 2008, "Water Resource Management in Cambodia: History and Current Challenges", Cambodia Development Review, January – March 2008

1. Irrigation & Agricultural Development Status

Agriculture in Cambodia

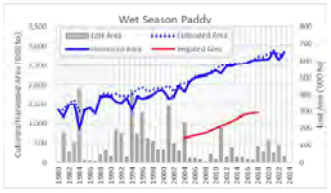
Farmers mainly cultivate 'Temporary crops', and Rice is ranked as the most dominant crop production among them.
About 60% of crop production are mainly used for home consumption

Items	Description
Ratio of farming household[1]	94% households produce crops
Crop type[1]	Temporary crop: 92.5%, Permanent + fallow: 7.5%
Crop production (1,000 tons)[3]	1. Cassava (13,512), 2. Rice (10,886), 3. Maize (895), 4. Vegetables (682), 5. Sugar cane (618)
Home consumption or selling[2]	58% for home consumption 42% for sale
Ownership of farmland[1]	98% for owned 2% for rent or others

Source: *1: Cambodia Agriculture Survey 2020 (CAS2020), *2: Cambodia Agriculture Survey 2021 (CAS2021),
*3: Statistical Yearbook of Cambodia 2021 (SYC2021)

1. Irrigation & Agricultural Development Status

Change in Paddy Cultivated & Harvested Area with Irrigated Area between 1980-2023



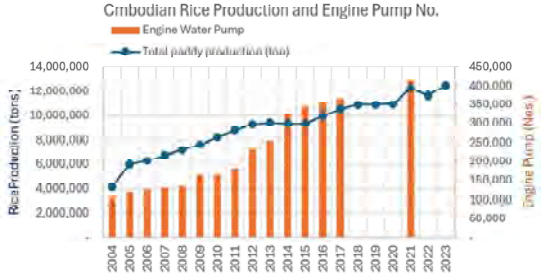
- Steady increase trend is confirmed for both wet and dry season paddy.
- Irrigation development contributes to the increase in yield in wet season and increase in irrigation area in dry season.

Source: MAFF Annual Report 2023 and MOWRAM (2024) and National Strategic Development Plan 2019-2023

1. Irrigation & Agricultural Development Status

Change in Engine Water Pumps and Rice Production

Until 2012, urgent rehabilitation of the existing irrigation system was required for self-sufficiency in the country. Around 2010 and after, the rehabilitation policy would be changed from urgent work to a modernized Irrigation system establishment.
The rice production tends to increase with the increase in engine pumps.

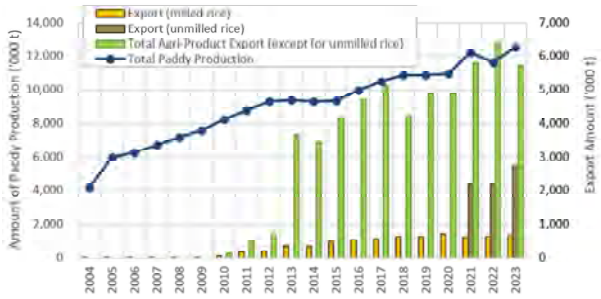


Source: Arranged from the data in the Statistical Yearbook of Cambodia 2021, MAFF Annual Report (2021)

1. Irrigation & Agricultural Development Status

Agricultural Export Status in Cambodia

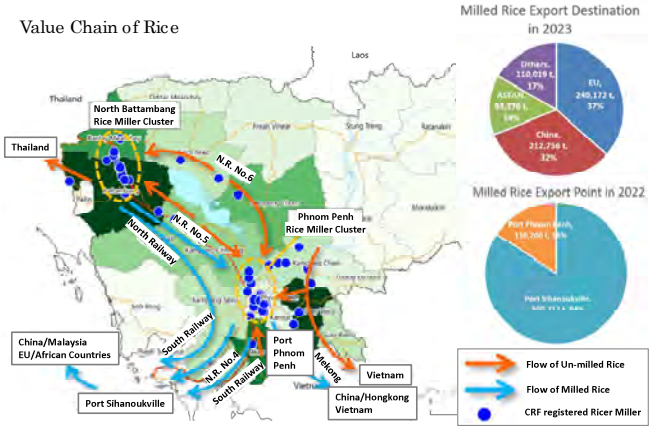
Agriculture sector accounts 25% of total GDP, and lately both production and export of rice are increasing, which made Cambodia one of the world's 10th largest rice exporters (8th in 2022)



Source: MAFF Annual Report (2023)

1. Irrigation & Agricultural Development Status

Value Chain of Rice

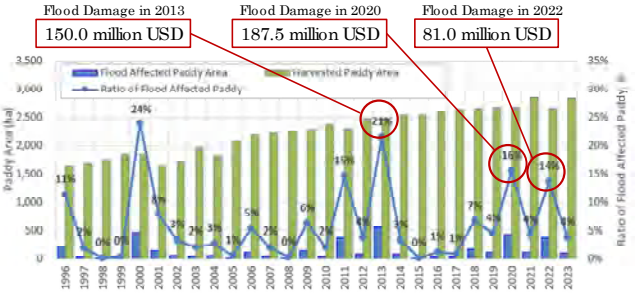


Source: Final Report on the project for Improving the Logistics System of Cambodia Phase 2 (JICA 2023)

1. Irrigation & Agricultural Development Status

Impact of Flood in Agriculture Sector – Impact to Crop

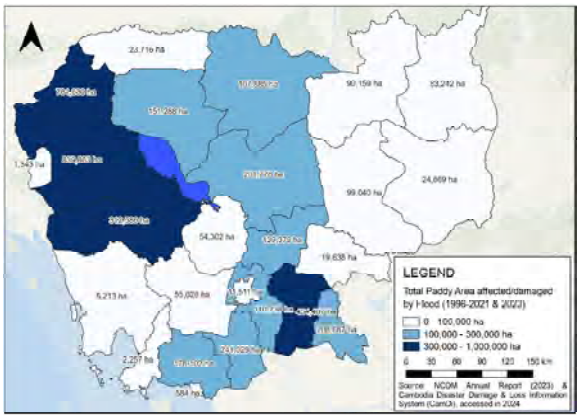
Based on the data of National Committee for Disaster Management (NCDM), serious impact of flood on the paddy area can be periodically seen.



Source: MAFF Annual Report 2023, NCDM Annual Report 2020-2023, Cambodia Disaster Damage & Loss Information System (NCDM 2024)

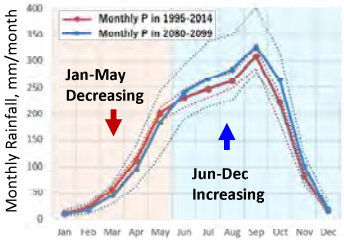
1. Irrigation & Agricultural Development Status

Impact of Flood in Agriculture Sector – Impact to Crop



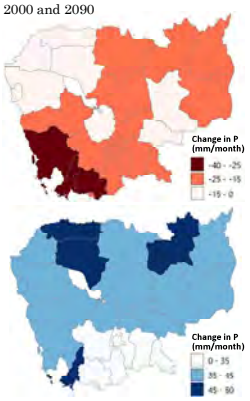
1. Irrigation & Agricultural Development Status

Future Projection of the Rainfall



Source: Climate Change Knowledge Portal (WB 2023)

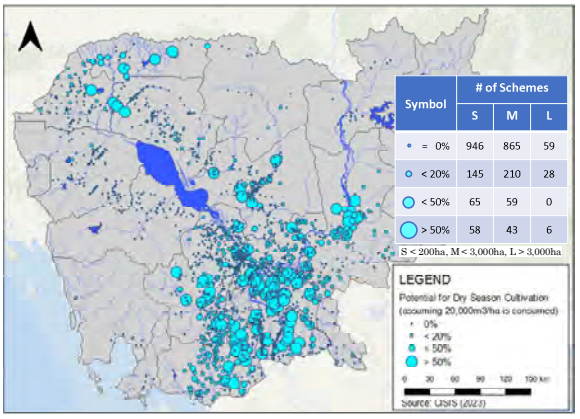
Change in Monthly Precipitation in May (top) and October (bottom) between 2000 and 2090



CCKP analysis with CMIP6 predicts extremes in rainfall patterns in future, which makes more frequent and stronger flood and drought events would occur in the future.

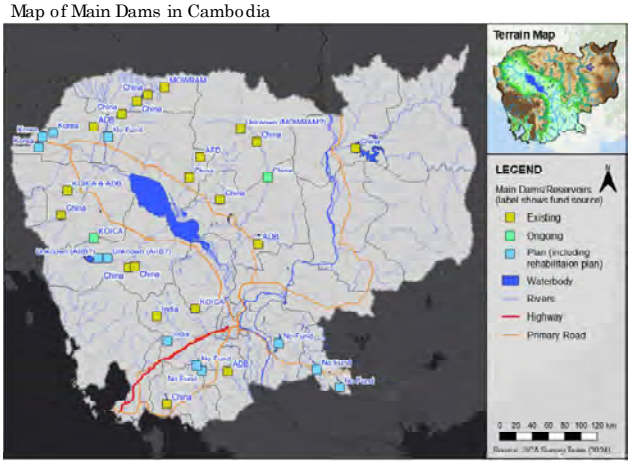
1. Irrigation & Agricultural Development Status

Storage of Reservoirs for Dry Season Cultivation



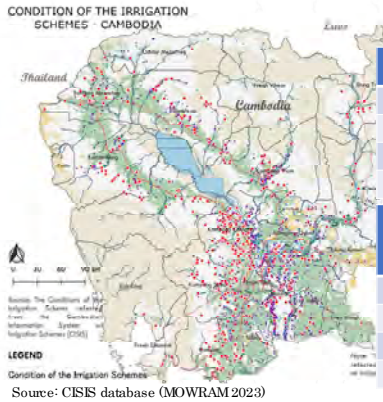
1. Irrigation & Agricultural Development Status

Map of Main Dams in Cambodia



1. Irrigation & Agricultural Development Status

Condition of the Irrigation Facilities



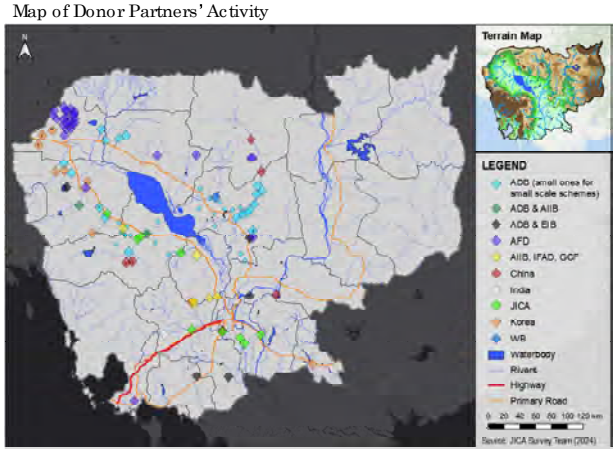
Symbol	Type of maintenance/ rehabilitation required
•	Routine
•	Periodic
•	Rehabilitation
●	Write off (Full-replacement)

Symbol	Overall Scheme Condition Assessment Rating	Number of Schemes (based on CISIS)
•	80-100 %	447
•	60-79 %	675
•	30-59 %	1,060
●	< 30 %	301

Source: CISIS database (MOWRAM 2023)

1. Irrigation & Agricultural Development Status

Map of Donor Partners' Activity



2. Irrigation Development Scenario

Pentagonal Strategy-Phase I (2023 – 2028)

The Five Strategic Objectives

1. Ensuring crisis-resilient economic growth of around 7% per year on average.
2. Creating more jobs, both quantity and quality, for Cambodian people, especially for youth.
3. Achieving the poverty reduction targeting of below 10% and continuing to reduce the poverty rate to a minimum.
4. Continuing to strengthen governance capacity and enhancing institutional quality, both at national and sub-national levels, aimed at ensuring efficiency of public services, as well as strengthening private sector governance, and continuing to promote environment conducive to businesses, investment, and trade.
5. Ensuring sustainable socio-economic development and building resilience to climate change.

2. Irrigation Development Scenario

Pentagonal Strategy – Phase I

Pentagon 4: Resilient, Sustainable and Inclusive Development

4-3) Promotion of Agriculture and Rural Development

4-3-3) Strengthening the rationalization of irrigation investments to ensure water security for agriculture and rural development

- 4-3-7) Continuing to enhance domestic market connectivity and export promotion

To the Next 25 Years Towards Realizing the Cambodia Vision 2050

- ...the state emphasizes the importance of ...builds modern and automatic irrigation systems; mitigates and builds adaptation system to climate change...utilizes ecological system sustainably; equips modem technology in the agriculture sector

2. Irrigation Development Scenario

National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

The vision of the Road Map is sustainable management and development of Cambodia's water resources to support economic growth and protection of water resources for social benefits and ecosystem functions.

(i) increased public awareness of the status of water resources and the water requirements of all water users, including the environment, across the country;

(ii) strengthened management arrangements to support competing water use interests and protecting water for social and environmental needs

(iii) improved rural communities' resilience to flooding including reducing economic, social, and environmental impacts

(iv) water resources management decision-making processes underpinned by best available scientific information; and

(v) improved efficiency and effectiveness of irrigation schemes to support profitable agriculture.

2. Irrigation Development Scenario

National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

Framework for Modernization of Water Resources and irrigation Sector

1. Sustainable Water Resources Management,
2. Complete Irrigation Schemes,
3. Self-sustaining Operation and Maintenance, and
4. Profitable Irrigated Agriculture

Table A4.1: Prioritization framework for selecting irrigation schemes for rehabilitation

Prioritization Criteria	High level		
	Lower	Medium	Higher
1. Security of water supply	Mekong Delta	3S, Upper Mekong	Tonle Sap, Coastal
2. Condition of irrigation scheme	>80%	>60%, ≤80%	≤60%
3. Size of irrigation scheme	Medium	Small	Large
4. Water delivery infrastructure	Pump		Gravity

2. Irrigation Development Scenario

Based on the irrigation & agricultural development status, JICA Survey Team identified the following main challenges:

- Vulnerability to flood and drought due to followings:
  - Small capacity of the reservoirs/ dams,
  - Deterioration of facilities,
  - Lack of hydrological information as well as the capacity development of information sharing/management,
- Lack of national standards for Irrigation development planning, design, and construction,
- Not sustainable operation and maintenance of irrigation facilities by FWUC, and
- Un-milled rice is unofficially exported to the neighboring country.

2. Irrigation Development Scenario

Irrigation Development Scenario for short/mid/long term is suggested as follows:

Time Frame	Development Scenario	Relevance of MOWRAM plans and development scenarios
Short-term	● Rehabilitation of Irrigation Facilities ● Improvement of vulnerability to Flooding (Development of Drainage Canals, Improvement of Irrigation Facilities Durability against Flood) ● Establishment of Hydrological/Meteorological Information Monitoring Structure with Information Sharing ● Establishment and strengthening of FWUC and Land Holding Survey ● Improve Market Access for Agricultural Products ● Improve Agricultural Extension Service	● WRM and development including irrigation extension [1] ● Flood/Drought Management & Meteorology Info. Management [1] ● Ensure all services related to water resources will be used for more benefits for women in FWUC
Mid-term	● Water Resources Development for Dry Season Cropping & Flood Mitigation Measures through dam construction ● Implementation of Integrated Water Resources Management ● Increase in Value-added Agricultural Products for Export	● WRM and development including irrigation extension [1] ● Flood/Drought Management & Meteorology Info. Management [1]
Long-term	● Strengthening of Integrated Water Resources Management ● Modernization of the Irrigation Facilities ● Consolidation of Farmland ● Introduction of modern agriculture with agri-tech.	● Water resources management decision-making processes underpinned by best available scientific information [2] ● Approval of the sub-decrees on water licensing and water quality[2]

1) National Strategic Development Plan 2019-2023
2) National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

2. Irrigation Development Scenario

Based on the irrigation & agricultural development status, JICA Survey Team proposes the following conditions to determine the 1st development priority:

1) Spatial Frame Conditions

Natural conditions or artificial conditions which seem very hard to change

1. **Water Resources (Availability & Variability)**
2. **Land Resources (Land Use and Fertility)**
3. **Change in Paddy Area**

2) Time Frame Conditions

Artificial conditions which can change but taking time, or type of irrigation applied in each irrigation scheme

1. **Water Resources (Reliability: Capacity of Reservoir)**
2. **Irrigation Type (Gravity, Pump or Mixed)**
3. **Distance from the Primary Road**

3) Screening Conditions

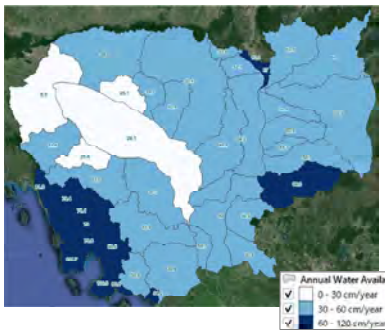
- **"Condition" should be less than 60% in CISIS data**
- **Scale of Irrigation Scheme should be more than 3,000 ha**

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-1) Water Resources (Availability)

Annual Basin-wise Water Resources are simply estimated based on the Satellite Data



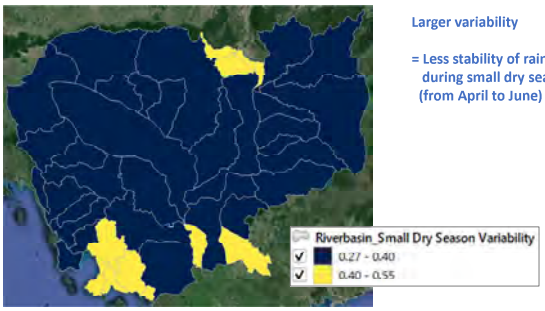
1. Determine Rainfall Amount by Basin with GSMaP data
2. Determine Land Use by Basin with Satellite data from Open Development Cambodia
3. Set Runoff Coefficient based on the Land Use
4. Set Rice Cultivation Area (Irrigated and Rainfed) by the above Land Use and CISIS data
5. Subtract the Water Utilization by Rice Cultivation and Calculate the Rest of Available Water

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-2) Water Resources (Variability)

Interannual variability of rainfall during small dry season is evaluated by river basin



Larger variability

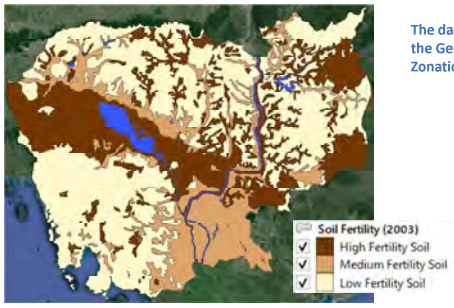
= Less stability of rainfall during small dry season (from April to June)

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-3) Land Resource

"Medium fertile" or "Fertile" soils are selected for high priority area.



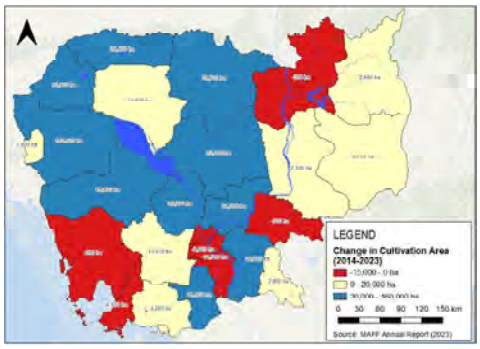
The data is obtained from the Gene-Ecological Zonation of Cambodia.

2. Irrigation Development Scenario

1) Spatial Frame Conditions

1-4) Change in Paddy Cultivation Area

The irrigation scheme that has in the province of increasing trend should be prioritized.



