

CHAPTER D3 CONCEPT AND STRATEGY TO IRRIGATION AND DRAINAGE DEVELOPMENT

D3.1 Problem Analysis and Needs of Irrigation and Drainage Development

D3.1.1 Problem Analysis

In the previous chapters, present conditions of four River Basins are explained including their constraints and potentials backed by relevant political and legal framework of the irrigation sector, field investigation and quantitative resource assessment. On the basis of those outputs, this section analyzes constraints of irrigation development to find out those co-relations, which support pinpointing needs of irrigation development as well as preparing development approach in four River Basins.

The purpose of irrigation and drainage is, first and foremost, to utilize available resources under irrigation systems in effective, sustainable and equitable manner. As discussed and assessed in Chapter 5, resource of irrigation consists of three aspects: water, land and human. Considering such fundamental purpose of irrigation as well as findings in the course of the Study, core problem in the irrigation and drainage in four River Basins can be defined as, "Available resources are not utilized in effective, sustainable and equitable manner." Through digging out exercises, this core problem is caused by three primary categories of issues: ineffective water resources utilization; ineffective land resources utilization and; ineffective human resources utilization, followed by various sub-issues as listed below and illustrated afterward. In addition, problem tree in details are attached in Figure D3.1-1.

WR: Water Resources are not effectively utilized.

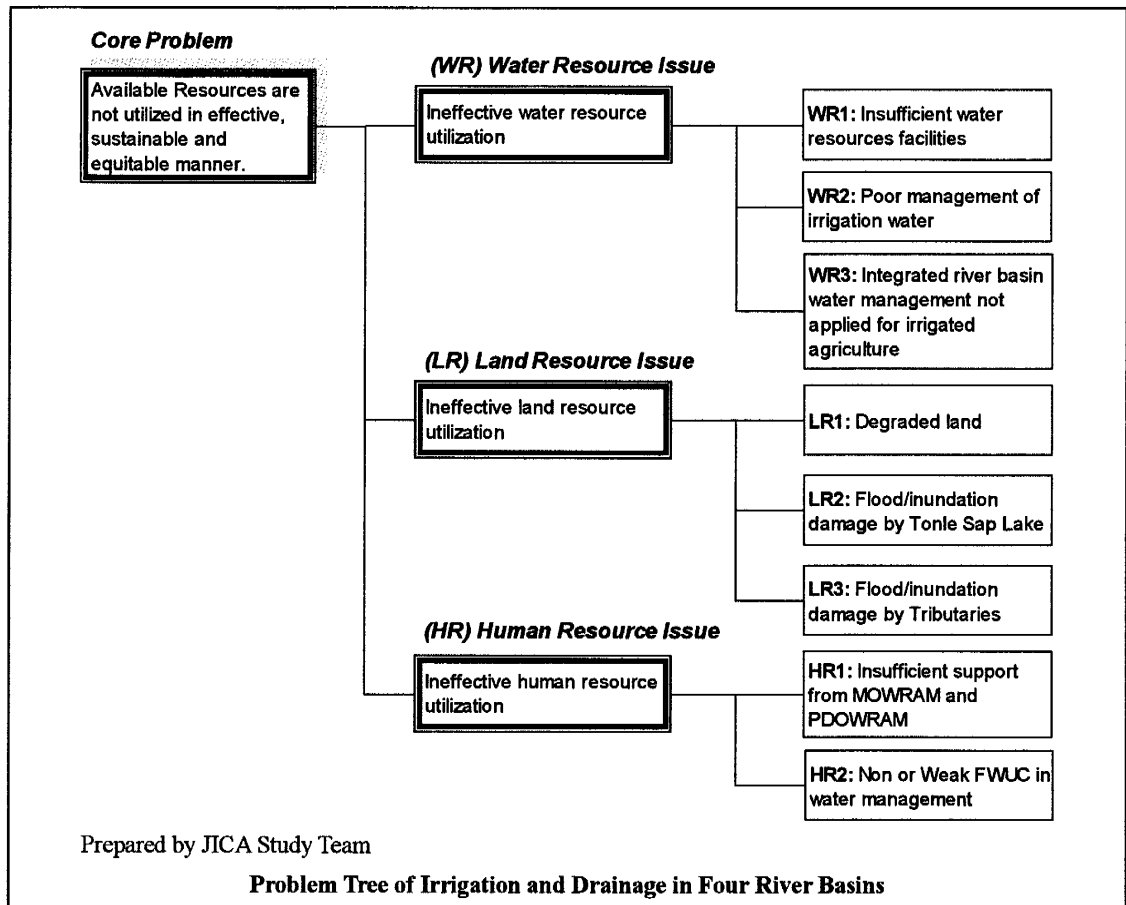
- WR1 Water resource facilities are insufficient.
- WR2 Irrigation water management remains low level.
- WR3 Integrated river basin water management is not applied for irrigated agriculture.

LR: Land Resources are not effectively utilized.

- LR1 Land and soil degradation have been making farmland unproductive
- LR2 Land are affected and/or damaged by flood/inundation by Tonle Sap Lake
- LR3 Land are Land are affected and/or damaged by flood/inundation by Tributaries.

HR: Human Resources are not effectively utilized.

- HR1 Support form MOWRAM and PDOWRAM is insufficient in order to revitalize irrigation systems.
- HR2 FWUCs are not established or still weak to carry out O&M of irrigation facilities and water management at tertiary level.



Those problems are surely associated with various factors including physical, organizational, budget, capability, human behavior and so forth. In addition, three resources, water, land and human are not solely independent issues as shown in Figure D3.1-1. Rather, they are closely correlated. Therefore, in order to improve and develop irrigation and drainage in four River Basins, it is required to take holistic approach to tackle those written problems listed and illustrated above.

D3.1.2 Needs of Irrigation Development

(1) Effective Water Resource Utilization

The considerable issue to effectively carry out water resource utilization is to improve functionality of existing irrigation systems significantly deteriorated at present. Since rainfed cultivation is prevailing under malfunctioned facilities in four River Basins, the rice production remains low, 1.5 t/ha by transplanting, 1.0 t/ha by direct sowing. As shown in SEILA database 2005, in the River Basins, only 9.3 % of farmers have field with water provided by irrigation facilities, therefore, they are threatened by unstable agricultural production due to erratic and unreliable rainfall. There is not shadow of doubt that, in order to improve this undesirable situation as well as to utilize existing water resources, rainfall and river discharge, rehabilitation of irrigation facilities is essential.

(2) Effective Land Resource Utilization

As discussed in the previous Chapter, a great deal of land is affected by flood both from the

Tonle Sap Lake and its tributaries. Flooding is the constraints to hinder effective land resource utilization by eroding fertile soils as well as damaging crops under holding inundation. On the other hand, this phenomenon is invaluable resources since it conveys water resources and fertilized soils as land resources. In the framework of irrigation and drainage development in four River Basins, it is really necessary to consider how to utilize flood area effectively such as irrigation systems efficaciously catch up and store receding water for farming. Recently, on the other hand, many systems suffer from inundation due to poor drainage including the systems in four River Basins. Irrigation rehabilitation is essential to improve drainage so that land can be productive under well-drained condition, which also contributes to the creation of enabling environment for crop diversification.

(3) Effective Human Resource Utilization

Effective water and land resources utilization requires effective human resource utilization. Under the irrigation systems, MOWRAM and PDOWRAM staffs shall be responsible for construction and management of main and secondary level facilities as well as provision of technical support to Farmers. On the other hand, it is essential for Farmers Water Users community (FWUC) to be in charge of O&M of tertiary level facilities and water management.

Problem analysis in section D3.1.1 clearly shows that many issues are concerned with human resources such as “insufficient number of staff,” “insufficient training” and so on. Institutional strengthening and development particularly consisting of MOWRAM, PDOWRAM and FWUCs strengthening, through water and land resource development project, is prerequisite to enhance achievement and sustainability of irrigation and drainage in four River Basins.

(4) Contribution to Stable Food Supply and Poverty Alleviation

Self-sufficiency of rice production was achieved in 1995, therefore, in the next step, food security maintenance is one of the most important commitment by the Government. Effective resource utilization through irrigation and drainage development in the four River Basins is of great significance toward this matter. Of reviewing previous food production performance, four River Basins shall be demanded to continuously play an important role of engine, as a granary of the country, for food supply in the future. In addition, as well as maintenance of self-sufficiency, quality improvement of agricultural products is supported greatly by timely water supply through appropriate irrigation facilities.

The agriculture is a main pillar of industry in rural areas of four River Basins. In particular, rice production is the main source of income for the community. Stabilization and/or increase of production contribute to the increase of farmers’ income thereby conducting the alleviation of poverty in rural areas, which is also one of the Government policy as elaborated in the National Poverty Reduction Strategy (NPRS). Currently, urban and rural poverty headcount ratio is 28.21 % and 45.38 % respectively in the Tonle Sap Zone.¹ Irrigation and drainage development will raise rural income to bridge the gap through improving rural livelihood and minimizing vulnerability.

¹ Ministry of Planning (2006), A Poverty Profile of Cambodia 2004

D3.2 Development Objectives and Strategies for Irrigation and Drainage

D3.2.1 Rehabilitation and Development of Water Resources Infrastructures

In order to realize the project objectives, the following basic strategies for Irrigation and drainage are envisaged.

- 1) First priority should be given to complete water supply for wet season paddy in the existing irrigation area.
- 2) Existing canals should be utilized to maximum extent.
- 3) Rehabilitation and construction plan of irrigation systems should be formulated within the limitation of existing water resources.
- 4) Weirs should be constructed for major river irrigation systems.
- 5) Additional irrigation and drainage canals should be constructed to supply irrigation water equitably and timely, and to drain out excessive water in the fields.
- 6) Reservoir and pond irrigation system for water harvesting should be rehabilitated.

(1) Complete water supply to wet season paddy in the existing irrigation area.

The proposed project aims to supply stable water to existing irrigation area. Under the project design, the project should guarantee the wet season paddy production in a drought year that may occur once per five years.

Surplus water taken from a river in a flood period should be utilized for supplemental irrigation in adjacent agricultural land through canals in project area. Therefore, canals in the project with potential irrigation system in adjacent area should have sufficient capacity for supplemental water supply.

(2) Utilization of existing canals

Most of canals constructed in the late 1970's have been unused because of serious deterioration and incompleteness of system development.

Some canals have technical difficulties in gravity irrigation. However, utilization of these existing irrigation canals would have the following advantages.

- To minimize land acquisition cost and

It is said that negotiation with farmers about land acquisition is extremely difficult. For the early implementation of the project, land acquisition should be minimized.

- To save construction cost of canal system
- Not to lose historical peoples' effort
- To utilize various functions of canals such as storage and water harvesting

The January 7 canal acts could be utilized as a collector canal. The canal could supply water to pond irrigation systems located in the downstream area by collecting water from

small streams in the foot of mountains. New structures such as water control gates and level crossing could recover the unction.

Canals, which constructed in grid pattern within an irrigation system, act as small storage pond for a portable pump irrigation method at present. Some of these canals would be utilized in the system making minor modification.

(3) Utilization of existing water resources

River water levels in the target basins fluctuate largely in wet season. These fluctuations make effective water use difficult. Development of water resources would be necessary for effective use of limited water resources in each river basin. However, large scale water resources development is not recommendable at present due to lack of reliable hydrological data observed over a long period. Without sufficient data, impacts on residents, environments and ecological system in the river basin would not be evaluated adequately.

Therefore, this Master Plan Study should formulate rehabilitation and development plans of irrigation and drainage within the existing available water resources.

(4) Construction of weir for river irrigation system

A weir is a key structure for river irrigation system. Although MOWRAM constructed recently two weirs, namely the Damnak Ampil weir in the Prusat River and the Pok Pen weir in the Svay Chek River of the Boribo river basin, development of river water resources has been limited in the study area.

In this context, construction of weirs at suitable locations should be constructed to utilize river water resources effectively.

(5) Construction of additional canals and structures

One of the fundamental reasons for no functioning of existing systems would be lack of the numbers of canals and canal related structures. In addition to rehabilitation of existing irrigation canals, additional canals especially at secondary and tertiary levels should be constructed.

Drainage canals should be also constructed as recommended by the design manual of MOWRAM. Drainage canals would increase productivity of the paddy field and decrease damages by floods.

Analysis of existing irrigation systems indicates that required irrigation canal density for full function would be 35 m/ha. Drainage canals would be also necessary with the density of 15 m/ha.

(6) Rehabilitation of reservoir and pond irrigation systems for water harvesting

Reservoir and pond irrigation systems have two major functions of the supplemental irrigation water supply in wet season and the daily water supply to residents in dry season.

Reservoirs and ponds constructed in the past have no spillway to drain out floodwater coming from upstream area. For this reason of no spillway, floodwater overtopped dykes of reservoirs and ponds, and damaged the reservoir and ponds seriously. In addition, many intake structures

are seriously damaged, and gates are not functioning.

Reservoir and pond irrigation systems should be rehabilitated in conformity with the fundamental principles stipulated in the national water resources policy.

D3.2.2 Formation and Strengthen of Farmer Water User Community (FWUC) and O&M

In conformity with the government policy, FWUC should be established for operation and maintenance (O&M) of irrigation facilities.

(1) Problems and Constraints Concerning FWUC

Socio-economic survey conducted by the Study team and existing carious survey results identified. The followings summarized the major problems and constraints related to operation and maintenance of irrigation facilities.

- Lack of awareness of FWUC's role and activity

The socio-economic survey shows that awareness ration is limited to 70% of FWUC members and 8 % of households interviewed by survey team.

- Insufficient water supply

According to the socio-economic survey, 90 % of households depend on only rainfall for paddy cultivation, and canal system irrigates only 2 % of them.

- Lack of support services by the government

Some farmers pointed out the lack of technical and management supports by the government.

- Low formation ratio of FWUC

Basically, FWUCs were established in projects that the rehabilitation work were carried out. In the proposed project areas, the average formation ratio of FWUC is limited to 17%.

(2) Strategies for Formation and Strengthen of FWUC and Proper O&M

1) Arrangement of Clear Responsibilities between FWUC and Agencies Concerned

In order to increase awareness of FWUC's roles and activities, responsibilities should be made clear between FWUC and agencies concerned.

As stipulated in the "Policy for Sustainability of Operation and Maintenance Irrigation System", the Department of Irrigated Agriculture of MOWRAM shall conclude necessary agreement with the FWUC for proper utilization of irrigation facilities and related infrastructures.

In order to share a clear idea about O&M, responsibilities should be clearly mentioned at every canal and structure in the agreement. Then the responsibilities should be transferred to each FWUC member through on-the-job trainings to be provided by the government.

2) Transfer of Water Management of Major Facilities to FWUCs at Small Scale Systems

Basically, the government should have a responsibility for the water management of major facilities such as weir, intake structure and main canal. Moreover, secondary, tertiary canals

and water course should be managed by FWUC. However, for example, in some small scale irrigation system, intake structure and main canal are as small as those of tertiary canal in size. In this case, entire water management should be transferred to FWUC.

The boundary of O&M transfer is not always clear.

According to the latest information, MOWRAM is preparing a guideline or a regulation about transfer of responsibilities for operation and management of irrigation facilities. Therefore, arrangement of responsibilities should be made based on the new guideline or regulation.

3) Involvement of Village chief and Village Development Committee (VDC)

In the previously mentioned government policy, the Farmer Organizer (FO) shall be selected from an irrigation block/area for formation of FWUC.

According to the various study results, the organizers need to be selected among village chief and VDC members, who were selected by villagers, for smooth formation of FWUC. Moreover, village chief and VDC would play an important role for spreading knowledge about roles and activities of FWUC among water users.

In addition to FWUC, village leader and VDC would need to be involved from the planning stage of the project for smooth implementation of the proposed project.

4) Preparation of comprehensive O&M training program

Water management has close relationship with the agricultural extension services. In this context, training program for water management should be prepared together with the agricultural support program. In addition, sufficient duration of training would be necessary to develop the capacity of water users. In the project plan, three years' training is envisaged.

5) Promotion of Participatory Irrigation Management and Development (PIMD)

The government intends to *“adopt PIMD to encourage farmers to take over responsibility for managing their own irrigation systems and to better make use of limited government and donor resources.”* Training programs for O&M of the project should be prepared based on the PIMD concept and manuals.

6) Participation of Farmer Water User Group (FWUG) at construction stage

As a step of adopting PIMD, FWUG should construct water courses under the technical support of PDOWRAM and MOWRAM. This activity should be made under the mutual understanding through workshops including village chief and VDC members.

D3.2.3 Drainage Improvement Plan

(1) **Development Concept**

The development concept for drainage improvement is worked out as follows:

- (a) Main crop in the Target Area is paddy, and drainage from paddy field is a main target of the drainage development plan.
- (b) Small streams are to be utilized for drains as much as possible to minimize construction cost.

(c) The most of irrigation area is water scarce area. An extensive drainage improvement is planned in general. A drain was planned to drain from a tertiary block.

(2) Allowable Flooding Depth, Allowable Inundation Period

Paddy suffers a serious loss if it is submerged at booting stage by flood. The booting stage will start at about 6 days before flowering (heading) which occurs 30 days before harvesting (refer to Table D2.3-1). The height of paddy stem is generally more than 30 cm at the booting stage. The allowable maximum flooding depth and allowable inundation period in the paddy field is planned to be 300 mm and 3 days respectively by making reference with the study by Ministry of Agriculture, Forestry and Fishery of Japan.

(3) Design Rainfall and Drainage Water Requirement

A probable rainfall with a 1/5 to 1/10 year return period is applied for planning of drainage system in the paddy field. An annual maximum 3 consecutive days rainfall are analyzed as described in section 4.1.3.3. The unit drainage water requirement is figured out by the following equation.

$$q=0.152 \times 10,000 / (3 \times 86400) \times 1000 = 5.86$$

where, 0.152 is a probable 3 consecutive days rainfall at Battambang

q is the drainage water requirement (lit./sec/ha)

As a result of calculation, the design rainfall and drainage water requirement in four river basins are summarized in the following table.

