Appendix VI

Meeting Memo

Contents

VI-1

Subject: Kick-off meeting

Date & Time:	December 19, 2023 11:00 a.m. - 12:05 p.m. (JST)
Location:	Online Conference
Participants:	JICA:
	MOWRAM:
	JICA Survey Team:

Survey team:

Main Agenda

During the online meeting, Mr. Hashiguchi, the Team Leader, delivered a presentation outlining the survey's overview to JICA and MOWRAM staff. The discussions revolved around the future plans for conducting the survey in Cambodia. MOWRAM expressed gratitude for JICA's support and provided comments on the current state of irrigation facilities, as follows:

- The country has about 2300 irrigation systems of varying scales, some of which require rehabilitation or modernization. This includes the construction of headworks to facilitate proper and swift gate operation, essential for flood mitigation, and protection against the collapse or damage of irrigation facilities including the embankments and canals. Some facilities also require updates in design, as they were originally conceived during the Civil War period.
- A significant portion of the irrigation systems lack meteorological and hydrological information due to the absence of relevant stations. Operators face challenges in opening and closing canals, particularly during floods, while irrigation systems that were rehabilitated and/or improved through Japanese ODA showed effectiveness and resilience. Addressing these issues can contribute to the increase of rice production, fostering economic growth, and reducing poverty, thus improving people's living standard.
- MOWRAM is presently benefiting from a JICA's technical assistance project, specifically aimed at developing standard designs for irrigation facilities. This project holds great importance for MOWRAM, as the ministry has operated for 30 years without a national design standard. The outcomes of this initiative will not only be utilized in the nation, but also will be shared with other development partners, standardizing and simplifying future projects, operations and maintenance both technically and financially.
- The Technical Service Center for Irrigation and Meteorology (TSC), the Department of Planning and International Cooperation, the Department of Meteorology, and the Department of Hydrology will collaborate closely to support the consultant team. Relevant data requests from the consultant team will be promptly fulfilled by the respective contact officers.

... and upwards

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VI-2

Subject: Physical Kick-off meeting in MOWRAM

Date & Time:	January 18, 2024, 14:30 p.m. – 16:00 p.m. (GMT+7)
Location:	In-person meeting conference at the MOWRAM, Phnom Penh
Participants:	Refer to the attachement

The physical kick-off meeting was held for the Data Collection Survey on Irrigation and Flood Protection on the date of January 18, 2024, between the Ministry of Water Resources and Meteorology (MOWRAM) and the JICA Survey Team (JST).

First of all, H. E. Veasna, Under Secretary of the State, had a opening remark to welcome the JST with the reason that the physical kick-off meeting is necessary to start the data collection, and all attendants introduced themselves After that, JST gave an outline of the Survey including the timeline and a brief presentation about its content. During the discussions, both sides have confirmed the main items described in the following:

Main Agenda

・Target irrigation schemes

Participants agree that the target irrigation schemes for the long/short lists should be selected not only from the 11 prioritized irrigation schemes selected by MOWRAM, but from all the irrigation schemes in Cambodia. Therefore, information of irrigation schemes in Cambodia (such as CISIS) and hydrological/meteorological data are essential to consider the irrigation development scenario and shot/long lists.

・Water Potential Map

MOWRAM noted that the map of water resources availability is not the same as the common sense they have. For example, Spean Sraeng and areas around Krosaing, Beoung Sne, Vaico, and Chantrea. Spean Sraeng has a water reservoir, while building a canal in areas around Krosaing, Beoung Sne, Vaico, and Chantrea can increase crop production. JST answered the water availability map is not considered the storage effect of dams, so it will be updated after the information of reservoirs/dams are provided.

・Concept of Time Frame Approach

JST explained the irrigation development scenarios are formulated partly by the evaluation in time frame, specifically by the irrigation type (gravity, pump, and flood protection) and water resources stability (reservoirs/dams, river, and residual flood water). MOWRAM noted that the importance of flood protection should be re-considered because the proposed approach seems to exclude all the schemes for flood protection.

JST mentioned that this is general approach to consider the rapidity of project effects and economic impact, but not consider the Cambodian context, especially the importance in flood protection in Cambodia. Therefore, JST will collect the information for the damages of natural hazards (flood/drought) and reflect them to consider time frame approach.

・Importance of Hydrology/Meteorology stations

MOWRAM recommended that the survey plan should include hydrology and meteorology. Operators face challenges in opening and closing canals due to the absence of hydrology and meteorology stations. MOWRAM also highlighted that these issues can impact operational effectiveness. JST agreed that the status of hydrological/meteorological stations distribution will be considered in the target area to enable FWUC and MOWRAM to operate and maintain the facilities.

・Undertakings by MOWRAM

Respective contact officers assigned by MOWRAM will assist in obtaining any necessary information, permits, and appointments required for the survey. Furthermore, answers to the 20 major questions regarding the 11 priority projects will be provided by the assigned officers as soon as possible.

The office located in MOWRAM for the survey project will be provided to JST.

Attachment: Participant List

No	Name	Position
MOWRAM		
1		Under Secretary of State
2		Advisor
3		Director of Technical Service Center for Irrigation and Meteorology
4		Deputy Director of Water Resources Management and Conservation Department
5		Officer in ASEAN Office, Department of Planning and International Cooperation
JICA Survey Team		
6		Co-Team Leader/Hydrology/Flood Protection
7		Secretary/ Survey Assistant

No.26

Subject: Progress Meeting with MOWRAM regarding the irrigation development scenario and Prioritization of the future Japanese ODA loan Projects

Date & Time: February 29, 2024, 9:30 - 11:30
Location: Meeting room at the MOWRAM
Participants: Attached below

The meeting with the MOWRAM was held to discuss proposed irrigation development scenario as well as the prioritized projects focusing on future Japanese ODA loan projects. The JICA Survey Team (JST) delivered the result of the field visit and prioritized schemes. The result of the meeting is shown below:

Data Collection

- The data of flood damage, H.E. Pich Veasna will provide a contacting person of CNDM. There is a power-point file of the flood damage of the whole Cambodia in 2023 mentioned by H.E. Pich Veasna. Mr. Uch Hing will try gathering unobtained data and contacting person necessary, especially Mr. Soim Monichhoth who is a responsible person of NWRDMC.

Prioritization Criteria

- JST explained the large number of irrigation schemes are in a state of malfunction (1,361 schemes out of 2,483, or 55% of irrigation schemes need rehabilitation, which cannot be treated by PDWRAM or FWUC). JST also explained the correlation between the increase in rehabilitated irrigation area and increase in the yield of wet season rice. H.E. Pich Veasna agreed the potential of rehabilitating irrigation facilities. Rehabilitation of the existing irrigation systems will increase crop yield significantly.

- Regarding the time frame evaluation (reliability of water resources), MOWRAM agreed with the methodology and the draft result of the prioritization. However, they requested JST to add the missing reservoirs such as Tang Krasang in Kampong Thom, Stung Chinit in Battambong, and Reaksa reservoir in Preah Vihear. JST agreed to include the information of main reservoirs as soon as possible after receiving the data. The prioritization result will be finalized after receiving the data above as well as the rainfall data.

- JST mentioned the importance of storage facilities in Cambodia. Having reservoirs/dams with proper water management will contribute both flood control in the wet season and water shortage in the dry season. H.E. Pich Veasna stated the change in tendency of donor partners from only rehabilitation to the construction of reservoirs upstream of watersheds. For example, ADB has been changing their policy form working on rehabilitating to focusing on upstream, followed by AFD.

- Regarding the Bati flood control, irrigation and drainage, H.E. Pich Veasna marked the involvement of Chinese development and urbanization at the Bati including Chinese construction project for the Techo airport and related drainage projects. JST agreed his opinion, showing the result of site visit at the irrigation scheme of Bati.

Others:

- The term branch canal is used to include secondary canal, tertiary canal, and reached farm canal by MOWRAM.

Next meeting is scheduled on 7th March 2024 from 9:30 am, showing the prioritization result with updated data. MOWRAM will provided the necessary data before then.

and upwards

Attachment: Attendance List

No.	Name	Position
MOWRAM		
1		Project Director
2		Project Manager
3		D.D. Director of Adimation Afair
4		Official
5		Official
JICA Survey Team		
6		TL of JICA Survey Team
7		Co-TL of JICA Survey Team
8		Secretary/ Survey Assistance

MINUTES OF MEETING
ON
PROGRESS MEETING
FOR DATA COLLECTION SURVEY ON
IRRIGATION AND FLOOD PROTECTION
BETWEEN
THE MINISTRY OF WATER RESEROUCES AND METEOROLOGY
AND
THE JICA SURVEY TEAM

The progress presentation meeting for the determination of the irrigation schemes on the short list for the future Japanese ODA loan Project was held for the Data Collection Survey on Irrigation and Flood Protection on the date of March 25, 2024, between the Ministry of Water Resources and Meteorology (MOWRAM) and the JICA Survey Team (JST). As a result of the discussions, both sides have hereby agreed all items presented in the meeting recorded in the attached documents prepared in English.

March 25, 2024

Mr. KITA Hajime
Team Leader/ Hydrology/ Flood Protection
JICA Survey Team for Data Collection Survey on Irrigation and Flood Protection

H.E. PICH Veasna
Project Director
Under Secretary of State, MOWRAM

1. Irrigation Development Scenario

The JICA Survey Team (JST) presented the results of the survey, including the results of the information collection, analysis of the information, the issues identified for the development in irrigation and agriculture sectors, and the irrigation development scenarios to mitigate and/or solve those issues, as follows.

1.1 Main Issues JST identified

JST reported the information collected and analysis results of the survey, emphasizing the importance of rehabilitation of existing deteriorated facilities (rehabilitation of irrigation facilities including reservoirs/dams can directly contribute to the increase of the agricultural production especially during dry season), importance of geographical location considering the rice millers (competitiveness against middlemen from Vietnam is better in Battambang than the one in Phnom Penh and southeast area).

Regarding the flood impact, JST explained the significance of flood protection/ mitigation, showing the history of flood impact since 1996 and the impact is stronger especially in the northwest side of Cambodia such as Battambang and Banteay Meanchey Provinces. JST also showed the projection of monthly rainfall pattern, which makes more extreme flood and drought in the future condition. All the evidence clearly indicate that flood control measures are essential.

Based on the irrigation and agricultural development status in Cambodia, JST summarized the following main challenges:

- Vulnerability to flood and drought due to following:
  - Small capacity of the reservoirs/ dams,
  - Deterioration of facilities, and
  - 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 countries.

1.2 Development Scenarios

The development scenarios were suggested based on the results of the above information analysis and main challenges. Those were collated with the existing higher plans such as Pentagonal Strategy Phase1 (2023-2028), Strategic Development Plan on Water Resources and Meteorology (2019-2023), and National Water Resources Management and Sustainable Irrigation Road Map and Investment Program (2019-2033), and confirmed the scenarios below aligned with those plans and strategies.

MOWRAM made a comment that establishment/improvement of FWUC and continuous land holding survey that supports the sustainability of FWUC activity should be included in the short-term scenario, and JST agreed the comment. Thus, the development scenario finalized with MOWRAM is shown below:

Table. Irrigation Development Scenarios in Shortm Mid, and Long Term TimeScale

Time Frame	Development Scenarios	Relevance of MOWRAM Plans/Goals and Road Map
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 • Improvement of Market Access for Agricultural Products • Improvement of Agricultural Extension Service	• WRM and Development including Irrigation Extension [1] • Flood/ Drought Management & Meteorology Information Management [1] • Ensure all services related to water resources will be used for more benefits for women in FWUC [1]
Mid-term	• Water Resources Development for Dry Season Cropping & Flood Mitigation Measures through Dam Construction • Implementation of Integrated Water Resources Management • Improvement of Agricultural Extension Service • Increase in Value-added Agricultural Products for Export	• WRM and Development including Irrigation Extension [1] • Flood/Drought Management & Meteorology Information 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.	• WRM Decision-making Processes underpinned by Best Available Scientific Information [2] • Approval of the Sub-decrees on Water Licensing and Water Quality [2]

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

2. Methodology and Result of Prioritization for the Long List

The prioritized irrigation schemes to be rehabilitated by Japanese ODA loan were selected from all the irrigation schemes in Cambodia (registered in Cambodian Irrigation Scheme Information System: CISIS). JST explained the methodology of the selection principally based on two evaluation frames: Spatial Frame and Time Frame.

Spatial frame is mainly composed of natural conditions and artificial conditions which seem unrealistic to change by the MOWRAM, considering the availability/variability of water resources, land fertility, and change in paddy area between 2014 and 2023 (10 years). Regarding the availability of water resources, the water consumption by agriculture is considered by rough calculation based on the statistical data from Ministry of Agriculture, Forestry and Fishery (MAFF) annual report 2023.

Time frame is, on the other hand, the artificial conditions which can be variable, but it takes time to change. JST also considers the type of irrigation applied (gravity, pump, or mixed). The pump irrigation is generally higher cost than gravity irrigation especially in Cambodia where the electricity cost is higher than surrounding countries. Therefore, it will take time to recover the investment of the pump irrigation project. In addition, the distance from the main road is the important condition for the prioritization to easy water management especially during flood time as well as the market access.

JST explained the evaluation results were divided into 3 levels for both the time frame and spatial frame, making 3x3 grid. The results were then screened so that only the irrigation schemes with less than 60%

in "Condition" which is equivalent to "need rehabilitation or replacement" and with more than 3,000 ha of beneficiary area remained.

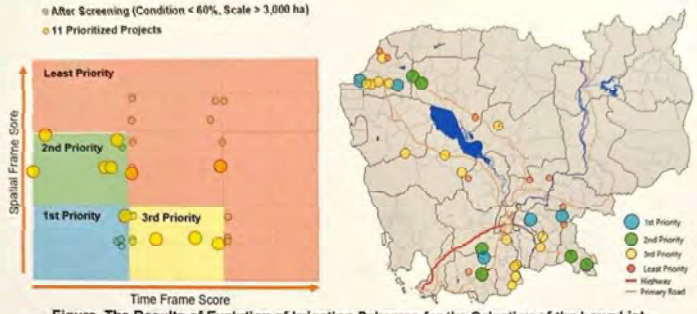

Figure. The Results of Evalution of Irrigation Schemes for the Selection of the Long List (left: score of time and spatial frames, right: location map of the selected irrigation schemes with priority)

3. Methodology and Result of Prioritization for the Short List

The irrigation schemes for the short list are selected based on the following criteria. Each criterion section is compared with the ones of the other nominated irrigation schemes, and categorized them into "◎", "○", and "△" according to the degree of contribution. The contents of criteria and their importance are shown below:

1. Overlapped Projects by the Government and/or Other Donors Fund (pre-requisite condition)

   The nominated scheme is excluded from the list if any projects/studies (partially or fully) are already undertaken.

2. Degree of Emergency to Implement the Project (Significance: High)

   It shows the necessity of the support from Japanese ODA loan, which considers the importance on improvement of irrigation schemes regarding flood mitigation, market access improvement, and expansion of cultivation area during dry season. The MOWRAM's intentions are also considered in this evaluation.

3. Impacts of Economic Benefits (Significance: High)

   The scale of the beneficiary area is primarily considered for future benefits from the project. It principally has larger profits if the target beneficiary area is larger. In addition, geographical advantage for agro-processing is also considered with the aim of increasing future exports (It is better if the irrigation scheme is located close to the cluster of rice mill companies which are more competitive against the companies in Vietnam).

4. Adaptation Degree to Climate Change (Significance: High)

   This section considers the contribution to the mitigation measures and adaptation measures against the climate change. More in specific, the adaptation measures for flood impact which will be most likely stronger in the future. If the target irrigation scheme has a pump irrigation system, it is evaluated as negative impact in mitigation measures because it tends to emit more GHG compared to the gravity irrigation system.

5. Synergy/ Ripple Effects with Other ODA and Government Projects (Significance: Middle)

   Past projects implemented by the government and other development partners around each target irrigation scheme are considered. It is prioritized if the project which has synergy effect with the future ODA loan such as the ones for soft components like as training of FWUC, development of value chain or one for development of infrastructure facilities cases like market access by road improvements.

6. Degree of Poverty Reduction (Significance: Middle)

   Poverty ratio in the beneficiary area is evaluated based on the result of Cambodia Poverty Assessment (WB 2022). It should be prioritized if the beneficiary area is categorized in a higher poverty rate zone.

7. O&M Capacity of Farmer Water User Community (Significance: Low)

   The condition of FWUC is also an important criterion because it basically has a responsibility for the operation and maintenance of the facilities so that it connects to the sustainability of the irrigation facilities.

8. Land Acquisition and Resettlement (treated as remarks)

   In MOWRAM proposal, the capacity of the reservoir will become larger through raising the reservoir by additional embankment. In this case, the affected area by raising water level should be considered, which will be studied in the next field survey.

JST explained the result of evaluation for 11 nominated irrigation schemes and calculation method for the total evaluation score, which resulted the following 4 irrigation schemes are the most prioritized for future Japanese ODA loan projects: No.1 Khpob Trobek & Tumnup Lok Reservoirs, No.6 Khpob Krous Reservoir, No.7 Spean Sraeng, and No.8 Plaing. The all attendants of the meeting agreed with the result of the evaluation.

Table. The Result of Evalution of Irrigation Schemes for the Selection of the Short List

No.		1	2	3	4	5	6	7	8	9	10	11
Item	Weight	Khpob Trobek & Tumnup Lok	Kamhor Srer	Khal Dum Reservoir	Chor Dam	Chhnok Tru Dam	Khpob Kruos Reservoir	Spean Sraeng	Plaing	Daun Tey Reservoir	Tonle Vaiko Reservoir	Trapeang Boung Reservoir
Priority (1st Screening)	-	1	1	1	1	1	2	2	2	2	2	2
Overlap of the Project	-	—	—	Exc.	—	—	—	—	—	—	—	Exc.
Emergency	High	◎	△	—	△	△	○	○	○	○	○	—
Impact on Economy	High	○	○	—	△	△	○	◎	◎	○	○	—
Degree of Adaptation on Climate Change	High	◎	△	—	○	○	◎	◎	○	◎	○	—
Synergy with Other Projects	Middle	◎	○	—	△	△	○	△	△	△	○	—
Impact on Poverty Reduction	Middle	○	○	—	△	△	○	◎	◎	△	△	—
Capacity of FWUC	Low	◎	△	—	△	△	△	○	△	△	△	—
Land Acquisition, Environmental/Social Consideration	-	Note that further land acquisition for increase in dike height is required	Hard for irrigation development as 1/3 of embankment is owned & utilized by farmers.	—	Hard for irrigation development as 1/3 of embankment is owned & utilized by farmers.	Development cost will be very high considering the topography of reservoir (narrow long shape)	Note that further land acquisition for increase in dike height is required.	may be hard to construct a new reservoir even though the land is owned by the government considering farmers keep utilizing the land.	It requires a lot of land acquisition in case of the construction of inter-basin (connection) canal.	River flows directly into Vietnam, so the impact of irrigation development/flood drainage must be carefully considered.	River flows directly into Vietnam, so the impact of irrigation development/flood drainage must be carefully considered.	—
Remarks	-	The flood water from Kon Trom reservoir could be conveyed with the support of China. In this case, the design would need to take into account the planned release of water from upstream.	—	—	—	—	Further survey to confirm the capacity of each reservoir	Technical Cooperation is necessary for the water resources management of Upstream reservoirs (Spean Sraeng 1, Spean Sraeng2).	Technical Cooperation is necessary for the water resources management of Upstream reservoirs (Ou Bay Tap Reservoir).	—	—	—
Evaluation Result	-	◎	△	×	△	△	○	○	○	△	△	×

*Note: the evaluation result is calculated as basic point multiplies evaluation point. The definition of basic point is that the significance of the criteria to register in the short list (High: 3 points, Middle: 2 points, and Low: 1 point), while the evaluation point is defined as the evaluation result of each criterion (◎: 3 points, ○: 2 points, and △: 1 point).

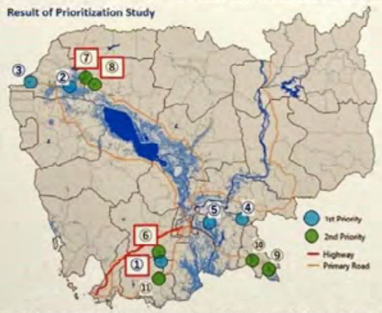

Figure. Location Map of Prioritized Schemes for the Short List

4. Others

MOWRAM made a comment for the assumption of water consumption during dry season. They suggested 12,000m^3/ha to 14,000m^3/ha in the dry season, 4,000m^3/ha to 6,000m^3/ha in the wet season to estimate supplemental irrigation, instead of 20,000 m^3/ha, which was created by a Russian professor, although it doesn't have any problem with JST's assumption.

MOWRAM mentioned the No.7 Spean Sraeng and No.8 Plaing were intended to be in one project. However, those could be separated because of Spean Sraeng and Plaing are partly connected. The water resources of the Spean Sraeng is from Sraeng 1 and Sraeng 2 reservoirs, while there is no reservoir for the Plaing. Moreover, the Spean Sraeng can supply more water to the Plaing but in the current condition, small percentage of water can be irrigated to Plaing.

Regarding the inter-basin canal from the Prek Thnot river basin (Kon Trom reservoir) to Slakou river basin (Tumnup Lok reservoir), MOWRAM confirmed the PMU of the China fund project and obtained the answer that there is no plan to connect the basin for flood discharge.

5. Further Schedule

The result of discussion will be shared with the other members of MOWRAM and will be authorized soon after sharing the meeting result. The attendants from MOWRAM mentioned that it would be approved without any problem in this stage. The representatives from both sides should sign the minutes of the meeting after obtaining consensus of approval. Therefore, JST will prepare further survey for the second field survey starting from May 2024.

JST will prepare the further survey for the selected 4 prioritized projects especially for social economic survey for farmers, soil test, and topographic survey during April. JST will start the further survey in the target irrigation schemes from May 2024. MOWRAM expressed the continuous cooperation with JST's activities for the further survey as they have done in the 1st field survey.

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Attachment 1: Attendance List
Attachment 2: Meeting Material1 (presentation material)
Attachment 3: Meeting Material2 (comparison table for the selection of short list projects)

Attachment 1
Attendance List

No.	Name	Position
MOWRAM		
1		Project Director, Under Secretary, MOWRAM
2		Project Manager, Deputy Director General of Technical Affairs, MOWRAM
3		Project Member
4		Project Member
5		Project Member
JICA Survey Team		
6		Team Leader (TL)/ Hydrology / Flood Control
7		Co-TL/ Irrigation Development Planning
8		Secretary

Memorandum of Interim Report Meeting

Date and time:	21st May 2024, 9:30-11:30
Location:	MOWRAM conference room
Attendees:	MOWRAM: (Under Secretary of State) and MOWRAM officers
	JICA:
	The Ambassador of the Japanese Embassy:
	JICA Survey Team (JST):

1. Purpose of meeting

To explain the result and progress of the survey and ask the comments from the related counterpart (MOWRAM).

To discuss how to involve the MEF (Ministry of Economic and Finance) to reflect their opinion into the result of the survey.

2. Agenda

Time	Contents	Presented by
9:30 – 9:40	Welcoming Remarks	MOWRAM
9:40 – 11:00	Presentation for the Progress of the Survey 1. Irrigation & Agricultural Development Status 2. Irrigation Development Scenario 3. Selection for the Long List 4. Selection for the Short List 5. Further Schedule 6. Confirmation after Site Survey Result	JICA Survey Team
11:00 – 11:20	Discussion	Participants
11:20 – 11:30	Closing Remarks	MOWRAM

3. Details of discussion

1) Explanation of the survey progress to MOWRAM.

The Team Leader, Mr. Kita, explained the results and progress of the survey, focusing on the update parts from the material on the end of March. Main update parts are: Irrigation Development Scenario (slide no.24-25) and Wording of the selection criteria for the long list projects from "Spatial Frame/Time Frame" to "Agricultural Potential/Investment Potential") (slide no.27). There is no negative comment on the update parts from MOWRAM side. The other discussions are listed below:

Involvement of other ministries (MEF and MAFF)

- Meeting with MEF is very important for smooth implementation of the project because MEF is the decision maker in Cambodia. Regarding the future explanations to MEF, Ms. Miyashita mentioned that we should follow the order of "Sharing the current status," "Conducting an on-site inspection," and then "Explanation of the final report." The 1st meeting with MEF should be conducted in the 2nd week of June so that the survey team can collect additional information based on their comments. The 2nd meeting could be on June 19th or 20th.
- The attendants discussed the timing of the meeting with MEF, and MOWRAM decided to have a meeting on 11th (Tue) or 14th (Fri) June. MOWRAM is going to ask MEF for the meeting, and the date will be fixed. During the meeting, the necessity of site visit will be discussed.

