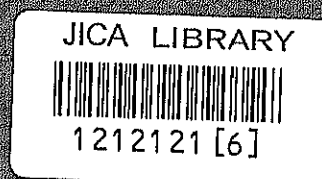


MINISTRY OF WATER RESOURCES
AND METEOROLOGY,
THE KINGDOM OF CAMBODIA

PREPARATORY SURVEY
FOR
IRRIGATION AND DRAINAGE SYSTEM
REHABILITATION AND IMPROVEMENT PROJECT
IN
THE KINGDOM OF CAMBODIA

FINAL REPORT

(EXECUTIVE SUMMARY)



SEPTEMBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIPPON KOEI CO., LTD.

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IR(先)
13-060

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1212121 [6]

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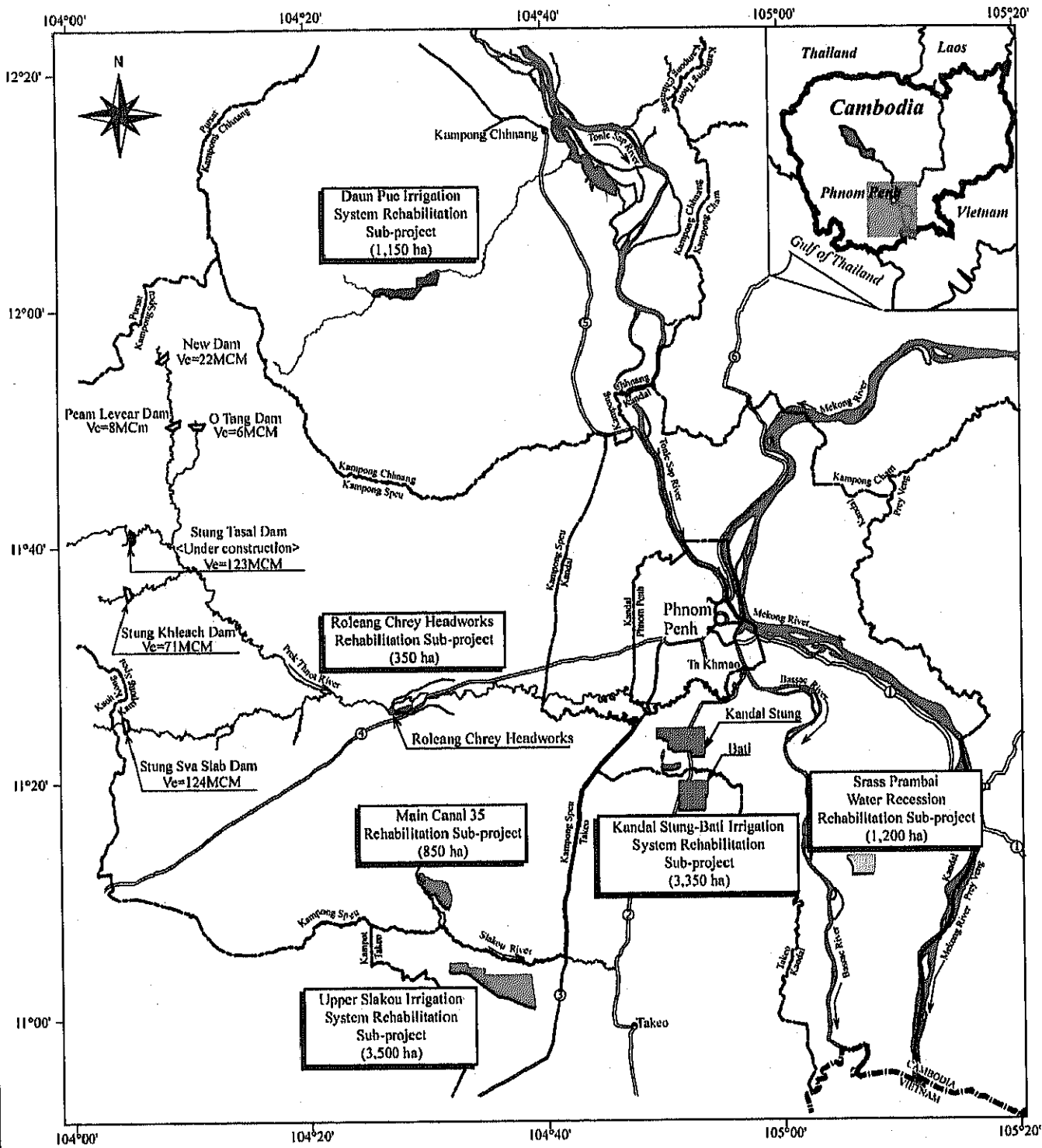
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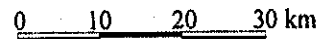
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ANNEX J: Draft Resettlement Framework for Upper Slakou Irrigation System Rehabilitation Sub-project

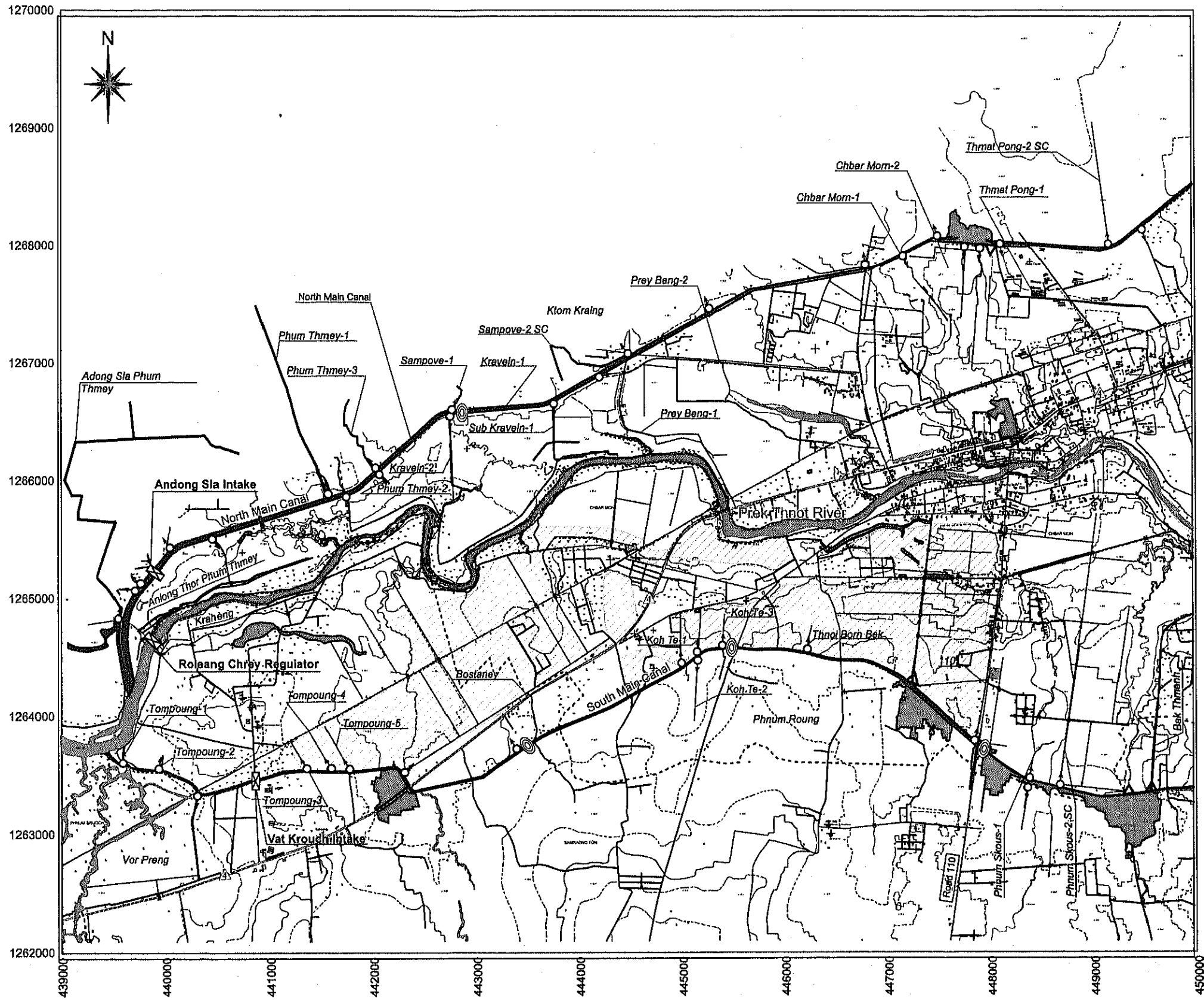


LEGEND

- River
- Capital / Provincial Capital
- National Boundary
- Provincial Boundary
- National Road
- Sub-project Area
- Dam (under construction)
- Dam (plan)
- Ve: Effective Storage Volume*