Consecutive 3-day rainfall and Drainage Water Requirement

River basin	Consecutive 3-day rainfall in 1/5 return period (mm)	Drainage water requirement (lit./sec/ha)
Battambang	152	5.86
Moung Russey	186	7.17
Pursat	164	6.32
Kg. Chnnang	177	6.82

Prepared by JICA Study Team

(4) Drainage Canals

Drainage system is composed of field drains, tertiary, secondary, and main drains. Field drains is planned to be excavated by FWUC together with construction of quaternary irrigation canal. A density of tertiary and secondary drains is to be similar with tertiary and secondary irrigation canals. A field drain is planned to be excavated at lowest edge of the field unit which is irrigated by a field irrigation canal. A tertiary drain is planned to be excavated at lowest edge of each tertiary unit. Most of the small tributaries in the Target Area will serve as the secondary drains. However, the tributaries are to be excavated to smoothly flow the drainage water.

The excavated material for drains will be used for embankment of irrigation canal.

CHAPTER D4 PRELIMINARY DESIGN OF IRRIGATION AND DRAINAGE REHABILITATION AND IMPROVEMENT PROJECTS

D4.1 General

Existing irrigation systems are not always designed properly, and require additional canals and structures in most systems. In this preliminary design, required additional canals and structures were estimated on a basis of existing systems functioning fully.

D4.2 Irrigation System

This section mainly dealt with preliminary design of irrigation systems, such as weirs, main and secondary canals, related structures, dykes.

D4.2.1 Weir

(1) List of Weirs

According to the project formulation shown in Chapter D5, rehabilitation of weirs was planned for the following systems.

List of weir to be rehabilitated

No.	River Basin	Province Concerned	Code by JICA Inventory	Name of System	District Concerned	Type of Data
1.	Battambang	Battambang	BAN-001	Kong Hort (Bannan)	Bannan, Sang Ker, Kas Kralor	Photo 1/100,000 Map
2.		Battambang	AKP-003	Or Samrong Knong	Aek Phunum	Photo 1/100,000 Map
3.	Moung Russey	Battambang	MRS-006	Ream Kon	Moung Russey	Topo-Survey ¹⁾
4.			MRS-018	Dai Ta Chan	Moung Russey	Photo 1/100,000 Map
5.		Pursat	BAK-008	Wat Chre	Bakan	Topo-Survey ¹⁾
6.	Pursat	Pursat	PKV-004	Domnak Chhe Kram	Som Pove Meas	Photo 1/100,000 Map
7.			SPM-003	Damnak Ampil	Som Pove Meas	Document by MOWRAM ³⁾
8.	Boribo	Kg. Chhnang	BRB-001	Lum Hach	Boribo	Topo-Survey ¹⁾
9.			TKP-001	Khvet	Tuek Phos	Supple. Invent. ²⁾
10.			TKP-002	Ta Ram	Tuek Phos	Topo-Survey ¹⁾
11.			TKP-013	Trapeang Khlong	Tuek Phos	Supple. Invent. ²⁾

1) Topo-survey=Topographic Survey, by the JICA Study Team.

2) Supple. Invent. = Supplemental Inventory Survey, by the JICA Study Team.

3) Document by MOWRAM=

Source: Prepared by the JICA Study Team

(2) Preliminary Design of Weirs

In order to carry out the preliminary design of weirs, the following information was collected and utilized, as shown in “Type of Data” in the table on the previous page.

- Topographic Survey Results: River Profiles, Cross sections of river (RCS) near main canal inlet
- Inventory Survey Results: Sketch of existing or destroyed weir structures, when lack of topographic survey
- Photographs of the concerning sites and 1/100,000 Maps: for cases where the above two types of data were not collected
- Documents: Refer to “previous report(s)”, if any.

By utilizing the above information, the preliminary design of weir was carried out through the following steps:

1) Weir site along the river:

- Using the profile of a river,
Identify the location of Intake(s) or inlet(s) for Main canal(s) along the River.
Weir would be constructed at the downstream of intake(s) for Main canal(s).
- Using the profile of Main Canals
Plot elevations of the Main Canal center and the River center on each “profiles”, referring to the “cross sections” of both Main Canals (MCS), and River (RCS).

2) River bed elevation at Weir site (EL1):

- Using the profile and cross sections of a river,
Examine the river bed elevations along the rivers including the proposed weir site, upstream and downstream of the weir site to find out average gradient of river bed.
Determine the appropriate river bed elevation at the weir site based on the average gradient along the river.
- It is noted that:
Avoid confusion with elevation of “natural dam” acting like a weir, constructed by farmers.
The designed river bed elevation at a weir site should be lower than the elevation(s) of canal bed at the inlet(s) or intake(s) of Main Canal(s) to avoid sedimentation at canal inlet(s).

3) Design water level for Weir (WL):

- Using the cross sections of secondary canals (SCS),
Determine Design water level (WL) at a weir would be as follows, based on the

“Design Manual” prepared by the MOWRAM

Find and choose the highest Paddy field Elevation (EL_p) along secondary canal

A Design water level $WL = EL_p + 0.3m$

- It is noted that if the river profile showed any lower dyke elevations compared to a design WL, the dyke elevation should be heightened enough to prevent the flooding from back water of design WL.

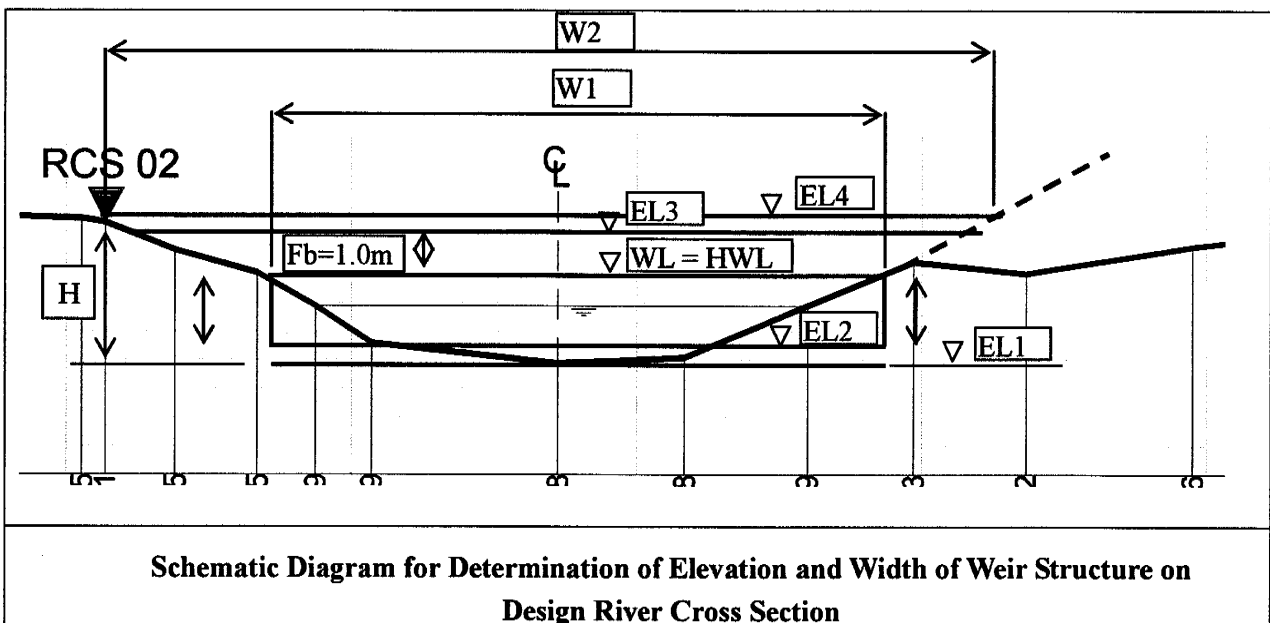
4) Design bottom elevation of Operation Bridge (Slab) of Weir, EL_3 :

- Slab bottom elevation (EL_3) for a weir would be estimated from a High Water Level (HWL) at “Design Flood discharge” and its “free board (Fb)” as follows:

$$EL_3 = HWL + Fb$$

- “Free board (Fb)” height must be 0.6m or more, desirably 1.0m.
- In case that the “Flood Discharge” or a HWL is unknown, temporarily use the design WL of the weir as HWL, with “Free board (Fb)” height of 1.0m.

$$EL_3 = HWL + Fb = WL + 1.0m$$



5) Design upper elevation of the Operation Bridge (Slab) of weir, EL_4 :

- Slab upper elevation (EL_4) for a weir would be given by structural calculation of slab thickness.
- Here, the values of slab thickness would be estimated between 0.3m and 0.5m, according to the span of the weir.
- Therefore, the slab upper elevation (EL_4) for a weir would be estimated to be:

$$EL4 = EL3 + (\text{between } 0.3\text{m and } 0.5\text{m})$$

6) Design Width of Weir, W1:

- Required cross sectional area for a river could be desirably calculated based on its Design Flood Discharge and HWL.
- However, since “Design Flood Discharge data” were not available for the concerned rivers, Design Water level was temporarily used as HWL.
- Determine the Design Weir Width (W1), using WL (=HWL) and crossing points of river banks, drawn on the River Cross Section nearest to Weir Site.

7) Design total width of Weir, W2:

- Determine the Design Total Weir Width (W2), by using EL4 and crossing points of river banks, drawn on the River Cross Section nearest to Weir Site.

8) Design Weir height:

- Determine the Design Weir height (H), by using EL3 – EL1.

$$H = EL3 - EL1$$

9) Design Gate sill elevation (EL2) and Gate height:

- Determine the Design Gate sill elevation. For rather small rivers, EL2 could be set as EL1. For the cases that EL3 – EL1 become 10m or higher, try to adjust the Gate height within 10m.
- Determine the Design Gate height, by using WL – EL2.

10) Design Total Weir Height (H):

- Determine the Design Total height, by using EL3, EL4 and EL1.

$$H = EL3 - EL1$$

$$H' = EL4 - EL1$$

11) Design Gate Width:

- Assume the piers thickness as 2.8 m, referring to dimension of the Damnak Ampil Weir, take into account for the construction of counter weight guide hole.
- Determine the Design gate width by subtracting the number of piers with 3.0m as follows

$$B = ((W1 - n \times 3.0) / (n + 1))$$

Note that the number of gate was determined to limit the gate width to be within 10m.

12) Non-Gate Type:

- For Khvet, Ta Ram, Trapeang Khlong systems, since the weir size were rather small and the number of beneficial area were also small, non-gated type weir was planned, in order to reduce the construction costs.

13) Sluice-Gate:

- In order to flush the sedimentation at the upstream apron of the weirs, Sluice gates were installed as the following manner:

Weir width \leq 20m: 1 Sluice gate on one side

Weir width $>$ 20m: 1 Sluice gates on both sides

Weir width $>$ 40m: 2 Sluice gates on both sides

Preliminary Design Result of Weirs in Proposed Systems

No.	River Basin	Code by JICA Inventory	Name of sub System	Weir Dimensions								
				Location	River bed EL1 (m)	Water Level WL (m)	Upper Slab EL4	Total Height H (m)	Width W1(m) W2(m)	Gate Sill Elev. (m)	Gate Size (B X H) and Nos	Sluice Gate Size (B X H) and Nos
1.	Battambang	BAN-001	Kong Hort (Bannan)	St.550101	4.50 (Estimated)	20.00 (h=15.5m)	21.00 21.50	16.50 (H=17.0m)	50.00 100.00	EL2= 12.0	8.9 x 8.0 N = 3	2.0 x 4.0 N=2 x 2 = 4
2.	Battambang	AKP-003	Or Samrong Knong	St.550102	1.50 (Estimated)	11.00 (h=9.5m)	12.00 12.50	10.50 (H=11.0m)	60.00 110.00	EL2= 3.6	9.0 x 7.4 N = 4	2.0 x 4.0 N=2 x 2 = 4
3.	Moung Russey	MRS-006	Ream Kon	RCS03+20m	11.40	14.40 (h=3.0m)	15.40 15.80	4.00 (H=4.4m)	26.00 43.00	EL2= 11.9	7.7 x 2.5 N = 2	2.0 x 2.5 N=1 x 2 = 2
4.	Moung Russey	MRS-018	Dai Ta Chan		N.D	EL1+2.1m	WL+1.0m EL4+0.4m	3.10 (H=3.5m)	22.00 28.00	EL1	5.7 x 2.0 N = 2	2.0 x 2.0 N=1 x 2 = 2
5.	Moung Russey	BAK-008	Wat Chre	RCS02+20m	9.50	12.40 (h=2.9m)	13.40 13.90	3.90 (H=4.4m)	22.00 28.00	EL2= 10.5	2.1 x 1.9 N = 3	2.0 x 2.0 N=1 x 2 = 2
6.	Pursat	PKV-004	Domnak Chhe Kram		N.D	EL1+2.0m	WL+1.0m EL4+0.4m	3.00 (H=3.4m)	38.00 54.00	EL1+0.5m	8.6 x 1.5 N = 4	1.2 x 2.0 N=2
7.	Pursat	SPM-003	Damnak Ampil		12.00 (concrete)	17.00 (h=5.0m)	20.00 20.50	8.00 (H=8.5m)	104.80 152.80	EL2= 13.0	10.0 x 4.0 N = 7	2.0 x 4.0 N=2 x 2 = 4
8.	Boribo	BRB-001	Lum Hach	RCS01	30.00	39.10 (h=9.1m)	40.10 40.60	10.10 (H=10.6m)	42.00 83.50	EL2= 34.0	7.2 x 5.1 N = 3	2.0 x 4.0 N=2 x 2 = 4
9.	Boribo	TKP-001	Khvet	RCS02+30m	129.00	131.10 (h=2.1m)	131.70 132.00	2.70 (H=3.0m)	15.00 21.00	EL2= 129.0 (EL2+131.1m)	- (Fixed Weir)	2.0 x 2.0 N=1
10.	Boribo	TKP-002	Ta Ram		N.D	EL1+2.2m	WL+1.0m EL4+0.3m	3.20 (H=3.5m)	15.00 21.00	EL2=EL1 (EL2+2.2m)	- (Fixed Weir)	2.0 x 2.0 N=1
11.	Boribo	TKP-013	Trapeang Khlong		N.D	EL1+2.2m	WL+1.0m EL4+0.3m	3.20 (H=3.5m)	15.00 21.00	EL2=EL1 (EL2+2.2m)	- (Fixed Weir)	2.0 x 2.5 N=1 x 2 = 2

Source: Prepared by the JICA Study Team

D4.2.2 Canals

(1) Suitable Rehabilitation Level

Analysis of Existing Data

Suitable rehabilitation level was analyzed based on the following data:

- Survey result of the JICA inventory conducted in 2006,
- Stung Chinit Irrigation and Rural Infrastructure Project, and
- Thlea Maom Irrigation Rehabilitation Project.

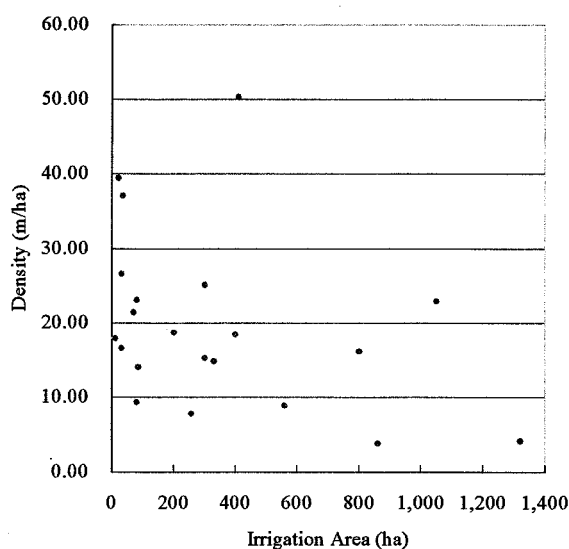
There are twenty-seven (27) irrigation systems categorized in fully functioning in the JICA inventory. Twenty-three (23) systems out of twenty-seven systems (27) have irrigation canal data.

The Stung Chinit project is believed to be one of the successful projects in Cambodia. The Thlea Maom irrigation project is the latest designed project by MOWRAM with technical assistance of Technical Service Center (TSC) supported by JICA.

As calculated in the table below, the average density of irrigation canals of twenty-three (23)

systems of JICA inventory was 35.3 m/ha.

The following Figure shows the relationship between canal density and irrigation area. In addition, there are three systems with the density of more than 80m/ha, which are not shown on the Figure. Small scale-systems are showing a tendency to have high canal density. In case that the difference in system size was taken into consideration, the average of canal density, which was calculated by dividing the total irrigation area into total length of existing canals, was revised to 16.3 m/ha.



Relationship between Canal Density and Irrigation Area

Density of Canal

	Average of 24 Systems		Stung Chinit 3000 ha		Thlea Maom 1700 ha	
	(m)	(m/ha)	(m)	(m/ha)	(m)	(m/ha)
Main Canal		30.0	No data	-	6,600	3.9
Secon. Canal		5.3	20,200	6.7	15,600	9.2
Tertiary Canal		0.0	50,000	16.7	40,000	23.5
Main Drain		0.0	0	0.0		
Secn. Drain		0.0	23,600	7.9		
Tertiary Drain		0.0	56,100	18.7		
Total of Irigation Canal		35.3		23.4		36.6
Total of Drainage Canal				26.6		
Grand Total		35.3		50.0		36.6

Canal density of the Stung Chinit project is 23.4 m/ha without the main canal. Moreover, that of the Thlea Maom project is 36.6 m/ha.