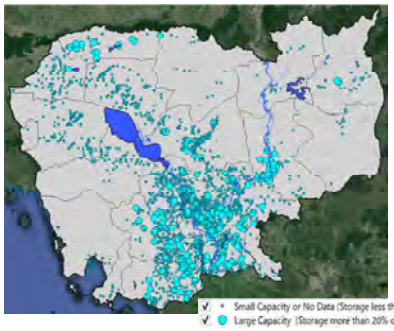
The cultivation area records in 2023 and in 2014 are compared by province.

2. Irrigation Development Scenario

2) Time Frame Conditions

2-1) Water Resources (Reliability)

Capacity of the reservoir/dam is evaluated compared to their scale of irrigation scheme.



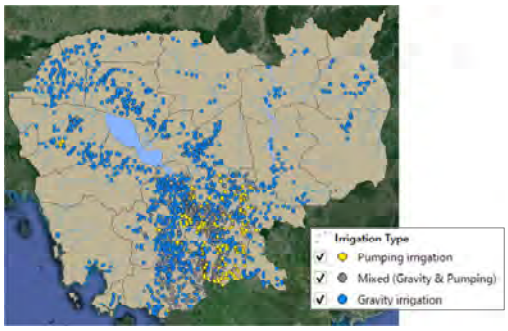
1. Set the required water volume as 20,000 m3/ha for dry season.
2. If more than 20% of potential beneficiary are can be supplied from the reservoir/dam, it is evaluated as "Sufficient water storage"
3. If there is a dam with smaller capacity than above or no information about the capacity, it is evaluated as "Not sufficient"
4. If there is no reservoir/dam info, it will be "No data" as the least priority on this condition.

2. Irrigation Development Scenario

2) Time Frame Conditions

2-2) Irrigation Type

Based on CISIS database, Gravity type, Pump type, or Mixed type are identified.



2. Irrigation Development Scenario

2) Time Frame Conditions

2-3) Distance from the Primary Road

Considering the accessibility from the Main Road, 10km buffer zone is created.

In the Wet season, 10km is assumed to be the distance that cars can reach in 1 hour.

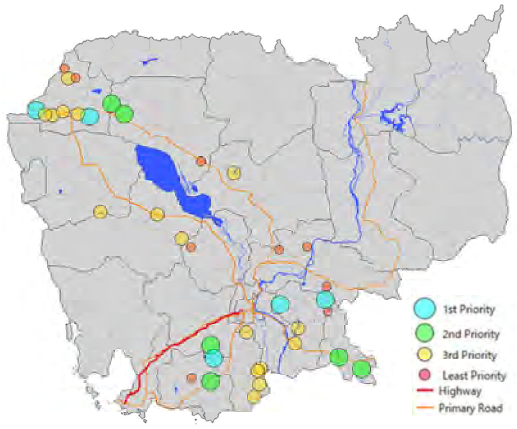
3. Prioritized Projects

Result of Prioritization Study

Result of the Spatial and Time Frame are plotted on the graph below, categorizing the priority into four.

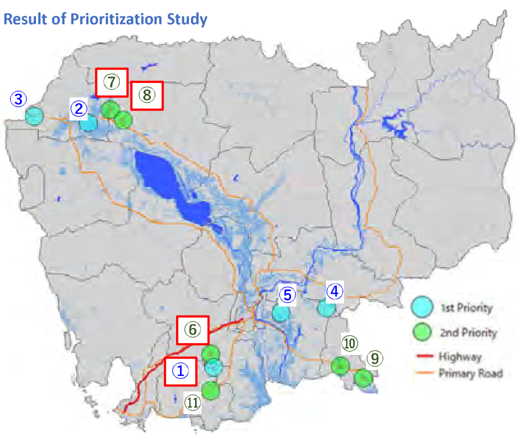
3. Prioritized Projects

Result of Prioritization Study



3. Prioritized Projects

Result of Prioritization Study



3. Prioritized Projects

Result of Prioritization Study (All the Projects)

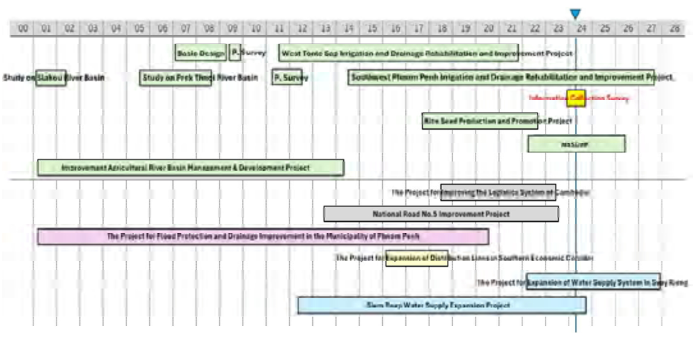
3. Prioritized Projects

Comparison Table for the Irrigation Schemes in First and Second Priority

No.	Indicators	Weights
-	Rationale of the Project: Necessity of Irrigation Rehabilitation/ Improvement/ Development	Pre-condition
-	Relevance to the Government National Policies, Strategies, Plans and Programs in Irrigation/ Agriculture Sector	
1	Overlapped Projects by the Government and/or Other Donors Fund	Exclude if overlapped
2	Degree of Emergency to Implement the Project	High
3	Impacts of Economic Benefits (Scale of Beneficiary Area/ No. of Beneficiaries, Flood Impact, etc)	High
4	Adaptation Degree to Climate Change	High
5	Synergy/ Ripple Effects with Other ODA and Government Projects (agriculture projects, irrigation projects, and road improvement projects, etc.)	Middle
6	Degree of Poverty Reduction	Middle
7	O&M Capacity of Farmer Water User Community	Low
8	Land Acquisition and Resettlement	Consultation with MOWRAM/ JICA

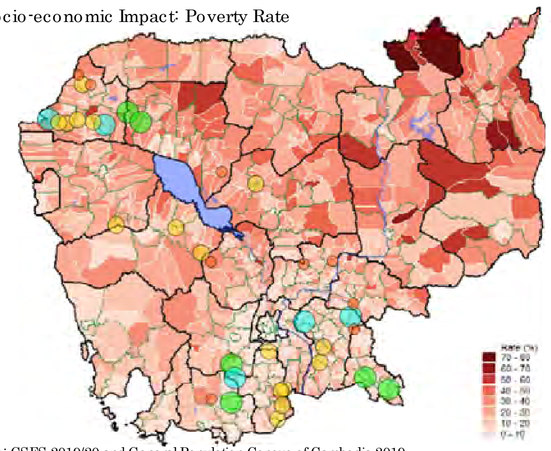
3. Prioritized Projects

History of related Japanese ODA Project



3. Prioritized Projects

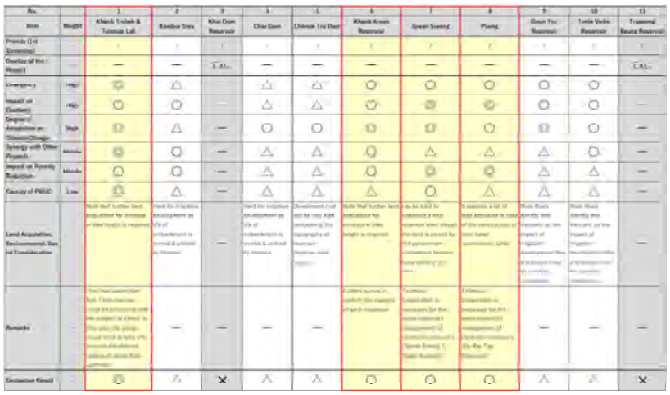
Socio-economic Impact: Poverty Rate



Source: CSES 2019/20 and General Population Census of Cambodia 2019

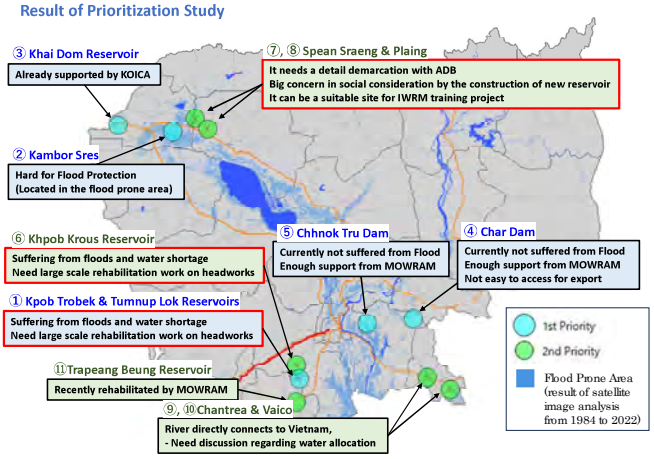
3. Prioritized Projects

Comparison Table for the Irrigation Schemes in First and Second Priority



3. Prioritized Projects

Result of Prioritization Study



4. Further Schedule

- Determination of Schemes on the Short List.
  Candidates Irrigation schemes are the followings:
  - Khpob Trobek & Tumnup Lok
  - Khpob Krous
  - Spean Sraeng
  - Plaing
- Preparation of Further Survey for the Target Irrigation Schemes
  - Water Balance Calculation incl. Design Flood Discharge
  - Soil Test for Rehabilitation
  - Farming/Socio-economic Survey

MANY THANKS

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

Progress Explanation Paper

March 28, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

1

Agenda

1. Irrigation & Agricultural Development Status
2. Irrigation Development Scenarios
3. Prioritized Projects
4. Further Schedule

2

1. Irrigation & Agricultural Development Status

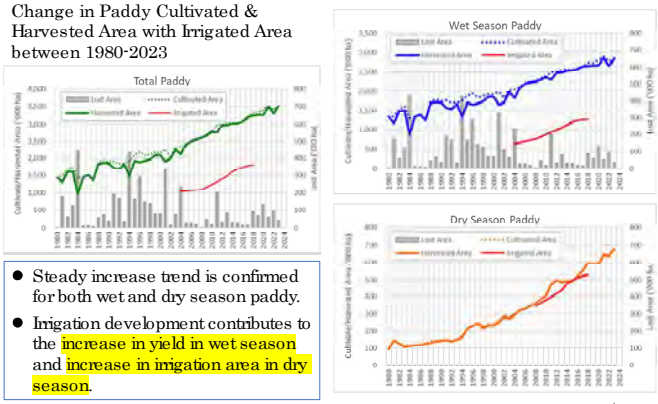
Comparison between Japan and Cambodia: Hydrology

Source: MAFF Annual Report 2023, MOWRAM (2024), and AQUASTAT (FAO 2024)

3

1. Irrigation & Agricultural Development Status

Change in Paddy Cultivated & Harvested Area with Irrigated Area between 1980-2023



- Steady increase trend is confirmed for both wet and dry season paddy.
- Irrigation development contributes to the increase in yield in wet season and increase in irrigation area in dry season.

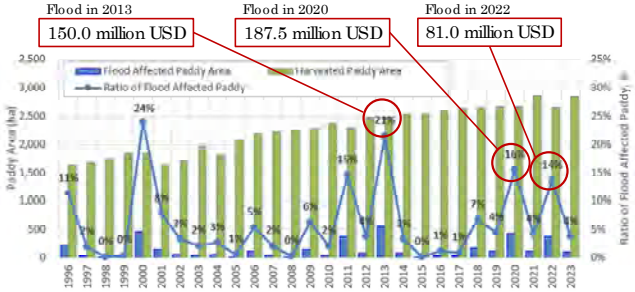
Source: MAFF Annual Report 2023 and MOWRAM (2024) and National Strategic Development Plan 2019-2023

4

1. Irrigation & Agricultural Development Status

Impact of Flood in Agriculture Sector – Impact to Crop

Based on the data of National Committee for Disaster Management (NCDM), serious impact of flood on the paddy area can be periodically seen.

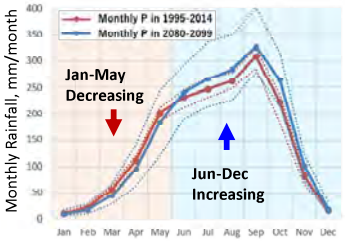


Source: MAFF Annual Report 2023, NCDM Annual Report 2020-2023, and Cambodia Disaster Damage & Loss Information System (NCDM 2024)

5

1. Irrigation & Agricultural Development Status

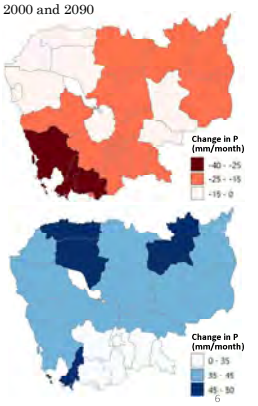
Future Projection of the Rainfall



Source: Climate Change Knowledge Portal (WB 2023)

CCKP analysis with CMIP6 predicts extremes in rainfall patterns in future, which makes more frequent and stronger flood and drought events would occur in the future.

Change in Monthly Precipitation in May (top) and October (bottom) between 2000 and 2090



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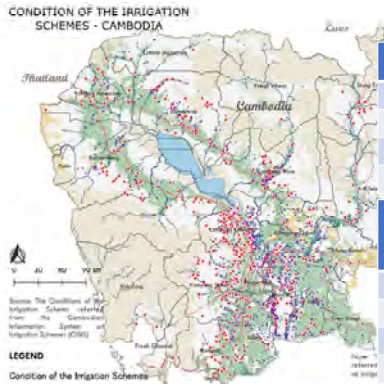
1. Irrigation & Agricultural Development Status

Condition of the Irrigation Facilities



Symbol	Type of maintenance/ rehabilitation required
●	Routine
●	Periodic
●	Rehabilitation
●	Write off (Full-replacement)

Symbol	Overall Scheme Condition Assessment Rating	Number of Schemes (based on CISIS)
●	80-100 %	447
●	60-79 %	675
●	30-59 %	1,060
●	< 30 %	301

2. Irrigation Development Scenario

Pentagonal Strategy-Phase I (2023 – 2028)

The Five Strategic Objectives

1. Ensuring crisis-resilient economic growth of around 7% per year on average.
2. Creating more jobs, both quantity and quality, for Cambodian people, especially for youth.
3. Achieving the poverty reduction targeting of below 10% and continuing to reduce the poverty rate to a minimum.
4. Continuing to strengthen governance capacity and enhancing institutional quality, both at national and sub-national levels, aimed at ensuring efficiency of public services, as well as strengthening private sector governance, and continuing to promote environment conducive to businesses, investment, and trade.
5. Ensuring sustainable socio-economic development and building resilience to climate change.

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2. Irrigation Development Scenario

Pentagon 4: Resilient, Sustainable and Inclusive Development

4-3) Promotion of Agriculture and Rural Development

- 4-3-3) Strengthening the rationalization of irrigation investments to ensure water security for agriculture and rural development
- 4-3-7) Continuing to enhance domestic market connectivity and export promotion

To the Next 25 Years Towards Realizing the Cambodia Vision 2050

- …the state emphasizes the importance of …builds modern and automatic irrigation systems; mitigates and builds adaptation system to climate change…utilizes ecological system sustainably; equips modem technology in the agriculture sector

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2. Irrigation Development Scenario

National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

The vision of the Road Map is sustainable management and development of Cambodia's water resources to support economic growth and protection of water resources for social benefits and ecosystem functions.

(i) increased public awareness of the status of water resources and the water requirements of all water users, including the environment, across the country;

(ii) strengthened management arrangements to support competing water use interests and protecting water for social and environmental needs

(iii) improved rural communities' resilience to flooding including reducing economic, social, and environmental impacts

(iv) water resources management decision-making processes underpinned by best available scientific information; and

(v) improved efficiency and effectiveness of irrigation schemes to support profitable agriculture.

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2. Irrigation Development Scenario

Based on the irrigation & agricultural development status, JICA Survey Team identified the following main challenges:

- Vulnerability to flood and drought due to followings:
  - Small capacity of the reservoirs/ dams,
  - Deterioration of facilities,
  - Lack of hydrological information as well as the capacity development of information sharing/management,
- Lack of national standards for Irrigation development planning, design, and construction,
- Not sustainable operation and maintenance of irrigation facilities by FWUC, and
- Un-milled rice is unofficially exported to the neighboring country.

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2. Irrigation Development Scenario

Japan's Proposal for Strengthening Cooperation with ASEAN towards Enhancing Resilient and Sustainable Agriculture and Food Systems for Ensuring Regional Food Security (Midori Cooperation Plan)

- Specific Scope:
  - i) Development, demonstration and dissemination of technologies for building resilient and sustainable agriculture and food systems through innovation, such as technologies enhancing smart /digital agriculture, circular economy, biomass energy, reducing Green House Gas (GHG) emission and Integrated Pest Management (IPM)
  - ii) Human resource development for building resilient and sustainable agriculture, forestry and food systems, and
  - iii) Other supports for the implementation of the ASEAN Regional Guidelines for Sustainable Agriculture in ASEAN. (e.g. ASEAN JICA Food Value Chain Development Project)

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2. Irrigation Development Scenario

The rehabilitation and modernization of the irrigation facilities with the introduction of better water management through Japanese ODA projects will enhance the development of cash crop cultivation and farmers' income generation under value chain development and improvement of post-harvest activities/technologies targeting the national/foreign market.

Cashew nut production is expanding in some of the targeted irrigated areas. It is expected that more cash crops will be grown once irrigation/drainage is stabilized and market access is improved.

Many of the beneficiary areas of the Colmatage Canal under the JICA grant project "The Project for Improvement of Facilities of Colmatage Systems in Kandal Province along the Mekong River (completed in 2001)" are being utilized to mango plantations.

2. Irrigation Development Scenario

Irrigation Development Scenario for short/mid/long term is suggested as follows:

Time Frame	Development Scenario	Relevance of MOWRAM plans and development scenarios
Short-term	● Rehabilitation of Irrigation Facilities ● Improvement of vulnerability to Flooding (Development of Drainage Canals, Improvement of Irrigation Facilities Durability against Flood) ● Establishment of Hydrological/Meteorological Information Monitoring Structure with Information Sharing ● Establishment and strengthening of FWUC and Land Holding Survey ● Improve Market Access for Agricultural Products ● Improve Agricultural Extension Service	● WRM and development including irrigation extension [1] ● Flood/Drought Management & Meteorology Info. Management [1] ● Ensure all services related to water resources will be used for more benefits for women in FWUC
Mid-term	● Water Resources Development for Dry Season Cropping & Flood Mitigation Measures through dam construction ● Implementation of Integrated Water Resources Management ● Increase in Value-added Agricultural Products for Export	● WRM and development including irrigation extension [1] ● Flood/Drought Management & Meteorology Info. Management [1]
Long-term	● Strengthening of Integrated Water Resources Management ● Modernization of the Irrigation Facilities ● Consolidation of Farmland ● Introduction of modern agriculture with agri-tech.	● Water resources management decision-making processes underpinned by best available scientific information [2] ● Approval of the sub-decrees on water licensing and water quality[2]

1) National Strategic Development Plan 2019-2023
2) National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

2. Irrigation Development Scenario

Based on the irrigation & agricultural development status, JICA Survey Team proposes the following conditions to determine the 1st development priority:

1) Spatial Frame Conditions

Natural conditions or artificial conditions which seem very hard to change

1. **Water Resources (Availability & Variability)**
2. **Land Resources (Land Use and Fertility)**
3. **Change in Paddy Area**

2) Time Frame Conditions

Artificial conditions which can change but taking time, or type of irrigation applied in each irrigation scheme

1. **Water Resources (Reliability: Capacity of Reservoir)**
2. **Irrigation Type (Gravity, Pump or Mixed)**
3. **Distance from the Primary Road**

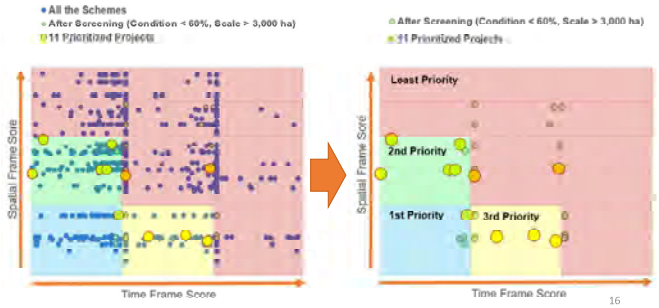
3) Screening Conditions

- **"Condition" should be less than 60% in CISIS data**
- **Scale of Irrigation Scheme should be more than 3,000 ha**

3. Prioritized Projects

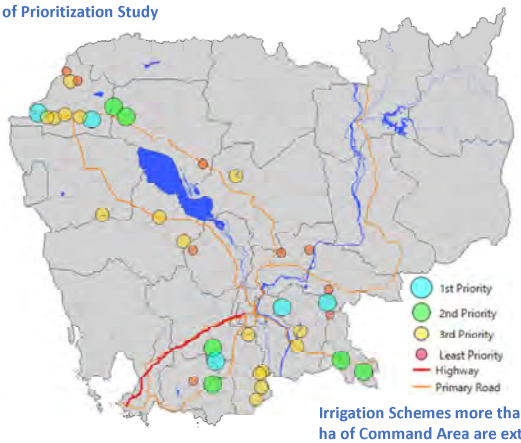
Result of Prioritization Study

Result of the Spatial and Time Frame are plotted on the graph below, categorizing the priority into four.