Location Map of Sub-projects

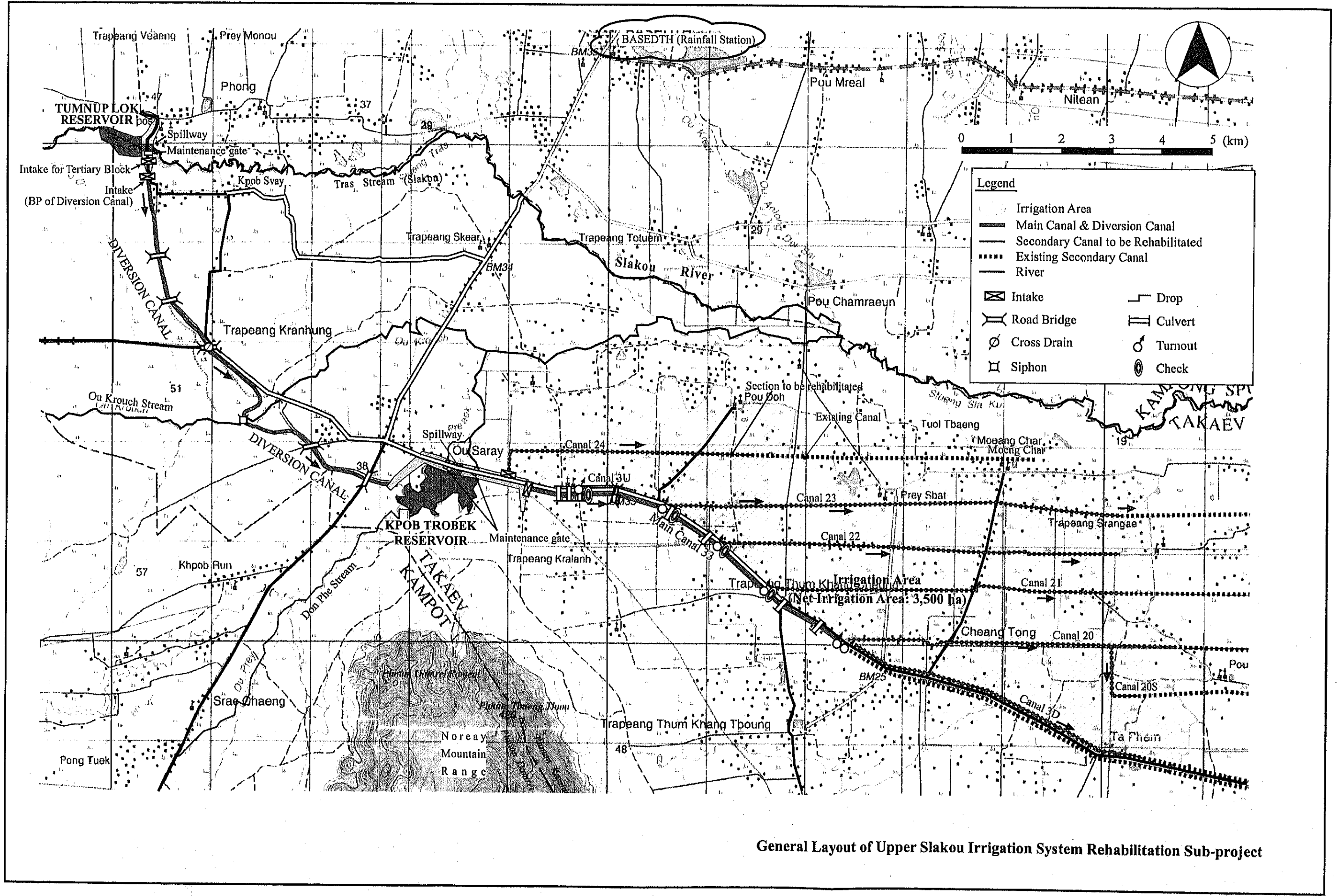


Legend

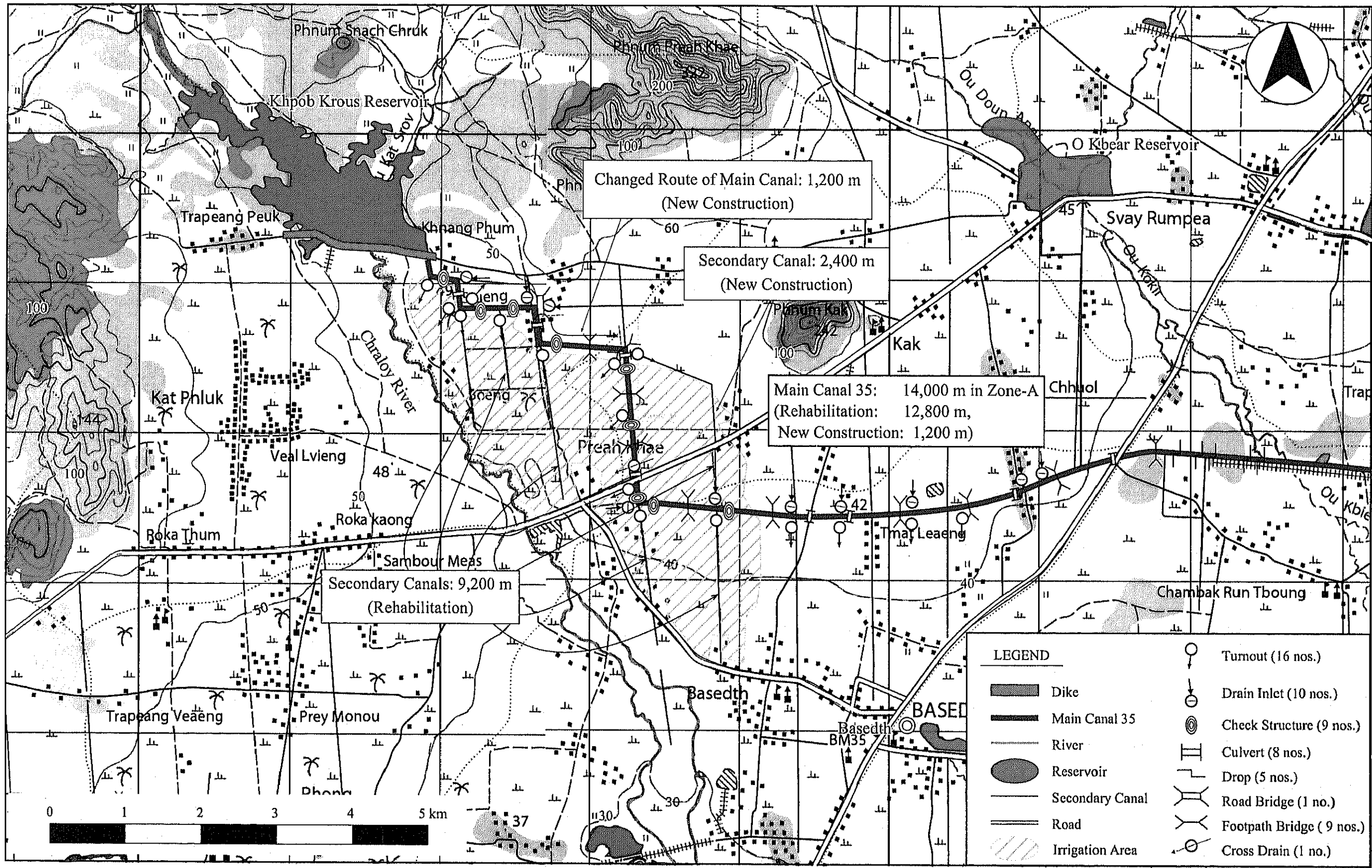
- Main Canal
- Secondary Canal
- Reservoir
- River
- Road
- Model Area
- Regulator or Intake
- Check Structure
- Turnout
- Spillway



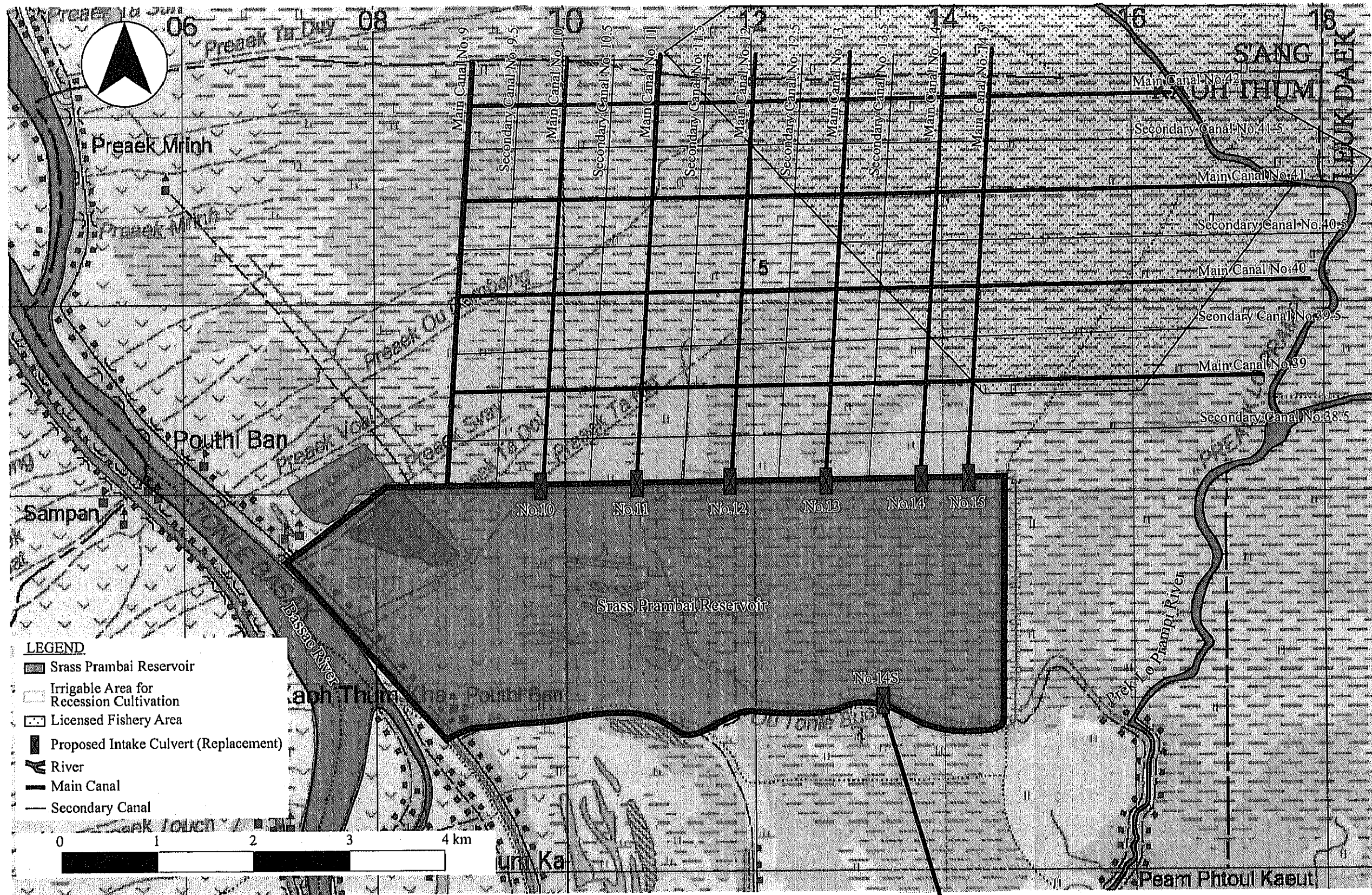
General Layout of Roleang Chrey Headworks Rehabilitation Sub-project