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- JST will work to calculate rough project cost for the rehabilitation on 4 prioritized irrigation schemes by the 11th of June.
- MOWRAM (H.E. Veasna) informed that projects in Spean Sraeng and Plaing are not expected to be opposed by MEF because they already visited the sites.

2) Explanation regarding the progress of the survey in terms of facilities

Dr. Hikasa explained the progress of the survey results to the attendants to ask MOWRAM's comments regarding the component of the candidate projects.

- In the Plaing irrigation scheme, a part of target area is under negotiation with residents for land acquisition. The length of the canal under negotiation is about 5 km. MOWRAM replied that the area of 5km under negotiation is unnecessary to include the project.
- Regarding the Khmeng Ancient (Angkor) Bridge at the edge of the Spean Sraeng Irrigation Scheme, JST suggested 3 options below, recommending option2, and MOWRAM agreed on it.

  Option 1: No Top-up embankment, no replacement of the 3 bridges by gate-structures.
  Option 2: Construction of the Dike and the Gate
  Option 3: Construction of a Dike at the upstream of the Khmeng Ancient Bridge.
- Regarding the Khpob Krous irrigation scheme, the JST recommended using the existing canal but MOWRAM replied to consult to the PDWRAM officer. PDWRAM plans to adopt a U-shape flume canal. JST explained the route of existing secondary canal shall be re-considered to avoid houses and shops. MOWRAM agreed on it.
- For Tumnup Lok and Khpob Trobek irrigation scheme, JST explained the route of connection canal between Tumnup Lok & Kpob Trobek. The plan shall be revised based on the current land use conditions. JST reported canal rehabilitation works along the Canal 33 (main canal of Khpob Trobek irrigation scheme) will be difficult under the current condition because there are many houses along both sides of canal. MOWRAM commented that this would not be a big problem for project implementation. They request JST to confirm number of affected structures (house and bridges).

4. Conclusion of the meeting

- JST will submit the meeting material to MOWRAM after minor modification (on slide12 and 24).
- MOWRAM will set a meeting with MEF on either June 11th or 14th. The JST will explain the cost of rehabilitation at the meeting.
- After the 1st meeting with MEF, MEF staff may request to conduct an "On-site inspection" and "Explanation of the final report.
- The JST will continuously collect data based on the meeting today and update the presentation accordingly.

-END-

MINUTES OF MEETING
ON
PROGRESS MEETING
FOR DATA COLLECTION SURVEY ON
IRRIGATION AND FLOOD PROTECTION
BETWEEN
THE MINISTRY OF WATER RESEROUCES AND METEOROLOGY
AND
THE JICA SURVEY TEAM

The meeting for reporting the result of Data Collection Survey on Irrigation and Flood Protection, including the priority of the projects for further study was held on the date of July 4, 2024, between the Ministry of Water Resources and Meteorology (MOWRAM) and the JICA Survey Team (JST). As a result of the discussions, both sides have hereby agreed all items presented in the meeting recorded in the attached documents prepared in English.

July 4, 2024

Mr. KITA Hajime
Team Leader/ Hydrology/ Flood Protection
JICA Survey Team for Data Collection Survey on Irrigation and Flood Protection

H.E. PICH Veasna
Project Director
Under Secretary of State, MOWRAM

1. Confirmation on the Contribution to Higher Plans in Irrigation/Agriculture Sector

The JICA Survey Team (JST) presented the referred higher plans/strategies promulgated in the Sector of Irrigation/Water Resources Management, Agriculture and Environment including Climate Change.

- Pentagonal Strategy Phase 1 (2023-2028)
- National WRM* and Sustainable Irrigation Road Map and Investment Plan 2019-2033
- Strategic Development Plan 2019-2023** for MOWRAM and MAFF
- Strategic Development Plan for Cambodian Agro-Industries 2019-2030
- National Development Plan on Agriculture Sector 2022-2030
- National Determined Contribution (2020)
- Circular Strategy on Environment 2023-2028

*WRM: Water Resources Management, **SDP 2024-2028 is under preparation

In the presentation, expected actions and direct/ indirect impacts by the candidate projects are explained, focusing on the improvement of the productivity, resiliency against the flood and drought, and water utilization efficiency as well as the mitigation measures for Climate Change. Main actions (components) and impacts are summarized below:

Actions (Main Components by Projects)	Direct/ Indirect Impacts
Functionalize Irrigation Facilities through Rehabilitation	Enhance Productivity & Quality of Agricultural Products
Install Secure & Durable Irrigation Facilities against Flood	Improve Sustainability of Irrigation Activity
Develop Water Resources (incl. construction of Diversion Canal)	Enhance Market Access and Ease of Passage
Install Hydro-meteorological Stations	Improve Water Utilization Efficiency
Establish/ Enhance FWUC	Improve Response to Flood/ Drought
Provide Agriculture Extension Services	Create the Env. For CC-Friendly Farming Tech.

2 Confirmation on the overlapping on-going/planned Projects by other DPs and MOWRAM

JST has collected the information on the irrigation/agriculture development projects by other Development Partners (DPs) and presented the project location map. JST mentioned ADB implemented a rehabilitation project in Spean Sraeng Irrigation Scheme in 2015 for the rehabilitation of spillway, but it needs to be updated due to the current condition of facilities. MOWRAM and JST re-confirmed that there are no overlapping projects on the 4 prioritized project sites.

3 Prioritized Project by MOWRAM (Evaluation for Prioritization)

Showing the comparison table between the best two prioritized irrigation schemes (Khpob Trobek & Tumnup Lok Irrigation Scheme and Spean Sraeng Irrigation Scheme), JST explained the differences in the beneficiary area, current/expected future cropping intensity, rough project cost, current annual income in riel/day/capita, and expected annual income after project. Based on only the information

above, there is not much clear differences in priority between Khpob Trobek & Tumnup Lok and Spean Sraeng, and both schemes are significant to implement the project.

In this context, however, JST emphasized that the 1st Priority is Khpob Trobek & Tumnup Lok Irrigation Scheme (KTTL), and 2nd Priority is Spean Sraeng (SS) due to the following reasons:

- 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.
- Rehabilitation in KTTL requires more technical consideration in design and construction to prevent erosion due to the existence of dispersive/expansive 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 the production of value-added agri-products and increase the amount of export. Considering those circumstances, change in cultivation crop from rice to vegetable or other profitable products can most probably occur in Takeo, which can contribute to the goals of the higher plans in Agriculture Sector.
- The water resources of SS is the Stung Sreng which has around 6,800km^2 of watershed. It makes much more effort to complete protection from flood without construction of reservoirs/dams with enough capacity (Sreng1 and Sreng2 reservoirs are still not enough for flood protection). 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 Discussion on the Prioritization of the Project

MOWRAM obtained the opinion from the MEF after sharing the meeting material, which is as follows:

- MEF and MOWRAM approve of the first and second priorities shown in the meeting materials. However, MEF request the FS (as well as the implementation) in the two most prioritized irrigation schemes, namely, Khpob Trobek & Tumnup Lok Irrigation Scheme and Spean Sraeng Irrigation Scheme, because MEF believes that the selection of one irrigation scheme cannot satisfy the current need. The one not selected will have to wait for another 5 to 10 years in case of next JICA assistance.
- MOWRAM does not perceive any issues related to the challenges arising from the remote nature of the target areas (e.g., difficulties in coordinating FS implementation and managing construction contractors simultaneously, etc).

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Attachment 1: Attendance List
Attachment 2: Meeting Material

Attachment 1
Attendance List

No.	Name	Position
MOWRAM		
1	H.E. Pich Veasna	Project Director, Under Secretary
2	H.E. Theng Tara	Advisor
3	Mr. Uch Hing	Project Manager, Deputy Director General of Technical Affairs
4	Mr. Touch Sovann	Project Member
5	Mr. San Sovithiea	Project Member
6	Mr. Pok Pichpunareay	Project Member
7	Mr. Chea Rady	Project Member
JICA Cambodia Office		
8	Ms. Miyashita Akiko	Representative
9	Ms. Chan Sokunthea	Program Officer
JICA Survey Team		
10	Mr. KITA Hajime	Team Leader (TL)/ Hydrology / Flood Control
11	Mr. Sambo SUN	Secretary (Local Staff)

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Subject: Draft Final Report Meeting with MOWRAM

Date & Time: August 13, 2024 11:30 - 12:30 (JST)
Location: Online
Participants: Attached below

1. Results from the Additional Survey of the Four Prioritized Irrigation Schemes

   The JICA Survey Team (JST) presented the updates made to the Draft Final Report (DFR) since the last briefing on July 4. The main additions to the report are in Chapters 5 through 10. Chapters 5 through 8 now incorporate the results of the additional surveys conducted for the four prioritized irrigation schemes.

   - Chapter 5 to 8 : Chapters cover the general features of each irrigation scheme, the current agricultural status, and development plans, an outline of the proposed project plans for each scheme, as well as project costs and anticipated benefits.
   - Chapter 9 : This chapter details common factors related to all four schemes, including impacts on poverty reduction, environmental and social considerations, and consultant services and procurement.
   - Chapter 10 : Conclusions and directions for further surveys are outlined.

2. Project Cost Estimation and Expected Benefits

   Additionally, the JST provided a detailed explanation during the presentation on project cost estimates and the key expected benefits. The cost estimates have increased compared to previous figures due to changes in the estimation conditions, including adjustments to price escalation rates, the inclusion of land acquisition costs, taxes for consulting services, and other factors.

   The JST further explained that the forecasted project benefits include an expected increase in annual income per capita (Riel/day), which is projected to exceed the national poverty line of 10,951 Riel/day.

3. Expected Yield Improvements in Different Rice Varieties and Water Balance Calculations

   JST further explained in the presentation that the proposed improvements to the irrigation facilities include an improvement in irrigation efficiency as summarized in water balance calculation. This enhancement is anticipated to boost yields for cultivation in both the wet and dry seasons for the Khpob Trobek & Tumnup Lok Irrigation Schemes and the Spean Sraeng Irrigation Scheme.

4. Considerations for Further Surveys

   For future surveys, JST outlined the following four areas for further investigation:

   - Soil Testing: Further investigations are needed to identify areas with dispersive soil, and project designs should be adapted accordingly.
   - Environmental Procedures: Special attention should be given to complying with environmental regulations.
   - Land Acquisition: Rapid development in certain areas necessitates comprehensive land acquisition plans to avoid delays in project implementation.
   - Need for Additional Surveys: In some areas, a lack of data has led to rough estimates of flood damage and design countermeasures. Additional investigations are required in next studies to refine these estimates and incorporate them into project designs.

5. Comments and Discussion

   MOWRAM raised discussion points and provided comments on the following key areas as additional considerations for the DFR.

   1. It was noted that, since the proposed projects fall under the rehabilitation category, obtaining environmental procedures such as an EIA or IEIA is not required according to current regulations.
      - However, JST emphasized that the reason and importance of integrating environmental considerations into the report were to align with the recommendations from the Ministry of Environment, Cambodia.
   2. Additionally, it was noted that investigating soil conditions will be a critical aspect to consider in the future surveys, as highlighted by the JST.
   3. The current rice varieties include dry season rice (January to March), early rainy season rice (May to July), and medium/long-term rainy season rice. It is recommended to use these classifications when specifying the existing rice varieties, as they reflect the terms and local classifications commonly used in Cambodia.

... and upwards

Attachment
Attendance List

No.	Name	Position
PDWRAM		
1		Project Director
2		Advisor
3		Project Manager, Deputy Director General of Technical Affairs
4		Project Member
5		Project Member
6		Project Member
7		Project Member
JICA HQ		
1		Senior Deputy Director, Southeast Asia Division 2
2		Southeast Asia Division 2
JICA Cambodia Office		
1		Representative, JICA Cambodia Office
2		Program Officer
JICA Survey Team		
4		Team Leader (TL)/ Hydrology / Flood Control
5		Co-TL/ Irrigation Development Planning
6		Environmental and Social Considerations
7		Irrigation Development Planning (3)
8		GIS/Irrigation Development Planning (2)
9		Secretary

Subject: Interview to Director of Research and Flood Forecast Warning, Dept. of Hydrology and River Works, MOWRAM

Date & Time:	January 25, 2024 9:00 a.m. - 10:00 a.m.
Location:	MOWRAM
Participants:	Director of Research and Flood Forecast Warning, Department of Hydrology and River Works

The meeting with the department of Hydrology and River Works (hereinafter referred to as "the department"), Research and Flood Forecast Warning Office, (hereinafter referred to as "the office") was conducted to confirm the availability of hydrological data and the general status of hydrological data in Cambodia. The following is the main points confirmed through the interview.

- Number of Officers in the department

  Approximately 50 to 60 officers in the whole department, and 15 officers of them belong to the office.

- Availability of Hydrological Data

  There are 30 manual water gauge stations in Cambodia. The office is calibrating and collecting the river water level from the manual stations every day. The data collection is done by the staff in PDWRAM, and the MOWRAM asked the staff by phone to collect water level records. Of them, 15 manual stations reported daily to MOWRAM has relatively reliable records targeting Mekong and Tonle Sap Rivers, but the others have many missing data or unreasonable values mainly due to the lack of budged as well as human resources for data collection and maintenance. (The river water level data will be provided after sending the letter from JST).

  In addition to the stations above, there are more than 100 automatic stations funded by ADB, UNDP and other donors, which has been transferred to MOWRAM. Regarding the calibrations of those stations, the special team set by 3 deputy directors in the department has that responsibility. However, it seems not working well considering the reliability of the collected data according to Mr. Seng's opinion. The data is available from the website below (only the records of 31 stations are available).

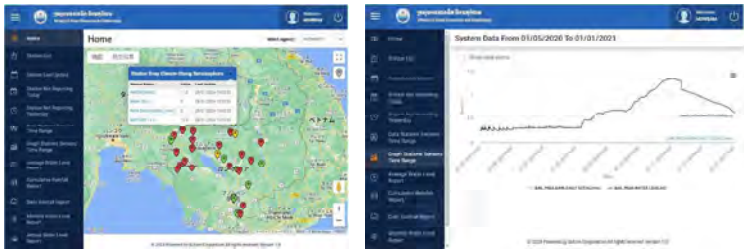

Figure 1. Database Platform for Hydrological Stations and their Records
Source: http://staging.ahs.whcambodia.com/Home/Index, accessed in January 2024

Furthermore, the data of 15 river water level is available through the website of Mekong River Committee, "Near Real-time Hydrometeorological Monitoring", which covers whole the Mekong and Tonle Sap Rivers. Those data are not managed by the department, so JST couldn't obtain the raw data.

Figure 2. Website for Near Real-time Hydrometeorological Monitoring in MRC
Source: https://monitoring.mrcmekong.org/ accessed in January 2024

- Involvement with the ADB project (especially the progress and the status of WRIS)

  They do not have any information about the ADB project.

- Tendency of Water Level in Cambodia

  According to Mr. Seng, the water level during wet season becomes lower than the past because more large-scale dams have been constructed along the upper Mekong River (by other countries). For example, water level at Chaktomuk (located in Phnom Penh) used to record more than EL.11m during the wet season in 2000s, but it became EL.8m to 9m in 2020. JST will review the change in water level after receiving the original water level data.

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Subject: Interview to Deputy Director, Department of Meteorology, MOWRAM

Date & Time:	January 25, 2024 11:00 a.m. - 12:00 a.m.
Location:	Lobby at the Hotel
Participants:	Deputy Director of Department of Meteorology, MOWRAM
	JICA Survey Team (JST)

The meeting with the department of Meteorology (hereinafter referred to as "the department") was conducted to confirm the availability of meteorological data and the general status of meteorological data in Cambodia. The following is the main points confirmed through the interview.

- Availability of Hydrological Data

  Currently there are a total of 68 meteorological stations in Cambodia, all equipped with automatic recording capabilities. Notably, there seems to be a significant variation in menu options, possibly related to equipment. Maintenance and calibration activities are undertaken by PDOWRAM.

  Regarding this, JST obtained the documentation "GBON National Contribution Plan of Cambodia (Nov 2023)", which is published to enhance the quality and provision of weather forecasting, early warning systems, and climate services for the detail information in SOFF (Systematic Observations Financing Facility) program supported by UNDP.

Information from "GBON National Contribution Plan of Cambodia (Nov 2023)"

1) Observation network by the department:

The Cambodian Meteorological Department presently manages a surface observation network comprising 85 automatic weather stations (AWS) and 25 manual stations. Among the 85 AWS, 39 are reported to be in optimal condition, while 40 are experiencing degraded functionality due to issues with individual sensor modems. These stations measure various parameters such as temperature, humidity, rainfall, barometric pressure, evaporation, soil temperature, soil moisture, and total solar radiation. 26 stations (made by WEATHEX) do not measure evaporation, soil temperature, soil moisture, or total solar radiation.

Meteorological observations are manually conducted in each of Cambodia's 24 provinces. Observers, employed through PDWRAM are responsible for manual observations and basic maintenance of Automatic Weather Stations (AWS) equipment, including the Global Basic Observing Network (GBON) sites.

2) ADB Project for NWRDMC:

Asian Development Bank (ADB) - The ADB's Irrigated Agriculture Improvement Project (Dec 2019 - Jun 2025) includes design and development of the National Water Resources Data Management Center (NWRDMC) and Water Resources information System (WRIS), which integrates all water resources data including, but not limited to i) hydro-meteorological information, ii) land use, crop distribution and soil maps as well as maps of irrigated/non-irrigated areas, iii) topography and river basin boundaries, iv) population distribution map, v) map and information on water infrastructures such as pumping stations, reservoirs, and vi) secondary data and products from modelling.

3) Budget Status of the department

The MOWRAM five-year strategic plan has a budget for implementation of USD 2.79 billion, of which 2.19 billion or 78.5% is allocated to the management and development of water resources including the repair, maintenance and expansion of irrigation and drainage systems, reservoirs, ponds and canals. However, only 1% or USD 15.7 million is provided for the installation and / or rehabilitation of hydro-meteorological equipment.

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The budget allocation for the department is dependent on the funds available at the national government level. In 2022, the department received USD 450,000 as budget allocation. The department do not sell any meteorological data or services and do not, therefore, have any further source of funds. The current observations network is fully funded by the government. These funds provide a minimum level of support to the department for this activity, which puts the network at risk.

To request the sharing of historical rainfall data from key observation points, a letter addressed to Director OUM Ryna of the Meteorological Department is recommended.

- Orr going donor Project related to your department.

  The department is undertaking many donor projects shown in the material "GBON National Contribution Plan of Cambodia (Nov 2023)" such as ADB, WB, UNDP, WMO and others. But it is not directly funded by the donor partners.

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farmers open the gates during wet season and close them during dry season for flood control and water utilization functions. However, those gate operations only consider the irrigation and not the fisheries, which should be considered as well.

- Categorization of River Basin:

  Mr. Virak and JST discussed how some basins are interconnected, making it challenging to manage water effectively when divided into separate entities. Mr, Virak emphasized the need for integrated planning and coordination between upstream and downstream basins. Additionally, he highlighted the misconception that basin management solely pertains to water resources (irrigation activities), noting its broader implications for sectors like fisheries, livelihoods, infrastructure development, and governance.

- Irrigation Development Policy of WB

  They will not work for new irrigation schemes, and only focus on the rehabilitation, re-functioning and retrofitting the schemes to be more effective, considering the whole the water related system. Furthermore, they shared examples of past projects where environmental considerations were overlooked, leading to wasted investments and environmental damage (JST guesses this project is the Vaico irrigation scheme project).

- Inventory of Dams and Reservoirs

  According to Mr. Virak, MOWRAM doesn't have the inventory of all the 289 dams and reservoirs in Cambodia. So the WB is now working on the Technical Assistance project with DHI company, using satellite images and AI to detect the location with ground true validation (expected to end in June 2024). Their final goal is to establish the dashboard for all the Cambodian dams and reservoirs as step2. This work has just started and JST can join the instructions consultation workshop in February (date will be fixed and informed later).

- Flood report in 2020

  Mr. Virak will share the document regarding the impact assessment of the flood occurred in 2020. Also, he advised us the information published by Mekong River Commission is generally reliable to study the disaster risks.

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

  JST asked the existence of "National Water Resource Management and Sustainable Irrigation Strategy (2019-2030)" in WB's document. It was developed by the secretary of the state, and anyhow not shared in MOWRAM. The document will be shared after scanning the hard copy.

- Implementation Status of Nature based Solutions (NbS)

  The World Bank (WB) is actively involved in trials and studies dedicated to aligning human activities with nature. They have conducted feasibility studies on the application of Nature-based Solutions (NbS) in Cambodia, although the report's sharing is restricted due to the inclusion of sensitive topics. The NbS concept will be integrated into the irrigation design of the water security project mentioned earlier.

  One NbS approach is the river training work model, exemplified by using natural materials like sand, clay, and bamboo for canal structures instead of concrete. This includes designing buffer zones for flood mitigation and simultaneous consideration of watershed management as part of the river training work activities.

Subject: Interview to PDWRAM and Site Visit to Kpob Trobek & Tumnup Lok Irrigation Schemes

Date & Time:	February 6, 2024 13:30 - 16:30
Location:	Meeting room at PDWRAM, Takeo Province
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.

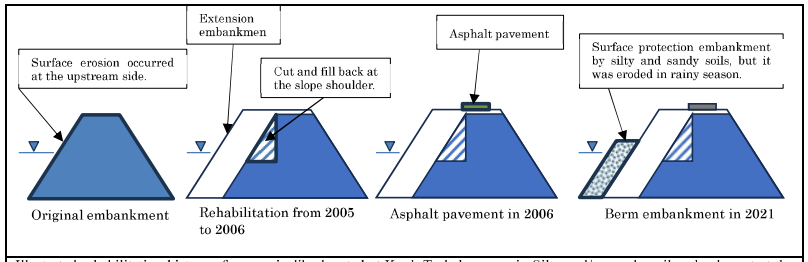
Table 1. General Information (Kpob Trobek & Tumnup Lok Irrigation Schemes)

Item	Contents
Component	1. Reconstruction of reservoir dike, headworks, intake and maintenance facilities (incl. rehabilitation of existing reservoir dike and improvement of road network) 2. Rehabilitation of diversion canal 3. Rehabilitation of main/secondary/branch canals with related facilities 4. Construction of FWUC building 5. Installation of Automatic Hydro-meteorological Station 6. Establishment & Strengthening of FWUC/FWUGs 7. Strengthening of Agricultural Extension Services
Beneficiary Area	4,630 ha (Kpob Trobek: 4,115 ha, Tumnup Lok: 515 ha) *MOWRAM added 500 ha of additional area by the Tumnup Lok reservoir compared to the proposed area in the past preparatory survey (JICA 2012)
Beneficiary Households	3,334 Households (13,337 farmers)
Capacity of Reservoir *1)	Kpob Trobek Dam: 2.6 MCM Tomnup Lok Reservoir: 1.0 MCM
Catchment Area of Reservoir *2)	Kpob Trobek Dam: 141 km^2 Tomnup Lok Reservoir: 405 km^2
FWUC Activity	There is FWUC in the pilot site (100 ha, established by JICA in the past). However, farmers voluntary collected money to maintain the canals damaged by flood, which is not the activity of FWUC.

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

After a meeting and site visit at Kpob Trobek and Tumnup Lok Dams Flood control, Irrigation and Drainage JST found following:

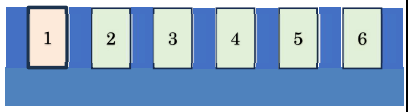
- Condition of the Irrigation Facilities
  - The dike of Kpob Trobek dam was build in Khmer Rouge regime, and has been rehabilitated 2 times: (1) the first rehabilitation was conducted from 2005 to 2006, removing a part of the upstream side of the embankment and extend upstream embankment about 4m at the top by MOWRAM. In 2006, asphalt pavement was provided on the dike top by the Ministry of Public Works. (2) In 2021, protection embankment shaping like a berm was provided at the upstream of those reservoir dike by MOWRAM because the surface of the reservoir embankment was eroded seriously.
  - The soil used for upstream berm contained silt and sand a lot and those soils have been eroded during two (2) rainy seasons. Currently many places of berm have already been eroded and it becomes nearly the same situation as before rehabilitation.
  - The chief considers that clay soils in the reservoir shall be used and the silty and sandy soils shall be replaced by it. It means that a disposal area is not necessary for this purpose.
  - On the clay embankment, the chief recommends placing riprap to protect the upstream surface.