3. Prioritized Projects

Result of Prioritization Study



Irrigation Schemes more than 3,000 ha of Command Area are extracted.

3. Prioritized Projects

Comparison Table for the Irrigation Schemes in First and Second Priority

No.	Indicators	Weights
-	Rationale of the Project: Necessity of Irrigation Rehabilitation/ Improvement/ Development	Pre-condition
-	Relevance to the Government National Policies, Strategies, Plans and Programs in Irrigation/ Agriculture Sector	
1	Overlapped Projects by the Government and/or Other Donors Fund	Exclude if overlapped
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8	Land Acquisition and Resettlement	Consultation with MOWRAM/ JICA

3. Prioritized Projects

History of related Japanese ODA Project

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3. Prioritized Projects

Comparison Table for the Irrigation Schemes in First and Second Priority

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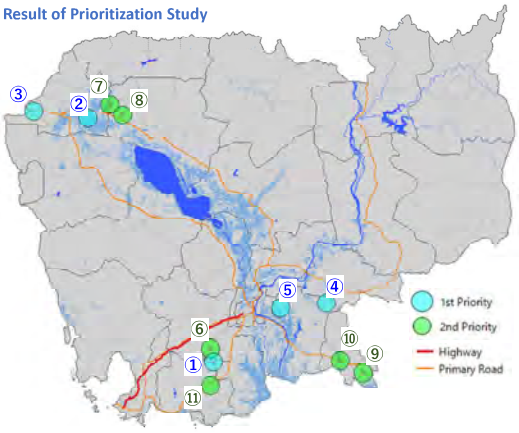
3. Prioritized Projects

Result of Prioritization Study



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4. Further Schedule

- Determination of Schemes on the Short List.
  Candidates are the followings:
  - No.1 Kpob Trobek & Tumnup Lok
  - No.6 Khpob Krous
  - No.7 Spean Sraeng
  - No.8 Plaing
- Preparation of Further Survey for the Target Irrigation Schemes
  - Water Balance Calculation incl. Design Flood Discharge
  - Soil Test for Rehabilitation
  - Farming/Socio-economic Survey

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DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

ITR Meeting

May 21, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

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Agenda

1. Irrigation & Agricultural Development Status in Cambodia
2. Irrigation Development Scenarios
3. Selection for the Long List
4. Selection for the Short List
5. Further Schedule

2

1. Irrigation & Agricultural Development Status

Irrigation Development in Cambodia

Period	Activities in Development
The 7th Century [1]	Commencement of Irrigation. Surplus rice production was obtained. Those products were exchanged for cloth and other goods.
The 9th to the 15th century [1] (Angkor Wat period)	Water management systems, including 2 seasons of irrigation, were further developed. West Barai reservoir was developed.
The 15th to 19th century [1] (before French colonial time)	The economy declined, and rice surplus became low because irrigation systems were not properly managed due to wars.
1863 to 1953 [1] (French colonial time)	The economy was not so healthy. Rice was exported with developed road networks. The irrigation system was slowly strengthened.
1975 to 1978 [1] (Democratic Kampuchea regime)	Many irrigation systems were constructed, but the engineering viewpoint was not given importance to design and construction.
1980s – 2000s	Urgent irrigation system rehabilitation was implemented with international donors' assistance. Rice production increased based on mechanization (power tiller, engine pump).
2010s - current	Modernized irrigation systems based on meteorological data have been developing. The existing irrigation systems shall be improved before implementing a new project, which is essential to be done because of cost and investment efficiencies.

*1 Source: Cambodia Development Research Institute (CDRI), 2008, "Water Resource Management in Cambodia: History and Current Challenges", Cambodia Development Review, January – March 2008

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1. Irrigation & Agricultural Development Status

Agriculture in Cambodia

Farmers mainly cultivate 'Temporary crops', and Rice is ranked as the most dominant crop production among them.
About 60% of crop production are mainly used for home consumption

Items	Description
Ratio of farming household[1]	94% households produce crops
Crop type[1]	Temporary crop: 92.5%, Permanent + fallow: 7.5%
Crop production (1,000 tons)[3]	1. Cassava (13,512), 2. Rice (10,886), 3. Maize (895), 4. Vegetables (682), 5. Sugar cane (618)
Home consumption or selling[2]	58% for home consumption 42% for sale
Ownership of farmland[1]	98% for owned 2% for rent or others

Source: *1: Cambodia Agriculture Survey 2020 (CAS2020), *2: Cambodia Agriculture Survey 2021 (CAS2021), *3: Statistical Yearbook of Cambodia 2021 (SYC2021)

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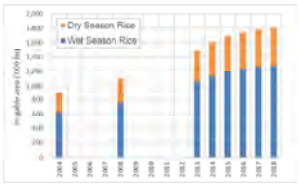
1. Irrigation & Agricultural Development Status

Change in Paddy Cultivated & Harvested Area with Irrigated Area between 1980-2023

- Steady increase trend is confirmed for both wet and dry season paddy.
- Irrigable area is steadily increasing, but new rainfed paddy area is also developed so that irrigation ratio is not growing well, and more than 40% of the area can be irrigated.

Change in Irrigable Area b/w '04-'18



Change in Irrigable Ratio b/w '04-'18

Source: MAFF Annual Report 2023 and MOWRAM (2024)

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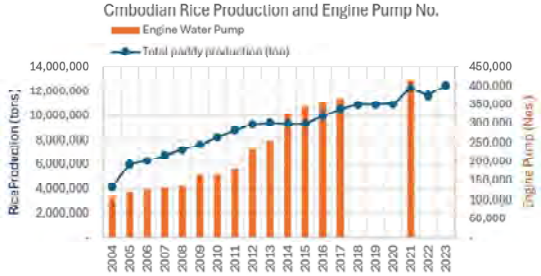
1. Irrigation & Agricultural Development Status

Change in Engine Water Pumps and Rice Production

Until 2012, urgent rehabilitation of the existing irrigation system was required for self-sufficiency in the country. Around 2010 and after, the rehabilitation policy would be changed from urgent work to a modernized Irrigation system establishment.
The rice production tends to increase with the increase in engine pumps.



Source: Arranged from the data in the Statistical Yearbook of Cambodia 2021, MAFF Annual Report (2021)

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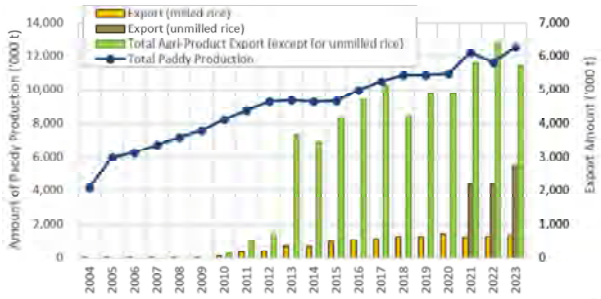
1. Irrigation & Agricultural Development Status

Agricultural Export Status in Cambodia

Agriculture sector accounts 25% of total GDP, and lately both production and export of rice are increasing, which made Cambodia one of the world's 10th largest rice exporters (8th in 2022)

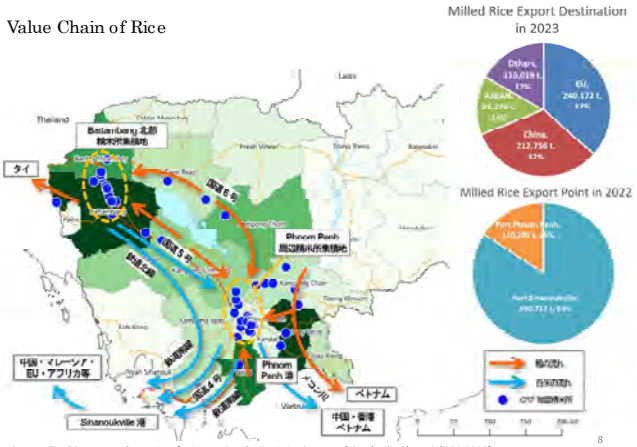


Source: MAFF Annual Report (2023)

1. Irrigation & Agricultural Development Status

Value Chain of Rice

Milled Rice Export Destination in 2023



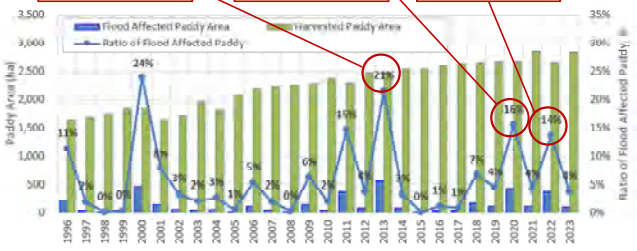
Source: Final Report on the project for Improving the Logistics System of Cambodia Phase 2 (JICA 2023)

1. Irrigation & Agricultural Development Status

Impact of Flood in Agriculture Sector – Impact to Crop

Based on the data of National Committee for Disaster Management (NCDM), serious impact of flood on the paddy area can be periodically seen.

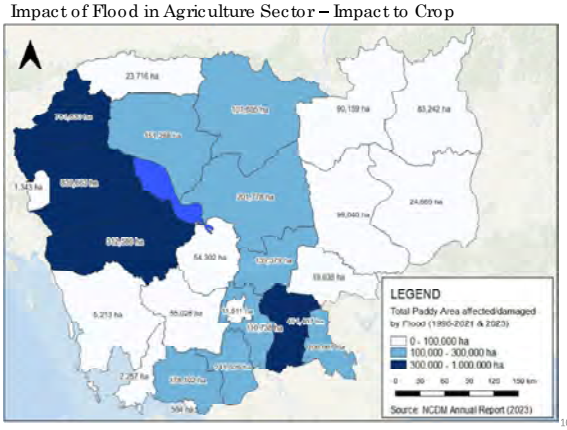
Flood in 2013: 150.0 million USD
Flood in 2020: 187.5 million USD
Flood in 2022: 81.0 million USD



Source: MAFF Annual Report 2023, NCDM Annual Report 2020-2023, Cambodia Disaster Damage & Loss Information System (NCDM 2024)

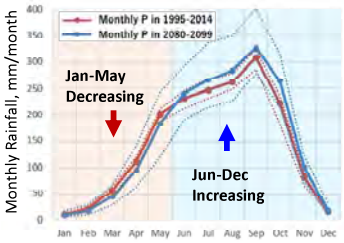
1. Irrigation & Agricultural Development Status

Impact of Flood in Agriculture Sector – Impact to Crop



1. Irrigation & Agricultural Development Status

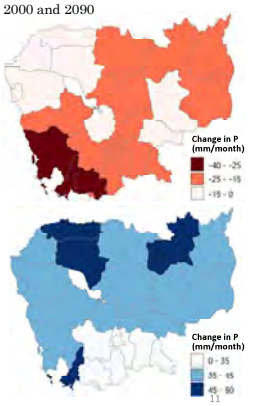
Future Projection of the Rainfall



Source: Climate Change Knowledge Portal (WB 2023)

CCKP analysis with CMIP6 predicts extremes in rainfall patterns in future, which makes more frequent and stronger flood and drought events would occur in the future.

Change in Monthly Precipitation in May (top) and October (bottom) between 2000 and 2090



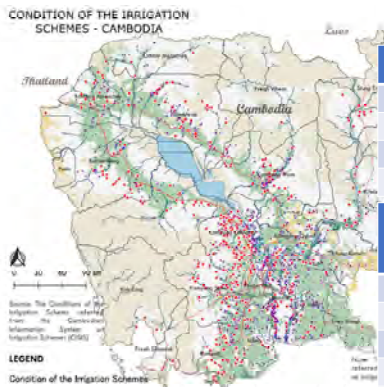
1. Irrigation & Agricultural Development Status

CISIS Database: Cambodia Information System on Irrigation Schemes

No	Item	Description
1	CISIS ID	Unique ID for each scheme
2	Survey Date	Last Survey Date
3	Province, District, Commune	Name of Province, District, and Commune
4	Scheme Name	Name of Irrigation Scheme
5	Location (X & Y)	Coordinates (WGS84 UTM48N)
6	Scale of Schemes	Small, Medium and Large
7	Construction Year	-
8	Latest Rehabilitation Year	-
9	Potential Area (Dry and Wet Seasons)	Potential Area in case the scheme fully functions
10	Real Area (Dry, Wet, Recession, Early Wet Seasons)	Actual Area under the current condition
11	Existence of FWUC	Yes or No
12	Establish Year of FWUC	-
13	O&M Start Year of FWUC	-
14	Condition of Facility	Condition of Irrigation Facility from 0% to 100%
15	Reservoir surface (ha)	Water Surface Area of Reservoir
16	Length of Dam	-
17	Max Capacity of Reservoir	Capacity of Reservoir (in m^3)
18	Length of Dike	-
19	Nos Main/Secondary/Tertiary Canals	Number of each canal
20	Length of Main/Secondary/Tertiary Canals	Length of each canal
21	Distribution Method	Gravity, Pump, or Mixed Type
22	Yield (Dry and Wet Season)	-
23	River Basin	Name of River Basin

1. Irrigation & Agricultural Development Status

Condition of the Irrigation Facilities

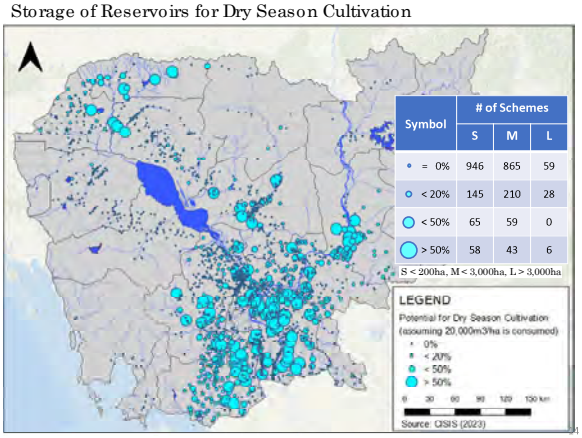


Symbol	Type of maintenance/ rehabilitation required
●	Routine
●	Periodic
●	Rehabilitation
●	Write off (Full-replacement)

Symbol	Overall Scheme Condition Assessment Rating	Number of Schemes (based on CISIS)
●	80-100 %	447
●	60-79 %	675
●	30-59 %	1,060
●	< 30 %	301

1. Irrigation & Agricultural Development Status

Storage of Reservoirs for Dry Season Cultivation

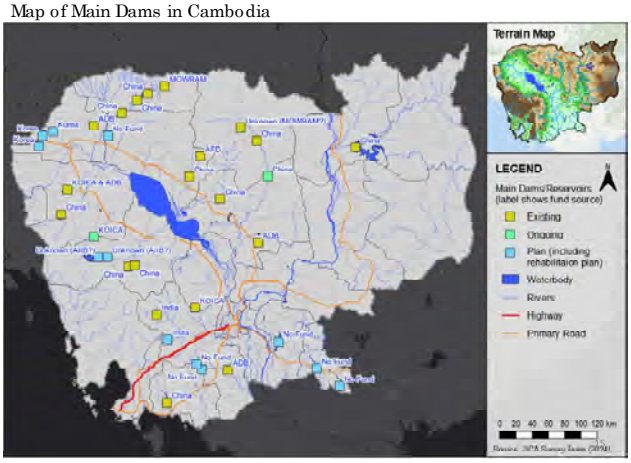


Symbol	# of Schemes		
	S	M	L
● = 0%	946	865	59
○ < 20%	145	210	28
○ < 50%	65	59	0
○ > 50%	58	43	6

S < 200ha, M < 3,000ha, L > 3,000ha

1. Irrigation & Agricultural Development Status

Map of Main Dams in Cambodia



1. Irrigation & Agricultural Development Status

Hydrological Information

Manual River Gauging Station
- Total 30 stations along the Mekong and its main tributaries

Automatic River Gauging Station
- More than 100 stations
  (Data of 30 stations are accessible through MOWRAM's portal)
- 15 additional stations managed by Mekong River Commission (MRC)

The number of stations are not enough for water resources management
- ➢ Most reservoirs do not have their water level record
- ➢ PDWRAM staff needs training for water management

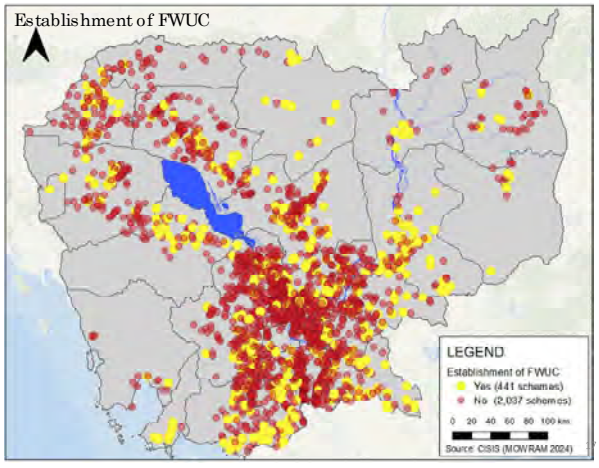
Meteorological Information

Manual Rainfall Gauge Station
- Total 25 Stations (one in 24 provinces and Phnom Penh)

Automatic Weather Station
- Total 85 Stations (of them, 39 stations are fully functioning)

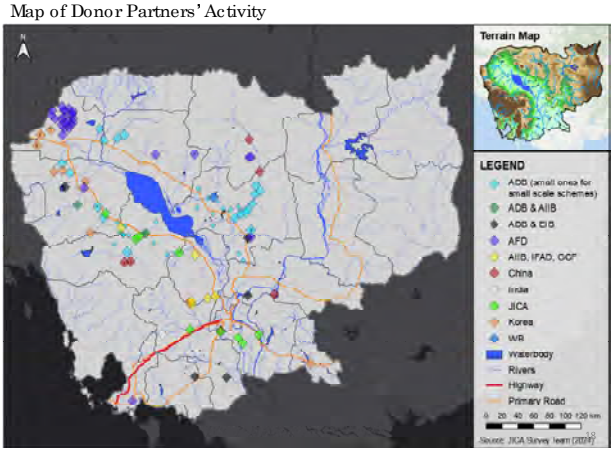
1. Irrigation & Agricultural Development Status

Establishment of FWUC



1. Irrigation & Agricultural Development Status

Map of Donor Partners' Activity



2. Irrigation Development Scenario

Pentagonal Strategy-Phase I (2023 – 2028)

The Five Strategic Objectives

1. Ensuring crisis-resilient economic growth of around 7% per year on average.
2. Creating more jobs, both quantity and quality, for Cambodian people, especially for youth.
3. Achieving the poverty reduction targeting of below 10% and continuing to reduce the poverty rate to a minimum.
4. Continuing to strengthen governance capacity and enhancing institutional quality, both at national and sub-national levels, aimed at ensuring efficiency of public services, as well as strengthening private sector governance, and continuing to promote environment conducive to businesses, investment, and trade.
5. Ensuring sustainable socio-economic development and building resilience to climate change.