Suitable Canal Density for Irrigation Canal

Judging from the canal layouts of former mentioned projects, size of the tertiary irrigation block is 50 ha. Irrigation canal density in the case of the tertiary block size of 50ha is estimated at 35 m/ha under the following conditions:

- An interval of tertiary canal is 500m
- Average length of tertiary canal is 1,000m

Taking all above into consideration, the necessary canal density for fully functioning irrigation system is estimated as follows:

- Main Canal: 5 m/ha
- Secondary Canal: 10 m/ha
- Tertiary Canal: 20 m/ha

2) Design of Additional Irrigation Canals

Additional irrigation canals are designed based on the “Design Manual For Small and Medium Scale Irrigation System Planning” prepared by MOWRAM in 2004.

The following design values stipulated in the manual are applied to the canal design.

Roughness coefficient, Manning’s “n”

Surface condition	Manning’s “n”
Earth (Primary and Secondary canals)	0.025
Earth (Tertiary and Quaternary canals)	0.030
Concrete (and plastered masonry)	0.015
Masonry	0.020
Gabion	0.025

Side Slope

Soil Condition	Slope (V:H)		
	0.1 to 5.0 (m ³ /s)	5.0 to 10.0 (m ³ /s)	10.0 to 20.0 (m ³ /s)
Hard Clay	1 : 1.0	1 : 1.0	1 : 1.0
Medium Clay	1 : 1.0	1 : 1.25	1 : 1.5
Soft Clay	1 : 1.25	1 : 1.5	1 : 1.75
Silt	1 : 1.25	1 : 1.75	1 : 2.0
Sandy Soil	1 : 1.5	1 : 2.0	1 : 2.5
Lined	1 : 1.0	1 : 1.5	1 : 1.5

Limiting Velocity

Bed Material	Limiting Velocity (m/s)	
	No material carried in suspension	Material carried in suspension
Fine Sand	0.45	0.75
Sandy Clay	0.55	0.75
Soft Clay	0.60	0.90
Muds	0.75	1.05
Coarse Sand	0.75	1.50
Medium Clay	1.15	1.50
Gravel	1.20	1.85
Shingle	1.50	1.70
Hard Clay	1.85	1.85

Minimum Width of Top Bank

Canal Discharge	Minimum Width of Top Embankment
$Q \leq 1.0 \text{ m}^3/\text{s}$	1.0 m
$1.0 \text{ m}^3/\text{s} < Q \leq 5.0 \text{ m}^3/\text{s}$	1.5 m
$5.0 \text{ m}^3/\text{s} < Q$	2.0 m
Where embankment is light access road	4.0 m
Other roads	As required for road embankment

Freeboard

Design Case	Freeboard f_b (m)
Bank freeboard (earth canals)	
For Main Canal	0.80
For Secondary Canal	0.50
For Tertiary and Quaternary Canals	0.15
Lining freeboard (lining canals)	
For design discharge $Q < 1.5 \text{ m}^3/\text{s}$	0.15
For design discharge $Q = < 10.0 \text{ m}^3/\text{s}$	0.25
For design discharge $10.0 \text{ m}^3/\text{s} < Q$ (with flow)	0.30
For design discharge $10.0 \text{ m}^3/\text{s} < Q$ (when water is standing)	0.20
For Conveyance Structures (Section 5)	
Open channels	0.30
Inlet to conveyance and drop structures	0.30

Typical canal sections based on the design criteria and the balance of earth volume between embankment and excavation are set as follows.

Typical Canal Section of Additional Irrigation Canals

Irrigation Area (ha)	Q (m^3/s)	Bottom Width (m)	Side Slope	Canal Gradient	Water Depth (m)	Embankment (m^3)	Excavation (m^3)
50	0.10	0.6	1.00	1/1,000	0.28	1.50	1.50
50 – 150	0.30	1.0	1.00	1/2,000	0.47	2.25	2.25
150 – 500	1.01	2.0	1.25	1/2,000	0.67	2.63	2.62
500 – 1,500	3.02	3.0	1.25	1/2,000	1.08	5.52	5.52
1,500 – 2,000	4.02	3.5	1.25	1/2,500	1.17	6.29	6.29
2,000 – 2,700	5.43	4.0	1.75	1/3,000	1.29	8.19	8.19
2,700 – 3,000	6.03	4.5	1.75	1/3,000	1.30	8.62	8.62
7,000	14.07	6.0	1.75	1/4,000	1.96	8.62	8.62

D4.2.3 Irrigation Canal Related Structures

Existing irrigation systems are very limited in number of irrigation canal related structures, especially water control facilities such as a gated check and an intake. Moreover, structures constructed in the late 1970's are deteriorated seriously.

The average numbers of structure are 1.39 nos./km in a main canal, and almost no structures are constructed in a secondary canal. For the former mentioned layout plan of canals with a tertiary block size of 50 ha, at least 1 check and 1 intake structures are necessary per 1 km of a main canal, and 2 check and 2 intake structures are necessary for a secondary canal.

Necessary irrigation canal structures are:

- Intake structure at a mouth of a main canal,
- Check and intake structures for water distribution in canal system,
- Cross drainage or overchute,
- Inlet for tertiary canal,
- Culvert and bridge, and
- Terminal structure.

D4.2.4 Irrigation Pond Dyke

Technical problems of irrigation ponds were:

- Lack of safe dimension of dyke,
- Deterioration of gated-outlet structure, and
- Lack of emergency facility such as spillway.

Required menu of rehabilitation works for irrigation pond dyke are:

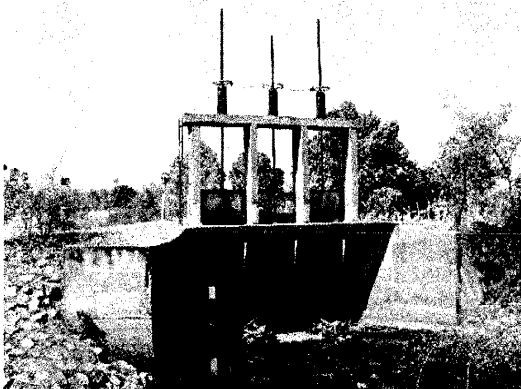
- Re-embankment of dyke with safe dimensions,
- Construction of a gated-outlet, and
- Construction of an emergency spillway and an overflow type spillway.



Existing Dyke



Rehabilitation to have safe dimension



Construction of Gated-Outlet



Construction of overflow type spillway

D4.3 Drainage Systems

D4.3.1 Drainage Canals

Only four (4) systems have drainage systems in the study area. Drainage canals are not generally constructed. The reasons may be:

- Many irrigation canals are dual-purpose ones that act as drainage canals in recession periods,
- Farmers have a tendency to keep water in their field instead of draining it because of unstable water source especially in the hilly area, and
- Farmers refuse to lose their farm-lands in most cases.

In the circumstances, it would be difficult to construct drainage canals. However, construction of proper drainage canal is necessary in order to increase paddy production. In the project plan, the following drainage canals are proposed.

Main drainage canal: 5 m/ha

Secondary drainage canal: 10 m/ha

Rehabilitation of existing natural stream as a drainage canal is proposed as much as possible.

D4.3.2 Related Structures

Necessary drainage structures are:

- Canal bank protection work at junction of large-scale canals, and
- Drop structure on steep section, if any.

For smooth drainage and cost saving, minimum numbers of structure are proposed.

CHAPTER D5 FORMATION OF IRRIGATION AND DRAINAGE DEVELOPMENT PLAN

D5.1 General

D5.1.1 Selection of Target Area

Based on the result of resource potential assessment and basic concept of the development mentioned in the previous chapters, target area of irrigation and drainage development was selected taking into consideration the following qualitative and quantitative factors.

- i) Existing and potential irrigation area reported by JICA Inventory 2006:

The existing irrigation area is given the first priority for selection as far as the subject area is not located in the marginal soil area.

- ii) Potential irrigation area by resources assessment by the Study:

The water resources is the most critical factor in the irrigation development in the four river basins as described in chapter D2. The area of irrigation development in the subject river basin, therefore, is supposed not to exceed the potential irrigation area by resources assessment including on-going and or promised project area.

The evaluation result of human resources potential is utilized evaluation of the proposed project for priority ranking.

- iii) Irrigation area under on-going and or promised project

In the four river basins, several projects are being implemented, promised, or under study. Those area should be taken into account in the study so that water resources is utilized evenly.

- iv) Possible unification of water source by geographic location

In the selection, the existing irrigation systems stand close or on the same river can be selected conjunctively and unified so that irrigation water source can be unified aiming to achieve efficient use of water resources.

- v) Characteristics of the river basin

As summarized in chapter 3, in the Battambang River and Pursat River Basins, a few medium-scale irrigation systems are dominant. On the other hand, in the Boribo River Basin, a large number of small scale have been developed although the total irrigation area of those small scale systems is not dominant.

These different feature of irrigation systems derive from different characteristics of the rivers in the basin. The target area should be selected reflecting the river characteristics in the subject river basin.

D5.1.2 Formation of Irrigation and Drainage Development Projects

Irrigation and drainage development projects are formed taking into consideration the above factors, the development objective and strategies discussed in section D3.2, location and condition of the existing irrigation and drainage facilities, topography, etc. The results of

topographic survey and supplementary inventory survey executed by the Study Team were fully used in the formation.

D5.1.3 Evaluation of Present Condition of Irrigation and Drainage System

The present condition of the existing irrigation system was carried based on the result of Inventory Survey¹.

JICA Inventory Survey 2006 defined present condition by 4 categories i.e. Fully functioning, Partly functioning, Mal functioning, and Not functioning. The definition of each category is not clearly described in the Inventory Survey Report. The Study Team assumed the definition as follows based on the result of field check including Topographic Survey and Supplementary Inventory Survey:

a) Fully functioning:

The system is functioning well but actual irrigation area is limited to the area where irrigation canal and structure exists; Fully functioning does not mean the irrigation canal and structures are provided in the whole area of the system. Canal and structure are still lack in the system. Supplemental irrigation is generally practiced².

b) Partly functioning:

The system is fairly functioning; usable canal and structure is limited, actual irrigation area is limited to.

c) Mal functioning:

The system is marginally functioning; usable canal and structure is very limited, actual irrigation area is also very limited.

d) Not functioning:

The system is severely broken and all field is left in rainfed condition.

D5.2 Development Plan in the Battambang River Basin

D5.2.1 Selection of the Target Area

(1) Existing and Potential Irrigation Area Reported by JICA Inventory 2006

The JICA Inventory 2006 reported (refer to section D1.1):

- Existing irrigation area; 21,600ha approx.
- Potential irrigation area; 41,900ha approx.

(2) Potential Irrigation Area by Resources Assessment by the Present Study

The resources assessment study shows about 32,200ha can be irrigated for medium paddy

¹ Final Report of the Survey on the Irrigation System Inventory for the River Basins of Battambang, Dauntry, Pursat, Boribo and Remaining Part of Prek Thnot, JICA Cambodia Office, Cambodia Engineering Groups Co., Ltd.

² To supply water to paddy field when water content of the field is closed to temporary wilting point of crop.

(August-December) with 80% dependability. The irrigation area in dry season is negligible small in all sub-basins.

- Battambang a1)+a2)³; 28,000ha in wet season
- Battambang b1); 1,300ha in wet season
- Battambang b2); 2,900ha in wet season

(3) Irrigation Area under On-going and or Promised Project

NWISP selected five initial candidate sub-projects which amount irrigation area about 5,400ha including Koas Kralor in the Moung Russey River Basin⁴, although conclusion have not been reached, and the irrigation area have been fixed for only one sub-project out of 4 as described in section D1.3.1. The area of 5,400ha should be taken into account in the Study.

- Battambang a1)+a2); 3,400ha
- Battambang b1); 2,000ha

(4) Possible Development Area

The possible irrigation area can be figured out at about 27,500ha by deducting (3) from (2).

- Battambang a1)+a2); 24,600ha in wet season
- Battambang b1); Exceed the potential area from water resources, not included in the further study
- Battambang b2); 2,900ha in wet season

(5) Formation of Irrigation and Drainage Development Projects

The following projects are formed and presented in Figure D5.2-1.

No.	Sub-basin	Name of Project	Proposed irrigation area (ha)	Existing irrigation systems (no.)
1	Battambang a1) + a2)	Kong Hort Rehabilitation	12,773	33
2	Battambang a1) + b2)	Sala Taon Weir Rrehabilitation	10,400	17
3	Battambang a2)	Ratanak-Battambang Water Harvesting Rehabilitation	580	13
	Total		23,753	63

Source: JICA Study Team

Kong Hort Rehabilitation Project is a run-of-river type irrigation system, and commands a large number of existing irrigation systems by rehabilitating a diversion weir on the Battambang River and irrigation and drainage canals. The Battambang River has sufficient water to irrigate two large scale project i.e. Kong Hort Rehabilitation Project and Sala Taon

³ The alphabet and number shows sub-basin in four river basins determined in A1.3.1 in Appendix-A Meteorology and Hydrology

⁴ The Study Team considers the Koas Kralor is located in the Battambang River Basin.

Weir Rehabilitation Project.

Sala Taon Weir Rehabilitation Project is also a run-of-river type irrigation system with a diversion weir, irrigates 10,400ha by rehabilitating a weir in the Battambang River in the Battambang City. The weir is to be equipped with a boat pass for navigation and fish ladder for fishery.

Ratanak-Battambang Water Harvesting Rehabilitation Project consists of 13 stand alone small water harvesting ponds and irrigation systems. They are scattered in the hilly areas of middle reach of the Battambang River.

The total irrigation area of 23,753ha is smaller than the possible development area of 27,500ha because:

- The irrigation systems located very close to Battambang town were excluded from economical point of view,
- Small irrigation systems which do not have a water harvesting pond was not contained in the Ratanak-Battambang Water Harvesting Rehabilitation Project from water availability view point.

D5.2.2 Present Condition of Irrigation and Drainage Systems

Sixty three existing irrigation systems which amounts 17,478ha in total were selected. The present condition of those irrigation systems are summarized below and Table D5.2-1 together with information of the others basins.

Present Condition of Irrigation Systems in the Project Area (Battambang River Basin)

Inventory existing area (ha)	Existing irrigation systems (No.)	Fully functioning		Partly functioning		Mal functioning		Not functioning		Proposed irrigation area (ha)
		(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	
17,478	63	12	2,950	30	6,387		-	21	8,141	23,753

Source: JICA Study Team

D5.3 Development Plan in the Moung Russey River Basin

D5.3.1 Selection of the Target Area

(1) Existing and Potential Irrigation Area Reported by JICA Inventory 2006

The JICA Inventory 2006 reported:

- Existing irrigation area; 1,200ha approx.
- Potential irrigation area; 48,000ha approx.

(2) Potential Irrigation Area by Resources Assessment by the Present Study

a) Moung Russey River sub-basin (c)

The resources assessment study shows about 10,000ha can be irrigated in the Moung Russey sub-basin for medium paddy (August-December) with 80% dependability after rehabilitation of Bassac reservoir.

- b) Svay Don Keo River sub-basin
 - Main stream d1)⁵; about 2,400ha in wet season.
 - Residual Sub-basin d2); about 800ha
 - Residual Sub-basin (d3); about 1,100ha

(3) Irrigation Area under On-going and or Promised Project

- a) Moung Russey River sub-basin
NWISP (ADB) selected Prek Chik Irrigation sub-project which will develop about 2,600ha for irrigation.

- b) Svay Don Keo River sub-basin
The NWISP selected 3 sub-projects which have about 2,700ha in total.

World Bank assisted the following irrigation system and flood control facilities:

- Prek Ta Am 400ha (2001-2003)
- Boeung Kanthor 380ha (2002-2003)
- Kompang 1,149ha (2003-2004)

The total of the above irrigation area amounts 4,629ha in the Svay Don Keo River sub-basin.

(4) Possible Development Area

Based on the above discussion, the possible irrigation area can be figured out at 11,700ha follows:

- a) Moung Russey River sub-basin: 7,400ha (=10,000-2,600)
- b) Svay Don Keo River sub-basin: 4,300ha

(5) Formation of Irrigation and Drainage Development Projects

The following projects are formed.

No.	Sub-basin	Name of Project	Proposed irrigation area (ha)	Existing irrigation systems (no.)
1	Moung Russey c)	Bassac Reservoir Rehabilitation	3,500	1
2	Moung Russey c)	Ream Kon Rehabilitation	2,300	1
3	Moung Russey c)	Por Canal Rehabilitation	1,200	1
4	Svay Don Keo d1)	Nikom Le/Dai Ta Chan Rehabilitation	600	2
	Total		7,600	5

Source: JICA Study Team

Bassac Reservoir Rehabilitation Project is located most upstream of the Moung Russey River. The project area is directly irrigated by a reservoir which has been planned by MOWRAM

⁵ The alphabet and number shows sub-basin in four river basins determined in A1.3.1 in Appendix-A Meteorology and Hydrology

and be implemented by Japanese Government (refer to chapter D1.3.6). The project proposed by MOWRAM seems to consist of rehabilitation of reservoir but not contain rehabilitation and improvement of irrigation and drainage canals. The above project proposed by the present study mainly consists of rehabilitation and improvement of irrigation and drainage canals.

Ream Kon and Por Canal Rehabilitation Projects are run-of-river type irrigation system, and are located downstream of the Moung Russey River near National Road No.5. The projects rely irrigation water on Moung Russey main river from Bassac Reservoir. Por Canal Project is proposed to use the diversion weir of Ream Kon Project. A successful implementation of Bassac Reservoir Rehabilitation Project is a key point of the others 2 projects as well as candidate sub-projects of NWISP.

The total irrigation area of the proposed projects above No.1 to No.3 amounts 7,000ha is nearly same as possible development area.

Nikom Le/Dai Ta Chan Project is located on the downstream of Svay Don Keo River, and needs irrigation water from Damnak Ampil weir which was constructed by MOWRAM in the Pursat River in 2006. A new weir is required for the project to take irrigation water from Svay Don Keo River.

