

Appendix-IIID
INSTITUTION

**THE STUDY
ON
COMPREHENSIVE AGRICULTURAL DEVELOPMENT
OF
PREK THNOT RIVER BASIN
IN
THE KINGDOM OF CAMBODIA**

FINAL REPORT

Volume-VII: Appendixes for Feasibility Studies for Priority/Urgent Projects

Appendix-IIID

Institution

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APPENDIX-III: INSTITUTION

Chapter III-1 Government Institutions (PDA and PDOWRAM)

III-1.1 Present Condition

(1) PDA Kampong Speu

PDA was established to specialize in agriculture including fishery and animal husbandry. As of June 2006, total number of the officers is 272 persons. The office is located in neighboring of Kampong Speu Provincial Center. It consists of 8 Offices; “Agronomy,” “Agricultural Extension,” “Agricultural Machinery,” “Agro-industry,” “Animal Health and Production,” “Fishery,” “Planning and Finance,” and “Human Resources and Administration.” Each office has its own building. Additionally, PDA Kampong Speu dispatches technical and administrative staff to 8 of all Districts’ Offices. MAFF recruits the staff based on the request from PDA. Some PDA officers hold Bachelor’s or Master’s degrees of Royal University of Agriculture or the other universities.

(2) PDOWRAM Kampong Speu

PDOWRAM was established to specialize in water resource management. The office building of PDOWRAM Kampong Speu is located along National Road No.4. As of June 2006, total number of the officers is 37 persons; 28 persons in Provincial Office and 9 persons in District Offices. 7 and 3 out of 28 officers are graduated from Institute of Technology of Cambodia and Royal University of Agriculture, respectively. PDOWRAM Kampong Speu consists of 5 Offices; “Irrigated Agriculture,” “Water Resource Management and Conservation,” “Water Supply and Sanitation,” and “Meteorology and Hydrology,” and “Administration.” PDOWRAM assigns the officers of PDOWRAM. Most of the officers have been working for PDOWRAM since 1999 after PDOWRAM was divided into 2 organizations; PDOWRAM and PDA.

III-1.2 Constraints and Problems for Improvement

(1) PDA Kampong Speu

- Some PDA officers who hold Bachelor’s or Master’s degrees work for NGOs as a full-time staff. They regard that they sacrifice themselves to the government; however, most of them would be reinstated in PDA due to their dignity and social status.
- The middle-level officers who stay at the offices should be in charge of several agricultural and rural development projects sponsored by RGC and donors simultaneously. Therefore, they are always busily occupied. Nevertheless, many of them are highly motivated and contribute to the success of the projects.
- It should be noted that many of low-level officers have already lost their incentives to devote to their works because of low salary and unfixed working schedule.

(2) PDOWRAM Kampong Speu

- Many of PDOWRAM officers are lowly motivated and do not have any incentives for their work. The main cause of this situation is low salary; for example, the minimum one is Riel 53,100 (about US\$ 13)/ month in case of a high school graduate. Therefore; they constantly seek for the better posts and working environment. They make a life through having a side job such as a motorbike taxi driver and a farmer.
- The budget provided to PDOWRAM is so limited that it is hard for them to complete their tasks such as regular monitoring of irrigation facilities.
- PDOWRAM officers do not have much opportunity to build capacity of water resource management and administration of their organization through training, study tour and OJT (On the Job Training).

IIID-1.3 Government Institution Strengthening

(1) Background

(a) Necessity of Support from Government Institutions

Success of “Irrigated Agriculture Improvement Model Project” surely requires the support and advice from governmental agencies concerned; MAFF and MOWRAM in the central level and PDA and PDOWRAM in the provincial level. MAFF and PDA are involved in farming practices, while MOWRAM and PDOWRAM are in charge of irrigation management and development. Among them, it is essential that PDA and PDOWRAM work closely with farmers as supporting government institutions on the farm. Needless to say, main actors in irrigated agriculture improvement are farmers. PDA does not need to play a main role for farming practices because irrigated area is cultivated by farmers themselves. Nevertheless, farmers need their technical support. PDOWRAM does not need to play a main role for irrigation management and development but need to remain a supporting agency of farmers because RGC promotes PIMD (Participatory Irrigation Management and Development). PIMD expects that FWUC would take the leading role in managing and repairing their irrigation systems, as well as promoting and guiding development of new irrigation systems. Activities for strengthening PDA and PDOWRAM are described in III-2.4 Agricultural Support Service Strengthening Plan and (3) PDOWRAM Kampong Speu Strengthening, respectively.

(b) Necessity of Coordination between PDA and PDOWRAM

As mentioned above, the support from both PDA and PDOWRAM is crucial to improve irrigated agriculture. Obviously, if the approach of both government institutions to farmers were not coherent, their support would not work effectively. Therefore, the coordination between PDA and PDOWRAM requires to be strengthened through the activities mentioned in (4) Coordination between PDA and PDOWRAM Strengthening.

(2) PDA Kampong Speu Strengthening

See Appendix IIIB Agriculture.

(3) PDOWRAM Kampong Speu Strengthening

(a) Objective and Activities of PDOWRAM Kampong Speu Strengthening

The objective of PDOWRAM Kampong Speu Strengthening is to improve the working capacity and capability of PDOWRAM for achieving the Strategic Target of the Master Plan “Agricultural productivity centering rice is improved” in “Irrigated Agriculture Improvement Model Project.” Surely, efficient and effective planning, designing, and management and O&M of irrigation systems can make a prominent contribution to improve agricultural productivity.

Nevertheless, it can be said that the knowledge and skills of the PDOWRAM officers in their specialized fields mentioned above as well as administration are still limited. About 50% of the officers lack the incentives to work due to low salary and lack of the budget for rehabilitation works; however, it is also true that there are some officers that are highly motivated but have not developed their potentials yet. Consequently, this plan will focus on capacity building of the PDOWRAM officers through executing the following activities.

1) Holding of Participatory SWOT Workshop

As the first step of strengthening PDOWRAM, it is necessary to hold a participatory workshop on SWOT (Strengths, Weaknesses, Opportunities, and Threats) for understanding a present situation of the PDOWRAM. SWOT is a method commonly utilized for institutional analysis. Application of SWOT by participatory

way is useful for effective grasp of the institutional condition from the viewpoint of PDOWRAM officers as well as for making them easily realized their current situation.

2) Conducting of Capacity Building Activities

The capacity of PDOWRAM officers can be built through 3 ways; i) provision of training courses, ii) conducting the study tour, and iii) OJT (On the Job Training). During the training courses, they can learn how to plan, design, and manage irrigation facilities as well as how to administrate their works efficiently. The study tour can give them opportunities to see the advanced organization and/or advanced irrigation area. The study tour can make PDOWRAM officers understand their strengths, opportunities, weakness, and threats identified in the SWOT workshop more clearly and come up with actions to be taken for overcoming their weakness and threats easily. It is expected that the OJT during “Irrigated Agriculture Improvement Project” and the other donor/ RGC’s project implementing with engineers or administrative experts of donors and MOWRAM could make a great contribution to capacity building of the PDOWRAM officers. “Learning by Doing” is the best way to achieve knowledge and/or technique.

3) Continuation of Regular Inter-Offices Meeting

The PDOWRAM holds a weekly inter-offices meeting for reporting to Director and sharing information among the officers. Sharing and exchange of the information related to irrigation management and development as well as administration are very important for staying the institutional function sound. Therefore, this activity should be continued regularly.

4) Monitoring and Evaluation

The process and outputs of the activities discussed above should be monitored and evaluated precisely. The results of monitoring and evaluation need a timely feedback to the on-going and future activities for better outcome.

(b) Cost Estimation

Required cost for executing “PDOWRAM Strengthening” can be estimated in the table below. Total cost would be US\$ 5,910.

Cost Estimation of PDOWRAM Strengthening

Activity	Cost (Unit: US\$)
(1) Holding of participatory SWOT workshop	80
(2) Conducting of capacity building activities (training, study tour, OJT)	5,830
(3) Continuation of regular inter-offices meeting	0
(4) Monitoring and evaluation	0
Total	5,910

(c) Implementation Schedule

The implementation schedule of “PDOWRAM Strengthening” is indicated in the tables below. The whole period is 2 years.

Implementation Schedule of PDOWRAM Strengthening

Activities		2008		2009				2010							
		Oct.-Dec.	Jan.-March	April-June	July-Sep.	Oct.-Dec.	Jan.-March	April-June	July-Sep.	Oct.-Dec.					
(1)	Holding of participatory SWOT workshop	▲													
(2)	Conducting of capacity building activities (training, study tour, OJT)	Training	▲	▲	▲	▲	▲	▲							
		OJT													
(3)	Continuation of regular inter-offices meeting														
(4)	Monitoring and evaluation														

(4) Coordination between PDA and PDOWRAM Strengthening

(a) Objective and Activities of Coordination between PDA and PDOWRAM Strengthening

The objective of “Coordination between PDA and PDOWRAM Strengthening” is to strengthen the bond and the relationship between two provincial departments concerning on development of irrigated agriculture for achieving the Strategic Target of the Master Plan; “Agricultural productivity centering rice is improved” in “Irrigated Agriculture Improvement Model Project.”

As conducting the workshop on promoting the coordination between PDA and PDOWRAM in June 2006, following issues were identified; i) the officers of both provincial departments are associated with personally as ex co-workers because PDA and PDOWRAM used to be one department (PD AFF) from 1979 to 1999, ii) PDA and PDOWRAM continue to have a weekly meeting from 1999, and iii) PDA and PDOWRAM execute two projects; “Early Season Rice” and “Intervention during the Drought” jointly every April and May from 1999 although a joint team has not been officially organized. Accordingly, there is not severe problem on the coordination and cooperation between PDA and PDOWRAM for implementing a project jointly. There are only some points to be considered for smooth implementation of “Irrigated Agriculture Improvement Model Project.” They are i) frequent share and exchange of information among donor and both agencies, and ii) offering of same working condition from the aspect of allowance. Moreover, their higher organizations; MAFF and MOWRAM respectively, allocate the tasks properly according to their specialties and instruct the continuation of coordination between both provincial departments.

In the Project, the Project Office will be established to strengthen the cooperation and coordination between PDOWRAM and PDA.

In this current circumstance, the proposed activities to strengthen the coordination between PDA and PDOWRAM are as follows.

1) Continuation of Regular Inter-Departments Meeting

PDA and PDOWRAM continue to hold a weekly inter-departments meeting since 1999. This activity is helpful for keeping their relationship well.

2) Publishing of a News Letter on “Irrigated Agriculture Improvement Model Project”

Publishing of a news letter on the project implementation can make a considerable contribution to disseminating the on-going activities and the outcomes of the project. The project should be recognized well among all stakeholders such as high ranking officers of MAFF and MOWRAM for seeking their cooperation.

3) Monitoring and Evaluation

The process and outputs of the activities discussed above should be monitored and evaluated precisely. The results of monitoring and evaluation need to be reflected timely to the on-going and future activities for better outcome.

(b) Cost Estimation

Required cost for executing “Coordination between PDA and PDOWRAM Strengthening” can be estimated in the table below. Total cost would be US\$ 976.

Cost Estimation of Coordination between PDA and PDOWRAM Strengthening

Activity	Cost (Unit: US\$)	Remarks
(1) Continuation of regular inter-departments meeting	0	
(2) Publishing of a News Letter on "Irrigated Agriculture Improvement Model Project"	976	Every 2 months (totally 8 times)
(3) Monitoring and evaluation	0	
Total	976	

(c) Implementation Schedule

The implementation schedule of “Coordination between PDA and PDOWRAM Strengthening” is indicated in the tables below. The whole period is 2 years.

Implementation Schedule of Coordination between PDA and PDOWRAM Strengthening

Activities	2008		2009				2010													
	Oct.-Dec.	Jan-March	April-June	July-Sep.	Oct.-Dec.	Jan-March	April-June	July-Sep.	Oct.-Dec.											
(1) Continuation of regular inter-departments meeting																				
(2) Publishing of a News Letter on "Irrigated Agriculture Improvement Model Project"		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲
(3) Monitoring and evaluation																				

Chapter IIID-2 Farmer Water Users Community (FWUC)

IIID-2.1 Present Condition

There are two Farmer Water Users Communities (FWUC) in the Project Area; one is Ou Veang FWUC and the other is Phoum Rong FWUC. Both FWUCs were organized on the initiative of PDOWRAM Kampong Speu (hereinafter PDOWRAM) and donors; PRASAC for Ou Veang and WB for Phoum Rong.

(1) Ou Veang FWUC

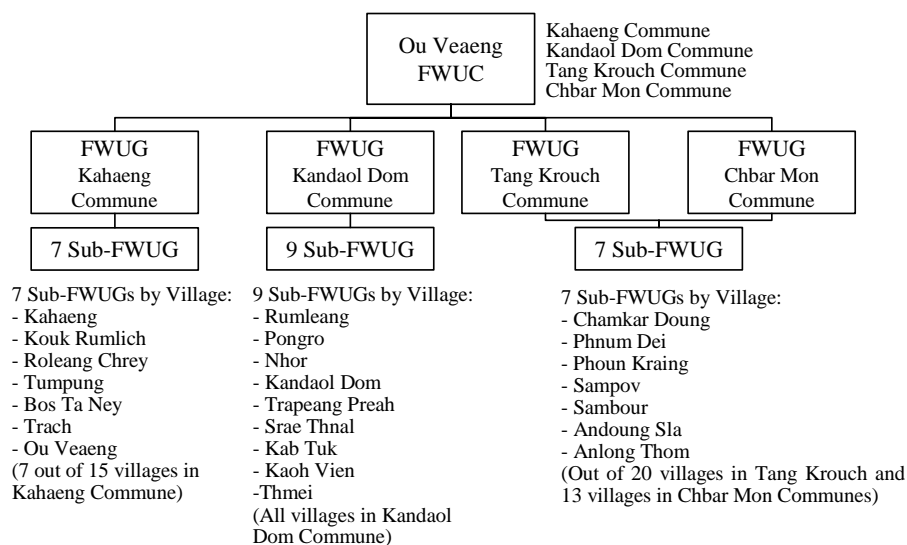
(a) Location of Ou Veang FWUC Management Area

Ou Veang FWUC manages the irrigation area covering totally 23 Villages in 4 Communes (Kahaeng and Tang Krouch Communes of Samraong Tong District, and Chbar Mon and Kandaol Dom Communes of Chbar Mon District in Kampong Speu Province) as of January 2007. It manages the upstream irrigation area spreading over 13 Villages in the Project Area. The size of irrigation area is 976ha, and 514ha out of 976ha is irrigable at present and the beneficiaries are 2,432 farm households as of January 2007. The size of irrigation area and the number of benefited farmers are not accurate because these figures are estimated based on the report from Village Chiefs without cadastral survey. Additionally, PDOWRAM does not keep track of these figures because the FWUC Committee Chief did not report them to PDOWRAM.

Generally and technically said, a 976ha irrigation area is too large to be managed by 1 FWUC. The area can be divided into at least two; irrigation area of the South Main Canal and that of the North Main Canal. Cadastre of the benefited farmers with their thumbprint was arranged by PDOWRAM in 2002 but have not updated yet. Moreover, the cadastre was made based on the interview with farmers without the cadastral survey. It means the data in the cadastre is not accurate. A cadastral map was not prepared from the beginning due to lack of the budget.

(b) Organizational Structure

Ou Veang FWUC was organized in 2002. It consists of 4 FWUG (Farmer Water Users Group)s and 23 Sub-FWUGs. The organizational chart of Ou Veang FWUC is described in the figure below. As the subordinate organizations of FWUC, FWUG and Sub-FWUG were also formed in 2002. They were organized by administrative boundary; by Commune and by Village respectively. Nevertheless, these two groups have never been functioning since they were organized.



Organizational Chart of Ou Veang FWUC

(c) Executed Procedure of Organizing Ou Veang FWUC

The steps to organize Ou Veang FWUC were as follows.

Step 1: PDOWRAM built up the relationship with farmers to collect basic information.

Step 2: PDOWRAM held a public meeting with all villagers.

Step 3: 2 FWUG nominated 1 candidate of the FWUC Committee Chief respectively.

Step 4: The Chief and the other Committee members were selected by election.

Step 5: The Chief prepared the draft of bylaw with the support from PDOWRAM.

Step 6: PDOWRAM trained the FWUC Committee members.

Step 7: The Chief submitted the registry application to PDOWRAM.

Step 8: PDOWRAM submitted the required documents for registration to MOWRAM.

All of the steps were taken in 2002; however, the registration procedure is still in the process. It means that Ou Veang FWUC has not been officially registered yet.

(d) Management Board

Ou Veang FWUC is managed by the Committee consisting of 4 persons; Chief, 1st Deputy Chief, 2nd Deputy Chief and Accountant. They were selected in the election mentioned in (b) Executed Procedure of Organizing Ou Veang FWUC. The roles of each committee member are indicated in the table below.

Roles of Each Committee Member

Position	Role
Chief	General management of the Committee (+ opening gates for water distribution)
1st Deputy Chief	Planning of irrigation management and maintenance
2nd Deputy Chief	Being in charge of water distribution
Accountant	Being in charge of collecting irrigation service fee and keeping accounting records

Source: Interview with the Committee Chief of Ou Veang FWUC (June 2006)

The Committee partly works. It holds the Committee meeting only 3 times a year and tries to collect irrigation service fee. A part of the reason for rare meetings might be lack of a meeting place such as its office building. The main occupation of the members is a farmer. They do not receive any rewards or allowance from the FWUC activities.

(e) Irrigation Service Fee

Bylaw was arranged by the Committee of the FWUC in November 2001 in accordance with the model bylaw stated in Circular No. 1 on the Implementation Policy for Sustainable Irrigation Systems prepared by MOWRAM in 2000. The bylaw defines the calculating method of irrigation service fee, but the amount is not clearly mentioned in it. The table below mentions irrigation service fee according to PDOWRAM Kampong Speu Officers.

Irrigation Service Fee

Type of Irrigation	Amount
Gravity	Riel 30,000/ha/season
Pump-up	Riel 10,000/ha/season
Gravity + Pump-up	Riel 20,000/ha/season

Source: PDOWRAM Kampong Speu officers

The Chief of FWUC Ou Veang Committee claimed the different amount. It is Riel 40,000/household/ha for any type of irrigation. Payment rate of irrigation service fee is very low. 90% of the members have never paid the irrigation service fee. According to the Chief, many members do not pay the determined amount because their land holding size has never been measured accurately. It means that sometimes the FWUC overestimates or underestimates the irrigation service fee. The fee collecting system is also poor. The Chief uses the cadastre prepared in 2002 to collect irrigation service fee although he knows the recent enlargement of irrigation area and benefited farmers. Consequently, the collected amount was Riel 600,000 (US\$ 15) in the year of 2004. It is noteworthy that those who have been paying the fee hold farmland along RT-2 tertiary canal. Many of them live in 5

out of 23 Villages; Kahaeng, Ou Veaeng, Bos Ta Ney of Kahaeng Commune, and Pongro and Srae Thnal of Kandaol Dom Commune. Installed good check structures with RT-2 tertiary canal might bring about this result.

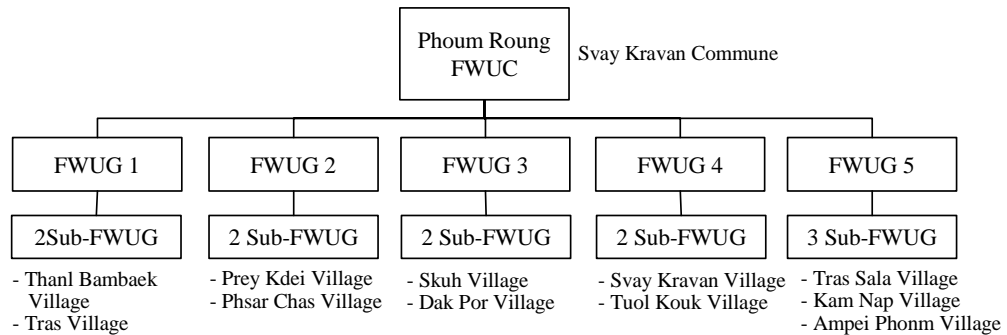
(2) Phoum Rong FWUC

(a) Location of Phoum Rong FWUC Management Area

Phoum Rong FWUC manages the irrigation area covering totally 11 Villages in Svay Kravan Commune. The irrigation area of Svay Kravan Commune was used to be a part of Ou Veaeng FWUC management area and separated from it in 2004. Phoum Rong FWUC manages the downstream irrigation area spreading over 5 Villages in the Project Area. The size of irrigation area is 518ha and beneficiaries are 1,106 farm households as of January 2007, according to the reports from Village Chiefs to the FWUC Committee Chief. The cadastral map which covers about 50% of Phoum Rong FWUC management area was prepared by MOWRAM and PDOWRAM on the budget of WB's Flood Emergency Rehabilitation Project in 2004. Nevertheless, the cadastre of the benefited farmers with their thumbprints was arranged based on the interview of farmers without the cadastral survey. It means the data in the cadastre is not accurate at all.

(b) Organizational Structure

Phoum Rong FWUC consists of 5 FWUGs and 11 Sub-FWUGs. Sub-FWUGs were organized by canal layout. One Sub-FWUG consists of 2-3 villages which share one tertiary canal. The organizational chart of Phoum Rong FWUC is described in the figure below.



Organizational Chart of Phoum Rong FWUC

(c) Executed Procedure of Organizing Phoum Rong FWUC

Phoum Rong FWUC was organized in 2004 by PDOWRAM Kampong Speu. The steps to organize Phoum Rong FWUC were as follows.

Step 1: PDOWRAM staff surveyed geography, area of irrigable land, and the number of farmers in that area. MOWRAM staff prepared a cadastral map.

Step 2: PDOWRAM announced the local farmers they had a plan to establish FWUC.

Step 3: PDOWRAM organized the election of selecting 4 representatives of each Sub-FWUG by village (44 persons).

Step 4: PDOWRAM organized the election of selecting 4 representatives of each FWUG (20 persons).

Step 5: PDOWRAM organized the election of selecting Chief of FWUC.

Step 6: The Committee of FWUC prepared the FWUC bylaw → The Committee explained its contents to farmers. → The Committee reflected the opinions of the farmers to the bylaw → The Committee sent the draft to Chbar Mon District Office of PDOWRAM. → The Committee received the approved bylaw from the District Office.

Step 7: The Committee sent the finalized bylaw to PDOWRAM.

Step 8: PDOWRAM sent the finalized bylaw to MOWRAM and WB.

Step 9: The team of WB, MOWRAM, and PDOWRAM provided the training to the Committee and villagers in the villages.

Step 10: PDOWRAM handed over the facilities to the FWUC under the supervision of WB, MOWRAM, and Commune Council.

All of the steps were taken in 2004; however, the registration procedure is still in the process. It means that Phoum Rong FWUC has not been officially registered yet.

(d) Management Board

Phoum Rong FWUC is managed by the Committee consisting of 4 persons; Chief, 1st Deputy Chief, 2nd Deputy Chief, Accountant and the representatives of FWUGs and Sub-FWUGs. They were selected in the election mentioned in (b) Executed Procedure of Organizing Phoum Rong FWUC. The roles of each committee member are indicated in the table below. The representatives of FWUG and Sub-FWUG generally work for distributing information to the benefited farmers and collecting irrigation service fee.