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2. Irrigation Development Scenario

Pentagon 4: Resilient, Sustainable and Inclusive Development

4-3) Promotion of Agriculture and Rural Development

4-3-3) Strengthening the rationalization of irrigation investments to ensure water security for agriculture and rural development

- 4-3-7) Continuing to enhance domestic market connectivity and export promotion

To the Next 25 Years Towards Realizing the Cambodia Vision 2050

- ...the state emphasizes the importance of ...builds modern and automatic irrigation systems; mitigates and builds adaptation system to climate change...utilizes ecological system sustainably; equips modern technology in the agriculture sector

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2. Irrigation Development Scenario

National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

The vision of the Road Map is sustainable management and development of Cambodia's water resources to support economic growth and protection of water resources for social benefits and ecosystem functions.

(i) increased public awareness of the status of water resources and the water requirements of all water users, including the environment, across the country;

(ii) strengthened management arrangements to support competing water use interests and protecting water for social and environmental needs

(iii) improved rural communities' resilience to flooding including reducing economic, social, and environmental impacts

(iv) water resources management decision-making processes underpinned by best available scientific information; and

(v) improved efficiency and effectiveness of irrigation schemes to support profitable agriculture.

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2. Irrigation Development Scenario

National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

Framework for Modernization of Water Resources and irrigation Sector

1. Sustainable Water Resources Management,
2. Complete Irrigation Schemes,
3. Self-sustaining Operation and Maintenance, and
4. Profitable Irrigated Agriculture

The roadmap introduces the 'Excel-based Irrigation Investment Analysis Tool (IIAT)' as a tool for estimating project costs. IIAT assesses investment risk from the four Criteria shown in the Table below.

Table A4.1: Prioritization framework for selecting irrigation schemes for rehabilitation

Prioritization Criteria	Risk level		
	Lower	Medium	Higher
1. Security of water supply	Mekong Delta	3S, Upper Mekong	Tonle Sap, Coastal
2. Condition of irrigation scheme	>60%	=60%, ≤80%	≤60%
3. Size of irrigation scheme	Medium	Small	Large
4. Water delivery infrastructure	Pump		Gravity

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2. Irrigation Development Scenario

Based on the irrigation & agricultural development status, JICA Survey Team identified the following main challenges:

- Vulnerability to flood and drought due to followings:
  - Small capacity of the reservoirs/ dams,
  - Deterioration of facilities,
  - Lack of hydrological information as well as the capacity development of information sharing/management,
- Lack of national standards for Irrigation development planning, design, and construction,
- Not sustainable operation and maintenance of irrigation facilities by FWUC

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2. Irrigation Development Scenario

3 Phases for Irrigation Development

Phase	Features and Development Direction	Actor
1st Phase (Short - Medium) Rehabilitation and Management within the Irrigation Scheme	• The rehabilitation projects will continue as they have been conducted, primarily targeting small to medium-scale irrigation schemes. • It is believed that Cambodia has obtained enough experience from carrying out these projects with the support of development partners and through its own budget. • Development led by the Cambodian government will be prioritized.	• MOWRAM
2nd Phase (Short - Medium) Management for Control and Adjustment	• Due to changes in land use and the presence of adjacent irrigation schemes, control of flooding and coordination with neighboring areas /irrigation schemes are necessary. • Because reservoirs and flood discharge areas are distant from each other, the installation of a monitoring system is essential. • Support from development partners is deemed necessary.	• Donor Partners • RGC (MOWRAM)
3rd Phase (Medium - Long) New Development and Integrated Water Resource Management	• A plan that encompasses the entire watershed is required. • A hydrological information monitoring system is necessary. • Development by the Cambodian government has begun, but waiting for the monitoring system to become operational would make for a more effective investment.	• Donor Partners • RGC (MOWRAM)

While the three stages are thought to be implemented concurrently, this survey primarily focuses on the second phase: 'Management for Control and Adjustment.'

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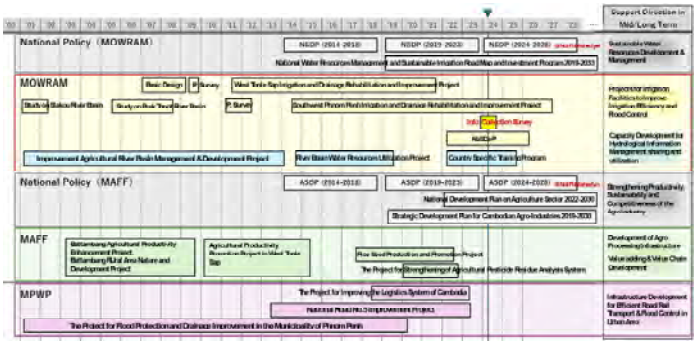
2. Irrigation Development Scenario

Irrigation Development Scenario for short/mid/long term is suggested as follows:

Time Frame	Development Scenario	Relevance of MOWRAM Policies and Development Scenarios
Short-term	**【Improvement of Productivity】** ● Rehabilitation of Small & Medium Irrigation Schemes and Strengthening O&M structure including FWUC ● Improvement of vulnerability to Flooding (Development of Drainage Canals, Improvement of Irrigation Facilities Durability against Flood) ● Establishment of Hydrological/Meteorological Information Monitoring Structure with Information Sharing ● Establishment and strengthening of FWUC and Land Holding Survey ● Improve Market Access for Agricultural Products ● Improve Agricultural Extension Service	● WRM and development including irrigation extension [1] ● Flood/Drought Management & Meteorology Info. Management [1] ● Ensure all services related to water resources will be used for more benefits for women in FWUC
Mid-term	**【Adaptation Measures for Climate Change Issues (Flood/Drought), Collaboration with the FVC Strengthening Projects】** ● Rehabilitation of Mid/Large Scale Irrigation Schemes ● Water Resources Development for Dry Season Cropping & Flood Mitigation Measures through dam construction ● Implementation of Integrated Water Resources Management for Adequate Water Allocation ● Increase in Value-added Agricultural Products for Export	● WRM and development including irrigation extension [1] ● Flood/Drought Management & Meteorology Info. Management [1]
Long-term	**【Mitigation Measures for Climate Change Issues (e.g. Application of AWD or CSA)】** ● Water Resources Development by Dam Construction ● Strengthening of Integrated Water Resources Management including Water Quality Management ● Modernization of the Irrigation Facilities ● Consolidation of Farmland ● Introduction of modern agriculture with agri-tech.	● Water resources management decision-making processes underpinned by best available scientific information [2] ● Approval of the sub-decrees on water licensing and water quality[2]

1) National Strategic Development Plan 2019-2023
2) National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033

2. Irrigation Development Scenario



3. Project for the Long List

Based on the irrigation & agricultural development status, JICA Survey Team proposes the following conditions to determine the 1st development priority:

1) Agricultural Land Potential for Irrigation Development

Natural conditions or artificial conditions which seem very hard to change

No.	Item	Score
1	Water Resources (Availability)	1
2	Water Resources (Variability)	1
3	Land Resources (Fertility)	1
4	Change in Paddy Area	2

2) Investment Potential for Irrigation Development

Artificial conditions which can change but taking time, or type of irrigation applied in each irrigation scheme

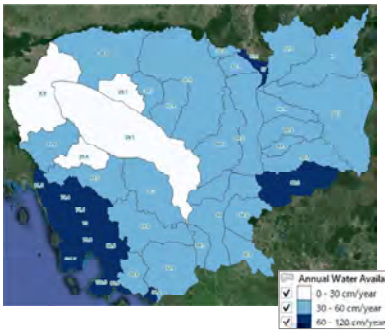
No.	Item	Score
1	Water Resources (Reservoir)	2
2	Irrigation Type (Gravity, Pumped)	1
3	Distance from the Primary Road	1

3. Project for the Long List

1) Agricultural Land Potential

1-1) Water Resources (Availability)

Annual Basin-wise Water Resources are simply estimated based on the Satellite Data



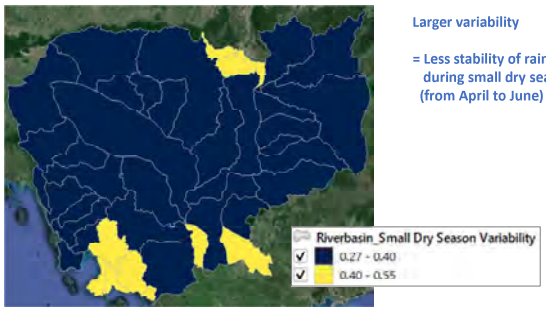
1. Determine Rainfall Amount by Basin with GSMaP data
2. Determine Land Use by Basin with Satellite data from Open Development Cambodia
3. Set Runoff Coefficient based on the Land Use
4. Set Rice Cultivation Area (Irrigated and Rainfed) by the above Land Use and CISIS data
5. Subtract the Water Utilization by Rice Cultivation and Calculate the Rest of Available Water

3. Project for the Long List

1) Agricultural Land Potential

1-2) Water Resources (Variability)

Interannual variability of rainfall during small dry season is evaluated by river basin



Larger variability

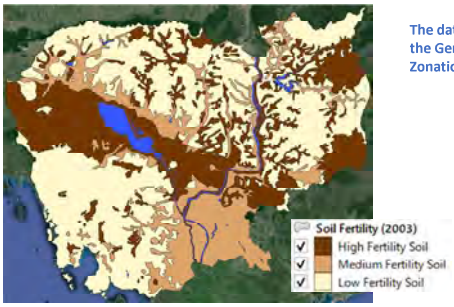
= Less stability of rainfall during small dry season (from April to June)

3. Project for the Long List

1) Agricultural Land Potential

1-3) Land Resource

"Medium fertile" or "Fertile" soils are selected for high priority area.



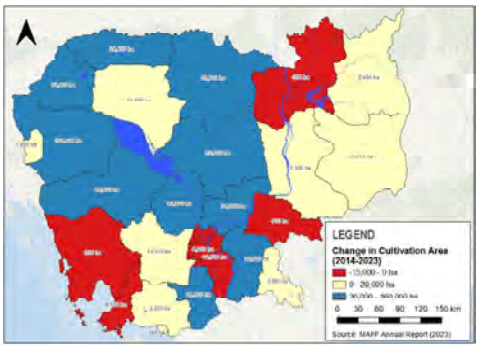
The data is obtained from the Gene-Ecological Zonation of Cambodia.

3. Project for the Long List

1) Agricultural Land Potential

1-4) Change in Paddy Cultivation Area

The irrigation scheme that has in the province of increasing trend should be prioritized.



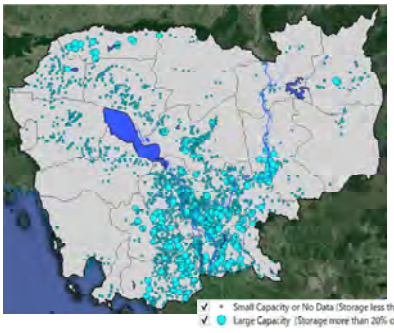
The cultivation area records in 2023 and in 2014 are compared by province.

3. Project for the Long List

2) Investment Potential

2-1) Water Resources (Reliability)

Capacity of the reservoir/dam is evaluated compared to their scale of irrigation scheme.



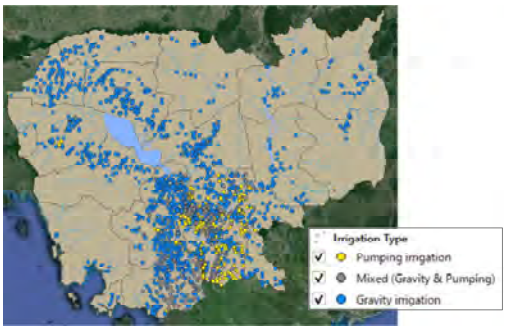
1. Set the required water volume as 20,000 m3/ha for dry season.
2. If more than 20% of potential beneficiary are can be supplied from the reservoir/dam, it is evaluated as "Sufficient water storage"
3. If there is a dam with smaller capacity than above or no information about the capacity, it is evaluated as "Not sufficient"
4. If there is no reservoir/dam info, it will be "No data" as the least priority on this condition.

3. Project for the Long List

2) Investment Potential

2-2) Irrigation Type

Based on CISIS database, Gravity type, Pump type, or Mixed type are identified.



3. Project for the Long List

2) Investment Potential

2-3) Distance from the Primary Road

Considering the accessibility from the Main Road, 10km buffer zone is created.

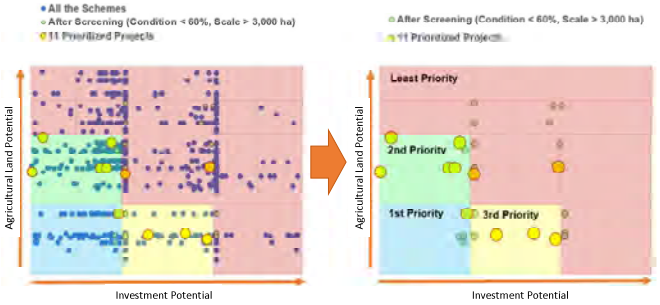
In the Wet season, 10km is assumed to be the distance that cars can reach in 1 hour.

3. Project for the Long List

3) Screening Conditions

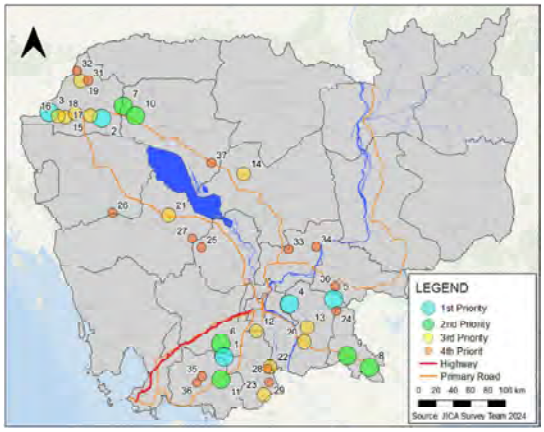
- "Condition" should be less than 60% in CISIS data
- Scale of Irrigation Scheme should be more than 3,000 ha

Result of the Potential of Agricultural Land and Investment plotted on the graph below, categorizing the priority into four.



3. Project for the Long List

Result of Prioritization Study



3. Project for the Long List

Annual Budget of MOWRAM (Unit: USD)

Item	2018	2019	2020	2021	2022	2023
MOWRAM	71,294,000	79,304,000	78,596,000	78,570,000	82,800,000	87,020,000
Headquarter	63,530.000	70,271.000	69,315.00	69,300,000	72,760,000	76,220,000
PDWRAM (25)	7,763,750	9,033,000	9,281,000	9,270,000	10,130,000	11,000,000

Source: MOWRAM (2024)

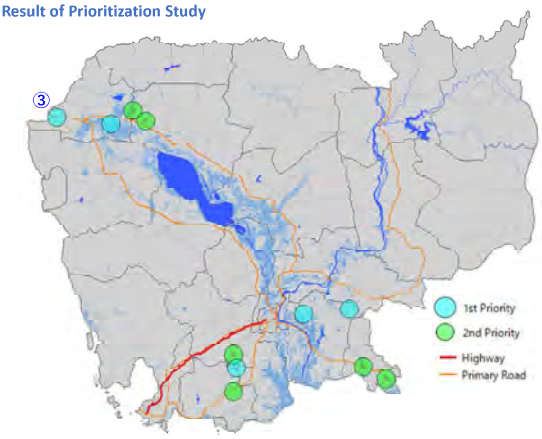
- MOWRAM's Budget: 63 to 76 million USD
- Rough Estimate of the Rehabilitation Projects: 15 to 80 million USD
  - Assuming the Long List is for the irrigation schemes which need to be rehabilitated in approximately 10 years, total 11 Projects (5 schemes for 1st Priority and 6 schemes for 2nd Priority) can be selected.

3. Project for the Long List

Result of Prioritization Study

3. Project for the Long List

Result of Prioritization Study



4. Project for the Short List

Comparison Table for the Irrigation Schemes in First and Second Priority

No.	Indicators	Weights
-	Relevance to the Government National Policies, Strategies, Plans and Programs in Irrigation/ Agriculture Sector	Pre-condition
1	Overlapped Projects by the Government and/or Other Donors Fund	Exclude if overlapped
2	Degree of Emergency to Implement the Project	High (base score: 3)
3	Impacts of Economic Benefits (Impact on Agricultural Productivity/Geographical Advantage for Agro-processing)	High (base score: 3)
4	Adaptation Degree to Climate Change	High (base score: 3)
5	Synergy/ Ripple Effects with Other ODA and Government Projects (agriculture projects, irrigation projects, and road improvement projects, etc.)	Middle (base score: 2)
6	Degree of Poverty Reduction	Middle (base score: 2)
7	O&M Capacity of Farmer Water User Community	Low (base score: 1)
8	Land Acquisition and Resettlement	Consultation with MOWRAM/ JICA

Evaluation Score: ◎=3, ○=2, △=1, and
Total Score is calculated as Base Score x Evaluation Score

4. Project for the Short List: Emergency 1/2

No		Emergency (Weight: High)
1	◎	Although the embankment was rehabilitated in 2006 and 2022, erosion of the dam embankment was observed as of February 2024, indicating a need for permanent measures. MOWRAM has proposed this project as a priority based on the erosion issue. The Tumnup Lok area has non-functional irrigation facilities, requiring rehabilitation of small reservoir embankments, headworks, and canals for flood mitigation and dry season cultivation. Tumnup Lok also serves as a route crossing the river, and early rehabilitation is desired to facilitate the transportation of agricultural products and commuting.
2	△	While the area surrounding this scheme is prone to flooding, flood control itself is very difficult due to its very low and plain geography. Therefore, the urgency of flood countermeasures is not high.
4	△	While the reservoir exists, it is mainly used for supplementary irrigation during the rainy season. Planting during the dry season is not conducted, and there have been no reports of floods. Based on this information, the urgency is considered low.
5	△	While this area was previously prone to frequent floods, the water level of the Mekong River has been decreasing due to hydropower development upstream countries in recent years, resulting in a reduced occurrence of extreme floods in this area. According to the local office of MOWRAM, major rehabilitations are not required, and the current maintenance status is feasible, indicating a low urgency.
6	○	There are operational difficulties during flood, necessitating the installation of automatic gates to prevent downstream flooding. Additionally, raising the embankment is proposed to expand the dry season planting area. Considering these factors, it has been identified as one of the priority areas proposed by MOWRAM.
7	○	In recent years, the flood damage has become significantly serious, necessitating urgent countermeasures. In addition to flood mitigation, the construction of the reservoir (raising embankments) is proposed to increase the dry season paddy planting area. Downstream areas have farmland that can be submerged for up to two months during floods, necessitating drainage facilities to control floods. Considering these circumstances, MOWRAM has proposed it as one of the priority projects.