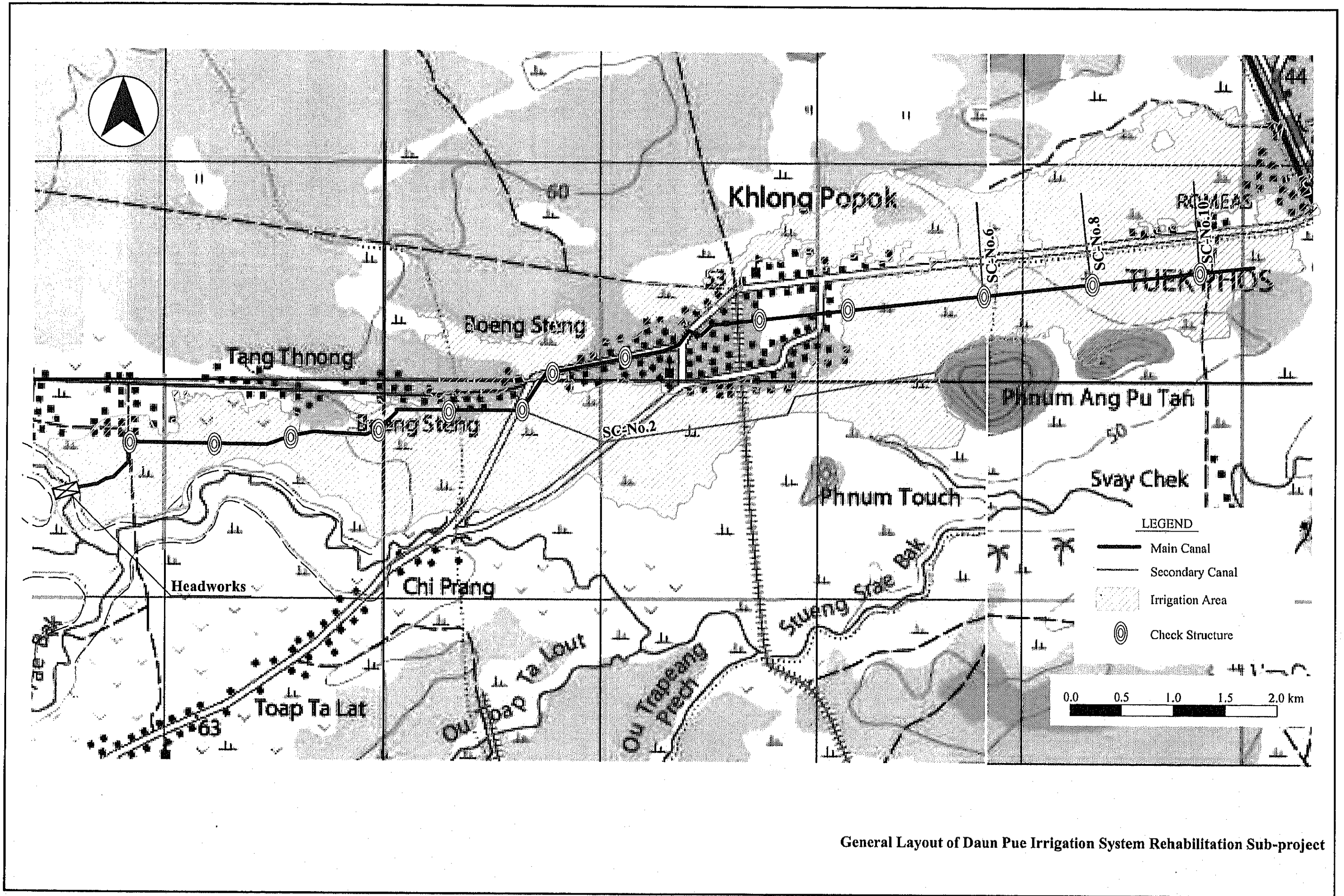
General Layout of Upper Slakou Irrigation System Rehabilitation Sub-project



General Layout of Main Canal 35 Rehabilitation Sub-project



General Layout of Srass Prambai Water Recession Rehabilitation Sub-project



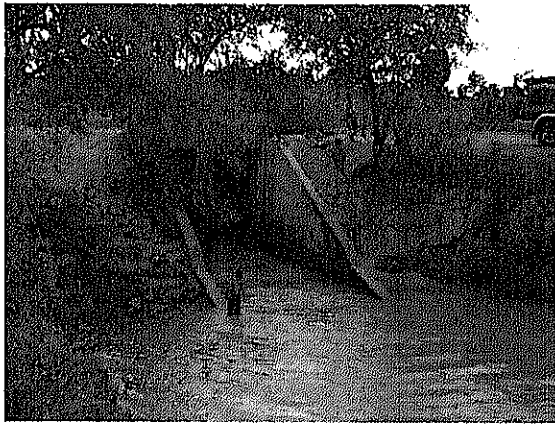
General Layout of Daun Pue Irrigation System Rehabilitation Sub-project



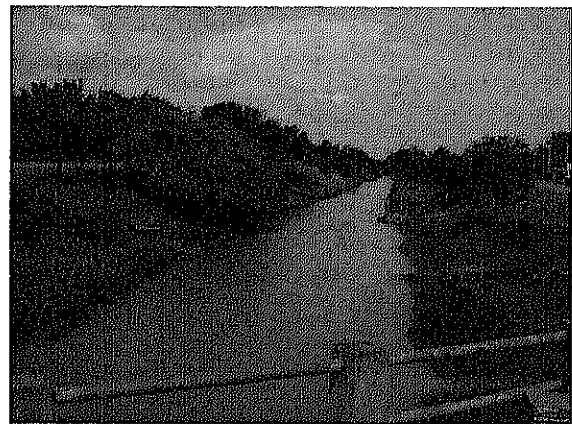
Roleang Chrey Regulator
(downstream view)



Andong Sla Intake
(downstream view)



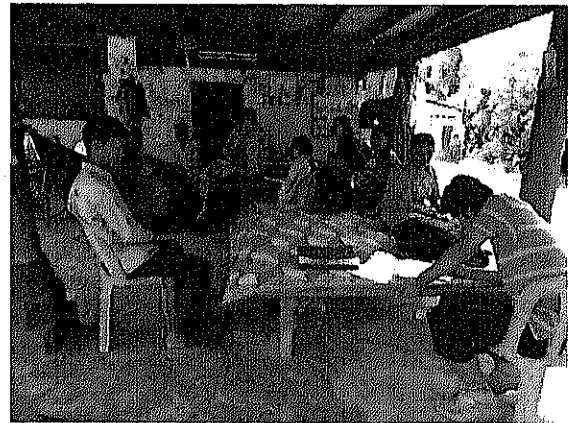
Vat Krouch Intake
(downstream view)



North Main Canal



South Main Canal



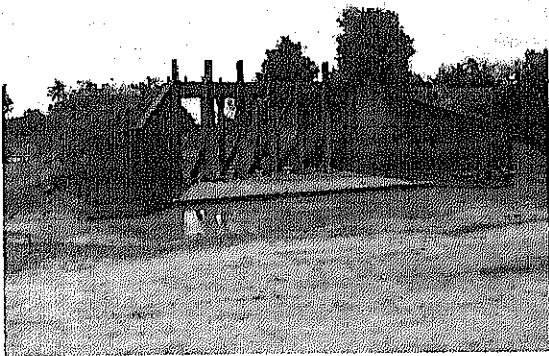
Socio-economic Survey in Kampong Speu

Sub-project Name:

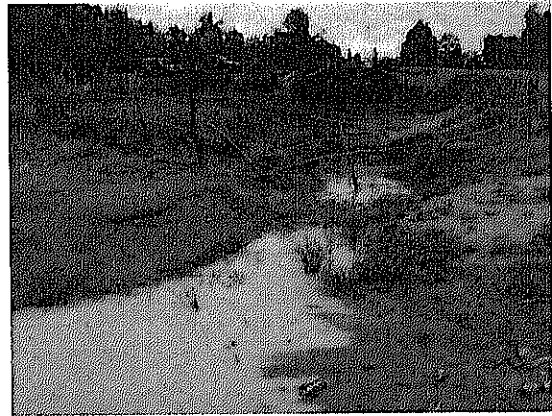
Roleang Chrey Headworks Rehabilitation Sub-project

Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project in the Kingdom of Cambodia

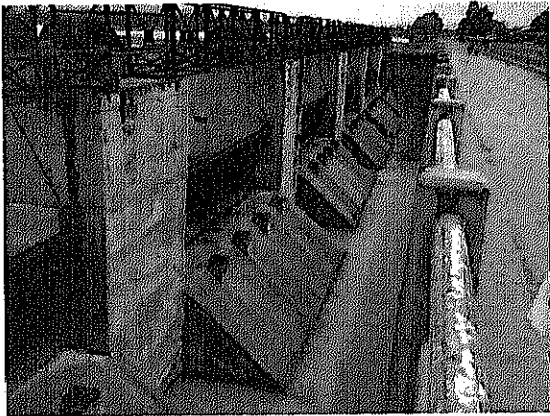
JICA Survey Team



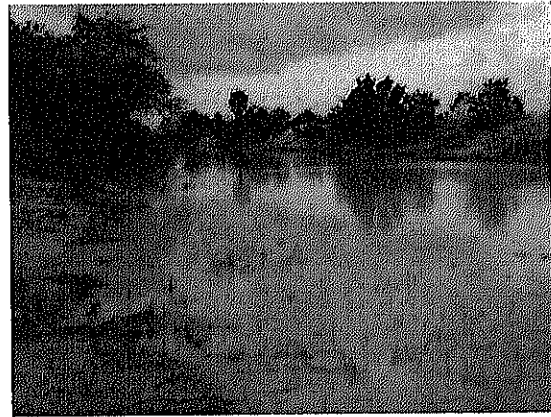
Intake gate on Tumnap Lok Reservoir



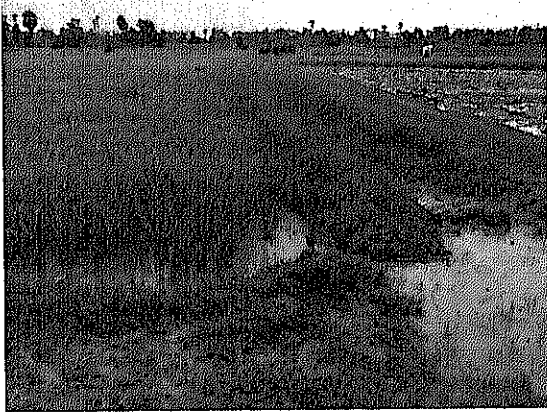
Diversion structure on Tumnap Lok Reservoir



Spillway of Kpob Trobek Reservoir



Diversion canal



Rainy season rice
(Supplying water from tertiary canal)



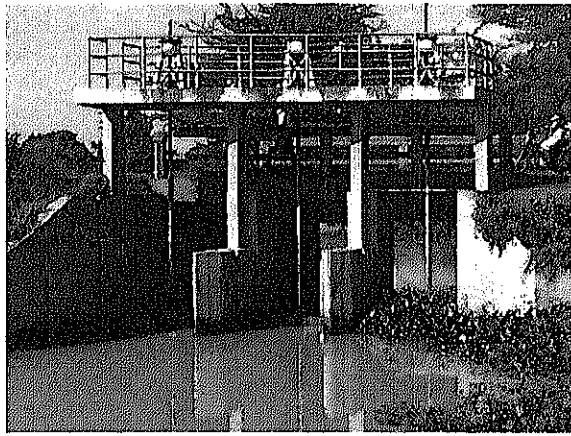
Socio-economic survey in Takeo

Sub-project Name:

Upper Slakou Irrigation System Rehabilitation Sub-project

Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project in the Kingdom of Cambodia