Roles of Each Committee Member

Position	Role
Chief	General management of the Committee
1st Deputy Chief	Planning related to rehabilitation of some parts of secondary canals and facilities
2nd Deputy Chief	Being in charge of water distribution and water management
Accountant	Being in charge of keeping all records of the collected ISF and expenses

Source: Interview with Phoum Rong FWUC Committee (Jan. 2007)

The FWUC functions rather properly. It holds 2 types of the meeting depending on the necessity; i) Committee member meeting and ii) Sub-FWUG meeting. The Committee member meetings are usually held in the FWUC office building. The main occupation of the members is a farmer. Chief and 1st Deputy Chief are also carpenters, and Accountant is also Tras Village Chief. The Chief is not a member of the Commune Council at present, but he closely works with it and will run as a candidate of the next Commune Council member election. He manages the FWUC with a strong leadership. Additionally, he understands well the condition of the irrigation system in his FWUC management area.

(e) Irrigation Service Fee

Bylaw was arranged by the Committee of the FWUC in June 2004 in accordance with the model bylaw stated in Circular No. 1 on the Implementation Policy for Sustainable Irrigation Systems prepared by MOWRAM. The table below mentions irrigation service fee determined in the bylaw.

Irrigation Service Fee

Type of Irrigation	Amount
Gravity	Riel 40,000/ha/season
Pump-up	Riel 10,000/ha/season

Source: Interview with Phoum Rong FWUC Committee (Jan. 2007)

75% of collected irrigation service fee is utilized for repair and maintenance of water gates and repair of damaged canals. The rest 25 % is utilized for allowance of the Committee members (12%), the representatives of FWUG and Sub-FWUG (12%), and the Commune Council member who is actively involved in the FWUC's activities (1%). The collected amount was Riel 3,100,000 (US\$ 775) in the year of 2005. Majority of the benefited farmers pay the irrigation service fee but its amount is about 35% of estimated one. The main reason of this is that they pay some portions of irrigation service fee levied on their irrigated land, for example, Farmer A holds 1ha of irrigated land but pays irrigation service fee for only 0.5ha.

IIID-2.2 Constraints and Problems for Improvement

(1) Ou Veang FWUC

The problems and constraints Ou Veang FWUC faces are;

(i) Physical/ infrastructural problems

- Some of the reconstructed canals have been already broken.
- Farmers continue to excavate reservoirs and canals deeper and deeper without any permission from the Committee of the FWUC.
- Irrigation water does not come to the plot timely.

(ii) Financial problems

- Ou Veang FWUC cannot receive continuous support from PDOWRAM due to lack of governmental budget for it.
- The Committee members and representatives of Sub-FWUGs do not receive any rewards or allowance from the FWUC activities. Therefore, they are lowly motivated.
- Many of the member farmers do not pay the determined amount because their land holding size has never been measured accurately.
- Accounting system is not transparent. Accountant does not keep book appropriately and does not release financial report of the FWUC to the member farmers.

(iii) Administrative problems

- Cadastre of the benefited farmers with their thumbprints was arranged by PDOWRAM but cadastral map was not.
- The FWUC is organized according to administrative boundary but not to irrigation canal layout.
- The Committee holds the meeting only 3 times a year. A part of the reason for rare meetings might be lack of a meeting place such as its office building.
- The Committee faces lack of personnel to cover large irrigation area.
- The representatives of Sub-FWUG who were elected in 2002 do not work.
- It takes a lot of time to organize the farmer water users but the Chief cannot spend much time for it due to his severe family condition.
- The Chief has to do all works of the FWUC by himself although the roles of each Committee member are determined in the bylaw.
- Farmers water users are not aware of roles of the FWUC because it doesn't function properly.
- The official registration of the FWUC in MOWRAM is still in the process.

(2) Phoum Rong FWUC

The problems and constraints Phoum Rong FWUC faces are;

(i) Physical/ infrastructural problems

- In the original plan, farmers can use water both in the rainy and dry seasons. However; in a current condition, they cannot use water in the dry season because water doesn't come from the Roleang Chrey South Main Canal.
- Irrigation facilities are getting deteriorating.
- Check structure are insufficient.
- Water gates are often illegally destroyed.

(ii) Financial problems

- There is not subject to punishment for non-payers of irrigation service fee.
- Some of the farmers do not want to pay irrigation service fee and cheats the FWUC.
- Representatives of FWUG and Sub-FWUG are not paid monthly. They can obtain small amount of money only during irrigation service fee collection.
- The FWUC Committee members work throughout a year but they cannot get monthly payment.

(iii) Administrative problems

- The cadastre and cadastral map were prepared by MOWRAM and PDOWRAM but do not cover whole management area and have not updated since 2004.
- The Committee members except Chief want to resign because of low allowance.
- Not all of representatives of FWUC and Sub-FWUC work properly.
- The registration of the FWUC in MOWRAM is still in the process.

IIID-2.3 FWUC Strengthening

(1) Background

(a) Participatory Irrigation Management and Development (PIMD)

The RGC intends to implement the PIMD strategy throughout the country. It expects that all donor-assisted development programs will follow the same strategy of organizing FWUCs, building their managerial, technical and financial capacity, adopting Irrigation Service Plans and Audits and transferring irrigation management authority to the FWUCs.

In Cambodia, PIMD means that FWUC take over primary responsibility and authority; i) to manage, repair and improve existing irrigation systems and ii) to develop new irrigation systems. Additionally, PIMD means that FWUC will take the lead role in managing and repairing their irrigation systems. It means that FWUC will take the lead role in promoting and guiding development of new irrigation systems. It does not mean that farmers will have to pay all the cost of irrigation management and development. Necessary assistance will be provided in ways that build the capacity of the FWUC to be self-reliant.

(b) Proposed Steps in Training Manual for PIMD in Cambodia

“Steps for Organizing the Farmer Water Users Community” are proposed in “Training Manual for Participatory Irrigation and Management (PIMD) in Cambodia” prepared by MOWRAM in 2003 with assistance from the Asian Development Bank (ADB Loan No. 1445-CAM, SF). These steps are strongly recommended by MOWRAM, and therefore, the FWUCs in the Project Area; Ou Veang and Phoum Rong FWUCs should be strengthened in the similar manner as considering the current condition of them. The proposed steps for organizing FWUC, building capacity, transferring authority and repairing and improving irrigation infrastructure are as follows.

Step 1: Hold initial meetings at system or sub-system level

Step 2: Identify irrigation service area and potential members of FWUC and conduct Participatory Rural Appraisals (PRA)

Step 3: Farmers agree to form FWUC and plan organizing activities

Step 4: Farmers prepare and adopt FWUC Statute and By-laws

Step 5: Farmers establish FWUC and select leaders

Step 6: Build capacity of FWUC to prepare an Irrigation Service Plan

Step 7: FWUC adopts and implements initial Irrigation Service Plan

Step 8: Prepare and adopt Management Transfer Agreement (or Certificate of Management Authority)

Step 9: Repair and improvement of irrigation infrastructure

Step 10: Continue capacity building and provision of support services

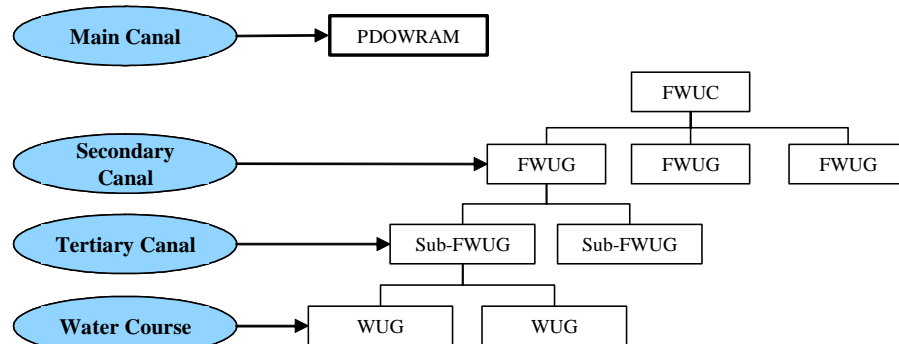
Additionally, the most considerable issue to establish FWUC can be abstracted from “Training Manual for PIMD in Cambodia”; “an FWUC should be established where a majority of all water users who own or cultivate the land within the hydraulic unit vote to establish it. Those who vote against establishment of the FWUC should be obliged to join out of difference to the majority or in case of refusal, should be charged a higher price for water. If they refuse to pay for water service, they should be denied access to water, except whether they obtain water from an independent source entirely through their own efforts and expenses.”

(2) Objective of FWUC Strengthening

The objective of “FWUC Strengthening” is to develop and improve the function of the FWUCs, as complying with the Statute of the FWUC and the concept of PIMD, and referring to the experience of the Pilot Project. Strengthened FWUCs would surely contribute to achieving the objective of Irrigated Agriculture Improvement Model Project; “To demonstrate proper water management and increase rice production.” There are two FWUCs in the Project Area; Ou Veang and Phoum Rong. Hereinafter, the FWUCs aiming at this objective is described in details, respectively in the following thematic sections.

(a) Demarcation of Water Management and O & M

According to the Policy for Sustainability of Operation and Maintenance Irrigation System, main canals should be managed by FWUC and FWUC Board (= Association of FWUCs). Nevertheless, main canals need to be managed by PDOWRAM Kampong Speu for effective and efficient distribution of irrigation water and O&M of the irrigation facilities. Accordingly, it is proposed that the FWUCs would coordinate secondary canal water uses of FWUGs which would be in charge of O&M of each secondary canal. Sub-FWUGs and WUGs would be responsible for tertiary canals and water courses, respectively. The figure below describes the proposing O&M system.



Demarcation of Water Management and O & M

1) Ou Veang FWUC

Ou Veang FWUC was organized by administrative boundary, and thus consists of 4 FWUG by Commune and 23 Sub-FWUGs by Village. The present FWUG and Sub-FWUG should be restructured by canal layout as proposed above.

2) Phoum Rong FWUC

Phoum Rong FWUC, 5 FWUGs, and 11 Sub-FWUGs were organized by hydraulic boundary. 2-3 Sub-FWUG commonly utilizes one tertiary canal. Thus, the FWUC requires organizing WUGs additionally for newly constructed water courses.

(b) Organizational Structure

The FWUC would be led by 4 Committee members; Chief, 1st Deputy Chief, 2nd Deputy Chief, and Accountant, selected by the member farmers through election. The election should start from selecting the WUG representatives. Secondly, Sub-FWUG representatives would be elected among the representatives of some WUGs organized by water course. Thirdly, the representatives of FWUG would be elected among the representatives of some Sub-FWUGs organized by secondary canal, and then finally, the Committee members of FWUC would be elected among the representatives of some FWUGs. The first election, which selects the WUG representatives, needs to be conducted by the all benefited farmers’ participation for the sequential FWUC’s activities. The number of the representatives of FWUG, Sub-FWUG, and WUG can be determined based on the area of the management irrigation land by each Group; however, it is ideal if

4 representatives (Chief, 1st and 2nd Deputy Chiefs, and Accountant) were elected. The roles that each of them is expected to play are summarized in the table below.

Expected Roles of Each Committee Member

Position	Role
Chief	<ul style="list-style-type: none"> - To be in charge of general supervision. - To chair the meeting concerning on irrigation. - To direct and prepare annual irrigation plan including budgeting. - To examine the activities of all subordinate groups.
1st Deputy Chief	<ul style="list-style-type: none"> - To be in charge of maintenance and repairing plan. - To monitor the irrigation system regularly (if possible, daily). - To define the scope of work for farmers to maintain and repair canal network. - To report regularly on the repairs to the irrigation system
2nd Deputy Chief	<ul style="list-style-type: none"> - To be in charge of water supply and distribution and record keeping. - To prepare water distribution plan. - To supervise the implementation of the water distribution plan regularly (if possible, daily).
Accountant	<ul style="list-style-type: none"> - To be in charge of finance. - To collect irrigation service fee from the Chief of FWUGs. - To keep revenue and expenditure. - To report revenue and expenditure to the other Committee members and the member farmers.

The expected roles of the representatives of each subordinate group are almost same with those of the Committee members.

1) Ou Veang FWUC

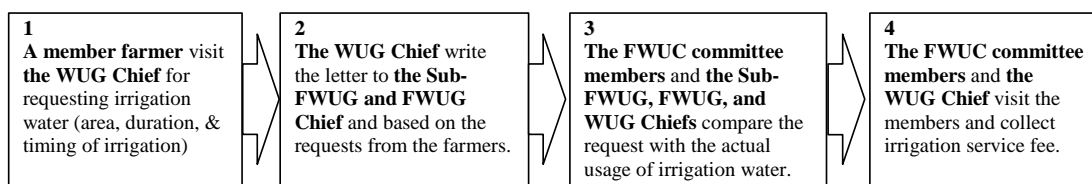
Ou Veang FWUC consists of 4 members; however, the Chief has to do all works of the FWUC by himself. It is necessary to provide the training for the members to become capable to carry out the roles of each proposed in the table above. The representatives of FWUG and Sub-FWUGs have never worked. Therefore, new representatives should be elected by the benefited farmers in each management area.

2) Phoum Rong FWUC

Phoum Rong FWUC is managed mainly by 4 members of the Committee, and supportively by representatives of FWUGs and Sub-FWUGs. They are relatively working well. The representatives of FWUGs and Sub-FWUGs play an important at the collection of irrigation service fee. FWUGs and Sub-FWUGs should be restructured, and the new representatives should be selected by canal layout.

(c) Collection of Irrigation Service Fee

Proposing procedure of collecting irrigation service fee is described in the figure below. This is the actual procedure practiced by Ou Traeng FWUC in Prey Neat Commune, Kong Pisei District, Kampong Speu Province. This procedure is simple but relatively high payment rate of irrigation service fee (80-85%) proves its effectiveness. Among the 4 steps, 1 and 4 should be absolutely included. Irrigation water should be distributed according to the request from the farmers, and his/her request and the actual usage/ water distribution should be checked by the persons in charge of water distribution. Moreover, accounting should be properly kept and reported to the member farmers regularly for financial transparency. Otherwise, it is afraid that most of the farmers would not pay irrigation service fee.



Proposing Procedure of Collecting Irrigation Service Fee

1) Ou Veang FWUC

Payment rate of irrigation service fee of Ou Veang FWUC is very low, less than 10%. The Chief collects irrigation service fee by himself as visiting the benefited farmers from door to door. This method is very ineffective and time consuming. Therefore, it is recommended for the FWUC to trial the proposing procedure with newly elected representatives of FWUGs, Sub-FWUGs, and WUGs.

2) Phoum Rong FWUC

The representatives of FWUGs and Sub-FWUGs are in charge of collecting irrigation service fee and work for this currently. Nevertheless, the payment rate of irrigation service fee of the FWUC is not so high, about 35%. Thus, it is recommended that the FWUC would trial the proposing procedure with the present representatives and newly elected ones of WUGs by using the updated cadastre based on the newly prepared cadastral map.

(d) Meeting

Regular meetings should be held according to the need for monitoring the implementation of the irrigation service plan and for preparing the sequential months. It is recommended for the FWUC Committee to hold four types of meetings; i) the Committee meeting, for example, for preparing the draft of irrigation service plan, at least monthly, ii) the Committee members and representatives of FWUG, Sub-FWUG and WUG meeting at least monthly, for example, for discussing the draft and sharing the information, iii) annual general assembly, for example, for understanding the financial condition of the FWUC, and iv) Inter-FWUCs (Ou Veang FWUC, Phoum Rong FWUC and Bak Thmei FWUC*) Meeting led by PDOWRAM for coordinating irrigation water use and O & M of the common irrigation facilities. The FWUC Committee had better invite local authorities for these meetings such as Commune Chief, Deputy Commune Chief, the member (s) of Commune Council and/or Village Chiefs for seeking their support.

*The FWUC that manages the downstream irrigation area of the Phoum Rong FWUC

1) Ou Veang FWUC

The Committee of Ou Veang FWUC holds the meeting only 3 times a year. The interval of each meeting is too large. It can be assumed the Committee does not discuss enough to manage the FWUC. The Committee needs to commence receiving the training on how to organize and facilitate meetings by themselves.

2) Phoum Rong FWUC

The Committee of Phoum Rong FWUC has already got accustomed to have regular meetings.

(e) Repair, Improvement, and Construction of Irrigation Infrastructure

The FWUC Committee is expected to participate in simple feasibility study and cost estimation on repair, improvement, and construction of small-scaled irrigation facilities. In case of those of medium and large-scaled ones, the Committee needs to make the proposal submitting to PDOWRAM and MOWRAM for seeking assistance. The repair, improvement, and construction of large-scaled irrigation facilities require the involvement of MOWRAM.

1) Ou Veang FWUC

The Committee of Ou Veang FWUC has never been trained for required works mentioned above. They need to receive the training concerning on repair, improvement, and construction of irrigation infrastructure.

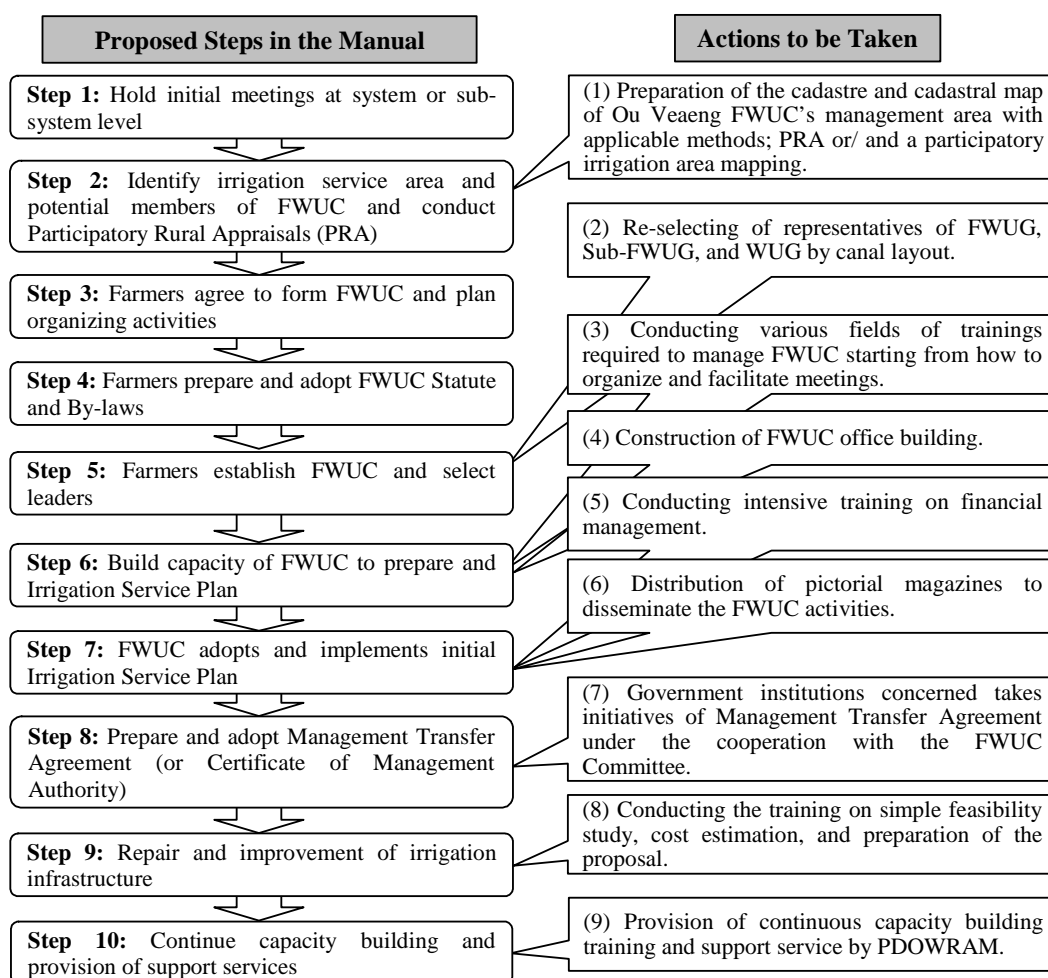
2) Phoum Rong FWUC

The Committee of Phoum Rong FWUC has experience of repairing small-scaled irrigation facilities and damaged canals; however, has not tried to seek assistance of MORWRAM for medium and large-scaled ones. So, the Committee members need the training on how to prepare the proposal to MOWRAM.

- (3) Comparison with Proposed Step in “Training Manual for Participatory Irrigation and Management (PIMD) in Cambodia”

Due to difference of the advance level of each FWUC, the necessary activities of “FWUC Strengthening” are described separately.

(a) Ou Veang FWUC



Actions to be Taken for Strengthening Ou Veang FWUC

As compared to the proposed steps mentioned above, Ou Veang FWUC has completed until Step 5. Additionally, it is hard to state that the Step 2; “Identify irrigation service area and potential members of FWUC and conduct Participatory Rural Appraisals (PRA),” has been completed. It means identification of irrigation service area and potential members of FWUC has not successfully done yet. Ou Veang FWUC started without accurate cadastre and cadastral map. This causes ineffective distribution of irrigation water and low payment rate of irrigation service fee. Therefore, the first step should be taken by Ou Veang FWUC is “Identify irrigation service area and potential members of FWUC and conduct Participatory Rural Appraisals.” In short, Ou Veang FWUC requires preparing the cadastre and cadastral map of its management area based on accurate measurement of irrigation area (Action to be taken (1)). If it is difficult to apply PRA due to lack of an expert or the other reasons, the other methods such as a

participatory irrigation map making by combination of interview with farmers and surveying with GPS can be applied, instead. A participatory irrigation map making was trialed in the Pilot Project of Zone-1 and produced satisfactory results. Additionally, it should be noted that the cadastre and cadastral map should be updated when irrigation area and/or the number of members are/is enlarged or reduced. Timely updating is possible only with the cadastral survey method which PDOWRAM officers can apply for financially and technically. PDOWRAM officers should achieve the method through measuring the irrigation plot by themselves; at first with the expert from MOWRAM or donor agency (OJT) and then exclusively by themselves.

As for Step 5; “Farmers establish FWUC and select leaders,” the farmers elected the representatives of FWUG, Sub-FWUG, and WUG in 2002 according to “Detailed FWUC Formation of FWUC for Rolaing Chrey South Main Canal Irrigation Scheme” prepared by MOWRAM in January 2003 in the PRASAC project. Nevertheless, elected representatives have never worked for the FWUC. Therefore, new representatives should be selected by all of the identified members in Step 2, again (Action to be taken (2)). Emphatically, they should be selected not by administrative but by hydraulic boundary for smooth water distribution.