4. Project for the Short List: Emergency 2/2

No		Emergency (Weight: High)
8	○	The same as No.7, but it does not have reservoir, so inter-basin water transfer proposals have been made.
9	○	Downstream areas experience frequent flooding, necessitating drainage facilities. In addition to flood mitigation, plans for the construction of a new reservoir are in place to increase the dry season planting area. Including the construction of the new reservoir, MOWRAM has proposed it as one of the priority projects.
10	○	To address flood control, proposals for raising embankments have been made. Additionally, an increase in reservoir capacity (from 30 MCM to 70 MCM) is deemed necessary for dry season irrigation, water supply to economic zones, and ensuring drinking water stability. Considering the poor operability and water leakage from the numerous concrete gates installed around the embankments, facility upgrades are deemed necessary. Taking these conditions into account, MOWAM has proposed this irrigation scheme as one of the priority projects.

4. Project for the Short List: Economic Impact

No		Economic Impact (Weight: High)	
		Beneficiary Area "()" is for dry season	Geographical Advantage for Agro-Processing
1	◎	○ 4,630 ha (+ 0 ha*)	○ CRF-registered rice millers in Takeo creates better env.
2	△	○ 3,600 ha (+1,200 ha)	◎ Rice millers are highly competitive against Vietnamese
4	△	○ 3,129 ha (+ 0 ha)	△ Rice millers are less competitive against Vietnamese
5	△	○ 3,500 ha (+ 1,700 ha)	△ Rice millers are less competitive against Vietnamese
6	○	○ 3,018 ha (+ 300 ha)	○ Rice millers are less competitive against Vietnamese
7	◎	◎ 12,500 ha (+ 0 ha*)	◎ Rice millers are highly competitive against Vietnamese
8	◎	◎ 14,800 ha (+ 0 ha*)	◎ Rice millers are highly competitive against Vietnamese
9	○	◎ 11,791 ha (+ 2,355 ha)	△ Rice millers are less competitive against Vietnamese
10	○	◎ 16,360 ha (+5,560 ha)	△ Rice millers are less competitive against Vietnamese

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4. Project for the Short List: Degree of Climate Change Adaptation

No		Degree of Climate Change Adaptation (Weight: High)
1	◎	Water level/flow monitoring in upstream reservoirs (Khpob Trobek and Tumnup Lok reservoirs) and automatic gates can contribute to flood mitigation in downstream areas.
2	△	The area is a regular flood-prone area, making it geographically difficult to implement flood countermeasures.
4	○	Improvement of vulnerability against flood is a little difficult due to lack of upstream storage facilities although drainage capacity can be improved.
5	○	Improvement of vulnerability against flood is a little difficult due to lack of upstream storage facilities although drainage capacity can be improved.
6	◎	Water level/flow monitoring in upstream reservoirs (Khpob Krous Dam) and automatic gates can contribute to flood mitigation in downstream areas.
7	◎	Water level/flow monitoring in upstream reservoir (Sraeng 1 and Sraeng 2 reservoirs) and Sraeng rivers and automatic gates can contribute to flood mitigation in downstream areas.
8	○	Improvement of vulnerability against flood is a little difficult due to lack of upstream storage facilities although drainage capacity can be improved.
9	◎	Water level/flow monitoring in upstream reservoir (Doun Toy Reservoir) and automatic gates can contribute to flood mitigation in downstream areas.
10	○	Water level/flow monitoring in upstream reservoir (Tonle Vaico Reservoir) and automatic gates can contribute to flood mitigation in downstream areas. However, pumping irrigation system tends to emits more Green House Gases compared to the gravity irrigation system.

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4. Project for the Short List: Synergy with Other Projects

No		Synergy with other projects (Weight: Medium)
1	◎	➢ Some of the beneficiary areas include pilot areas for capacity strengthening of FWUC/G (implemented by JICA in 2014). ➢ The project area is the target province of the Seed Production and Extension Project, and technical assistance was conducted in the project area (Ou Saray Commune). ➢ The project area (Ou Saray Commune) is also a target province of the CAVAC VC Strengthening Project.
2	△	➢ Although some synergies in terms of post-harvest processing and distribution can be recognized, as the project is accessible via National Road No. 5 and National Road No. 6 (30 km) to Thailand, it is difficult to say that any particular synergies can be demonstrated since the project has little connection with other JICA projects and no other donor projects can be identified.
4	△	➢ The project is not closely related to any donor projects.
5	△	➢ The project is not closely related to any donor projects.
6	○	➢ The ADB project (Climate-Friendly Agribusiness Value Chains Sector Project) is practicing facility rehabilitating and strengthening of the FWUC in the neighboring area, which makes it relatively easy to understand the management for adjustment after the facility rehabilitation.
7	○	➢ The ADB-supported Northwest Irrigation Sector Project and the Water Resources Management Sector Development Program are included in this project.
8	○	➢ WAT4CAM project provided support for the collection of information on watershed management committees and the establishment of such committees.
9	△	➢ There is no closely related projects that can make synergy with this project.
10	○	➢ The Project for Expansion of Water Supply System in Svay Rieng is underway at the reservoir that will serve as the water source.

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4. Project for the Short List: Impact on Poverty Reduction

No		Impact on Poverty Reduction (Weight: Medium)
1	○	Poverty Rate in the beneficiary area is between 20% to 30%
2	○	Poverty Rate in the beneficiary area is between 20% to 30%
4	△	Poverty Rate in the beneficiary area is between 10% to 20%
5	△	Poverty Rate in the beneficiary area is between 10% to 20%
6	○	Poverty Rate in the beneficiary area is between 20% to 30%
7	◎	Poverty Rate in the beneficiary area is between 40% to 50%
8	◎	Poverty Rate in the beneficiary area is between 40% to 50%
9	△	Poverty Rate in the beneficiary area is between 10% to 20%
10	△	Poverty Rate in the beneficiary area is between 0% to 10%

National Average of the Poverty Rate is following:

9.6% in the Urban Area
22.8% in the Rural Area

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4. Project for the Short List: Capacity of Farmer Water User Community (FWUC)

No		Capacity of FWUC (Weight: Medium)
1	◎	FWUC is well functioning (JICA pilot site is located inside of the beneficiary area)
2	△	No FWUC established
4	△	No FWUC established
5	△	No FWUC established
6	△	No FWUC established
7	○	FWUC was functioning before they faced funding shortfall due to flood in 2022.
8	△	No FWUC established
9	△	No FWUC established
10	△	No FWUC established

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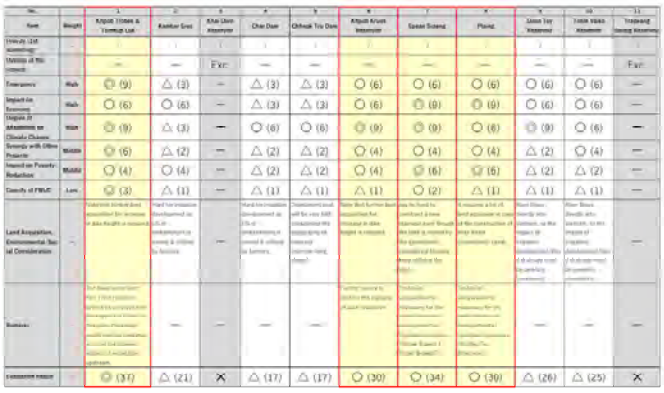
4. Project for the Short List

Comparison Table for the Irrigation Schemes in First and Second Priority



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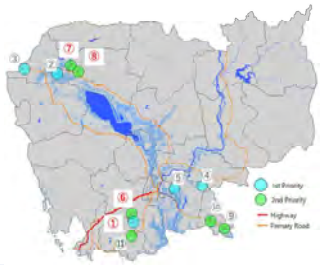
4. Project for the Short List

Considering the Short List is for the irrigation schemes which need to be rehabilitated within 3-4 years, following 4 projects are selected.

No.1 Khpob Trobek & Tumnup Lok
No.6 Khpob Krous
No.7 Spean Sraeng
No.8 Plaing



Criteria	Weight	Irrigation Scheme No.										
		1	2	3	4	5	6	7	8	9	10	11
Emergency	High	9	3	-	3	3	6	6	6	6	6	-
Economic Impact	High	6	6	-	3	3	6	9	9	6	6	-
Adaptation to CC.	High	9	3	-	6	6	9	9	6	9	6	-
Synergy	Medium	6	2	-	2	2	4	4	4	2	4	-
Poverty Reduction	Medium	4	4	-	2	2	4	6	6	2	2	-
FWUC	Low	3	1	-	1	1	1	2	1	1	1	-
Evaluation (Total)	–	◎	△	-	△	△	○	○	○	△	△	-
		37	19	-	17	17	30	36	32	26	25	-

5. Further Schedule

- 23rd May – 4th June
  - Meeting with PDWRAM and PDA for further inquiries in terms of Farming/ Socio-economic Survey and Water Management Structure including FWUC
- 5th June – 19th June
  - Meeting with PDWRAM for Environmental Considerations
- Late June
  - Meeting for 2nd Field Survey with related organizations including MEF

MANY THANKS

DATA COLLECTION SURVEY
ON IRRIGATION AND FLOOD PROTECTION

CONFIRMATION AFTER SITE SURVEY RESULT

May 21, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

1. Plaing & Spean Sraeng Irrigation

Plaing Irrigation Project
1. There are land acquisition issues in the latter parts of the main canal, where MOWRAM is currently implementing the canal development project.
2. End of Main Canal of the Plaing project shall be confirmed
3. Diversion canal not necessary to construction.
4. Food Affected Area(Prey Chruk)
   ➡ New Flood Control Gate (MOWRAM surveyed past year)
5. Food Affected Area(Sasar Sdam) (Currently the MOWRAM project is under implementation)

Spean Sraeng Irrigation Project
1. Khmeng Ancient (Angkor) Bridge will be affected by rising water levels to improve reservoir capacity.
2. There are three (3) options for this issue.
3. The hydraulic gates constructed by ADB (2015) are in need of rehabilitation.

1. Plaing & Spean Sraeng Irrigation

- End of Plaing Main Canal (currently the MOWRAM project is under implementation), there is an issue on land acquisition.
- The end of the main canal shall be confirmed.

- Intervention on flood issue at Preah Dak village by the installation of the gate on the original river course.

Existing Bridges

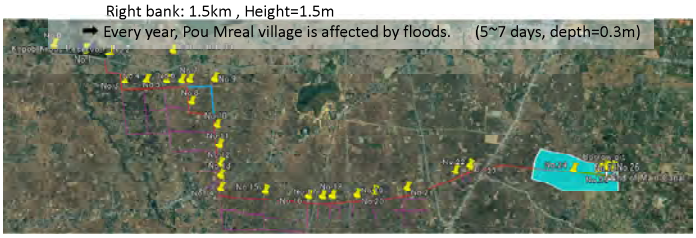
1. Plaing & Spean Sraeng Irrigation

- Khmeng Ancient (Angkor) Bridge

- Three options for the bridge issue.
- No project implementation
- Existing bridge along the embankment shall be replaced by embankment
- Provide dike and gate at the upstream side.

2. Khpob Krous Irrigation

1. MOWRAM was requested to identify the command area on February 24th, 2024.
2. PDWRAM plans to increase the water level by increasing the embankment top level +0.50 m.
3. Shall the Pond beneath the reservoir be included in JICA loan Project?
4. There is a domestic Water Supply project near the reservoir.
5. PDWRAM plans rehabilitation with the U-shape concrete canal (sandy soil).
6. Some canal routes in the existing plan shall be changed. Some secondary canals affect the existing houses and shops.
7. Food Affected Area is located around the end of the main canal.
   ➡ Last year, Main Canal dikes were broken by flood.
   Left bank: 1.0km, Height=1.5m
   Right bank: 1.5km , Height=1.5m
   ➡ Every year, Pou Mreal village is affected by floods. (5~7 days, depth=0.3m)

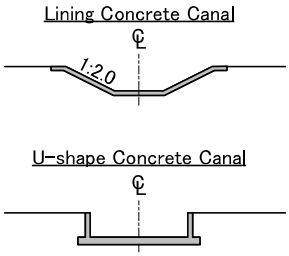


2. Khpob Krous Irrigation (1/4)

- The pond beneath the reservoir.

- The domestic water supply project.
- The current customer number is 700 households.
- After reservoir capacity increasing, the number will be increased as much as 2,000 H/H.

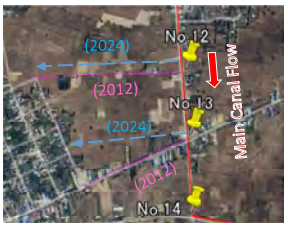
2. Khpob Krous Irrigation (2/4)



- PDWRAM plans to adopt U-shape flume canal.

- The existing main canal routes shall be changed because of land acquisition issue. (Blue line)

2. Khpob Krous Irrigation (3/4)



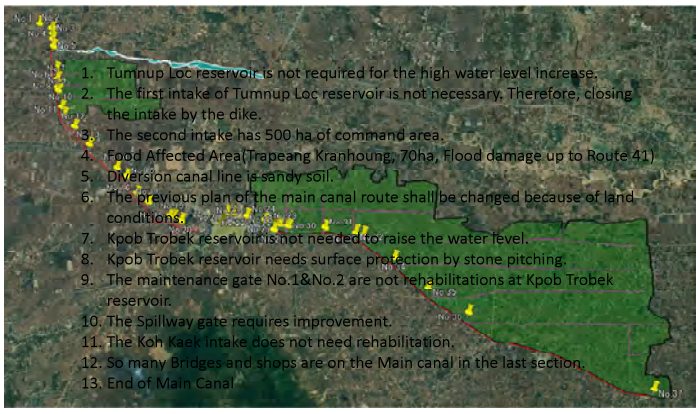
- The existing secondary canal route shall be re-considered because of houses and shops along the planned secondary canal routes. (Blue line)

2. Khpob Krous Irrigation (4/4)

- Embankment is damaged every year due to flood inundation.

- Mralal Thnot Cheung village is affected by flood inundation every year near the end of the main canal.

3. Tumnup Loc & Kpob Trobek Irrigation



1. Tumnup Loc reservoir is not required for the high water level increase.
2. The first intake of Tumnup Loc reservoir is not necessary. Therefore, closing the intake by the dike.
3. The second intake has 500 ha of command area.
4. Food Affected Area(Trapeang Kranhoung, 70ha, Flood damage up to Route 41)
5. Diversion canal line is sandy soil.
6. The previous plan of the main canal route shall be changed because of land conditions.
7. Kpob Trobek reservoir is not needed to raise the water level.
8. Kpob Trobek reservoir needs surface protection by stone pitching.
9. The maintenance gate No.1&No.2 are not rehabilitations at Kpob Trobek reservoir.
10. The Spillway gate requires improvement.
11. The Koh Kaek intake does not need rehabilitation.
12. So many Bridges and shops are on the Main canal in the last section.
13. End of Main Canal

3. Tumnup Lok & Kpob Trobek Irrigation (1/4)

- The required intake places confirmed with the Village leader and PDWRAM staff.
- The command area for the second intake is 500 ha (to be confirmed).
- Flood affected area (70 ha)

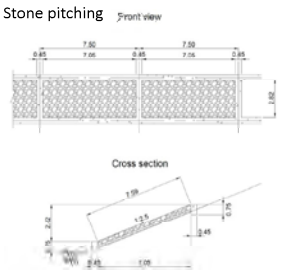
- The previous plan of the main canal route shall be gotten back because of land conditions.

3. Tumnup Lok & Kpob Trobek Irrigation (2/4)

- The two maintenance gates do not need rehabilitation.

- The Spillway gate requires improvement
- The bridge on the spillway shall be widen the width.

3. Tumnup Lok & Kpob Trobek Irrigation (3/4)



- The upper side bank of Khopb Trobek needs to be protected by stone pitching.

- The Koh Kaek intake does not need rehabilitation.

3. Tumnup Lok & Kpob Trobek Irrigation (4/4)

- There are many bridges on the main canal.
- Some shops are constructed on the main canal, especially at the end part of the canal.

- Canal rehabilitation works will be difficult because the canal area is restricted by the road and the houses.

MANY THANKS

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

Progress Meeting

June 14, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Objectives & Work Schedule

The objectives of this Survey are:

1) To identify the development needs in the irrigation sector,
2) To identify future candidate irrigation development projects for Japanese ODA loans.

Major Activities	2024				
	Apr	May	Jun	Jul	Aug
Field Survey in Cambodia					
Formulation of Irrigation Development Scenarios					
Identification of Potential Projects (long list & short list)					
Identification of Loan Candidate Projects					
Development of the Outlines for the Loan Candidate Projects					
Reporting (DFR)					

Agenda

1. Irrigation & Agricultural Development Status in Cambodia
2. Irrigation Development Scenarios
3. Selection for the Long List
4. Selection for the Short List
5. Examination on the 4 Prioritized Project

1. Irrigation & Agricultural Development Status

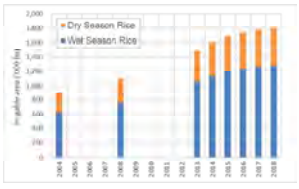
Current Higher-Level Plans and Development Strategies

- Pentagonal Strategy-Phase I (2023 – 2028)
  - ✓ Achieving the poverty reduction targeting of below 10% and continuing to reduce the poverty rate to a minimum.
  - ✓ Strengthening the rationalization of irrigation investments to ensure water security for agriculture and rural development
  - ✓ Continuing to enhance domestic market connectivity and export promotion
- National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033
  - ✓ Improving rural communities' resilience to flooding including reducing economic, social, and environmental impacts
- Strategic Development Plan for Cambodian Agro-Industries 2019-2030
  - ✓ Regarding rice as one of the agricultural commodities with potential for promoting agro-industry development (targeting 1.0 million tons/year of milled rice export)
- National Development Plan on Agriculture Sector 2022-2030
  - ✓ Aiming to transform Cambodia's agriculture sector into a more productive, sustainable, and competitive force by 2030. It seeks to leverage modern technologies, enhance irrigation systems, and improve farmers' skills and knowledge.

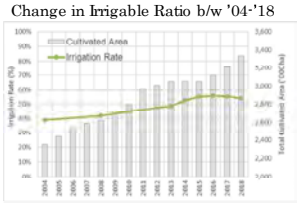
1. Irrigation & Agricultural Development Status

Change in Paddy Cultivated & Harvested Area with Irrigated Area between 1980-2023

Change in Irrigable Area b/w '04-'18



Change in Irrigable Ratio b/w '04-'18



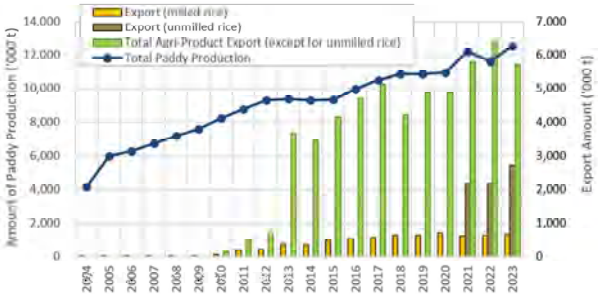
- Steady increase trend is confirmed for both wet and dry season paddy.
- Irrigable area is steadily increasing, but new rainfed paddy area is also developed so that irrigation ratio is not growing well, and more than 40% of the area can be irrigated.