Illustrated rehabilitation history of reservoir dike located at Kpob Trobek reservoir. Silty and/or sandy soil embankment at the upstream is found. At the time of February 2024, only 2 years passed after completion of berm embankment but serious erosions were found at many locations and protection function for upstream slope is not much expected. Replacement by the impervious soil with riprap is recommended.

Embankment of Kpob Trobek Dam. It has been heavily eroded even though MOWRAM rehabilitated in 2022. In the flood season, the water level sometimes reaches almost the same level of the top of embankment, which implies the lack of discharge capacity.

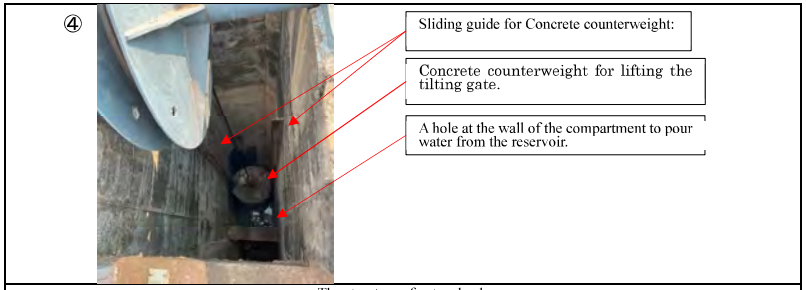
- There is a spillway along the Kpop Trobek reservoir embankment composed of six (6) tilting gates with 10m width. Gates are manually operated. Opening the gate is not so much problem but closing gate is quite difficult especially for the 2 gates at the center.
- In normal operation, No. 5 gate is firstly opened because No. 3 and No. 4 gates are difficult to close them: opening of plural gates' series is normally started from the gate at the center, then, both side gates are opened according to water release requirement. In this gates' case, the two (2) gates at the center cannot be easily closed, then, a neighboring gate (No. 5) is opened instead of the center gates.



Above: Looking from upstream to downstream, gate is numbered from the left side. Considering the hydraulic stability in the reservoir, the center gates No. 3 and No.4 are usually operated (gate opening). And then, No. 2 and/or 5 are operated in the next.

In the Kpob Trobek reservoir, No. 3 and No. 4 are difficult to close after opening, so that No. 2 is firstly opened instead of No. 3 and No.4.

- A concrete counterweight is used for the gate closing operation, but it is difficult to lift the counterweight up probably because high friction between the sliding guide and concrete counterweight.
- To minimize a required lifting force against the counterweight, operators pour reservoir water through a hole opened at the wall of counterweight compartment. After finishing water pouring, the counterweight can obtain hydraulic up-lift effect, then it becomes lighter than before.
- Wire rope is used for the gate lifting, but wire rope wheel is very hard to rotate because of high friction between sliding guide and counterweight, then, operators also use a normal rope to lift the concrete counterweight. The operator climbs down the ladder and ties the rope to the counterweight.



The structure of gate wheels

Downstream view of the Kpob Trobek spillway. There is no problem in its condition.

Broken facility from the main canal to secondary canal. It is not functioning.

- The Tumnup Lok reservoir which was also built in Por pot regime, has damaged in many places, and there is no major rehabilitation after it construction. Therefore, gates of the three intakes are not existing or heavily damaged, access road (bridge) has been broken, and the reservoir is not well functioning due to sedimentation.
- Road (reservoir dike) rehabilitation coupled with intake rehabilitation at 3 locations are proposed: the road becomes muddy during rainy season, and villagers face much difficulty to move from village to other places.

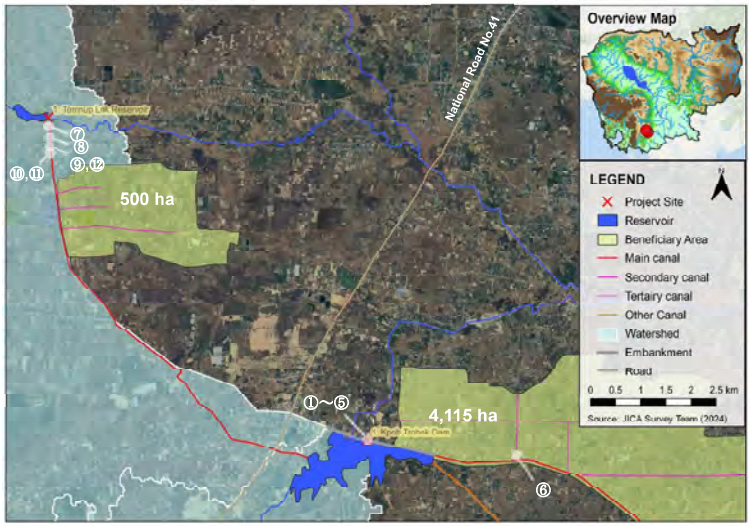
Two intakes and one spillway located along the Tumnup Lok reservoir dike (road). A type of these intakes is stop-log, which is difficult for quick operation.

⑩	⑪	⑫
		
Connection canal from Tomnup Lok reservoir to Kpob Trobek reservoir. There is no rehabilitation work after construction in Por Pot regime.	The maximum gate opening height is about 3m. If it becomes higher than 3m, hydraulic pressure to the logs become large and villagers cannot remove them.	PDWRAM officer showing the water level during flood event. Access road along the main canal is completely submerged during the flood season.

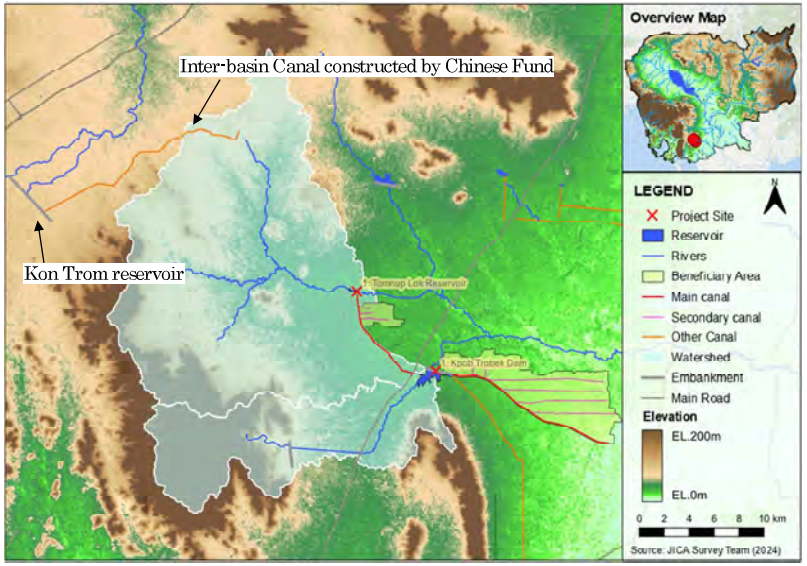
➢ Change in Water Allocation

- Inter-basin connection canal (Kon Trom canal) from the Kon Trom dam (which belongs to the Slakou river basin) is constructed by China fund. Therefore, the impact of the project above must be considered into the design of the discharge facilities for both Tomnup Lok reservoir and Kpob Trobek dam.
  - When the Kon Trom dam opens the gate about over 2 hours, the water flows to Tumnup Lok reservoir, then to the Kpob Trobek dam. A gate keeper needs to check the Kpob Trobek dam and open at one or two gates but the sometimes the gate keeper cannot open the gates due to the problem above.
- In addition, there is another existing canal flowing toward Kampot province, which was not considered in the past preparatory survey although the canal has existed since long time ago. The water balance calculation should be done with the water allocation to this irrigation scheme. JST needs a further study for this canal if necessary.

Map of Kpob Trobek Reservoir and Tumnup Lok Reservoir Irrigation Schemes-1



Map of Kpob Trobek Reservoir and Tumnup Lok Reservoir Irrigation Schemes-2



Attachment: Attendance List

No.	Name	Position
PDWRAM Siem Reap		
1		Chief Officer of Department Agricultural Irrigation
JICA Survey Team		
2		Team Leader (TL)/ Hydrology / Flood Control
3		Co-TL/ Irrigation Development Planning
4		Agriculture
5		Secretary
6		Survey Assistance
7		Survey Assistance
8		Survey Assistance

VI-11

Subject: Interview to PDWRAM and Site Visit to Kpob Trobek & Tumnup Lok Irrigation Schemes

Date & Time:	May 23 & 24, 2024
Location:	Meeting room at PDWRAM, Takeo Province
Attendants:	Refer to the attached Attendance List

The meeting with the PDWRAM was conducted to collect information related to the general and local water management rule as well as the O&M of facilities and current FWUC activities.

1. Inquiry Topics

PDWRAM Takeo

- About water management: The general O&M rule is that small scale irrigation schemes (<200 ha) are managed by the District Level Office, medium scale schemes (200 ha < 5,000 ha) are managed by PDWRAM, and large scale schemes (>5,000 ha) are managed by MOWRAM. However, in practice, O&M is mostly implemented by PDWRAM.
- The district level office, which is under the provincial city hall, is established as the responsible organization for small irrigation scheme O&M, but it is not functioning. PDWRAM doesn't have any connection with the district level office.
- Status of river basin management committees (national/state/city level): No action has been taken by PDWRAM level. According to PDWRAM Takeo, MOWRAM should be the responsible organization for it.
- Annual O&M cost details: The annual budget is 50 million riel/year, with 30 million riel/year for community level maintenance against flood-induced landslides. The community (district) requests the budget for maintenance from PDWRAM. In case of flood/drought treatment, the ministry (central level) will be involved in the cost.
- Methods of water allocation and flood warning/response: One irrigation scheme has one FWUC, and the FWUC makes its own rules (terms of conditions). Principally, all facilities, including gate operation and O&M of the main canal for Khpob Trobek, are managed by FWUC. Gatekeepers are the contracted persons with PDWRAM. Gatekeepers also have the responsibility for flood warning and inform PDWRAM and the gatekeepers at downstream irrigation schemes of the situation by phone. PDWRAM then gives instructions for gate control.
- Possibility of AWD: There is some experiences with AWD in Phnom Penh, but it did not continue. No information is available for the Khpob Trobek Irrigation Scheme. The water level decrease rate is estimated to be 5cm/day because the soil is mainly composed of sand.
- For the Ko Key irrigation scheme (Canal Length: 24km), there is no dry season cropping. Mainly cash crops (leafy vegetables) are grown.

Inquiries to FWUC (Prey Kdouch Irrigation System Dam FWUC and FWUC Khpob Trobek)

- Number of FWUC members (by gender):

  For Prey Kdouch Irrigation System Dam FWUC, there are 26 committee members (male: 15, female: 11), with a duration of 5 years. It is consisted by 1 Head of FWUC, 2 Deputy Heads, 1 Accountant,

and 3 committee members each for 7 villages composing FWUG. The total number of FWUC is 500 household, covering 550 ha (currently only 260 households registered).

For FWUC Khpob Trobek, there are an estimated 26 committee members (male 21, female 5). The total FWUC member is 750 households. It is consisted by 1 Head of FWUC, 2 Deputy Heads, 1 Accountant, and 2 committee members each for 11 villages composing FWUG.

In addition, there are 2 gate keepers who are contracted with PDWRAM for each FWUC.

- Registration rules for becoming an FWUC member:

  To become a member, a household member must register by submitting the application paper with some essential information such as name, address, holding farmland area etc. Multiple members from a household are counted as 1.

- Irrigation service fee (ISF) and collection method:

  For Prey Kdouch Irrigation System Dam FWUC, the ISF is 40,000 Riel/ha/season for gravity irrigation, 30,000 Riel/ha/season for gravity & pumping, and 15,000 Riel/ha/season for only pumping. Fee collection has not started yet (established in 2022). They plan to collect money after harvest.

  For FWUC Khpob Trobek, the ISF is a flat rate of 40,000 riel/ha/season. Only 2 times collection has been achieved because of the political reason. A governor made farmers stop collecting ISF.

- Expense details:

  For both FWUC, there is no expenditure because of no budget.

- Activities and their frequency:

  For Prey Kdouch Irrigation System Dam FWUC, there are meetings before planting for plantation planning (variety and water allocation), meetings after harvesting to report finance and harvest results, and an annual conference for collection of each monthly report, evaluation, and new strategy for next year.

  For FWUC Khpob Trobek, there are 3 meetings/month for asking about problems and water allocations, daily patrols, and water level monitoring during the wet season, 3 times a day (until September & October).

- Issues FWUC faced:

  For Prey Kdouch Irrigation System Dam FWUC, there is no experience as FWUC, difficulty in having meetings (due to off-farm business), and not enough storage (Volume: approx. 1 MCM).

  For FWUC Khpob Trobek, drinking water usage is not allowed during the dry season since 2017. It is estimated that approximately 1,400 households (6,440 people) are benefited by the water supply. *Assuming water consumption rate is 60L/day/person, it is calculated as 386m^3/day.

- Requests to the government:

For Prey Kdouch Irrigation System Dam FWUC, the requests are to make the reservoir capacity larger by digging, prevent farmers from using reservoir land (illegal land use) by making a boundary around the reservoir, and to add more check structures (currently 7 structures).

For FWUC Khpob Trobek, the requests are to increase the Khpob Trobek capacity by digging, fix the gate, and rehabilitate the canal (make deeper, establish check structures).

Attachment: Attendance List

No.	Name	Position
PDWRAM Siem Reap		
1		Deputy Director of PDWRAM
2		Chief Officer of Department Agricultural Irrigation
3		PDWRAM Staff
4		PDWRAM Staff
JICA Survey Team		
5		Team Leader (TL)/ Hydrology / Flood Control
6		Agriculture
7		Survey Assistant
8		Survey Assistant

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

Date & Time:	February 8, 2024, 9:00 - 11:00
Location:	Site Visit at Bati Flood Control, Irrigation and Drainage, Takeo Province
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

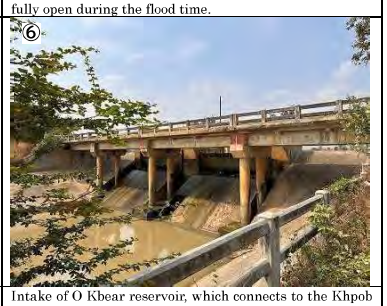
Item	Contents
Component	1. Demolition of existing spillway with bridge by construction of the headwork 2. Rehabilitation of existing reservoir dike and road network 3. Installation of U-shape concrete flume for the Main canal 4. Construction of FWUC building 5. Rehabilitation of Secondary/Branch canals 6. Installation of Automatic Hydro-meteorological Station 7. Establishment & Strengthening of FWUC/FWUGs 8. Strengthening of Agricultural Extension Services
Beneficiary Area	3,018 ha (Zone A: 1,935 ha, Zone B: 705ha, Zone C: 378 ha) *According to the interview, the command area is 5,000 ha, and it will increase to 20,000 ha
Beneficiary Households	14,372 Households (50,302 farmers)
Capacity of Reservoir *1)	Khpob Krous: 15 MCM (4.68 MCM based on the past preparatory survey, JICA 2012) O Kbear: 0.57 MCM (based on the past preparatory survey, JICA 2012) Ka Ek Tom: 1.96 MCM (based on the past preparatory survey, JICA 2012)
Catchment Area of Reservoir *2)	Khpob Krous Reservoir: 100 km^2 O Kbear: 93km^2 Ka Ek Tom: 14km^2
FWUC Activity	There is no FWUC in the irrigation scheme, but PDWRAM requested to MOWRAM to establish FWUC.

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

After a meeting with PDWRAM Kampong Speu and site visit at Kpob Krous Reservoir Flood control, Irrigation and Drainage JST found following:

- Condition of the Facility
  - Khpob Kruos reservoir is located in Bosedth district, Kompong Speu province. It was constructed during the Por Pot Regime in 1976. The MOWRAM implemented the rehabilitation for the gate in 2007, but now the condition of the gate is not good so that the flow is not stable. Currently, rehabilitation of a series of gates are required to mitigate the flood. Regarding the gate operation in case of flood, PDWRAM usually open 2 gates because if all the 4 gates are open, downstream area becomes inundated.
  - PDWRAM requires an automated gate operation system to enable systematic and integrated gate operation by observing water levels in the reservoir and downstream river. PDWRAM also mentioned that flood water releasing alarm system shall be installed to provide alarm to the downstream people before water releasing.
  - In addition, PDWRAM plan to increase the storage capacity by raising the high-water level by 0.5m to mitigate the flood as well as to keep more water for dry season. The crest level of dikes is raised to keep with 1.5m free board.
  - Current bridge on the spillway shall be replaced by the wider width bridge because traffic volume on the dam crest road has been increasing.

- All the main/secondary and branch canals have earthen canal and seepage from the bottom of canal is not ignorable (bottom of the canal is composed of silty and/or sandy soil). Therefore, the PDWRAM requested those be upgraded to concrete lining canal to realize higher irrigation efficiency.

① 	② 
Spillway of the Khpob Krouse reservoir constructed in 1976 and rehabilitated in 2007 by MOWRAM. It has four automatic gates (8.0m of width and 2.2m of height). PDWRAM requested replace it because there is difficulty to open the gate due to the malfunction of the motor.	Base soil of the main canal is composed of silty and/or sandy materials. Permeability of this soil will be high, then it is not suitable for the base of hydraulic structure. It will be easily eroded and water in the canal will infiltrate into soil: water loss at canal conveyance becomes high.
③ 	④ 
Downstream of the Khpob Krouse reservoir. Failure to release the amount of water caused flooding.	Intake facility of the Khpob Krous reservoir, which has 3 manual gates with 1.5m of width and 3.0m of height. It is fully open during the flood time.
⑤ 	⑥ 
Main canal constructed in 1976. It is earthen canal and requested to install the U-shape concrete flume.	Intake of O Kbear reservoir, which connects to the Khpob Krous Irrigation system. There is no problem and no need to rehabilitate based on the document provided by MOWRAM.

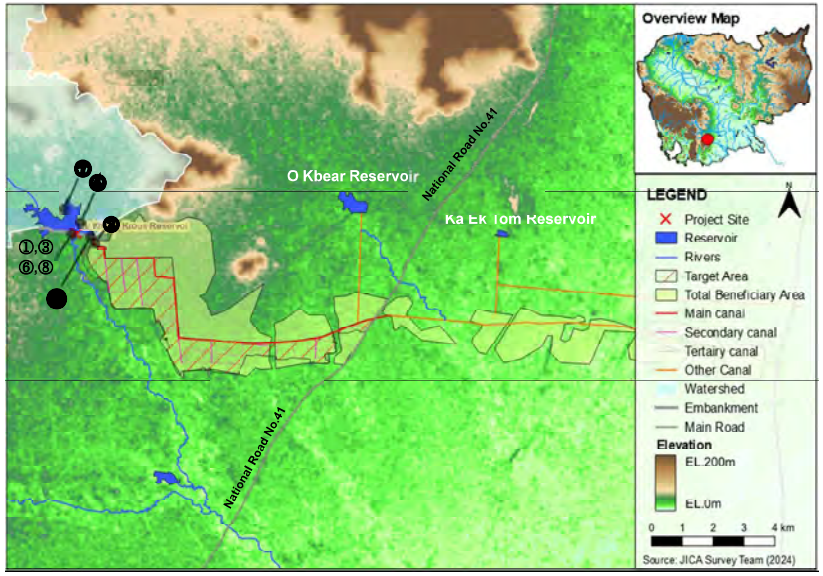
- There are some houses and farmland inside of the reservoir where the water is dried up during dry season. Furthermore, small shops and houses are observed along the dike. The survey for the social considerations should be carried out before the project implementation.

⑦ 	⑧ 
A house and farmlands on an islet in the reservoir. The house seems to be recently constructed. During wet season, persons in the house move to other place according to explanation of PDOWRAM staff.	A house at the downstream of dike embankment. If crest level is heightened, additional embankment may affect this house area.

- Impact of Flood and Drought
  - Downstream area of the irrigation scheme where the farmland area close to the National Road No.3 (around Panksey Market) gets affected by flood every year. It usually occurs from July to October, lasting 7-10 days (0.7m in depth on the farmland). There is no big damage to agricultural activities but affects to the other business activities due to inundation of the road (30 factories were affected by flood in 2023 for example). There is no change regarding the scale of flood compared to the past flood.
  - Farmers utilize the irrigation water during the small dry season in wet season. The water cannot be reserved until the dry season (early December) so that the water utilization is limited only for their domestic water use and small-scale horticulture. Due to this water limitation, PDA and PDWRAM prohibit farmers to cultivate paddy beyond the plan of cultivation area. (During the wet season, all the farmers cultivate paddy)
- Others
  - Khpob Krous Irrigation Scheme is composed of 3 reservoirs: Khpob Krous reservoir, O Kbear reservoir, and Ka Ek Tom reservoir. In this interview, PDWRAM cannot identify the exact target area, so further confirmation to MOWRAM is required to identify the command area.
  - Solar energy system is not appropriate because it is unreliable during the case of emergency. Generator is preferable. PDWRAM or farmers will pay the cost.
  - Flood caution announcement can be made if the project is implemented.

VI-20

Map of Khpob Krous Irrigation Scheme-1



Attachment: Attendance List

No.	Name	Position
PDWRAM Siem Reap		
1		Director of Provincial Department of Water Resource and Meteorology
2		Vice Director of Provincial Department of Water Resource and Meteorology
3		Chief Officer of Department Agricultural Irrigation
4		Chief of Preah Khae Commune
5		Vice Chief of Preah Khae Commune
6		Chief of Trapeang Kyorng Commune
7		Vice Chief of Trapeang Kyorng Village
JICA Survey Team		
8		Team Leader (TL)/ Hydrology / Flood Control
9		Co-TL/ Irrigation Development Planning
10		Agriculture
11		Secretary
12		Survey Assistance
13		Survey Assistance

VI-13

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

Date & Time:	February 13, 2024, 9:00 – 17:00
Location:	Meeting Room at the PDWRAM Siem Reap, Site Visit at Plain Irrigation Scheme
Attendants:	See 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 (Plain)

Item	Contents
Component	1. Construction of connection canal (16km) 2. Construction of one headwork and four new intake facilities 3. Rehabilitation of main/secondary canals with related structures 4. Construction of branch canals with related structures 5. Installation of Automatic Hydro-meteorological Station 6. Establishment & Strengthening of FWUC/FWUGs 7. Strengthening of Agricultural Extension Services
Beneficiary Area	14,800 ha
Beneficiary Households	7,444 Households (38,878 farmers)
Capacity of Reservoir *1)	Ou Bay Tap reservoir (located in Varin district, Siem Reap province): unknown (very small) Stoeng Sreng 1 reservoir located in Srey Snom district, Siem Reap province): unknown Stoeng Sreng 2 located in Chongkal district, Orror Meanchey province: 260 MCM
Catchment Area*2)	Plain: 2,882 km^2 Ou Bay Tap reservoir: 425 km^2
FWUC Activity	There is no FWUC in this irrigation scheme. FWUC building is required along National Road 63 combined with FWUC Spean Sraeng.

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

After a meeting with PDWRAM Siem Reap and site visit at Plain Flood control, Irrigation and Drainage JST found following:

- Reason for Prioritization
  - There is a water release problem due to the malfunction of gates. Every 1 to 10 years, huge flood occurs in this irrigation system. Automatic gate are required because quick gate operation is necessary during flood.
  - During the dry season, there is no cultivation in Plain area because no water is available (there is no reservoir that has enough storage upstream). Therefore, PDWRAM is planning to transfer the water resource from Spean Sraeng (connection canal with a length of 16km).
  - Dam embankment rehabilitation (to increase storage capacity), using the soil on the reservoir. MOWRAM has carried out the soil test in around 2014. Construction has started in 2015 by ADB but it stopped (*Main canal was constructed by Chinese fund). The data is available if JST asks the data, but PDWRAM recommended to test again.
- Impact of Flood and Drought
  - In the flood season, the water overflows the embankment and farmland submerged (0.5m in depth) for 7 to 10 days.
  - Flood affected area is estimated as 5,000 ha (mainly in the Spean Sraeng area). Farmers are used to the flood environment, so PDWRAM mentioned there is no big damage by flood. However, farmers in the Plain area cannot get 100 % yield even in wet season because the water becomes salty.