As for Step 6; “Build capacity of FWUC to prepare an Irrigation Service Plan” the Committee members are not sufficiently trained for organizing and facilitating meetings for discussing the FWUC activities and reporting them to the benefited farmers, administrating the tasks of the Committee including accounting and budgetary control, formulating the plans concerning on water distribution and its management, and technique of water management. In brief, the capacity building of the Committee should start from the initial level to be able to prepare an Irrigation Service Plan (Action to be taken (3)). The training encourages the Committee members to start the expected FWUC activities by themselves. As a part of the training for the capacity building, a study tour to see the advanced organization and/or advanced irrigation management area could be effective. The office building will be constructed for providing the space of the trainings at the same timing (Action to be taken (4)).

In Step 7; “FWUC adopts and implements initial Irrigation Service Plan,” the FWUC Committee is expected to implement the Plan based on the capacity built in Step 7. However; as mentioned above, the capacity of the Committee is very limited. It is very hard for the Committee members to calculate and collect irrigation service fee and keep book. The intensive training on financial management is obviously needed for financially sound management of the FWUC (Action to be taken (5)). Simultaneously, the Committee is required to reconstruct the method/ procedure of irrigation service fee collection with the representatives of FWUG and Sub-FWUG newly elected in Step 5. Public relations should be considered to increase the rate of irrigation service fee payment. Distribution of the pictorial magazines written in Khmer is effective for dissemination of the FWUC activities (Action to be taken (6)). This magazine will be prepared mainly by PDOWRAM on the budget of the Model Project.

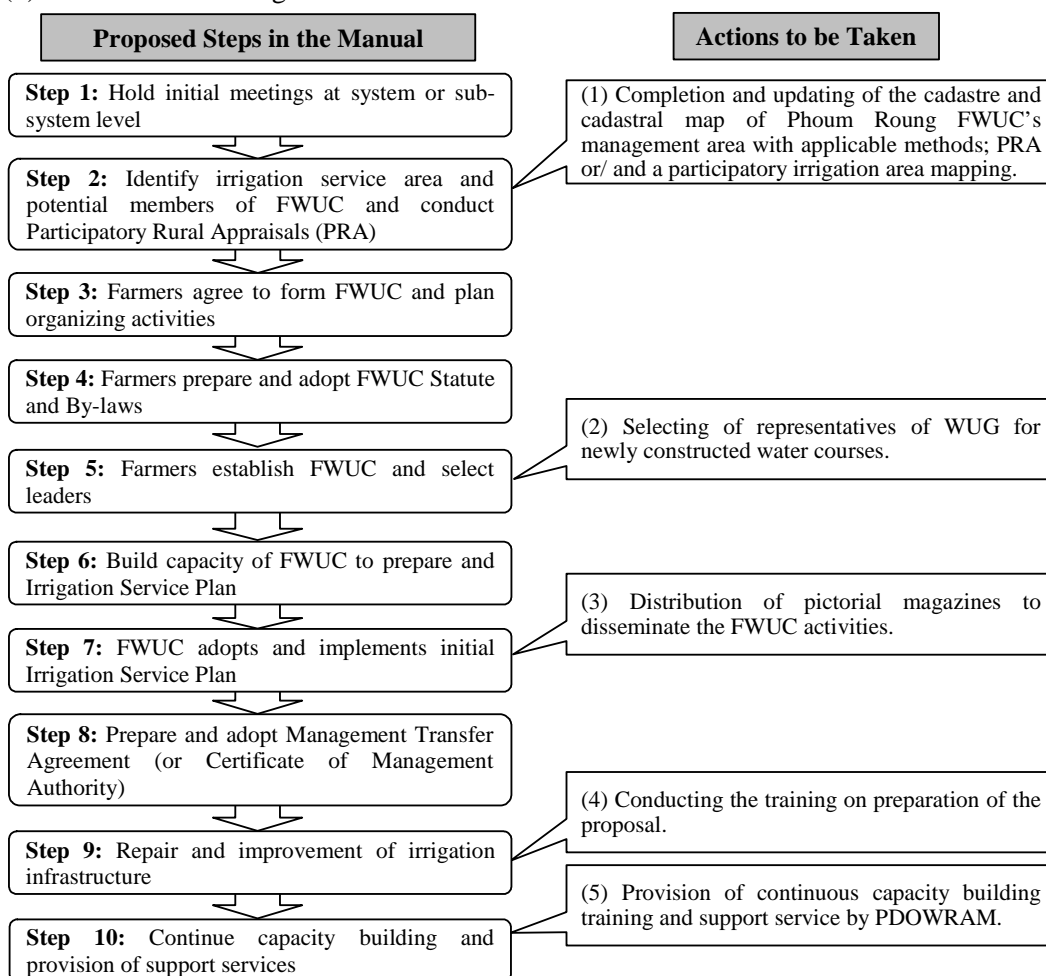
Proceeding Step 8; “Prepare and adopt Management Transfer Agreement” demands the initiatives of FWUC, PDOWRAM, MOWRAM and the provincial government authority (Action to be taken (7)). The ceremony for this step would be effective for showing the legally entitled authority of the FWUC such as having the right to collect irrigation service fee from the member farmers.

In Step 9; “Repair and improvement of irrigation infrastructure,” the FWUC Committee is expected to participate in simple feasibility study and cost estimation as well as to make the proposal submitting to PDOWRAM and MOWRAM for seeking assistance of medium and large-scaled irrigation facilities’ repair and improvement. The FWUC needs additional training on how to participate in these activities (Action to be taken (8)).

Step 10; “Continue capacity building and provision of support service” is absolutely

required for continuation of FWUC activities. Support service should be provided by PDOWRAM strengthened during the Irrigated Agriculture Improvement Project (Action to be taken (9)).

(b) Phoum Rong FWUC



Actions to be Taken for Strengthening Phoum Rong FWUC

As compared to the proposed steps mentioned above, Phoum Rong FWUC has completed all of 10 Steps. Nevertheless, Step 2; “Identify irrigation service area and potential members of FWUC and conduct Participatory Rural Appraisals (PRA),” has been not been completed. It means identification of irrigation service area and potential members of FWUC has not successfully done yet. Phoum Rong FWUC started with the cadastre and cadastral map covered about 50% of its management area. Thus, the first step that Phoum Rong FWUC should take is to survey the remaining part of the management area and update the data which obtained through cadastral map making survey in 2004 with the same method of Ou Veaeng FWUC (Action to be taken (1)).

Moreover, as for Step 5; “Farmers establish FWUC and select leaders,” the farmers elected the representatives of FWUGs and Sub-FWUGs in 2004. The elected representatives have been working for the FWUC. However; in the Model Project, farmers’ construction of water courses is designed. Therefore, the farmers need to select the representatives of WUG for newly constructed water courses (Action to be taken (2)).

In Step 7; “FWUC adopts and implements initial Irrigation Service Plan,” the FWUC Committee is expected to implement the Plan. As for the collection of irrigation service fee, the rate is not so high (about 35%) although the Committee members and the representatives of FWUGs and Sub-FWUGs have been trying to increase it. In this case, public relations should be considered. Distribution of the pictorial magazines written in

Khmer is effective for dissemination of the FWUC activities (Action to be taken (3)). This magazine will be prepared mainly by PDOWRAM on the budget of the Model Project.

In Step 9; “Repair and improvement of irrigation infrastructure,” the FWUC Committee is expected to participate in simple feasibility study and cost estimation as well as to make the proposal submitting to PDOWRAM and MOWRAM for seeking assistance of medium and large-scaled irrigation facilities’ repair and improvement. The FWUC has experience of the activities for small-scaled facilities but does not have that for medium and large-scaled facilities directly controlled by MOWRAM. Accordingly, the FWUC need some supports for preparing the proposal to seek the assistance from MOWRAM (Action to be taken (4)).

Step 10; “Continue capacity building and provision of support service” is required for Phoum Rong FWUC as well as Ou Veang FWUC. Support service should be provided by PDOWRAM strengthened during the Irrigated Agriculture Improvement Project (Action to be taken (5)).

(4) Cost Estimation

Required cost for executing FWUC Strengthening activities can be estimated in the table below. Sub-total and grand total are varied depending on the activity; a) PRA or b) Participatory irrigation area mapping in Activity (1). In case of a), grand total is US\$ 27,464, and of b), that is US\$ 60,964.

Cost Estimation of FWUC Strengthening

(1) Ou Veang FWUC

Activity	Cost (Unit: US\$)	Remarks
(1) Preparation of cadastre and cadastral map		12 tertiary blocks
a) PRA	1,960	
b) Participatory irrigation area mapping	24,460	
(2) Re-selecting of representatives of FWUG, Sub-FWUG and WUG by canal layout	1,470	1place/day 23 villages + 12 tertiary block
(3) Conducting of various fields of trainings required to manage FWUC	1,550	
(4) Construction of FWUC office building	5,000	
(5) Conducting intensive trainings on financial management	1,550	
(6) Distribution of pictorial magazines to disseminate the FWUC activities	4,820	3 times x 1,000 magazines
(7) Government institutions concerned takes initiatives of Management Transfer Agreement under the cooperation with FWUC Committee	320	
(8) Conducting the training on simple feasibility study, cost estimation, and preparation of the proposal	1,512	3 days/ tertiary block
(9) Provision of continuous capacity building training and support service by PDOWRAM	864	2 times/month X 12 months
Sub-total: In case of a) in (1)	19,046	
Sub-total: In case of b) in (1)	41,546	

(2) Phoum Rong FWUC

Activity	Cost (Unit: US\$)	Remarks
(1) Preparation of cadastre and cadastral map		10 tertiary blocks
a) PRA	1,960	
b) Participatory irrigation area mapping	12,960	
(2) Selecting of representatives of WUG for newly constructed water courses	420	1place/day 10 tertiary block
(3) Distribution of pictorial magazines to disseminate	4,820	3 times x 1,000 magazines

Activity	Cost (Unit: US\$)	Remarks
the FWUC activities		
(4) Conducting of the trainings on preparation of the proposal	354	
(5) Provision of continuous capacity building training and support service by PDOWRAM	864	2 times/month X 12 months
Sub-total: In case of a) in (1)	8,418	
Sub-total: In case of b) in (1)	19,418	
Grand total: In case of a) in (1)	27,464	
Grand total: In case of b) in (1)	60,964	

(5) Implementation Schedule

The implementation schedule of FWUC Strengthening activities is indicated in the tables below. The whole period is 2 years.

Implementation Schedule of FWUC Strengthening

(1) Ou Veang FWUC Strengthening

Activities	2008	2009				2010				
	Oct.-Dec.	Jan.-Mar.	Apr.-Jun.	July-Sep.	Oct.-Dec.	Jan.-Mar.	Apr.-Jun.	July-Sep.	Oct.-Dec.	
(1) Preparation of cadastre and cadastral map (Ou Veang FWUC)	■	■	■	■						
(2) Re-selecting of representatives of FWUG, Sub-FWUG and WUG by canal layout (Ou Veang FWUC)				■						
(3) Conducting of various fields of trainings required to manage FWUC (Ou Veang FWUC)					▲					
(4) Construction of FWUC office building (Ou Veang FWUC)					■					
(5) Conducting intensive trainings on financial management (Ou Veang FWUC)					▲					
(6) Distribution of pictorial magazines to disseminate the FWUC activities (Ou Veang FWUC)						▲	▲	▲		
(7) Government institutions concerned takes initiatives of Management Transfer Agreement under the cooperation with FWUC Committee (Ou Veang FWUC)						▲				
(8) Conducting the training on simple feasibility study, cost estimation, and preparation of the proposal (Ou Veang FWUC)					■					
(9) Provision of continuous capacity building training and support service by PDOWRAM (Ou Veang FWUC)						■	■	■	■	

(2) Phoum Rong FWUC Strengthening

Activities	2008	2009				2010				
	Oct.-Dec.	Jan.-Mar.	Apr.-Jun.	July-Sep.	Oct.-Dec.	Jan.-Mar.	Apr.-Jun.	July-Sep.	Oct.-Dec.	
(1) Preparation of cadastre and cadastral map (Phoum Rong FWUC)	■	■	■	■						
(2) Selecting of representatives of WUG for newly constructed water courses (Phoum Rong FWUC)				■						
(3) Distribution of pictorial magazines to disseminate the FWUC activities (Phoum Rong FWUC)						▲	▲	▲		
(4) Conducting the training on preparation of the proposal (Phoum Rong FWUC)					▲					
(5) Provision of continuous capacity building training and support service by PDOWRAM (Phoum Rong FWUC)						■	■	■	■	

Chapter IIID-3 Other Farmers Organization

IIID-3.1 Present Condition

(1) Overview

In a narrow sense, “Farmers’ Organization” can be defined as “the group in which farmers take active roles and are responsible for its management.” Nevertheless, herein, “Farmers’ Organization” is defined as “the group consisting of voluntary farmers who have the common interest and/ or objective” because it is hard to apply a narrow sense meaning “Farmers’ Organization” to the existing ones in the Project Area. According to the results of rapid questionnaire survey on farmers’ organizations, 36 farmers’ organizations are identified in 15 out of 18 villages in the Project Area. It is commonly observed that they were organized currently (after 2000) on the initiatives of external actors such as NGOs (CEDAC: *Centre d’ Etude et de Development Agricole Cambodien*, CGA: *Cambodia Global Action*, AOG: *Assemblies of God – Cambodia*, CWPD: *Cambodian Women for Peace and Development*, RHAC: *Reproductive Health Association of Cambodia*), micro finance institutions (Amret, ACLEDA Bank), and donors’ (PRASAC, SEILA) or government’ projects (IPM: Integrated Pest and Crop Management, promoted by MAFF). Thus, it can be said most of them are only a gathering of farmers who willingly join in the activities and/or in the training that the donors provide. These groups were roughly divided into three categories; rural finance (cash and in-kind), agriculture (farming and aquaculture), and the others. The table below indicates the overview of farmers’ organizations in the Project Area.

Overview of Farmers’ Organization

Group Category		Supporting Agency	No. of Groups
Agriculture	Farming	MAFF·PDA	2
		IPM (MAFF/NGO)	3
		CEDAC	1
		CWPD/ N.A.	2
	Aquaculture	IPM/ Others	2
			Total 10
Finance	Cash	CEDAC	4
		AMRET	5
		ACLEDA	1
		PRASAC	2
		IPM	2
		Self-support	1
In-kind (Rice, cow, pig)	CGA (pig/ cow/ rice)	3	
	AOG (cow/ rice)	3	
	Chhei Program	1	
			Total 7
Others	Health care	CGA	2
	Road construction	SEILA	1
	Village Security network	RHAC	1
			Total 4

Source: Rapid questionnaire survey (Jan. 2007) by the Study Team

(2) Objectives and Activities of Farmers’ Organization

(a) Agriculture

There are three types of farmers’ groups whose main activities are related to agriculture; i) farming group, ii) multiple farming group and iii) aquaculture group. These groups were mainly organized for improving farmers’ living standard through receiving agricultural extension service to increase its productivity. In other words, they are merely recipient groups of external support. Their activities, problems/ constraints, and strengths/ advantages are summarized in the following table.

Features of Farmers' Organization (Agriculture)

Group Category	Activities	Problems/ Constraints	Strengths/ Advantages
Farming group	<u>Receiving</u> the training on farming technique; multiple farming, land preparation, vegetable cultivation, pesticide use, organic farming	- Still facing difficulties on farming - Hard to achieve new technique - Hard to accept new technique due to insisting on old one - Hard to accept new technique due to unallowable expenditure - Small # of members attending meetings	- Increase of yield - Achievement of new technique - Increase of food from own farm
	<u>Receiving</u> agricultural inputs	None	- Reduction of expenditure
Aquaculture group	<u>Receiving</u> the training on aquaculture	- Water shortage especially in the dry season - Low profit due to thin fish	- Increase of food - Increase of income by selling the remaining of self-consumption - Reduction of expenditure from buying fish

Source: Rapid questionnaire survey (Jan. 2007) by the Study Team

(b) Finance

There are three types of farmers' groups related to finance; i) joint guarantors' group, ii) in-kind bank users' group, and iii) saving group. Totally, there are 22 groups. It means these types of farmers' groups are popular in the Project Area.

1) Joint guarantors' group

This is a group of debtors who borrow money from Amret or ACLEDA. Amret is a formal micro finance institution and ACLEDA is a bank. Both of them are located along National Road No. 4 near the Kampong Speu Central Market, and are commonly known among farmers. The farmers are required to organize the group for guaranteeing each other and obtaining relatively low interest rate (3%/month). The problems they face are i) sometimes a debtor delays repayment, and ii) it is hard for farmers to prepare many kinds of documents for borrowing money. On the other hand, the advantage to be a member is that the members do not need to go to informal financial institutions for borrowing money when they face emergency.

2) In-kind bank users' group

Pig, Cow, and/or Rice Banks function in 7 out of 18 villages in the Project Area. These in-kind banks are not managed by farmers' groups. NGOs provide this service to the groups of the users. The users do not identify any serious problems with the Cow Banks. They are satisfied with the system of this bank that the users can obtain a borrowed cow after the cow delivers two babies, and the users return them to the bank. The benefit of using the Cow Bank is that the users can keep draft animal for farming, timely. The users' groups of Rice Bank do not identify any serious problems and enjoy the system of the bank which they can surely keep rice seed for a next cropping season. On the contrary, the farmers claimed the problem with the Pig Bank administrated by a Christian NGO, CGA. The farmers are required to convert to be a Christian for borrowing a pig.

3) Saving group

Only "Saving Group" initiated by CEDAC, IPM, or PRASAC can be regarded as a farmers' group in a narrow sense. For more concrete example, Phsar Chas Village, Svay Kravan Commune, a saving group is a gathering of villagers who starts raising money voluntarily to support the poor villagers, who face an emergency financial

problem such as ceremony and disease. Strengths and opportunities of the saving groups identified through the survey are; i) easy access to loan in the village and ii) financial self-reliance for own village development. Moreover, the depositors of the saving groups in IPM and PRASAC can obtain interest. Nevertheless, there are several problems in the saving groups. For instance, i) some villagers who do not have money to save cannot join in the group, and ii) some debtors delay repayment or become default debtors. The saving group of Roleang Chrey Village applies the penal regulations to avoid the problem ii).

(c) Others

The other farmers' organizations are formed for dissemination of the information on health care and hygiene, and of human rights protection such as trafficking. SEILA program organized farmers for road construction and maintenance. The farmers do not identify any severe problems with them. Moreover, there are farmers' communities for integrated village development organized by AOE, a Christian NGO, in Srae Thnal Village.

IIID- 3.2 Constraints and Problems for Improvement

Generally, the nature of the farmers' organizations in the Project Area is passive because they were organized mainly for receiving the support from supporting agencies. It is difficult to expect most of them to grow as self-reliant groups, spontaneously. The other constraints and problems by group category are as follows.

(1) Agriculture (Farming and Aquaculture)

- It is hard for farmers to achieve new technique informed during the training due to insistence to old technique and fear for introduction of new technique.
- The contents and concepts are too difficult for farmers to understand.
- Farmers cannot allow introducing new technique.
- Farmers cannot keep water for aquaculture during the dry season.

(2) Finance (Cash and In-Kind)

- Debtors delay repayment.
- Sometimes, debtors fall in default.
- It is difficult for farmers to prepare the document for borrowing money, in case that creditor is a formal financial institution.
- Poor villagers cannot enjoy the benefit of existing saving groups in their village.

IIID-3.3 Farmers Organization Development

(1) Objective of Farmers Organization Development

Achievement of Strategic Target of the Master Plan, "Agricultural productivity centering rice is improved" requires development of farmers' organization because this target could be achieved only under well-harmonization of agriculture, irrigation and drainage, and institutional development. A farmers' organization is one of the important institutions which can contribute much to achievement of the target if it was developed until the midterm of the Model Project. The reason why it should be developed until the midterm is that the developed farmers' organization could be expected to create the basis of self-reliant and empowered farmers' unity, and this unity would play a role of an engine for promoting farmers' participation in the Model Project after its midterm. However, presently, the nature of most of the farmers' organizations is passive. If the farmers' organization does not need to play such an important role in the Model Project, they can remain a recipient group of agricultural extension service and the other external support. Nevertheless, repeatedly say, to achieve the Strategic Target, it is inevitable to grow them as aiming at a self-reliant organization until the midterm of the Model Project.

(a) Expected Functions of Farmers' Organization

Future expected functions of the farmers' organization are i) joint purchase of agricultural inputs such as fertilizer, pesticide, and farming equipment, ii) collective shipment and sale of agricultural products, and iii) saving and credit. The organization which has these functions is a so-called Agricultural Cooperative. It would take much time to complete all the steps to establish the Agricultural Cooperative, in consideration of the present condition of the farmers' organizations in the Project Area. It means establishment of the Agricultural Cooperative would not be succeeded until the midterm of the Model Project. Therefore, "Farmers Organization Development" aims at developing a basic organization for the future Pre-Agricultural Cooperative in 2 years (until the midterm of the Model Project).

(b) Required Activities of Farmers' Organization Development

The basic farmers' organization for the Pre-Agricultural Cooperative can be developed from existing saving groups organized in the initiatives of CEDAC (NGO) or IPM (a project). There are 4 CEDAC's and 2 IPM's saving groups in the Project Area. These saving groups are gatherings of the farmers who willingly join in the group for sharing the benefit of group activities; saving and borrowing money easily with relatively low interest rate. Their capital fund is collected money (saving) from the members. It means they are financially independent. Additionally, due to the nature of "Saving Group," the members got accustomed to having a regular meeting and already have the regulations. Knowledge/Skill of organizing and facilitating meetings is crucial for the managements of group activities. In short, it can be said that the saving groups are only farmers' groups which are democratically managed by their members in the Project Area. In this current circumstance, the proposing activities to improve the saving groups as basic organizations of Pre-Agricultural Cooperatives are the followings.

1) Clarification/ Review of the existing regulations

The problems of existing saving groups are default and delay of repayment. Even though this is not so serious at present, it cannot be left as it is. The existing regulations should be clarified or reviewed to reduce the default and delay of repayment through all members' meetings. For example, the group can apply more severe penal regulation for violators. During the meeting, the members need to make efforts to motivate each other and confirm the compliance with the regulations determined by them.

2) Keeping/ Improving of financial transparency

One of the considerably important issues for continuing group activities is to sustain credibility among the members and to committee members of the group. For this purpose, it is inevitable to keep or improve accounting transparency. Book keeping should be clear or become clearer for easy understanding of the member farmers. The books should be accessible to the members anytime. Accordingly, the person in charge of accounting should be selected very carefully among the group members. It is risky if the group selects only one person who is responsible for money transaction. Thus, the group should be managed by the committee consisting of at least 2 persons; Chief and Accountant. When a certain amount of money is accumulated, Chief and Accountant had better open a bank account to obtain interest and to keep collected money safely.

3) Increase of capital fund

It is necessary to increase capital fund to expand the group activities and boost the number of beneficiaries. There are two recommendable ways to increase capital fund; i) increase of the member and ii) increase of amount of compulsory saving. Here, it should be noted that the group needs to keep the self-finance principle,

although they intend to increase their capital fund easily and quickly. Introduction of capital fund from the donors might possibly cause complicated accounting problems. This also leads to the group's losing the self-reliant attitude and confidence. This situation should be avoided because the saving group is expected to play a Pre-Agricultural Cooperative in the later stage.