Source: MAFF Annual Report 2023 and MOWRAM (2024)

1. Irrigation & Agricultural Development Status

Agricultural Export Status in Cambodia

Agriculture sector accounts 25% of total GDP, and lately both production and export of rice are increasing, which made Cambodia one of the world's 10th largest rice exporters (8th in 2022)



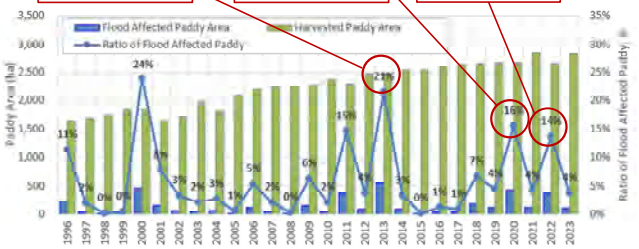
Source: MAFF Annual Report (2023)

1. Irrigation & Agricultural Development Status

Impact of Flood in Agriculture Sector – Impact to Crop

Based on the data of National Committee for Disaster Management (NCDM), serious impact of flood on the paddy area can be periodically seen.

Flood in 2013: 150.0 million USD
Flood in 2020: 187.5 million USD
Flood in 2022: 81.0 million USD



Source: MAFF Annual Report 2023, NCDM Annual Report 2020-2023, Cambodia Disaster Damage & Loss Information System (NCDM 2024)

1. Irrigation & Agricultural Development Status

Main Challenges in Irrigation Sector:

- Vulnerability to flood and drought due to followings:
  - Small capacity of the reservoirs/ dams due to terrain condition,
  - Deterioration/ Lack of facilities including the facility management system
  - Lack of hydrological information as well as the capacity development of information sharing/management,
- Lack of national standards for Irrigation development planning, design, and construction,
- Not sustainable operation and maintenance of irrigation facilities by FWUC

2. Irrigation Development Scenario

Irrigation Development Scenario for short/mid/long term is suggested as follows:
* The Future Project will contribute the achievement in red letters

Time Frame	Development Scenario and Goals	Relevance of MOWRAM Policies and Development Scenarios (NSDP & Road Map)
Short-term (- 3 years)	【Improvement of Productivity】 ● Rehabilitation of Small & Medium Irrigation Schemes and Strengthening O&M structure including FWUC ● Improvement of vulnerability to Flooding (Development of Drainage Canals, Improvement of Irrigation Facilities Durability against Flood) ● Establishment of Hydrological/Meteorological Information Monitoring Structure with Information Sharing ● Establishment and strengthening of FWUC and Land Holding Survey ● Improve Market Access for Agricultural Products ● Improve Agricultural Extension Service	● WRM and development including irrigation extension (1) ● Flood/Drought Management & Meteorology Info. Management (1) ● Ensure all services related to water resources will be used for more benefits for women in FWUC
Mid-term (3-10 years)	【Adaptation Measures for Climate Change Issues (Flood/Drought), Collaboration with the FVC Strengthening Projects】 ● Rehabilitation of Mid/Large Scale Irrigation Schemes ● Water Resources Development for Dry Season Cropping & Flood Mitigation Measures through dam construction ● Implementation of Integrated Water Resources Management for Adequate Water Allocation ● Increase in Value-added Agricultural Products for Export	● WRM and development including irrigation extension (1) ● Flood/Drought Management & Meteorology Info. Management (1)
Long-term (10 years -)	【Mitigation Measures for Climate Change Issues (e.g. Application of AWD or CSA)】 ● Water Resources Development by Dam Construction ● Strengthening of Integrated Water Resources Management including Water Quality Management ● Modernization of the Irrigation Facilities ● Consolidation of Farmland ● Introduction of modern agriculture with agri-tech.	● Water resources management decision-making processes underpinned by best available scientific information (2) ● Approval of the sub-decrees on water licensing and water quality(2)

3. Project for the Long List

Evaluation Condition for Long List Selection

Long List Selection is based on the following two-axis evaluation

1) Agricultural Land Potential

Natural conditions or artificial conditions which seem very hard to change

1. Water Resources (Availability & Variability)
2. Land Resources (Land Use and Fertility)
3. Change in Paddy Area

2) Investment Potential

Artificial conditions which can change but taking time, or type of irrigation applied in each irrigation scheme

1. Water Resources (Reliability: Capacity of Reservoir)
2. Irrigation Type (Gravity, Pump or Mixed)
3. Distance from the Primary Road

3) Screening Conditions

- **"Condition" should be less than 60% in CISIS* data**
- **Scale of Irrigation Scheme should be more than 3,000 ha**

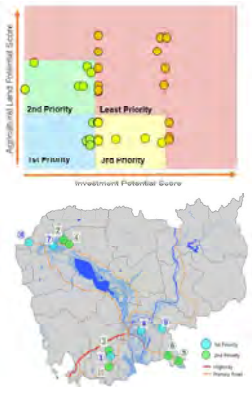
*CISIS: Cambodian Irrigation Scheme Information System

3. Project for the Long List

Result of Long List Selection

Following 11 Irrigation Schemes were selected for the Long List

No	Scheme Name	Province	Potential Area (ha)
1	Khpob Trobek & Tumnup Lok	Takeo	4,630
2	Spean Sraeng	B. Meanchey Siem Reap	12,500
3	Khpob Krous	Kampong Speu	3,018
4	Plaing	Siem Reap	14,800
5	Doun Toy	Svay Rieng	17,000
6	Tonle Vaico	Svay Rieng	16,360
7	Kambor Sres	B. Meanchey	3,600
8	Char Dam	Prey Veng	3,120
9	Chhnok Tru	Prey Veng	3,500
10	Khai Dorn	B. Meanchey	10,000
11	Trapeang Beung	Kampot	3,178



4. Project for the Short List

Criteria for Short List Selection

No.	Indicators	Weights	Evaluation
-	Relevance to the Government National Policies, Strategies, Plans and Programs in Irrigation/ Agriculture Sector	Pre-condition	◎=3 ○=2 △=1
1	Overlapped Projects by the Government and/or Other Donors Fund	Exclude if overlapped	
2	Degree of Emergency to Implement the Project	High (base score: 3)	
3	Impacts of Economic Benefits (Impact on Agricultural Productivity/Geographical Advantage for Agro-processing)	High (base score: 3)	
4	Adaptation Degree to Climate Change	High (base score: 3)	
5	Synergy/ Ripple Effects with Other ODA and Government Projects (agriculture projects, irrigation projects, and road improvement projects, etc.)	Middle (base score: 2)	
6	Degree of Poverty Reduction	Middle (base score: 2)	
7	O&M Capacity of Farmer Water User Community	Low (base score: 1)	
8	Land Acquisition and Resettlement	Consultation with MOWRAM/ JICA	

Weights x Evaluation Score = Total Score

4. Project for the Short List

Comparison Table for the Irrigation Schemes in First and Second Priority

No.		1	2	3	4	5	6	7	8	9	10	11
Item	Weight	Khpob Trobek & Tumnup Lok	Spean Sraeng	Khpob Kruos Reservoir	Plaing	Doun Toy Reservoir	Tonle Vaiko Reservoir	Kambor Sres	Char Dam	Chhnok Tru Dam	Khal Dom Reservoir	Trapeang Beung
Priority (1st Screening)	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Overlap of the Project	—	—	—	—	—	—	—	—	—	—	Exc.	Exc.
Emergency	3	◎ (3)	○ (2)	○ (2)	○ (2)	○ (2)	○ (2)	△ (1)	△ (1)	△ (1)	—	—
Impact on Economy	3	○ (2)	◎ (3)	○ (2)	◎ (3)	○ (2)	○ (2)	○ (2)	△ (1)	△ (1)	—	—
Degree of Adaptation on Climate Change	3	◎ (3)	◎ (3)	◎ (3)	○ (2)	◎ (3)	○ (2)	△ (1)	○ (2)	○ (2)	—	—
Synergy with Other Projects	2	◎ (3)	○ (2)	○ (2)	○ (2)	△ (1)	○ (2)	△ (1)	△ (1)	△ (1)	—	—
Impact on Poverty Reduction	2	○ (2)	◎ (3)	○ (2)	◎ (3)	△ (1)	△ (1)	○ (2)	△ (1)	△ (1)	—	—
Capcity of FWUC	1	◎ (3)	○ (2)	△ (1)	△ (1)	△ (1)	△ (1)	△ (1)	△ (1)	△ (1)	—	—
Total Score (Weight x Evalution)		◎ (37)	○ (34)	○ (30)	○ (30)	△ (26)	△ (25)	△ (21)	△ (17)	△ (17)	×	×

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5 Examination on Prioritized Irrigation Schemes

① Khpob Trobek & Tumnup Lok

* Project cost excludes resettlement & land acquisition cost

Item	Description
General Info	Province: Takeo Beneficiary Area: 5,115 ha, Beneficiary HHs: 3,334 HHs (1.53 ha/HH)
Main Component	Dike (U/S: Stone pitching), Headwork, Main Canal (lining) including Diversion Canal with Syphon Structure, Branch & Drainage Canals, and other structures such as intakes, a bridge and check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 41%, Drought Affected Area: 14%
Cropping Intensity	Wet Season: 100%, Dry Season: 10%
Poverty Ratio	Between 20% and 30% (Average in the Rural Area)
Rough Benefit	+273 USD/ha (168 to 441 USD/ha)
Rough Project Cost*	61.0 million USD, Direct Cost: 40.7 million USD
Synergy/Ripple Effects	FWUC through River Basin Water Resources Utilization Project (JICA, 2014), ASPIRE-AT (2015 -, IFAD, EIB, etc), Rice Seed Production and Promotion (JICA, 2017-2023), Cambodia Agricultural Value Chain (CAVAC) (Australia, 2010-2021), Irrigated Agriculture Improvement Project (ADB, 2019-2027), Climate-Friendly Agribusiness Value Chains Sector Project (ADB, 2020-2021)

The project especially contributes to…

(1) increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought
(especially to canal erosion by flood and water supply by diversion canal)
(3) capacity development for the medium-scale water allocation and flood response

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5 Examination on Prioritized Irrigation Schemes

② Spean Sraeng

* Project cost excludes resettlement & land acquisition cost

Item	Description
General Info	Province: Banteay Meanchey & Siem Reap Beneficiary Area: 12,500 ha, Beneficiary HHs: 4,459 HHs (2.80 ha/HH)
Main Component	Embankment (Surface leveling and Laterite pavement), Spillway (labyrinth weir) and headworks (constructed by ADB in 2015), Intakes (3 bridges replacement by gate structure), Main Canal (lining), Branch & Drainage Canals, and other structures such as check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 41%, Drought Affected Area: 12%
Cropping Intensity	Wet Season: 80%, Dry Season: 20%
Poverty Ratio	Between 40% and 50% (Double compared to the Rural Average)
Rough Benefit	+414 USD/ha (64 to 478 USD/ha)
Rough Project Cost	96.6 million USD, Direct Cost: 64.4 million USD
Synergy/Ripple Effects	Rice Seed Production and Promotion (JICA, 2017-2023), *Battambang province Northwest Irrigation Sector Project (ADB, 2005-2011), Water Resources Management Sector Development Program (ADB, 2007-2015), Upstream Reservoir Construction (Spean Sraeng 1 & 2) (China, 2015)

The project especially contributes to…

(1) great increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought by installation of drainage facilities,
and water supply structures by new gates installation,
(3) capacity development for the large-scale water supply management
(4) indirectly assisting the value adding product development and future cash crop cultivation 15

5 Examination on Prioritized Irrigation Schemes

③ Khpob Krous

* Project cost excludes resettlement & land acquisition cost

Item	Description
General Info	Province: Kampong Speu Beneficiary Area: 3,318 ha, Beneficiary HHs: 4,714 HHs (0.70 ha/HH)
Main Component	Raising Dam Embankment by 50cm (U/S: Stone pitching), Spillway Gate, Intakes, Main Canal (U-shape flume), Branch & Drainage Canals, and other structures such as check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 2%, Drought Affected Area: 14%
Cropping Intensity	Wet Season: 100%, Dry Season: 10%
Poverty Ratio	Between 20% and 30% (Average in the Rural Area)
Rough Benefit	+75 USD/ha (424 to 499 USD/ha)
Rough Project Cost	64.3 million USD , Direct Cost: 42.9 million USD
Synergy/Ripple Effects	ASPIRE-AT (2015 -, IFAD, EIB, etc), Climate-Friendly Agribusiness Value Chains Sector Project (ADB, 2020-2021)

The project especially contributes to…

(1) increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought
(especially to canal erosion by flood, water supply by raised embankment),
(3) capacity development for the medium-scale water allocation & flood response

16

5 Examination on Prioritized Irrigation Schemes

④ Plaing

* Project cost excludes resettlement & land acquisition cost

Item	Description
General Info	Province: Siem Reap Beneficiary Area: 16,300 ha, Beneficiary HHs: 7,309 HHs (2.23 ha/HH)
Main Component	Embankment (Surface leveling and Laterite pavement), Installation of Spillway Structure, Intakes, Main Canal (lining), Branch & Drainage Canals, and other structures such as check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 17%, Drought Affected Area: 8%
Cropping Intensity	Wet Season: 100%, Dry Season: 10%
Poverty Ratio	Between 40% and 50% (Double compared to the Rural Average)
Rough Benefit	+300 USD/ha (132 to 432 USD/ha)
Rough Project Cost	106.6 million USD, Direct Cost: 71.1 million USD
Synergy/Ripple Effects	ASPIRE-AT (2015 -, IFAD, EIB, etc), Northwest Irrigation Sector Project (ADB, 2005-2011), Water Resources Management Sector Development Program (ADB, 2007-2015), Upstream Reservoir Construction (Spean Sraeng 1 & 2) (China, 2015)

The project especially contributes to…

(1) great increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought by installation of drainage facilities,
and water supply structures by new gates installation,
(3) capacity development for the large-scale water supply management
(4) indirectly assisting the value adding product development and future cash crop cultivation 17

Thank You

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

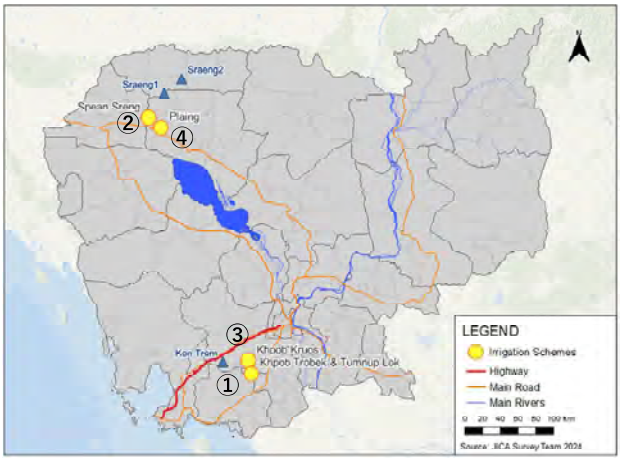
Supporting Maps and Photos

June 14, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

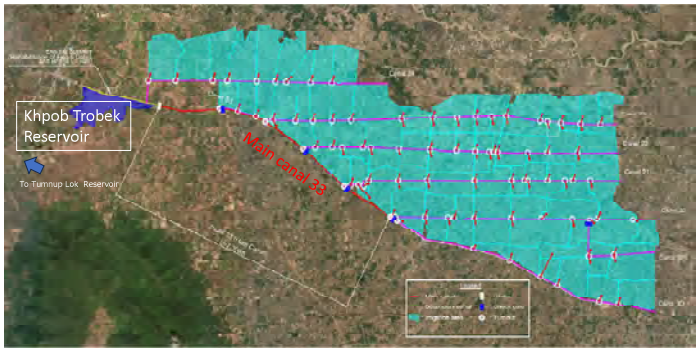
1

5 Examination on Prioritized Irrigation Schemes



2

① Khpob Trobek Irrigation Scheme



Beneficial area: 4,115 ha

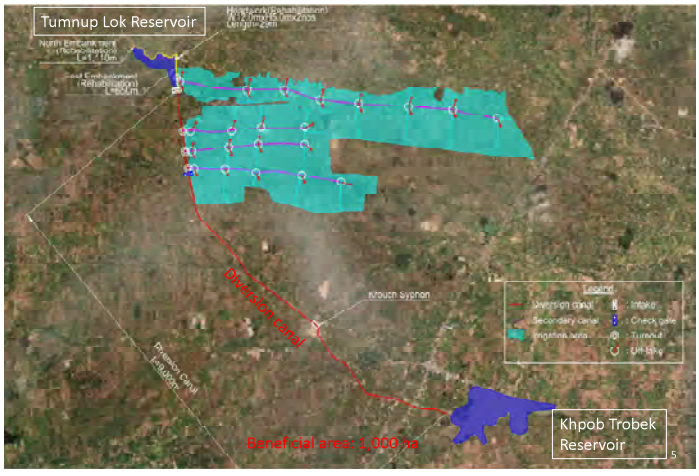
3

① Khpob Trobek Irrigation Scheme

	
Spillway	Intake for Main Canal 33
	
Check Gate on the Main Canal 33	Main Canal 33

4

① Tumnup Lok Irrigation Scheme



5

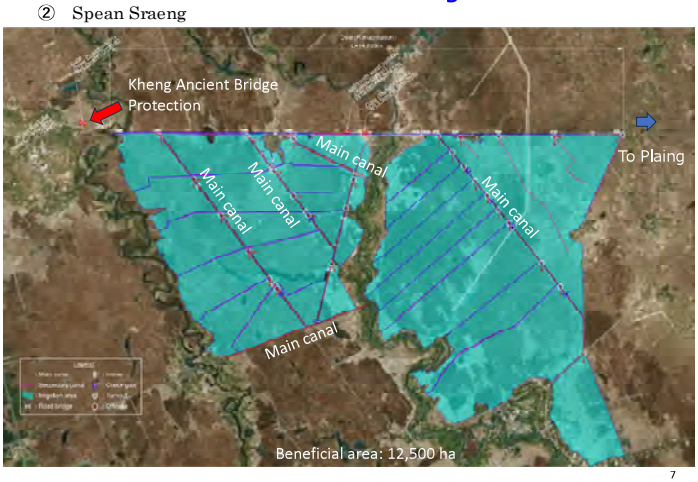
① Tumnup Lok Irrigation Scheme

	
Headwork	Intake for Diversion Canal
	
Syphon	Diversion Canal

6

5 Examination on Prioritized Irrigation Schemes

② Spean Sraeng



7

② Spean Sraeng Irrigation Scheme

Khmeng Ancient Bridge

Main Canal

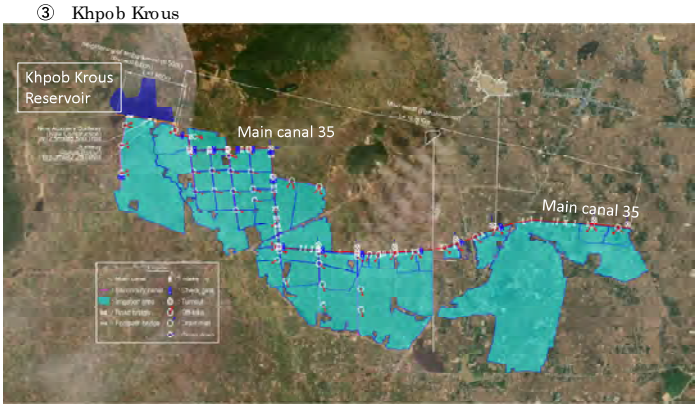
Gate constructed by ADB

Branch Canal

8

5 Examination on Prioritized Irrigation Schemes

③ Khpob Krous



Beneficial area: 3,318 ha

9

③ Khpob Krous Irrigation Scheme

Spillway

Intake for Main Canal

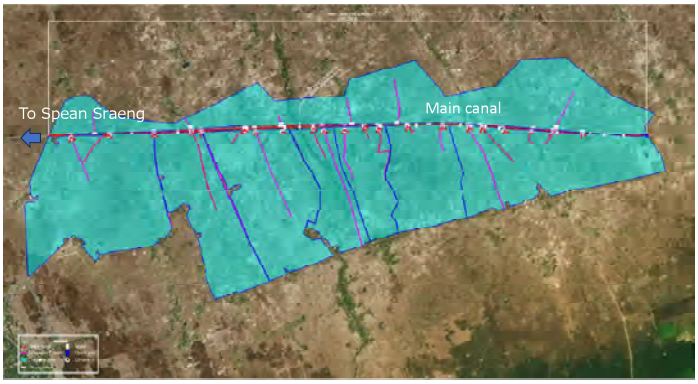
Main Canal

Bare Soil of Main Canal

10

5 Examination on Prioritized Irrigation Schemes

④ Plaing



Beneficial area: 16,300 ha

11

④ Plaing Irrigation Scheme

Dike Crest of Main Canal

Main Canal

Gate

Branch Canal

12

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

Progress Meeting

June 24, 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Follow-up Task for Finalization

1. Check again if the project aligns with higher plans in Agriculture & Irrigation Sector,
   - Confirmation on Strategic Development Plan on 2024-2028
2. Check again if there are any overlapped projects,
   - Confirmation on the record of rehabilitation/ maintenance (Implementation Year, Budget, Contents)
3. Confirm MOWRAM's thoughts on prioritization among four schemes with latest info,
   - Final Decision on the most prioritized Irrigation Scheme based on the updated Survey Results
4. Discussion with JICA and JICA's decision on prioritization, and finally
5. Meeting with MEF again

2

1. Check again if the project aligns with higher plans in Agriculture & Irrigation Sector

Current Higher-Level Plans and Development Strategies

- Pentagonal Strategy-Phase I (2023 – 2028)
  - ✓ Achieving the poverty reduction targeting of below 10% and continuing to reduce the poverty rate to a minimum.
  - ✓ Strengthening the rationalization of irrigation investments to ensure water security for agriculture and rural development
  - ✓ Continuing to enhance domestic market connectivity and export promotion
- National Water Resources Management and Sustainable Irrigation Road Map and Investment Program 2019-2033
  - ✓ Improving rural communities' resilience to flooding including reducing economic, social, and environmental impacts
- Strategic Development Plan for Cambodian Agro-Industries 2019-2030
  - ✓ Regarding rice as one of the agricultural commodities with potential for promoting agro-industry development (targeting 1.0 million tons/year of milled rice export)
- National Development Plan on Agriculture Sector 2022-2030
  - ✓ Aiming to transform Cambodia's agriculture sector into a more productive, sustainable, and competitive force by 2030. It seeks to leverage modern technologies, enhance irrigation systems, and improve farmers' skills and knowledge.