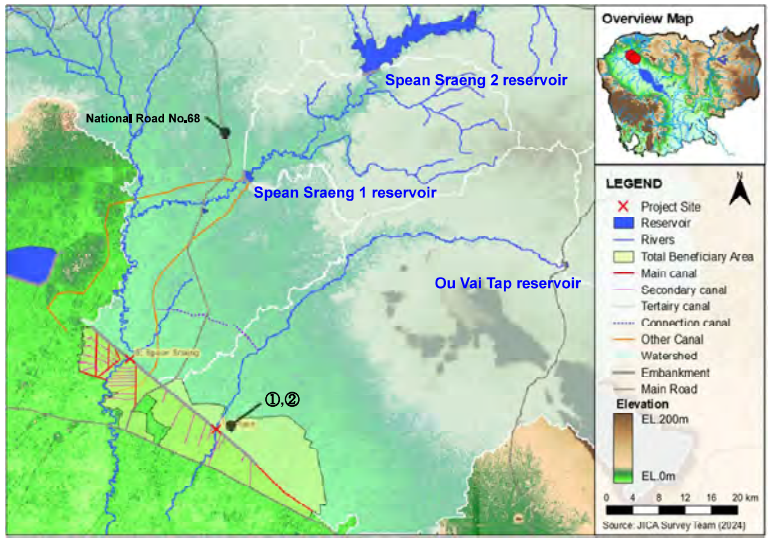
- The slope of canals is eroded by flood, so PDWRAM requested to rehabilitate the canals with concrete slope.

➢ Water Allocation

- Total water allocation of the Plain and the Spean Sraeng area is 153MCM. There is a dam upstream which capacity is 260 MCM in Oddor Meanchey province. MOWRAM and all the related PDWRAMs discuss to determine the water allocation among three provinces (Siem Reap, Banteay Meanchey and Oddor Meanchey).
- Especially during dry season, an official letter will be sent from FWUC to PDWRAM and to MOWRAM (if necessary), and responsible organization will be responsible for water allocation.

	
Spillway of the Plain Irrigation Scheme (left: downstream, right: upstream). Flood makes overflow on the embankment almost every year. On the other hand, there is no water during dry season so that farmers cannot cultivate rice on this period.	The downstream of the embankment. There is no facility on the downstream and almost natural condition.

Map of Spean Sraeng and Plain Irrigation Scheme



Attachment: Attendance List

No.	Name	Position
PDWRAM Siem Reap		
1		Director of Provincial Department of Water resource and Meteorology
2		Chief Officer of Department Agricultural Irrigation
3		Deputy Officer of Department Administrative
4		Deputy Officer of Department Agricultural Irrigation
5		Chief Officer of Department Administrative
JICA Survey Team		
6		Team Leader (TL)/ Hydrology / Flood Control
7		Co-TL/ Irrigation Development Planning
8		Agriculture
9		Secretary
10		Survey Assistance
11		Survey Assistance
11		Survey Assistance

VI-14

Subject: Interview to the PDWRAM Siem Reap and FWUC

Date & Time:	May 30, 2024, 9:00 - 11:00
Location:	Meeting Room at the PDWRAM Siem Reap, Site Visit at Spean Sraeng Irrigation Scheme
Attendants:	See the attached Attendance List

The meeting with the PDWRAM was conducted to collect information related to the general and local water management rule as well as the O&M of facilities and current FWUC activities.

[PDWRAM Siem Reap]

Water management

- The general O&M rule is that small scale irrigation schemes (<200 ha) are managed by the District Level Office, medium scale schemes (200 ha < 5,000 ha) are managed by PDWRAM, and large scale schemes (>5,000 ha) are managed by MOWRAM. However, in practice, O&M is mostly implemented by PDWRAM (same as PDWRAM Takeo and Banteay Meanchey)
- MOWRAM (TSC) usually provides training for maintenance of irrigation facilities.
- River Basin Management Committee along Stung Sreng was established by MOWRAM in three provinces. Three PDWRAM directors discussed the current utilization status of water resources, but the discussion didn't continue after that (attendants do not know why).
- In addition, two gate keepers are contracted by PDWRAM and they record the water level of the reservoir everyday (even during dry season).

Operation and maintenance of small and medium-sized schemes

- PDWRAM is responsible for the maintenance of irrigation facilities (in small scale), which budged is 300 million Riel/year. They are also responsible for the gate operation of the existing spillway facility in Spean Sraeng that is constructed in 2015 by ADB.

Water allocation and flood warning/response methods

- Flood warning rules:

  There are rainfall stations upstream (Oddar Meanchey?). If the rainfall amount is more than the criteria (100-200 mm/day), they start to prepare floods. Risk Management Committee in Siem Reap province prepare the measures based on the information.

  Meteorological office is responsible for monitoring the rainfall data everyday. Meteorological office report to the director of PDWRAM, and the director share this information to Risk Management Committee and MOWRAM. After checking the rainfall data, gate keepers start to monitor the river/reservoir water level.

  Regarding the flood response, when heavy rainfall event (more than 100mm/day) is observed, the upstream gate keepers inform the downstream gate keepers of that information (EL17.50m is the Flood water level in the reservoir). The gate keepers in the FWUC record the water level every day and report to PDWRAM (not only during wet season but also in dry season as well.

  *Discharge Station: Kralanh → can be obtained from PDWRAM. They will provide it later.

- Drought management

  Regarding the Sraeng1 reservoir, there is water management committee which is consisted by each PDWRAM Director.

  Farmers inform water request to sub-group, and they inform this commune level. Commune level request to FWUC director, who made letter. And based on the letter, PDWRAM makes a decision. Regarding the water allocation, there is no official meeting among multiple provinces on water allocation.

  Request to open the gate in upstream PDWRAM (Oddar Meanchey) to provide enough water for cultivation. (Only if there is enough water in Oddar Meanchey). However, PDWRAM Oddar Meanchey has never opposed to the water supply request (no discussion even though the water seems to not enough for cultivation).

[FWUC] Makak Dombon FWUC (established in 2012 and activated in 2022)

- Number of FWUC members (by gender):

  There are 164 Committee members. It is consisted by 1 Head of FWUC, 2 Deputy Heads, 1 Accountant, and 24 committee members each for 6 FWUG, and 136 sub-committee members in 68 sub-FWUG. The total number of FWUC is 12,352 household, covering 21,155 ha. It is described as the election is necessary 1 in 5 years to determine the committee members.

- Registration rules for becoming an FWUC member:

  To become a member, a household member must register by submitting the application paper with some essential information such as name, address, holding farmland area etc. Multiple members from a household are counted as 1. Registration fee is free.

- Irrigation service fee (ISF) and collection method:

  ISF is described as 40,000 Riel/ha/season, but it depends on the damaged area of flood (50% damaged, it becomes 20,000 Riel/ha*). The fee is directly collected in sub-FWUG level. Village chief gave them permission. Fee collection rate is around 30%, which fluctuate based on the impact of flood and drought.

- Expense details:

  Budged allocation is described as below:
  - FWUC Administration (4%)
  - Commune Head (1%)
  - Commune Admin (15%)
  - 6 Groups of Commune (2%)
  - Sub-Groups (10%)
  - Maintenance/Rehabilitation of Irrigation Facilities (approx. 70%)
  - Saving (depending on situation of facilities condition).

- Activities and their frequency:

  - Meeting (4 tines/year: before planting during early wet season, before harvesting, after harvesting, Annual report meeting which is usually taken in January)

- Announce of Fee Collection
- Announce of Cropping Calendar
- Solve Water Conflict when FWUG cannot solve.

- Issues FWUC faced:

  There is water conflict between sub-FWUG (common conflict: duration of water utilization is limited but they don't obey the rule). In that case, they make opportunity for the meeting. If not solved, FWUC intervenes to solve the problem.

Attachment: Attendance List (PDWRAM Siem Reap)

No.	Name	Position
PDWRAM Siem Reap		
1		Chief of Agricultural Irrigation Office
2		Vice Chief of Agricultural Irrigation Office
3		FWUC Office
4		FWUC Director (Makak Section 1)
5		Deputy 1
6		Deputy 2
7		Accounting
8		Contracted officer (gate keeper)
9		Contracted officer (gate keeper)
JICA Survey Team		
10		Team Leader (TL) / Hydrology / Flood Control
11		Agriculture
12		Survey Assistance
13		Survey Assistance

VI-23

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

Date & Time:	February 13 2024 9:00 - 17:00 (Siem Reap), 14 9:00 - 15:00 (Banteay Meanchey)
Location:	Meeting Room at the PDWRAM Siem Reap, Site Visit at Spean Sraeng Irrigation Scheme
Attendants:	See 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 (Spean Sraeng)

Item	Contents (Siem Reap province)	Contents (Banteay Meanchey province)
Component	1. Rehabilitation of main embankment (6.5km) 2. Rehabilitation of 1 headwork, 2 intakes, and main/secondary canals (14km/23km each) with related structures 3. Construction of branch canals 4. Improvement of road network 5. Construction of FWUC building 6. Installation of Automatic Hydro-meteorological Station 7. Establishment & Strengthening of FWUC/FWUGs 8. Strengthening of Agricultural Extension Services	1. Rehabilitation of main embankment (9.0km) 2. Rehabilitation of 1 headwork, 3 intakes, and main/secondary canals (23km/30km each) with related structures 3. Construction of branch canals 4. Improvement of road network 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	12,500 ha for both of two provinces	
Beneficiary Households	4,459 Households (22,889 farmers) for both of two provinces.	
Capacity of Reservoir *1)	Ou Bay Tap reservoir (located in Varin district, Siem Reap province): unknown (very small) Stoeng Sraeng 1 reservoir located in Srey Snom district, Siem Reap province: unknown Stoeng Sraeng 2 reservoir located in Chongkal district, Onor Meanchey province: 260 MCM	
Catchment Area*2)	Spean Sraeng: 6,803km^2 (3,256 km^2 for Stoeng Sraeng1 and 2,502km^2 for Stoeng Sraeng2)	
FWUC Activity	FWUC functioned until 2022. Now it is not active due to flood in 2022 which caused severe damage in farmland.	

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

After a meeting with PDWRAM Siem Reap & Banteay Meanchey and site visit at Spean Sraeng Flood control, Irrigation and Drainage JST found following:

- Reason for Prioritization (Condition of Facility)
  - Spean Sreng river is water rich river which has 6,803 km^2 of catchment area. However, there is a water release problem due to the malfunction of gates. Every 1 to 10 years, huge flood occurs in this irrigation system. Automatic gates are required because quick gate operation is necessary during flood.
  - The headwork was fully replaced in 2015 by ADB fund. However, all the 4 gates (6.0m in width and 7.0m in height) of the headwork should be further rehabilitated because water leakage was observed even the gates were fully closed. Furthermore, there is no gate-grooves for stoplog installation, which makes repairing work for the existing gate much harder. The design did not consider about the maintenance and/or repairing works after completion of construction.
  - Some gates of the embankment that area located in the Banteay Meanchey province were dismantled in 2018, and the bridge was constructed by ADB financed project. PDWRAM staff are not sure why gates were replaced by the bridge. Since then, water from the reservoir ran off to the downstream freely. Then, main canal of the downstream has been eroded during flood.

Sign board for headwork construction project, financed by ADB, completed in 2015

Upstream side view of the headwork. There is no gate-groove for stoplog installation, which makes repairing work quite difficult.

Downstream side view of the headwork. Water leakage was observed at the bottom side edge.

Gates from downstream side. There are four (4) gates in the headwork. All gates are closed but water leakage was observed at the contact portion between gate and guide frame, where water tightness is not enough. Precise construction management and control are usually required for gate installation.

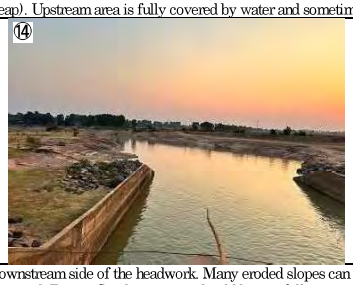
Left: No.1 intake place. Intake was rehabilitated in 2015-2018 by ADB fund. Gate size is 1.0m width and 1.2m height, total 6 numbers. Gates operation takes time because the gates are operated manually.
Center & Right: Bridge constructed by ADB fund. It used to be gates there, so now there is no function to store the water.

- Downstream of the Spean Sraeng irrigation scheme is flood prone area (sometimes the area is submerged for 2 months), so strengthening the discharge ability and the construction of the flood protection dike along the river is crucial in this irrigation scheme.
- To keep proper mobility of the access road during wet season for prompt gate operation, it is proposed that raising the height of embankment having certain height from the water surface during the wet season, paving the dike top with asphalt. Current maintenance road condition during wet season becomes muddy and quite difficult to approach to the site.
- Canals and roads which were constructed long time ago are damaged through floods, which caused the malfunction of gates (they cannot be open properly and promptly). In 2020 flood case, houses in downstream of the reservoir were affected and some hydraulic facilities including Spean Sraeng dike (slope slide was observed) as well as the canal lining to prevent from the flood damage (mainly slope erosion).

Upstream side of the embankment. Spean Sraeng river has a flow during the dry season, and also there is a big dam (Spean Sraeng 2, capacity: 260 MCM).

Connection Point of Spean Sraeng and Plain Irrigation Scheme. Water flows from Plain to Spean Sraeng, so Plain irrigation scheme cannot obtain water from the Spean Sraeng river.

East end of the Spean Sraeng irrigation Scheme (upstream of the embankment). Photo at the left side was taken on the date of this survey whereas the one at the right side was the same location during the wet season 2023 (obtained from PDWRAM Siem Reap). Upstream area is fully covered by water and sometimes overflow on the embankment.



Downstream side of the headwork. Many eroded slopes can be observed. During flood time, gate should be carefully operated to avoid the inundation of downstream residential area.

Downstream side of the main canal intake (Currently bridge). Slope of the canal got damaged every year due to flood, and farmers repair the canal voluntary according to PDWRAM Banteay Meanchey.

The connection point between secondary to main canals. The right bank of a main canal was broken due to flood.

The secondary canal connected from the eroded intake. After the main canal erosion, flashed water scoured the secondary canal

	
Tertiary canal. It is not directly connected to the intake structure. Only the canal trench was excavated.	Intake to the tertiary canal. There is an intake structure but there is no canal trench connecting to the intake structure.

- Dam embankment rehabilitation (to increase storage capacity), using the soil on the reservoir. MOWRAM has carried out the soil test in around 2014. Construction has started in 2015 by ADB but it stopped (*Main canal was constructed by Chinese fund). The data is available if JST asks the data, but PDWRAM recommended to test again. In addition, some of the main canals were rehabilitated with concrete lining, which is financed by ADB and constructed by Chinese company.
- PDWRAM Siem Reap estimates the increase in cultivation area by 5,000 ha if the water is supplied during dry season (currently, only 700 ha is cultivated in the downstream of the Spean Sraeng irrigation scheme).

➢ OM of Facility and Water Management

- Spean Sraeng 1 reservoir is regulating reservoir to discharge water to two provinces (Siem Reap and Banteay Meanchey). 153 MCM of water resources are allocated to Spean Sraeng river.
- Activities of gate opening, requesting to MOWRAM for water supply from the upstream dam reservoir are collaboratively done by FWUC and PDWRAM. If there is a problem which cannot be solved by themselves, they will ask MOWRAM to provide solution.
- Before Spean Sraeng, facilities are managed by FWUC and PDWRAM Banteay Meanchey province. After construction, it is managed by FWUC and PDWRAM Seam Reap province. In case of heavy flood occurring, both provinces discuss with MOWRAM.

	Power transmission line seen at No.3 intake place. According to 'Power Development Plan 2022 - 2040' established in September 2022 by the Ministry of Energy, Royal Government of Cambodia, power supply in Banteay Meanchey province will be 1) imported from Thailand, and 2) solar PV(Photovoltaic). If the power source is solar PV, power supply in wet season will not be stable.

➢ Others

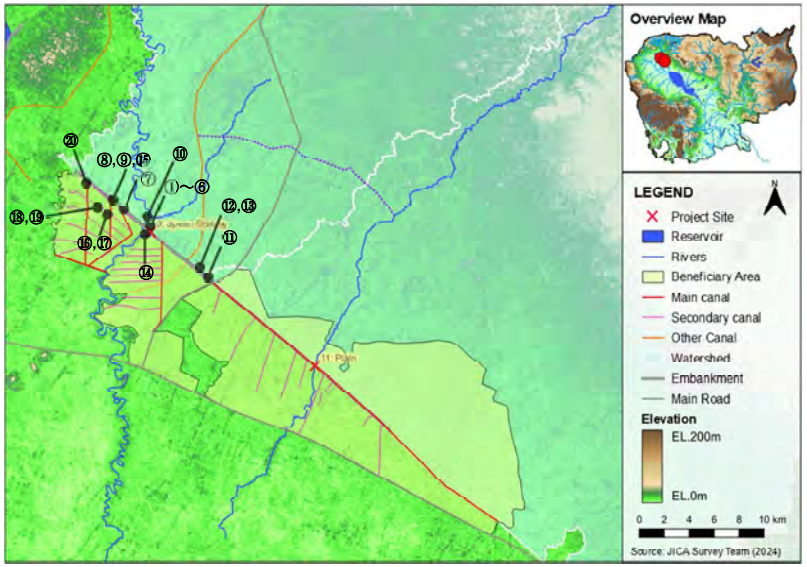
- The existing FWUC building is too small considering its scale. Therefore, PDWRAM requests to construct the larger FWUC building at the boundary of Spean Sraeng and Plaing Irrigation Scheme for both irrigation schemes.
- At the locations of No.3 and No.2 intakes, power transmission line is provided by a private company. If it is expanded to another edge of dike in the project, automatic gate operation can be considered.
- There is no on-going project or study in the Spean Sraeng irrigation scheme. For the other area in

Banteay Meanchey, Irrigation Development and Flood Mitigation Project 2021 - 2026 is on-going by KOICA.

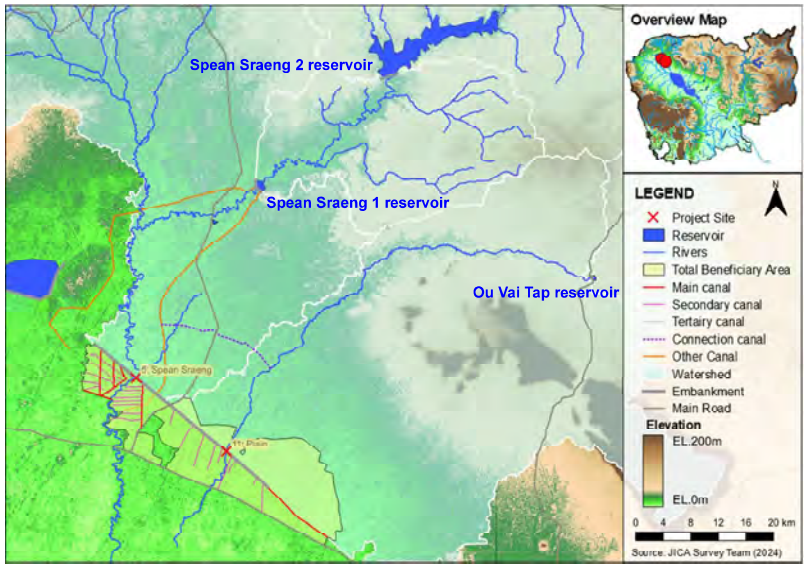
- 7 reservoirs and related canals are studied for dredging by AFD.

	
Project map of KOICA project. Components of the project are composed of canals' rehabilitation and improvement under 4 reservoirs. After completion of the project, total beneficiary area will be 18,416 ha	Project schedule of the KOICA project. Project has started in January 2022 and it will complete in June 2026.

Map of Spean Sraeng & Plain Irrigation Scheme -1



Map of Spean Sraeng & Plain Irrigation Scheme-2



Attachment: Attendance List (PDWRAM Siem Reap & Banteay Meanchey)

No.	Name	Position
PDWRAM Siem Reap		
1		Director of Provincial Department of Water resource and Meteorology
2		Chief Officer of Department Agricultural Irrigation
3		Deputy Officer of Department Administrative
4		Deputy Officer of Department Agricultural Irrigation
5		Chief Officer of Department Administrative
PDWRAM Banteay Meanchey		
6		Deputy Officer of Agriculture Irrigation
7		Deputy Officer of Meteorology
JICA Survey Team		
8		Team Leader (TL)/ Hydrology / Flood Control
9		Co-TL/ Irrigation Development Planning
10		Agriculture
11		Secretary
12		Survey Assistance
13		Survey Assistance
14		Survey Assistance

Subject: Interview to the PDWRAM Banteay Meanchey

Date & Time:	May 27, 2024, 9:00 - 11:00 (PDAFF)
Location:	Meeting Room at the PDWRAM Siem Reap, Site Visit at Spean Sraeng Irrigation Scheme
Attendants:	See the attached Attendance List

The meeting with the PDWRAM was conducted to collect information related to the general and local water management rule as well as the O&M of facilities and current FWUC activities.

1. Inquiry Topics

[PDWRAM Banteay Meanchey]

Water management

- The responsibility for O&M of PDWRAM is with PDWRAM and FWUC, as they operate and manage small-scale irrigation schemes, so there is no district irrigation office.
- For large-scale irrigation schemes, MOWRAM and PDWRAM are responsible for O&M. However, MOWRAM only supports training for PDWRAM staff, and O&M is mainly carried out by PDWRAM. The budget is provided from MOWRAM, but it is very small.
- As for large scale irrigation schemes, the PDWRAM usually asks permission from the MOWRAM to open and close the gate.

Operation and maintenance of small and medium-sized schemes

- MOWRAM is responsible for providing a budget to FWUC (not enough for FWUC to maintain on its own). PDWRAM is responsible for training (financial management, administrative management, maintenance and operation training, etc., how to open and close gates, how to resolve water disputes). Training will be provided in Spain Slan in 2025.
- Regarding the water conflict, there are no more disputes because the responsibility for gate opening and closing was changed to Siem Reap in 2023. Siem Reap cultivates during the wet rice season, while Banteay Meanchey farmers cultivate mainly during the dry season.
- O&M activities: PDWRAM and MOWRAM (responsible for major facilities such as gates and embankments, major canals, but FWUC is responsible for secondary canals)

Water allocation and flood warning/response methods

- Flood warning rules:

  In case of heavy rain, PDWRAM Oddar Meanchey (upstream PDWRAM) calls downstream Directors of PDWRAM (Banteay Meanchey and Siem Reap). The directors instructs the responsible department (Agriculture and Irrigation Department), and they obtain the keys for gate operation (however, the responsibility has now been completely transferred to Siem Reap).

- Drought management

  Request to open the gate in upstream PDWRAM (Oddar Meanchey) to provide enough water for cultivation. (Only if there is enough water in Oddar Meanchey). Regarding the water allocation, there is no official meeting among multiple provinces on water allocation.

[FWUC] Spean Sraeng Rorlun Chrey (established in 2015 by Institute of Standard of Cambodia)

- Number of FWUC members (by gender):

  There are 30 Committee members. It is consisted by 1 Head of FWUC, 2 Deputy Heads, 1 Accountant, and 2 committee members each for 13 villages composing FWUG. The total number of FWUC is 1,365 household, covering 3,044 ha (Part of beneficiary area is under Spean Sraeng Irrigation Scheme). It is described as the election is necessary 1 in 5 years to determine the committee members, but it has never been implemented due to the lack of budged.

- Registration rules for becoming an FWUC member:

  To become a member, a household member must register by submitting the application paper with some essential information such as name, address, holding farmland area etc. Multiple members from a household are counted as 1. Registration fee is 20,000 Riel.

- Irrigation service fee (ISF) and collection method:

  ISF is described as 40,000 Riel/ha, but it depends on the damaged area of flood (50% damaged, it becomes 20,000 Riel/ha*). The fee is collected by 4 committee members by directly going to the committee village and collecting the money one by one. Village chief gave them permission. Fee collection has been achieved 70-80% in 2017 and 2018, but after 2019 they couldn't collect money due to flood impact.