D5.3.2 Present Condition of Irrigation and Drainage Systems

Five existing irrigation systems which amounts 650 ha in total were selected. The proposed irrigation area increase drastically provided that the Bassac Reservoir would be rehabilitated by Japanese Non-project Grant Aid for Structural Adjustment. It will have a reservoir of 32 million m³ effective storage in accordance with the design by MOWRAM. The present condition of those irrigation systems are summarized below and Table D5.2-1 together with information of the others basins.

Present Condition of Irrigation Systems in the Project Area (Moung Russey River Basin)

Inventory existing area	Existing irrigation systems	Fully functioning		Partly functioning		Mal functioning		Not functioning		Proposed irrigation area
		(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	
650	5	-	-	3	600	1	50	-	-	7,600

Source: JICA Study Team

D5.4 Development Plan in the Pursat River Basin

D5.4.1 Selection of the Target Area

(1) Existing and Potential Irrigation Area Reported by JICA Inventory 2006

The JICA Inventory 2006 reported:

- Existing irrigation area; 43,800ha approx.
- Potential irrigation area; 60,000ha approx.

(2) Potential Irrigation Area by Resources Assessment by the Present Study

The resources assessment study shows about 49,800ha can be irrigated in the Pursat River Basin for medium paddy (August-December) with 80% dependability after rehabilitation of Bassac reservoir.

- a) Pursat main river (e1+e2)⁶ at Damank Ampil; 47,300ha approx.; 900ha in dry season
- b) Pursat residual sub-basin (f1); 700 ha in wet season, no irrigation in dry season
- c) Pursat residual sub-basin (f2); 1,800ha; no irrigation in dry season; however, the sub-basin extends near Tonle Sap Biosphere Transition Zone. Accordingly, it should not be included in the further analysis in the Study.

(3) Irrigation Area under On-going and or Promised Project

Char Rek Weir Construction Project is on-going at downstream of the Pursat River sub-basin near or inside of Transition Zone of Tonle Sap Biosphere Reserve. The irrigation area of the Char Rek Weir is assumed at 6,450ha as follows:

- Char Rek irrigation system; 5,540ha approx.
- Thlok Water Gate irrigation system; 910 ha approx.

(4) Possible Development Area

Based on the above discussion, the possible irrigation area can be figured out at 41,150ha as follows:

- a) Pursat main river sub-basin

40,850ha (=47,300-6,450) at maximum in 1/5 years return period dry year. This figure is slightly smaller than the existing irrigation area reported. Accordingly, the main part of irrigation development in the Pursat River Basin should be rehabilitation of the existing irrigation system.

- b) Pursat residual sub-basin (f1); 700 ha in wet season

(5) Formation of Irrigation and Drainage Development Projects

The following projects are formed.

No.	Sub-basin	Name of Project	Proposed irrigation area (ha)	Existing irrigation systems (no.)
1	Pursat river e1)	Beoun Preah Ponley Rehabilitation	8,500	2
2	Pursat river e1)	Damnak Ampil Extension	8,000	1
3	Pursat river e1)	Wat Loung Rehabilitation	3,940	3
4	Pursat river e1)	Wat Chre Rehabilitation	1,000	1
	Pursat river e1)	Anlong Knouchi, Wat Leal, Kosh Khsach Water Harvest. and Recess.	2,602	3

⁶ The alphabet and number shows sub-basin in four river basins determined in A1.3.1 in Appendix-A
Meteorology and Hydrology

		Rice Rehab.		
	Total		24,042	10

Beoun Preah Ponley rehabilitation project is a run-of-river type, and is located upstream of the Pursat River. A diversion weir is to be rehabilitated to divert water, and a conveyance canal is also rehabilitated to the existing pond (Beoun Preah Ponley).

Damank Ampil Extension Project consists of 13 km extension of the existing main canal from Damank Ampil Weir. The main canal is proposed to connect the Svay Don Keo River to supply water to the Svay Don Keo River from Pursat River. The proposed project above contains rehabilitation and improvement of automatic gates, irrigation and drainage canals.

Wat Loung Rehabilitation Project is located just downstream of the project area of Damnak Ampil Project. The Wat Loung irrigation system is proposed to receive irrigation water from Damnak Ampil Weir by expanding a secondary canal.

Wat Chre Rehabilitation Project is located in the Boeung Khnar - Chambot Streams which start in the tributary of Pursat River downstream of Damnak Ampil Weir. The stream has a very small catchment and not have stable water. Accordingly, Damnak Ampil Weir has to supply irrigation water from Pursat River.

Anolng Knouchi, Wat Leal, Kosh Khsach Water Harvesting and Recession Rice Project is located at downstream of Wat Chre Project area near transition zone of Tonle Sap Lake. In the project area, recession rice is cultivated as well as ordinary rice. The project will be a second model of similar irrigation of reservoir and recession system following to the Toul Kou Irrigation Project as described in chapter D1.3.8.

The total irrigation area amounts 24,042ha is smaller than the possible development. The Pursat River, however, is expected to supply irrigation water to many projects in the Svay Don Keo River Sub-basin because the water in the Svay Don Keo River is not stable.

D5.4.2 Present Irrigation and Drainage Systems

About 39 existing irrigation systems which amounts about 5,110ha in total were selected. The present condition of those irrigation systems are summarized below and Table D5.2-1 together with information of the others basins.

Present Condition of Irrigation Systems in the Project Area (Pursat River Basin)

Inventory existing area	Existing irrigation systems	Fully functioning		Partly functioning		Mal functioning		Not functioning		Proposed irrigation area
		(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	
20,717	10	1	560	5	12,019	4	8,138	-	-	24,042

Source: JICA Study Team

D5.5 Boribo River Basin

D5.5.1 Selection of the Target Area

(1) Existing and Potential Irrigation Area Reported by JICA Inventory 2006

The JICA Inventory 2006 reported:

Sub-basin	Existing irrigation area (ha)	Potential irrigation area (ha)
Bomank-Thlea Maam g1)/2+g2)	2,800	4,700
Bomnak-Boribo g1)/2+g4)	7,900	13,200
Boribo North h1)	5,200	8,700
Boribo Middle North i1)	2,400	4,000
Boribo Middle South j1)	19,800	33,200
Boribo South k1)(Krang Ponley)	8,700	14,700
Total	46,800	78,500

Source: JICA Study Team

(2) Potential Irrigation Area by Resources Assessment by the Present Study

The resources assessment study shows about ha can be irrigated in the Boribo River Basin with 80% dependability as follows;

Sub-basin	Wet season (ha in approx.)	Dry season (ha in approx)
Bomank-Thlea Maam g1)/2+g2)	3,400	520
Bomnak-Boribo g1)/2+g4)	3,700	1,120
Boribo North h1)	900	0
Boribo Middle North i1)	2,320	0
Boribo Middle South j1)	3,400	0
Boribo South k1)(Krang Ponley)	1,300	0
Total	15,020	1,640

* The on-going water resources development project is not considered.

Source: JICA Study Team

The others 4 sub-river basins i.e. sub-river basins h2), i2), j2), and k2) are excluded from the Study because:

- In the sub-river basins h2) and i2), marginal soil for paddy field exists (refer to Figure D5.5-2 Paddy Field Development Potential),
- These 4 sub-river basins are not important tributaries which flow in the Boribo River Basin, there is no stable stream which can be a water source for irrigation

(3) Irrigation Area under On-going and or Promised Project

The new water resource development and irrigation project is on-going in the Boribo South Sub-basin (Krang Ponley River Basin) under assistance by KOICA. The project will divert water from Prek Thnot River to increase water resources in the Krang Ponley River as described in section D1.3.2. This Boribo South k1) Sub-basin, accordingly is eliminated from the Study.

The NWISP selected 8 initial candidate sub-projects for further selection in the Bomnak-Thlea Maam and Boribo North Sub-basins. The total irrigation area amounts about 7,800ha approximately, though the irrigation area will be carefully studied in the feasibility study in NWISP. Accordingly, the Bomnak-Thlea Maam {g1)/2+g2}} and Boribo North h1) Sub-basins are to be excluded in the Study.

(4) Possible Development Area

Based on the above discussion, the possible irrigation area can be figured out at 9,420ha as follows:

- Bomnak-Boribo g1)/2+g4)⁷ Sub-basin; 3,700ha in wet season, 1,120ha in dry season
- Boribo Middle North i1) Sub-basin; 2,320ha in wet season
- Boribo Middle South j1) Sub-basin; 3,400ha in wet season

These figures are smaller than the existing irrigation area reported. Accordingly, the main part of irrigation development in the Boribo River Basin should be rehabilitation of the irrigation system.

(5) Formation of Irrigation and Drainage Development Projects

The following projects are formed.

No.	Sub-basin	Name of Project	Proposed irrigation area (ha)	Existing irrigation systems (no.)
1	Bomnak-Boribo g1)/2+g4)	Lum Hach Rehabilitation	3,700	30
2	Boribo Middle North i1)	7 th January Canal Rehabilitation	2,000	No. data
3	Boribo Middle South j1)	Khvet Rehabilitation	250	1
4	Boribo Middle South j1)	Ta Ram Rehabilitation	180	1
5	Boribo Middle South j1)	Chak Teum, Trapeang Khlong, Don Pov Rehabilitation	980	3
6	Boribo Middle South j1)	Teuk Laak and Trapeang Thlan Rehabilitation	230	2
7	Boribo Middle South j1)	Toul Champey Rehabilitation	360	1
8	Boribo Middle South j1)	Chan Keak Rehabilitation	110	1
		Total	7,810	More than 39

Source: JICA Study Team

Lum Hach Rehabilitation Project is located downstream of Boribo main river. The existing run-of-river type intake (without diversion weir) is to be rehabilitated to a diversion weir type intake. After rehabilitation, the weir seems to have a storage capacity though topographic data is not available. About 30 irrigation systems can be irrigated by the new diversion weir

⁷ The alphabet and number shows sub-basin in four river basins determined in A1.3.1 in Appendix-A Meteorology and Hydrology

and irrigation canals.

7th January Canal Rehabilitation Project is proposed to rehabilitate 7th Canal which cross middle of north-western plain in the Kompong Chhnang Province. The Canal intercepts many small streams which almost run from west to east in the plain. The Canal, therefore collect runoff from those streams and supply to irrigation systems which are scattered along the 7th January Canal.

Khvet Rehabilitation Project and Ta Ram Rehabilitation Project are located in the most upstream of stand alone small streams in the Boribo River Basin. Both projects are run-of-river type irrigation system with diversion weir. The existing weir and irrigation canals are to be rehabilitated.

Chak Teum, Trapeang Khlong, Don Pov Rehabilitation Project is a pond type irrigation project. Chak Teum pond which is located upstream of stand alone small stream in the Boribo River Basin is to be rehabilitated.

Teuk Laak and Trapeang Thlan Rehabilitation Project and Toul Champey Rehabilitation Project are pond type irrigation systems, and located middle reach of small stand alone streams in the Boribo River Basin. Ponds and irrigation and drainage canals are to be rehabilitated.

Chan Keak Rehabilitation Project is a pond system in recession rice area. The catchment area seem to be same as just water surface area in the pond.

The total irrigation area of 7,810ha is smaller than the possible development area of 9,420ha. The reason is only existing irrigation area reported is contained in the proposed projects, no new development was considered because water source are not stable particularly in small size project in the Boribo Middle South sub-basin.

D5.5.2 Present Condition of Irrigation and Drainage Systems

Based on the result of resource potential assessment and basic concept of the development mentioned in the previous chapters, irrigation systems were selected for the master plan study.

The present condition of the existing irrigation system was carried based on the result of Inventory Survey.

About 39 existing irrigation systems which amounts about 5,110ha in total were selected. The present condition of those irrigation systems are summarized below and Table D5.2-1 together with information of the others basins.

Present Condition of Irrigation Systems in the Project Area (Boribo River Basin)

Inventory existing area	Existing irrigation systems	Fully functioning		Partly functioning		Mal functioning		Not functioning		Proposed irrigation area
		(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	(No.)	(ha)	
5,110	39	-	-	1	110	8	2,000	-	-	7,810

Note: No data is available for 30 irrigation systems

Source: JICA Study Team

**CHAPTER D6 DIGEST SHEET FOR IRRIGATION AND DRAINAGE
REHAIBILITATION AND IMPROVEMENT PROJECTS**

D6.1 Proposed Projects in the Battambang River Basin

D6.1.1 Kong Hort Rehabilitation Phase I Project

(1) Project description:

Item	Description			
1.1 Location	District	Commune	Village	UTM Reference
	Banan, SangKe	Kan Teur Mouy- Peir, Reang Kessei, Tourl Thnong Mouy, and other 3 communes	Wat Kandal, Tourl Thnong, and other 17 villages	298625 1423219
1.2 River basin/ water source	Battambang river basin/ Battambang river			
1.3 Target group	1) Number of household = 6,554 (Wet season medium- paddy) 2) Staff of PDOWRAM and DPA			
1.4 Objective of the project or program	1) Enhancement of rice production through construction of weir and rehabilitation of existing irrigation system			
1.5 Type of project or program	1) Rehabilitation of existing irrigation system			
1.6 Objective area	10,040 ha			
1.7 Necessity of project/program	<p>The Phase I project consists of 3 existing systems.</p> <p>The Kong Hort Irrigation system is located at upstream reaches of the Battambang river. Irrigation service started in 1978. After a few years' operation, the Kong Hort weir was completely washed away by a series of floods, and then the system lost the water source.</p> <p>The system requires weir re-construction, and rehabilitation of abandoned canals and structures to recover the original system function.</p>			

(2) Agriculture:

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I) Area (ha)
	Area		Area		
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	7,035	60	10,040	85	3,005
Normal Irrigation Paddy Field			10,040	85	10,040
Supplemental Irrigation Paddy Field	9	0			-9
Field under Rainfed Condition	7,026	60			-7,026
2. Rainfed Paddy Field	3,525	30			-3,525
3. Right-of-ways	1,240	11	1,760	15	520
Total	11,800	100	11,800	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	0					10,040					10,040			
Wet Season Rice							10,040	100	2.9	29,307		10,040		29,307
Upland Crops							90	1	0.5	45		90		45
Supplemental Irr. Field	9					0					-9			
Wet Season Rice		9	0.1	1.7	15							-9		-15
Rainfed Paddy Field	10,551					0					-10,551			
Wet Season Rice		10,551	100	1.1	11,448							-10,551		-11,448
Annual Rice		10,560	100	1.1	11,463		10,040	100	2.9	29,307		-520	0	17,844
Upland Crops							90	1	0.5	45		90		45
Total	10,560	10,560	100		11,463	10,040	10,130			29,352	-520	-430		17,889

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Kong Hort I

As shown in the tables; overall yield increase of 1.8 ton/ha and paddy production increase of 17,800 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 3 systems	Kong Hort (10,000ha), Tourl Thnong Moury (20 ha), Kampong Kor (20 ha)
1.1 Kong Hort Weir re-construction	Total width = 100m, Weir body = 50m, Height = 17m Gate: Automatic gate 3 nos. (W 8.9 m x H 8.0 m) Slide gate 4 nos. (W 2.0 m x H 4.0 m)
- Intake structure re-construction	Slide gate 3 nos. (W 2.0 m x H 2.5 m) Access road L= 3km, Weir operation office 1 nos.
1.2 Canal rehabilitation*	Main = 11km, Secondary = 0.4 km
Canal construction* (*; including structures)	Main = 48km, Secondary = 100 km, Tertiary = 200km Drainage = 151 km
1.3 Irrigation pond rehabilitation	1 dyke
- Dyke rehabilitation	600 m
- Structure construction	1 spillway, 1 outlet
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- | | |
|--|---|
| (a) Survey, investigation, design, and tender; | 12 months, (Tender; 3 months) |
| (c) Construction; | 5 years |
| (d) Establishment of FWUC and training; | 7 years (2 years for establishment, 5 years for training) |
| (e) Agriculture extension service; | 5 years (3 years overlap w/ construction) |

(5) **Cost Estimate;** Total Investment Costs: 27,267 (1,000USD)

Project Name	Total Construction Costs	Other Costs			Total Investment Costs
		FWUC level training & mobilization	Agricultural & other support	Land Acquisition Cost	
	(1,000 USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)	(1,000 USD)
Kong Hort Rehab. Project (Phase I)	25,375	1,015	116	761	27,267

(6) **Evaluation**

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	14
3.	Social factor	20	9.17
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	6
	Total	100	66.17

D6.1.2 Kong Hort Rehabilitation Phase II Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Banan, SangKe, Battambang</td> <td>KanTeurPeir, RangKessei, Tapon, WatKor, and other 8 communes</td> <td>ChhayRumPeat, PreyTotoeng, PreySvay, RangKessei, And other 32 villages</td> <td>298625</td> <td>1423219</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Banan, SangKe, Battambang	KanTeurPeir, RangKessei, Tapon, WatKor, and other 8 communes	ChhayRumPeat, PreyTotoeng, PreySvay, RangKessei, And other 32 villages	298625	1423219
District	Commune	Village	UTM Reference								
Banan, SangKe, Battambang	KanTeurPeir, RangKessei, Tapon, WatKor, and other 8 communes	ChhayRumPeat, PreyTotoeng, PreySvay, RangKessei, And other 32 villages	298625	1423219							
1.2 River basin/ water source	Battambang river basin/ Battambang river										
1.3 Target group	Number of household = 3,070 (Wet season medium- paddy)										
1.4 Objective of the project or program	Enhancement of rice production through rehabilitation of existing irrigation system and water supply from the Kong Hort weir										
1.5 Type of project or program	1) Rehabilitation of existing irrigation system 2) Construction of canals										
1.6 Objective area	2,733 Ha										
1.7 Necessity of project/program	Thirty existing irrigation systems in the project area rely on pump system, unstable floodwater along the Battambang river, and rainfall in flat area. Consequently, irrigation systems are suffering from unstable water supply. On the other hand, available water resources in the Battambang river are enough to supply water to existing irrigation area in the basin. In order to utilize available water source from the Kong Hort weir by gravity, rehabilitation of the existing systems would be necessary.										