3

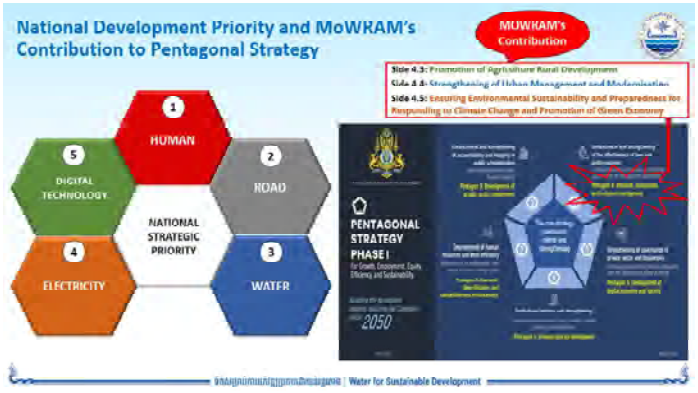
Confirmation on Strategic Development Plan on 2024-2028

Reference

4

Confirmation on Strategic Development Plan on 2024-2028

Reference



5

Confirmation on Strategic Development Plan on 2024-2028

Reference

6

Confirmation on Strategic Development Plan on 2024-2028

Reference

7

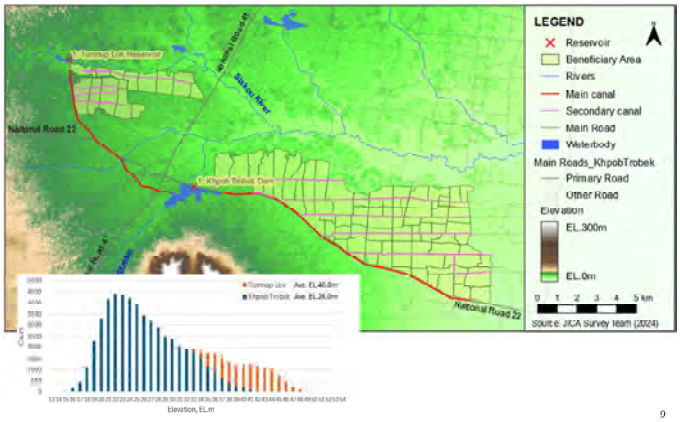
2. Confirmation on the record of rehabilitation/maintenance (Implementation Year, Budget, Contents)

1. Khpob Trobek
   - Rehabilitation in 2005 (by MOWRAM)
   - Rehabilitation in 2015 (500,000 USD by MOWRAM)
   - Rehabilitation in 2022 (600,000 USD by MOWRAM)
2. Tumnup Lok
   - No Rehabilitation/Maintenance ever
3. Khpob Krous
   - Rehabilitation in 2007 (based on PDWRAM)
   - Rehabilitation in 2010 (past FS report)
4. Spean Sraeng
   - Rehabilitation in 2015 (by ADB)
   - Rehabilitation/ Maintenance in 2020 (150,000 USD by MOWRAM)
   - Rehabilitation/ Maintenance in 2024 (850,000 USD by MOWRAM)
5. Plaing
   - No Rehabilitation/Maintenance ever

8

5 Examination on Prioritized Irrigation Schemes

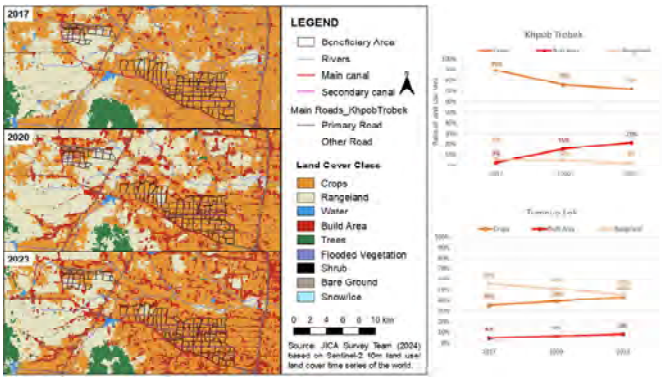
① Khpob Trobek & Tumnup Lok



9

5 Examination on Prioritized Irrigation Schemes

① Khpob Trobek & Tumnup Lok



10

5 Examination on Prioritized Irrigation Schemes

① Khpob Trobek & Tumnup Lok

* Project cost excludes resettlement & land acquisition cost

Item	Description
General Info	Province: Takeo Beneficiary Area: 5,115 ha, Beneficiary HHs: 3,334 HHs (1.53 ha/HH)
Main Component	Dike (U/S: Stone pitching), Headwork, Main Canal (lining) including Diversion Canal with Syphon Structure, Branch & Drainage Canals, and other structures such as intakes, a bridge and check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 41%, Drought Affected Area: 14%
Cropping Intensity	Wet Season: 100%, Dry Season: 10%
Poverty Ratio	Between 20% and 30% (Average in the Rural Area)
Rough Benefit	+343 USD/ha (110 to 452 USD/ha)
Rough Project Cost*	58.7 million USD, Direct Cost: 39.2 million USD
Synergy/Ripple Effects	FWUC through River Basin Water Resources Utilization Project (JICA, 2014), ASPIRE-AT (2015 -, IFAD, EIB, etc), Rice Seed Production and Promotion (JICA, 2017-2023), Cambodia Agricultural Value Chain (CAVAC) (Australia, 2010-2021), Irrigated Agriculture Improvement Project (ADB, 2019-2027), Climate-Friendly Agribusiness Value Chains Sector Project (ADB, 2020-2021)

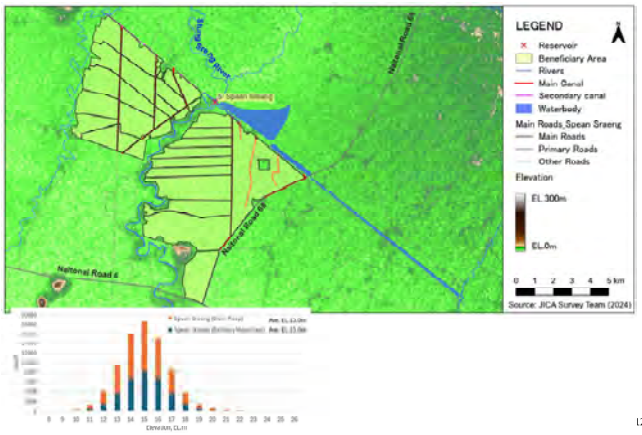
The project especially contributes to…

(1) increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought
(especially to canal erosion by flood and water supply by diversion canal)
(3) capacity development for the medium-scale water allocation and flood response

11

5 Examination on Prioritized Irrigation Schemes

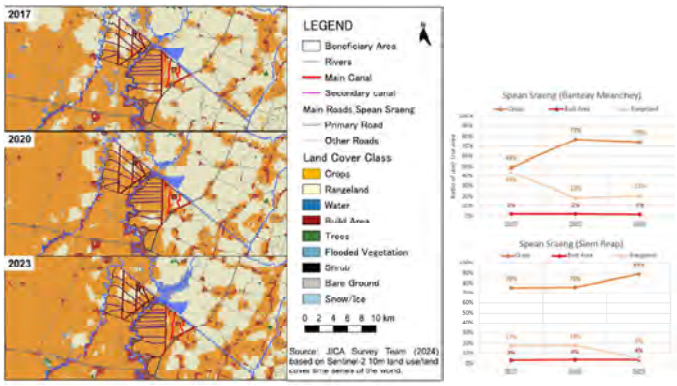
② Spean Sraeng



12

5 Examination on Prioritized Irrigation Schemes

② Spean Sraeng



5 Examination on Prioritized Irrigation Schemes

② Spean Sraeng

* Project cost excludes resettlement & land acquisition cost

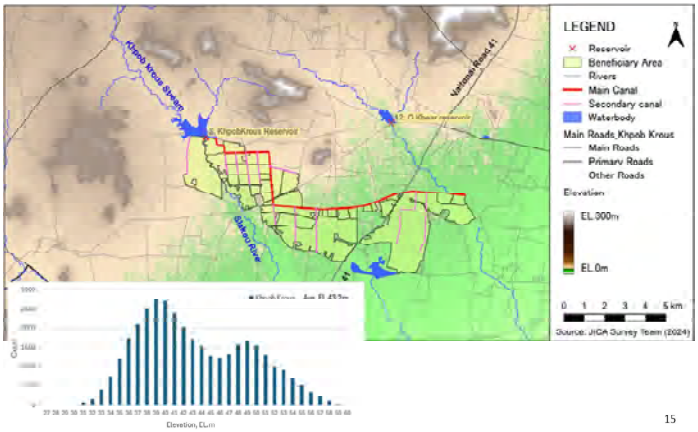
Item	Description
General Info	Province: Banteay Meanchey & Siem Reap Beneficiary Area: 12,500 ha, Beneficiary HHs: 4,459 HHs (2.80 ha/HH)
Main Component	Embankment (Surface leveling and Laterite pavement), Spillway (labyrinth weir) and headworks (constructed by ADB in 2015), Intakes (3 bridges replacement by gate structure), Main Canal (lining), Branch & Drainage Canals, and other structures such as check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 41%, Drought Affected Area: 12%
Cropping Intensity	Wet Season: 80%, Dry Season: 20%
Poverty Ratio	Between 40% and 50% (Double compared to the Rural Average)
Rough Benefit	+360 USD/ha (134 to 494 USD/ha)
Rough Project Cost	112.0 million USD, Direct Cost: 74.7 million USD
Synergy/Ripple Effects	Rice Seed Production and Promotion (JICA, 2017-2023), *Battambang province Northwest Irrigation Sector Project (ADB, 2005-2011), Water Resources Management Sector Development Program (ADB, 2007-2015), Upstream Reservoir Construction (Spean Sraeng 1 & 2) (China, 2015)

The project especially contributes to…

(1) great increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought by installation of drainage facilities, and water supply structures by new gates installation,
(3) capacity development for the large-scale water supply management
(4) indirectly assisting the value adding product development and future cash crop cultivation

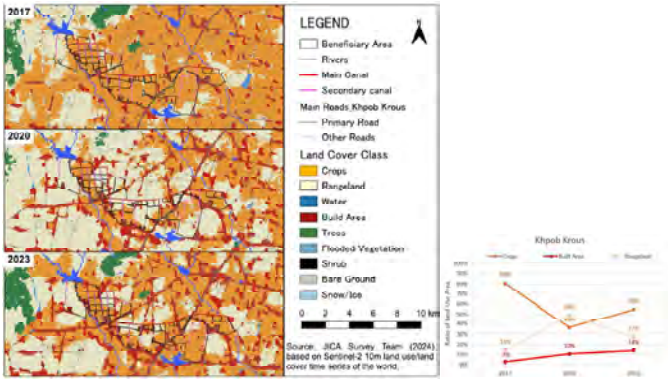
5 Examination on Prioritized Irrigation Schemes

③ Khpob Krous



5 Examination on Prioritized Irrigation Schemes

③ Khpob Krous



5 Examination on Prioritized Irrigation Schemes

③ Khpob Krous

* Project cost excludes resettlement & land acquisition cost

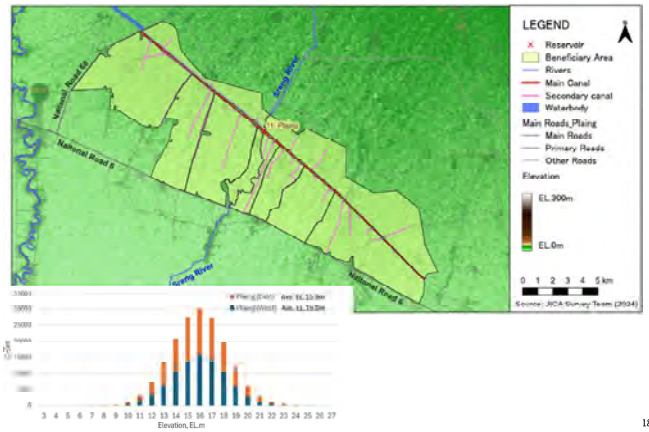
Item	Description
General Info	Province: Kampong Speu Beneficiary Area: 3,318 ha, Beneficiary HHs: 4,714 HHs (0.70 ha/HH)
Main Component	Raising Dam Embankment by 50cm (U/S: Stone pitching), Spillway Gate, Intakes, Main Canal (U-shape flume), Branch & Drainage Canals, and other structures such as check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 2%, Drought Affected Area: 14%
Cropping Intensity	Wet Season: 100%, Dry Season: 10%
Poverty Ratio	Between 20% and 30% (Average in the Rural Area)
Rough Benefit	+123 USD/ha (375 to 498 USD/ha)
Rough Project Cost	64.7 million USD , Direct Cost: 43.1 million USD
Synergy/Ripple Effects	ASPIRE-AT (2015 -, IFAD, EIB, etc), Climate-Friendly Agribusiness Value Chains Sector Project (ADB, 2020-2021)

The project especially contributes to…

(1) increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought (especially to canal erosion by flood, water supply by raised embankment),
(3) capacity development for the medium-scale water allocation & flood response

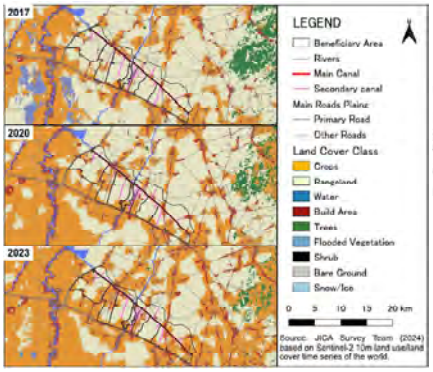
5 Examination on Prioritized Irrigation Schemes

④ Plaing



5 Examination on Prioritized Irrigation Schemes

④ Plaing



5 Examination on Prioritized Irrigation Schemes

④ Plaing

* Project cost excludes resettlement & land acquisition cost

Item	Description
General Info	Province: Siem Reap Beneficiary Area: 16,300 ha, Beneficiary HHs: 7,309 HHs (2.23 ha/HH)
Main Component	Embankment (Surface leveling and Laterite pavement), Installation of Spillway Structure, Intakes, Main Canal (lining), Branch & Drainage Canals, and other structures such as check facilities and FWUC Office
Damage by Flood and Drought	Flood Affected Area: 17%, Drought Affected Area: 8%
Cropping Intensity	Wet Season: 100%, Dry Season: 10%
Poverty Ratio	Between 40% and 50% (Double compared to the Rural Average)
Rough Benefit	+340 USD/ha (191 to 531 USD/ha)
Rough Project Cost	136.9 million USD, Direct Cost: 91.3 million USD
Synergy/Ripple Effects	ASPIRE-AT (2015 -, IFAD, EIB, etc), Northwest Irrigation Sector Project (ADB, 2005-2011), Water Resources Management Sector Development Program (ADB, 2007-2015), Upstream Reservoir Construction (Spean Sraeng 1 & 2) (China, 2015)

The project especially contributes to…

(1) great increase in agricultural productivity and quality,
(2) improvement of resiliency to flood & drought by installation of drainage facilities, and water supply structures by new gates installation,
(3) capacity development for the large-scale water supply management
(4) indirectly assisting the value adding product development and future cash crop cultivation

Ver. 2024 June 20

6. Project Cost (1/2)

UNIT: US$

Items	Tumnup Lok	Khpob Trobek	Khpob Krous	Spean Sraeng	Plaing
Dike	1,131,420 (5.48%)	453,181 (2.45%)	836,985 (1.94%)	295,823 (0.40%)	5,868,376 (6.43%)
Spillway / Headwork	12,785,554 (61.90%)	976,005 (5.28%)	14,753,849 (34.20%)	21,489,977 (28.77%)	50,245,365 (55.05%)
Other structure	59,906 (0.29%)	1,290,597 (6.98%)	770,472 (1.79%)	17,183,948 (23.00%)	157,803 (0.17%)
Main canal	3,902,986 (18.90%)	4,828,052 (26.10%)	21,627,500 (50.13%)	27,456,827 (36.75%)	25,028,560 (27.42%)
Other canals	1,392,041 (6.69%)	7,116,960 (38.48%)	2,496,929 (5.79%)	6,799,325 (9.10%)	9,405,935 (10.31%)
Others	1,392,195 (6.74%)	3,832,411 (20.72%)	2,656,693 (6.16%)	1,481,684 (1.98%)	568,416 (0.62%)
Direct Cost	20,654,102	18,497,206	43,142,428	74,707,584	91,274,455
Other Cost	10,323,952	9,245,830	21,564,743	37,342,586	45,623,538
Project Cost	30,978,054	27,743,036	64,707,171	112,050,170	136,897,993
	58,721,090				

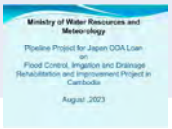
Note: Percentage of Direct Cost in parentheses ( )
Other Cost = In-direct Cost + Miscellaneous Cost + Consultant Fee
+ Physical contingency(Including Price escalation) + Administration Fee