4) Preparation of developing into a Pre-Agricultural Cooperative

Just before the midterm of the Model Project, the group is required to start some activities to prepare developing into a Pre-Agricultural Cooperative, gradually. The saving group can consolidate with the other farmers' groups, which have the other objective and activities related to agriculture, in order to organize "Farmers' Association." One of the candidates is a recipient group of agricultural extension service. Or the saving group can start collective activities related to agriculture as a core of the association. In either manner, the saving group can organize a farmers' association and this association can be regarded as a Pre-Agricultural Cooperative (total number of the members should be at least 25 physical entities). Until the termination of the Model Project, the Pre-Agricultural Cooperative would be matured enough to register as an Agricultural Cooperative. Then, the Pre-Agricultural Cooperative needs to start preparing the official registration as an Agricultural Cooperative under the coordination of MAFF (Department of Agricultural Extension) and PDA. As for the registration, the Pre-Agricultural Cooperative should follow the legal framework mentioned below.

- Royal Decree NS/RKT/0701/234 on the Establishment and Functioning of Agricultural Cooperative, Union of the Agricultural Cooperative and the Pre-agricultural Cooperative, 16 of July 2001
- Prakas promulgating the Model Statute and Bylaws of Agricultural Cooperatives, 2003
- Model Statute of Agricultural Cooperatives, 2003
- Model bylaw of the Agricultural Cooperatives, 2003

In Royal Decree NS/RKT/0701/234, a cooperative is defined as "a commercial enterprise, which is democratically managed by its members, who contribute their capitals and hope for dividends, and are also willing to incur losses according to the proportion of their shares contributed." It should have bylaws, objective and structure, and be approved by PDA.

(c) Role of Supporting Agency

Provision of the external support is absolutely necessary to develop a saving group into an Agricultural Cooperative. Nevertheless, it should be limited to capacity building during strengthening of saving group's activities (1) ~3)) and R&D (Research and Development) of the market for the agricultural products during (4)) preparation of developing into a Pre-Agricultural Cooperative. The R&D of the market is inevitable because it is frequently reported that existing farmers' organizations (production) face the lack of the market of their products, and this problem becomes a bottleneck of continuing their activities.

Offering the minimum support is important for the farmers' organization to be grown as a highly self-reliant one. These supports can be provided by mainly PDA and complementarily by the NGO whose main activities are oriented to agriculture and farmers' empowerment, such as CEDAC. On the occasion of registering as an Agricultural Cooperative, PDA should assist the farmers' organization with preparing official documents.

(2) Cost Estimation

Required cost for executing Farmers Organization Development activities can be estimated in the table below. Total is US\$ 26,944.

Cost Estimation of Farmers Organization Development

Activity	Cost (Unit: US\$)	Remarks
(1) Clarification/ Review of the existing regulations	1,192	2 IPM's saving group 4 CEDAC's saving group
(2) Keeping/ Improving of financial transparency	14,304	2 times/month X 12 months
(3) Increase of capital fund	3,576	Supervision and advice 1 time/month X 6 months
(4) Preparation of developing into a Pre-Agricultural Cooperative	7,872	R&D of Market 2 times/month X 6 months
Total	26,944	

(4) Implementation Schedule

The implementation schedule of Farmers Organization Development activities is indicated in the tables below. The whole period is 2 years.

Implementation Schedule of Farmers Organization Development

Activities	2008	2009				2010			
	Oct.-Dec.	Jan.-Mar.	Apr.-Jun.	July-Sep.	Oct.-Dec.	Jan.-Mar.	Apr.-Jun.	July-Sep.	Oct.-Dec.
(1) Clarification/ Review of the existing regulations	▲								
(2) Keeping/ Improving of financial transparency	▲	▲	▲	▲	▲	▲	▲	▲	▲
(3) Increase of capital fund						▲	▲	▲	▲
(4) Preparation of developing into a Pre-Agricultural Cooperative							▲	▲	▲

Appendix-III E
PROJECT EVALUATION

**THE STUDY
ON
COMPREHENSIVE AGRICULTURAL DEVELOPMENT
OF
PREK THNOT RIVER BASIN
IN
THE KINGDOM OF CAMBODIA**

**FINAL REPORT
Volume-VII: Appendixes for Feasibility Studies for Priority/Urgent Projects
Appendix-III
Project Evaluation**

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APPENDIX-III E: PROJECT EVALUATION

Chapter III E-1 Objectives and Evaluated Project

III E-1.1 Objectives

The objectives of project evaluation for Feasibility Study is to evaluate the anticipated economic and social impacts of the prioritized projects in the Master Plan with higher degree of accuracy and updated data, as well as from different angles other than quantifiable monetary terms but from qualitative terms. The project evaluation for Feasibility Study consists of three different types of evaluation approaches with each of them focusing on different aspects of the project, as listed below.

Evaluation Approaches Applied and Their Objectives

Evaluation Approaches	Objectives
(1) Economic Evaluation	To evaluate the economic impact of the Project in quantifiable, monetary terms from the viewpoint of “national economy”
(2) Financial Evaluation	To evaluate the financial viability of the Project in quantifiable, monetary terms from viewpoint(s) of project entity and/or beneficiaries
(3) Socio-Economic Impact Evaluation	To evaluate the Project’s socio-economic impacts in non-monetary, qualitative terms

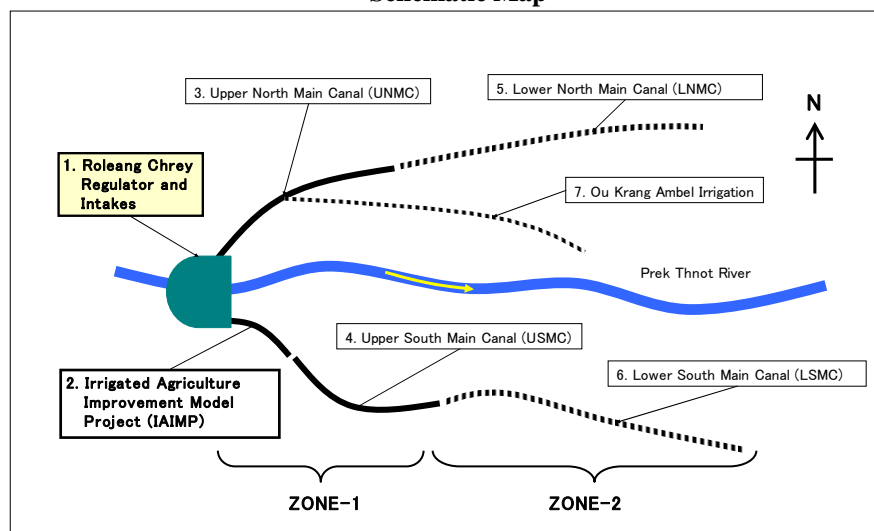
III E-1.2 Evaluated Project

Based on the results of economic evaluation at Master Plan stage, 2 out of 9 proposed projects were selected for Feasibility Study, they are;

- (1) Roleang Chrey Regulator and Intakes Improvement Project, and
- (2) Irrigated Agriculture Improvement Model Project (IAIMP).

In this Appendix-III E, **Irrigated Agriculture Improvement Model Project (hereinafter referred to as “the Project”)** will be evaluated.

Schematic Map



Chapter IIIE-2 Economic Evaluation

III E-2.1 Evaluation Procedures

The purpose of economic evaluation is to quantitatively assess the overall impact of a project in contributing national economic objectives. Therefore, the impact of the Project is assessed in the context of national economy rather than in the context of the project entity or the beneficiaries. The project economic evaluation was carried out through the standard methodology in project appraisal, i.e. estimation of Economic Internal Rate of Return (EIRR), Cost-Benefit Ratio (B/C), and Benefit minus Cost (B-C).

All prices for Feasibility Study evaluation were expressed in constant prices as of January 2007, applying the average monthly official exchange rate of USD 1.0 = Riel 4,060. The economic life of the Project is assumed to be 50 years beginning from year 2008, the proposed commencement year for construction.

Economic farm gate prices of internationally traded agricultural inputs and outputs were based on their export and import parity prices derived from the World Bank Commodity Price Forecasts as of October 2006. The long-run projected prices in 2010 at 2007 constant prices were used in the analysis. The average of export and import parity prices of farm products of rice, maize, and import parity prices of fertilizer were calculated and applied for the economic prices as shown in Table III E-1 (1/5 to 3/5).

A standard conversion factor (SCF) of 0.98 and shadow wage rates (SWR) were applied for the adjustment of prices and labor costs reflecting the market distortion, as shown in Table III E-1 (4/5 to 5/5). Economic prices applied for preparation of crop production budgets were summarized in Table III E-2.

Transfer payment such as tax, duty, subsidy, interest, etc., were excluded in estimating the economic costs and benefits. Financial construction costs were converted into their economic values by applying the construction conversion factors (CCFs).

III E-2.2 Economic Benefit

Irrigation and drainage benefit will be accrued from increase in cropping areas and productivity of target crops comprising paddy and upland crops such as mungbean and vegetables. The economic benefit is estimated as the increment of net production value between future “with” and present “without” project conditions.

The economic crop budgets of respective crops for both “with” and “without” project cases were prepared in Table III E-3 and III E-4, by applying requirements for farm inputs and total labor, unit crop yields, and their economic prices.

The irrigation and drainage benefit (increment of Net Present Value: NPV) for the Project was estimated as follows (for details, see Table III E-5).

Economic Benefit of the Project

Project Area (ha)	Cropping Intensity (%)		Net Production Value (Million Riels)		
	Without Project	With Project	Without Project	With Project	Increment
570	135	155	674.6	1,496.0	821.4

Annual economic benefit flow was estimated based on the progress of the area developed. Built-up period of increment of NPV is four years (Table III E-6).

III E-2.3 Negative Benefit

Existing farmlands will be acquired and used for the construction of irrigation and drainage facilities. The agricultural production foregone defined as the annual net production value under without project condition was accounted for negative benefit in the evaluation, as follows.

Negative Project Benefit of the Project

Area to be Acquired for Construction (ha)	NPV Without Project Condition (Riel'000/ha)	Foregone Amount (Riel Million)
10	811.6	8.1

III E-2.4 Economic Cost

(1) Cost for Project Investment

The economic construction cost was classified by (i) preparatory works, (ii) direct construction, (iii) agricultural supporting activities, (iv) formation and strengthening of FWUC, (v) farmers organization development, (vi) Kampong Speu PDOWRAM strengthening, (vii) coordination strengthening between PDA and PDOWRAM, (viii) land acquisition arrangement, (ix) administration, (x) engineering services, and (xi) physical contingencies (See Table III E-7). The economic project investment cost was estimated by applying relevant conversion factors to the components of financial foreign and local currency costs comprising equipments, materials and labor. The total economic project cost was estimated as follows.

Economic Investment Cost of the Project

Project Area (ha)	Economic Investment Cost (Riel, Million)	Cost Per ha (Riel '000)
570	6,357	11,152

(2) O&M Cost

The financial O&M cost was converted to economic value by applying relevant conversion factors to the components of financial foreign and local currency costs, in the way same as the project investment costs. The O&M cost of the Project was estimated as follows (Table III E-8).

Economic O&M Cost of the Project

Project Area (ha)	O & M Cost (Riel, Million/year)	Cost Per ha (Riel)
570	21.2	37,193

(3) Replacement Cost

The replacement cost of the project facilities and equipments was estimated by applying the conversion factors to the respective financial cost for replacement. The useful life of the main, secondary and tertiary gates of the Project is 25 years and their economic replacement cost in total was estimated as 615 Million Riels (Table III E-9).

III E-2.5 Economic Evaluation Results

The economic cost and benefit stream comprising (i) the cost for project investment, O&M and replacement, and (ii) the benefit as well as negative benefit from irrigation and drainage, was prepared for the economic life of the Project.

In this section, two different cost and benefit streams were created and used for evaluation, they are; (1) the Project as an independent project, and (2) the Project and Roleang Chrey Regulator and Intakes Improvement Project as one, integrated project. The reason being that while in theory of evaluation, all previously-implemented-investments should be treated as sunk cost and therefore Roleang Chrey Regulator and Intakes Improvement Project and the Project should be evaluated separately, these two projects are proposed to be implemented in parallel and in fact they have very strong hydrological relationship, i.e. implementation of Roleang Chrey as the precondition for implementation of the Project.

Based on this reasoning, two sets of evaluation were carried out and they both are presented in the following, though second evaluation (Roleang Chrey and the Project as an integrated project) just for referential purpose.

(1) The Project as an independent project

Economic internal rate of return (EIRR) and other indicators for the Project as an independent project were calculated and summarized as follows (see Table IIIE-10 for details).

Economic Benefit of the Project

EIRR (%)	NPV (Riel, Million) (7% discount rate)			B/C
	Benefit	Cost	B-C	
11.1	8,486	5,517	2,969	1.5

(2) The Project and Roleang Chrey Regulator and Intakes Improvement as an integrated project

Economic internal rate of return (EIRR) and other indicators for the Project and Roleang Chrey Regulator and Intakes Improvement as an integrated project were calculated and summarized as follows (see Table IIIE-11 for details).

Economic Benefit of the Project + Roleang Chrey Regulator and Intakes Improvement*

EIRR (%)	NPV (Riel, Million) (7% discount rate)			B/C
	Benefit	Cost	B-C	
13.2	28,220	17,645	10,575	1.6

* These figures are presented just for referential purpose.

III E-2.6 Sensitivity Analysis

The project sensitivity in terms of EIRR was analyzed in respect of changes in project cost and benefit as follows:

- (1) Project cost increase 30%
- (2) Project benefit decrease 30%
- (3) Project cost increase 20% and benefit decrease 20%
- (4) Delay of project benefit derivation for 2 years

The result of sensitivity test is summarized as follows.

Sensitivity of the Project*

Cases of Change	Change in Variation	EIRR (%)	Switching Value EIRR: 7.0 %
Base case	-	11.1	-
- Cost increased	+ 30 %	8.5	+57%
- Benefit decreased	- 30 %	7.6	-35%
- Cost increased & benefit decreased	+ 20 % - 20 %	7.3	-
- Delay of benefit derivation	2 years	9.2	6 years

* Sensitivity test is conducted only for the case IAIMP as an independent project

The sensitivity test revealed that the Project is relatively more sensitive to the benefit reduction rather than cost increase, though it can accommodate considerable changes in these variables.

Chapter IIIE-3 Financial Evaluation

III E 3.1 Cash Flow Analysis

The cash flow analysis was made under the following conditions and on the assumption that MOWRAM implements the Project under the financial cooperation from foreign aid agency.

(1) Loan conditions of foreign aid agency

- 1) Interest rate : 2.3% per year
- 2) Grace period : 10 years
- 3) Repayment period : 30 years (including grace period)
- 4) Items not eligible for financing are listed below.

- General administration expense
- Taxes and duties
- Purchase of land and other real property
- Compensation
- Other indirect items

(2) Raising capital other than foreign loan: the national treasury covers all the costs other than foreign-aid loans under the condition of no interest and no repayment.

Based on these conditions, the total fund requirement and internal capital raising amount were estimated as follows.

Capital Cost to be raised for the Project

(Unit: Riel Million)

Items	External Loan	National Budget	Total
a) Engineering service cost	1,770	-	1,770
b) Direct Construction cost	4,324	-	4,324
c) Administration cost	-	434	434
d) Agricultural Support Services	187	-	187
e) Formation and Strengthening of FWUC	244	-	244
f) Farmers Organization Development	110	-	110
g) Kampong Speu PDOWRAM Strengthening	24	-	24
h) Coordination Strengthening between Kampong Speu PDA and PDOWRAM	4	-	4
i) Land Acquisition Arrangements	-	24	24
j) Land Acquisition	-	487	487
k) Physical contingency	609	45	654
l) Price contingency	1,425	378	1,803
Total	8,697	1,368	10,065

As shown in above Table, the loan requirement from the foreign aid agency was estimated at about Riel 8,697 Million (US\$ 2.14 Million). The MOWRAM's cash flow statement to this loan amount is presented in Table IIIE-12. The annual repayment of the fund is estimated to be Riel 635-445 million during the repayment period from 11th to 30th year. Repayment of the fund will have to be made by subsidy from government.

III E 3.2 Farm Budget under with Project

(1) Farm Budget Analysis

Farm budget analysis of typical farms (Type A: farm families having double cropped rice field, and Type B: having only a single cropped rice field) for present without-project and

future with-project conditions is conducted as shown below (for details, see Appendix IIIB Agriculture).

Farm Budget Analysis: Type A (unit: Riel '000)

		Present	With	Increment
Gross Incomes	Rice Production	1,302	1,986	684
	Other Farm Income	1,066	1,066	0
	Non-farm Income	2,267	2,267	0
	Total Income	4,635	5,319	684
Expenditures	Production Costs of Farm Products	1,076	1,291	215
	Other Expenditures	3,017	3,017	0
	Total Expenditures	4,093	4,308	215
Net Surplus (Capacity to Pay)		542	1,011	469

Source: JICA Study Team

Farm Budget Analysis: Type B (unit: Riel '000)

		Present	With	Increment
Gross Incomes	Rice Production	680	1,385	705
	Other Farm Income	1,145	1,145	0
	Non-farm Income	1,959	1,959	0
	Total Income	3,784	4,489	705
Expenditures	Production Costs of Farm Products	797	1,054	257
	Other Expenditures	2,483	2,483	0
	Total Expenditures	3,280	3,537	257
Net Surplus (Capacity to Pay)		504	952	448

Source: JICA Study Team

(2) Improvement of Farm Economy

Under the with project condition, average gross income of farming households would increase 87% for Type A and 89% for Type B farming households, and annual net incremental income would average Riel 469,000 for Type A and Riel 448,000 for Type B farming households, respectively. These would be accrued from increasing cropping intensity with crop yields through the improvement of irrigation facilities and strengthening of agricultural support services.

(3) Farmers' Solvency for Irrigation Service Fee

After the completion of improvement works, all the irrigation facilities from secondary canals to field canals and their turnouts (except the turnouts in main canal) will be maintained by the farmers themselves. All costs including material and labor required for O & M of facilities will be borne by the FWUC.

The farmers' solvency is evaluated to a ratio of the ISF to the annual net incremental income under with project condition. The average ISF is estimated at Riel 47,400/year/household for Type A and Riel 15,300/year/household for Type B, respectively.¹ The amount accounts for below 11% of the annual net incremental income of Type A and merely below 4% of Type B households, will enable almost all farmers to pay the ISF.

With regard to the ISF collection, since the Project has a component aimed at formation and strengthening of the FWUC, the coverage rate of the ISF would be high after the completion of the Project.

¹ Riel 30,000/year/ha, based on Model Bylaw stated in Circular No.1 on the implementation Policy for Sustainable Irrigation System, prepared by MOWRAM.

Chapter IIIE-4 Socio-economic Impact

III E 4.1 Improvement of Farmers' /Peoples' Income and Employment Opportunities

As a result of improvement of irrigation facilities and strengthening of agricultural support services, the farmers' income will considerably improve through increase of crop yields. In addition, construction labor for the improvement to be created as additional employment opportunities will in effect reduce the present unemployment especially in the lean production season.

III E 4.2 Self-sufficiency of Upland Crops and Vegetables in the Project Area

After the completion of the project, annual increment of the upland crops and vegetable production in the project area will be around 47 ton which is equivalent to Riel 26 million (US\$6,400) at the farm gate value. Future with-project upland crops and vegetable production will partially substitute the vegetable importation from outside of the Project area.

III E 4.3 Activation of Regional Economy

In addition to the increase of production, marketing of farm inputs and outputs would expand through Farmers Organization Development component of the Project. Under this activity, joint purchase of agricultural inputs, collective shipment and sale of agricultural products, and improved saving and credit, etc. will be carried out. Farmers' purchasing as well as the collective bargaining power would increase along with the improvement of farmers' income. All these would contribute to the activation of regional economy.

III E 4.4 Capacity Development of Staff Concerned

The Project plan includes the following programs: i) Agricultural Supporting Activities, ii) Formation and Strengthening of FWUC, iii) Farmers Organization Development, iv) Kampong Speu PDOWRAM Strengthening, and v) Coordination Strengthening between Kampong Speu PDA and PDOWRAM. All these activities involve the local government staff of the line service agencies, to a greater or lesser extent. Such capacity building to these officials in dealing with farmers as well as among officials would largely contribute in implementation of other development project in the future.

III E 4.5 Ripple Effect as a Development Model into Neighboring and Other Areas

As its name (i.e. the Irrigated Agriculture Improvement Model Project) embodies, this project is not only aiming at the improvement of irrigation facilities and agricultural productivities in the project area, but also aiming at expanding its effects to the adjacent area downstream of the Roleang Chrey Regulator and Intakes, as well as to other areas where irrigation agriculture is practiced in Cambodia. By dealing with all the multi-faceted aspects of the irrigated agriculture, i.e. irrigation water, agricultural technology and extension methodology, various institutions that involve stakeholders concerned, in integrated manner, the Project is expected to become a model which would be replicated in the future and accordingly to bring about the multiplier effect in the future Cambodian agricultural development.

Tables

Table IIIE-1 Economic Price Estimate for Traded Goods, F/S Study (1/5)

Item	Import Parity Price			Export Parity Price		
	Operation	Unit	Price	Operation	Unit	Price
I. Rice/Paddy						
1. Projected 2010 World Price (in 1990 price) /a		US\$/ton	225		US\$/ton	225
2. Projected 2010 World Price (in 2007 price) /a		US\$/ton	258.0		US\$/ton	258
3. Quality Adjustment	x	%	90	x	%	90
4. CIF/FOB Price at Kompong Som Port /b	=	US\$/ton	232.2	=	US\$/ton	232.2
5. Port Charge, Handling and Warehousing	+	US\$/ton	13.2	-	US\$/ton	13.2
6. Price at Kompong Som Port	=	US\$/ton	245.4	=	Riel/kg	219.0
Equivalent in Riel / kg /c	=	Riel/kg	996	=	Riel/kg	889
7. Transportation Cost /d						
(Kampong Som-Phnom Penh)	+	Riel/kg	26			
(Kampong Speu-Kampong Som)				-	Riel/kg	22
(Kampong Speu -Phnom Penh)	-	Riel/kg	3			
8. Ex-Mill /Wholesale Price in Kampong Speu	=	Riel/kg	1,019	=	Riel/kg	867
9. Milling Cost and Margin /d	-	Riel/kg	23	-	Riel/kg	23
10. Processing Ratio	x	%	66	x	%	66
11. By-Products through Processing /e	+	Riel/kg	70	+	Riel/kg	70
12. Millgate Paddy Price	=	Riel/kg	727	=	Riel/kg	627
13. Transport/Handling from Farmgate /d	-	Riel/kg	16	-	Riel/kg	16
14. Farmgate Price	=	Riel/kg	711	=	Riel/kg	611
			50%			50%
17. Weighted average economic farm gate price		Riel/kg	661			
II. Maize						
1. Projected 2010 World Price (in 1990 price) /a		US\$/ton	91		US\$/ton	91
2. Projected 2010 World Price (in 2007 price) /a		US\$/ton	104.3		US\$/ton	104.3
3. International Shipping and Handling	+	US\$/ton	35.0			
4. CIF/FOB Price at Kompong Som Port	=	US\$/ton	139.3	=	US\$/ton	104.3
5. Port Charge, Handling and Warehousing	+	US\$/ton	13.2	-	US\$/ton	13.2
6. Price at Kompong Som Port	=	US\$/ton	152.5	=	Riel/kg	91.1
Equivalent in Riel / kg /c	=	Riel/kg	619	=	Riel/kg	370
7. Transportation Cost /d						
(Kampong Som-Phnom Penh)	+	Riel/kg	26			
(Kampong Speu -Kampong Som)				-	Riel/kg	22
(Kampong Speu -Phnom Penh)	-	Riel/kg	3			
8. Price in Kampong Speu	=	Riel/kg	642	=	Riel/kg	348
9. Transport/Handling from Farmgate /d	-	Riel/kg	16	-	Riel/kg	16
10. Farmgate Price	=	Riel/kg	626	=	Riel/kg	332
			50%			50%
17. Weighted average economic farm gate price		Riel/kg	480			

Note : /a ; Based on the World Bank, Global Commodity Forecast, Oct. 2006

The projected prices in 1990 constant US\$ were adjusted by the factor of 1.147 (MUV) to allow for price escalation between 1990 and 2007.