(2) Agriculture:

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	(ha)	(%)	(ha)	(%)	
	1. Irrigation Area	2,140	70	2,733	89
Normal Irrigation Paddy Field	236	8	2,685	88	2,449
Supplemental Irrigation Paddy Field	574	19			-574
Field under Rainfed Condition	1,282	42			-1,282
Recession Paddy Field	48	2	48	2	0
2. Rainfed Paddy Field	744	24			-744
3. Right-of-ways	182	6	333	11	151
Total	3,066	100	3,066	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/PM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	236					2,685					2,449			
Early Wet/Dry Season		241	8	3.0	723							-241		-723
Wet Season Rice		236	8	2.2	512		2,685	100	2.9	7,837		2,449		7,325
Upland Crops							20	1	0.5	10		20		10
Supplemental Irr. Field	574					0					-574			
Dry Season		50		2.5	125							-50		-125
Wet Season Rice		574	20	1.6	910							-574		-910
Rainfed Paddy Field	2,026					0					-2,026			
Dry Season		50	2	2.0	100							-50		-100
Wet Season Rice		2,026	70	1.1	2,198							-2,026		-2,198
Recession Paddy Field	48	48	2	2.0	96	48	48	2.0	2.5	120	0	0		24
Annual Rice		3,225	112	1.4	4,664		2,733	100	2.9	7,957		-492	-12	3,293
Upland Crops							20	1	0.5	10		20		10
Total	2,884	3,225	112		4,664	2,733	2,753			7,967	-151	-472		3,303

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Kong Hort II

As shown in the tables; overall yield increase of 1.5 ton/ha and paddy production increase of 3,300 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 30 systems	Sor Kheng (1,000ha) Kou (200ha) Bot Sala (150ha) Kampong Sromor (20ha) Rang Kesel (200ha) Anglong Reussei (200ha) Bour Khnar (100ha) Timat Poug (150 ha) Beung Teum (20ha) Bor Sert (20ha) Braset Sangker (40ha) Changor Tmat (50ha) Chhoung Trordork (20ha) Or Longor (25ha) Or Krarsang (5ha) Or Samdach (15ha) Ream Chakkrei (20ha) Sras Kev (80ha) Svay Sor Beung Teum (30ha) Svay Sor (25ha) Ta Hem (10ha) Ta Kdam (20ha) Ta Krouch (23ha) Ta Oum (100ha) Ta Toel (40ha) Changor Krang (60ha) Spong (30ha) Or Kcheay (30ha) Baos Por (30ha) Khsach Pouy (20ha)
1.1 Canal rehabilitation* Canal construction* (*; including structures)	Main = 41 km , Secondary = 5 km, Main = 2 km, Secondary = 25 km, Tertiary =45 km Drainage = 41 km
1.2 Irrigation pond rehabilitation	8 dykes , 25,400 m, 8 spillways, 10 outlets
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
(c) Construction; 2 years
(d) Establishment of FWUC and training; 6 years (2 years for establishment, 4 years for training)
(e) Agriculture extension service; 4 years (1 year overlap w/ construction)

(5) Cost Estimate; Total Investment Costs: 9,340 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
Kong Hort Rehab. Project (Phase II)	8,700	348	31	261	9,340

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	8
3.	Social factor	20	9.17
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	6
	Total	100	60.17

D6.1.3 Sala Taon Weir Rehabilitation Project

(1) Project description:

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	SangKe, AekPhnum, Battambang	NoRea, PeamAek, SamRongKnung, Prek Kpob, and other 3 communes	KorHa, TaKok, OTrea NoRea, and other 38 villages	306849	1450839
1.2 River basin	Battambang river basin/ Battambang river				
1.3 Target group	Number of household = 4,648 (Wet season medium- paddy)				
1.4 Objective of the project	Enhancement of rice production through re-construction of Sala Taon weir and rehabilitation of existing irrigation system				
1.5 Type of project	Rehabilitation of existing irrigation system				
1.6 Objective area	10,400Ha				
1.7 Necessity of project	<p>The Sala Taon weir is located at 5 km downstream from Battambang city center. Construction work of the weir commenced in 1994 and the work was suspended at the completion rate of 20%.</p> <p>Irrigation of the existing systems in the project area relies on pump system or unstable floodwater. In this regard, construction of Sala Taon weir is strongly requested by farmers for stable and low cost water supply. After construction of the weir, seventeen existing systems could receive irrigation water by gravity.</p>				

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I)	
	(ha)	(%)	(ha)	(%)	Area (ha)	
	1. Irrigation Area	7,995	66	10,400	85	2,405
Normal Irrigation Paddy Field	117	1	10,400	85	10,283	
Supplemental Irrigation Paddy Field	2,345	19			-2,345	
Field under Rainfed Condition	5,533	45			-5,533	
2. Rainfed Paddy Field	2,818	23			-2,818	
3. Right-of-ways	1,393	11	1,806	15	413	
Total	12,206	100	12,206	100	0	

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	117					10,400					10,283			
Early Wet/Dry Season		117	1	3.0	351									
Wet Season Rice		117	1	2.2	254		10,400	100	2.8	30,358		10,283		30,104
Upland Crops							90	1	0.5	45		90		45
Supplemental Irr. Field	2,345										-2,345			
Dry Season		40		2.5	100									
Wet Season Rice		2,345	22	1.6	3,717									
Rainfed Paddy Field	8,351										-8,351			
Wet Season Rice		8,351	77	1.1	9,061									
Annual Rice		10,970	101	1.2	13,483		10,400	100	2.8	30,358		-570	-1	16,875
Upland Crops							90	1	0.5	45		90		45
Total	10,813	10,970	101		13,483	10,400	10,490	101		30,403	-413	-480		16,920

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Salat

As shown in the tables; overall yield increase of 1.6 ton/ha and paddy production increase of 16,900 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 17 systems	Nor Rea (600ha) Or Daun Teav (3,000) Or Samrong Knong (150) Or Snaor (1,800ha) Prek Kroch (150ha) Or Svay Chrom (200ha) Prek Khpob (2,800ha) Or Andemg (30ha) Or Bak Angrerk (85ha) Or Kvit (40ha) Preak Ambil (30ha) Preak Loung (10ha) Or Sdei (50ha) Or Doung Mea (10ha) Oe Damrei Slab (35ha) Preak Norin (10 ha) O Kdol (1,400ha)
1.1 Weir Rehabilitation	Weir; Total width =110m, Weir body = 60m, Height =11.4m Gate: Automatic gate w/motor 4 nos. (W 9.0m x H 7.4m) Slide gate 4 nos. (W 2.0 m x H 4.0 m)
- Intake Structure	5 nos. Gate: Slide gate 3 nos. (W 2.0 m x H 2.5 m)
- Other facilities	Weir operation office, Boat pass way, Fish ladder, Flood Protection wall H=7m, L=10km (= 5km x 2 sides)
1.2 Canal rehabilitation*	Main = 24 km , Secondary = 22 km,
Canal construction*	Main = 22 km, Secondary = 86 km, Tertiary =190 km
(*; including structures)	Drainage = 156 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 5 years
(d) Establishment of FWUC and training; 7 years (2 years for establishment, 5 years for training)
(e) Agriculture extension service; 5 years (3 years overlap w/ construction)

(5) Cost Estimate; Total Investment Costs: 58,239 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Sala Taon Weir Rehab. Project	54,317	2,173	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21.5
2.	Economic factor	20	11
3.	Social factor	20	9.61
4.	Environmental factor	10	0
5.	Ease of implementation	10	10
6.	Maturity factor	10	6
	Total	100	58.11

D6.1.4 Sala Taon Rehabilitation Project (Alternative)

(1) Project description:

Item	Description			
1.1 Location	District	Commune	Village	UTM Reference
	SangKe, AekPhnum, Battambang	NoRea, PeamAek, SamRongKnung, Prek Kpob, and other 3 communes	KorHa, TaKok, OTrea NoRea, and other 38 villages	306849 1450839
1.2 River basin	Battambang river basin/ Battambang river			
1.3 Target group	Number of household = 4,648 (Wet season medium- paddy)			
1.4 Objective of the project	Enhancement of rice production through re-construction of pump stations and rehabilitation of existing irrigation system			
1.5 Type of project	Rehabilitation of existing irrigation system			
1.6 Objective area	10,400Ha			
1.7 Necessity of project	<p>The project is proposed to supply irrigation water to existing seventeen systems by five pump stations to be constructed instead of construction of weir.</p> <p>By pump irrigation method, prospective environmental and social negative effects by construction of weir would be eliminated.</p>			

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I)	
	(ha)	(%)	(ha)	(%)	Area (ha)	
1. Irrigation Area	7,995	66	10,400	85	2,405	
Normal Irrigation Paddy Field	117	1	10,400	85	10,283	
Supplemental Irrigation Paddy Field	2,345	19			-2,345	
Field under Rainfed Condition	5,533	45			-5,533	
2. Rainfed Paddy Field	2,818	23			-2,818	
3. Right-of-ways	1,393	11	1,806	15	413	
Total	12,206	100	12,206	100	0	

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	117					10,400					10,283			
Early Wet/Dry Season		117	1	3.0	351									
Wet Season Rice		117	1	2.2	254		10,400	100	2.8	30,358		10,283		30,104
Upland Crops							90	1	0.5	45		90		45
Supplemental Irr. Field	2,345										-2,345			
Dry Season		40		2.5	100									
Wet Season Rice		2,345	22	1.6	3,717									
Rainfed Paddy Field	8,351										-8,351			
Wet Season Rice		8,351	77	1.1	9,061									
Annual		10,970	101	1.2	13,483		10,400	100	2.8	30,358		10,283		30,104
Upland Crops							90	1	0.5	45		90		45
Total	10,813	10,970	101		13,483	10,400	10,490	101		30,403	-413	10,283		16,920

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Salat

As shown in the tables; overall yield increase of 1.6 ton/ha and paddy production increase of 16,900 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 17 systems	Nor Rea (600ha) Or Daun Teav (3,000) Or Samrong Knong (150) Or Snaor (1,800ha) Prek Kroch (150ha) Or Svay Chrom (200ha) Prek Khpob (2,800ha) Or Andemg (30ha) Or Bak Angrerk (85ha) Or Kvit (40ha) Preak Ambil (30ha) Preak Loung (10ha) Or Sdei (50ha) Or Doumg Mea (10ha) Oe Damrei Slab (35ha) Preak Norin (10 ha) O Kdol (1,400ha)
1.1 Pump station rehabilitation (Fix type, w/ Power House) - Regulator	Re-construction of pump station; 5 nos. 0.35m ³ /s x 48kWx 2nos., 0.75m ³ /s x 95kWx 2nos. 1.8m ³ /s x 220kWx 2nos, 2.8m ³ /s x 330kW x 2nos. 4.4m ³ /s x 514kWx 2nos. 5 nos. Slide gate 3 nos. / station (W 2.0 m x H 2.5 m)
1.2 Canal rehabilitation* Canal construction* (*; including structures)	Main = 24 km , Secondary = 22 km, Main = 22 km, Secondary = 86 km, Tertiary =190 km Drainage = 156 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 5 years
(d) Establishment of FWUC and training; 7 years (2 years for establishment, 5 years for training)
(e) Agriculture extension service; 5 years (3 years overlap w/ construction)

(5) Cost Estimate; Total Investment Costs: 44,101 (1,000USD)

No.	Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
			FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
			3'	Sala Taon Rehab. Project (Alternative to No.3)	40,724	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	-
2.	Economic factor	20	-
3.	Social factor	20	-
4.	Environmental factor	10	-
5.	Ease of implementation	10	-
6.	Maturity factor	10	-
	Total	100	-

D6.1.5 Ratanak-Battambang Water Harvesting Rehabilitation Project

(1) Project description:

Item	Description			
1.1 Location	District	Commune	Village	UTM Reference
	Banan, RatanakMondol	Sdao, Treng, Sneung, hlovMeas, and other 2 communes	BaosPor, BaosKnor, Sdao, Roung, and other 9 villages	291681 1419667
1.2 River basin	Battambang river basin/ Battambang river			
1.3 Target group	Number of household = 677 (Wet season medium- paddy)			
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing pond irrigation system			
1.5 Type of project	Rehabilitation of existing irrigation system			
1.6 Objective area	580 Ha			
1.7 Necessity of project	<p>The proposed project consists of thirteen (13) water harvesting systems in the upper basin.</p> <p>Irrigation ponds are only solution to secure water supply in irrigation and in daily life in the area.</p> <p>The capacities of irrigation ponds have been reduced due to deterioration of dyke banks and outlet structures. Consequently, water shortage problems are prone to occur. In order to improve the water shortage situation, rehabilitation works would be necessary.</p>			

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I)	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	
1. Irrigation Area	308	52	580	98	272	
Normal Irrigation Paddy Field			580	98	580	
Supplemental Irrigation Paddy Field	25	4			-25	
Field under Rainfed Condition	283	48			-283	
2. Rainfed Paddy Field	286	48			-286	
3. Right-of-ways			14	2	14	
Total	594	100	594	100	0	

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						580					580			
Wet Season Rice							580	100	2.9	1,693		580		1,693
Upland Crops							5	1	0.5	2.5		5		3
Supplemental Irr. Field	25										-25			
Dry Season		25	4	2.5	63							-25		-63
Wet Season Rice		25	4	1.6	40							-25		-40
Rainfed Paddy Field	569										-569			
Dry Season		15	3	2.5	37							-15		-37
Wet Season Rice		569	96	1.1	618							-569		-618
Annual Rice		634	107	1.2	758		580	100	2.9	1,693		-54	-7	935
Upland Crops							5	1		3		5		3
Total	594	634	107		758	580	585	101		1,696	-14	-49		938

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Ratanak

As shown in the tables; overall yield increase of 1.7 ton/ha and paddy production increase of 940 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 13 irrigation pond systems	Beung Anlorck Dam(30ha) Beung Snourl (20ha) Or Ta Kdourch (30ha) Anlong Mean (30ha) Kbal Krabei (40ha) Beung Anlorck Canal(50ha) Pai Lam (50ha) Trodork Pong (80ha) Svay Choir (10ha) Beung Borrei (30ha) Ta Krouk (90ha) Tuek Sab (30ha) Rum Lech (90ha)
1.1 Canal work including structures - Canal rehabilitation - Canal construction	Main = 3 km , Secondary = - km, Main = 2.4 km, Secondary = 6 km, Tertiary =10 km Drainage = 9 km
1.2 Irrigation pond rehabilitation - Dyke rehabilitation - Structure construction	13 dykes 13,150 m in total 13 spillways, 16 outlets
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
(e) Agriculture extension service; 3 years

(5) Cost Estimate; Total Investment Costs: 2,266 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Ratanak-Battambang Water Harvesting Pjt.	2,109	84	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	20.3
2.	Economic factor	20	7
3.	Social factor	20	9.07
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	2
	Total	100	54.37

D6.2 Proposed Projects in the Moung Russey River Basin

D6.2.1 Bassac Irrigation System Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>MoungRussey</td> <td>PrekChik</td> <td>PrekTaVen, PrekChik</td> <td>318474</td> <td>1389697</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		MoungRussey	PrekChik	PrekTaVen, PrekChik	318474	1389697
	District	Commune	Village	UTM Reference							
MoungRussey	PrekChik	PrekTaVen, PrekChik	318474	1389697							
1.2 River basin/ water source	Moung Russey river basin/ Moung Russey river										
1.3 Target group	1) Number of household = 2,670 (Potential, Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project or program	1) Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project or program	1) Rehabilitation of existing irrigation system										
1.6 Objective area	3,500 Ha										
1.7 Necessity of project/program	The Bassac irrigation system was designed to take water from the Bassac reservoir. However, the dam construction has been left uncompleted since the late 1970's. Consequently, the system has not been irrigated. According to the latest information, the dam is scheduled to be rehabilitated by the assistance of Japanese government by 2008. In this connection, rehabilitation of existing irrigation system would be necessary to utilize storage water in the reservoir effectively.										