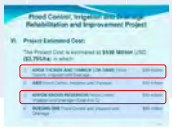
Ver. 2024 June 20

6. Project Cost (2/2)

UNIT: US$

Items	Tumnup Lok	Khpob Trobek	Khpob Krous	Spean Sraeng	Plaing
Beneficiary Area (ha)	5,115 ha		3,318 ha	12,500 ha	16,300 ha
Project Cost	58,721,090		64,707,171	112,050,170	136,897,993
Project Cost (per ha)	11,480		19,502	8,964	8,399
Rank on Cost Effectiveness	**3**		**4**	**2**	**1**
[Reference] Pipeline Project for Japan ODA Loan (MOWRAM)	39,000,000		35,000,000	65,000,000	60,000,000





Thank You

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

Prioritization of the 4 Projects

July 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Follow-up Task for Finalization

1. Contribution to Higher Plans
2. Projects and Plans by the Other DPs
3. Prioritized Project
4. Further Schedule

2

1. Contribution to Higher Plans – Expected Impact by Project

Actions (Main Components by Expected Project)

- Functionalize Irrigation Facilities through Rehabilitation
- Install Secure & Durable Irrigation Facilities against Flood
- Develop Water Resources (Diversion Canal & Raising Embankment)
- Install Diversion Canal between Watersheds (Khpob Trobek & Tumnup Lok)
- Install Hydro-meteorological Stations (Scientific-evidence-based Management)
- Establish/Enhance Farmer Water User Community (FWUC)

Direct Impacts

- Enhance Productivity & Quality of Agricultural Products
- Improve Sustainability of Irrigation Activity (Resiliency against Flood)
- Enhance Market Access and Ease of Passage
- Improve Water Utilization Efficiency (Resiliency against Drought)
- Improve Response to Flood/Drought (Water Management)
- Create the Environment for Climate Change Friendly Farming Technique

Indirect Impacts

- Assist to Boost Production of the Value-Added Products
- Assist to Boost the Export Amount of Agriculture Products

3

1. Contribution to Higher Plans

Pentagonal Strategy Ph1 (2023-2028)

[Objective]

- *Achieving the poverty reduction targeting of below 10% and continuing to reduce the poverty rate to a minimum.*

[Key Priorities] Pentagon4

Side3. Promotion of Agriculture and Rural Development

3.2 Promoting agricultural production with a focus on enhancing productivity, quality, safety, diversity, values added and resilience

3.3 Strengthening the rationalization of irrigation investment to ensure water security for agriculture and rural development, and

3.7 Continuing to enhance domestic market connectivity and export promotion

National WRM* and Sustainable Irrigation Road Map and Investment Program 2019-2033

[Vision]

- *Sustainable management and development of Cambodia's water resources to support economic growth and protection of water resources for social benefits and ecosystem functions*

[Goals]

(iii) Improved rural communities' resilience to flooding including reducing economic, social, and environmental impacts;

(v) Improved efficiency and effectiveness of irrigation schemes to support profitable agriculture

*WRM: Water Resources Management

4

1. Contribution to Higher Plans

National Agricultural Development Policy 2022-2030

[Overall goal]

- *To increase agricultural growth with high competitiveness and inclusivity by providing high-quality products, which result in food safety and nutrition, while taking into account sustainable management of land, water, forestry and fishery resources .*

[Objective]

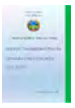
Objective 1: Enhance the competitiveness of agricultural value chains

1.1 Increase productivity and value addition of crop value chain

1.10 Improve market access for small and medium farmers

Objective 2: Increase support for infrastructure in agriculture and agribusiness facilitation

2.1 Increase effectiveness of agricultural irrigation system



Strategic Development Plan for Cambodian Agro-Industries 2019-2030

[Overall goal]

- *To increase share of export of processed agricultural products to 15% in total export volume by 2030.*

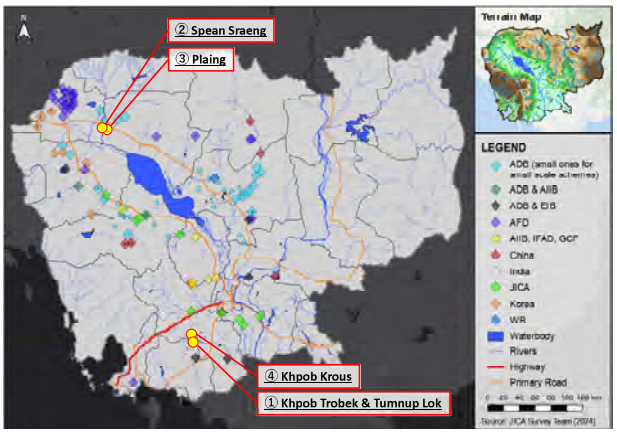
[Strategy]

Stage 1: Agro-Industry Strengthening Phase

optimizing – enhancing, strengthening and modernizing – existing agribusinesses that produce products potential for export and import substitution.

5

2. Projects and Plans by the Other DPs



MOWRAM and the Survey Team have confirmed there is no overlapped on-going or planned Projects

6

3. Prioritized Project by MOWRAM – Further Comparison Table

Name		① Khpob Trobek & Tumnup Lok	② Spean Sraeng
Score on Short List Selection		37 (1st)	36 (2nd)
Potential Beneficiary Area		5,115 ha	12,500 ha
Before Project	Cropping Intensity	Wet: 100% Dry: 5%	Wet: 80% Dry: 32%
	Flood/Drought Damaged Ratio	Flood: 30% Drought: 7%	Flood: 41% Drought: 12%
After Project (Estimated)	Cropping Intensity	Wet: 100% Dry: 8%	Wet: 100% Dry: 38%
	Flood/Drought Damaged Ratio	Flood: 0% Drought: 0%	Flood: 21% Drought: 0%
Estimated Rough Cost (million USD)		58.7	112.1
Current Annual Income (Riel/capita)		10,987	9,269
Expected Additional Income by Project (Riel/capita)		1,285	2,478
Annual Income after Project (Riel/capita)		12,271	11,747

Source: JICA Survey Team 2024

3. Prioritized Project by MOWRAM – Further Comparison Table

JICA Survey Team and MOWRAM agree with the following priority:

1st Priority: Khpob Trobek & Tumnup Lok Irrigation Scheme **(KTTL)**

2nd Priority: Spean Sraeng Irrigation Scheme **(SS)**

Reason:

- As a basic premise, both irrigation schemes are equally very significant to implement.
- The KTTL has more in emergency from the aspect of drought measure, and therefore plan to functionalize a diversion canal from the Tumnup Lok reservoir.
- Furthermore, rehabilitation in KTTL requires more technical consideration in design and construction to prevent erosion due to the existence of dispersive soil, which is more suitable for the support from Japan.
- Takeo province has largest number of Agriculture Cooperatives and has received many supports that can make synergy effect with the KTTL project. Those past projects can assist to boost value-added agri-products' production and increase the amount of export. Considering those circumstances, change in cultivation crop from rice to vegetable or other profitable products can be most probably occur in future, which can contribute to the goals of the higher plans in Agriculture Sector.
- The water resource of SS is Stung Sreng which has around 8,000km^2 of watershed. It makes much more effort to complete protection from flood without construction of reservoirs/dams with enough capacity (Sreng1 and 2 reservoirs are still not enough). Therefore, impact in flood protection would be limited and a larger scale of study is necessary to clarify the impact of the rehabilitation, which may result in the increase of implementation cost to expect enough impact.

4. Further Schedule

By Friday 5 July 2024, please let the survey team or JICA know MEF's opinion on the following two issues:

1. **Whether MEF would agree with the proposed first priority irrigation site, which is Khpob Trobek & Tumnup Lok Irrigation Scheme (KTTL).**
2. **Would MFE agree on the first priority irrigation site can be considered as the candidate site for JICA's Feasibility Study.**

The schedule for the report submission is as follows:

- **Draft Final Report**

  Middle of July 2024 (submission to JICA as draft version)
- **Final Report**

  End of August 2024

DATA COLLECTION SURVEY ON IRRIGATION AND FLOOD PROTECTION

DFR Meeting

August 2024

SANYU CONSULTANTS INC., (SCI) TOKYO, JAPAN

Topic

1. Updates from the Last Meeting
   - 1.1 Contents of DFR
   - 1.2 Project Cost
   - 1.3 Project Benefit
2. Considerations for Further Survey
3. Further Schedule

1.1 Contents of Draft Final Report

From the Interim Report, the following chapters are added

Chapter 5 to 8 show Result of Additional Survey for 4 Prioritized Irrigation Scheme, composing of following:

1. General Feature
   (1) Location, (2) Topography, (3) Land Use, (4) Meteo/Hydro Conditions, (5) Existing Irrigation Facilities, (6) Socio-Economic Factors, and (7) Environmental and Social Conditions
2. Agricultural Status and Agricultural Development Plans
   (1) Agricultural Status, and (2) Agricultural Development Plan
3. Outline of the Project Plan
   (1) Basic Concept, (2) Flood Assessment and Water Balance Calculations, and (3) Irrigation Development Plan
4. Project Cost and Benefit
   (1) Conditions for Cost Estimation, (2) Project Cost, and (3) Project Benefit

1.1 Contents of Draft Final Report

From the Interim Report, the following chapters are added

Chapter 9 shows examination result of common factors for each project, which consists of:

1. Summary of Chapter 5 to 8
2. Construction Schedule and Project Duration
3. Applicable Technology
4. Management, O&M of Irrigation Scheme
5. Establishment of FWUC
6. Impact on Poverty Reduction
7. Environmental and Social Considerations
8. Consultant Services and Procurement

Chapter 10 describes the conclusion and considerations for further surveys

1.2 Project Cost

Name		① Khpob Trobek & Tumnup Lok	② Spean Sraeng
Score on Short List Selection		37 (1st)	36 (2nd)
Potential Beneficiary Area		5,115 ha	12,500 ha
Before Project	Irrigated Area	Wet: 3,300 ha (65%) Dry: 256 ha (5%)	Wet: 10,000 ha (80%) Dry: 4,000 ha (32%)
	Flood/Drought Damaged Area	Flood: 1,535 ha (30%) Drought: 716 ha (7%)	Flood: 5,125 ha (41%) Drought: 1,250 ha (12%)
After Project (Estimated)	Irrigated Area	Wet: 5,115 ha (100%) Dry: 512 ha (10%)	Wet: 12,500 ha (100%) Dry: 4,750 ha (38%)
	Flood/Drought Damaged Area	Flood: 0 ha (0%) Drought: 0 ha (0%)	Flood: 2,625 ha (21%) Drought: 0 ha (0%)
Estimate Rough Direct Cost		51.4 million USD	96.1 million USD
Estimated Rough Project Cost		90.1 million USD (75.6 million USD for Loan)	168.1 million USD (140.9 million USD for Loan)

Source: JICA Survey Team 2024

1.2 Project Cost

Condition of Cost Estimation

No.	Items	Contents
1	Direct Cost	Cost of Civil & Structure Works
2	In-direct Cost	1) × 15%
3	Miscellaneous Cost	1) × 10%
4	Consultant Fee	8%
5	Price Escalation Rate	FC: 3.24% LC: 5.65%
6	Physical Contingency	5%
7	Land Acquisition	1) × 5%
8	Administration Fee	5%
9	VAT	10%
10	Tax for Consulting Service	15%
11	Exchange Rate	US$1 = 4,006 Riel = 156.8 JPY

Source: JICA Survey Team 2024

1.3 Project Benefit

Name		① Khpob Trobek & Tumnup Lok	② Spean Sraeng
Score on Short List Selection		37 (1st)	36 (2nd)
Potential Beneficiary Area		5,115 ha	12,500 ha
Before Project	Irrigated Area	Wet: 3,300 ha (65%) Dry: 256 ha (5%)	Wet: 10,000 ha (80%) Dry: 4,000 ha (32%)
	Flood/Drought Damaged Area	Flood: 1,535 ha (30%) Drought: 716 ha (7%)	Flood: 5,125 ha (41%) Drought: 1,250 ha (12%)
After Project (Estimated)	Irrigated Area	Wet: 5,115 ha (100%) Dry: 512 ha (10%)	Wet: 12,500 ha (100%) Dry: 4,750 ha (38%)
	Flood/Drought Damaged Area	Flood: 0 ha (0%) Drought: 0 ha (0%)	Flood: 2,625 ha (21%) Drought: 0 ha (0%)
Current Benefit by Farming		1,386,000 Riel/HH/year	4,507,000 Riel/HH/year
Future Benefit by Farming		3,544,000 Riel/HH/year	8,578,000 Riel/HH/year
Current Annual Income (Riel/day/capita)		10,987	9,269
Expected Additional Income by Project (Riel/day/capita)		1,285	2,478
Annual Income after Project (Riel/day/capita)		12,271	11,747

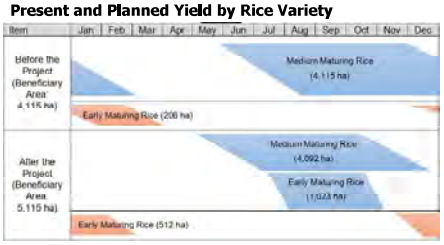
Source: JICA Survey Team 2024

1.3 Project Benefit – Calculation Condition for KT&TL

Present and Planned Yield by Rice Variety

Rice Variety	Yield (Present)	Yield (Plan)	Remarks
Phka Rumduol	2.4 t/ha	3.7 t/ha	1.2 t/ha for farmland with flood/drought damage
OM 5451	3.9 t/ha	5.0 t/ha	
Sen Kro Ob	1.9 t/ha	4.5 t/ha	Currently, not much planted, but planned in future to make synergy effect with the other JICA project.

Present and Planned Yield by Rice Variety



Yield before Project

Season	Yield (Present)
Wet	2.4 t/ha
Dry	3.9 t/ha

Yield after Project

Season	Yield (Plan)
Wet	3.7 t/ha
Dry	5.0 t/ha

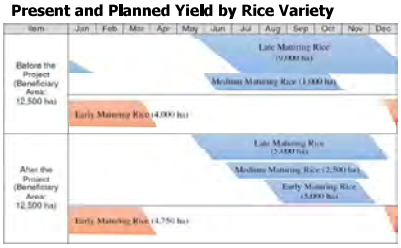
Source: JICA Survey Team 2024

1.3 Project Benefit – Calculation Condition for SS

Present and Planned Yield by Rice Variety

Rice Variety	Yield (Present)	Yield (Plan)	Remarks
Deep Water Rice	1.6 t/ha	2.0 t/ha	1.2 t/ha for farmland with flood/drought damage
Phka Rumduol	1.6 t/ha	3.0 t/ha	
OM 5451	5.0 t/ha	5.5 t/ha	
Sen Kro Ob	-	4.5 t/ha	Currently, not much planted, but planned in future to make synergy effect with the other JICA project.

Present and Planned Yield by Rice Variety



Yield before Project

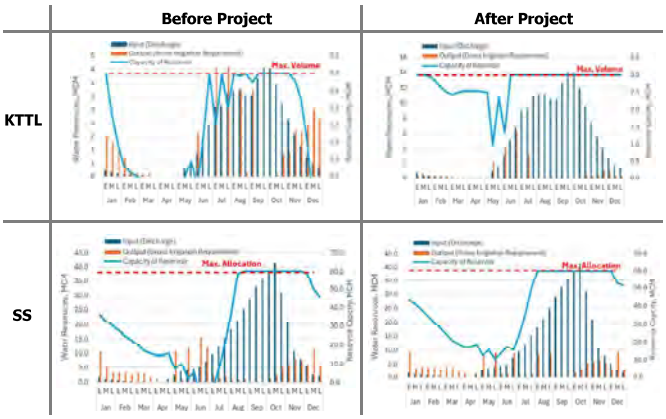
Season	Yield (Present)
Wet	1.6 t/ha
Dry	5.0 t/ha

Yield after Project

Season	Yield (Plan)
Wet	3.1 t/ha
Dry	5.1 t/ha

Source: JICA Survey Team 2024

1.3 Project Benefit – Water Balance Calculation



Source: JICA Survey Team 2024

2. Considerations for Further Surveys

- Distribution of Dispersive Soils
  - Dispersive soils are widely distributed in Cambodia, including in the target schemes. Soil analyses in the Khpob Trobek and Tumnup Lok Irrigation Schemes, as well as Khpob Krous Irrigation Scheme, have confirmed the presence of dispersive soils. The NaSDeP report recommends considering appropriate measures for these soils, suggesting concrete block-lined canals due to their ease of repair. Therefore, it is crucial to assess the distribution of dispersive soils during the next feasibility study and incorporate the findings into the design.
- Environmental Procedures
  - According to the Ministry of Environment's EIA Department, for rehabilitation projects, similar to new irrigation development areas, an Environmental Protection Contract (EPC) is required for areas ranging from 1,000 to 5,000 hectares, and an Initial Environmental Impact Assessment (IEIA) is required for areas exceeding 5,000 hectares.
  - For example, Korean project in Svay Rieng Province, "Eastern Mekong Delta-Water Supply Measures and Flood Mitigation for the Prek Niel River Basin," required an IEIA. Since the beneficiary areas for the first priority schemes are Khpob Trobek Irrigation Scheme (4,115 ha) and Tumnup Lok Irrigation Scheme (1,000 ha), it must be determined whether separate EPC submissions are necessary or if they should be treated as a single scheme for an IEIA.

2. Considerations for Further Surveys

Result of Soil Test for Khpob Trobek & Tumnup Lok Irrigation Scheme

Items/ Location	Grain Size				Liquid limit (%)	Plasticity Index	Liner Shrink	Slaking (dry) (s)	Slaking (moist) (s)
	63mm	16mm	2mm	0.063mm					
Accept. range	100	70-100	35-100	30-90	30-70	PI > 12	LS <18	S > 30	S > 30
Tumnup Lok	100	100	98	39	19.8	1.7	0.7	60	60
River at halfway	100	100	94	19	15.8	2.7	0.7	6<30	6<30
Khpob Trobek	100	100	100	20	18.2	2.2	0.7	30	30

Result of Soil Test for Spean Sraeng Irrigation Scheme

Items/ Location	Grain Size				Liquid limit (%)	Plasticity Index	Liner Shrink	Slaking (dry) (s)	Slaking (moist) (s)
	63mm	16mm	2mm	0.063mm					
Accept. range	100	70-100	35-100	30-90	30-70	PI > 12	LS <18	S > 30	S > 30
Spean Sraeng	100	100	87	57	33.2	18.5	10.7	S>300	S>300

2. Considerations for Further Surveys

- Land Acquisition
  - The Khpob Trobek Irrigation Scheme, studied in 2012, has undergone significant urbanization over the past decade, particularly along National Road 22, leading to the expansion of businesses. This development is expected to increase the need for land acquisition related to canal rehabilitations. Typically, affected areas are limited to shopfronts or pillars rather than entire buildings, thus, resettlement is not anticipated. However, challenges in land acquisition may delay project implementation.
- Need for Additional Survey
  - The second priority scheme, Spean Sraeng, is a large area with a beneficiary area of 12,500 hectares and significant irrigation potential due to large upstream reservoirs such as Sraeng1 and Sraeng2. However, the scheme's extensive river basin and low-lying areas, prone to frequent flooding, make it complex in terms of flood impact.
  - To estimate project costs and feasibility, it is necessary to evaluate the potential for flood mitigation and productivity improvement. Given the current lack of detailed data on river flow and upstream reservoirs compared to other regions, additional preliminary surveys are recommended to assess feasibility.

3. Further Schedule

The schedule for the report submission is as follows:

- **Final Report**

  End of August 2024

Thank you