CHAPTER 11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

(1) Master Plan Study

The four river basins: Battambang, Moung Russey, Pursat and Boribo are the granary of the country having been contributing to the supply of 17 % of the national paddy production. The area, however, currently encompasses ineffective irrigation resource utilization from the view points of water, water and human.

Corresponding to such situations, the Master Plan (M/P) presents the strategies and the approaches for irrigation and drainage development in the basins including the Road Map of Irrigation and Drainage Development in the Four River Basins Toward Year 2020. Under the M/P, 21 numbers of sub-projects, comprising of three main components: (i) rehabilitation and improvement of irrigation and drainage facilities, (ii) establishment and strengthening of FWUC and (iii) agriculture extension activities, are proposed with the total target area of about 63,000 ha. In addition, four project supporting programs are proposed, all of which cover cross-cutting issues related with irrigation and drainage for enhancement of the basis of project implementation:

(i) Meteorological and hydrological observation strengthening program,

(ii) Capacity development support program for MOWRAM,

(iii) Capacity development support program for PDOWRAM, and

(iv) Upland crops production promotion program.

The Road Map 2020 is elaborated for three terms with thematic goals as follows:

(i) Short Term (2008-2010): Capacity development of the Government Staffs and FWUCs,

(ii) Medium Term (2011-2015): PDOWRAM and FWUCs Initiative Management under MOWRAM Support, and

(iii) Long Tem (2016-2020): Self-Reliant Irrigation Sector Under Co-Administration

In the Road Map 2020, about 63,000 ha of irrigation areas are proposed to be rehabilitated and improved contributing to poverty alleviation in the four river basins. An increase in production of 259,000 ton of paddy per year is expected by year 2020 to meet population increase of the country. Therefore, it is concluded that the M/P on the basis of the Road 2020 should be implemented as proposed.

(2) Pre-Feasibility Study

On the basis of the M/P, six priority sub-projects are selected for Pre-Feasibility Study (Pre-F/S). Rehabilitation and development plan are prepared at the Pre-F/S level. In this process, available topographic maps and aerial photographs were utilized together with additional field investigation for the delineation of the sub-project areas. In parallel with such

field investigation, series of workshop and public meetings were organized with the farmers, government staffs from the central, provincial and local level concerned at each sub-project site. As a result, alternative sub-project areas to be rehabilitated were determined in order to formulate optimum rehabilitation plan for each sub-project from technical, economic and social view points. Then, a comparative study of the alternative plans was performed for Ream Kon, Damnak Ampil and Lum Hach Rehabilitation Sub-Projects, based on the irrigation plan, water balance study, costs and incremental benefits of each of the sub-projects. Through the comparative study results, the optimum size of the area to be rehabilitated for each sub-projects, which is the basis of Pre-F/S of the rehabilitation, was determined as summarized on the right.

Proposed Rehabilitation Area of the Sub-Projects

No.	Sub-Project	Area (ha)
1	Ream Kon Rehabilitation	1,890
2	Por Canal Rehabilitation	1,940
3	Damnak Ampil Rehabilitation	2,270
4	Wat Loung Rehabilitation	2,540
5	Wat Chre Rehabilitation	1,020
6	Lum Hach Rehabilitation	3,100
	Total	12,760

Prepared by JICA Study Team

Anticipated Indirect Benefit Area

Existing Structure to be Rehabilitated by Project	Scheme Indirectly Benefited	Command Area (ha)
Damnak Ampil Main Canal	Damnak Ampil Extension	7,650
	Bakan & Krouchi Seuchi	1,000
	Svay Daun Keo River	2,200
Lum Hach Head Works	O Roluss Irrigation	3,400
Total		14,250

Prepared by JICA Study Team

In the Pre-F/S, six sub-projects are packaged into one Project, ***West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project***. The Study revealed that the Project is technically feasible and economically viable. From the social, natural and environmental points of view, it is also justified that the Project is wholly sound. Implementation of the Project is expected to achieve the following principle objectives: (i) stable water supply to irrigate 12,760 ha with the cropping intensity of 144 %, (ii) increase of rice production of 27,300 ton per year, (iii) introduction and increase of upland crops/vegetables of 6,800 ton per year and (iv) enhancement of capability of MOWRAM, PDOWRAM and FWUCs in irrigation development and management. In addition, indirect benefit is anticipated particularly from the downstream of Damnak Ampil Rehabilitation Sub-Project and the O Roluss Irrigation System on the left bank of Lum Hach Rehabilitation Sub-Project.

In conclusion from Pre-F/S, the Project should be carried out in the manner proposed in the Study.

11.2 Recommendations

(1) Urgent Commencement of Implementation of the Road Map 2020

The food security poses one of the serious issues in the world and Cambodia is not left out. The increasing population pressure will further aggravate the situation if appropriate countermeasures are not taken on time. Irrigation development is a key factor to improve the

productivity in agriculture as proposed. It is, therefore, highly recommended that the Road Map 2020 be implemented as early as possible.