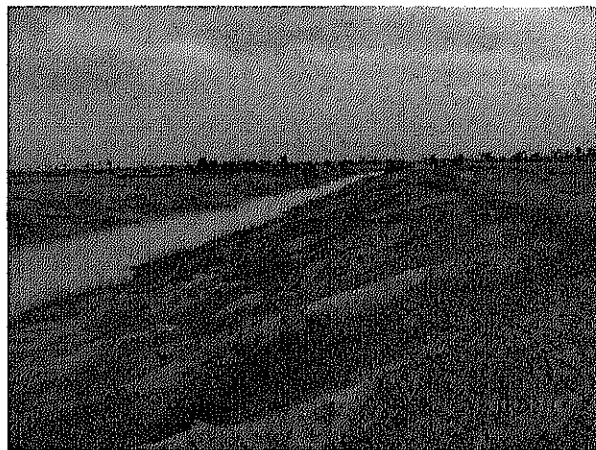
JICA Survey Team



Daeum Ruse Regulator on connection canal between Prek Thnot River and Stung Touch River



Existing intake and pump station at Tonle Bati Lake (intake gates are heavily deteriorated and pump capacity is much less than required one)



Abandoned "incomplete connection canal of NS-78" and rainfed paddy fields on both bank



Tertiary canal in priority area of Kandal Stung



House on canal bank (MR-1, Sta. 0.7 km)



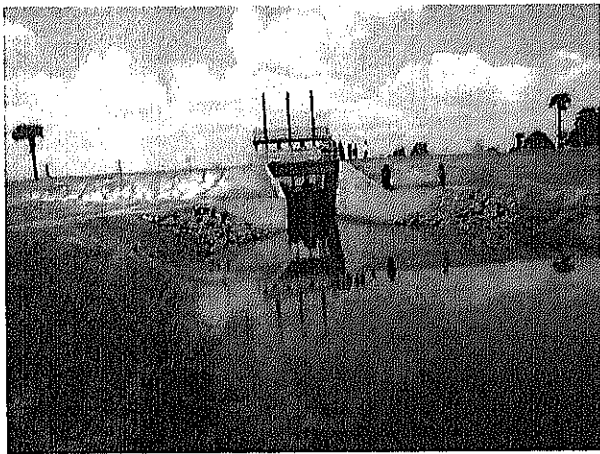
Upland crop field irrigated by watering pot

Sub-project Name:

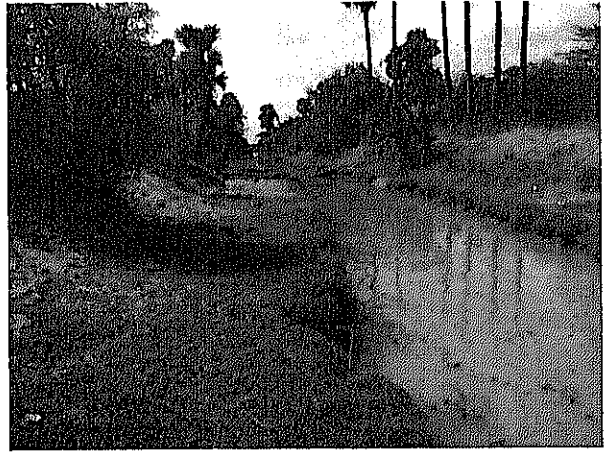
Kandal Stung - Bati Irrigation System Rehabilitation Sub-project

Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project in the Kingdom of Cambodia

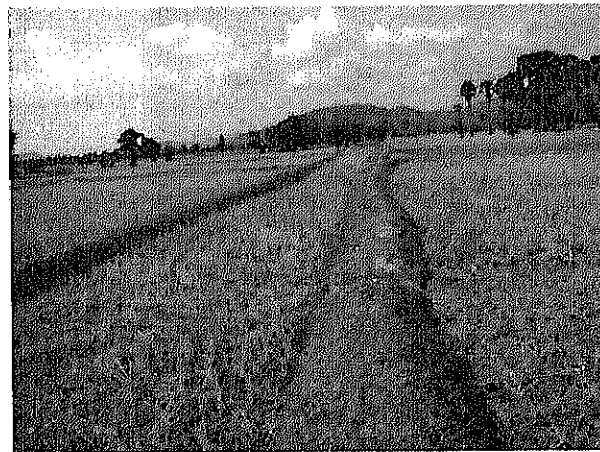
JICA Survey Team



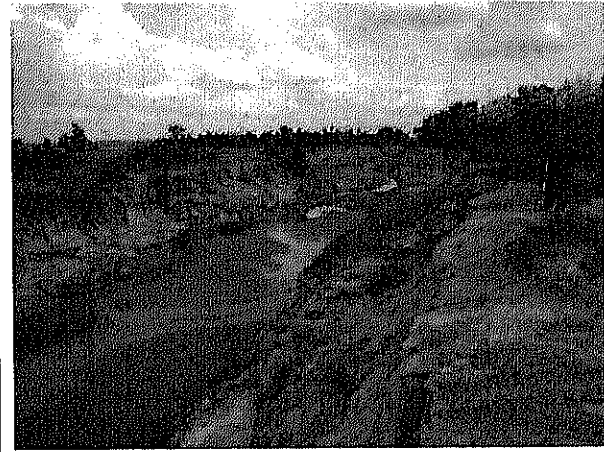
Intake of Khpob Krous Reservoir



Main Canal 35
(near Khpob Krous Reservoir)



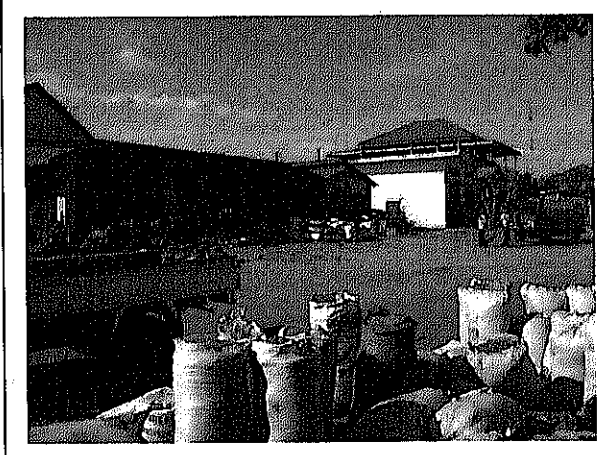
Main Canal 35
(3 km downstream of Khpob Krous Reservoir)



Main Canal 35
(Downstream area)



Rice field (Early rainy season)
(near Khpob Krous Reservoir)



Rice trading company in Basedth District

Sub-project Name:

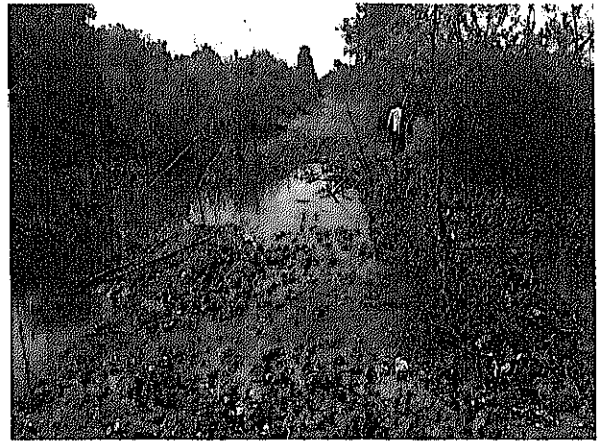
Main Canal 35 Rehabilitation Sub-project

Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project in the Kingdom of Cambodia

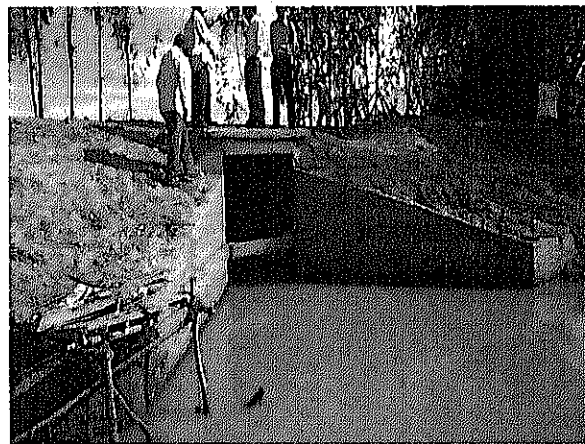
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Srass Prambai Reservoir Dike (already rehabilitated)



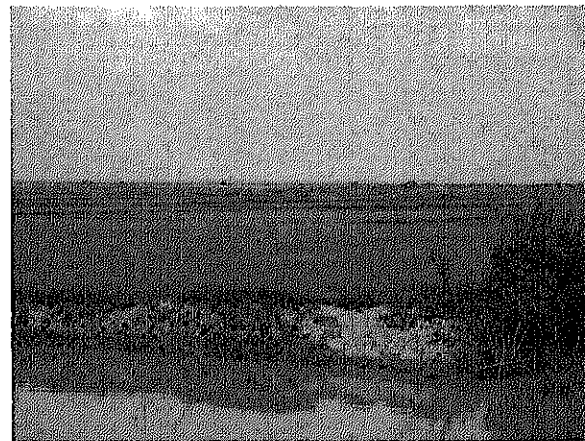
Srass Prambai Reservoir Dike (to be rehabilitated)



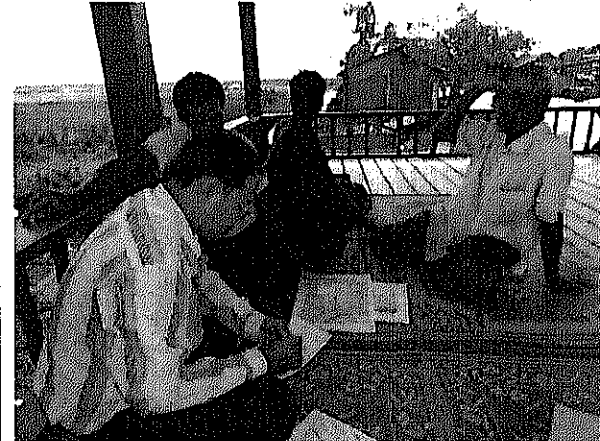
Intake culvert on reservoir dike



Main canal after recession



Rice field under recession cultivation



Interview with villagers on Sub-project implementation

Sub-project Name:

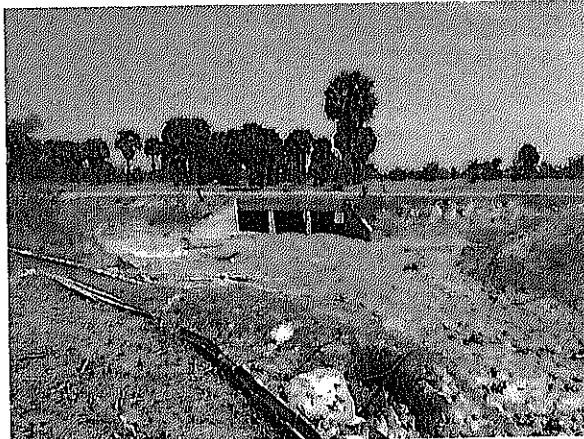
Srass Prambai Water Recession Rehabilitation Sub-project

Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project in the Kingdom of Cambodia

JICA Survey Team



Temporary weir for Daun Pue Intake made with sand bags and wooden material



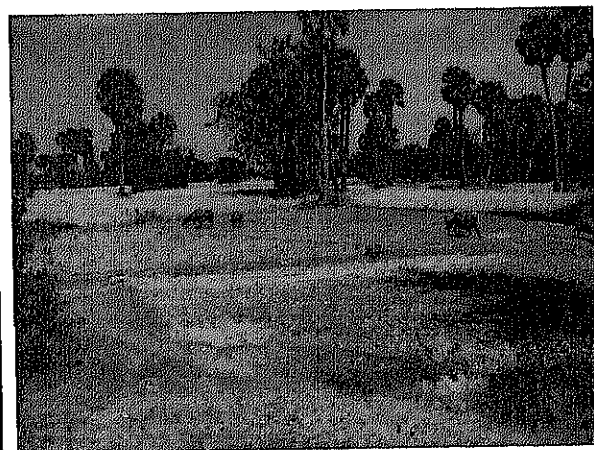
Main canal and culvert



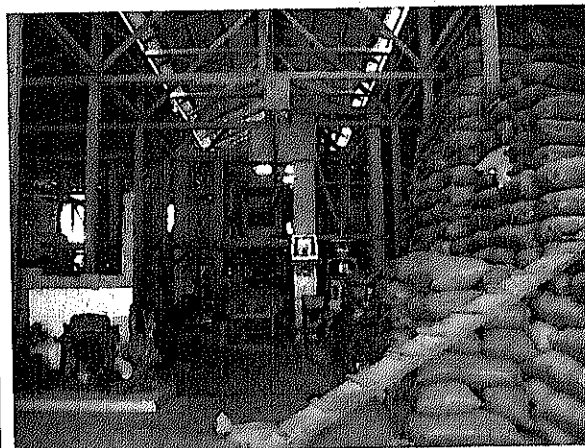
Stung Chieb River



Pipe culvert on main canal (to be replaced)



Rice field in dry season



Private rice milling company in Kampong Chhnang Province

Sub-project Name:

Daun Pue Irrigation System Rehabilitation Sub-project

Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project in The Kingdom of Cambodia

JICA Survey Team

PREPARATORY SURVEY
FOR
IRRIGATION AND DRAINAGE SYSTEM
REHABILITATION AND IMPROVEMENT PROJECT
IN
THE KINGDOM OF CAMBODIA

SUMMARY

PART I GENERAL INFORMATION

CHAPTER I-1 INTRODUCTION

General

- (1) This final report has been prepared in accordance with the Minutes of Discussion on Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project (the Survey) between the Japan International Cooperation Agency (JICA) and the Royal Government of Cambodia (RGC) signed on February 25, 2011. (*P I-1-1*)
- (2) The report shows the works executed from June 2011 to April 2012 such as the results of the study on scope, implementation organization, implementation plan, economic evaluation, environmental and social consideration, and preliminary water balance on Prek Thnot River Basin of the Southwest Phnom Penh Irrigation and Drainage Rehabilitation and Improvement Project (SPPIDRIP) consisting of the Roleang Chrey Headworks Rehabilitation Sub-project (RCHRSP), Upper Slakou Irrigation System Rehabilitation Sub-project (USISRSP), Kandal Stung-Bati Irrigation System Rehabilitation Sub-project (KSBISRSP), Main Canal 35 Rehabilitation Sub-project (MC35RSP), Srass Prambai Water Recession Rehabilitation Sub-project (SPWRRSP) and Daun Pue Irrigation System Rehabilitation Sub-project (DPISRSP), which were part of the Irrigation and Drainage System Rehabilitation and Improvement Project (the Project). (*P I-1-1*)

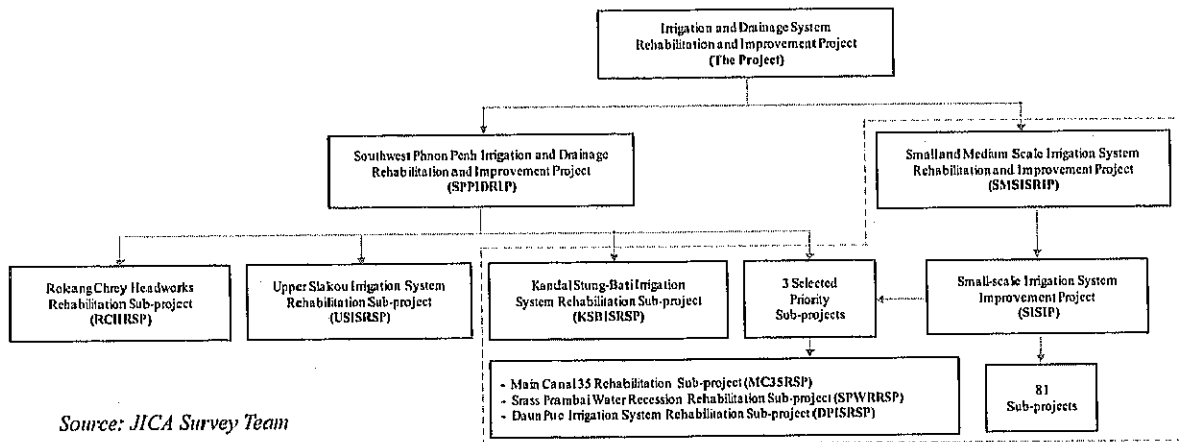
Background of the Project

- (3) The agriculture sector in Cambodia, a major component of its economy, contributed 36% to the gross domestic product (GDP) or around US\$4,047 million in 2010. About 80% of the country's population dwells in the rural area, where about 90% of them live in poverty. Based on these figures, agricultural development in the country plays an important role for poverty reduction as well as economic development. The main crop in the country is paddy. The paddy field was estimated to be approximately 2,547,000 ha in 2009. Out of this, about 773,000 ha (30%) is irrigated during the rainy season and about 347,000 ha (14%) is irrigated during the dry season. (*P I-1-1*)
- (4) This implies that rainfed cultivation is dominant in the country, which results to low and unstable agricultural production. Under such situation in agriculture, RGC requested the Government of Japan (GOJ) to provide development support to high potential areas for agricultural production. In reply to the request, JICA executed a series of technical assistance in these said areas.

Thereafter, RGC requested GOJ to provide further assistance for the implementation of projects where feasibility study (F/S) was executed to identify priority studies in the surrounding areas. In answer to this further request and consideration from the previous request of RGC for small-scale irrigation project, JICA decided to carry out the Survey aiming to prepare for possible loan application. (P I-1-2)

Components of the Project

(5) The following figure shows the components of the Project. (P I-1-2)



Objective of the Survey

(6) The objective of the Survey is to scrutinize the project cost for the rehabilitation of irrigation and drainage facilities through confirmation of the suitable project scope and construction method. This work is undertaken by collecting and analyzing the necessary information for project preparation as repayable aid of loans, and by reviewing the existing F/S or M/P relevant to the Project and the project proposal on SISIP. (P I-1-2)

CHAPTER I-2 NATIONAL AND SECTORAL POLICIES RELATED TO THE PROJECT

(7) There are 8 national and sectoral policies related to the Project. These are the (i) *Rectangular Strategy-Phase II*, (ii) *National Strategic Development Plan Update 2009-2013*, (iii) *Strategy for Agriculture and Water Program 2010-2013*, (iv) *Agriculture Strategic Development Plan 2009-2013*, (v) *Action Plan on Water Resources and Meteorology Management and Development 2009-2013*, (vi) *Policy Paper for Promotion of Paddy Production and Rice Export*, (vii) *Action Plan for Implementing Government Policy on Promotion of Paddy Production and Rice Export*, and (viii) *National Water Resources Policy for the Kingdom of Cambodia*. (P I-2-1 to I-2-6)

(8) Of these 8 policies, the *Rectangular Strategy-Phase II* is the most fundamental policy for RGC. Other policies are therefore formulated by referring to the said strategy. *Rectangular Strategy-Phase II* accords top priority for the enhancement of the agriculture sector as *Rectangle 1*, and adopted the *Improvement of Agricultural Productivity and Diversification* as the crucial strategy in *Rectangle 1*. In the *Strategy for Agriculture and Water Program 2010-2013*, the following quantifiable indicators are closely related to the Project: (P I-2-1 to I-2-3)

- Agriculture output will be increased by 20% over the four-year period from 2010-2013 or there will be an estimated increase of 1.5 million ton for rice;

- Beneficiary income will be increased by 20% over the 4-year period from 2010-2013 or there will be an estimated increase of about US\$30/month/household in rural areas; and
- The area of cropping land with access to irrigated service will be increased by 100,000 ha over the 4-year period from 2010-2013.

CHAPTER I-3 RELEVANT ORGANIZATIONS

Ministry of Water Resources and Meteorology

(9) The Ministry of Water Resources and Meteorology (MOWRAM) became an independent ministry of the Ministry of Agriculture, Forestry, and Fisheries (MAFF) in 1999 with the mission of an effective, equitable, and sustainable development and management of water resources of the country. MOWRAM is composed of 7 technical departments, 3 administrative departments, the Technical Service Center (TSC) for Irrigation and Meteorology and 24 Provincial Departments of Water Resources and Meteorology (PDOWRAM). There are 5 categories in staff qualification, i.e., (i) engineer, (ii) technician, (iii) vocational, (iv) qualified, and (v) non-qualified. There is a total staff of 666 at the central level and 623 at the provincial level as of March 2011. (P I-3-1)

(10) The annual budget and actual expenditure of MOWRAM are summarized below:

Item	2007	2008	2009	2010	2011	2012
Budget	13,210	14,327	18,756	90,366*	149,894*	141,356
(US\$ 1,000)**	3,235	3,508	4,593	22,127	36,703	34,612
Actual Expenditure	12,392	15,650	17,268	88,316*	146,090	Not available
(US\$ 1,000)**	3,034	3,832	4,228	21,625	35,771	Not available

Source: Department of Finance, MOWRAM

*: Including investment for irrigation system (70 million Riel in 2010 and 90 million Riel in 2011)

** : US\$1=4,084 Riel

As seen in the above table, the budget excluding investment for irrigation system has increased steadily. (P I-3-2)

Ministry of Agriculture, Forestry, and Fisheries

(11) MAFF has a mission to support the economic growth of Cambodia by providing high quality services to agriculture, fishery, and forestry-based sectors in order to secure food supply and increase agricultural output with added-value in a sustainable and cost-effective manner. MAFF consists of 19 departments, namely, the Fisheries Administration, the Forestry Administration, the National Agricultural Laboratory, the Agricultural Information and Documentation Center, the Financial Control Unit, the public institutions, and 24 provincial and municipal departments of agriculture and forestry. The total number of staff of the central and local offices is 7103 as of June 30, 2011. (P I-3-2)