(2) Agriculture:

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	(ha)	(%)	(ha)	(%)	
	1. Irrigation Area	0	0	3,500	85
Normal Irrigation Paddy Field			3,500	85	3,500
Supplemental Irrigation Paddy Field					
Field under Rainfed Condition					
2. Rainfed Paddy Field	4,120	100			-4,120
3. Right-of-ways		0	620	15	620
Total	4,120	100	4,120	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						3,500					3,500			
Wet Season Rice							3,500	100	3.0	10,560		3,500		10,560
Upland Crops							60	2	0.5	30.0		60		30
Supplemental Irr. Field														
Wet Season Rice														
Rainfed Paddy Field	4,120										-4,120			
Wet Season Rice		4,120	100	1.2	4,759						-4,120			-4,759
Annual Rice		4,120	100	1.2	4,759		3,500	100	3.0	10,560		-620	0	5,801
Upland Crops							60	2		30		60	-	30
Total	4,120	4,120	100		4,759	3,500	3,560	102		10,590	-620	-560	2	5,831

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Bassac

As shown in the tables; overall yield increase of 1.8 ton/ha and paddy production increase of 5,800 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
1.1 Reservoir operation office const. Other facilities	1 nos. Canal extension L= 1km, Erosion protection extension
1.2 Canal work - Canal rehabilitation* - Canal construction* (*; including structures)	Main = 9 km , Secondary = - km, Main = 8.5km, Secondary = 35 km, Tertiary = 70 km Drainage = 53 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
- (c) Construction; 2 years
- (d) Establishment of FWUC and training; 6 years (2 years for establishment, 4 years for training)
- (e) Agriculture extension service; 4 years (1 year overlap w/ construction)

(5) Cost Estimate; Total Investment Costs: 7,447 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
Bassac Irrigation System Rehab. Project	6,920	277	42	208	7,447

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	13
3.	Social factor	20	9
4.	Environmental factor	10	10
5.	Ease of implementation	10	2
6.	Maturity factor	10	10
	Total	100	65.00

D6.2.2 Ream Kon Rehabilitation Project

(1) Project description:

Item	Description				
	1.1 Location	District	Commune	Village	UTM Reference
MoungRussey		Kea, Chrey, Prey Svay	6 villages	318474	1389697
1.2 River basin/ water source	Moung Russey river basin/ Moung Russey river				
1.3 Target group	1) Number of household = 405 (Potential, Wet season medium- paddy) 2) Staff of PDOWRAM and PDA				
1.4 Objective of the project or program	Enhancement of rice production through rehabilitation of existing irrigation system				
1.5 Type of project or program	1) Rehabilitation of existing weir and irrigation system				
1.6 Objective area	2,300 Ha				
1.7 Necessity of project/program	<p>The Ream Kon irrigation system was constructed in the late 1970's as a dyke irrigation project, having a weir together with an intake structure in the source river. At present, the system almost lost the function because of destruction of intake structure and deterioration of canals.</p> <p>Rehabilitation of the Bassac reservoir could regulate river flow of the Moung Russey to a certain degree.</p> <p>In order to utilize the regulated flow effectively and to recover the system function, re-construction of weir and intake structure, and rehabilitation of canals would be necessary.</p>				

(2) Agriculture:

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I)
	Area		Area		
	(ha)	(%)	(ha)	(%)	Area (ha)
1. Irrigation Area	200	7	2,300	85	2,100
Normal Irrigation Paddy Field			2,290	85	2,290
Supplemental Irrigation Paddy Field	40	1			-40
Field under Rainfed Condition	150	6			-150
Recession Paddy Field	10	0.4	10	0.4	0
2. Rainfed Paddy Field	2,470	91			-2,470
3. Right-of-ways	40	1	410	15	370
Total	2,710	100	2,710	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						2,290					2,290			
Wet Season Rice							2,290	100	3.0	6,909		2,290		6,909
Upland Crops							40	2	0.5	20		40		20
Supplemental Irr. Field	40										-40			
Wet Season Rice		40	1	1.7	66							-40		-66
Rainfed Paddy Field	2,620										-2,620			
Wet Season Rice		2,620	98	1.2	3,026							-2,620		-3,026
Recession Paddy Field	10	10	0.4	2.0	20	10	10	0.4	2.5	25	0	0		5
Annual Rice		2,670	100	1.2	3,112		2,300	100	3.0	6,934		-370	0	3,822
Upland Crops							40	2		20		40		20
Total	2,670	2,670	100	1.2	3,112	2,300	2,340	102	2.5	6,954	-370	-330	2	3,842

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Ream

As shown in the tables; overall yield increase of 1.8 ton/ha and paddy production increase of 3,800 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
1.1 Ream Kon weir rehabilitation.	Total width =43m, Weir body = 26m, Height =4m. Gate: Automatic gate 2 nos. (W 7.7m x H 2.5 m) Slide gate 2 nos. (W 2.0 m x H 2.5 m)
- intake structure	1 nos. Slide gate 3 nos. (W 2.0 m x H 2.5 m)
1.2 Canal work - Canal rehabilitation* - Canal construction* (*; including structures)	Main = 12 km , Secondary = 26 km, Main = - km, Secondary = - km, Tertiary = 46km Drainage = 35 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team (q.v. 6.4.1.4)
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 6 years (2 years for establishment, 4 years for training)
(e) Agriculture extension service; 4 years (1 year overlap w/ construction)

(5) Cost Estimate; Total Investment Costs: 5,357 (1,000USD)

Project Name	Total Construction Costs	Other Costs			Total Investment Costs
		FWUC level training & mobilization	Agricultural & other support	Land Acquisition Cost	
		(1,000 USD)	(1,000 USD)	(1,000 USD)	
Ream Kon Rehab. Project	4,983	199	26	149	5,357

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	13
3.	Social factor	20	9
4.	Environmental factor	10	7
5.	Ease of implementation	10	10
6.	Maturity factor	10	6
	Total	100	66.00

D6.2.3 Por Canal Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Moung Russey</td> <td>Chrey, Taloas</td> <td>ChreyI, ChreyII, Traos, Chon Sannab, and other 9 villages</td> <td>332439</td> <td>1412586</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Moung Russey	Chrey, Taloas	ChreyI, ChreyII, Traos, Chon Sannab, and other 9 villages	332439	1412586
	District	Commune	Village	UTM Reference							
Moung Russey	Chrey, Taloas	ChreyI, ChreyII, Traos, Chon Sannab, and other 9 villages	332439	1412586							
1.2 River basin	Moung Russey river basin/ Moung Russey river										
1.3 Target group	Number of household = 350 (Potential, Wet season medium- paddy)										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation canals										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	1,200Ha										
1.7 Necessity of project	<p>The system was constructed in the late 1970's, and experienced rehabilitation works twice in 1995 and 2005. Despite of rehabilitation works, the system works limitedly.</p> <p>After rehabilitation work of the Bassac reservoir, the system could receive regulated flow. In this connection, comprehensive rehabilitation of irrigation system would be necessary to utilize regulated water effectively.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	Area (ha)	(%)	Area (ha)	(%)	
	1. Irrigation Area	400	28	1,200	85
Normal Irrigation Paddy Field			1,200	85	1,200
Supplemental Irrigation Paddy Field	100	7			-100
Field under Rainfed Condition	300	21			-300
2. Rainfed Paddy Field	940	67			-940
3. Right-of-ways	70	5	210	15	140
Total	1,410	100	1,410	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						1,200					1,200			
Wet Season Rice							1,200	100	3.0	3,620		1,200		3,620
Upland Crops							20	2	0.5	10		20		10
Supplemental Irri. Field	100										-100			
Wet Season Rice		100	7	1.7	166							-100		-166
Rainfed Paddy Field	1,240										-1,240			
Wet Season Rice		1,240	93	1.2	1,432							-1,240		-1,432
Annual														
Annual Rice		1,340	100	1.2	1,598		1,200	100	3.0	3,620		-140		2,022
Upland Crops							20	2		10		20		10
Total	1,340	1,340	100		1,598	1,200	1,220	102		3,630	-140	-120	2	2,032

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Por Canal

As shown in the tables; overall yield increase of 1.8 ton/ha and paddy production increase of 2,000 ton are expected under the project.

(3) **Project scope:**

Item	Description
1. Direct Construction	
1.1 Canal work including structures - Intake structure - Canal rehabilitation - Canal construction	Slide gate 1 nos. (W 2.5 m x H 2.0 m) Main = 11 km , Secondary = 4.5 km, Main = - km, Secondary = 3.2 km, Tertiary = 24 km Drainage = 18 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) **Implementation Schedule**

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
- (c) Construction; 1 year
- (d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
- (e) Agriculture extension service; 3 years

(5) **Cost Estimate;** Total Investment Costs: 2,402 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Por Canal Rehab. Project	2,232	89	

(6) **Evaluation**

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	14
3.	Social factor	20	9
4.	Environmental factor	10	8
5.	Ease of implementation	10	10
6.	Maturity factor	10	6
	Total	100	68.00

D6.2.4 Nikom/Dai Ta Chan Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Moung Russey</td> <td>Prek Chik</td> <td>PrekTaVen, PrekChik</td> <td>352689</td> <td>1401179</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Moung Russey	Prek Chik	PrekTaVen, PrekChik	352689	1401179
	District	Commune	Village	UTM Reference							
Moung Russey	Prek Chik	PrekTaVen, PrekChik	352689	1401179							
1.2 River basin	Moung Russey river basin/ Svay Don Keo river										
1.3 Target group	1) Number of household=560 (Potential, Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through construction of Dai Ta Chan weir and rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	600Ha										
1.7 Necessity of project	<p>The Nikom Le and the Dai Ta Chan systems were constructed in the late 1970's. The Nikom Le system was rehabilitated in 2005 by MOWRAM and the Dai Ta Chan was in 2002 by SEILA program. However, the systems have remained at "partly function" level because of limited rehabilitation works.</p> <p>In order to secure irrigation water supply, construction of a weir, reconstruction of intake structures, and rehabilitation of the existing canals would be crucially important.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	Area (ha)	(%)	Area (ha)	(%)	
	1. Irrigation Area	50	7	600	86
Normal Irrigation Paddy Field			600	86	600
Supplemental Irrigation Paddy Field	13	2			-13
Field under Rainfed Condition	37	5			-37
2. Rainfed Paddy Field	650	93			-650
3. Right-of-ways			100	14	100
Total	700	100	700	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						600					600			
Early Wet/Dry Season							60	10	3.5	210		60		210
Wet Season Rice							600	100	3.0	1,810		600		1,810
Upland Crops							10	2	0.5	5		10		5
Supplemental Iri. Field	13										-13			
Dry Season														
Wet Season Rice		13	2	1.7	22							-13		-22
Rainfed Paddy Field	687										-687			
Wet Season Rice		687	98	1.2	794							-687		-794
Annual														
Annual Rice		700	100	1.2	816		660	110	3.1	2,020		-40	10	1,204
Upland Crops							10	2		5		10		5
Total	700	700	100		816	600	670	112		2,025	-100	-30	12	1,209

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

As shown in the tables; overall yield increase of 1.9 ton/ha and paddy production increase of 1,200 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation 2 existing systems	Nikom Le (300 ha), Dai Ta Chan (300 ha)
1.1 Dai Ta Chan weir rehabilitation.	Total width =28m, Weir body = 22m, Height =3.5m. Gate: Automatic gate 2 nos. (W 5.5m x H 2.0m) Slide gate 2 nos. (W 2.0 m x H 2.0 m)
- Intake structure	2 nos. Slide gate 3 nos. (W 2.0 m x H 2.0 m)
1.2 Canal work including structures	Main = 8 km , Secondary = 1 km, Main = - km, Secondary = - km, Tertiary = 12 km Drainage = 9 km
- Canal rehabilitation	
- Canal construction	
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
(e) Agriculture extension service; 3 years

(5) Cost Estimate; Total Investment Costs: 2,150 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Nikom/Dai Ta Chan Rehab. Project	2,000	80	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	10
3.	Social factor	20	9
4.	Environmental factor	10	10
5.	Ease of implementation	10	10
6.	Maturity factor	10	6
	Total	100	66.00

D6.3 Proposed Projects in the Pursat River Basin

D6.3.1 Beoung Preah Ponley Rehabilitation Project

(1) Project description:

Item	Description
1.1 Location	District
	Commune
1.1 Location	Village
	UTM Reference
	Phnom Kra Vanh
	Sam Rong, Phtas Rong
	Prek I, Phtas Rong
	341435 1381043
1.2 River basin/ water source	Pursat river basin/ Pursat river
1.3 Target group	1) Number of household=7,141 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA
1.4 Objective of the project or program	1) Enhancement of rice production through re-construction of weir and rehabilitation of existing irrigation system
1.5 Type of project or program	1) Rehabilitation of existing irrigation system
1.6 Objective area	8,500 Ha
1.7 Necessity of project/program	The proposed project consists of two irrigation systems, namely the Beoung Preah Ponley reservoir and the Domnak Chheu Kram. The weir located at the uppermost flat area commenced irrigation water supply to two systems in the late 1970's. At present, floods destroyed the weir, and irrigation canals lost their capacity. In order to recover stable water supply and to irrigate the irrigation systems, rehabilitation of dyke and canals, and re-construction of weir are of crucial importance.

(2) Agriculture:

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment Area (II - I)
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	7,703	77	8,500	85	797
Normal Irrigation Paddy Field	30	0	8,500	85	8,470
Supplemental Irrigation Paddy Field	1,138	11			-1,138
Field under Rainfed Condition	6,535	65			-6,535
2. Rainfed Paddy Field	940	9			-940
3. Right-of-ways	1,357	14	1,500	15	143
Total	10,000	100	10,000	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	30					8,500					8,470			
Early Wet/Dry Season		30		3.0	90		800	9	3.5	2,800		770		2,710
Wet Season Rice		30		2.8	83		8,500	100	3.3	28,382		8,470		28,299
Upland Crops							30	0.4	0.6	17		30		17
Supplemental Irr. Field	1,138										-1,138			
Dry Season														
Wet Season Rice		1,138	13	1.9	2,145							-1,138		-2,145
Rainfed Paddy Field	7,475										-7,475			
Wet Season Rice		7,475	86	1.4	10,353							-7,475		-10,353
Annual		8,673	100	1.5	12,671		9,300	109	3.4	31,182		627	9	18,511
Upland Crops							30	0		17		30		17
Total	8,643	8,673	100		12,671	8,500	9,330	110		31,199	-143	657	9	18,528

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Beoun

As shown in the tables; overall yield increase of 1.9 ton/ha and paddy production increase of 18,500 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 2 existing systems	Beoung Preah Ponley Res. (8,000ha), Domnak Chheu Kram (500ha)
1.1 Beoun Preah Ponley weir - Intake Structure	Total width =54m, Weir body = 38m, Height =4m Gate: Automatic gate 3 nos. (W 7.4m x H 2.0m) Slide gate 2 nos. (W 2.0 m x H 2.0 m) 1 nos. Slide gate 3 nos. (W 2.0 m x H 2.0 m)
1.2 Canal work - Canal rehabilitation* - Canal construction* (*; including structures)	Main = 11 km , Secondary = 12.0 km, Main = 32 km, Secondary = 73 km, Tertiary = 170 km Drainage = 128 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
(c) Construction; 4 years
(d) Establishment of FWUC and training; 6 years (2 years for establishment, 4 years for training)
(e) Agriculture extension service; 4 years (2 years overlap w/ construction)

(5) Cost Estimate

Total Investment Costs: 18,897 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Beoun Preah Ponley Rehab. Project	17,571	703	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	16
3.	Social factor	20	8
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	6
	Total	100	67.00

D6.3.2 Damnak Ampil Extension Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>SamPovMeas</td> <td>LorLokSar</td> <td>DamNakAmPil</td> <td>370829</td> <td>1380406</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		SamPovMeas	LorLokSar	DamNakAmPil	370829	1380406
	District	Commune	Village	UTM Reference							
SamPovMeas	LorLokSar	DamNakAmPil	370829	1380406							
1.2 River basin/ water source	Pursat river basin/ Pursat river										
1.3 Target group	1) Number of household = 33,790 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project or program	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project or program	1) Improvement of existing automatic gate 2) Rehabilitation of existing irrigation system/ Construction of canals										
1.6 Objective area	8,000 Ha										
1.7 Necessity of project/program	<p>Damnak Ampil weir commenced the service in 2007. The main canal was rehabilitated for 7 km, and remaining main canal section of 13 km, and construction of the whole length of secondary and tertiary canals were left.</p> <p>The extension project would rehabilitate remaining main canal section and construct secondary and tertiary canals for effective use of diverted water at the weir.</p> <p>The weir has a high potential to irrigate existing systems located in the downstream area. In order to secure the potential, improvement of the weir would be necessary.</p>										

(2) Agriculture:

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	7,700	82	8,000	85	300
Normal Irrigation Paddy Field	1,170	12	8,000	85	6,830
Supplemental Irrigation Paddy Field	1,632	17			-1,632
Field under Rainfed Condition	4,898	52			-4,898
2. Rainfed Paddy Field	350	4			-350
3. Right-of-ways	1,360	14	1,410	15	50
Total	9,410	100	9,410	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	1,170					8,000					6,830			
Early Wet/Dry Season		1,170	15	3.0	3,510		755	9	3.5	2,643				-867
Wet Season Rice		1,170	15	2.8	3,241		8,000	100	3.3	26,712		6,830		23,471
Upland Crops							325	4.1	0.5	166		325		166
Supplemental Irr. Field	1,632										-1,632			
Dry Season														
Wet Season Rice		1,632	20	1.9	3,077							-1,632		-3,077
Rainfed Paddy Field	5,248										-5,248			
Wet Season Rice		5,248	65	1.4	7,269						0	-5,248		-7,269
Annual														
Annual Rice		9,220	115	1.9	17,097		8,755	109	3.4	29,355		-465	-5	12,258
Upland Crops							325	4		166		325		166
Total	8,050	9,220	115		17,097	8,000	9,080	114		29,521	-50	-140	-1	12,424

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Damnak

As shown in the tables; overall yield increase of 1.5 ton/ha and paddy production increase of 12,300 ton are expected under the project.