(2) Urgent Need of Institutional Strengthening related with Irrigation Sector

The M/P delineates the need of 21 irrigation and drainage sub-projects and 4 project supporting programs. As for the project supporting programs, 3 programs are finally proposed while 1 program, upland crop production promotion program is merged into soft component attached to sub-project, as to support enhancement of institutional capacity in MOWRAM and PDOWRAM. Since MOWRAM and PDOWRAM shall be responsible for smooth implementation of the Road Map 2020, it should be emphasized that such proposed supporting programs need to be properly carried out as software aspect in parallel with physical rehabilitation and improvement.

(3) Need of Monitoring and Evaluation, and Stepwise Update and Revision of M/P

The M/P shows framework and strategies of irrigation and drainage development in the four river basins, which includes implementation schedule in the Road Map toward Year 2020. in consideration such comprehensive aspects as priority, security etc. In order to attain substantial progress of the Road Map 2020, it is essential to carry out periodical monitoring and evaluation. In addition, M/P needs to be updated and revised in stepwise manner based on lessons to be learned in the implementation.

(4) Necessity of Financial Resources for the Implementation of the Road Map 2020

The insufficient resources are one of the primary concerns which would hamper the satisfactory implementation of the Road Map 2020. In the M/P and the Pre-F/S, the cost of irrigation and drainage development is estimated for 21 sub-projects at the M/P level, and, out of them, six sub-projects at the Pre-F/S level. The available financial resource envelope for irrigation development would be inadequate on the basis of past actual expenditure allocated. It is, therefore, recommended that RGC should arrange the necessary budget for the implementation of the Road Map 2020, including the cost for O&M transfer process by the Government initiative, noting the study result mentioned above.

(5) Need of Inter-sectoral and Inter-ministerial Coordination among MOWRAM, MAFF and Other Relevant Agencies

Through implementing the Road Map 2020 proposed, 108,000 ton of paddy per year are estimated to be increased from the 21 proposed sub-projects which catch up production requirement to be performed by four river basins, so as to support maintenance of country’s food self-sufficiency. Among others, implementation of six sub-projects is of urgent needs as proposed in Pre-F/S. It is strongly recommended that other supporting services required to increase value-addition of agriculture, such as agricultural extension, marketing of products, input supply, rural credit and rehabilitation of rural infrastructure, are carried out concurrently so that increase of food production is guaranteed and farmers’ incomes are increased leading to irrigation sector vital and attractive. Prior to and during the implementation, the inter-sectoral and inter-ministerial coordination is highly required centered by MOWRAM and MAFF in collaboration with other relevant ministries.

Tables

Table 2.7-1 Kong Hort Rehabilitation Phase I Project

(1) Project description:

Item	Description
1.1 Location	District: Banan, SangKe; Commune: Kan Teur Mouy-Peir, Reang Kessei, Tourl Thnorng Mouy, and other 3 communes; Village: Wat Kandal, Tourl Thnorng, and other 17 villages; UTM Reference: 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	The Phase I project consists of 3 existing systems. 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. The system requires weir re-construction, and rehabilitation of abandoned canals and structures to recover the original system function.

(2) Agriculture:

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

Land Use Sub-category	I. Present Area (ha)	I. Present Area (%)	II. With Project Area (ha)	II. With Project Area (%)	Increment (II - I) Area (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 Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	With-project Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Increment 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 Irri. 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	**Annual Rice**		**10,560**	**100**	**1.1**	**11,463**		**10,040**	**100**	**2.9**	**29,307**		-520	0	**17,844**
Annual	Upland Crops							90	1	0.5	45		90	-	45
Annual	**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 Thnorng 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

Table 2.7-2 Kong Hort Rehabilitation Phase II Project

(1) Project description:

Item	Description
1.1 Location	District: Banan, SangKe, Battambang Commune: KanTeurPeir, RangKessei,Tapon, WatKor, and other 8 communes Village: ChhayRumPeat, PreyTotoeng, PreySvay, RangKessei, And other 32 villages UTM Reference: 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 (ha)	I. Present Area (%)	II. With Project Area (ha)	II. With Project Area (%)	Increment (II - I) Area (ha)
1. Irrigation Area	2,140	70	2,733	89	593
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/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 Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	With-project Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Increment 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 Irri. 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	**Annual Rice**		**3,225**	**112**	**1.4**	**4,664**		**2,733**	**100**	**2.9**	**7,957**		**-492**	**-12**	**3,293**
Annual	Upland Crops							20	1	0.5	10		20	-	10
Annual	**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 Poung (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	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 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

Table 2.7-3 Sala Taon Weir Rehabilitation Project

(1) Project description:

Item	Description
1.1 Location	District: SangKe, AekPhnum, Battambang; Commune: NoRea, PeamAek, SamRongKnung, Prek Kpob, and other 3 communes; Village: KorHa, TaKok, OTrea NoRea, and other 38 villages; UTM Reference: 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	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%. 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.