(12) The summary of the annual budget and actual expenditure of MAFF is as follows:

Item	2007	2008	2009	2010	2011	2012
Budget	39,274	42,873	48,758	54,779	64,048	87,695
(US\$1,000)*	9,617	10,498	11,939	13,413	15,683	21,473
Actual Expenditure	36,896	49,132	52,257	54,525	57,878	Not available
(US\$1,000)*	9,034	12,030	12,796	13,351	14,172	Not available

Source: Department of Finance, MAFF

*: US\$1 =4,084Riel

The growth rate of the annual budget ranges from 9.2% to 36.9%, and has increased every year. (P I-3-3)

Provincial Department of Water Resources and Meteorology

- (13) PDOWRAM is placed in each province as a sub-ordinate agency of MOWRAM. It consists of 5 offices, namely; (i) Administration and Personnel Office, (ii) Irrigated Agriculture Office, (iii) Water Resources Management and Conservation Office, (iv) Water Supply and Sanitation Office, and (v) Hydro-meteorological Office. Under PDOWRAM, there are district offices, of which there are a total of 183 district offices in the whole country. (P I-3-3)

Provincial Department of Agriculture

- (14) The Provincial Department of Agriculture (PDA) is established in each province as a sub-ordinate agency of MAFF. PDA has several technical offices such as (i) Agricultural Extension, (ii) Veterinary & Animal Production, (iii) Agricultural Machinery, (iv) Agricultural Legislation, (v) Agro-industry, (vi) Agronomy & Land Improvement, and (vii) Administrative Offices, which subordinated some district agriculture offices (DAO). Extension workers assigned in DAO are directly controlled by the deputy director of PDA. Agricultural support services are provided by DAO, of which the major activity is the demonstration of improved rice farming practices. (P I-3-3 and I-3-4)

Farmer Water Users Community

- (15) In 1999, RGC issued Circular No.1 on the Implementation Policy for Sustainable Irrigation Systems. Circular No.1 indicates that Farmer Water Users Community (FWUC) shall be responsible for O&M of irrigation systems, payment of irrigation service fee (ISF) for O&M, and water distribution to paddy fields under the support of MOWRAM. Prakas 306 issued in July 2000 shows the structure and functions of FWUC including collection of ISF. Presently, MOWRAM is finalizing the sub-decree on establishing FWUC by following Circular No.1 and Prakas 306. The sub-decree will relate the organizational structure, statute, establishment procedures, and roles and responsibility of FWUC. (P I-3-4)
- (16) According to MOWRAM, there are some 350 FWUCs established nationwide, as of 2011. Out of 350 FWUCs, 150 FWUCs are registered to MOWRAM. Depending on the source of project support, some FWUCs are registered at PDOWRAM level only. (P I-3-5)

CHAPTER I-4 DONOR'S ASSISTANCE

Irrigation Projects Completed in Ten-year Period from 2001 to 2010

- (17) The irrigation projects completed in the 10-year period from 2001 to 2010 are listed as follows: (P I-4-1)

List of Irrigation Projects Completed in 10 Years by 2010

Project	Donor	Completed Year	Amount (US\$ 10 ⁶)	Province
Colmatage Irrigation Rehabilitation Project (2,122 ha)	Japan	2002	8.7	Kandal
Stung Chinit Irrigation and Rural Infrastructure Project (3,000 ha)	ADB+AFD	2008	25.6	Kampong Thom
Integrated Development in Battambang Province (1,950 ha)	FAO	2008	3.3	Battambang
Bathey Irrigation Construction Project (8,000 ha)	Korea	2010	4.3	Kampong Cham
Jameuk Reservoir Dike Rehabilitation Project (4,051 ha)	Korea	2004	1.4	Kandal
Bassac Dam Rehabilitation Project in Battambang Province (20,000 ha)	Japan	2006	2.0	Battambang
Rehabilitation of the Kandal Stung Irrigation System in the Lower Prek Thnot River Basin	Japan	2007	16.3	Kandal
Grant Assistance for Grass-Roots Human Security Project (11 Sub-projects, 11 River basin, 12,200 ha)	Japan	2005-2009		
Study on the Comprehensive Agricultural Development of Prek Thnot River Basin	Japan	2008	4.0	Kampong Speu
River Basin and Water Use Study for Northwest Irrigation Sector Project (NWISP)	ADB+AFD	2006	30.9	Pursat, Battambang, Banteay Measchey, Siem Reap
M/P on Water Resources Development in Cambodia	Korea	2008	1.5	Whole Country
The Basin-Wide Basic Irrigation and Drainage M/P Study	Japan	2009	4.0	Kampong Chhnang, Pursat, Battambang
Technical Cooperation for TSC-Phase 2	Japan	2009	7.2	Kandal, Pursat, Takeo

Source: Irrigation Development in Cambodia, as of March 2011

On-going Projects

(18) The following are the on-going projects as of March 2011: (P I-4-2 and I-4-3)

List of On-going Irrigation Projects

Project	External Support		Implementation		Province	Project Cost (US\$' 000)	Fund Resource (US\$ '000)		Status as of March 15, 2011
	Donor	Fund Type	From	To			External	Local	
North West Irrigation Sector Project	ADB+ AFD	Loan+ Grant	2005	2012	Pursat, Battambang, Banteay Meanchey, Siem Reap	30,870	21,740	9,130	On-going
Eastern Rural Irrigation Development Project	IMF	MDRI	2007	2013	Kampong Cham, Prey Veng, Svay Rieng, Kratie, Stung Treng, Rotanak Kiri, Mondul Kiri	33,380	32,763	617	On-going
Krang Ponley Multipurpose Water Resources Project	Korea	Loan	2008	2012	Kampong Spue	29,505	26,098	3,407	On-going
Tonle Sap Lowlands Rural Development Project (TSLRDP)	ADB	Loan+ Grant	2008	2015	Kampong Chhnang, Pursat, Kampong Thom	24,000	20,000	4,000	On-going
Water Resources Management Sector Development Program (WRMSDP)	ADB + OPEC + AFD	Loan+ Grant	2011	2018	Kampong Thom, Siem Reap, Banteay Meanchey	31,900	24,800	7,100	On-going
Kampong Trabek River Flood Control Project	China	Loan	2010	2014	Prey Veng	31,010	31,010	0	On-going
Stung Sreng Irrigation Development Project	China	Loan	2011	2015	Preah Vihear, Kampong Thom	65,000	54,780	10,220	Loan Processing
Mongkol Borey Dam Development Project	Korea	Loan	2009	2013	Battambang	24,301	18,700	5,601	On-going
Kong Hort Irrigation Development Project	China	Loan	2010	2014	Battambang	61,000	49,900	11,100	On-going
Dauntri Multipurpose Dam Development Project	Korea	Loan	2009	2013	Battambang	45,958	40,283	5,675	Loan Processing
Stung Pursat Dam No.3 and No.5 Development Project	China	Loan	2011	2014	Pursat	80,000	66,460	13,540	On-going
Stung Tasal Storage Reservoir Development Project	India	Loan	2011	2013	Kampong Spue	19,000	19,000	0	On-going
Surrounding Bayong Kouv Reservoir Improvement Project	Korea	Grant	2010	2013	Takeo	3,012	3,012	0	Committed
Prek Stung Kev Water Resources Development Project	China	Loan	2011	2015	Kampot	52,000	42,620	9,380	On-going
Technical Cooperation for TSC-Phase 3	Japan	Grant	2009	2014	Battambang, Pursat, Kampong Chhnang	4,625 (¥370 x 10 ⁶)	4,625	0	On-going

Source: Irrigation Development in Cambodia, as of March 2011

*: Loan processing as of March 2011

Work Progress on Stung Tasal Storage Reservoir Development Project

- (19) The contract agreement for the design and construction of the project was signed among MOWRAM, WAPCOS Ltd, and Angelique International Limited on January 12, 2011. The contract agreement includes (i) infrastructure development works, (ii) civil works including dam with instrumentation, (iii) hydro-mechanical work, and (iv) engineering works such as geo-technical survey, detailed design, and preparation of construction drawings. (P I-4-5)
- (20) The time for completion of the entire scope of work is 18 months from the date the contract comes into full force and effect. According to MOWRAM, Angelique International Limited mobilized the team in the site on May 19, 2011, and has started the topographic survey and finalization of land for colony and access road. The third quarterly progress report (November 2011 to February 2012) shows that excavation of the dam foundation and spillway has been 80% completed at the end of February 2012. (P I-4-5)

Current Situation on Other Dam Projects Located Upstream of Prek Thnot River

- (21) There are 3 dam development plans prepared by the Korea International Cooperation Agency (KOICA), which are located upstream of Prek Thnot River. Out of them identified, 2 dams, namely, Peam Levear Dam and O Tang Dam are planned to be rehabilitated, while the other one is planned for dam construction. Presently, F/S has been completed for these dam projects. However, there are no definite plans for their implementation so far. (P I-4-5 and I-1-4-6)
- (22) MOWRAM planned 2 dam construction projects on the tributaries of Prek Thnot River, i.e., Stung Sva Slab Water Resources Development Project and Stung Khleach Water Resources Development Project. MOWRAM prepared and submitted the proposals for these projects to

MEF in September 2010. Thereafter, RGC requested financial assistance from the Prime Minister of India when he made an official visit to Cambodia. Currently, MOWRAM expects that F/S for these projects will be carried out in 2012, however no plans yet are carried out at the moment. (P I-4-6)

CHAPTER I-5 OTHER RELEVANT INFORMATION

Information on Mines and Unexploded Bombs in the Project Area

- (23) For RCHRSP, the project area is not contaminated with mines and unexploded ordinances (UXOs) although considerable bombs had been dropped in its command area. For USISRSP, according to the results of a hearing survey conducted by Cambodian Mine Action Center (CMAC) in 2000, suspected areas with mines and bombs would be located along about 4 km upstream of the diversion canal from the Tumnup Lok Reservoir and around the proposed borrow pit area. In addition, around the southern part of Main Canal 33, where the battle was once conducted, the possibility of buried UXOs might exist. On the other hand, there are suspected areas in the southern and central parts of Kandal Stung Area of KSBSRSP although these areas are small in size. It is thus deemed necessary for CMAC to carry out the detailed technical ground survey prior to the commencement of the detailed design. (P I-5-6)

CHAPTER I-6 OUTLINE OF PREVIOUS STUDIES

- (24) As for SPPIDRIP, the following studies were conducted so far:

List of Previous Studies/Proposal

Sub-project	Study/Proposal	Period	Finance
RCHRSP	The Study on Comprehensive Agricultural Development of Prek Thnot River Basin (Master Plan Study)	2005-2008	JICA
	Roleang Chrey Regulator and Intakes Improvement Project (Feasibility Study)	2006	JICA
	Roleang Chrey Regulator Improvement Project (Grant Aid)	2007-2008	JICA
USISRSP	The Study on the Rehabilitation and Reconstruction of Agricultural Production System in the Slakou River Basin (Master Plan Study)	2001-2002	JICA
	Upper Slakou River Irrigation Reconstruction Plan (Feasibility Study)	2002	JICA
KSBSRSP	Master Plan Study on the Integrated Agricultural and Rural Development Project in the Suburbs of Phnom Penh	1993-1994	JICA
SISIP	Project Proposal Document to Small Scale Infrastructure Project	2009	MOWRAM

Source: JICA Survey Team

Immediately after the commencement of the Survey, these studies/proposals were reviewed to examine the appropriateness of the project scope proposed by MOWRAM by scrutinizing the development concept and features of the project and relevant information. (P I-6-1 to I-6-32)

- (25) The Project also includes SISIP consisting of 84 sub-projects. The project proposals were prepared by PDOWRAM under the direction of MOWRAM and TSC-2. Based on the results of the review, problems on the studies/proposals were identified as follows: (i) no observation on the definition of small scale, (ii) lack of technical information on water resources, (iii) overestimation of targeted irrigation area, (iv) less understanding/appreciation on the project area in project evaluation, (v) incomplete rehabilitation plan proposed, (vi) insufficient back-up data and breakdown, and (vii) insufficient data storage system in PDOWRAM. Under such poor situations, the priority sub-projects were barely selected through first screening and priority ranking by backbreaking data collection and analysis. The items for priority ranking are

as follows: (i) availability of data, design and cost estimate, and satellite image, (ii) social conditions, (iii) scale of irrigation area, (iv) effect of sub-project, and (v) PDOWRAMS's intension. (P I-6-26 to I-6-31)

- (26) The selected sub-projects were accepted by MOWRAM too. Thus, the following were decided as priority sub-projects in the Survey: (P I-6-32)

Decided Priority Sub-projects

Sub-project	Water Source	Province
Main Canal 35 Rehabilitation Sub-project (MC35RSP)	River/Reservoir	Kampong Speu
Srass Prambai Water Recession Rehabilitation Sub-project (SPWRRSP)	River/Flood Water	Kandal
Daun Pue Irrigation System Rehabilitation Sub-project (DPISRSP)	River/Headworks	Kampong Chhnang

Source: JICA Survey Team

PART II SOUTHWEST PHNOM PENH IRRIGATION AND DRAINAGE REHABILITATION AND IMPROVEMENT PROJECT

CHAPTER II-1 PROJECT AREA

Roleang Chrey Headworks Rehabilitation Sub-project

Socio-economy

- (27) According to the Commune Database managed by the National Committee for Democracy Development (NCDD), the poverty rate of Kampong Speu Province was 30.1% in 2010 which was higher than the average of the whole country estimated around 25.8% in 2010. Therefore, RCHRSP is located in a poverty-stricken area. (P II-1-7)

Agriculture

- (28) Agricultural situation in the command area of RCHRSP has no drastic change from the previous study period. Therefore, it is deemed that the rice production in the area could be characterized as low and unstable. The cropping calendar in the area is diversified depending on locations and seasons affected by the availability of irrigation water. Since this situation has not been improved so far, it is concluded that there are no changes in the prevailing cropping calendar and patterns in the area. Compared with rice production, production of other crops such as upland crops, vegetables, and fruits are extremely limited in the area. This situation is likely the same with the previous study. (P II-1-9 to II-1-11)

Roleang Chrey Headworks

- (29) The Roleang Chrey Headworks consist of (i) Roleang Chrey Regulator, (ii) Andong Sla Intake, and (iii) Vat Krouch Intake and their approach channels. Based on the results of the review of previous studies, site visit with drawings at hand and hearing survey from Kampong Speu PDOWRAM, it was confirmed that there were no remarkable changes in the conditions of the headworks from the time of detailed design preparation. (P II-1-12 to II-1-14)

Irrigation and Drainage

- (30) MOWRAM already executed some rehabilitation works for the Roleang Chrey Irrigation Canal System as per request of Kampong Speu PDOWRAM for 4 years from 2006 to 2009 after the M/P study had been substantially completed. The total cost was Riel 24,035 million. These rehabilitated works were examined whether it is included in the upstream 10 km of NMC and SMC which were requested by MOWRAM. Consequently, it was clarified that these works were out of the scope of RCHRSP. (P II-1-14 to II-1-18)

Upper Slakou Irrigation System Rehabilitation Sub-project

Socio-economy

- (31) The commune database indicated that poverty rate in Takeo Province was 23.4% in 2010, which was slightly better than the poverty rate (25.8%) of the whole country, therefore, Takeo Province does not show serious poverty. (P II-1-22)

Agriculture

- (32) Rice is the major crop in the USISRSP Area. Diversified crops are few although their profitability is higher than paddy. Further, it is not easy to cultivate them in paddy field due to unsuitable condition with high soil moisture content, soil structure, water management, etc. It was confirmed that these crops were planted less in the farmlands of the USISRSP Area. In parts of the USISRSP Area, double cropping paddy combined with early maturing varieties of high yielding varieties (HYVs) is being undertaken since irrigation water becomes available after the rehabilitation of the Kpob Trobek Reservoir in 2005. (P II-1-24 and II-1-25)

Irrigation and Drainage

- (33) The review on the irrigation and drainage development plan was carried out by (i) field reconnaissance including interviews and discussions with concerned agencies and farmers, and (ii) inventory survey of the existing canals for 69 km and related structures of 412 nos. on the canals. Based on the results of the review, it was confirmed that rehabilitation should be urgently provided for water resource facilities such as Tumnap Lok Reservoir, Kpob Trobek Reservoir, Diversion Canal, and other canal systems. On the other hand, it was also confirmed that some rehabilitation works were already conducted for Kpob Trobek Reservoir in 2005 by MOWRAM, following the preliminary design in F/S, so minor rehabilitation works such as repair of erosion of dike and improvement of flap gates are only required. (P II-1-25 to II-1-30)

Kandal Stung-Bati Irrigation System Rehabilitation Sub-project

Socio-economy

- (34) Based on the results of the socio-economic survey conducted by the JICA Survey Team, the sampled population of the KSBISRSP Area showed higher per capita daily expenditure than the poverty line. This is equivalent to a per capita daily expenditure of US\$0.58 set for Cambodia rural areas by the *Achieving Cambodia's Millennium Development Goals 2010*, which ranges from US\$0.63 to US\$1.12. From this, it is deemed that the KSBISRSP Area is not seemingly below the poverty line. (P II-1-34)

Agriculture

- (35) The main crop in the KSBISRSP Area is also rice similar to other irrigated agriculture projects in Cambodia. The cropping calendar of paddy is diversified depending on locations and seasons affected by the availability of irrigation water. Since this situation has not improved so far, it is deemed that there is no big difference between the previous and present cropping patterns in the area from the previous study time. (P II-1-35 to II-1-37)

Irrigation and Drainage (Kandal Stung Area)

- (36) The present irrigation canal system was constructed during 1975 to 1979 (Pol Pot Regime). Canals were constructed following the latitude and longitudinal gridlines regardless of the topographic conditions. In addition to such technical problem, due to absence of substantial

improvement or rehabilitation work for the canals and related structures for more than 30 years, the degree of deterioration of irrigation facilities is severe, thus these do not function well. (P II-1-37 and II-1-38)

- (37) In consideration of such severe condition of the existing canal system, completion of construction works for Kandal Stung New Diversion Weir on the Prek Thnot River was done in 2007 and the completion of the Stung Tasal Dam is expected in 2012 MOWRAM prepared an official proposal to rehabilitate the existing irrigation canal system covering 1750 ha by utilizing the original flow of the Stung Touch River and supplemental water from the Prek Thnot River. (P II-1-37)

Irrigation and Drainage (Bati Area)

- (38) The present irrigation canal system in the Bati Area as well as the Kandal Stung Area was constructed at the same time. The canals were constructed following the latitude and longitudinal grid lines regardless of the topographic conditions as applied to the Kandal Stung Area. During the period of 1987 to 1992, rehabilitation of some irrigation canals and related structures were carried out by the World Council of Churches (WCC) and the Mekong Secretariat with the financial assistance of United Nations Development Program (UNDP). (P II-1-38)
- (39) However, after rehabilitation in 1992, no substantial rehabilitation and improvement has been executed so far, except for ad-hoc works such as dredging of canal bed and construction of regulators (check structures). Through inventory survey for this existing irrigation canal system, it was confirmed that canals were heavily deteriorated and the number of structures for water management of irrigation was still short. (P II-1-38 and II-1-39)

Main Canal 35 Rehabilitation Sub-project

Socio-economy

- (40) MC35RSP is located at Kampong Speu Province. As mentioned in RCHRSP, the poverty rate of Kampong Speu Province was 30.1% in 2010 which was largely higher than the average of the whole country estimated around 25.8% in 2010, therefore serious poverty situation is experienced in Kampong Speu Province. (P II-1-41)

Agriculture

- (41) The total area of MC35RSP is estimated to be around 900 ha. The whole area is categorized as paddy field. Out of 900 ha, 850 ha is rainfed paddy fields, and double cropping is carried out in limited area. Harvested paddy is normally threshed at the farmers' backyard, and thus sold to traders at farm gate. Meanwhile rice millers are not available in and around the area although mobile rice miller is popular. (P II-1-42 and II-1-43)

Irrigation and Drainage

- (42) The existing Main Canal 35 Irrigation System, consisting of 3 reservoirs and main and secondary canals, was originally constructed during the Pol Pot regime (1975-1977) targeting to irrigate more than 3,000 ha of the paddy field. Since then 2 reservoirs upstream located were rehabilitated by MOWRAM in 2009/10, but the remaining facilities have remained as they are. Thus, the system does not function well now. (P II-1-43)

Srass Prambai Water Recession Rehabilitation Sub-project

Socio-economy

- (43) The SPWRRSP Area is administratively situated in Po Ti Ban Commune, Kaoh Thum District, Kandal Province. Poverty rate in Kandal Province was 15.9% in 2010, which was better than the average (25.8%) poverty rate of the whole country. Poverty situation in this province is not a serious condition as far as this rate is concerned. (P II-1-48)

Agriculture

- (44) During the rainy season, the SPWRRSP Area is flooded due to the increased water level of the Bassac River. Water level becomes lower from the beginning of November, and then rice cultivation starts in the area, depending on the decrease of water level. Early rice varieties are common in this area. (P II-1-49 and II-1-50)