(3) **Project scope:**

Item	Description
1. Direct Construction	
1.1 Damnak Ampil weir - Improvement of gates - Other works	(Total width =152.8m, Weir body = 104.8m, Height =8m) Automatic gate 7 nos. (W 10.0m x H 4.0m) Extension of erosion protection, etc.
1.2 Canal work including structures - Canal rehabilitation - Canal construction	Main = 16 km , Secondary = 150 km, Main = - km, Secondary = - km, Tertiary = 160 km Drainage = 120 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) **Implementation Schedule**

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
- (c) Construction; 4 years
- (d) Establishment of FWUC and training; 7 years (2 years for establishment, 5 years for training)
- (e) Agriculture extension service; 5 years (3 years overlap w/ construction)

(5) **Cost Estimate** Total Investment Costs: 17,175 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
Damnak Ampil Ext. Project	15,964	639	93	479	17,175

(6) **Evaluation**

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	23
2.	Economic factor	20	16
3.	Social factor	20	12
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	10
	Total	100	77.00

D6.3.3 Wat Loung Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Sam Pov Meas, Ba Kan</td> <td>Lor Lok Sar, Tra Peang Chorng</td> <td>Wat Lourng, Kosh, Ba Kan</td> <td>375467</td> <td>1382469</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Sam Pov Meas, Ba Kan	Lor Lok Sar, Tra Peang Chorng	Wat Lourng, Kosh, Ba Kan	375467	1382469
	District	Commune	Village	UTM Reference							
Sam Pov Meas, Ba Kan	Lor Lok Sar, Tra Peang Chorng	Wat Lourng, Kosh, Ba Kan	375467	1382469							
1.2 River basin	Pursat river basin/ Pursat river										
1.3 Target group	1) Number of household = 1,724 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	3,940Ha										
1.7 Necessity of project	<p>The system construction was completed excluding intake weir in the late 1970's, and the system lost its function after a few years' operation.</p> <p>In order to secure water source, utilization of Damnak Ampil weir would be a highly possible alternative. In order to receive water from the weir, a channel connecting the weir to the Wat Loung main canal would need to be constructed.</p> <p>In addition, existing irrigation system is seriously deteriorated, and lack of canals at the secondary and tertiary levels. Rehabilitation and additional construction of canals would be necessary.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I) Area (ha)
	Area		Area		
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	1,800	39	3,940	85	2,140
Normal Irrigation Paddy Field	45	1	3,940	85	3,895
Supplemental Irrigation Paddy Field	410	9			-410
Field under Rainfed Condition	1,345	29			-1,345
2. Rainfed Paddy Field	2,535	55			-2,535
3. Right-of-ways	305	7	700	15	395
Total	4,640	100	4,640	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Staff Empowerment
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	45					3,940					3,895			
Early Wet/Dry Season		45	1	3.0	135		250	6	3.5	875		205		740
Wet Season Rice		45	1	2.8	125		3,940	100	3.3	13,156		3,895		13,031
Upland Crops							160	4.1	0.5	82		160		82
Supplemental Irrig. Field	410										-410			
Dry Season														
Wet Season Rice		410	9	1.9	773							-410		-773
Rainfed Paddy Field	3,880										-3,880			
Wet Season Rice		3,880	90	1.4	5,374							-3,880		-5,374
Annual		4,380	101	1.5	6,407		4,190	106	3.3	14,031		-190		5
Upland Crops							160	4		82		160		82
Total	4,335	4,380	101		6,407	3,940	4,350	110		14,113	-395	-30	9	7,706

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Wat Loung

As shown in the tables; overall yield increase of 1.8 ton/ha and paddy production increase of 7,600 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 3 existing systems	Wat Loung (2,000ha) Thnos Tachap (1,230ha) Bakan (710ha)
1.1 Canal work - Canal rehabilitation* - Canal construction* (*; including structures)	Main = 25 km , Secondary = 8 km, Main = 11 km, Secondary = 32 km, Tertiary = 79 km Drainage = 59 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
- (c) Construction; 2 years
- (d) Establishment of FWUC and training; 6 years (2 years for establishment, 4 years for training)
- (e) Agriculture extension service; 4 years

(5) Cost Estimate; Total Investment Costs: 8,545 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Wat Loung Rehab. Project	7,943	318	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	23
2.	Economic factor	20	13
3.	Social factor	20	8.72
4.	Environmental factor	10	10
5.	Ease of implementation	10	10
6.	Maturity factor	10	6
	Total	100	70.72

D6.3.4 Wat Chre Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>BaKan</td> <td>BoeungKhnar</td> <td>WatChre</td> <td>361652</td> <td>1398459</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		BaKan	BoeungKhnar	WatChre	361652	1398459
	District	Commune	Village	UTM Reference							
BaKan	BoeungKhnar	WatChre	361652	1398459							
1.2 River basin	Pursat river basin/ BoeungKhnar Stream/Chambot river from DamNakAmpil weir										
1.3 Target group	1) Number of household= 926 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through re-construction of Wat Chre weir and rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	1,000Ha										
1.7 Necessity of project	<p>In the late 1970's, system construction was completed, and the system lost the function after 2 years' operation. The system problem would be a lack of stable water source and deterioration of irrigation facilities.</p> <p>The water source problem could be mitigated by receiving water supply from the Damnak Ampil extension project in future stage.</p> <p>In order to utilize the water source effectively, re-construction of weir and rehabilitation of canal network would be required.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I) Area (ha)
	Area		Area		
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	1,000	85	1,000	85	0
Normal Irrigation Paddy Field	20	2	1,000	85	980
Supplemental Irrigation Paddy Field	98	8			-98
Field under Rainfed Condition	882	75			-882
2. Rainfed Paddy Field					
3. Right-of-ways	180	15	180	15	0
Total	1,180	100	1,180	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	20					1,000					980			
Early Wet/Dry Season		20	2	3.0	60		70	7	3.5	245		50		185
Wet Season Rice		20	2	2.8	55		1,000	100	3.3	3,339		980		3,284
Upland Crops							40	4.0	0.5	20		40		20
Supplemental Irri. Field	98										-98			
Dry Season														
Wet Season Rice		98	10	1.9	184							-98		-184
Rainfed Paddy Field	882										-882			
Wet Season Rice		882	88	1.4	1,222							-882		-1,222
Annual														
Annual Rice		1,020	102	1.5	1,521		1,070	107	3.3	3,584		50	5	2,063
Upland Crops							40	4		20		40	-	20
Total	1,000	1,020	102	1.5	1,521	1,000	1,110	111		3,604	0	90	9	2,083

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Wat Chre

As shown in the tables; overall yield increase of 1.8 ton/ha and paddy production increase of 2,100ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
1.1 Wat Chre weir - Intake Structure	Total width =28m, Weir body = 22m, Height =3.5m Gate: Automatic gate 2 nos. (W 5.5m x H 2.0m) Slide gate 2 nos. (W 2.0 m x H 2.0 m) 1 nos. Slide gate 3 nos. (W 2.0 m x H 2.0 m)
1.2 Canal work - Canal rehabilitation* - Canal construction* (*; including structures)	Main = 3.5 km , Secondary = 9 km, Main = 1.5 km, Secondary = 1.5 km, Tertiary = 20 km Drainage = 15 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
(e) Agriculture extension service; 4 years

(5) Cost Estimate Total Investment Costs: 2,800 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
Wat Chre Rehab. Project	2,604	104	14	78	2,800

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	23
2.	Economic factor	20	12
3.	Social factor	20	8
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	10
	Total	100	69.00

D6.3.5 Anlong Khouch, Wat Leap, Kosh Khsach Water Harvesting and Recession Rice Rehabilitation Project

(1) Project description:

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	BaKan	O Tapong, MeTeuk	Sras Mkak, Me Teuk, Kosh Khsach	359818	1405630
1.2 River basin	Pursat river basin/ O Tapong Stream/BoeungKhnar Stream				
1.3 Target group	1) Number of household=1,394 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA				
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system				
1.5 Type of project	Rehabilitation of existing irrigation system				
1.6 Objective area	2,600 Ha				
1.7 Necessity of project	The project comprises three typical water harvesting and recession rice systems. The Anlong Khouch and the Koah Khsach systems were constructed in the late 1970's. On the other hand, the Wat Leap system construction was completed in 1994. Among three systems, deterioration of the Anlong Khouch is serious and requires total rehabilitation. The other two projects require partial rehabilitation of dyke system and comprehensive rehabilitation of canal systems.				

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I) Area (ha)
	Area		Area		
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	2,514	82	2,602	85	88
Normal Irrigation Paddy Field			1,231	40	1,231
Supplemental Irrigation Paddy Field	226	7			-226
Field under Rainfed Condition	917	30			-917
Recession Paddy Field	1,371	55	1,371	45	0
2. Rainfed Paddy Field	100	3			-100
3. Right-of-ways	446	15	458	15	12
Total	3,060	100	3,060	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						1,231					1,231			
Early Wet/Dry Season							324	12	3.5	1,134		324		1,134
Wet Season Rice							1,231	47	3.3	4,111		1,231		4,111
Upland Crops							147	5.6	0.6	93		147		93
Supplemental Irrig. Field	226										-226			
Dry Season		72	3	2.5	180							-72		-180
Wet Season Rice		226	9	1.9	426							-226		-426
Rainfed Paddy Field	1,017										-1,017			
Dry Season		103	4	2.0	206							-103		-206
Wet Season Rice		1,017	39	1.4	1,409							-1,017		-1,409
Recession Paddy Field	1,371	1,371	52	2.0	2,742	1,371	1,371	52.7	2.5	3,428	0	0		686
Annual Rice		2,789	107	1.8	4,963		2,926	112	3.0	8,673		137	6	3,710
Upland Crops							147	6		93		147	-	93
Total	2,614	2,789	107	1.8	4,963	2,602	3,073	118		8,766	-12	284	11	3,803

Note: Direct sowing & transplanting combined in wet season rice & yield is a weighted average of the two

Ou Tapoung

As shown in the tables; overall yield increase of 1.2 ton/ha and paddy production increase of 3,700 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 3 existing systems	Anlong Khouch (800 ha), Wat Leap (570 ha) Kosh Khsach (1,230 ha)
1.1 Canal work including structures - Canal rehabilitation - Canal construction	Main = 6 km , Secondary = 1 km, Main = 7 km, Secondary = 26 km, Tertiary = 52 km Drainage = 39 km
1.2 Irrigation Pond Rehabilitation - Dyke - Structures	10,150 m Spillway, intake structure
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 6 years (2 years for establishment, 4 years for training)
(e) Agriculture extension service; 4 years

(5) Cost Estimate; Total Investment Costs: 6,036 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Ou Tapoung / Boeung Khnar Water Harvest. Pjt.	5,610	224	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	23
2.	Economic factor	20	11
3.	Social factor	20	10.88
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	2
	Total	100	62.88

D6.4 Proposed Projects in the Boribo River Basin

D6.4.1 Lum Hach Rehabilitation Project

(1) Project description:

Item	Description			
	District	Commune	Village	UTM Reference
1.1 Location	Boribo, RoLeaPha-ea	AnChagnRoung, PonLey, PoPel, ProSneb, and other 7 communes	TaingPrich, Prosneb, TaingThneum, Kdol, and other 27 villages	425898 1362360
1.2 River basin/ water source	Boribo river basin/ Boribo river			
1.3 Target group	1) Number of household = 17,321 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA			
1.4 Objective of the project or program	1) Enhancement of rice production through rehabilitation of Lum Hach reservoir and existing irrigation system			
1.5 Type of project or program	1) Rehabilitation of existing irrigation system			
1.6 Objective area	3,700 Ha			
1.7 Necessity of project/program	<p>Water source for irrigation is limited in the Boribo basin. The Boribo, the largest river in the basin, originates from the Lum-Hack reservoir.</p> <p>Since the reservoir has no structure to control water, effective usage of storage water of the reservoir is not attained. In order to increase capacity of the reservoir and to realize effective water supply using limited water source, provision of water control facilities would be crucial.</p> <p>Rehabilitation of existing irrigation systems would be also a key issue to increase irrigated agriculture area.</p>			

(2) Agriculture:

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (I - II) Area (ha)
	(ha)	(%)	(ha)	(%)	
	1. Irrigation Area	2,000	46	3,700	85
Normal Irrigation Paddy Field	380	9	3,700	85	3,320
Supplemental Irrigation Paddy Field	405	9			-405
Field under Rainfed Condition	1,215				
2. Rainfed Paddy Field	2,000	46			-2,000
3. Right-of-ways	350	8	650	15	300
Total	4,350	100	4,350	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	380					3,700					3,320			
Early Wet/Dry Season		380	10	3.0	1,140									
Wet Season Rice		380	10	3.0	1,140									
Upland Crops							190	5.1	0.5	95		190		95
Supplemental Irr. Field	405										-405			
Wet Season Rice		405	10	2.0	810									-810
Rainfed Paddy Field	3,215										-3,215			
Wet Season Rice		3,215	80	1.5	4,823									-4,823
Annual Rice		4,380	110	1.8	7,913		3,700	100	3.5	12,950		-680	-10	5,037
Upland Crops							190	5		95		190		95
Total	4,000	4,380	110		7,913	3,700	3,890	105		13,045	-300	-490	-4	5,132

As shown in the tables; overall yield increase of 1.7 ton/ha and paddy production increase of 5,000 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
1.1 Lum Hack reservoir outlet weir - Intake structure	Total width =84m, Weir body = 42m, Height =10m Gate: Automatic gate 3 nos. (W 7.2 m x H 5.1 m) Slide gate 4 nos. (W 2.0 m x H 4.0 m) 2 nos. ; Slide gate 3 nos. (W 2.0 m x H 2.5 m)/ intake
1.2 Canal rehabilitation* Canal construction* (*; including structures)	Main = - km, Secondary = 12 km Main = 7km, Secondary = 25 km, Tertiary = 74 km Drainage = 56 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 2 years
(d) Establishment of FWUC and training; 6 years (2 years for establishment, 4 years for training)
(e) Agriculture extension service; 4 years

(5) Cost Estimate Total Investment Costs: 10,174 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Lum Hach Rehab. Project	9,467	379	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	22.5
2.	Economic factor	20	11
3.	Social factor	20	10
4.	Environmental factor	10	8
5.	Ease of implementation	10	10
6.	Maturity factor	10	10
	Total	100	71.50

D6.4.2 7th January Canal Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Boribo, RoLeaPha-ea</td> <td>BanTeayPreal, MeLum, Chork, ProSneb, and other 9 communes</td> <td>TopTbeng, Prosneb, ChralornKok, Saorngl, and other 18 villages</td> <td>425898</td> <td>1362360</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Boribo, RoLeaPha-ea	BanTeayPreal, MeLum, Chork, ProSneb, and other 9 communes	TopTbeng, Prosneb, ChralornKok, Saorngl, and other 18 villages	425898	1362360
District	Commune	Village	UTM Reference								
Boribo, RoLeaPha-ea	BanTeayPreal, MeLum, Chork, ProSneb, and other 9 communes	TopTbeng, Prosneb, ChralornKok, Saorngl, and other 18 villages	425898	1362360							
1.2 River basin/ water source	Small streams such as Khlong Anlong, Chrang, Svay, etc.										
1.3 Target group	1) Number of household = 5,887 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	2,000Ha										
1.7 Necessity of project	<p>The 7th January canal has a role of water source for more than 20 sub-systems. The canal was constructed in the late 1970's to collect water from streams, and then to supply water for irrigation sub-systems and pond systems located in downstream area. However, the canal lost the function because of natural disasters in the early 1980's. Although local people, government and other organizations made many efforts for repair work to sub-systems, they recovered only a part of the function.</p> <p>In order to recover the function, comprehensive rehabilitation of the 7th canal, and sub-irrigation systems are necessary.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I) Area (ha)
	Area		Area		
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	1,000	43	2,000	85	1,000
Normal Irrigation Paddy Field	190	8	2,000	85	1,810
Supplemental Irrigation Paddy Field	203	9			-203
Field under Rainfed Condition	607				
2. Rainfed Paddy Field	1,170	50			-1,170
3. Right-of-ways	180	8	350	15	170
Total	2,350	100	2,350	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test
- Demonstration plot, Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course, FFS/IPM
- Study Tour, VEA Training
- Mass guidance/Workshop
- Provision of Transportation Means
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field	190					2,000					1,810			
Early Wet/Dry Season		190	9	3.0	570									-570
Wet Season Rice		190	9	3.0	570		2,000	100	3.5	7,000		1,810		6,430
Upland Crops							100	5.0	0.5	50		100		50
Supplemental Irri. Field	203										-203			
Wet Season Rice		203	9	2.0	406							-203		-406
Rainfed Paddy Field	1,777										-1,777			
Wet Season Rice		1,777	82	1.5	2,666							-1,777		-2,666
Annual		2,360	109	1.8	4,212	2,000	100	3.5	7,000		-360		-9	2,788
Upland Crops							100	5	50			100		50
Total	2,170	2,360	109		4,212	2,000	2,100	105		7,050	-170	-260	-4	2,838

As shown in the tables; overall yield increase of 1.7 ton/ha and production increase of 2,800 ton are expected under the project.