  * Farmer need to claim the discount of ISF to village chief in the commune-level monthly meeting (attendants: village chief, local authority such as police, district council member, FWUC village committee members). After meeting, the information is provided to FWUC community and district level. Final decision maker of farmers' claim is FWUC.

- Expense details:

  Budged allocation is described as below:
  Committee: 6%,
  District Admin: 2%,
  Commune Admin: 3%, and
  FWUG committee: 4%.

  However, budged is not properly allocated due to very small budged through unsuccessful ISF collection. In addition, During the duration from July to November, 20,000 riel/day is paid to FWUG for facility check.

- Activities and their frequency:

  ・Meeting (2 tines/year: beginning and end of season) to determine O&M policy
  ・Announce of Fee Collection
  ・Announce of Cropping Calendar
  ・Solve Water Conflict when FWUG cannot solve.

- Issues FWUC faced:

  FWUC need lining canals, drainage facilities and access roads. All of them are in case of flood.

Attachment: Attendance List (PDWRAM Banteay Meanchey)

No.	Name	Position
PDWRAM Banteay Meanchey		
1		Head of Clean Water and Hygiene Office
2		Contracted Officer
3		Contracted Officer
JICA Survey Team		
4		Team Leader (TL)/ Hydrology / Flood Control
5		Agriculture
6		Survey Assistant
7		Survey Assistant

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

Date & Time:	February 15, 2024, 9:00 - 15:00
Location:	Meeting Room at the PDWRAM Kampong Thom, Site Visit at Samseb Kanha Dam
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 (Samseb Kanha Dam)

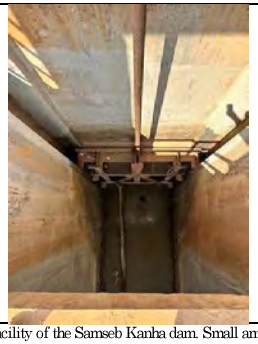
Item	Contents
Component	1. Rehabilitation of existing spillway (replacement to a new headworks) 2. Rehabilitation of 6 intake structures (replacement) 3. Rehabilitation of reservoir (15km of embankment) 4. Rehabilitation of main/secondary canals, construction f branch canals 5. Construction of FWUC building 6. Installation of Automatic Hydro-meteorological Station 7. Establishment & Strengthening of FWUC/FWUGs 8. Strengthening of Agricultural Extension Services
Beneficiary Area	35,339 ha (PDWRAM mentioned the potential area as 50,000 ha)
Beneficiary Households	55,132 Households (220,528 farmers)
Capacity of Reservoir *1)	Samseb Kanha Dam: 35 MCM (estimation from water surface area by PDWRAM)
Catchment Area*2)	Spean Sraeng: 1,756 km^2
FWUC Activity	FWUC functioned until 2022. Now it is not active due to flood in 2022 which caused severe damage in farmland.

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)
  - This Irrigation Scheme is suffering from water shortage during dry season. Water storage volume of the dam is not enough to supply water to the beneficiary area (3 districts), and furthermore the gates of the dam cannot be closed properly.

Intake Facility of the Samseb Kanha dam. It works without any problems, but PDWRAM requests replacement.



Gate Facility of the Samseb Kanha dam. Small amount of water seepage is observed.

Spillway of the Samseb Kanha Dam (Constructed in 1990 by MOWRAM and rehabilitated by China in 2017). The fulcrum of the gate is bent due to flood.

Spillway apron of the Kanha Dam. It is broken due to inappropriate design (reinforcement bar was not properly set).

- Main canal and branch canals are already rehabilitated by Chinese fund in 2017. However, the capacity of drainage canal is not enough compared to inlet volume, which causes floods. Flood occurs almost every year, and the most severe flood recently occurred is the one in 2022/2023. It affected even the national road No.6 (Western area of the irrigation scheme). 50,000 ha area in lowland of the irrigation schemes got inundated (depth: 1.0 - 1.2m) for 2 weeks.

- Condition of the Facilities
  - Due to poor design of rehabilitation in terms of hydraulic condition, irrigated/flood water flows at right angle at the terminal, which causes heavy erosion. After washing out of base soils, concrete structures above the soil were damaged and broken into pieces (picture below at the left side).
  - A connecting canal and an intake gate to the main canal terminal. Overflowed flood water caused damage at this canal (picture below at the center)
  - The original width is about 3 times wider than the rehabilitated canal. The right side in the photo is a part of the original canal (picture below at the right side).

End of point of the main canal

Intake gate and main canal at terminal

Comparison of the original main canal and rehabilitated canal.

- Canals are rehabilitated with irrigation oriented, without flood control purpose, then, plain concrete/mortar was placed for all concrete lining parts, without providing any reinforcement bars. When high speed flood comes, canals are heavily eroded. It makes concrete lining canals broken: the bottom of the canals is lifted upward, making cracks, and broken soon.

Concrete canal lining (Main canal). Some portions of canal bottom are lifted up.

Close up view of raised portion of canal bottom. Uplift water pressure during flood period lifted those concrete slab. Without reinforcement bars, those were broken soon.

Samseb Kanha reservoir. There is no house upstream area but there are some illegal paddy areas inside of the reservoir for dry season cultivation.

Secondary canal (concrete lining) which was rehabilitaed in 2017 by Chinese fund. There are no significant damages on the canal.

- Due to urbanization of the downstream, existed urban drainage system was buried under houses. Then, drainage water from the urban also comes to canals of the project.
- There is no facility to record the water level of the dam. PDWRAM takes photos every day, but this is not the official data.

➢ Domestic Water Supply

- The water from the Samseb Kanha dam is also used for domestic purposes. After the construction of water storage facilities by MOWRAM, shortage of domestic water was solved.

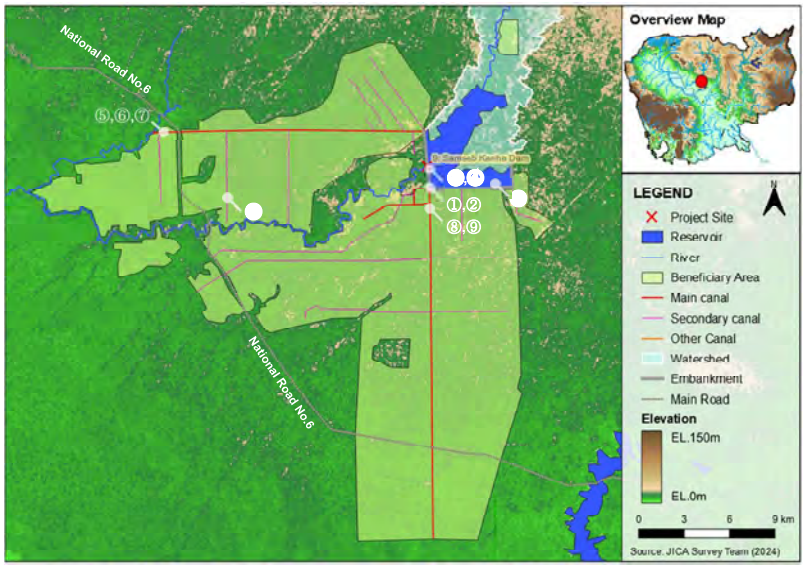
➢ Activity of FWUC

- FWUC has never been established in the irrigation scheme.

➢ Other Donor Activity

- Irrigation Project was conducted in 2017 (written above). They also do the study in upstream of the scheme regarding the construction of a reservoir.
- The World Bank made a study in 2023 about the rehabilitation of the same irrigation schemes.

Map of Samseb Kanha Irrigation Scheme



Attachment: Attendance List (PDWRAM Kompong Thom)

No.	Name	Position
PDWRAM		
1		Chief Kompong Thom PDWRAM
2		Voice-Chief of Kompong Thom PDWRAM
JICA Survey Team		
3		Team Leader (TL)/ Hydrology / Flood Control
4		Co-TL/ Irrigation Development Planning
5		Agriculture
5		Secretary
6		Survey Assistance
7		Survey Assistance
8		Survey Assistance

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

Date & Time:	February 19, 2024, 9:00 - 15:00
Location:	Prey Veng PDWRAM Meeting Room & Site Visit at Boeung Sne Irrigation Scheme
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 (Boeung Sne)

Item	Contents
Component	1. Construction of new pumping stations and connection canals (total 40km) 2. Rehabilitation/Construction of new intakes 3. Rehabilitation of main/secondary canals, construction of branch canals 4. Construction of FWUC building 5. Installation of Automatic Hydro-meteorological Station 6. Establishment & Strengthening of FWUC/FWUGs 7. Strengthening of Agricultural Extension Services
Beneficiary Area	5,550 ha
Beneficiary Households	5,411 Households (30,140 farmers)
Capacity of Reservoir *1)	Boeung Sne Lake: 85 MCM
Catchment Area*2)	Boeung Sne Lake: N/A (water supply mainly from the Mekong River)
FWUC Activity	There are 1 FWUC each for the Boeung Sne Irrigation scheme. One of them is collecting the water tariff (100,000 to 150,000 riel/ha) for the operation cost of the pump station to main canal. The other two FWUCs cannot collect money because there is no intake pumping station (they rehabilitate their related canals by themselves)

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

After a meeting with PDWRAM Prey Veng and site visit at Boeung Sne Flood control, Irrigation and Drainage JST found following:

- Background of the Irrigation Scheme
  - Boeung Sne had constructed since French colonial period around 1930s to store water and irrigate for rice during dry season. The water sources of Boeung Sne is the Mekong River and rainwater.
  - The surface of water body of Boeng Sne is 5,100 ha, and the capacity is estimated 85 MCM. It irrigates 11,300 ha of rainy season rice and 6,800 ha of dry season rice in the cultivation area for 4 districts and 1 town.
  - There are 3 irrigation schemes (2 schemes upstream, and 1 scheme downstream). The proposed irrigation scheme is the one downstream, which has 4,091 ha in dry season. As for rainy season, cultivation area is unknown but less than the cultivation area in dry season due to flood.
  - There are two type of dry season rice cultivation: Recession cultivation and the cultivation by irrigation with ponds and groundwater as water resources.
  - Boeung Sne is connected to the Vaico Irrigation Scheme which construction was completed by Chinese donor in 2021 (Taking over completed in 2023), so the water during flood season comes from Vaico Irrigation Scheme (no water resource comes during dry season).

Connection canal from the Vaico Irrigation Scheme. Canal slope is not properly shaped and compacted.

Gate of the connection canal. It is made of reinforced concrete (cheap but very heavy, so rare to use for gate)

Terminal gate of the connection canal. Two spindles have already vent although they are still functioned.

- Reason for Prioritization (Condition of Facility)
  - Recent rehabilitation was 2008 by MOWRAM, and the facility becomes old and damaged, especially for dam embankment (2,450m), main spillway (100m), and secondary spillway (230m). The embankment has been damaged by vehicle as well as floods. *Those components are not included in the material provided by MOWRAM.

Main spillway. Some parts of slope at flood induction portion are required minor maintenance works.

Apron of the main spillway. Some parts of concrete slab are damaged but it van be repaired by minor works.

Secondary spillway. Th elevation of secondary spillway is higher than the main spillway. During flood season, the dike top sometimes becomes inundated. There are some shops on the road.

  - It used to have a small rainfall period (around 1 week) during dry season (January to early March), but for last 2 years, there is no rainfall. Therefore, farmers cannot cultivate crops during dry season (Some of farmers have groundwater wells but they utilize it as supplemental water resource considering the cost of operation). Therefore, PDWRAM needs intake structures with pump stations (5 sites are proposed).

Construction of one pumping station to the main canal is required instead at the place where North Korea constructed a pumping station during Pol Pot period (It is not functioning at all)

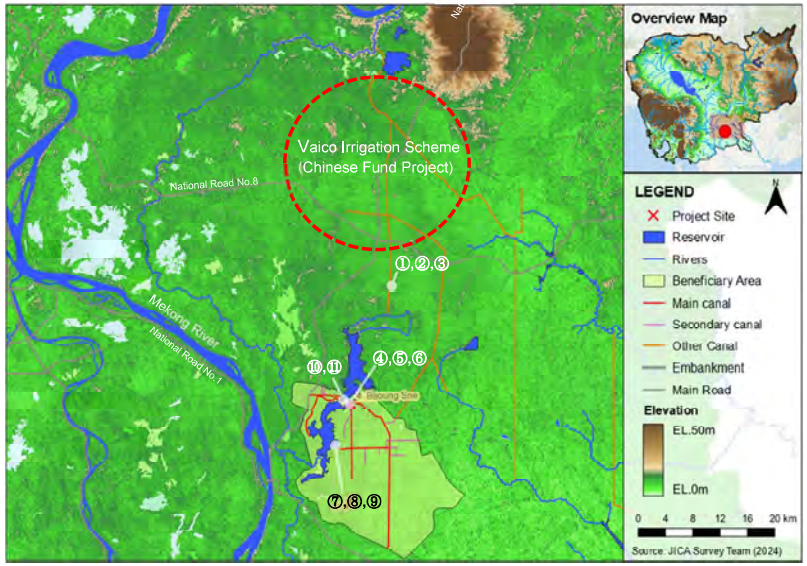
  - Regarding the embankment of the Boeung Sne, ministry of transportation and public works is responsible for repairing (repairing works have already been done). When a heavy truck comes, asphalt pavement on the embankment is sometimes damaged. Then, the ministry bans the heavy trucks' passage on the dike during inundation period.
  - Gates of intakes connecting to the main canals seems old and rusted, so they need to be replaced.

Intake Facility of the main canal. Gate plates are rusted and they should be replaced by new ones.

Main canal connecting from the intake. Dredging and slope shaping are required, but it seems functioning without problem.

- Groundwater record and rainfall data is available in the irrigation scheme, which will be shared after permission from the director of PDWRAM.

Map of Boeung Sne Irrigation Scheme



Attachment: Attendance List (PDWRAM Prey Veng)

No.	Name	Position
PDWRAM		
1		Deputy of Provincial of Department of Water Resource and meteorology
2		Deputy of Provincial of Department of Water Resource and meteorology
3		Deputy of Provincial of Department of Water Resource and meteorology
JICA Survey Team		
5		Team Leader (TL)/ Hydrology / Flood Control
6		Co-TL/ Irrigation Development Planning
7		Secretary
8		Survey Assistance
9		Survey Assistance

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

Date & Time:	February 20, 2024, 9:00 - 15:00
Location:	Meeting Room at the PDWRAM Svay Rieng, Site Visit at Vaico 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 (Vaico Reservoir)

Item	Contents
Component	1. Rehabilitation of the embankment (500m) 2. Rehabilitation of the upstream flood control embankment (40km) with drainage canals 3. Rehabilitation of the spillway (U-shape type) 4. Rehabilitation of 5 existing intakes 5. Rehabilitation of South/West/East main canals 6. Rehabilitation/Construction secondary canals, Construction of branch canals 7. Construction of FWUC building 8. Installation of Automatic Hydro-meteorological Station 9. Establishment & Strengthening of FWUC/FWUCs 10. Strengthening of Agricultural Extension Services
Beneficiary Area	16,360 ha (currently 10,800 ha in wet season and 5,560 ha in dry season)
Beneficiary Households	6,735 Households (39,092 farmers)
Capacity of Reservoir *1)	Vaico reservoir: 30 MCM
Catchment Area*2)	Vaico reservoir: 272km^2
FWUC Activity	FWUC functioned until 2022. Now it is not active due to flood in 2022 which caused severe damage in farmland.

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 Vaico Flood control, Irrigation and Drainage JST found following:

- Reason for Prioritization (Condition of Facility)
  - 3 Purpose of use: (1) Water resources for dry season rice production. (2) Drinking water use and (3) Domestic water use. This Irrigation Scheme is suffering from water shortage during dry season due to increase in the water use above.
  - 5 facilities: Spillway (160m) which was constructed in 2006 has a problem in water seepage because it is made by concrete, main dam embankment, main canal, intake gate and the flood protection embankment (40km). As for the embankment, 2.3km of 40km was complete by MOWRAM (now no plan to continue). *JST cannot observe the serious water seepage from the spillway through the site visit.
  - PDWRAM plan to transfer water to the Krong Bavet SEZ, by plastic pipe from the Vaico reservoir, which purpose is groundwater conservation. In the SEZ, many types of factories are under operation, such as car, bicycle, shoes, garment and others with employment of 7,000 labors.
  - To satisfy the water demand in the area, PDWRAM want to increase the capacity of the reservoir from 30 MCM to 70MCM.

Duck bill shape buttress type spillway. Even in the dry season, the reservoir water level seems higher than base elevation of buttress spillway. Any significant leakage was not observed.

Pipeline for domestic use attached to the bridge at the downstream side of the spillway. Domestic water demand is now increasing according to PDWRAM staff.

Proposed intake construction site (main canal at the left bank). Water level in the reservoir is lower than the existing canal, deep excavation is required for rehabilitation.

Connecting point between main canal and secondary canal. Since the bottom level of the main canal is lower than the secondary canal, pump is necessary for irrigation.

Flood Protection Dike (EL. 4.9m) constructed by MOWRAM. Only 2.3km of 40km was finished, and no plan for further construction.

Drainage canal. The canal is halfway ended. Flood water will spread in those areas.

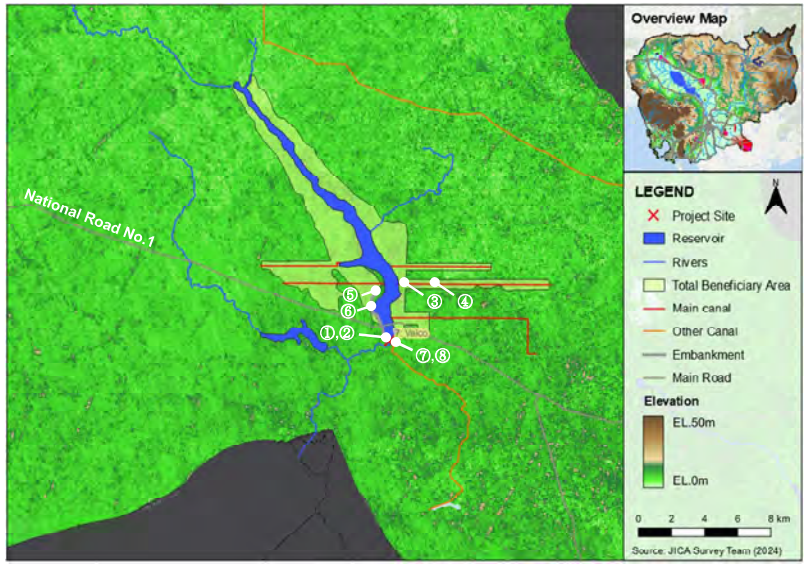
- Impact of Flood and Drought
  - Cultivation area becomes inundated (along the reservoir, estimating 1,200 ha), but there is no impact on residential area. Flow of flooded water is fast and it lasts from 4 to 10 days. Therefore, no big impact to farmers (farmers know how to treat flood).
  - However, PDWRAM concerns the impact of climate change (Lately, the PDWRAM officer mentioned the rainfall intensity becomes stronger in shorter time. They feel the flood water level becomes higher than before).
- Activity of FWUC
  - There is no FWUC in the scheme, and PDWRAM operate the gates. Facilities O&M conditions (e.g. main canal, secondary canal) are maintained by PDWRAM as well, not farmers. Farmers mostly take water from the main canal, so they do not feel to receive the irrigation service.

➢ Other Donor Activity

- The Project for Expansion of Water Supply System in Svay Rieng by JICA (G/A, approx.30 million USD project)
- The study for the construction of secondary/tertiary canals in the downstream of Vaico Irrigation Scheme was started in 2023 through the support of Korea.

	
Intake of the downstream main canal. It seems old but is functioning.	South Main Canal. Southern (Downstream area was now under study by Korean fund).

Map of Vaico Irrigation Scheme



Attachment: Attendance List (PDWRAM Siem Reap)

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

Subject: Interview to the PDWRAM and Site Visit on Achang II

Date & Time:	February 22, 2024, 9:00 - 15:00
Location:	Meeting Room at the PDWRAM Kampong Chhnang, Site Visit at Achang II site
Attendance list:	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 (Achang II)

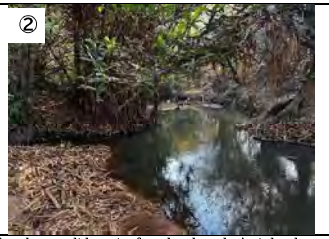
Item	Contents
Component	1. Construction of earth dam with 4.2km length and 13.0m high 2. Construction of main/secondary canals (20km, 60km each) 3. Construction of main/secondary drainage canals (10km, 40km each) 4. construction of branch canals 5. Construction of FWUC building 6. Installation of Automatic Hydro-meteorological Station 7. Establishment & Strengthening of FWUC/FWUGs 8. Strengthening of Agricultural Extension Services
Beneficiary Area	13,289 ha
Beneficiary Households	2,066 Households (11,776 farmers)
Capacity of Reservoir *1)	-
Catchment Area*2)	Unknown
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 Chhnang and site visit at the proposal site of Achang II site, the JST found following:

- Background of the Achang II Irrigation Scheme
  - Achang II is located on the upstream of Lum Hach (3,212 ha in the wet season, 310 ha in the dry season) and Achang I (10,300 ha in the wet season, 4,000 ha in the dry season) along the Boribo river. The water resources of those two schemes are from Achang II and Pursat provinces. PDWRAM Kampong Chhnang want to develop the water resource for both irrigation schemes because water from the Pursat province (that a headwork to keep water) is fully consumed before reaching to Kampong Chhnang province during the dry season.
  - The existing facilities in Achang II was being constructed in Por Pot Regime, but was uncomplete and only some main canals are left now. Water storage reservoir is suggested as a new structure, which has never been studies before. Therefore, location has not been fixed yet.
  - New water resources are utilized to the neighbor communes first and then Lum Hach irrigation scheme for dry season cultivation (currently 1 commune of 10 communes were only irrigated, and most of farmers cultivate rice only in rainy season.
  - Roads to Achang II is all by sand, which becomes muddy road during wet season. Considering the location of Achang II (1.5 hour from the PDWRAM Kampong Chhnang by car)
  - Currently farmers can cultivate only 80% of the potential area (around 2,600 ha) due to the topographic and soil difficulties.

Candidate site for a headworks (Width/depth is 3m/ 0.15m). Flow volume can be estimated as 0.45m³/sec.



Another candidate site for a head work. As it has larget catchment area, base flow seems larget than the previous site. During flood season, the water level rises by 3m.

Perennial crop planting farmland near the proposed site. If headworks construction is implemented, resettlement and compensation will be required.

Canal connecting to a local village. It was constructed during Por Pot Regime, and water flow only during wet season. PDWRAM proposes the rehabilitatino of the canal as well.

- Impact of Flood
  - Achang I has no flood problem. Flood occurs in September, there is no damage for agriculture, but less than 5 % has damage in irrigation facilities. The main canal is no problem because of concrete lining, but secondary canals have no lining and slopes are damaged.
- West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project
  - One of JICA ODA Loan Projects which started in 2016 and completed in 2020. Canals are constructed with triple-sided concrete lining. There is no damage on canal itself, but one place of inspection road was eroded according to PDWRAM staff during flood season.
  - During past heavy flood time in 2020, all gates were opened 100%. There was no problem in gate operation.
  - There is a hydro/meteorological station close to Achan II, which is automatic one. Constructed by the river basin project by JICA.

Triple-sided concrete canal lining, there is no damage by flood.

Eroded portion of inspection road. Farmers repaired there according to PDWRAM staff.

⑦ 	⑧ 
Lum Hach headworks. Both sides' banks are protected by concrete, not bare soil banks.	Generator house. It works in case of flood events.