Paddy : Thai, milled, 5% broken, FOB Bangkok

Maize : US No.2, Yellow, FOB Gulf Ports

/b ; Assumed at the same price at Bangkok port in Thailand

/c ; Exchange rate : US\$ = Riel 4,060

/d ; Adjusted with SCF of 0.98

/e ; Rice bran : Riel 300 /kg of rice bran, 18% of paddy weight

Broken rice: Riel 320 /kg of broken rice, 5 % of paddy weight.

Table IIIE-1 Economic Price Estimate for Traded Goods, F/S Study (2/5)

Item	Import Parity Price			Export Parity Price		
	Operation	Unit	Price	Operation	Unit	Price
III. Soybean						
1. Projected 2010 World Price (in 1990 price) /a		US\$/ton	220		US\$/ton	220
2. Projected 2010 World Price (in 2007 price) /a		US\$/ton	252.2		US\$/ton	252.2
3. International Shipping and Handling	+	US\$/ton	35.0			
4. CIF/FOB Price at Kompong Som Port	=	US\$/ton	287.2	=	US\$/ton	252.2
5. Port Charge, Handling and Warehousing	+	US\$/ton	13.2	-	US\$/ton	13.2
6. Price at Kompong Som Port	=	US\$/ton	300.4	=	Riel/kg	239.0
Equivalent in Riel / kg /b	=	Riel/kg	1,220	=	Riel/kg	970
7. Transportation Cost /c (Kampong Som-Phnom Penh)	+	Riel/kg	26			
(Kampong Speu -Kampong Som)				-	Riel/kg	22
(Kampong Speu -Phnom Penh)	-	Riel/kg	3			
8. Trade Price in Kampong Speu	=	Riel/kg	1,243	=	Riel/kg	948
9. Transport/Handling from Farmgate /c	-	Riel/kg	16	-	Riel/kg	16
10. Farmgate Price	=	Riel/kg	1,227	=	Riel/kg	932
	50%			50%		
11. Weighted average economic farm gate price		Riel/kg	1,080			
IV. Groundnut						
1. Projected 2010 World Price (in 1990 price) /a		US\$/ton	687		US\$/ton	687
2. Projected 2010 World Price (in 2007 price) /a		US\$/ton	787.6		US\$/ton	787.6
3. Conversion to Shelled Groundnuts (50%)		US\$/ton	393.8		US\$/ton	393.8
4. International Shipping and Handling	+	US\$/ton	35.0			
5. CIF/FOB Price at Kompong Som Port	=	US\$/ton	428.8	=	US\$/ton	393.8
6. Port Charge, Handling and Warehousing	+	US\$/ton	13.2	-	US\$/ton	13.2
7. Price at Kompong Som Port	=	US\$/ton	442.0	=	Riel/kg	380.6
Equivalent in Riel / kg /b	=	Riel/kg	1,795	=	Riel/kg	1,545
8. Transportation Cost /c (Kampong Som-Phnom Penh)	+	Riel/kg	26			
(Kampong Speu-Kampong Som)				-	Riel/kg	22
(Kampong Speu -Phnom Penh)	-	Riel/kg	3			
9. Trade Price in Kampong Speu	=	Riel/kg	1,818	=	Riel/kg	1,523
10. Transport/Handling from Farmgate /c	-	Riel/kg	16	-	Riel/kg	16
11. Farmgate Price - Without Shell	=	Riel/kg	1,802	=	Riel/kg	1,507
- With Shell (80%)	=	Riel/kg	1,442	=	Riel/kg	1,206
	50%			50%		
12. Weighted average economic farm gate price		Riel/kg	1,324			

Note : /a ; Based on the World Bank, Global Commodity Forecast, Oct. 2006

* The projected prices in 1990 constant US\$ were adjusted by the factor of 1.147 (MUV) to allow for price escalation between 1990 and 2007.

Soybeans, Groundnut oil : CIF Rotterdam

/b ; Exchange rate : US\$ = Riel 4,060

/c ; Adjusted with SCF of 0.98

Table IIIE-1 Economic Price Estimate for Traded Goods, F/S Study (3/5)

Item	Import Parity Price		
	Operation	Unit	Price
V. Fertilizer			
(1) Urea			
1. Projected 2010 World Price (in 1990 price) /a		US\$/ton	173.0
2. Projected 2010 World Price (in 2007 price) /a		US\$/ton	198.3
3. International Shipping and Handling	+	US\$/ton	40.0
4. CIF Price at Kompong Som Port	=	US\$/ton	238.3
5. Port Charge, Handling and Warehousing	+	US\$/ton	13.2
6. Price at Kompong Som Port	=	US\$/ton	251.5
Equivalent in Riel / kg /b	=	Riel/kg	1,021
7. Transportation Cost /c (Kampong Som-Kampong Speu)	+	Riel/kg	22
8. Trade Price in Kampong Speu	=	Riel/kg	1,043
9. Transport/Handling to Farmgate /c	+	Riel/kg	16
10. Farmgate Price	=	Riel/kg	1,059
		Price of Nutrient (N) /e	Riel/kg 2,302
(2) DAP (Diammonium Phosphate)			
1. Projected 2010 World Price (in 1990 price) /a		US\$/ton	190
2. Projected 2010 World Price (in 2007 price) /a		US\$/ton	217.8
3. International Shipping and Handling	+	US\$/ton	45.0
4. CIF Price at Kompong Som Port	=	US\$/ton	262.8
5. Port Charge, Handling, Warehousing and Bagging	+	US\$/ton	13.2
6. Price at Kompong Som Port	=	US\$/ton	276.0
Equivalent in Riel / kg /b	=	Riel/kg	1,121
7. Transportation Cost /c (Kampong Som-Kampong Speu)	+	Riel/kg	22
8. Trade Price in Kampong Speu	=	Riel/kg	1,143
9. Transport/Handling to Farmgate /c	+	Riel/kg	16
10. Farmgate Price	=	Riel/kg	1,159
		Price of Nutrient (P) /e	Riel/kg 2,520
		Price of Nutrient (N) /e	Riel/kg 6,439
(3) Potassium Chloride (KCL) /d			
1. Projected 2010 World Price (in 1990 price) /a		US\$/ton	124.0
2. Projected 2010 World Price (in 2005 price) /a		US\$/ton	142.2
3. International Shipping and Handling	+	US\$/ton	40.0
4. CIF Price at Kompong Som Port	=	US\$/ton	182.2
5. Port Charge, Handling, Warehousing and Bagging	+	US\$/ton	13.2
6. Price at Kompong Som Port	=	US\$/ton	195.4
Equivalent in Riel / kg /b	=	Riel/kg	793
7. Transportation Cost /c (Kampong Som-Takeo)	+	Riel/kg	22
8. Trade Price in Takeo	=	Riel/kg	815
9. Transport/Handling to Farmgate /c	+	Riel/kg	16
10. Farmgate Price	=	Riel/kg	831
		Price of Nutrient (K) /e	Riel/kg 1,385

Note : /a ; Based on the World Bank, Global Commodity Forecast, Oct. 2006

* The projected prices in 1990 constant US\$ were adjusted by the factor of 1.147 (MUV) to allow for price escalation between 1990 and 2007.

Urea : Bagged, FOB Black Sea
DAP : Bulk, FOB US Gulf
KCL : Bulk, FOB Black Sea

/b ; Exchange rate : US\$ = Riel 4,060

/c ; Adjusted with SCF of 0.98

/d ; Potassium Chloride (Muriate of Potash)

/e ; Nutrient content is 46%, 46%(18-46-0), and 60%, respectively for Urea, DAP and KCL.

Table IIIE-1 Economic Price Estimate for Traded Goods, F/S Study (4/5)

VI. Estimation of Standard Conversion factors

Year	Total Import Value to Cambodia (CIF)	Total Export Value from Cambodia (FOB)	Import Subsidy /a	Import Tax /b	Export Subsidy	Export Tax	Standard Conversion Factor
	(Unit ; US\$ Million)						
	I	E	Is	It	Es	Et	SCF
1998	1,262	802		98.7		0.7	0.955
1999	1,723	1,130		108.9		4.3	0.965
2000	2,096	1,397		96.7		4.1	0.974
2001	2,270	1,571		92.8		2.5	0.977
2002	2,554	1,770		104.0		3.7	0.977
2003	2,888	2,087		117.1		4.5	0.978
2004	3,538	2,589		153.3		4.8	0.976
2005	4,254	2,910		134.3		4.6	0.982
Average Standard Conversion Factor (SCF)							
1998-2004							0.973
1998-2003							0.971
2001-2005							0.978

Note : $SCF = (I+E) / [(I-Is+It)+(E+Es-Et)]$

/a ; Import subsidy is accounted at the import tax exemption.

/b ; Custom duties are accounted.

Sources : Ministry of Planning, Cambodia Statistical Yearbook 2006

Table IIIE-1 Economic Price Estimate for Traded Goods, F/S Study (5/5)

VII. Estimate of Shadow Wage Factor in the Study Area

Item	Operation	Unit	2005	2010	2020
1. Total Population in the Study Area (Population growth rate)/a		Person (%)	322,706	357,658 (1.73)	441,610 (2.13)
2. Labor Force Population		Person			
Total /b	(37.6%)		121,300	134,500	166,000
For agriculture			78,800 (65.0%)	80,700 (60.0%)	91,300 (55.0%)
3. Annual Available Person-Day	236 (P.day/person/year)	P.day/year	18,596,800	19,045,200	21,546,800
4. Net Annual Available Person-Day for Agriculture	(50%)	P.day/year	9,298,400	9,522,600	10,773,400
5. Agricultural Labor Input /c		Distribution P.day/year			
5.1 Present/Without Project Condition	(41,500ha)				
1) Wet season paddy (irrigated)	(580ha)	1.40%		69,600	69,600
2) Wet season paddy (supplement)	(5,420ha)	13.06%		525,740	525,740
3) Wet season paddy (rainfed)	(35,500ha)	85.54%		2,769,000	2,769,000
4) Diversified crop (rainfed)					
Mungbean	(1,250ha)	3.00%		62,500	62,500
Other cereals/vegetables	(1,660ha)	4.00%		149,400	149,400
(1) + 2) + 3) + 4))	(44,410ha)	107.00%		3,576,240	3,576,240
5) Other farm works	(30% of cropping)			1,072,900	1,072,900
Total (1, 2), 3), 4) and 5))				4,649,140	4,649,140
5.2 Future/With Project Condition	(17,300ha)				
A. Upper North & South Main Canal (MC)	(5,660ha)				
1) Wet season paddy (irrigated)	(570ha)	10.07%		71,250	71,250
2) Wet season paddy (supplement)	(5,090ha)	89.93%		559,900	559,900
3) Wet season paddy (rainfed)	(0ha)	0.00%		0	0
4) Diversified crop (irrigated/rainfed)					
Mungbean	(170ha)	3.00%		10,200	10,200
Vegetables	(230ha)	4.00%		20,880	20,880
(1) + 2) + 3) + 4))	(6,060ha)	107.00%		662,230	662,230
5) Other farm works	(30% of cropping)			198,700	198,700
Total (1, 2, 3, 4 and 5))				860,930	860,930
B. Lower North & South MC and Ou Kr	(11,040ha)				
1) Wet season paddy (irrigated)	(0 ha)	0.00%		0	0
2) Wet season paddy (supplement)	(11,040 ha)	100.00%		1,159,200	1,159,200
3) Wet season paddy (rainfed)	(0 ha)	0.00%		0	0
4) Diversified crop (irrigated/rainfed)					
Mungbean	(330 ha)	3.00%		19,800	19,800
Vegetables	(440 ha)	4.00%		39,600	39,600
(1) + 2) + 3) + 4))	(11,810ha)	107.00%		1,218,600	1,218,600
3) Other farm works	(30% of cropping)			365,600	365,600
Total (1, 2), 3), 4) and 5))				1,584,200	1,584,200
C. Water Harvesting Irrigated Ag.	(600ha)				
1) Wet season paddy (irrigated)	(0 ha)	0.00%		0	0
2) Wet season paddy (supplement)	(300 ha)	50.00%		31,500	31,500
3) Wet season paddy (rainfed)	(300 ha)	50.00%		27,000	27,000
4) Diversified crop (irrigated/rainfed)					
Mungbean	(20 ha)	3.00%		1,200	1,200
Vegetables	(20 ha)	4.00%		1,800	1,800
(1) + 2) + 3) + 4))	(640ha)	107.00%		61,500	61,500
3) Other farm works	(30% of cropping)			18,500	18,500
Total (1, 2), 3), 4) and 5))				80,000	80,000
D. Rainfed Ag. Improvement	(23,980ha)				
1) Wet season paddy (rainfed)	(23,980 ha)	100.00%		2,158,200	2,158,200
2) Diversified crop (rainfed)					
Mungbean	(10 ha)	1.00%		600	600
Vegetables	(10 ha)	1.00%		900	900
(1) + 2))	(24,000ha)	102.00%		2,159,700	2,159,700
3) Other farm works	(30% of cropping)			647,900	647,900
Total (1, 2), and 3))				2,807,600	2,807,600
Total (A + B + C + D)					5,332,730
6. Shadow Wage Factors					
Without Project Condition				0.49	0.43
With Project Condition				0.56	0.49
7. Shadow Wage Rate					
(Standard conversion factor : 0.98)					
Without Project Condition				0.48	0.42
With Project Condition				0.55	0.49

Note : /a ; Estimated by data from: Statistical Year Book 2006, NIS, Ministry of Planning, and First Revision, Population Projection for Cambodia 1998 - 2020, NIS, Ministry of Planning.

/b ; Percentage of economically active population aged 10 and over (Kampong Speu) 51.9 % (1)
Percentage of population aged 10 and over (Kampong Speu) ; 72.5 % (2)
Labor force population ratio ; (1 x 2) 37.6 %

/c ; Labor requirement per ha

Crops	Person-day/ha				
	Present	With Project			W-har
		IAIMP	UP-NS	LW-NS&OK	
Paddy					
Rainfed	78	0	0	90	90
Irrigated	120	125	125	0	0
Supplement	97	0	110	105	105
Mungbean	50	60	60	60	60
Vegetables	90	150	90	90	90

Table IIIE-2 Summary of Financial and Economic Prices Applied, F/S Study

Particulars	Unit	Financial Price Applied /a	Conversion	Economic Price Applied
1. Farm Products				
Dry Paddy	(Riel/kg)			
- High yielding varieties (Dec. 2006)		550	b	661
- Improved local varieties		600	b	661
Maize/Corn	(Riel/kg)	600	b	480
Mungbean	(Riel/kg)	1,500	c	1,470
Vegetable average	(Riel/kg)	519	c	509
2. By-Products				
Rice straw	(Riel/kg)	28	c	27
By-products of Mung B & M	(Riel/kg)	30	c	29
3. Seeds				
Paddy (degraded HYV)	(Riel/kg)	630	c	617
Paddy (local variety)	(Riel/kg)	710	c	696
Paddy (improved variety)	(Riel/kg)	900	c	882
Maize	(Riel/kg)	2,000	c	1,960
Mungbean	(Riel/kg)	1,400	c	1,372
Vegetable average	(Riel/kg)	1,000	c	980
4. Fertilizer				
Urea	(Riel/kg)	1,500	b	1,059
DAP	(Riel/kg)	1,600	b	1,159
KCL	(Riel/kg)	1,400	b	831
Compost	(Riel/ton)	15,000	d	6,300
5. Chemical	(Riel/litre)	10,000	c	9,800
6. Tool and Equipment				
5% of the cost for inputs and draft animals				
7. Labor, Animal Power and Machinery				
Labor	(Riel/Person-day)	6,000	d	2,520
Animal	(Riel/Animal-day)	10,000	d	4,200
8. Transportation				
Farmgate to Kampong Speu	(Riel/kg)	30	c	29
Remarks:				
/a ; Dec. 2006 prices				
/b ; Economic price estimate based on the WB Commodity Markets Forecast				
/c ; Financial prices are converted to economic value multiplying by SCF of <u>0.98</u>				
/d ; Multiplied by shadow wage rate of <u>0.42</u>				
Based on the shadow wage rate factor <u>0.43</u>) multiplied by SCF <u>0.98</u>				

Table IIIE-3 Economic Crop Budget, Present Condition, F/S Study

Name of crops	Unit	Paddy (H.Y.V) Gravity Irrig.			Paddy (Impr. Local V). Gravity Irrig.			Paddy (Local V. for Rainfed)			Paddy (H.Y.V) Pump Irrig.			Paddy (Impr. Local V.) Pump Irrig.		
		Qty	Price (Riel)	Value (1000Riel)	Qty	Price (Riel)	Value (1000Riel)	Qty	Price (Riel)	Value (1000Riel)	Qty	Price (Riel)	Value (1000Riel)	Qty	Price (Riel)	Value (1000Riel)
1. Gross Income	Riel			1,651			1,582			1,307			1,651			1,586
Main products	kg	2,400	661	1,586	2,300	661	1,520	1,900	661	1,256	2,400	661	1,586	2,300	661	1,520
By-product	kg	2,400	27	65	2,300	27	62	1,900	27	51	2,400	27	65	2,300	27	66
		(straw)			(straw)			(straw)			(straw)			(straw)		
2. Production Cost	Riel			653			676			606			910			888
2.1 Inputs	Riel			186			205			205			186			205
Seed	kg	40	617	25	50	696	35	80	696	56	40	617	25	50	696	35
Farm manure (compost)	ton	2	6,300	11	2	6,300	11	2	6,300	11	2	6,300	11	2	6,300	11
Fertilizer	kg	70	1,059	74	80	1,059	85	60	1,059	64	70	1,059	74	80	1,059	85
DAP	kg	60	1,159	70	60	1,159	70	60	1,159	70	60	1,159	70	60	1,159	70
KCL	kg	0	831	0	0	831	0	0	831	0	0	831	0	0	831	0
Agro-chemicals	liter	1	9,800	6	0	9,800	4	0	9,800	4	1	9,800	6	0	9,800	4
2.2 Labor	P-d			290			302			252			290			302
Hired labor	P-d	23	2,520	58	24	2,520	60	20	2,520	50	23	2,520	58	24	2,520	60
Family labor	P-d	92	2,520	232	96	2,520	242	80	2,520	202	92	2,520	232	96	2,520	242
2.3 Draft animal	Riel			146			137			120			146			143
Land preparation	Ani-d	18.0		76	18		76	18		76	18.0		76	18		76
Plowing	Ani-d	15.0	4,200	63	15.0	4,200	63	15.0	4,200	63	15.0	4,200	63	15.0	4,200	63
Paddling	Ani-d	3.0	4,200	13	3.0	4,200	13	3.0	4,200	13	3.0	4,200	13	3.0	4,200	13
Transportation	Ani-d	2,400.0	29	70	2,100.0	29	61	1,500.0	29	44	2,400.0	29	70	2,300.0	29	67
2.4 Pumping Cost	Riel															196
2.5 Tool/Equipment	Riel			31			32			29			31			42
3. Net Return	Riel			998			906			701			998			698
(N.Return/P. Cost Ratio)				1.53			1.34			1.16			1.53			0.79

Name of crops	Unit	Paddy (H.Y.V) G + P Irrig.			Paddy (Impr. Local V.) G+P Irrig.			Mungbean			Vegetables (average)		
		Qty	Price (Riel)	Value (1000Riel)	Qty	Price (Riel)	Value (1000Riel)	Qty	Price (Riel)	Value (1000Riel)	Qty	Price (Riel)	Value (1000Riel)
1. Gross Income	Riel			1,651			1,586			675			4,708
Main products	kg	2,400	661	1,586	2,300	661	1,520	450	1,470	662	9,250	509	4,708
By-product	kg	2,400	27	65	2,300	29	66	450	29	13	9,250	0	0
		(straw)			(straw)			(waste bean)			(stem and waste nuts)		
2. Production Cost	Riel			782			785			274			1,570
2.1 Inputs	Riel			186			205			97			735
Seed	kg	40	617	25	50	696	35	50	1,372	69	166	980	163
Farm manure (compost)	ton	2	6,300	11	2	6,300	11	0	6,300	0	15	6,300	95
Fertilizer	kg	70	1,059	74	80	1,059	85	15	1,059	16	177	1,059	187
DAP	kg	60	1,159	70	60	1,159	70	10	1,159	12	215	1,159	249
KCL	kg	0	831	0	0	831	0	0	831	0	0	831	0
Agro-chemicals	liter	1	9,800	6	0	9,800	4	0	9,800	0	4	9,800	39
2.2 Labor	P-d			290			302			126			376
Hired labor	P-d	23	2,520	58	24	2,520	60	15	2,520	38	53	2,520	132
Family labor	P-d	92	2,520	232	96	2,520	242	35	2,520	88	97	2,520	244
2.3 Draft animal	Riel			146			143			38			318
Land preparation	Ani-d	18.0		76	18		76	5.0	4,200	25	10.0	4,200	42
Plowing	Ani-d	15.0	4,200	63	15.0	4,200	63	1.0	4,200	4	2.0	4,200	8
Paddling	Ani-d	3.0	4,200	13	3.0	4,200	13	450.0	29	13	9,250.0	29	268
Transportation	Ani-d	2,400.0	29	70	2,300.0	29	67						
2.4 Pumping Cost	Riel			123			98			13			268
2.5 Tool/Equipment	Riel			37			37			13			143
3. Net Return	Riel			870			801			401			3,138
(N.Return/P. Cost Ratio)				1.11			1.02			1.46			2.00