(3) **Project scope:**

Item	Description
1. Direct Construction	
1.1 Canal work including structures	
- Canal rehabilitation	Main = 20 km, Secondary = 12 km
- Canal construction	Secondary = 8 km, Tertiary = 40 km Drainage = 30 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) **Implementation Schedule**

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
- (c) Construction; 1 year
- (d) Establishment of FWUC and training; 6 years, (2 years for establishment, 4 years for training)
- (e) Agriculture extension service; 4 years

(5) **Cost Estimate** Total Investment Costs: 5,339 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		7th January Canal Rehab. Project	4,967	199	

(6) **Evaluation**

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	11
3.	Social factor	20	8
4.	Environmental factor	10	10
5.	Ease of implementation	10	6
6.	Maturity factor	10	6
	Total	100	62.00

D6.4.3 Khvet Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>Kbal Teuk</td> <td>Khvet</td> <td>422564</td> <td>1314964</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	Kbal Teuk	Khvet	422564	1314964
	District	Commune	Village	UTM Reference							
Teuk Phos	Kbal Teuk	Khvet	422564	1314964							
1.2 River basin/ water source	Boribo river basin/ Chreav stream										
1.3 Target group	1) Number of household = 330 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through re-construction of Khvet weir and rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	250Ha										
1.7 Necessity of project	<p>The proposed Khvet rehabilitation project is a typical small river irrigation system.</p> <p>The Khvet weir was constructed twice in French colonial period and in the 1970's. Both of them completely lost their function, and the system area has relied only on rainfall since the late 1970's.</p> <p>In order to cover irrigation area widely, re-construction of weir at the location of French colonial period would be necessary. In addition, rehabilitation of irrigation canals would be also required to irrigate existing cultivation area.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	250	86	250	86	0
Normal Irrigation Paddy Field			250	86	250
Supplemental Irrigation Paddy Field	25	9			-25
Field under Rainfed Condition	225	78			-225
2. Rainfed Paddy Field					
3. Right-of-ways	40	14	40	14	0
Total	290	100	290	100	0

Agricultural Support Programs Planned

- Field Programs
- Demonstration plot
- Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						250					250			
Early Wet/Dry Season												0		0
Wet Season Rice							250	100	3.5	875		250		875
Upland Crops							10	4.0	0.5	5		10		5
Supplemental Irr. Field	25										-25			
Wet Season Rice		25	10	2.0	50							-25		-50
Rainfed Paddy Field	225										-225			
Wet Season Rice		225	90	1.5	338							-225		-338
Annual														
Annual Rice		250	100	1.6	388		250	100	3.5	875		0	0	487
Upland Crops							10	4		5		10		5
Total	250	250	100	1.6	388	250	260	104		880	0	10	4	492

As shown in the tables; overall yield increase of 1.9 ton/ha and paddy production increase of 490 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
1.1 Khvet weir	Total width =21m, Weir body = 15m, Height =3 m Slide gate 1 no. (W 2.0 m x H 2.0 m)
- Intake structure	1 no. ; Slide gate 2 nos. (W 2.0 m x H 2.0 m)
1.2 Canal rehabilitation*	Main = 1.5 km, Secondary = - km
Canal construction* (*; including structures)	Main = - km, Secondary = 2.5 km, Tertiary = 5 km Drainage = 3.8 km
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
- (c) Construction; 1 year
- (d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
- (e) Agriculture extension service; 3 years

(5) Cost Estimate Total Investment Costs: 890 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
Khvet Rehab. Project	825	33	7	25	890

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	26
2.	Economic factor	20	10
3.	Social factor	20	8
4.	Environmental factor	10	8
5.	Ease of implementation	10	2
6.	Maturity factor	10	2
	Total	100	56.00

D6.4.4 Ta Ram Rehabilitation Project

(1) Project description:

Item	Description
1.1 Location	District
	Commune
1.1 Location	Village
	UTM Reference
1.1 Location	Teuk Phos
1.1 Location	Kbal Teuk
1.1 Location	Khvet
1.1 Location	424500
1.1 Location	1317058
1.2 River basin/ water source	Boribo river basin/ Sre Bak Stream
1.3 Target group	1) Number of household = 230 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA
1.4 Objective of the project	Enhancement of rice production through re-construction of Ta Ram weir and rehabilitation of existing irrigation system
1.5 Type of project	Rehabilitation of existing irrigation system
1.6 Objective area	180Ha
1.7 Necessity of project	The proposed Ta Ram rehabilitation project is a typical small river irrigation system with a regulating pond. The Ta Ram weir was constructed in the upper reaches of the Sre Bak stream in the 1970's. After four years' operation, the system lost the function. The main canal dyke near the regulating pond has collapsed repeatedly. In order to recover the function, comprehensive rehabilitation would be required.

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I) Area (ha)
	Area		Area		
	(ha)	(%)	(ha)	(%)	
1. Irrigation Area	180	95	180	95	0
Normal Irrigation Paddy Field			180	95	180
Supplemental Irrigation Paddy Field	18	10			-18
Field under Rainfed Condition	162	86			-162
2. Rainfed Paddy Field					
3. Right-of-ways	9	5	9	5	0
Total	189	100	189	100	0

Agricultural Support Programs Planned

- Field Programs
- Demonstration plot
- Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						180					180			
Early Wet/Dry Season												0		0
Wet Season Rice							180	100	3.5	630		180		630
Upland Crops							10	5.6	0.5	5		10		5
Supplemental Iri. Field	18										-18			
Wet Season Rice		18	10	2.0	36							-18		-36
Rainfed Paddy Field	162										-162			
Wet Season Rice		162	90	1.5	243							-162		-243
Annual		180	100	1.6	279		180	100	3.5	630		0	0	354
Upland Crops							10	6		5		10		5
Total	180	180	100		279	180	190	106		635	0	10	6	356

As shown in the tables; overall yield increase of 1.9 ton/ha and paddy production increase of 350 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
1.1 Ta Ram weir	Total width =21m, Weir body = 15m, Height =3.5 m
- Intake structure	Slide gate 1 no. (W 2.0 m x H 2.5 m) 1 no. ; Slide gate 2 nos. (W 2.0 m x H 2.0 m)
1.2 Canal rehabilitation*	Main = 3.5 km, Secondary = - km
Canal construction* (*; including structures)	Main = - km, Secondary = 2 km, Tertiary = 4 km Drainage = 2.7 km
1.3 Irrigation pond	1 no.
Dyke rehabilitation	L = 0.5km
Spillway	Spillway 1 no., Outlet 1 no.
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
- (c) Construction; 1 year
- (d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
- (e) Agriculture extension service; 3 years

(5) Cost Estimate Total Investment Costs: 981 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Ta Ram Rehab. Project	911	36	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	26
2.	Economic factor	20	7
3.	Social factor	20	8
4.	Environmental factor	10	10
5.	Ease of implementation	10	2
6.	Maturity factor	10	2
	Total	100	55.00

D6.4.5 Chak Teum, Trapeang Khlong, Don Pov Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>Chieab</td> <td>KoshKhtum, Ta Ney, Chieab</td> <td>426405</td> <td>1331406</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	Chieab	KoshKhtum, Ta Ney, Chieab	426405	1331406
	District	Commune	Village	UTM Reference							
Teuk Phos	Chieab	KoshKhtum, Ta Ney, Chieab	426405	1331406							
1.2 River basin/ water source	Boribo river basin/ O Khley stream										
1.3 Target group	1) Number of household=1,473 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through re-construction of weir and rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	980 Ha										
1.7 Necessity of project	<p>The proposed project consists of three irrigation systems. The project is a typical combination system of irrigation pond and small river.</p> <p>The systems were constructed in the late 1970's. After a few years' operation, they lost their functions.</p> <p>Small river irrigation systems would need a weir for secure water supply, and rehabilitation of the dyke is necessary for the Chak Teum system.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	(ha)	(%)	(ha)	(%)	
	1. Irrigation Area	980	85	980	85
Normal Irrigation Paddy Field			980	85	980
Supplemental Irrigation Paddy Field	98	9			-98
Field under Rainfed Condition	882	77			-882
2. Rainfed Paddy Field					
3. Right-of-ways	170	15	170	15	0
Total	1,150	100	1,150	100	0

Agricultural Support Programs Planned

- Field Programs
- Field Adaptability Test, Demonstration plot
- Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						980					980			
Early Wet/Dry Season												0		0
Wet Season Rice							980	100	3.5	3,430		980		3,430
Upland Crops							50	5.1	0.5	25		50		25
Supplemental Irr. Field	98										-98			
Wet Season Rice		98	10	2.0	196							-98		-196
Rainfed Paddy Field	882										-882			
Wet Season Rice		882	90	1.5	1,323							-882		-1,323
Annual Rice		980	100	1.6	1,519		980	100	3.5	3,430		0	0	1,911
Upland Crops							50	5		25		50		25
Total	980	980	100	1.6	1,519	980	1,030	105		3,455	0	50	5	1,936

As shown in the tables; overall yield increase of 1.9 ton/ha and production increase of 1,900 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 3 existing systems	Chak Teum (230 ha), Trapeang Khlong (530 ha) Don Pov (220 ha)
1.1 Weir construction	Total width =21m, Weir body = 15m, Height =3.5 m Slide gate 1 no. (W 2.0 m x H 2.5 m)
- Intake structure	1 no. ; Slide gate 2 nos. (W 2.0 m x H 2.0 m)
1.2 Canal work including structures	
- Canal rehabilitation*	Main = 5 km, Secondary = - km
- Canal construction*	Main = 2 km, Secondary = 10 km, Tertiary = 17 km Drainage = 15 km
1.3 Irrigation Pond	1 no.
- Dyke rehabilitation	500 m
- Structure	Spillway 1, Intake 1
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
(e) Agriculture extension service; 3 years

(5) Cost Estimate Total Investment Costs: 2,465 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Chak Teum, Trapeang Khlong, Don Pov Rehab.	2,291	92	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	23
2.	Economic factor	20	12
3.	Social factor	20	10.83
4.	Environmental factor	10	10
5.	Ease of implementation	10	2
6.	Maturity factor	10	6
	Total	100	63.83

D6.4.6 Teuk Laak and Trapeang Thlan Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>KhlongPoPork, Aphivat</td> <td>TeukLaak, SreTaChey</td> <td>442624</td> <td>1333278</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	KhlongPoPork, Aphivat	TeukLaak, SreTaChey	442624	1333278
	District	Commune	Village	UTM Reference							
Teuk Phos	KhlongPoPork, Aphivat	TeukLaak, SreTaChey	442624	1333278							
1.2 River basin/water source	Boribo river basin/ Pernarng stream										
1.3 Target group	1) Number of household = 296 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	230Ha										
1.7 Necessity of project	<p>The proposed project consists of two systems, namely Teuk Laak and Trapeang Thlan. The project is a typical water harvesting system in undulated hilly area without secured water resource.</p> <p>These systems were constructed in the late 1970's. After a few years' operation, the dykes for water harvesting were damaged, and the systems lost their water source.</p> <p>In order to recover the function, rehabilitation of dyke and canals are necessary.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	(ha)	(%)	(ha)	(%)	
	1. Irrigation Area	230	95	230	95
Normal Irrigation Paddy Field			230	95	230
Supplemental Irrigation Paddy Field	23	9			-23
Field under Rainfed Condition	207	85			-207
2. Rainfed Paddy Field		0			0
3. Right-of-ways	13	5	13	5	0
Total	243	100	243	100	0

Agricultural Support Programs Planned

- Field Programs
- Demonstration plot
- Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						230					230			
Early Wet/Dry Season												0		0
Wet Season Rice							230	100	3.5	805		230		805
Upland Crops							10	4.3	0.5	5		10		5
Supplemental Irr. Field	23										-23			
Dry Season														
Wet Season Rice		23	10	2.0	46							-23		-46
Rainfed Paddy Field	207										-207			
Dry Season														
Wet Season Rice		207	90	1.5	311							-207		-311
Annual														
Annual Rice		230	100	1.6	357		230	100	3.5	805		0	0	448
Upland Crops							10	4		5		10	-	5
Total	230	230	100		357	230	240	104		810	0	10	4	453

As shown in the tables; overall yield increase of 1.9 ton/ha and paddy production increase of 450 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
Rehabilitation of 2 existing systems	Teuk Laak (105 ha), Trapeang Thlan (125 ha)
1.1 Canal work including structures - Canal rehabilitation - Canal construction	Main = 5 km, Secondary = 0.5 km Main = - km, Secondary = 1.8 km, Tertiary = 4.6 km Drainage = 3.5 km
1.2 Water harvesting dyke work - Dyke rehabilitation - Construction of structure	2 nos. 2,000 m 2 intakes
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 5 years (2 year for establishment, 3 years for training)
(e) Agriculture extension service; 3 years

(5) Cost Estimate Total Investment Costs: 744 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Teuk Laak, Trapeang Thlan Rehab. Project	688	28	

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	21
2.	Economic factor	20	10
3.	Social factor	20	9.72
4.	Environmental factor	10	10
5.	Ease of implementation	10	2
6.	Maturity factor	10	2
	Total	100	54.72

D6.4.7 Toul Champey Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>Chorng Mornng</td> <td>Khset</td> <td>448882</td> <td>1326116</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	Chorng Mornng	Khset	448882	1326116
	District	Commune	Village	UTM Reference							
Teuk Phos	Chorng Mornng	Khset	448882	1326116							
1.2 River basin	Boribo river basin/ Small stream										
1.3 Target group	1) Number of household = 468 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	360Ha										
1.7 Necessity of project	<p>The proposed project is a typical irrigation pond system in undulated hilly area.</p> <p>The system was constructed in the late 1970's. Immediately after completion of construction work, the system lost the function.</p> <p>In order to recover the function, rehabilitation of the dyke system by construction of a new spillway and re-construction of intake structures would be a key issue. In addition, rehabilitation and additional construction of canals would be required because of insufficient canals in paddy fields.</p>										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present		II. With Project		Increment (II - I) Area (ha)
	Area (ha)	(%)	Area (ha)	(%)	
1. Irrigation Area	360	86	360	86	0
Normal Irrigation Paddy Field			360	86	360
Supplemental Irrigation Paddy Field	36	9			-36
Field under Rainfed Condition	324	77			-324
2. Rainfed Paddy Field					
3. Right-of-ways	60	14	60	14	0
Total	420	100	420	100	0

Agricultural Support Programs Planned

- Field Programs
- Demonstration plot
- Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						360					360			
Early Wet/Dry Season														
Wet Season Rice							360	100	3.5	1,260		360		1,260
Upland Crops							20	5.6	0.5	10		20		10
Supplemental Irr. Field	36										-36			
Wet Season Rice		36	10	2.0	72							-36		-72
Rainfed Paddy Field	324										-324			
Wet Season Rice		324	90	1.5	486							-324		-486
Annual														
Annual Rice		360	100	1.6	558		360	100	3.5	1,260		0	0	702
Upland Crops							20	6		10		20	-	10
Total	360	360	100		558	360	380	106		1,270	0	20	6	712

As shown in the tables; overall yield increase of 1.9 ton/ha and paddy production increase of 700 ton are expected under the project.

(3) Project scope:

Item	Description
1. Direct Construction	
1.1 Canal work including structures - Canal rehabilitation - Canal construction	Secondary = 3.6 km, Tertiary = 7.2 km Drainage = 5.4 km
1.2 Water harvesting dyke work - Dyke rehabilitation - Construction of structure	1 no. 800 m 1 intake
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) Implementation Schedule

- (a) Survey, investigation, design, and tender; 12 months, (Tender; 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 5 years (2 year for establishment, 3 years for training)
(e) Agriculture extension service; 3 years

(5) Cost Estimate Total Investment Costs: 685 (1,000USD)

Project Name	Total Construction Costs	Other Costs			Total Investment Costs
		FWUC level training & mobilization	Agricultural & other support	Land Acquisition Cost	
		(1,000 USD)	(1,000 USD)	(1,000 USD)	
Toul Champey Rehab.Project	633	25	8	19	685

(6) Evaluation

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	26
2.	Economic factor	20	14
3.	Social factor	20	8
4.	Environmental factor	10	10
5.	Ease of implementation	10	2
6.	Maturity factor	10	2
	Total	100	62.00

D6.4.8 Chan Keak Rehabilitation Project

(1) Project description:

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Kampong TraLach</td> <td>O russey</td> <td>KraLagn</td> <td>471184</td> <td>1317474</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Kampong TraLach	O russey	KraLagn	471184	1317474
	District	Commune	Village	UTM Reference							
Kampong TraLach	O russey	KraLagn	471184	1317474							
1.2 River basin	Boribo river basin										
1.3 Target group	1) Number of household = 151 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	110Ha										
1.7 Necessity of project	The proposed Chan Keak project is a typical irrigation pond system in recession area. The system was constructed in the late 1970's. After few years operation, system lost the function. The system requires rehabilitation of dyke and canals, construction of spillway, installation of intake gates.										

(2) Agriculture

Present/Without-project & With-project Land Use of the Project Area

Land Use Sub-category	I. Present Area		II. With Project Area		Increment (II - I) Area (ha)
	(ha)	(%)	(ha)	(%)	
	1. Irrigation Area	110	95	110	95
Normal Irrigation Paddy Field			110	95	110
Supplemental Irrigation Paddy Field	27	23			-27
Field under Rainfed Condition	83	72			-83
2. Rainfed Paddy Field					
3. Right-of-ways	6	5	6	5	0
Total	116	100	116	100	0

Agricultural Support Programs Planned

- Field Programs
- Demonstration plot
- Seed Multiplication etc.
- Farmer/Farmer group Training Programs
- Training Course
- Mass guidance/Workshop
- Support Fund for Extension Staff
- Provision of Transportation Means

Present/Without-project & With-project Crop Production in the Project Area

Land Use Sub-category/ Crops	Present/Without-project					With-project					Increment			
	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Production (ton)
Normal Irrigation Field						110					110			
Early Wet/Dry Season												0		0
Wet Season Rice							110	100	3.5	385		110		385
Upland Crops							10	9.1	0.5	5		10		5
Supplemental Irr. Field	28										-28			
Dry Season		28	25	2.0	56							-28		-56
Wet Season Rice														
Rainfed Paddy Field	82										-82			
Dry Season														
Wet Season Rice		82	75	1.5	123							-82		-123
Annual														
Annual Rice		110	100	1.6	179		110	100	3.5	385		0	0	206
Upland Crops							10	9		5		10		5
Total	110	110	100	1.6	179	110	120	109		390	0	10	9	211

As shown in the tables; overall yield increase of 1.9 ton/ha and paddy production increase of 210 ton are expected under the project.

(3) **Project scope:**

Item	Description
1. Direct Construction	
1.1 Canal work including structures - Canal rehabilitation - Canal construction	Main = 1 km, Secondary = - km Main = - km, Secondary = 1.1 km, Tertiary = 2.2 km Drainage = 1.7 km
1.2 Irrigation Pond rehabilitation - Dyke rehabilitation - Construction of structure	1 no. 550 m spillway, intake gate installation
2. Other Components	
2.1 FWUC level training	Training by FWUC support team through PDOWRAM and MOWRAM
2.2 Agricultural support services	Field extension & training program by PDA/MAFF

(4) **Implementation Schedule**

- (a) Survey, investigation, design, and tender; 12 months, (Tender, 3 months)
(c) Construction; 1 year
(d) Establishment of FWUC and training; 5 years (2 years for establishment, 3 years for training)
(e) Agriculture extension service; 3 years

(5) **Cost Estimate** Total Investment Costs: 355 (1,000USD)

Project Name	Total Construction Costs (1,000 USD)	Other Costs			Total Investment Costs (1,000 USD)
		FWUC level training & mobilization (1,000 USD)	Agricultural & other support (1,000 USD)	Land Acquisition Cost (1,000 USD)	
		Chan Keak Rehab.Project	326	13	

(6) **Evaluation**

No.	Criteria	Full point	Point obtained
1.	Resources factor	30	24.5
2.	Economic factor	20	10
3.	Social factor	20	8
4.	Environmental factor	10	10
5.	Ease of implementation	10	10
6.	Maturity factor	10	2
	Total	100	64.50