(2) Agriculture

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

Land Use Sub-category	I. Present Area (ha)	I. Present Area (%)	II. With Project Area (ha)	II. With Project Area (%)	Increment (II - I) 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 Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	With-project Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Increment 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							-117		-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 Irri. Field	2,345										-2,345			
	Dry Season		40		2.5	100							-40		-100
	Wet Season Rice		2,345	22	1.6	3,717							-2,345		-3,717
	Rainfed Paddy Field	8,351										-8,351			
	Wet Season Rice		8,351	77	1.1	9,061							-8,351		-9,061
Annual	**Annual Rice**		**10,970**	**101**	**1.2**	**13,483**		**10,400**	**100**	**2.8**	**30,358**		-570	-1	**16,875**
Annual	Upland Crops							90	1	0.5	45		90	-	45
Annual	**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 Doumg 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* (*; including structures)	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: 58,239 (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)
Sala Taon Weir Rehab. Project	54,317	2,173	119	1,630	58,239

(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

Table 2.7-4 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	The project is proposed to supply irrigation water to existing seventeen systems by five pump stations to be constructed instead of construction of weir. By pump irrigation method, prospective environmental and social negative effects by construction of weir would be eliminated.				

(2) Agriculture

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

Land Use Sub-category	I. Present Area (ha)	I. Present Area (%)	II. With Project Area (ha)	II. With Project Area (%)	Increment (II - I) 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 Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	With-project Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Increment 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							-117		-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 Irri. Field	2,345										-2,345			
	Dry Season		40		2.5	100							-40		-100
	Wet Season Rice		2,345	22	1.6	3,717							-2,345		-3,717
	Rainfed Paddy Field	8,351										-8,351			
	Wet Season Rice		8,351	77	1.1	9,061							-8,351		-9,061
Annual	**Annual Rice**		**10,970**	**101**	**1.2**	**13,483**		**10,400**	**100**	**2.8**	**30,358**		-570	-1	**16,875**
Annual	Upland Crops							90	1	0.5	45		90	-	45
Annual	**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 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)	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.		
- Regulator	5 nos. Slide gate 3 nos. / station (W 2.0 m x H 2.5 m)		
1.2 Canal rehabilitation*	Main = 24 km , Secondary = 22 km,		
Canal construction* (*; including structures)	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	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)
3'	Sala Taon Rehab. Project (Alternative to No.3)	40,724	1,629	119	1,629	44,101

(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	-

Table 2.7-5 Ratanak-Battambang Water Harvesting Rehabilitation Project

(1) Project description:

Item	Description
1.1 Location	District: Banan, RatanakMondol; Commune: Sdao, Trerng, Sneung, hlovMeas, and other 2 communes; Village: BaosPor, BaosKnor, Sdao, Roung, and other 9 villages; UTM Reference: 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	The proposed project consists of thirteen (13) water harvesting systems in the upper basin. Irrigation ponds are only solution to secure water supply in irrigation and in daily life in the area. 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.

(2) Agriculture

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

Land Use Sub-category	I. Present Area (ha)	(%)	II. With Project Area (ha)	(%)	Increment (II - I) 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 Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	With-project Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Increment 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 Irri. 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	**Annual Rice**		**634**	**107**	**1.2**	**758**		**580**	**100**	**2.9**	**1,693**		**-54**	**-7**	**935**
Annual	Upland Crops							5	1		3		5	-	3
Annual	**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 Anlork Dam(30ha), Beung Snourl (20ha), Or Ta Kdourch (30ha), Anlong Mean (30ha), Kbal Krabei (40ha), Beung Anlork 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	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)
Ratanak-Battambang Water Harvesting Pjt.	2,109	84	10	63	2,266

(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

Table 2.7-6 Bassac Irrigation System Rehabilitation Project

(1) Project description:

Item	Description
1.1 Location	District: MoungRussey; Commune: PrekChik; Village: PrekTaVen, PrekChik; UTM Reference: 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 (ha)	I. Present Area (%)	II. With Project Area (ha)	II. With Project Area (%)	Increment (II - I) Area (ha)
1. Irrigation Area	0	0	3,500	85	3,500
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 Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	With-project Area (ha)	Cropped Area (ha)	Cropping Intensity (%)	Yield (ton/ha)	Production (ton)	Increment 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 Irri. 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	**Annual Rice**		**4,120**	**100**	**1.2**	**4,759**		**3,500**	**100**	**3.0**	**10,560**		-620	0	**5,801**
Annual	Upland Crops							60	2		30		60	-	30
Annual	**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	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)
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