Table IIIE-4 Economic Crop Budget, With Project Condition, F/S Study

Economic Crop Budget

With Project Condition

Irrigated Agriculture Improvement Model Project (IAIMP) Area

Name of crops	Paddy Early Wet/Wet (H.Y.V)				Paddy Wet Med. (Impr V.)		
	Unit	Q'ty	Price (Riel)	Value (1000Riel)	Q'ty	Price (Riel)	Value (1000Riel)
1. Gross Income	Riel			2,615			2,270
Main products	kg	3,800	661	2,512	3,300	661	2,181
By-product	kg	3,800 (straw)	27	103	3,300 (straw)	27	89
2. Production Cost	Riel			775			792
2.1 Inputs	Riel			225			242
Seed	kg	25	882	22	25	882	22
Farm manure (wet)	ton	2	6,300	11	2	6,300	11
Fertilizer	Urea	kg	74	1,059	110	1,059	116
	DAP	kg	64	1,159	50	1,159	58
	KCL	kg	36	831	30	831	25
Agro-chemicals	liter	1	9,800	10	1	9,800	10
2.2 Labor	P-d			302			315
Hired labor	P-d	24	2,520	60	25	2,520	63
Family labor	P-d	96	2,520	242	100	2,520	252
2.3 Draft animal	Riel			211			197
Land preparation	Ani-d	24.0		101	24.0		101
Plowing	Ani-d	20.0	4,200	84	20.0	4,200	84
Paddling	Ani-d	4.0	4,200	17	4.0	4,200	17
Transportation	Ani-d	3,800.0	29	110	3,300.0	29	96
2.4 Tool/Equipment	Riel			37			38
3. Net Return (N.Return/P. Cost Ratio)	Riel			1,840			1,478
				2.37			1.87

Name of crops	Unit	Mungbean			Vegetables (average)		
		Q'ty	Price (Riel)	Value (1000Riel)	Q'ty	Price (Riel)	Value (1000Riel)
1. Gross Income	Riel			1,049			4,708
Main products	kg	700	1,470	1,029	9,250	509	4,708
By-product	kg	700 (waste bean)	29	20	9,250 (stem and waste nuts)	0	0
2. Production Cost	Riel			436			1,569
2.1 Inputs	Riel			219			732
Seed	kg	50	1,372	69	166	980	163
Farm manure (wet)	ton	2	6,300	13	15	6,300	95
Fertilizer	Urea	kg	55	1,059	177	1,059	186
	DAP	kg	50	1,159	215	1,159	249
	KCL	kg	25	831	0	831	0
Agro-chemicals	liter	0	9,800	0	4	9,800	39
2.2 Labor	P-d			151			376
Hired labor	P-d	18	2,520	45	53	2,520	132
Family labor	P-d	42	2,520	106	97	2,520	244
2.3 Draft animal	Riel			45			318
Land preparation	Ani-d	6.0		25	12.0		50
Plowing	Ani-d	5.0	4,200	21	10.0	4,200	42
Paddling	Ani-d	1.0	4,200	4	2.0	4,200	8
Transportation	Ani-d	700.0	29	20	9,250.0	29	268
2.4 Tool/Equipment	Riel			21			143
3. Net Return (N.Return/P. Cost Ratio)	Riel			613			3,139
				1.41			2.00

Table IIIE-5 Economic Irrigation and Drainage Benefit, F/S Study

Irrigated Agriculture Improvement Model Project (IAIMP) Area**(1) Present/Without Project Condition (2007)**

Crops	Planted Area (ha)	Net Production Value	
		Per ha (Riel '000)	Total (Riel 'Million)
Paddy	783		674.6
Early Wet Season Rice			
- Early Variety (HYV): Gravity	107	998	106.8
- Early Variety (HYV): Pump	29	741	21.5
- Early Variety (HYV): G & P	67	870	58.3
Wet Season Rice			
- Early Variety (HYV)	0	998	0.0
- Medium Variety: Gravity	306	906	277.2
- Medium Variety: Pump	84	698	58.6
- Medium Variety: G & P	190	801	152.2
- Medium Variety (rainfed)	0	701	0.0
Upland Crop	0		0.0
Upland Crops	0	401	0.0
Vegetables	0	3,138	0.0
Total	783		674.6
Total Physical Area	580	C. Intensity	135%
	NPV per ha	Riel '000	US\$
		1,163.1	286.5
Note :	Riel	4,060 /US\$	

(2) With Project Condition

Crops	Planted Area (ha)	Net Production Value	
		Per ha (Riel '000)	Total (Riel 'Million)
Paddy	855		1,470.0
Early Wet Season Rice			
- Early Variety (HYV)	285	1,840	524.4
Wet Season Rice			
- Early Variety (HYV)	285	1,840	524.4
- Medium Variety (irrigated)	285	1,478	421.2
- Medium Variety (rainfed)	0	701	0.0
Upland Crop	30		26.0
Upland Crops	27	613	16.6
Vegetables	3	3,139	9.4
Total	885		1,496.0
Total Physical Area	570	C. Intensity	155%
	NPV per ha	Riel '000	US\$
		2,624.6	646.4
Note :	Riel	4,060 /US\$	

(3) Increment (With - Without 2007)

Crops	Planted Area (ha)	Net Production Value	
		Per ha (Riel '000)	Total (Riel 'Million)
Paddy	72		795
Early Wet Season Rice			
- Early Variety (HYV): Gravity	-107	998	-106.8
- Early Variety (HYV): Pump	-29	741	-21.5
- Early Variety (HYV): G & P	-67	870	-58.3
- Early Variety (HYV)	285	1,840	524.4
Wet Season Rice			
- Early Variety (HYV)	285	1,840	524.4
- Medium Variety: Gravity	-306	906	-277.2
- Medium Variety: Pump	-84	698	-58.6
- Medium Variety: G & P	-190	801	-152.2
- Medium Variety (irrigated)	285	1,478	421.2
- Medium Variety (rainfed)	0	701	0.0
Upland Crop	30		26.0
Upland Crops	27	613	16.6
Vegetables	3	3,139	9.4
Total	102		821.4
Total Physical Area	570	C. Intensity	20%
	NPV per ha	Riel '000	US\$
		1,461.5	359.9

Table IIIE-6 Annual Incremental Economic Benefit Flow, F/S Study

Irrigated Agriculture Improvement Model Project (IAIMP) Area

Year in Order	Year	Area under Irrigation (ha)	Build-Up Ratio (%)	Benefit Build-Up (Riel Million)				Total
				Year 2010 Area	Year 2011 Area	Year 2012 Area	Year 2013 Area	
1	2009							
2	2010		5					
3	2011	150	70	11.0				11.0
4	2012	420	100	153.5	30.7			184.2
5	2013			219.2	429.7			648.9
6	2014			219.2	602.2			821.4
7	2015			219.2	602.2			821.4
8	2016			219.2	602.2			821.4
9	2017			219.2	602.2			821.4
10	2018			219.2	602.2			821.4
11	2019			219.2	602.2			821.4
12	2020			219.2	602.2			821.4

Note : Incremental net production value (Rp.'000/ha) 1,461.5

Table IIIE-7 Economic Investment Cost, F/S Study

Irrigated Agriculture Improvement Model Project (IAIMP)

(Unit : Riel Million)

Description	Financial Cost			Conversion Factors	Economic Cost									
	F/C	L/C	Total		Total	2009	2010	2011	2012	2013	2014	2015	2016	2017
1. Preparatory Works	61	26	86	0.76	66		40	26						
2. Direct Construction Cost	2,966	1,271	4,237	0.77	3,242		324	1,945	973					
3. O&M Equipment			0	-	0									
4. Agricultural Supporting Activities	56	131	187	0.79	148			37	44	37	30			
5. Formation and Strengthening of FWUC	49	195	244	0.81	196	20	98	79						
6. Farmers Organization Development	22	88	110	0.81	88	9	44	35						
7. Kampong Speu PDOWRAM Strengthening	5	19	24	0.81	20	2	10	8						
8. Coordination Strengthening between PDA and PDOWRAM	1	3	4	0.79	3	0	2	1						
9. Land Acquisition Arrangement	5	21	26	0.8	21		21							
10. Land Acquisition Cost		487	487											
11. Administration Cost	303	130	432	0.77	331		17	248	66					
12. Engineering Services	1,239	531	1,770	0.96	1,706	171	512	683	341					
Total (1 to 12)	4,706	2,902	7,608	0.77	5,822	201	1,067	3,063	1,425	37	30			
13. Physical Contingencies (10% of 1,2,11 and 12)	457	196	653		535	17	89	290	138					
14. Price Contingencies	1,425	378	1,803											
Grand Total	6,588	3,476	10,064		6,357	218	1,156	3,353	1,563	37	30			

Table IIIE-8 Economic Annual O&M Cost, F/S Study

Irrigated Agriculture Improvement Model Project Area (IAIMP)

(1) Economic Annual O&M Cost at Full Stage

Item	Financial Cost (Riel Million)	Conversion Factor	Economic Cost (Riel Million)
1. Materials	2.4	0.83	2
2. Equipment	2.4	0.75	1.8
3. Labor	4.8	0.48	2.3
4. O&M Staff	14.5	0.88	12.8
5. Environmental Monitoring	2.7	0.88	2.3
Total (ha) 570	26.9		21.2
Per ha (Riel)			<u>37,193</u>

(2) Annual Disbursement of Economic O&M Cost

Year in Order	Year	Area under Irrigation (ha)	Annual O&M Cost (Riel Million)
1	2009		
2	2010		
3	2011	100	3.7
4	2012	400	14.9
5	2013	<u>570</u>	<u>21.2</u>
6	2014	570	21.2
7	2015	570	21.2
8	2016	570	21.2
9	2017	570	21.2
10	2018	570	21.2
11	2019	570	21.2
12	2020	570	21.2
13	2021	570	21.2
14	2022	570	21.2
15	2023	570	21.2

Table IIIE-9 Economic Replacement Cost, F/S Study

Irrigated Agriculture Improvement Model Project Area (IAIMP)

(1) Economic Replacement Cost by Item

Item	Useful Life (year)	Financial Cost (Riel Million)	Conversion Factor	Economic Cost (Riel Million)
1. Project Facilities				
1) Gates (S. Main Canal, 2nd and Tertiary Gates)	25	759	0.81	615.0

(2) Annual Replacement Cost

(Unit : Riel Million)											
Year in Order	Year	With 5 Years'	With 10 Years'	With 25 Years'	Total	Year in Order	Year	With 5 Years'	With 10 Years'	With 25 Years'	Total
1	2012					26	2037				
2	2013					27	2038				
3	2014					28	2039				
4	2015					29	2040				
5	2016					30	2041				
6	2017					31	2042				
7	2018					32	2043				
8	2019					33	2044				
9	2020					34	2045				
10	2021					35	2046				
11	2022					36	2047				
12	2023					37	2048				
13	2024					38	2049				
14	2025					39	2050				
15	2026					40	2051				
16	2027					41	2052				
17	2028					42	2053				
18	2029					43	2054				
19	2030					44	2055				
20	2031					45	2056				
21	2032					46	2057				
22	2033					47	2058				
23	2034					48	2059				
24	2035					49	2060				
25	2036			615	615	50	2061				

Table IIIE-10 Economic Cost and Benefit Stream (1), F/S Study

Irrigated Agriculture Improvement Model Project (IAIMP)

EIRR : 11.1%	Net Present Value (Riel Million)	<i>Benefit</i>	<i>Cost</i>	<i>B/C Ratio</i>
	(7.00 % discount rate)	8,486	5,517	1.5

(Unit : Riel Million)

Year in Order	Year	Economic Cost				Economic Benefit			Net Cash Flow
		Project Investment	O&M	Replacement	Total	Irri. & Drainage	Production Foregone	Total	
1	2009	218.4			218.4			0.0	-218.4
2	2010	1,156.4			1,156.4			0.0	-1,156.4
3	2011	3,352.9	3.7		3,356.6	11.0	-5.0	6.0	-3,350.6
4	2012	1,562.5	14.9		1,577.4	184.2	-8.1	176.1	-1,401.3
5	2013	36.9	21.2		58.1	648.9	-8.1	640.8	582.7
6	2014	29.5	21.2		50.7	821.4	-8.1	813.3	762.6
7	2015		21.2		21.2	821.4	-8.1	813.3	792.1
8	2016		21.2		21.2	821.4	-8.1	813.3	792.1
9	2017		21.2		21.2	821.4	-8.1	813.3	792.1
10	2018		21.2		21.2	821.4	-8.1	813.3	792.1
11	2019		21.2		21.2	821.4	-8.1	813.3	792.1
12	2020		21.2		21.2	821.4	-8.1	813.3	792.1
13	2021		21.2		21.2	821.4	-8.1	813.3	792.1
14	2022		21.2		21.2	821.4	-8.1	813.3	792.1
15	2023		21.2		21.2	821.4	-8.1	813.3	792.1
16	2024		21.2		21.2	821.4	-8.1	813.3	792.1
17	2025		21.2		21.2	821.4	-8.1	813.3	792.1
18	2026		21.2		21.2	821.4	-8.1	813.3	792.1
19	2027		21.2		21.2	821.4	-8.1	813.3	792.1
20	2028		21.2		21.2	821.4	-8.1	813.3	792.1
21	2029		21.2		21.2	821.4	-8.1	813.3	792.1
22	2030		21.2		21.2	821.4	-8.1	813.3	792.1
23	2031		21.2		21.2	821.4	-8.1	813.3	792.1
24	2032		21.2		21.2	821.4	-8.1	813.3	792.1
25	2033		21.2		21.2	821.4	-8.1	813.3	792.1
26	2034		21.2		21.2	821.4	-8.1	813.3	792.1
27	2035		21.2		21.2	821.4	-8.1	813.3	792.1
28	2036		21.2	615.0	636.2	821.4	-8.1	813.3	177.1
29	2037		21.2		21.2	821.4	-8.1	813.3	792.1
30	2038		21.2		21.2	821.4	-8.1	813.3	792.1
31	2039		21.2		21.2	821.4	-8.1	813.3	792.1
32	2040		21.2		21.2	821.4	-8.1	813.3	792.1
33	2041		21.2		21.2	821.4	-8.1	813.3	792.1
34	2042		21.2		21.2	821.4	-8.1	813.3	792.1
35	2043		21.2		21.2	821.4	-8.1	813.3	792.1
36	2044		21.2		21.2	821.4	-8.1	813.3	792.1
37	2045		21.2		21.2	821.4	-8.1	813.3	792.1
38	2046		21.2		21.2	821.4	-8.1	813.3	792.1
39	2047		21.2		21.2	821.4	-8.1	813.3	792.1
40	2048		21.2		21.2	821.4	-8.1	813.3	792.1
41	2049		21.2		21.2	821.4	-8.1	813.3	792.1
42	2050		21.2		21.2	821.4	-8.1	813.3	792.1
43	2051		21.2		21.2	821.4	-8.1	813.3	792.1
44	2052		21.2		21.2	821.4	-8.1	813.3	792.1
45	2053		21.2		21.2	821.4	-8.1	813.3	792.1
46	2054		21.2		21.2	821.4	-8.1	813.3	792.1
47	2055		21.2		21.2	821.4	-8.1	813.3	792.1
48	2056		21.2		21.2	821.4	-8.1	813.3	792.1
49	2057		21.2		21.2	821.4	-8.1	813.3	792.1
50	2058		21.2		21.2	821.4	-8.1	813.3	792.1

Table IIIE-11 Economic Cost and Benefit Stream (2) , F/S Study

Irrigated Agriculture Improvement Model Project (IAIMP) + Roleang Chrey Regulator with Intakes (for reference)

EIRR :	13.2%	Net Present Value (Riel Million)			<i>Benefit</i>	<i>Cost</i>	<i>B/C Ratio</i>
		(7.00 % discount rate)			28,220	17,645	1.6

(Unit : Riel Million)

Year in Order	Year	Economic Cost						Economic Benefit			Net Cash Flow		
		Project Investment		O&M		Replacement		Total	Irri. & Drainage			Production Foregone	
		RC Reg.	IAIMP	RC Reg.	IAIMP	RC Reg.	IAIMP		RC Reg.	IAIMP			
1	2009	421.3	218.4					639.7			0.0	-639.7	
2	2010	997.7	1,156.4					2,154.1	1,533.5		1,533.5	-620.6	
3	2011	5,559.4	3,352.9		3.7			8,916.0	1,533.5	11	-1.0	1,543.5	-7,372.5
4	2012	6,910.2	1,562.5	29.9	14.9			8,517.5	1,533.5	184.2	-7.0	1,710.7	-6,806.8
5	2013		36.9	29.9	21.2			88.0	1,533.5	648.9	-8.1	2,174.3	2,086.3
6	2014		29.5	29.9	21.2			80.6	1,533.5	821.4	-8.1	2,346.8	2,266.2
7	2015			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
8	2016			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
9	2017			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
10	2018			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
11	2019			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
12	2020			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
13	2021			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
14	2022			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
15	2023			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
16	2024			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
17	2025			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
18	2026			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
19	2027			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
20	2028			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
21	2029			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
22	2030			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
23	2031			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
24	2032			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
25	2033			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
26	2034			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
27	2035				21.2	4,518.5		4,539.7	1,533.5	821.4	-8.1	2,346.8	-2,192.9
28	2036			29.9			615	644.9	1,533.5	821.4	-8.1	2,346.8	1,701.9
29	2037			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
30	2038			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
31	2039			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
32	2040			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
33	2041			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
34	2042			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
35	2043			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
36	2044			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
37	2045			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
38	2046			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
39	2047			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
40	2048			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
41	2049			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
42	2050			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
43	2051			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
44	2052			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
45	2053			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
46	2054			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
47	2055			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
48	2056			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
49	2057			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7
50	2058			29.9	21.2			51.1	1,533.5	821.4	-8.1	2,346.8	2,295.7

Table IIIE-12 Cash Flow Statement - Development Plan of the Model Project (IAIMP)

(Unit: Riel. Million)

Year in Order	Initial Investment Cost		Cash Outflow				Cash Inflow				Balance
	Total Investment Cost	Capital	Loan Repayment *2		O&M Cost *3	Replacement Cost *1	Total	Loan from Foreign Aid	Government Budget *4	Total	
			Interest	Total							
1	363.0	-	-	-	-	-	363.0	363.0	-	363.0	-
2	1,831.0	-	8.3	8.3	-	-	1,839.3	1,839.3	585.3	1,839.3	-
3	5,304.8	-	37.2	37.2	4.7	-	5,346.7	5,346.7	688.7	5,346.7	-
4	2,436.0	-	144.3	144.3	18.9	-	2,599.2	2,599.2	304.9	2,599.2	-
5	73.1	-	197.1	197.1	26.9	-	297.1	297.1	224.9	297.1	-
6	56.8	-	198.8	198.8	26.9	-	282.5	282.5	227.3	282.5	-
7	-	-	200.0	200.0	26.9	-	226.9	226.9	226.9	226.9	-
8	-	-	200.0	200.0	26.9	-	226.9	226.9	226.9	226.9	-
9	-	-	200.0	200.0	26.9	-	226.9	226.9	226.9	226.9	-
10	-	-	200.0	200.0	26.9	-	226.9	226.9	226.9	226.9	-
11	-	434.8	200.0	634.8	26.9	-	661.7	661.7	661.7	661.7	-
12	-	434.8	190.0	624.8	26.9	-	651.7	651.7	651.7	651.7	-
13	-	434.8	180.0	614.8	26.9	-	641.7	641.7	641.7	641.7	-
14	-	434.8	170.0	604.8	26.9	-	631.7	631.7	631.7	631.7	-
15	-	434.8	160.0	594.8	26.9	-	621.7	621.7	621.7	621.7	-
16	-	434.8	150.0	584.8	26.9	-	611.7	611.7	611.7	611.7	-
17	-	434.8	140.0	574.8	26.9	-	601.7	601.7	601.7	601.7	-
18	-	434.8	130.0	564.8	26.9	-	591.7	591.7	591.7	591.7	-
19	-	434.8	120.0	554.8	26.9	-	581.7	581.7	581.7	581.7	-
20	-	434.8	110.0	544.8	26.9	-	571.7	571.7	571.7	571.7	-
21	-	434.8	100.0	534.8	26.9	-	561.7	561.7	561.7	561.7	-
22	-	434.8	90.0	524.8	26.9	-	551.7	551.7	551.7	551.7	-
23	-	434.8	80.0	514.8	26.9	-	541.7	541.7	541.7	541.7	-
24	-	434.8	70.0	504.8	26.9	-	531.7	531.7	531.7	531.7	-
25	-	434.8	60.0	494.8	26.9	759.0	1,280.7	1,280.7	1,280.7	1,280.7	-
26	-	434.8	50.0	484.8	26.9	-	511.7	511.7	511.7	511.7	-
27	-	434.8	40.0	474.8	26.9	-	501.7	501.7	501.7	501.7	-
28	-	434.8	30.0	464.8	26.9	-	491.7	491.7	491.7	491.7	-
29	-	434.8	20.0	454.8	26.9	-	481.7	481.7	481.7	481.7	-
30	-	434.8	10.0	444.8	26.9	-	471.7	471.7	471.7	471.7	-
31	-	-	-	-	26.9	-	26.9	26.9	26.9	26.9	-
32	-	-	-	-	26.9	-	26.9	26.9	26.9	26.9	-

*1 Including price contingency and VAT.

*2 Interest rate: 2.3%/year Grace period: 10 year Prepayment period: 30 years including grace period

*3 O&M cost of regulator and intakes

*4 All deficit is covered by the Government budget.

Appendix-III F
ENVIRONMENT

**THE STUDY
ON
COMPREHENSIVE AGRICULTURAL DEVELOPMENT
OF
PREK THNOT RIVER BASIN
IN
THE KINGDOM OF CAMBODIA**

FINAL REPORT

Volume-VII: Appendixes for Feasibility Studies for Priority/Urgent Projects

Appendix-III F

Environment

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APPENDIX-III F: ENVIRONMENT

Chapter III F-1 Environment of the Project Site

III F-1.1 Social Environment

(1) People/ Community

(a) Population of the Project Area

The Project Area consists of 18 villages, 3 Communes and 2 Districts. According to SEILA Commune Data Base 2005, the population of these villages is 10,205 in total in 2005 as shown below. Average family size is 5.2. The annual growth rate is not changed so much for the past few years.

Population of the Project Area

District	Commune	Village	No. of Families	Population	Average family size
Samraong Tong	Kahaeng	Tumpung	135	705	5.2
		Roleang Chrey	90	492	5.5
		Kouk Rumlich	50	235	4.7
		Kahaeng	93	436	4.7
		Bos Ta Ney	94	476	5.1
		Ou Veang	92	505	5.5
Chbar Mon	Kandaol Dom	Rumleang	140	720	5.1
		Pongro	106	593	5.6
		Nhor	165	895	5.4
		Kandaol Dom	126	609	4.8
		Trapeang Preah	115	529	4.6
		Kab Tuk	75	344	4.6
		Srae Thnal	78	391	5.0
	Svay Kravan	Svay Kravan	122	687	5.6
		Phsar Chas	165	984	6.0
		Thnal Bambaek	129	660	5.1
		Prey Kdei	107	594	5.6
		Tras	65	350	5.4
Total			1,947	10,205	5.2

Source: SEILA Commune Data Base 2005

(b) Ethnic Group and Religion

The majority of ethnic group is Kumer and most of them are Buddhist. Pagodas as religious facilities for Buddhist have spread out around their life space.

(c) Gender Issue

The results of Socio-Economic Survey conducted by the JICA Study Team in 2006 indicated that there is no serious gender problems, as far as the sampled households are concerned. More than 90% of people feel that there is no social discrimination against women in the Project Area.