➢ Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR)

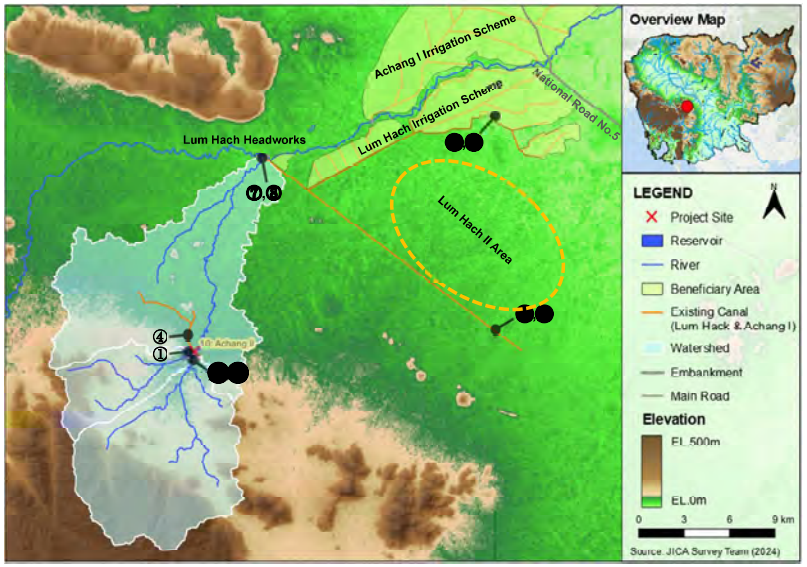
- The study of the above project was done in 2023 in Lum Hach II area, which was located on the southeast of Lum Hach I area. Details are unknown, but so far this is just the study with partial construction on their branch canal, and the concept is to store the water on their existing canals to mitigate the impact of climate change according to PDWRAM.
- Because the water source of Lum Hach II area will be the Lum Hack headworks, the appropriate water allocation should be required before the project starts (there is no extra water resource in Lum Hach I)

⑨ 	⑩ 
Main Canal connecting to Lum Hach 2 area. There is no rehabilitation work on the canal.	Headworks on the Lum Hach 2 area. It does not seem to function.

➢ Others

- There is 1 each FWUC in Lom Huch and Achang I controlled by MOWRAM. Chief of FWUC is stopping working because there is no benefit to be a chief.
- Farmers usually pays water tariff (30,000 riel/ha) to FWUC but it seems not working now considering the above situation. PDWRAM has the plan to train the chief of FWUC, to recruit farmer to join FWUC. Budget problem in PDWRAM.

Map of Achang II Irrigation Schemes



Attachment: Attendance List (PDWRAM Kampong Chhnang)

No.	Name	Position
PDWRAM		
1		Deputy of Clean Water Department
2		Deputy of Water Resource Department
3		Deputy of Administrative Department
4		Meteorology Department 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

Meeting Memo – Discussion with PDAFF of Takeo province

Subject: Discussion with Direction of Extension office of PDAFF Takeo province.
Date: 6 February 2024
Time: 8:00 AM – 10:00 AM
Location: PDA Office in Takeo province and Kpob Trabek dam at Tram kok District
Participants: See the attachment

Meeting Purpose:

The survey team went to meet the PDAFF Takeo province to confirmed the relate activities of agriculture about the current situation of land use, the damaging area (flood and drought) of agriculture land and how much that irrigation can help farmers.

Meeting Discussion

Cropping Calendar:

Variety	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Ave. Yield/ ha
Dry Rice variety													4,646 kg/ha
Wet rice variety													4,262 kg/ha

According to PDAFF (Mr. Seng Kronh), dry rice season have two varieties of OM5451 and IR85, from Vietnam. These two varieties can growth two or three time per year, depend on water supply. In 2023, insufficient water supply posed challenges for rice growers due to expanded land usage. Simultaneously, high prices incentivized farmers to exceed their planned cultivation.

Based on the final report of PDAFF in Takeo, the area of overgrowth was reported as 103,849 hectares, exceeding the planned 80,000 hectares. Additionally, during the dry season, rice fields also damaged by both rain floods and flooding from water level of Bassac river.

The three times of grow dry rice season is:
- October to December: It just the end of rainy season or farmers call early dry season, during that time there is no problem with water supply or irrigate the crops.
- January to March: farmers will be face with the suffer of water supply for irrigate their crops.
- May to August: In May, it starts of rainy season, during the rainy season farmers also face with small dry season in rainy season.

In wet season, there are two varieties of Phka Rumdul and Jasmine that farmers use. Farmers cultivate their crops starting from May to prepare soil and harvesting in the end of October or until the end of November. Nowadays, farmers in Takeo have changed their cultivation date for wet rice season. In the past, they prepared the soil from May, but now they cultivate the dry rice season and after they harvest the yield in the end of July. Then they start to cultivate the wet rice season in the early of August and harvest the yield in the end of November or the early of December of the year.

PDAFF mentioned, there are three types of life cycles for wet season rice: the one with Short lifecycle (120-130 days), Medium lifecycle, and Long lifecycle.

Cultivation technologies and Methods:

Farmers in Takeo province cultivate rice by direct seedling. Only farmers who do the seed production use a transplanting machine or sewing machine. The farmers harvest the yield by machine. These farmers rely on pump irrigation to irrigate their crops, covering approximately 90% of the cost themselves. But in the early of dry season farmers who cultivate rice at O'Saray corporative, some use flow irrigation system and use less pump machine. Farmers in Takeo got an average cultivate land about 0.6 hectares per person.

For the fertilizer and pesticide usage:

Farmers use 50/50 (chemical and organic).

Cultivation area in:

The report shows that only 180,000 ha of cultivation area was planned during wet season, and actual land cultivation area was with 213,353 ha with total production of 720,335 tons.

It also shows that planned cultivation area was 80,000 ha during dry season, and actual cultivation land was 103,849 ha with total production of 513,615 tons.

Cultivation status of cash crops during the dry season :

According to the final report 2023 of PDAFF Takeo, cultivation area of several cash crops increased by 1,092 hectares (The breakdown is as follows : Cassava by 27 hectares, Sweet potato by 68 hectares, Mung bean by 56 hectares, Peanuts by 39 hectares, Corn by 101 hectares, Sugar cane by 120 hectares, Watermelon by 155 hectares and Vegetables by 526 hectares).

According to PDAFF, there is no contract between farmers and company or rice mill processing i n Takeo.

Corporative status:

There are 118 corporative, in each corporative can form when the member is more than 15 members.

Flooding damage:

During rainy season flood have damaged on 8,715 hectares of agriculture land use for rice (flood by rain). The flood can release after 3 to 10 days depended on the current situation of water flow and the amount of raining. PDAFF also mentioned about, the rice also damaged by rats.

Materials store:

The total agricultural material store in Takeo province was recorded in collected data of "Total of Materails store in Takeo" with 668 stores. Including the chemical fertilizer store with 607 stores and pesticide store with 378 stores.

Sample from farmers Interview:

Following 4 farmers were interviewed during the site visit at Kpob Trobek dam, located in Stoeng village, O'Saray commune, Tram Kok district.

1. Mr. Khit Vanny owns 0.9 hectares of paddy field. Moreover, he is also own a mini store to earn the income for his family. The total rice production was with 2 tons in 2023.
2. Mr. Nop Samnang owns 0.8 hectares of paddy field, and he has another job is a tailor to earn more money. The total rice production was with 2 tons in 2023.
3. Mrs. Kan Sokchea (Accountant of Agricultural Cooperative) owns 0.56 hectares of paddy field. He also cultivates some cash crop such as mung bean and some leafy vegetables to earn more money during her spray time. The total rice production in 2023 was with 2.8 ton.
4. Mr. Ngoun Boet (Head of Stoeng Village) owns 0.22 hectares of paddy field. He also cultivates some cash crop such as mung bean and some leafy vegetables to earn more money during her spray time. The total production of rice in 2023 was with more than one ton.

Based on the farmers preference, farmers who have paddy field at the Kpob Trobek dam can cultivate rice two times per year:

- March to November: Phka Rumdul and Jasmine (Cambodia variety)

- December to February: OM5451 (Vietnam seed)

Irrigation type: Gravity irrigation (sometimes farmers use pump during dry season)

O'Saray Agricultural Cooperative: 2017

O'Saray Agricultural Cooperative was established in 2017 with 68 members. This cooperative is supported by Government of Cambodia, JICA project, and CAVAC. The cooperative mainly products the Phka Rumdul seed. In 2023, the total seed production was 20 tons.

Farmers mentioned there is no need to rehabilitate the dam, whereas the Tumnup Lok dam must be rehabilitated. They also said that the production cost of dry season rice is more than the one in wet season rice so that the revenue is almost the same even the yield of the dry season rice is higher compared to the wet season rice.

They usually start to work in the beneficiary area of the Kpob Trobek irrigation scheme in January (after the water recedes).

Attachment: Attendance List

No.	Name	Position
PDAFF Takeo and Farmers		
1		Vice Head of Extension Office
2		Officer of Extension Office
3		Association Community Member
4		Association Community Member
5		Association Community Accounting
6		Head of Village
JICA Survey Team		
1		Team Leader (TL)/Hydrology / Flood Control
2		Co-TL/ Irrigation Development planning
3		Agriculture
4		Survey Assistance
5		Secretary
6		Survey Assistance

Meeting Memo – Discussion with PDAFF in Kampong Speu province

Subject: Discussion with Direction of Extension office of PDAFF Kampong Speu province.
Date: 7 February 2024
Time: 2:00 PM – 5:00 PM
Location: PDAFF Office in Kampong Spue province and site visit at Kaheang commune, Samroung Tong District, Kampong Speu
Participants: See the attachment

Meeting Purpose:

The survey team went to meet the PDAFF in Kampong Speu to confirm the relate activities of agriculture about the current situation of land use, the damaging area (flood and drought) of agriculture land and how much that irrigation can help farmers.

Shared Documents:

- Agricultural Production Summary Report Year 2023
- Proposal to the Ministry of Agriculture, Forestry and Fisheries 2023

Meeting Discussion

Common Cropping Calendar:

In rainy reason, farmers start to prepare the land from the end of April to early of May or delay until June and they harvest the yield from end of October to December. Farmer in Kampong Speu, normally they cultivate Phka Rumdul and Jasmine rice as varieties use (see the Table below).

Variety	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Variety
Dry Rice Variety													
Wet Rice Variety													Phka Rumdul and Jasmine rice

As shown in the table below, famers in some area of Kampong Speu province (Bo sethr) can cultivate rice 4 times per year. They start to cultivate from December and harvest in February as first rice cultivation, and second cultivation period is from March to May, June to August for third time cultivation, and September to November as the forth cultivation period. Farmer use OM5451 (Vietnam variety) and IR66 (Cambodia variety) for varieties use.

Cropping Calendar in Bo sthr:

Variety	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Variety Yield (t/ha)
Dry Rice Variety													OM5451 3t/ha
Wet Rice Variety													IR 66 3t/ha

They usually cultivate their farmlands by agricultural machinery such as tractors, power tillers, seed broadcasting (rice seed production), and combines. Farmers use pumping machine 6 times during dry season, taking water from the canal which water resource is 3 dams upstream. The average yield in both seasons was 3 tons per hectare.

Apart from rice production, people in the province also grow other crops, fruits, mung bean, corn, sugar can, cassava, and sweet potato depending on the altitude of their farmlands. If floods destroy the rice plants, farmers will sow seeds and grow vegetables right away.

Interview in Kaheang commune in Kampong Speu:

It is an association community (called "AC") with 57 memberships.

Some members work as a labor in the construction site after rice harvest. Farmer can borrow funds to purchase cultivation materials at low interest rate (1-2%).

They focus on the rice and rice seed production. 10 out of 57 members are in seed production. Agricultural materials, market and farming contract with companies (Apsara rice, Prime rice).

The AC locate in O'veng village, Kaheang commune, Samroung Tong district was established with 25 households and started rice seed production in 2019. But, there is only ten households in 2024. This decrease is because of the increase of the rice seed production cost and the water shortage during dry and rainy season. The seed production was sold to memberships in AC and local farmers.

Fertilizers are used by about 50% of the farmers. The yield of rice is 2.5-2.8 tons/ha (200 kg/ha for rice seed) without fertilizer, and the use of fertilizer increase the yield to about 3.0 t/ha. Extension workers distribute pamphlets to inform farmers of appropriate use of fertilizers and pesticides.

Attachment: Attendance List

No.	Name	Position
PDAFF Kampong Spue		
1		Deputy of Provincial Department of Agriculture, Forestry and Fisheries
2		Chief of Extension Office
3		Officer of Extension Office
4		Officer of Extension Office
5		Officer of Extension Office
6		Officer of Extension Office
7		Officer of Extension Office
8		Office of Extension Office
9		Officer of Extension Office
JICA Survey Team		
1		Team Leader (TL)/Hydrology / Flood Control
2		Co-TL/ Irrigation Development planning
3		Agriculture
4		Survey Assistance
5		Secretary
6		Survey Assistance

Meeting Memo – Discussion with PDAFF Siem Reap province

Subject Discussion about the situation of agriculture in Siem Reap province
Date: 13 February 2024
Time: 2:00 PM – 4:30 PM
Location: PDAFF Office Siem Reap province
Participants: (Deputy director of PDAFF), (Chief of AoE)

Meeting Purpose:

The survey team convened to meet with the deputy director of PDAFF Siem Reap with the objective of validating agricultural activities concerning current land use status, evaluating the extent of damage (caused by flood and drought) to agricultural land, and assessing the potential impact of irrigation on assisting farmers. The meeting centered around the prioritized areas of MOWRAM in Siem Reap, specifically Spean Sraeng and Plain River.

Meeting Discussion

Percentage of employment by industry

As per the deputy director of PDAFF, agriculture, marketing, material store supplying, and small agricultural loans are the four major sectors in Siem Reap, with respective contributions of 6%, 18%, 38%, and 38%.

Rice cultivation area

In the 2023 wet season, total rice cultivation spanned 193,610 hectares, yielding 73,009 tons, with 24,784 hectares and 99,823 tons recorded during the dry season. Rice cultivation prevails due to its comparatively simpler practices compared to vegetable cultivation.

Rice Cropping Pattern

Rice cultivation typically commences in May in the lowlands, utilizing late duration or deepwater rice varieties, with harvesting taking place from December to January. Due to the absence of irrigation schemes, farmland can only be utilized once per year during the wet season. Cultivation of irrigated rice and rainfed lowland (using short-duration rice or during the dry rice season) begins in June.

Rice Cropping Calendar

Variety	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Variety
Dry Rice Variety													OM 5451
Wet Rice Variety													
													Phka Rumdul

Cultivation Expenditure

Seed production is managed by the association community, resulting in a total production of 30 tons in 2023, with seed prices ranging from 2,000 to 3,000 Riel/kg. Farmers predominantly opt for direct seeding into the soil rather than using transplanting or seed sowing machinery. The average yield during the wet rice season ranges from 2.5 to 3 tons per hectare, with the total cost of rice production estimated at approximately 500 to 600 USD per cycle.

Sales of Product

Rice farmers primarily sell their produce to local intermediaries (in Banteay Meanchey, Battambang Province), with some transactions occurring with rice milling companies.

Farmers also engage in the cultivation of cassava, watermelon, corn, and various types of vegetables, which they sell to locals and restaurants in Siem Reap.

Support to Farmers by Extension Officer

The extension office offers farmers training in cultivation techniques not only for rice but also for vegetables and fruits. Additionally, an agricultural technology consultation hotline is available for farmers to access support whenever necessary.

Meeting Memo – Discussion with PDAFF Banteay Meanchey province

Subject: Discussion about the situation of agriculture in Banteay Meanchey province
Date: 14 February 2024
Time: 2:00 PM – 3:30 PM
Location: PDAFF Office in Banteay Meanchey province
Participants: See the attachments

Meeting Purpose:

PDAFF survey team visited Banteay Meanchey to ascertain the current agricultural activities, particularly focusing on land use, damage assessment (due to flood and drought), and the potential of irrigation in supporting farmers.

Meeting Discussion

Banteay Meanchey Agricultural Situation

During the meeting, the Director of PDAFF highlighted the agricultural landscape in Banteay Meanchey, emphasizing the flexibility of farmers in selecting crops based on soil type and zoning. Farmers in the province can cultivate rice multiple times annually given adequate water supply. However, the region is currently facing water scarcity issues for dry season rice cultivation. In 2023, an increased demand from Vietnam led farmers to expand their dry rice cultivation areas, exacerbating the water shortage situation. Due to limited irrigation infrastructure, farmers are compelled to invest more resources in irrigation activities.

Rice Cropping pattern

Dry season rice cultivation is feasible in certain districts including Mongkol Borey, Preah Netr Preah, Phnom Srok, Serei Saophoan, Ou Chrov, Svay Chek, Malai, Poipet, and Thma Puok. Agricultural activities in Banteay Meanchey typically follow short growing periods and involve the cultivation of non-photoperiod varieties, allowing for year-round planting and harvesting as shown in the table below:

Variety	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Variety
Dry Rice Variety													Sen Kro Ob 01, IR 504, OM 5451 Sra Nge Sral
Wet Rice Variety													
													Phka Rumdul, Somaly

Usually, farmers in Banteay Meanchey use short duration varieties such as: Sen Kro Ob 01, IR 504, OM 5451 and Sra Nge Sral. Phka Rumdul and Somaly are the mid-duration that are the common varieties for farmers to cultivated.

Rice Cultivation Area

The average farmland per household in Banteay Meanchey is about 1 to 2 hectares.

In 2023, the cultivated area for dry-season rice amounted to 52,291 hectares, yielding 5.015 tons per hectare. However, this area expanded to 67,112 hectares by February 6, 2024, driven by increased market demand and prices from Vietnam. Wet season rice cultivation covered 266,437 hectares, yielding 3.345 tons per hectare.

Seed production in 2023 spanned 48.7 hectares across 7 communities, with a total of 110 tons of seeds distributed to members. Presently, 23 tons of seeds are stored, yet insufficient to meet the province's needs.

Status of Other Crop Cultivation

Apart from rice, other crops are extensively cultivated in the highlands, with varying acreages during dry and rainy seasons.

Season	Crop	Item	Area(ha)	Yield(t/ha)
rain	Vegetable	Fruit	1201	19.02
		Leafy	1773	19.88
		Roots	978	21.03
	Beans	Mung	105	
		Soy	54	
Dry	Vegetable	Fruit	678	18.49
		Leafy	1057	20
		Roots	24	21.45
	Beans	Mung	25	

Attachment: Attendance List

No.	Name	Position
PDAFF Banteay Meanchey		
1		Director of Provincial Department of Agriculture, Forestry and fisheries
2		Deputy of Provincial Department of Agriculture, Forestry and fisheries
3		Chief of Department Agro-industry
4		Vice Chief of Department of Agriculture
JICA Survey Team		
1		Agriculture
2		Survey Assistance
3		Secretary

Meeting Memo – Discussion with PDAFF in Kampong Thom province

Subject: Discussion about the situation of agriculture in Kampong Thom province
Date: 15 February 2024
Time: 2:00 PM – 3:30 PM
Location: PDAFF Office in Kampong Thom province
Participants: (Chief office of Agriculture office), (Vice chief Agro-Industry)(Chief office of Extension office)
-JICA Survey Team:

Meeting Purpose:

The survey team visited PDAFF Kampong Thom to assess various agricultural activities, including land use, the impact of floods and droughts on agricultural land, and the effectiveness of irrigation in supporting farmers.

Meeting Discussion

Agricultural situation in Kampong Thom province

PDAFF staff showed three main cropping areas:

1) Rice, with a notable increase in dry season cultivation, particularly in Samseb Kanha irrigation scheme.
2) Agro-industry crops such as Cashew and Rubber, grown in upland areas due to their low water requirements.
3) Mango, Corn, and Cassava in upland areas due to their low water requirements.

However, the expansion of rice cultivation area has led to water shortage, with more land cultivated than originally planned, causing insufficient water availability for farmers.

Timing of Soil Preparation for Rice Cultivation:

Farmers typically prepare soil at the end of April in the wet season and mid-November in the dry season, awaiting rainfall for cultivation. Direct seedling is the primary method for rice production, while transplanting is used by seed producers or those using sewing machines.

Irrigation:

During the early dry season, rice irrigation relies on water from the Samseb Kanha reservoir. Farmers utilize pumps to irrigate their farmlands, while farmlands near sub-canals may not require the water. The province has over 350,000 ha of rice cultivation, including 280,000 ha for wet season rice and over 70,000 ha for dry-season rice.

Lack of supplemental irrigation water during the rainy season has caused droughts in July and August, and the inability to store excess water from the rainy season has also affected dry-season agriculture.

Rice Varieties:

There are three types of wet rice seasons in the province: short, medium, and late duration varieties such as OM5154, Phka Rumdul, Sen Pidour, and Neang KraOrb.

If farmers can use an irrigated water, they could cultivate short-duration varieties 3 times per year. OM5154, a short-duration variety sourced from Vietnam, has gained popularity due to its high yield and demand in the Vietnamese market. The OM5154 variety is not distributed in the country because it is not to the liking of Cambodians. Unmilled OM5154 variety has been exported to Vietnam at least since 2018.

Pka-Rumdum is grown in the wet season in lowland areas or rainfed area. Pka Rumdul and local rice varieties are sold to local rice milling companies for both local use and export to Thailand. Thai market prefers Cambodian rice varieties such as Phka Rumdul, Jusmine and Red Jusmine.

OM5154 produces an average yield of about 4.5 tons per hectare and Pka-Rumdul produces an average yield of about 2.8 tons per hectare.

Seed Production:

There are 11 communities and seed production stations that do the seed production.

The production of seed at the biggest seed station was 130 tons in 2023. They produced Pka-Rumdul, Sen Pidor, Sen Krooup, and Neang Kra orb. The 161 tons of seeds were produced in the Trapiang Russei community. They produced only Pka Rumdul seed.

4 communities produced 252 tons of seeds through the support of the government project, encouraging rice production and exportation since 2013. The rest of the communities just do the rice production. Those seeds are sold to other communities and outside of the province. The unit price of the seed is 2500 riel per kg.

Other Crops:

In addition to rice, farmers also grow other crops such as Cashew nuts in more than 140,000 hectares, Kaev Romeat mango in about 90,000 hectares, and Cassava in about 50 000 hectares. They cultivate these crops depending on regional rainfall.

Rice Milling Factory

The province has 18 rice milling factories, insufficient to meet demand. Rice milling companies struggles with financial issues.

Contract Farming

37 contracts are in place in Kampong Thom province.

Agricultural Materials

Approximately 400 stores provide agricultural materials, though specific details were unavailable.

Meeting Memo – Discussion with PDAFF Prey Veng province

Subject: Discussion about the situation of agriculture in Prey Veng province
Date: 19 February 2024
Time: 2:00 PM – 3:30 PM
Location: PDAFF Office in Prey Veng province
Participants: See the attachments

Meeting Purpose:

The survey team convened a meeting with the PDAFF in Prey Veng to ascertain pertinent agricultural activities, including the present state of land usage, the extent of agricultural land damage caused by floods and droughts, and the efficacy of irrigation in assisting farmers. This discussion delved deeper into the specifics outlined in the area report provided by MOWRAM for JICA project, particularly concerning the Boeung Sne Flood Control, Irrigation, and Drainage initiatives.

Meeting Discussion:

Rice Cultivation in Prey Veng

Rice farming has seen a significant increase in Prey Veng province, attracting not only traditional rice growers but also cash crop growers and agro-industrial farmers due to the conveniences offered by modern methods. Mechanization, such as the use of machines for transplanting seedlings, has become prevalent throughout the cropping process.

Rice farming practices vary among agricultural communities, with some under farming contracts and others involved in rice seed production. However, data on these communities are not adequately stored by the provincial agriculture department.

Rice Cropping Calendar

1) Wet Season

During the rainy season, which lasts from May to October, farmers predominantly rely on rainfall. Short, medium, and long-term varieties such as Phka Rumdul, Kasaing Teab, Mjoum, Kon Srie, and Neang Orm are cultivated, with 80% of farmers across 13 districts engaging in wet season rice farming.

2) Dry season

Dry season rice cultivation spans from mid-November to mid-January and mid-January to mid-April, with short-term varieties like OM5451 and IR being commonly grown. The proportion of farmers engaging in dry season rice cultivation has risen drastically in recent years, reaching 80% from 2022-2023, compared to only 40% before 2022. However, the threat of water shortage in the late dry season remains a concern.

Water Resources

Farmers utilize various water resources, including canals, ponds, and groundwater, often employing labor to use pumps for irrigation. While water resources from the Mekong River are available, inadequate delivery systems in Prey Veng hinder their efficient utilization. The construction of hydroelectric dams in China has further exacerbated water supply issues.

Flood Damage

The traditional practice of growing deep-water rice varieties in flood-prone areas has shifted, with farmers now avoiding floods and opting for short-duration varieties instead. Rice farming now often begins after the flood or is harvested before its onset in September or October. Floods typically last 7 to 15 days, depending on upstream water intensity and Mekong River levels. In recent years, flood intensity has not significantly impacted rice fields during the rainy season.

Distribution of Products

Vietnam presents a significant market for rice produced in Prey Veng, with large trucks transporting rice to Vietnam immediately after harvest. The dominance of Vietnamese rice varieties in the market, coupled with the closure of local rice millers, underscores the challenges faced by Cambodian rice varieties in competing domestically and abroad.

Attachment: Attendance List

No.	Name	Position
PDAFF Prey Veng		
1		Chief of Department Extension
2		Officer of Department Extension
3		Chief of Department Association Community
4		Officer of Department Accounting Planning
JICA Survey Team		
1		Survey Assistance
2		Secretary

Meeting Memo – Discussion with PDAFF Svay Rieng

Subject: Discussion about the situation of agriculture in Svay Rieng province
Date: 20 February 2024
Time: 2:30 PM – 3:55 PM
Location: PDAFF Office in Svay Rieng province
Participants: See the attachments

Meeting Purpose:

The survey team conducted a meeting with PDAFF Svay Rieng to validate agricultural activities' relevance regarding the current state of land use, the extent of agricultural land damage due to floods and droughts, and the potential impact of irrigation on supporting farmers. This discussion delved into the detailed insights outlined in the report submitted by MOWRAM for JICA project. Specifically, the discussion focused on the Vaico, Chantrea, and Krosaing flood control, irrigation, and drainage initiatives.

Meeting Discussion:

Rice **Cultivation in** Svay Rieng

The discussion highlighted a significant increase in rice farming activities, particularly during the dry season, driven by market demand. Farmers can now cultivate rice two to three times per year if they have access to water and favorable market prices. Mechanization, including the use of machinery for soil ploughing and harvesting, is widespread among farmers, whether through ownership or rental arrangements.

Rice Cropping Calendar

The cropping calendars are generally synchronized across districts and cultivation areas, with farmers adjusting cultivation dates based on water levels.

1) Rainy Season

During the rainy season, farmers predominantly cultivate varieties such as Phka Rumdul, Kasaing Tab, Mrom, Tong Chhok, Sruv Smach, Sen Pidor, and Yeay TA, with an average yield of 2.5 tons/ha. Land preparation begins between May and June, with harvesting occurring between mid-November and December. Rainfall serves as the primary water source during this season.

2) Dry season

In the early dry season, typically starting in November, farmers opt for short-duration Vietnamese varieties like IR, OM5451, and OM4900, with average yields of 4.2 tons/ha. The cultivation period is from November to April, primarily utilizing canals and groundwater for irrigation.

Water Resource

In Chantrea, farmers face challenges with water leakage for irrigation. Some farmers near the Vietnam-Cambodia border purchase water from Vietnam, paying 160,000 to 300,000 Riels per hectare for the entire crop cycle. Similarly, farmers in Kampong Rou district (neighbors of Chantrea district) engage in rice farming two times during the wet season and one time in early dry season, with water sourced from Vietnam for irrigation purposes.

Flood and drought Damage

In Vaico, Krasiang and Chantrea, rice cultivation is exclusively done with rainwater, and groundwater is used for rice cultivation during the dry season. There is no connection canal from the region that can supply water to the reservoirs, and the reservoirs do not yet have sufficient capacity. Water supply challenges are similar anywhere in the Svay Rieng province.

Flooding does not affect rice cultivation but flooding from 15 to 20 days or more of rainfall in September and October affects rice cultivation during the rainy season. Flooding has its greatest impact in October and November, with 211 ha affected by flooding in 2023, affecting the harvest in 65 ha.

There is a dam on the border between Cambodia and Vietnam, and if Vietnam closes the dam, farmers in Chantrea are at risk of drought during the dry season.

Krosiang area: drought threat from July to September, affecting early-season rice cultivation.

Distribution of products

Both dry and rainy season production is sold to Vietnam at a unit price of 1,300 riel per kg, depending on the exchange rate.

The rice market in Svay Rieng is mainly dependent on Vietnam, with Vietnamese varieties accounting for most of the distribution. The markets for Chantrea, Vaico, and Krosiang are mainly for Vietnam, and the agricultural situation in these areas is similar.

Traditional varieties are having difficulty finding buyers, and only a few small-scale rice millers are serving the needs of local consumption. Rice mills in Svay Rieng province vary from small family-run, mobile, and small, with a total of 2,113 rice mills identified.

Attachment: Attendance List

No.	Name	Position
PDAFF Svay Rieng		
1		Deputy of Provincial Department of Agriculture, Forestry and Fisheries
2		Chief Officer of Department Extension Office
3		Deputy Officer of Department Agricultural Office
4		Chief Officer of Department Agricultural Office
5		Officer of Department Accounting Planning Office
JICA Survey Team		
1		Survey Assistance
2		Secretary

Meeting Memo – Discussion with PDAFF in Kampong Chhnang province

Subject: Discussion with seniors' officer of PDAFF Kampong Chhnang province.
Date: 26 February 2024
Time: 2:00 PM – 4:00 PM
Location: PDAFF Office in Kampong Chhnang province
Participants: See the attachment

Meeting Purpose:

- Confirmation of agricultural activities and land use in Kampong Chhnang
- Hearing flood and drought damage on agricultural land
- Discussion on irrigation and its impact on farmers

Meeting Discussion

Agricultural Activities in Kampong Chhnang:

Farmers are expanding rice fields due to high production prices.

Besides rice, they cultivate crops like mung bean, sweet corn, sesame, and vegetables.

Land ownership ranges from 0.5 to 3 hectares per household.

Seasonal Practices:

1) Rainy Season:

Land preparation and seeding occur from May to July, with harvest from mid-November to December. However, previously it started in April. Dates may change due to changes in rainfall due to the onset of the rainy season or climate change.

Varieties used include Phka Kra Van, Sen Pidou, Phka Rumdul, Rang Chey, Red Jasmine, Neang Orm, Neang Minh, and Srov Khsay.

Average yield: 3.763 tons per hectare.

2) Dry Season:

Dry season rice cultivation starts in mid-November, with potential for three cycles per year.

Varieties include OM5451, OM18, IR504, Sra Ngae, and Sen Kra Ob.

Average yield: 4.859 tons per hectare.

Market Situation:

Rice production is sold to rice mill factories in Kampong Chhnang and Vietnamese middlemen, with prices varying based on market conditions.

Cam Seed Company:

It is the Rice seed production company in Kampong Chhnang. A seed company in Kompong Tunan.

Procures seeds from various farmers, processes and distributes to several provinces.

Offering varieties such as Sra Ngae, Mlis Meanchey, OM, Phka Rumdul, etc. at 2500 Riel per kilo.

Cooperates with partners in the production and sale of rice seeds.

The partners of this company are major rice mills or exporters that are members of the Cambodia Rice Federation such as KTS, Phum Yerng, Apsara rice Co., Ltd., and Golden rice Co., Ltd. who work together to distribute quality seeds to farmers. The following table shows the volume of rice seed produced and sold by the company by Province.

The volume of rice seed distributed by the Cam Seed company

Province	Amount	Province	Amount
Kampong Chhnang	40t	Preah Vihear	1-3t
Prey Veng	25t	Kratie	1-3t
Banteay Meanchey	25t	Stung Treng	1-3t
Pursat	15t	Kampong Speu	1-3t
Tbong Khmum	10t	Kampot	1-3t
Kampong Cham	10t	Ratanakiri	1-3t
Kampong Thom	5t	Svay Rieng	1-3t

Source: JST based on the interview with PDAFF Kampong Chhnang

It sells varieties like Sra Ngae, Mlis Meanchey, OM6, and Phka Rumdul at 2500 riel per kilogram.

The company works with leading rice millers and export partners such as KTS Rice Mill (100 tons), Phumyang, Apsara Rice Co., Ltd. (50 tons) and Golden Rice Co., Ltd., members of the Cambodian Rice Federation, to distribute quality seeds to farmers.

Rice Mill Factories:

Kampong Chhnang has a total of 3,263 rice mill factories, categorized into "Big" (33 factories) and "Medium" (61 factories). Definition of each category depends on the processing capacity per hour shown in the table below.

Size classification of rice mills according to processing capacity per hour

Scale	Small	Medium	Big
Processing capacity per hour	< 1 ton	1 - 5 ton	> 5 ton
Number of rice mills	3,169	61	33

Source: JST based on the interview with PDAFF Kampong Chhnang

Agricultural Equipment:

According to the interview of PDAFF officer, Equipment inventory includes 2,232 tractors, 78,051 power tillers, 8 transplanting machines, 10,453 small water engine pumps, 15,791 big water engine pumps, and 452 combined machines in the province.

Attachment: Attendance List

No.	Name	Position
PDAFF Kampong Chnang		
1		Director of Extension office
2		Officer of Administrative Office
3		Director of Machinery Office
JICA Survey Team		
1		Survey Assistance
2		Secretary

Interview Memo – Material Shop & Rice mill-Svay Rieng

Subject: Interview and Discussion about the situation of agriculture in Svay Rieng province with farmers
Date: 20 February 2024
Time: 2:30 PM – 3:55 PM
Location: Svay Rieng Town and Svay Thab District
Participants: See the attachments

Interview Purpose:

This interview was mainly to confirm the information from Pumping machine store, Machinery store, owner of rice mill factory and rice mill factory and owner of tractor and combine machine as follows:

1) Pumping Machine Store:/

Location: Svay Rieng Town

Farmers in Svay Rieng province own a total of 40,726 machines, used primarily for pumping water to irrigate crops. Gasoline machines ranging from 6hp to 8hp are imported, with prices between USD 50 to USD 60.

2) Machinery Store (KUBOTA Company):

Location: Svay Rieng Town

Tractor: 60 hp tractors are predominantly used in Svay Rieng due to the small and easily manageable land (PDAFF data indicates 1,550 tractors in use).

Combine Machine: 70 hp combine machines are favored for their suitability to the local land conditions (PDAFF data indicates 427 machines in use).

Power Tiller: Various horsepower options available (12, 14, and 15.5 hp) at prices ranging from USD 1,000 to USD 1,500. (PDAFF data indicates 2,250 machines in use).

3) Rice Mill Factory:

Location: Svay Rieng Province

It is the only large milling factory in the province, capable of processing 2 to 3 tons per hour. Current operations focus on milling rice for farmers without small milling facilities. There is no specific rice supplier: and they purchase dried paddy rice depending on market prices. It can store more than 1,100 tons of rice, and supplies only to the domestic market, citing inability to compete with Vietnamese market suppliers.

4) Tractor, Combine Machine Owner and Farmer:

Location: Tul Trabek Village, Bro Sotr Commune, Svay Thab District

Tractor hiring rates range from 240,000 to 280,000 riels/ha. Similar costs apply for combined machine usage, varying based on field conditions and rice type. After harvest, farmers in remote areas pay 2,000 riels per one daily work process for tractor transportation.

Availability of harvesting machines enables farmers to harvest at any time, but water shortages occur from August to September in case of delayed rains. The area relies solely on rainfed water for agricultural purposes, lacking connected water supply systems.

Attachment: Attendance List

No.	Name	Position
PDAFF, Farmers and Store owner in Svay Rieng		
1		Deputy of Machinery Office
2		Sell Materials and Pump machine in Svay Rieng province
3		Sell Power tiller, Tractor, and Harvester in Svay Rieng province
4		Owner of Rice Mill Factory in Svay Rieng
5		Farmer and owner of Tractor and Harvester at Tul Trabek village, Bro Sotr commune, Svay Thab district
JICA Survey Team		
1		Survey Assistance
2		Secretary

Meeting Memorandum with Banteay Meanchey PDWRAM office

Date and time:	19th June 2024, 9:00-10:00
Location:	Banteay Meanchey PDWRAM office
Attendees:	Attached in the attendant list

1. Land Certificate and Compensation

- Farmers at Spean Sraeng have not yet obtained any official land ownership certificate, no land conflict.
- After Pol Pot regime, in 1980s, Communes could issue the temporary land identification card to farmers (this card will be used as the support document to apply for official land certificate), so Farmers can recognize their own land (since Pol Pot regime, plot belong to them as their ownership)
- Farmers don't have to request to governmental organizations to get official land certificate because the government has their own plan to issue the land certificate.
- There will be compensation provided by the government budget.
- The meeting to explain the farmers: from village to commune head, inviting farmers to explain their purposes. MEF is responsible for explanation of compensation rates to the affected persons.
- Range of compensation: The independent third party will conduct a study on the project area to collect data regarding to the compensation (Excluding PDWRAM)
- Who explain the compensation rates to the affected persons? Project committee: Ministry of Economy and Finance, Provincial administration, for instance, Provincial Departments of Rural Development, Provincial Department of Agriculture, Fishery and Forestry, are supposed to involved in the process, depending on project purposes, and local authorities.
- PDWRAM support the technical and measure the affected land.
- If farmers do not accept proposed compensation rates, it is needed to take time to solve the issue and to negotiate.
- Farmers still have their right to claim or against proposed compensation rates, then the Government needs to solve with farmers to accept.
- No land compensation for the affected land is implemented at this project area.
- Royal Government of Cambodia has implemented the policy to provide the US$150/time/household to 4 vulnerable groups: 1) Female head household, 2) Disability, 3) Low-income family, 4) Elderly people group
- If affected persons don't have official land ownership certificates, the compensation rates can be less compared to those who have certificates.

2. Gender Issue

- FWUC committee members (board members) are selected by the election from all the members.
- In a family, a member of FWUC can be represented by wife or husband, no need both of them to register as a member. Usually, the household heads join in FWUC.
- 10 to 15% of FWUC members at Spean Sraeng is Female, if household heads are female.
- Generally, men have more knowledge related to irrigation compared to women, and close/open of check gate during night and monitoring of sites are very tough for women. It is said that women don't waste money and they manage domestic accounts in their homes. Thus, position as accountant is suitable for women.

3. Immigration

- Dur to mechanization in agriculture, the necessity to hire labors is decreasing. People can rent tractor/machinery. As a result, young people immigrate to other provinces and foreign countries to work.

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Meeting Memorandum with Siem Reap PDWRAM office

Date and time:	20th June 2024, 9:00-10:00
Location:	Siem Reap PDWRAM office
Attendees:	Chief office of Agricultural Irrigation, PDWRAM Siem Reap
	Vice Chief office of Agricultural Irrigation, PDWRAM Siem Reap
	JICA Survey Team:

1. Land Certificate and Compensation

- ROW is to be kept for 5m from the edge of the branch canal, but, it is not implemented yet in the province. Probably, farmers can understand that canal rehabilitation is beneficial even though some farmlands are lost due to ROW. There would be no problem.
- Issuance of official land ownership certificates have been started at the beginning of 2024, which means that it is under processing at this moment. Thus, some farmers have already gotten the certificates while others have yet to get. It is expected the issuance will be completed within 2024.
- In 2015, PDWRAM have implemented rehabilitation with ADB. At that time, PDWRAM participated in Provincial Committee and provide technical information to the committee. The Provincial Committee is permanent organization, consisting of many departments and Commune representative, member departments vary depending on the project. In case of water resources development project, though., PDWRAM will join, but won't for road construction project.
- The calculation of compensation rate made by a special committee consisting of plural ministries and local authorities from province to village level. PDWRAM don't know how to set the rate, since PDWRAM did not participate in the payment process.
- When compensation rate was explained to the affected persons, the Provincial Committee including various departments was responsible for the explanation. Not only PDWRAM but also other departments joined.

2. Gender Issue

- There is no difference between men and women for agricultural activities. Both can cultivate and harvest. Since there is no FWUC in the Province, however, it is tough for women to check and open the gate during night and even during day. Thus, accountant is good position for women.
- Gender situations are almost same in whole Cambodia, there is no regional difference within the country.

3. Indigenous People

- There are no indigenous people around the Plaing Irrigation Scheme. However, there are some indigenous people in Varin District in the Siem Reap Province. PDWRMA don't know which indigenous people.

-END-

Attendant List

No.	Name	Position
1		Deputy PDWRAM BTMC
2		Deputy PDWRAM BTMC
3		Head office of Clean Water and Hygiene
4		Contracted officer
5		Chief of Department
6		Officer
7		Administrative officer
8		Officer
9		Environment and Social consideration
10		Assistant (National Staff)

Meeting Memorandum with Farmers in Siem Reap Province

Date & Time: June 20, 2024, 15:00 - 16:00PM

Location: Chror Neang Village Chief House (beneficiary area of Plaing Irrigation Scheme)

Participants: Attached in the attendant list

1. Issues related to water:

- Water shortage: flood occurs often in September and October
- One canal is shared by two districts consisting of 10 villages, respectively (10 villages in Pouk district, and 10 district in Krolanh district). Those villages use irrigation water and maintain the irrigation facilities in turn.
- There is no FWUC in this target area. When water is available for farming, FUWC will be established.
- In dry season, farmers depend on rainfall only.
- Even though they can access rainwater for farmlands during wet season, they still need the irrigation system from this project, since rainwater is stagnant due to insufficient function of drainage in the village.

2. Land Ownership:

- The area which is located to north of the beneficial area (to be inundated if the proposed project is implemented) is farmers' lands according to PDWRAM staff (Mr. Chea Bunthan).
- The villagers have yet to get the official land ownership certificates.
- The village chief know the concept ROW (right of way) and he understand that it is needed to set 52 m and 15 m intervals for main canal/rivers and branch canals, respectively, between river/canal center line and edge (*it is wrong information).
- The vice female village chief heard about ROW, but she doesn't know clearly.

3. Gender:

Women also participate in small-scale rehabilitation of irrigation facilities. For example, women carry soil to rehabilitate the broken/damaged canal. However, women are physically weak compared to men, and they face difficulties in immediate site monitoring. Thus, gate opening/closing is men's work. Water conflicts are solved by men. The process of opening/closing of gate is opened to all villagers including women.

- Women don't operate machineries, or they are little self-confident in using technical materials/tools.
- One female attendant is vice chief of the village, she was elected by voting in the village.

4. Others

- The mandate of village chief/vice chief and member of village committee is 5 years.
- There is no land conflict

Attendant List

No.	Name	Position
1		Chief office of Agricultural Irrigation, PDWRAM Siem Reap
2		Vice Chief office of Agricultural Irrigation, PDWRAM Siem Reap
3		Chromeang Village chief
4		Chromeang Vice Village chief
5		Farmer in Chromeang Village
6		Farmer in Chromeang Village
7		Farmer in Chromeang Village
8		Farmer in Chromeang Village
9		Environment and Social consideration
10		Assistant (National Staff)

Meeting Memorandum with FWUC members and Farmers in Banteay Meanchey Province

Date and time:	21st June 2024, 9:00-10:30
Location:	Spean Sraeng Ror Lom Chrey FWUC office, Banteay Meanchey Province
Attendees:	Attached in the table list

1. Land Certificate

- Farmers in Spean Sraeng irrigation scheme have not yet obtained any official certificate. They have the rights to cultivate the land after the Pol Pot regime.
- After Pol Pot regime, in 1980s, the commune could issue the temporary land identification card to farmers (this card will be used as the supported document to apply for official land certificate), so Farmers can recognize their own land (since Pol Pot regime, plot belong to them as their ownership).

2. Compensation for Land Loss

- Spean Sraeng Ror Lom Chrey FWUC members have experience a project funded by AFD in 2017.
- Spean Sraeng Trapeang Ambel FWUC members have experience a project funded by ADB in 2015.
- Multiple ministries official personnel came to their places to explain the project and compensation rates in for the ADB project and the AFD project.
- Due to the ADB project, canal width was expanded to some extent, resulting in land loss, thus, the 2nd deputy director got cash compensation for the land loss. Processing fee and tax were not included in the compensation rate (seemingly not full replacement cost compensation).

3. Others

- There are water conflicts. When they face water conflict, Committee of FWUC inspect the situation and discuss the matter. They call the subgroup committee to discuss the matter, then explain about the "terms of condition" to the FWUC members.
- The 2nd deputy director of Spean Sraeng Trapeang Ambel FWUC committee is female, it is really tough for her to monitor and close/open gate according to necessity. However, it is her duties, and she tries to accomplish her duties. Also, she and other committee members joined in training course organized by Technical Service Center, under MOWRAM.
- Spean Sraeng Trapeang Ambel FWUC did not implement election since it was established 8 years before. It is costly to organize election, e.g. holding meeting with meal, and difficult to find new committee members since current committee members have enough experience to manage FWUC.
- Spean Sraeng Trapeang Ambel FWUC and Spean Sraeng Ror Lom Chrey FWUC collaborate together against the water shortage. They used to meet and share experience together to each other for water allocation.
- There is a fish conservation area at ROUK village, managed by the commune. People are not allowed to catch fish in the conservation area.
- The area to the north of Spaen Sraeng irrigation scheme beneficiary area, which could be inundated by the construction of a reservoir, is owned by farmers, and it is needed to provide compensation if the proposed irrigation project is implemented. Noted that a plot of farmland to the north of the Spaen Sraeng is regarded as "ancient area", which is under the control of Ministry of Culture and Fine Art.

Attendant List

No.	Name	Position
1		Deputy PDWRAM BTMC
2		Head office of Clean Water and Hygiene
3		Contracted officer
4		Officer
5		Director of Spean Sraeng Ror Lom Chrey FWUC
6		Accountant
7		Spean Sraeng Commune council
8		Accounting assistant
9		Representative of village
10		Spean village chief
11		Spean village council
12		Deputy Spean Sraeng Ror Lom Chrey FWUC
13		Local farmer Spean village
14		Second vice village chief (Pongror village)
15		Poy Char Village farmer
16		Poy Char Village farmer
17		Poy Char Village farmer
18		Poy Char Village farmer
19		Environment and Social consideration
20		Assistant (National Staff)

Meeting Memorandum with PDWRAM Takeo

Date & Time: June 24, 2024, 14:00-15:00
Location: Meeting room at PDWRAM Takeo
Participants:
Chief Officer of Department Agricultural Irrigation, Environment and Social consideration, , Assistant (National Staff)

- Compensation is not provided for land loss within ROW.
- PDWRAM Takeo doesn't have experience related to compensation for land acquisition.
- Fruit/tree along the canal are planted by farmers or naturally. They will be cut down when canal rehabilitation works are implemented. Local authorities have informed the farmer about the ROW.
- PDWRAM provides technical support when land acquisition is necessary for a project.
- There is a trend that young generation to Phnom Penh, or other cities/towns.
- Along the main canal, there are many houses, and local authority has already explained to the people about ROW.
- There is one FWUC in the Khpob Trobek irrigation scheme.
- Khpob Trobek irrigation scheme is relatively small-scale, and each block has each gate. Gate keepers close or open the gate based on the request of beneficiaries. They allocate water to the priority block. The is no water conflict: because there is gate keeper to follow the water allocation.
- Gate keepers are contracted officer and get their salary from Governance and they maintenance the canal/gate and they local residents in the villages/blocks.
- Women who involved in irrigation and they can express their ideas/opinion, sometimes men can follow women's ideas and proposals.

Note*: The meeting at PDWRAM in Takeo also contributed from PDWRAM director

Meeting Memorandum with a Farmer in Takeo Province

Date and time: 25th June 2024, 11:00-12:00AM
Location: Near Canal 3U of Khpob Trobek, Trapeang Krasaing village, Takeo province
Attendants:
Trapeang Krasaing Village Chief, O'saray Commune (Farmer)
Chief Officer of Department Agricultural Irrigation, Takeo PDWRAM JICA Team,

- The village chief uses the main canal, which connects to the secondary/branch canal (not target canal of the proposed project). Surrounding farmers know that there is a canal called 3U. However, some farmers who stay along the canal didn't know when the project would start, thus, they expanded their houses and shops to the canal line. In this case, if the project on this canal starts, farmers will not have objection.
- Owners of shops, which are located along the main canal, have also farmlands, but their lands are far from this area.
- Farmer used the main canal as the main water resources. Anyways, rainfalls remain the source for water sufficient on farming.
- For last 20 years, water shortage was not a big challenge/problems, but he faces water shortage due to limited rainwater.
- FWUC has already been established, however, it is not functioned well since the members cannot access irrigation water.
- The village chief has already gotten the official land ownership certificate in 2024.
- He knows the concept of ROW (right of way), since the Provincial Department of Land Management, Commune staff came to his place for land identification and measurement, they explained ROW.
- It took 4 months to get the certificate after the measurement. 2 villages of Osaray Commune have been got the land certificates. Tramkok district be completed the land certificate within in 2024, according to the plan of Government.
- After the identification of his land, a part of his farmland is lost, since it is within the area of ROW.
- The is no complaint to the government of the ROW, farmer knows well about the ROW.
- In his case, land ownership is registered in his name and his wife's name. There is a case to put their children name on the certificate if the parents want to distribute the land to their children. If a member would like to sell the land, they need to agree between the persons listed in the certificates.
- The village chief remembers that U33 was buried by the shop owners nearby just before COVID19.