There are differences between male and female activities; housekeeping, cooking and care of children/elders are considered as female's main activities, while care of livestock seems as male's activity. Farming is undertaken by both sex. An outstanding difference is source of cash income between male and female. Income from weaving factory is mainly earned by female, while other cash income sources are no major difference found among both sexes.

Main activities of Male and Female

Activity	Male Main Activities (%)	Female Main Activities (%)
Housekeeping	6.6	22.1
Cooking	2.6	16.4
Farming	53.9	38.5
Handy crafting	1.3	0
Care of children/elders	1.3	5.6
Care of livestock	13.8	2.1
Making Palm sugar	0	0
Other (Garment worker, run small business)	20.4	15.4
Total	100.0	100.0

Source: Socio-economic survey 2006, JICA Study Team

(d) Education

SEILA Commune Data Base 2005 indicated that more than 90% of both sex of children (6 to 14 years old) go to school in 18 villages. Illiterate people over 15 years old account for 2.6% for man and 4.2% for woman.

(e) Local Community

Commune, the smallest administrative unit under Ministry of Interior, is governed by Commune Council. Commune Council Chief and members are elected every 5 years. In some villages, there is Village Development Committee (VDC). VDC members are elected through secret ballot by villagers, and thus the villagers rely on VDC and regard it as their representatives.

As for local communities related to agriculture, there are two Farmer Water Users Communities (FWUCs) in the Project Area. Both FWUCs were organized on the initiative of PDOWRAM Kampong Speu and donors. In addition, there are 36 farmers' organizations are identified in 15 out of 18 villages in the Project Area. These organization's main activities are related to agriculture; i) farming group, ii) multiple farming group and iii) aquaculture farming group.

(f) Local Conflict

According to the SEILA Commune Data Base 2005, 18 of local conflict for land issue have been recorded within 13 villages of the Project Area in the past.

(2) Land Use

Within the bounds of 2km of the Project Area, paddy fields account for about 40% of the land, while grass and shrub cover 40% and resettlement area occupied about 18%.

Out of the Project Area which is in total 580ha of irrigation area, field irrigable single cropping of rice account for 65% (377ha) and field irrigable double cropping of rice account for 35% (203ha).

(3) Public Facilities/Services

(a) Water Usage for Domestic

The result of Socio-Economic Survey regarding water source for drinking and domestic use is summarized as following table. Drinking water sources in the dry season are diverse; 34% of the sampled households are relying on well (tube well and dug well), while 23% are purchasing drinking water, followed by 9% on reservoir/canal/pond and 12% on spring/river. Distance to water sources from residence is about 160m in average while 50m in median. In the dry season, rainwater is utilized as the main resource for both drinking and domestic use. The distance to water sources from residence in wet season become around 130m in average, while 0m in median.

The result also indicated that people living in the upstream area of the South Main Canal apt to obtain water from reservoir/canal/pond water for both drinking and domestic use, while the people living in the downstream area rely on piped water. It is notable that people replied that there is not water shortage among sampled households in both the dry and rainy season.

Source of Drinking/Domestic Water in the Dry/Wet Season (Unit: %)

Commune	Season	Piped	Tube well	Dug well	Reservoir/Canal/Pond	Spring/River	Water Vender	Rain	Others
Drinking Water Source									
Kahaeng	Dry	0	33.3	20.0	20.0	13.3	6.7	6.7	0
	Rainy	0	0	0	12.5	12.5	0	75.0	0
Kandaol Dom	Dry	5.2	17.2	27.6	8.6	17.2	19.0	5.2	0
	Rainy	3.2	4.8	1.6	0	6.3	3.2	81.0	0
Svay Kravan	Dry	51.7	0	3.4	3.4	0	37.9	3.4	0
	Rainy	27.8	5.6	5.6	2.8	0	0	58.3	0
Total	Dry	17.6	14.7	19.6	8.8	11.8	22.5	4.9	0
	Rainy	10.4	4.3	2.6	2.6	5.2	1.7	73.0	0
Domestic Use									
Kahaeng	Dry	0	12.5	0	62.5	25.0	0	0	0
	Rainy	0	0	0	33.3	20.0	0	46.7	0
Kandaol Dom	Dry	3.2	14.5	19.4	37.1	22.6	3.2	0	0
	Rainy	3.0	3.0	6.1	30.3	15.2	0	42.4	0
Svay Kravan	Dry	30.0	6.7	23.3	23.3	10.0	6.7	0	0
	Rainy	11.8	8.8	17.6	17.6	2.9	0.	41.2	0
Total	Dry	10.2	12.0	17.6	37.0	19.4	3.7	0	0
	Rainy	5.2	4.3	8.7	27.0	12.2	0	42.6	0

Source: Socio-Economic Survey, JICA Study Team, 2006

(b) Energy

According to the Socio-Economic Survey, 94% of households rely on firewood for cooking fuel because it is easy to obtain it from surrounding shrub land, while 3% on kerosene and 1% on charcoal. As for lightning, around 40% of households use electricity and 20% use kerosene. It could be assumed that availability of electric power supply differ in the Project Area.

(c) Health and Medical service

Socio-Economic Survey result indicated that 90% of the sampled households go to clinic and/or health center for when they get sick, while 9% go to hospital. Approximately 70% of them uses their own motorbike to get these medical services, while others go on foot, bike taxi and bicycle. Required time to these medical service facilities ranges from 3 minutes to 60 minutes, with 14 minutes in average.

(4) Local Economy

According to Socio-Economic Survey result, more than 80% are predominantly farmer, followed by 10% of salaried worker and 7% of private business. In actual, around 85% of households are earning the money from both agricultural income and non-agricultural income, while both agricultural-income-only (8%) and non-agricultural-income-only (7%) households are small in number. Agricultural income includes sales from paddy, vegetable, fruits, palm sugar, livestock/poultry and fishes, while non-agricultural income includes permanent based salary, on-farm labor, off-farm labor, private business, remittance, selling of firewood/charcoal, handicraft/cottage industry products, forest vegetable/crop, and others. It should be noted that all sample households including the “non-agricultural-income- only” households listed above are cultivating rice in their fields and some of them are not selling (self-consuming) their rice.

As for expenditure, food expense averagely occupies more than 50% of total expenditure, followed by 14% of ceremony and ritual, 11% of education, 7% of health/medicine, 6%

of fuel/electricity,6% of transportation, and so on. Moreover, the Socio-Economic Survey result indicated that 31 out of 100 households answered as they purchase rice, while the rest are considered as self sufficient in rice.

In addition, the Socio-Economic Survey result indicated that only 10% of household do saving which is in form of cash followed by purchasing livestock. Nobody choose bank as saving form. On the other hand, around 25% of people have loan or debt from commercial bank (50% of all loan schemes utilized), followed by friends/relatives (35%). Popular purpose for loans/debts is agricultural inputs and livestock animals, those of which cover 20% and 17% respectively.

(5) Land Tenure

SEILA Data Base 2005 indicated 507 households have some irrigated rice land out of 554 households in 6 Project villages in Kahaeng commune¹. According to commune council of Kandaol Dom commune, currently there are no landless farmers.

As for land loss, according to the Socio-Economic Survey² conducted in 2005, 46% of interviewee living in the Project Area answered that in case they lose their land, they need compensation. Among them, 63% request to compensate by land, while 37% by money.

Opinion to Land Loss

	No accept	Need compensation	No problem	No answer
To loss present cultivation	6%	26%	26%	43%
To loss land for irrigation facilities	0%	46%	49%	6%

Source: Socio-Economic Survey, JICA Study Team, 2005

IIIF-1.2 Natural Environment

(1) Forest and Wildlife

As described above, there is no major forest area in and around the Project Area. In figure, 40% is covered by grass and shrub land, where more than 90% of households collect firewood for cooking fuel.

Though there is no specific data or record, bio-diversity seems poor in and around the Project Area because of its limited habitat as far as the site inspection.

(2) Fish and its habitat

Major water resources as fish habitat around the Project Site are Prek Thnot River and irrigation canals. According to the local people, there were many fishes both in the rainy and dry seasons in the past, however the amount and variety of fish are decreasing presently. The one reason was pointed out by the local people that people started using electric fishing gears, which have wiped out the fish. In addition, exotic species discharged are changing aquatic-diversity around.

According to relevant people including Department of Fishery, MAFF, the following species of fish exist in the Prek Thnot River.

Existing Fish in the PrekThnot River

	Khmer Name	English name	Scientific Name	indigenous/exotic
1	Tilapia	Nile tilapia	<i>Oreochromis niloticus</i>	Exotic
2	Kranh Srai	Climbing perch	<i>Anabas testudineus</i>	Indigenous
3	Phtuok/Rous	Snakehead	<i>Channa striata</i>	Indigenous
4	Trey Andaing Roueng	Walking catfish	<i>Clarias batrachus</i>	Indigenous
5	Andaing Tonle	Gray eel-catfish	<i>Plotosus canius</i>	Indigenous
6	Kanhtor	Snake-skin gourami	<i>Trichogaster pectoralis</i>	Indigenous
7	Chhpin	--	<i>Hypsibarbus pierrei</i>	Indigenous

¹ Data of Kandaol Dom commune and Svay Kravan commune is not available.

² The Socio-Economic Survey was conducted in 2005 under the Study to gather socio- economic information and to grasp the features of the Target Area of the Master Plan.

	Khmer Name	English name	Scientific Name	indigenous/exotic
8	Trey Raw	Snakehead murrel	<i>Channa striata</i>	Indigenous
9	Trey chhpin	Silver barb	<i>Barbodes gonionotus</i>	Indigenous
10	Trey chhlonh chhnoht	Peacock eel	<i>Macrogathussiamensis</i>	Indigenous
11	Trey kromorm	Butter catfish	<i>Ompok bimaculatus</i>	Indigenous
12	Carp sor	Silver carp	<i>Hypophthalmichthys molitrix</i>	Exotic
13	Carp samanh	Common carp	<i>Cyprinus carpio</i>	Exotic
14	Kulriang	Giant barb	<i>Catlocapio siamensis</i>	Exotic
15	Klia	Finescale tigerfish	<i>Daniooides microlepis</i>	Indigenous
16	Crobey	Crocodile catfish	<i>Bagarius suchus</i>	Indigenous

Source; Interview to Provincial Office of Fishery, PDE of Kampong Speu Province, the local people, 2006

IIIF-1.3 Pollution

(1) Usage of Fertilizer

According to the Socio-Economic Survey, sampled households apply around 70kg/ha of Urea, 60kg/ha of DAP and 1,800kg/ha of manure/compost to paddy field in average as shown below.

Usage of Fertilizer				(Unit: kg/ha)
	Urea	DAP^{*1}	15-15-15^{*2}	Manure/Compost
Average	70	58	0	1,759
Max	225	200	0	20,000
Minimum	0	0	0	0

Note*1; Diammonium phosphate, *2; 15-15-15 includes 15% of Nitrogen, 15% of P₂O₅, 15% of K₂O

More than 95% of the sampled households answered that fertilizer prices is too expensive. In addition, around 20% of the sampled households considered that use of adequate doses of fertilizer is effective for improvement of rice productivity, while 50% considered use of quality seed.

(2) Other Pollution

There are no available records about pollution such as air quality and water quality in the Project Area. As far as the site inspection was concerned, no serious problems of air pollution, water pollution, noise and vibration have been observed because pollution source can not be recognized in and around the Project Area.

Chapter III F-2 Environmental Study of the Project

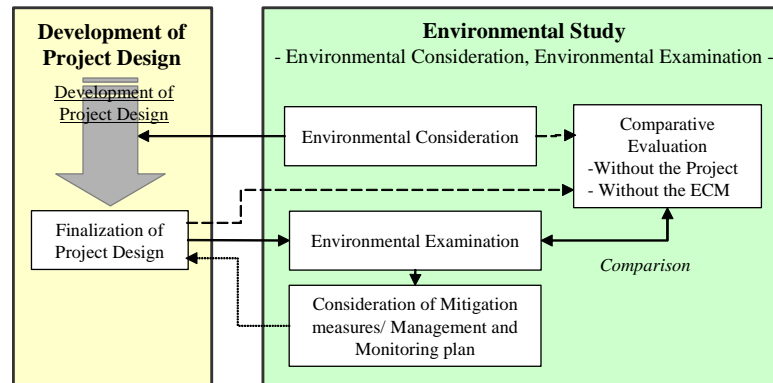
III F-2.1 General

Framework of environmental study for the Project is shown in the following figure.

In the process of formulation of improvement Plan, a series of environmental considerations were conducted in order to develop the Project more environmental friendly and sustainably.

Toward the developed Project design including a series of environmental consideration, environmental examination of the Project was preliminary implemented so as to examine potential impacts and consider mitigation measures and management/monitoring plan for minimization of negative impacts. It is noted that the Project don't require EIA study under the Sub-decree on EIA process in Cambodia.

In parallel, environmental impact on a condition without implementation of the Project was compared with the impact on a condition with the Project so as to analyze comparative evaluation of the Project design. In a similar way, contents of environmental considerations were evaluated by comparing condition with environmental considerations to condition without the considerations under the Project.



Framework of Environmental Study under the Project

III F-2.2 Environmental Consideration

In the process of formulation of improvement Plan, a series of environmental considerations were conducted in order to develop the Project more environmental friendly and sustainably. The considerable points under the Project were i) water availability during construction phase, ii) lining method of canals, and iii) air pollution by transportation of construction vehicle.

(1) Water Availability during Construction Phase

Currently, canal water in both the North and South Main Canals is used not only for agriculture but also for domestic use and drinking. Socio-Economic Survey results, which conducted in 2007 for 100 sample household living in the Project Area, shows that about 40% of households are taking canal water for domestic use in the dry season. Moreover, 10% of households are taking canal water for drinking in the dry season.

However, when considering rehabilitation works of canals, it requires to stop water flows in canals by any means during work period, which duration will be few months. As a conclusion, rehabilitation work of canals would be conducted in fallow period from December to March intensively in order not to impact to agricultural activities once.

Though the duration is not long, it impacts somehow to people who rely on canal water for drinking and domestic use directly. In order to deal with this impact, detailed survey toward the affected people will be conducted in order to make clear about possibility of other alternative water source for drinking and domestic use during construction period.

Toward the people who do not have any alternative water source, countermeasure such as distribution by water tanker would be proposed.

(2) Lining Method of Canals

Two canal lining methods, i.e. concrete lining and earth lining were examined in consideration of environmental aspects.

As a conclusion, lining of canals in South Main Canal would be rehabilitated by earth, instead of concrete. In case of concrete lining, concrete work will cause alkalified water that affect negatively on the aquatic-biodiversity. In addition, biodiversity will be in risk of damaging by artificial surface of the canals. In that respect, earth lining will minimize these kinds of negative impact to environment.

Moreover, block sodding along the canal bank will be conducted in order to keep up the bank and avoid land sliding by environmental friendly method.

(3) Air Pollution by Transportation of Construction Vehicle

Because most of roads around the Project Site are earthen road, dust is spread in the air especially in the dry season by running of vehicles.

During construction phase, construction vehicle will increase to run the road so that the dust problem will become more serious.

To cope with the dust problem, regular sprinkling activity to the road by watering vehicle was included into the construction work items.



Earthen road around the Project Site

IIIF-2.3 Environmental Examination

(1) General

In order to minimize the likely negative impact as much as possible and make the Project more environmental friendly and sustainably, Environmental examination of the Project was preliminarily conducted for integration of desirable mitigation measures and management/monitoring framework into the Project.

(2) Environmental and Social Elements to be examined

Based on available information on natural and social environment, environmental scoping for the Project were undertaken to identify anticipated impacts on environment to be examined as shown below.

When considering the scoping elements, the following issues were taken into consideration as assumption.

Designing Phase

Rehabilitation and new construction of irrigation and drainage canals will require land acquisition. Under the rule of Cambodia, the Government will compensate required land for main and secondary canals, while land for tertiary canals will not be compensated by the Government.

Construction Phase

Most of the construction works are not massive with no major disturbances to either the human population or the wildlife population.

Operation Phase

The Project consists of not only development of canals structures but also development

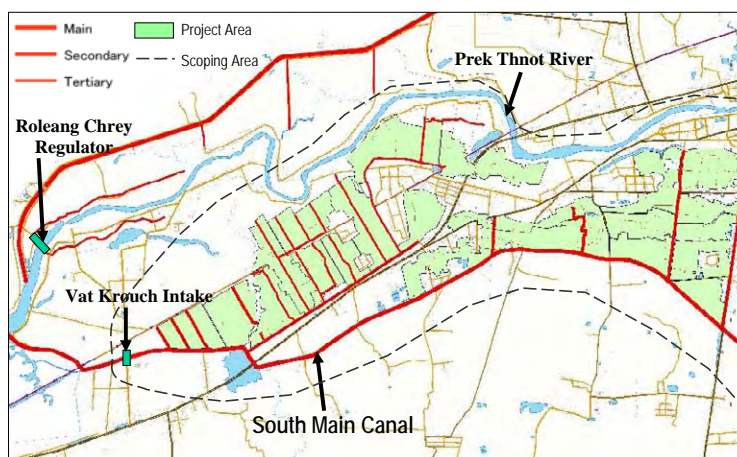
and support of activities of farmers and their communities (FWUCs) in order that farmers can manage water and their agricultural activities properly after water usage will increase.

The result of extracted elements to be examined is shown below.

Environmental and Social Conditions to be examined

Potential Impact		Phase		
		Designing	Construction	Operation
Social Environment	Land Acquisition	- Land acquisition by expansion of the canal width and extension length	—	—
	Inflow of Construction Workers	—	- Degradation of sanitation condition and corruption of security due to inflow of construction workers	—
	Water Availability	—	- Limitation of water usage in command area of the South Main Canal during rehabilitation work of canals	—
Pollution	Air Pollution	—	- Air pollution caused by emission gas	—
	Water Pollution	—	—	- Acceleration of nutrient load or chemical contamination in drain water by increase of farm inputs usage
	Noise and Vibration	—	- Noise and vibration caused by construction vehicle and heavy equipment	—

Taking into consideration of these anticipated impacts, scoping area to be examined was determined as shown below.



Scoping Area to be examined

(3) Consideration of Environmental/Social Impacts and Mitigation Measures

The results of examination toward each extracted conditions and proposed mitigation measures are shown below.

Land Acquisition (Designing Phase)

Activity	Construction of irrigation and drainage canals
Affected Area	Total 10.0ha in the Project Area

Projected Impact	<p>Required area for land acquisition that would be caused by expansion of existing canals and new construction of irrigation and drainage canals was preliminary estimated as shown below. Most land to be acquired is currently used as agricultural land.</p> <p style="text-align: center;">Preliminary Estimation of Land Acquisition under the Project</p> <table border="1" data-bbox="539 320 1394 421"> <thead> <tr> <th rowspan="2"></th> <th colspan="3">Irrigation Canals</th> <th colspan="4">Drainage Canals</th> <th rowspan="2">Total</th> </tr> <tr> <th>Secondary</th> <th>Tertiary</th> <th>Total</th> <th>Main</th> <th>Secondary</th> <th>Tertiary</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Area (ha)</td> <td>0.81</td> <td>3.43</td> <td>4.24</td> <td>0.12</td> <td>2.51</td> <td>3.13</td> <td>5.76</td> <td>10.0</td> </tr> </tbody> </table> <p>As for land tenure, more than 90% of farmers have their own irrigated land according to SEILA Data Base 2005, though there are no available data about tenure farming in the Project Area. At this moment, land users who will be acquired by the project are not identified.</p> <p>Under the rules of Cambodia, land acquisition for irrigation and drainage canals of main and secondary levels are to be managed by the Government, while tertiary level canals are to be the responsibility of the local community. This means that the Government will compensate the owners for land required for main and secondary canals, but not land for tertiary canals. Based on the proposed plan, 3.44ha will be required for main and secondary canals, and 6.56ha for tertiary canals that will be managed by the local community, all as shown below. A total of 20, out of the 22 tertiary blocks in the Project Area will require land for new tertiary canals.</p> <p style="text-align: center;">Responsible Organization for Land Acquisition</p> <table border="1" data-bbox="555 835 1378 902"> <thead> <tr> <th></th> <th>Government</th> <th>Local Community</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Area (ha)</td> <td>3.44</td> <td>6.56</td> <td>10.0</td> </tr> </tbody> </table>			Irrigation Canals			Drainage Canals				Total	Secondary	Tertiary	Total	Main	Secondary	Tertiary	Total	Area (ha)	0.81	3.43	4.24	0.12	2.51	3.13	5.76	10.0		Government	Local Community	Total	Area (ha)	3.44	6.56	10.0
	Irrigation Canals			Drainage Canals				Total																											
	Secondary	Tertiary	Total	Main	Secondary	Tertiary	Total																												
Area (ha)	0.81	3.43	4.24	0.12	2.51	3.13	5.76	10.0																											
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Area (ha)	3.44	6.56	10.0																																
Mitigation Measures	<p><u>Land acquisition for main/secondary canals</u></p> <ul style="list-style-type: none"> - To design canals in order to minimize land acquisition as much as possible through detailed investigation. - To cooperate with the Inter-ministerial Resettlement Committee (IRC) and adequately identify and evaluate the property and owners affected by the Project. - To conduct stage wise discussions with local people on i) canal layout design, ii) compensation measures, and iii) support programs, in order to obtain consensus of the affected people. - To compensate and support land users (tenant farmers) and land owner who will lose cultivation fields 	<p><u>Land acquisition for tertiary canals</u></p> <ul style="list-style-type: none"> - To design canals in order to minimize total area of land acquisition and individual burdens as much as possible through detailed investigation. - To cooperate with local communities such as the commune councils and village chiefs - To establish an appropriate implementation method for land acquisition and compensation through a series of discussions with local communities and local people. - To consider appropriate compensation measures for the affected people 																																	
Conclusions of the Examination	<p>Considering the great sensitivity of the people, the land acquisition process should be conducted very carefully beginning in the design phase. In addition, average holding size of agricultural land is only 0.84ha per capita in the Project Area. Therefore, even in the narrow area to be acquired, it might constitute a large impact to the agricultural activities of the affected people. Especially land for tertiary canals, which will not be compensated for by the Government. As a conclusion, it can be said that this matter may have a high-risk of social problems for project implementation without paying great attention and implementing proper measures like the proposed mitigation measures.</p>																																		

Inflow of Construction Workers (Construction Phase)

Activity	<ul style="list-style-type: none"> - Rehabilitation of South Main Canal and secondary canals - Construction of irrigation canals and drainage canals
Affected Area	In and around the Project Area
Projected Impact	Due to inflow of construction workers from outside during construction phase, following impacts were anticipated; i) deterioration of sanitation condition, ii) deterioration of public security, iii) increase of risk of diseases including AIDS/HIV, iv)

	local conflict among people and workers. Construction scale is not large and duration is at most 18 months.
Mitigation Measure	<ul style="list-style-type: none"> - To improve sanitary condition of workers by proper arrangement of accommodation, installation of toilets and proper water supply - To implement education program toward workers about sanitation, security and rules/discipline of daily activities - To implement periodical patrol of workers in order to avoid both occurrence of local conflict and epidemics of diseases - To hold a series of public meetings for surrounding people in order to explain construction work and its schedule.
Conclusion of Examination	Because the people in and around the Project Area is not familiar to construction workers from other areas, great attention toward management of construction workers and construction fields are significant. However, taking into consideration of work scale, the numbers of construction workers will not be large. Therefore, serious negative impacts are not envisaged with proper implementation of mitigation measure.