END

Meeting Memorandum with Kampong Speu PDWRAM

Date & Time:	June 25, 2024, 9:00-10:30 AM
Location:	Meeting room at PDWRAM Kampong Speu
Participants:	As shown in the attendant list

- Third-party is responsible for evaluation on the compensation.
- Multiple-ministries (Ministry of Economic and Finance, and other involved ministries) Provincial Department in the project area, as well as the local authority are the members of the committee join in the committee to decide the compensation rates.
- Ministry of Land Management has the responsibility for measurement of land.
- Compensation is considered and determined by Ministry of Economy and Finance.
- Mr. Oeuk Sophal, official personnel of PDWRAM, participated in the compensation fee setting of CP-P-14[1] funded by JICA in 2023, which is still on-going. He remembers that unit prices of farmland and road are US$7-8/$m^2$ and US$11/$m^2$, respectively. As for the compensation rates, the third party implemented a survey and submitted the results to MEF, which finally determined the rates.
- The compensation rates did not include tax and processing fee for CP-P-14.
- There was no special consideration to vulnerable groups such as handicapped persons and women headed families got additional payment aside from the compensation.
- In Cambodia, socio-economic survey, public consultation meeting and cost estimation are to be done in Detailed Design period. However, it is possible to apply JICA's procedure, if it is necessary. If JICA wants to do those activities during F/S, it is up to JICA.
- Farmers in Khpob Krous irrigation scheme have yet to official land certificate, however, they are expected to get the document within 2024. On the other hand, some farmers have already gotten 10 years before.
- International donor conducts the feasibility study, taking time to solve the negative impact.
- There are no indigenous people in the area.

Attendant List

No.	Name	Position
1		Director of PDWRAM Kampong Speu
2		Deputy director of PDWRAM Kampong Speu
3		Vice Head office of Clean Water and Hygiene
4		Chief officer, PDWRAM Kampong Speu
5		Officer, PDWRAM Kampong Speu
6		Staff, PDWRAM Kampong Speu
7		Environment and Social Consideration
8		Assistant (National Staff)

[1] There is CP14 on-going project in South Rorlum Chrey and North and North Rorlum Chrey in kamppng Speu province totally 20km (Construct new canal, wider the width, headwork, gate rehabilitation,).

Meeting Memorandum with Farmers in Kampong Speu Province

Date & Time:	June 25, 2024, 14:00-15:00
Location:	Preah Khae Commune Hall Kampong Speu
Participants:	As shown in the table list

- In 2024, dry season continued compared to previous year. In general, canal water is available in May.
- During 2010-2023, 5-10 members/village have implemented small-scale rehabilitate/ maintenance.
- In 2023, the FWUC submitted the draft Terms of Conditions to MOWRAM and is still waiting their approval. Currently, due to the limited number of members, it is difficult for them to prevent the flood destroy/damage by using sandbags.
- Committee: Due to immigration of one of member to another place, a new committee member was appointed by the FWUC director, it was agreed by current committee members and FWUC members.
- FEE: So far, farmers paid small amount of money, a kind of contribution and 5-10 members per village work for rehabilitation by using the money collected. After official approval for FWUC establishment by the MOWRAM, farmers will pay water fee in accordance with the Terms of Contract and such information will be disseminated to farmers later.
- According to a female farmer, said, in her village male and female are involved in the irrigation farming equally (fifty-fifty) because they want to develop their commune, so that all farmers can access to water and improve the living standard from water resource. However, the PDWRAM staff said that many men have been to urban areas to work.
- The farmers have not gotten land official land certificates yet, however, official government staff of Provincial Department of Land Management have already implemented measurement of their lands to issue the documents in 2023 December.
- Farmers know ROW (right of way) and a part of their farmland will be decreased after the issuance of the certificates.
- There are no indigenous people in the area.

Attendant List

No.	Name	Position
1		Preah Khae Commune Head
2		First vice head Preah Khae commune
3		Second deputy Pof commune
4		Prey Bakrong village (accountant)
5		Director Bosedht District Department of Agriculture, NR and Environment
6		Klork village head commitee
7		Knorng Phum village head
8		Klork village head commitee
9		FWUC member
10		Commune secretary
11		Commune council
12		Commune
12		FWUC member
13		Environment and Social consideration
14		Assistant (National Staff)

Memorandum of Meeting

Date and time:	26th June 2024, 10:00-11:00
Location:	Diamond Business Center
Attendees:	MOE: (Vice Chief of Office, Environmental Impact Assessment Department) (Deputy chief, MOE/EIA)
	JICA Survey Team:

1. Purpose of meeting

Confirm the current laws and regulations, and
Confirm the example cases to apply EIA, IEIA, and EPC and their reason of decision.

2. Details of discussion

- Members of EIA department: 71 members in Environmental Impact Assessment Department (19 females, 52 males).
- The latest laws on Environmental Impact Assessment (EIA) and procedure of EIA are as follows:
  - Code of Environmental and Natural Resources effective in 29th June 2024 (Only Khmer language).
  - Circular Strategy on Environment 2023-2028 (English)

  (Those documents were provided from the EIA department)
- Hierarchy of legal framework of environmental and social considerations are as follows :
  1) Constitution
  2) Law on Environmental Protection and Natural Resource Management Nov. 1996.
  3) Prakas (Declaration) on General Guideline for Developing IEIA/EIA Reports Sep. 2009
  4) Anukret (Sub-decree) on Environmental Impact Assessment (EIA) Process Aug. 1999
  5) Others
- A Project Owner (PO) implement EIA by hiring local consultancy firms to prepare an EIA/Initial EIA (IEIA) report. There are around 25 registered companies in MOE, and some of their certifications are expired.

  *In case of JICA Projects, it is necessary to hire a local registered consultant, since MOE always cares the quality of the report.
- If environmental and social impacts are minor, an Environmental Proception Contract (EPC), which include an Environmental Management Plan (EMP), should be prepared.
- Both EIA and ESIA are currently used in the laws/regulations. Not only environmental (natural) impacts but also social impacts are considered as important matters.
- As for the rehabilitation project, only EPC is principally needed. For, example in road construction, 100km is one of the criteria, but there are some cases to submit EIA depending on the project contents. It depends on the scale and location. If proposed project commands 5,000 ha and more, an IEIA would be necessary. Discussion with MOWRM is to be organized for the categorization.
- There is a case of IEIA report preparation for Water Supply and Flood Reduction Measures Project in the Prek Neal Basin in Svay Rieng Province by KOICA.
- One EIA/IEIA should be prepared per each province, if a project covers plural provinces. If connected plural sub-projects are proposed, preparation of one EIA/IEIA report is enough.

- EIA/IEIA reports are not officially disclosed in Cambodia, but they can be read in the Ministry's Library. If JICA requires to disclose an EIA/IEIA report if it is prepared by JICA, they can do (the person who has the copy right can do it).
- Public participation is important. For data collection, MOE staff's review, key information interview and so on, public participation is necessary without restriction. process:
- Monitoring should be implemented every 6 months in both construction and operation stages. Department of Inspection and Enforcement of Law, MOE is responsible for the monitoring activities.
- If people want to file a grievance due to environmental impacts by a project, they consult the matter with their village heads, and the heads consultant with local authorities, and finally with MOE by means of district and provincial offices. It is possible to use existing hierarchy instead of establishment of a new structure. If the case is very serious, local authorities with MOE can resort to court. The affected persons don't go to court directly.
- There are some cases that affected people file a grievance. In many cases, chemical material production factories cause water pollution due to careless management, which does not obey to contract to protect surrounding environment. Thus, monitoring is very important, and law enforcement is to be promoted.

-END-

Meeting Memorandum with Ministry of Culture and Fine Art

Date & Time:	June 28th 2024, 11:00 am to 11:30 am
Location:	MOCFA meeting room
Participants:	Attached below
Map of cultural heritage distribution (collected at the meeting): Annex	

Purpose of the meeting

The purpose of the meeting was discussing the protection of cultural heritage with the department of Preservation of Archeological Buildings and obtaining information and data on the latest laws on protection of historical heritages, distribution map of historical heritages in Cambodia, procedures when implementing a project that impacts on archeological sites, and documents for rehabilitation works of existing irrigation facility.

Discussion

- If a project is proposed, a comprehensive technical plan document (detailed map project, project plan, and overview of the project) and a request letter are to be submitted from project owner to the Ministry of Culture and Fine Arts (MoCFA) to obtain collaboration. Up on the request from the Project Owner the MoCFA will dispatch their experts to study the impact on archeology whether archeological rescue will be needed. Furthermore, the MoCFA will also coordinate to the study of Environmental Impact Assessment and Heritage Impact Assessment that will be carried out by the project owner. It is necessary to get a permission of project implementation from the Government of Cambodia.
- A project can be disrupted immediately if a project causes eventually impacts on archeological features or sites, and the MoCFA must be informed.
- The archaeological assessment and rescue excavation of cultural heritage will be carried out by the archaeologists of the MoCFA and the cost of this work is to be shouldered by the project owner. According to necessity, archeological excavation survey is required.
- The detailed procedure is stated in the National Cultural Protection Law of 1996. ~~Additional new law for protection of cultural heritages will very soon be adopted.~~
- In Banteay Meanchey Province, there is an Angkorian royal road identified by the MoCFA. If there are some cultural heritages around the proposed project sites, it is needed to inform the MoCFA.
- Distribution maps of heritage sites are attached below.

END

Attachment: Attendant List

No.	Name	Position
MOCFA		
1		Undersecretary of state, MoCFA
2		Acting Director, Archeology Department
3		Deputy chief of office, Preservation Department
4		Deputy chief of department, Preservation Department
5		Chief of office, Archeology Department
JICA survey team		
6		Environmental and Social Consideration
7		Secretary

Annex: Distribution Maps of Heritage

Figure 1: Distribution Map of Heritage Sties in Banteay Meanchey

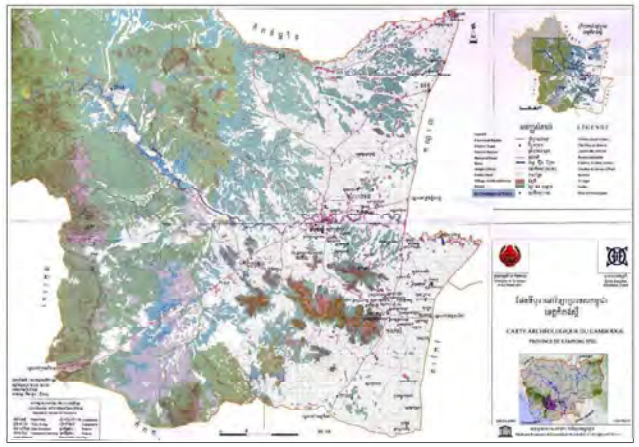


Figure 2: Distribution Map of Heritage Sites in Kampong Speu

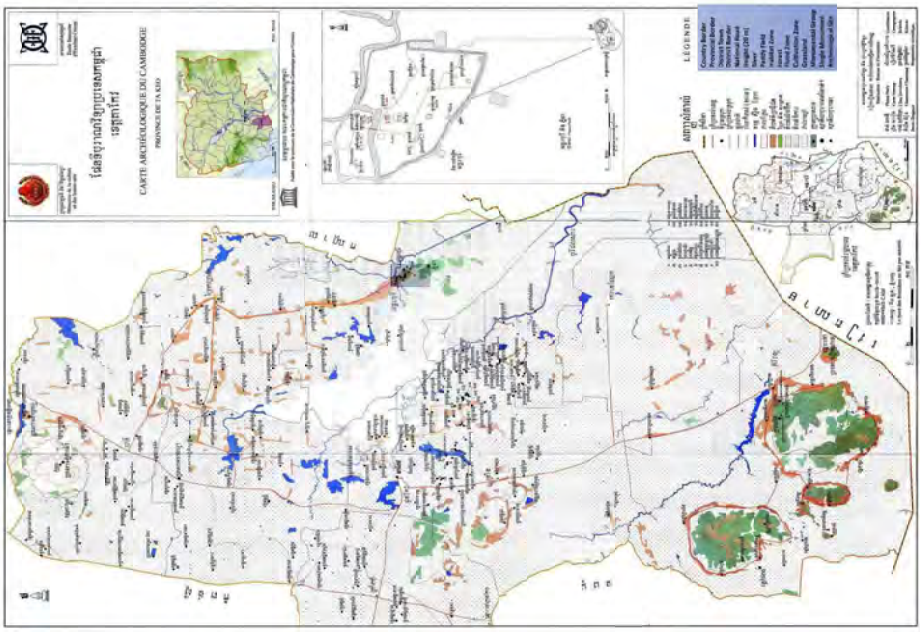


Figure 4: Distribution Map of Heritage Sites in Takeo

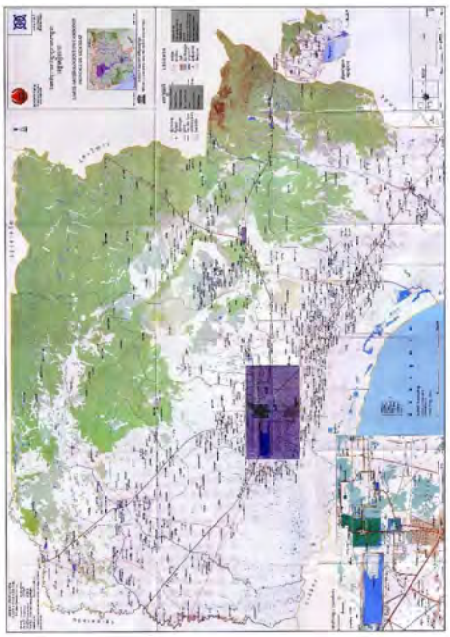


Figure 3: Distribution Maps of Heritage Sites in Siem Reap

VI-40

Meeting memorandum with General Department of Resettlement (GDR)

Date & Time:	July 2, 2024, 10:00 am – 11: 00 am
Location:	GDR meeting room
Participants:	Attached below

Purpose:

To discuss procedure of land acquisition and resettlement in Cambodia:

Discussion

- SOP was prepared based on guidelines and policies of international donors (development partners).
- Land acquisition and resettlement is a centralized process and handled by MEF. The role of MOWRAM is helping consultant firms to conduct necessary study.
- Rough estimation of land acquisition and resettlement during feasibility is not sufficient and acceptable for MEF as a final one. Since estimated cost for land acquisition and resettlement changes one-two years later, MEF regards F/S level RAP including compensation cost estimation as a kind of an environmental and social impact (based on expectation).
- GDR conducts a replacement cost study by hiring a consultant and estimates accurate compensation cost in D/D stage and not in F/S stage. GDR estimates the resettlement cost after the detailed design is completed so that that GDR can identify final affected area and accurate cost for the land loss and resettlement.
- A consultant and a project owner, e.g., MOWRAM organize a consultation meeting targeting broad community and no specific PAPs in F/S stage, since final PAPs are not identified at this stage.
- After a project approval and D/D completion, GDR organize a consultation meeting targeting PAPs prior to detailed measurement survey (socio-economic survey targeting 100% of PAPs in D/D stage).
- IRC (interministerial resettlement committee) is a permanent organization and consists of various line ministries and has mandate to review and evaluate the resettlement and land acquisition for public development projects. The IRC is led by Ministry of Finance.
- There are three types of compensation, for asset loss, income loss, and allowance loss.
- Definition of the poor in Cambodia are i) Poor households below poverty line as national definition, ii) Women headed households, iii) Elderly households without no support, iv) Disable headed households, and v) Customary land users and Indigenous People without formal title. Poor people are categorized into Poor 1 and Poor 2 depending on the type and they have ID cards, respectively, which makes it easy to identify the poor people for any project owners. If the poor are affected by any public projects, "the Poor" are entitled to doubled allowance compensation.

- When those who do not have land certificate are affected by any projects, they can get compensation for loss of standing crops and structures. However, they cannot get compensation for land loss. Similarly, person who use on the state-owned land such as cultivation within ROW can receives only compensation for loss of existing structure or crops and not for land loss.
- Land for land compensation is very rare in Cambodia. Cash compensation for land loss is very common. Farmers prefer cash compensation in general.
- "Corridor of Impact (COI)" mentioned in LAR-SOP is the boundary of the land, which will be acquired for any public project.
- The PAPs are entitled to receiving grants for start new businesses, technical assistance, training, and grants for vocational training. For physical displacement, the PAPs are entitled to livelihood restoration, new lands, new houses.
- Concept of "Full replacement cost" is applied for public project in Cambodia. When compensation is provided to PAPs, transaction cost and tax and so on are included to the compensation rate. However, if there are outstanding taxes levied by the government is not paid landowners, those cost are not included in the replacement costs.
- Regarding "Cut-off-Date", the Government sets on the date of completion of the consultation with PAPs prior to commencement of a detailed measurement survey. However, it is possible to set Cut-off-Date in F/S stage, as far as actual the project alignment/boundary is finalized, and PAPs can be identified.

END

Attachment: Attendant List

No.	Name	Position
MEF		
1		Director of DG
2		International Advisor
3		Director
4		Deputy Director
5		Official
JICA survey team		
8		Team Leader (TL)/ Hydrology / Flood Control
9		Environmental and Social Consideration
10		Secretary

Subject: Field Visit to Bati Irrigation Scheme

Date & Time:	February 7, 2024, 9:00 - 11:00
Location:	Site Visit at Bati Flood Control, Irrigation and Drainage, Takeo Province
Attendants:	Refer to the Attendance List

The meeting with the PDWRAM officer to visit 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 (Bati Irrigation Scheme)

Item	Contents
Component	1. Replacement of one existing pump station 2. Rehabilitation of two main/six secondary canals and branch canals with related structures 3. Rehabilitation of main drainage canals with related facilities 4. Construction of FWUC building 5. Installation of Automatic Hydro-meteorological Station 6. Establishment & Strengthening of FWUC/FWUGs 7. Strengthening of Agricultural Extension Services
Beneficiary Area	4,527 ha
Beneficiary Households	3,410 Households (13,640 farmers)
Capacity of Reservoir *1)	Tonle Bati Reservoir: 15.3 MCM
Catchment Area of Reservoir *2)	Tonle Bati Lake: 238 km^2
FWUC Activity	There is no FWUC in the irrigation scheme. Farmers voluntary collected money to maintain the canals damaged by flood, which is not the activity of FWUC.

1) CISIS data (MOWRAM 2024)
2) JICA Survey Team (2024) based on ASTER DEM

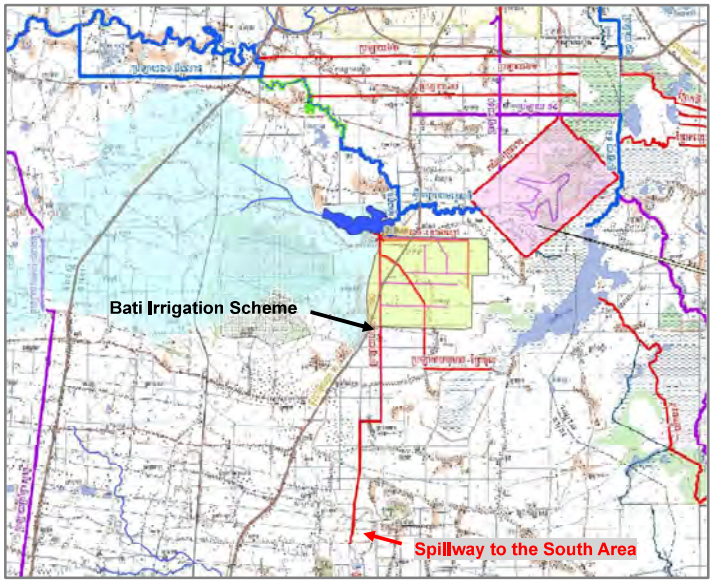
After a meeting and site visit at Bati Flood control, Irrigation and Drainage JST found following:

- Reason for Prioritization
  - 2 Main Reasons for Rehabilitation: (1) Increase in annual water demand (both paddy cultivation area and cropping intensity have been increasing), and (2) Preventing flood damage to the airport.
    - As for the increase in water demand, the cultivation area has increased doubled from 2,000 ha to 4,000 ha, and farmer has requested more water for dry season cultivation. Farmers apply plot-to-plot irrigation, which induces troubles for farmers who do not want to supply water into paddy field. In order to separate irrigation and drainage, canal rehabilitation of branch canals is necessary.
    - Regarding the flood protection, the Techo International Airport, some area of which is flood prone area is under construction financed by China (Construction period: 2019-2025. there is a small river connected to the Slakou river). Therefore, flood water must be discharged to the downstream during the flood season.
- Condition of the Facility
  - From 1987 to 1992, the facilities of the scheme was rehabilitated by the UNDP. After that, it had not been rehabilitated until 2022, and the first half length of the main canal (from the intake point to the cross point of national road 2) was rehabilitated by Chinese fund in 2022.
  - Pumps are operated 1 or 2 weeks from May to June for wet season rice cultivation, 80 – 90 days operation (mostly March and other months) for dry season rice.
  - In case of branch canal rehabilitation by new project, concrete lining is not suitable for the branch

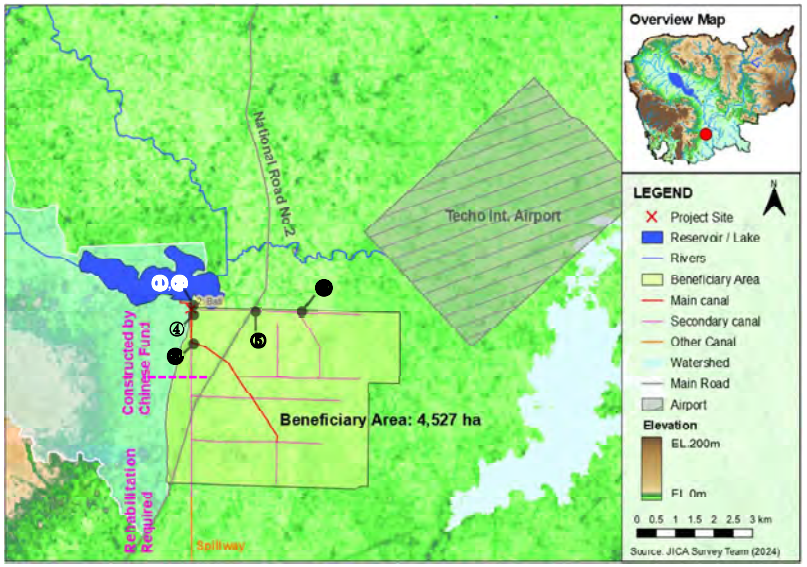
canal because the main canal has not provided concrete lining, and erosion and slide of the slope have already started along the main canal.

① 	② 	③ 
Main canal developed on the Tonle Bati lake. Chinese fund contributed for rehabilitation of this canal in 2022. Buildings at the both banks are operation houses of the irrigation pump	Pump in the operation house. PDWRAM says it should be replaced by new one because it is old.	Rehabilitated canal by Chinese fund. Some places are already eroded and/or slid because there is no lining work.
④ 	⑤ 	⑥ 
Junction from the main canal to branch canal. Gate installation is required according to the PDWRAM.	Secondary canal. There is no concrete lining, and damage from the flood is observed on the slope.	Pump irrigation to farmer's plot. Canal bottom elevation is lower than hydraulic design level.

Map of Bati Irrigation Scheme-1



Map of Bati Irrigation Scheme-2



Attachment: Attendance List

No.	Name	Position
PDWRAM Siem Reap		
1		Chief Officer of Department Agricultural Irrigation
2		Chairman of Put Sor Commune Council
JICA Survey Team		
1		Team Leader (TL)/ Hydrology / Flood Control
2		Co-TL/ Irrigation Development Planning
3		Agriculture
4		Secretary
5		Survey Assistance
6		Survey Assistance