Water Availability (Construction Phase)

Activity	- Rehabilitation of South Main Canal and secondary canals
Affected Area	Existing command area of South Main Canal
Projected Impact	Rehabilitation works of South Main Canal and secondary canals will stop water flow in canals in fallow period from December to March intensively. People living in command area of South Main Canal will be faced with limitation/nothing of canal water in the period. By rough estimation, around 3,000 people living in command area of South Main Canal will be affected for short of drinking water, while 12,000 people for short of water for domestic use. In addition, some rehabilitation works will be conducted in cultivation period in cases in which it is not avoidable. In these cases, agricultural activities will be limited for one phase in some areas.
Mitigation Measure	<ul style="list-style-type: none"> - To conduct construction work in fallow period intensively as much as possible. - To hold a series of public meetings when detailed construction work schedule will be planned in order to discuss the work schedule and decide it with affected people. - To consider other source of water for drinking and domestic use toward the affected people by consultation meetings with them.
Conclusion of Examination	Though impact on water availability can be minimized by implementation of ECP, at most 12,000 people will be affected to water availability by the rehabilitation work of canals in one fallow period. In addition, some areas will be limited on agricultural activities in one cultivation period, though the areas have been unclear. This will also be risk on feeling of unfairness among people. Therefore careful attention with proposed mitigation measure will be necessary.

Air Pollution (Construction Phase)

Activity	<ul style="list-style-type: none"> - Rehabilitation of South Main Canal and secondary canals - Construction of irrigation canals and drainage canals
Affected Area	In and around the Project Area
Projected Impact	Transportation of construction vehicles and transportation/operation of heavy equipment, such as dump truck, excavator, bulldozer, roller for flat and watering lorry, will exhaust emission gas including nitrogen dioxide (NO ₂) and suspended particulate matter (SPM).
Mitigation Measure	- To educate construction workers for minimizing idling of construction vehicles
Related regulation	Sub-decree on Air and Noise Control (June 10, 2000); Ambient air quality standard (CO, NO ₂ , SO ₂ , Ozone, Pb, TSP)
Conclusion of Examination	Because most of the construction works are small scale, the numbers of both heavy equipment and construction vehicle for the work will not be many. Therefore the impact to air quality will not be serious with proper management and mitigation measures.

Noise and Vibration (Construction Phase)

Activity	<ul style="list-style-type: none"> - Rehabilitation of South Main Canal and secondary canals - Construction of irrigation canals and drainage canals
Affected Area	In and around the Project Area (Mainly along the South Main Canal)
Projected Impact	During construction phase, transportation of heavy equipment will cause noise and vibration. Types of heavy equipment would be dump truck, excavator, bulldozer, roller for flat and watering lorry. On the other hand, along the South Main Canal, there are two settlement areas with several residences, while other areas are paddy fields.
Mitigation Measure	<ul style="list-style-type: none"> - To limit construction time. e.g. at daytime only - To hold public meetings to obtain consensus about the construction time with surrounding people.

Related regulation	Sub-decree on Air and Noise Control (June 10, 2000); Maximum permitted noise level in residential area is 60dB from 6am to 6pm, 50 from 6pm to 10pm and 45 from 10pm to 6am.
Conclusion of Examination	Because most of the construction works are small scale with less number of heavy equipment, the impact to noise and vibration will not be serious with proper management and mitigation measures.

Water Pollution (Operation Phase)

Activity	- Operation of the irrigation and drainage canals after rehabilitation and construction
Affected Area	In and around the Project Area, downstream of the Prek Thnot River
Projected Impact	Increased irrigation might encourage farmers to use higher levels of agrochemicals and fertilizer due to the reduction of crop risk when water is assured. In addition, Socio-Economic Survey results conducted in 2006 indicated that more than half of households want to use more fertilizer for improvement of rice productivity than now. In addition, based on the Project plan, double cropping area would increase 82 ha than current situation. Increased use of irrigation water might also result in greater amounts of water draining through irrigation systems and back into drainage canals and rivers. This might result in nutrient load or chemical contamination in water.
Mitigation Measure	<ul style="list-style-type: none"> - To conduct a support program regarding appropriate agricultural management - To introduce composting activity to the farmers - To introduce check system among the FWUC members regarding agricultural management - To monitor water quality and agricultural activities regularly.
Related regulation	Sub-decree on Water Pollution Control (April 6, 1999); Water quality standard in public water areas for bio-diversity conservation (pH, BOD, TSS, DO, Coliform, TN, TP), Water quality standard in public water areas for public health protection (DDT, Cadmium, Lead, and so on)
Conclusion of Examination	Without any countermeasure toward this anticipated impact, amount of fertilizer or agrochemicals may increase to raise a risk of nutrient load or chemical contamination in water from irrigated area. On the other hand, 27% of households use canal water for domestic in the rainy season, while 3% for drinking. Though irrigation canal and drainage canal will be separated under the Project, people may use water from drainage canal, in which water may contain higher nutrient load or chemical contamination. However, taken into consideration that the Project Area is already irrigated area, and most people in the Project Area are interested in using compost, water quality contamination may not become serious problem, when other components of the Project such as agricultural support services strengthening plan will be implemented with proposed mitigation measures.

In addition to the above, people living in the project site are concerned with issues relating to the irrigation service fee. They are worried that some people may not pay the fee and the cost for water management cannot be collected. Currently, the system of the irrigation service fee has not been functioned yet.

Under the pilot project of the Study, Ou Veang FWUC has started to collect irrigation service fee as a trail. As a result, they could improve the rate of collection of the fee spectacularly. The factors of this success were considered that i) water was properly distributed to each field, ii) the ability of FWUC was strengthened through a series of training and practice, iii) minimum of irrigation facilities which were necessary for water management were repaired and/or improved, and iv) farmers were grouped by each tertiary canal/watercourse for water management. Following the result of the pilot project, irrigation service fee would be collected accurately when the system of water supply and appropriate organization were promoted and maintained.

IIIF-2.4 Environmental Management and Monitoring Framework

Based on the environmental examination of the Project as explained above, two kinds of environmental management and monitoring plan are proposed as follows. By implementing these plans, the Project will be conducted more environmental friendly and smoothly with minimization of negative risks and impacts.

- i) Participatory Process of Land Acquisition for Tertiary Canals
- ii) Water Quality Monitoring

Brief explanations of the proposed plans are as follows.

Participatory Process of Land Acquisition for Tertiary Canals

Items	General Outline
Background	<p>As mentioned above, required land for main and secondary canal will be compensated by the Government with Inter-ministerial Resettlement Committee (IRC), of which roles are determination of entitlements, land values and appropriate compensations through detailed surveys and public consultations. On the other hand, land acquisition for tertiary canals will be responsible by the local community. It means that the Government will not compensate the land for tertiary canals.</p> <p>It was preliminary estimated in the proposed plan that around 7 ha of agricultural land will be required for the tertiary canals. These lands to be acquired are spread over 20 tertiary blocks, out of 22 tertiary blocks in total in the Project Area.</p> <p>Land acquisition for tertiary canals should be conducted very carefully in the beginning, because i) land acquisition is very sensitive issues, and ii) there is no official process of land acquisition and compensation by the government for tertiary level. It can be said that this matter is anticipated as a high-risk of social problem for project implementation.</p>
Objective	- To conduct land acquisition for tertiary canals properly and smoothly with people's consensus.
Proposed activity	<p>Since land acquisition should be responsible by the Government, the Government needs to develop proper process for land acquisition. One of the conceivable process is as follows;</p> <p>i) Establishment of Implementation Structure</p> <ul style="list-style-type: none"> - Joint committee; Joint committee as decision making body will implement land acquisition process, consisting of executing agencies (PDOWRAM, PDA), related agencies (Provincial Department of Land Management, Urban Planning and Construction (PDLMUPC), etc) and local communities (Commune Council, village representatives, FWUC leaders, etc) - Advisory group; Advisory group as independent body will consult implementation process with identification of validity of the process, consisting of experts, consultants and/or NGOs. - Local meetings; Local meetings will be called by Joint committee to discuss with related farmers by each tertiary block. At the local meetings, explanation by Joint committee, discussion among related people, and obtainment of people's consensus will be mainly conducted. <div style="text-align: center;"> <pre> graph TD AG[Advisory Group - Expert - Consultant - NGO, etc] -- Consultation --> JC[Joint Committee] subgraph JC [Joint Committee] EA[Executing Agency MOWRAM/MAFF PDOWRAM/PDA] RA[Related Agency PDLMUPC, etc] end JC --- PA[Project Area - Commune Council - Village Chief - FWUC] JC --- LM[Local Meetings Discussion, Consensus] LM --- TB1[Tertiary block - Farmers] LM --- TB2[Tertiary block - Farmers] LM --- IDM[Implementation Decision making] </pre> </div> <p>ii) Consideration of implementation process</p> <p>As a first step, implementation process for land acquisition for tertiary canals will be discussed including land compensation at Joint committee and next at local meetings. It is necessary to decide the process with people's consensus before practical implementation.</p> <p>iii) Discussion on canal layout</p> <p>After implementation process would be decided, layout of irrigation and drainage canals will be discussed at Joint committee and next at local meetings. Because a line of drainage canal might be crossed over several tertiary blocks, joint meetings among relevant tertiary blocks should be conducted as need arises.</p> <p>iv) Identification of the affected people, implementation of household inventory survey</p> <p>The affected people will be identified based on the developed tertiary canal layout. Targeted on the affected people, household inventory survey will be conducted to collect socio- economic data, their opinion, impacts by land acquisition, and demand related to land acquisition and so on. These activities also should be cooperated by Advisory group.</p> <p>v) Implementation by proposed process</p> <p>Based on the developed implementation process and results of household inventory survey, Joint committee will implement land acquisition and its compensation to the affected people. In the process, Joint committee should prepare documents for the record and open related information to local people and Advisory group.</p> <p>vi) Land acquisition with monitoring</p> <p>When land acquisition will be conducted, Advisory group will monitor the process to check its implementation and the affected people's condition. When problem arises, Advisory group should request Joint committee in order to consider countermeasures to solve it.</p>
Anticipated issue	<p>Though land acquisition for tertiary canal plan were proposed as mentioned above, there are still anticipated concerns as follows;</p> <p>a) Small holding size of farmers</p> <p>In the Project Area, the average holding size of agricultural land is only 0.84ha per capita and the land to be acquired to accommodate the width of the irrigation and drainage canals is about 6 m and 3.5 m respectively. For farmers holding small parcels, losing this amount of land would have a significant impact on their agricultural activities. Therefore, it is necessary to argue on canal layout and compensation method thoroughly with concerned communities. It is</p>

Items	General Outline
	<p>important to give careful consideration to farmers who own small size of land. Under the pilot project of the Study, for example, almost all farmers who had lands to be acquired for construction of watercourses accepted to contribute their land, if they would obtain water whenever they want for agricultural activities.</p> <p>b) Decision of drainage canal layout Land acquisition for drainage canals might be more difficult than that of irrigation canals, because it is normally difficult for the farmers to understand their necessity. In addition, drainage canals would cross several tertiary blocks based on the proposed layout. Therefore, discussions on drainage canal layout may face difficulty in obtaining the people's consensus. When they discuss this matter, it will be needed to discuss compensation method in parallel for main and secondary drains.</p> <p>c) Decision of compensation method In Cambodia, there are still a few experiences related to land acquisition for tertiary canals with compensation by the community, because of low density of existing canals or utilization of old canals, supposedly. Taken into consideration of these examples, several methods of compensation by the community can be considerable, though there might be merits and demerits to each method. One example is that acquired area will be shared by the community. It means that every farmer in a tertiary block contribute their own land at an equal ratio of existing area. This will require land rearrangement. Another way is that farmer will compensate to the affected people by paying money, though it depends on people's economic condition. Or in case that there is public land near their lands, the affected people could be compensated by the public land instead. Eventually the compensation method will be chosen by each community, but important point is that compensation method should be considered by community and decided with people's consensus.</p> <p>d) Forced contribution without consensus of the affected people It is anticipated that the affected people might have to accept to contribute the land for canal without any compensation because of the pressure of their surrounding. In order to avoid the situation, Advisory group should consult land acquisition process and support the affected people.</p> <p>e) Necessity of enough time for the process It might take time to conduct land acquisition process with people's consensus. In addition it requires a series of discussion among the stakeholders and the affected people. Therefore it can be said that it is better to undertake the process in the beginning phase of the Project.</p>

Water Quality Monitoring

Items	General Outline
Background	After irrigation and drainage canals will be operated, nutrient load or chemical contamination may increase in water from irrigated areas because of increase of agrochemicals and fertilizer to be used in the fields or increase of irrigation water use as a whole. In addition, people are taking canal water for both drinking and domestic use. Therefore, there are some risk for water pollution and eventually risk for human-health hazard.
Objective	<ul style="list-style-type: none"> - To monitor water quality from irrigated area - To monitor primary factors that would directly present a human-health hazard by water pollution
Items to be surveyed	<ul style="list-style-type: none"> - Temperature of air/water, flow rate, color, odor, appearance - Physico-chemical properties (pH, EC, TSS, BOD, DO) - Organo-chemical substances (N, P) - Micro-organisms (bacteria, coliform group) - Inorganic ions (Na, Mn, Fe, Zn, Cu, Cl)
Sampling points	Water quality should be monitored at six points such as i) drain ditches from irrigation area (2 points), ii) Ponds within the irrigation area (2 points), iii) wells within the irrigation area (1 point), and iv) downstream of the Prek Thnot River (1 point)
Frequency	Twice a year ; rainy season and dry season
Monitoring period	20 years after operation
Evaluation	Monitored values should be evaluated with reference to the related standards (WHO standard for drinking water, RGC water quality standard in public water areas). If a serious problem is recognized, proper countermeasures should be developed and implemented.
Executing Agency	PDOWRAM Kampong Spue Province

IIIF-2.5 Comparative Evaluation of the Project

(1) Examination of the Condition without the Project

The following table shows supposed condition under the "Without the Project" case

compared with the “with the Project” case. It was assumed that structures of South Main Canal will be out of order and fail to operate properly in near future in the “without the Project” condition.

Condition without Project and with the Project Case

Item	Without the Project	With the Project
Water Availability	- Spill of useless water from canals (main, secondary and tertiary) - Increase of regional and seasonal gap of water availability	- Expansion of command area of South Main Canal - Increase of water availability in command area of South Main Canal
Agriculture	- Decrease of agricultural productivity in command area of South Main Canal because of improper management of water and paddy field - Scaling down of paddy field in command area of South Main Canal because of no rehabilitation/expansion of canals	- Increase of agricultural productivity in command area of South Main Canal because of proper management of water and paddy field - Expansion of paddy field in command area of South Main Canal because of rehabilitation/expansion of canals
Society	- Increase of risk for local conflict because of regional gap of water availability	- Land acquisition caused by the Project - Proper management of water resource and fields through strengthening of FWUC.

The following table shows the comparison of potential impacts between with and without the Project.

As a result of comparison, it is expected that the improvement Plan will arise or increase positive impacts related to water usage, agricultural activities local society and land use condition. On the contrary, under “without the Project” condition, water availability of canals might decline than current condition and local economy and their lives will be negatively impacted accordingly.

Comparison between With and Without the Project

Potential Impact	Activity	Without Project	With Project	Remarks
Social Environment				
1	Involuntary Resettlement	*	*	
2	Local economy (employment, livelihood etc)	--/B	++/C	Limitation of agriculture and fishery because of worsening of water availability, improper management of land (w/o)
3	Land use and utilization of local resources	--/C	=/C	Wasteful of water (w/o), Land acquisition (w/)
4	Social institutions	--/B	++/C	Failure of FWUC (w/o)
5	Existing social infrastructures and services	--/B	++/C	No rehabilitation of canals and structures (w/o)
6	The poor, indigenous and ethnic people	--/C	*	
7	Misdistribution of benefit and damage	--/C	*	Misdistribution of water (w/o)
8	Cultural heritage	*	*	
9	Local conflict of interests	--/B	--/C	Land acquisition (w/)
10	Water Usage	--/B	++/B	Regional and seasonal gap of water availability because of no improvement of canal structures (w/o)
11	Sanitation	*	*	
12	Hazards (Risk), Infectious diseases	--/C	=/C	No drain system (w/o)
Natural Environment				
13	Topography and Geographical features	*	*	
14	Soil Erosion	*	*	
15	Groundwater	--/B	*	Reliance on groundwater (w/o)
16	Hydrological Situation (Hydraulic)	=/B	=/B	
17	Flora, Fauna and Biodiversity	*	=/C	
18	Meteorology	*	*	

Potential Impact	Activity	Without Project	With Project	Remarks
19	Landscape	*	*	
20	Global Warming	*	*	
Pollution				
21	Air Pollution	*	--/C	Construction work (w/)
22	Water Pollution	--/C	--/C	Overloaded of agricultural input because of limitation of agricultural practice (w/o), Construction work (w/)
23	Soil Contamination	*	*	
24	Waste	*	*	
25	Noise and Vibration	*	--/C	Construction work (w/)
26	Ground Subsidence	--/B	*	Reliance on groundwater (w/o)
27	Offensive Odor	*	*	
28	Bottom sediment	*	*	
29	Accidents	*	--/C	Construction work (w/)

Note) --/B: left-hand side of each cell represents a direction of impact, right-hand side represents a magnitude of impact. ++: Positive impact, --: Negative Impact, =: Neutral Impact, A: relatively significant impact, B: relatively medium-size impact, C: relative small impact, *: No impact or no corresponding impact, w/: with the Project, w/o: without the project

(2) Examination of the Condition without Environmental Considerations

In the process of formation of improvement plan, a series of environmental considerations were conducted in order to develop the Project environmental friendly and sustainably as mentioned in Section III-2.6. In order to examine effectively and validity of the Project component from a viewpoint of environment, these environmental considerations were evaluated by comparing condition “with environmental considerations” with condition “without environmental considerations”. Project components in the case of “without environmental considerations” are shown below.

Project Component Without Environmental Considerations

Items	Project Component Without Environmental Considerations
A) Water Availability during Construction Phase	Rehabilitation work of South Main Canals and secondary canals will be conducted in the rainy season without any consideration of water usage.
B) Lining Method of Canals	Lining of approach channels will be rehabilitated by concrete without earth and block sodding.
C) Air Pollution by Transportation of Construction Vehicle	Water sprinkling toward the dust by running of construction vehicle will not be conducted.

The following table shows the comparison of potential impacts between with and without environmental considerations. Main difference of impact between them is water availability that will cause relatively significant impacts to people’s life and agricultural activity directly. In addition, earth lining of canals will mitigate impact to aquatic-biodiversity, though proper management of canals is necessary in order to keep using canals appropriately. As a conclusion, it is clear that these considerations might be effective and valid to local people directly and natural environment.

Potential Impact with and without Environmental Considerations

Potential Impacts	Without Considerations	With Considerations
<i>A) Water Availability during Construction Phase</i>		
Water availability during construction phase	People living in command area of South Main Canal cannot access to canal water in cultivation period because of stop of water flow in the canals during rehabilitation work of South Canals.	People living in command area of South Main Canal will be limited to canal water in fallow period.
Local economy during construction phase	Agricultural activities in command area of South Canals (in total around 10,000ha) will be limited during cultivation time once.	Few/no impact to agricultural activities by construction work

Potential Impacts	Without Considerations	With Considerations
<i>B) Lining Method of Canals</i>		
Water pollution during construction phase	Alkalified water caused by the concrete works during construction phase will affect negatively on the biodiversity. People using canal water for drinking will be also affected in any way by alkalified water.	Murky water will increase in canals during construction phase. However the impact will not be serious to biodiversity.
Impact to biodiversity during operation phase	Biodiversity will be in risk of damaging by artificial surface of the canals.	Impact will be negligible during operation phase.
Breakdown of the canal during operation phase	Few impact	Canal is at slight risk of land sliding and breakdown of the embankment.
Disruption of water flow by grasses	No impact	Without any management of canals by farmers, water flow will be disrupted or stopped.
<i>C) Air Pollution by Transportation of Construction Vehicle</i>		
Air pollution by dust during construction phase	The dust will be spread especially in the dry season. People living along the road which is transported by construction vehicle will be affected by the dust.	Little dust will be spread if any.

IIIF-2.6 Conclusion of the Examination

Initial environmental examination of the Project concludes as follows;

- As a whole, the Project Plan was evaluated to be acceptable from an environmental viewpoint, if proper mitigation measures presented previously are undertaken.
- Some of likely negative impacts on both social and natural environment were pointed out such as limitation of water availability during construction phase and deterioration of water quality after operation. Therefore, proper management with proposed mitigation measures and management/monitoring plan should be implemented in order to avoid/mitigate anticipated negative impacts as much as possible.
- Considering of great sensitivity, land acquisition process should be conducted very carefully with proper management and implementation of proposed mitigation measures and management plan.

Chapter IIIF-3 Summary of the Activities and Recommendation

(1) Capacity Development Activities

Continuously from Phase I of the Study, capacity development activities were conducted through a series of workshops for environmental counterpart of MOWRAM and MAFF in the first half of Phase II. Main objectives of the activities in this phase were to practice initial environmental examination toward Feasibility Study Projects so as to manage and supervise an environmental impact assessment study as executing agency in future.

The target staff of MAFF, who are belonging to EIA Office, has started to join several activities related to environment, i.e. review of EIA report of hydropower, since the activities of Phase I. However, there are still few active role of EIA Office in MAFF. On the other hand, the target staff of MOWRAM has not worked any activities related to environment because of other heavy duty.

In the first half of Phase II, total three times of workshops were conducted with active participation by them. Under the workshops, field exploration in and around the Project Area, environmental scoping and initial examination of the anticipated negative impact toward the two Projects were practically implemented.



(2) Interim Results and Recommendation

Through capacity development activities in Phase I and first half of Phase II, basic idea of environmental impact assessment and framework/procedure of EIA study were transferred to the counterparts through practical examinations.

In practical examination of the environmental impacts, it reveals that counterparts could consider social environmental impacts well such as problems of limitation of accessibility and water usage during construction phase. On the other hand, it was difficult for them to understand technical issues related to physical environment and its proper management method such as water pollution by concrete works and its countermeasures.

In fact, MOWRAM (PDOWRAM) and MAFF (PDA), as executing agencies, should conduct environmental management and monitoring activities properly, when the projects of M/P including the Projects of F/S will be implemented. In the projects of F/S, several management and monitoring plans were proposed to be undertaken by the executing agency during construction and operation phases.

This signified that it seems essential for them to acquire i) basic knowledge of causes and mechanisms of the environmental issues related to water resource management and agricultural practice, and ii) proper management method related to environment in their fields. Therefore, it is expected that basic environmental management ideas related to water resource management and agricultural practices should be transferred to the both staff of ministerial level and provincial level.