Irrigation and Drainage

- (45) The Srass Prambai Irrigation System, consisting of the Srass Prambai Reservoir and main and secondary canals was originally constructed during the Pol Pot regime aiming to irrigate the flood recession cultivation area in the flood plain between the Tonle Basac and Mekong Rivers. The system was sufficiently operated until 2000 when the reservoir dike was damaged by flood. The recession cultivation lands have been facing shortage of irrigation water since then. (P II-1-50)

Daun Pue Irrigation System Rehabilitation Sub-project

Socio-economy

- (46) The DPISRSP Area lies in Chieb, Khlong Porpork, and Aphivath Communes in Teuk Phos District, Kampong Chhnang Province. Poverty rate in Kampong Chhnang Province was 30.4% in 2010, which was higher than the average (25.8%) poverty rate of the whole country, so serious poverty situation is still seen in the province. (P II-1-56)

Agriculture

- (47) The total area of DPISRSP is estimated at around 1,210 ha. The whole area is categorized as rice field. Out of 1,210 ha, 1,060 ha is rainfed rice field, and the remaining area is an irrigated rice field with supplemental irrigation. Harvested rice is normally threshed at farmers' back yards, and then sold to traders, while some farmers directly sell their products to rice millers in Kampong Chhnang, the capital of the province. (P II-1-58 and II-1-59)

Irrigation and Drainage

- (48) The Daun Pue Irrigation System was constructed in the Pol Pot regime (1975-1977) for targeting water supply from the Stung Chieb River to its command area of about 1400 ha. The existing Daun Pue Irrigation System is seriously deteriorated at present, and only limited parts near the main canal are currently provided with supplemental irrigation during the rainy season. (P II-1-58)

Institutions Concerned for Project Implementation

- (49) Four PDOWRAMs are closely related to SPPIDRIP. These are Kampong Speu, Kandal, Takeo, and Kampong Chhnang PDOWRAMs. These PDOWRAMs have 5 offices under the director. Major common missions of PDOWRAM are to: (i) prepare development plans, (ii) research and

observe natural disasters, (iii) collect meteorological and hydrological data, (iv) implement operation and maintenance of irrigation systems, (v) organize and train FWUC, and (vi) study, plan, design, and construct small-scale projects. When SPPIDRIP starts its implementation, these PDOWRAMs should play an important role for the smooth implementation although strengthening them is needed especially for O&M. (P II-1-60 to II-1-63)

- (50) Four PDAs of Kampong Speu, Kandal, Takeo, and Kampong Chhnang are related to SPPIDRIP. PDA is responsible for the agricultural development and provision of agricultural support services at the provincial, district, commune, and village levels. The major duties related to the functions of the Agronomy Office of PDA include technology development, seed production and plant protection, and the major duties related to the functions of the Extension Office which are provision of extension services and human resources development. Presently, PDAs' activities are not executed very well mainly due to limited budget. (P II-1-63 to II-1-66)
- (51) For the Roleang Chrey Irrigation System, 6 FWUCs were established in 2011. Whereas for USISRSP, Kpob Trobek FWUC was established at Ou Saray commune in 2005 when the Kpob Trobek Reservoir was rehabilitated. Most of FWUCs are generally inactive mainly due to the lack of functional irrigation systems and weak organization and management. The remaining 4 Sub-projects have no FWUCs at present. (P II-1-66 and II-1-70)

CHAPTER II-2 EXAMINATION OF PROJECT SCOPE

Necessity and Justification

National and Sectoral Policies

- (52) In the Rectangular Strategy-Phase-II, which is the most fundamental policy in Cambodia, the *Improving Agricultural Productivity and Diversification* and *Water Resources and Irrigation Management* strategies were taken up and given high priority in the implementation of the projects. The respective sectoral policies exactly follow the policy. The objective of SPPIDRIP is to provide timely and stable irrigation water to fields and finally increase the agricultural production through the integrated approach of hardware and software components. Thus, it can be said that SPPIDRIP duly contributes to attaining the goals specified in the said national and sectoral policies. (P II-2-1)

Policy of Official Development Assistance of Japan to Cambodia

- (53) JICA announced a new vision: *Promotion of Dynamic Development Granting Benefits to All People* in 2008. In order to realize this vision, JICA decided to draw 4 missions such as (i) addressing global agenda, (ii) reducing poverty through equitable growth, (iii) improving governance, and (iv) achieving human security. In Cambodia, the most important mission to be realized is reducing poverty through equitable growth. As mentioned in Rectangular Strategy-Phase II, agricultural development is the most effective means to realize this mission. JICA also recognizes that agriculture is one of the important sectors for sustaining economic growth and reducing poverty in Cambodia. The proposed SPPIDRIP will duly contribute to the above mentioned mission through increase of agricultural production by applying the integrated approach of hardware and software components. (P II-2-1 and II-2-2)

Necessity and Justification

- (54) Poverty reduction or improvement of the living standard is a crucial subject to be urgently

solved in Cambodia. The percentage of people living below poverty line accounted for 25.8% for the whole country in 2010, although the situation has been gradually improving yearly. Of the total number of poor, more than 90% live in rural areas. This implies that Cambodia's poverty is rooted in agriculture which is characterized by low and unstable productivity caused by unreliable rainfed cultivation. RGC promulgates the policy paper on the promotion of paddy production. According to this paper, RGC is planning to increase paddy production annually by 2.6% to 6.1% from 2010 to 2015, and 2.6% after 2016 focusing on at least catching up with the domestic consumption. (*P II-2-2 and II-2-3*)

- (55) SPPIDRIP is composed of 6 Sub-projects: RCHRSP, USISRSP, KSBISRSP, MC35RSP, SPWRRSP, and DPISRSP. Presently, the facilities involved in RCHRSP are mostly deteriorated and nonfunctional. In particular, the Roleang Chrey Regulator is seriously deteriorated. In case the regulator will malfunction completely, its large command area could not be irrigated and will rely on erratic rainfed cultivation. This would result in low and unstable productivity. Similarly, USISRSP and KSBISRSP are presently envisaged with incomplete existing irrigation and drainage system because of the absence of substantial rehabilitation works and inappropriate O&M works. Consequently, these systems could not properly convey irrigation water to fields and thus, hardly contributes to the increase in agricultural production. (*P II-2-2 and II-2-3*)
- (56) The remaining 3 Sub-projects, namely, MC35RSP, SPWRRSP, and DPISRSP which were selected as priority sub-projects from SISIP, were already provided with irrigation canal systems. However, these irrigation canal systems are mostly deteriorated or damaged at present. To increase agricultural production, it is necessary to execute, not only the rehabilitation and improvement works for these systems, but also strengthening of agricultural extension services and establishment of FWUC, which was the same concept with RCHRSP, USISRSP, and KSBISRSP. (*P II-2-3*)
- (57) SPPIDRIP aims to increase agricultural production especially on paddy through the rehabilitation and improvement of existing irrigation and drainage facilities, and also strengthening of agriculture support services and establishing/strengthening of FWUCs. It is certain that SPPIDRIP will contribute to poverty reduction or improvement of the living standards in rural areas by increasing agricultural production, which is the ultimate goal of Cambodia. In addition, if the increased rate pattern of rice production from 2010 to 2015, and after 2016 specified in the rice policy paper materializes, Kampong Speu, Kandal, Takeo, and Kampong Chhnang Provinces surrounding Phnom Penh will be required to play their regional roles as paddy producers in the country, especially for Phnom Penh, a big consuming city. It is positive that SPPIDRIP will contribute to some extent to the implementation of this political goal. (*P II-2-3*)

Roleang Chrey Headworks Rehabilitation Sub-project

Basic Concept

- (58) The examination of the scope of RCHRSP proposed by MOWRAM was carried out using the basic concepts of (i) application of integrated approach of hard and soft aspects, (ii) improvement of Roleang Chrey Headworks from appropriate permanent treatment viewpoint, (iii) priority ranking on scope of Sub-project as loan project, and (iv) reflection of

lessons learnt from Japan's grant aid program. (P II-2-3 and II-2-4)

Agricultural Development Plan

- (59) The following proposed cropping pattern and intensity in the M/P study could be applied after being confirmed through the water balance study since there were no changes in national policies and social conditions in the RCHRSP area since the M/P Study time: (P II-2-4)

Confirmed Cropping Patterns and Intensity in the Survey

Zone	Confirmed Cropping Pattern	Intensity	Definition of Zone
1	Early Rice (18%)- Medium Rice (91%)- Upland Crops (5%)	114%	80% Dependability Irrigation
2	Early Rice (14%)- Medium Rice (91%)- Upland Crops (5%)	110%	50% Dependability Irrigation
3	Medium Rice (100%) - Upland Crops (5%)	105%	Water Harvesting
4	Medium Rice (100%) - Upland Crops (1%)	101%	Rainfed Cultivation

Source: Final Report for the Study on Comprehensive Agricultural Development Prek Thnot River Basin

- (60) The current unit yield of crops was reviewed based on the latest agricultural statistics as well as the results of field inspection. Based on the result, it was found that the current unit yield was better than that in the M/P stage. Based on this finding, it was also found that the target unit yield of paddy could be estimated by referring to the *Verification Study on Paddy Cultivation* conducted in the latter stage of M/P Study, which showed the crop yield of paddy ranging from 3.3 ton/ha to 5.2 ton/ha. (P II-2-4 and II-2-5)

Water Balance Study

- (61) Based on the results of water balance calculation, the 80% dependable area was estimated at 6,500 ha as against 5,660 ha recorded in M/P, and the 50% dependable area was estimated at 18,100 ha as against 16,700 ha stated in M/P. For both cases, the review results were about 10% higher than those in M/P. Taking into consideration the calculation method and reliability of meteo-hydrological data, it could be considered that the difference in both cases would be rather positioned within allowable extent. From the reasons mentioned above and the conservative viewpoint, it was concluded that the 80% and 50% dependable areas stated in M/P, as shown in the right table, was acceptable. (P II-2-5 to II-2-7)

Probable Irrigation Area

Dependability	Early Rice	Medium Rice
80%	500 ha	5,660 ha
50%	2,100 ha	16,700ha

Source: The Study on Comprehensive Agricultural Development of Prek Thnot River Basin

Scope of Sub-project

- (62) The proposed scope of RCHRSP was examined through review of the previous studies and site investigation with detailed drawings at hand and discussions with MOWRAM and PDOWRAM. In the course of the Survey, MOWRAM/PDOWRAM strongly requested to include some works in the scope related to the upstream 10 km of NMC and SMC. Considering this request, the examined scope of RCHRSP is shown in the following table. (P II-2-17 and II-2-18)

Examined Scope of RCHRSP

Scope Proposed by MOWRAM in M/D ¹	Examined Scope of RCHRSP
a) Project Area Not specified	a) Project Area 350 ha excluding 220 ha to be implemented by TSC-3, but influence to 16,910 ha for project evaluation
b) Cropping Pattern and Intensity - Rice-based cropping system with upland crops - Crop intensity: 101% - 114%	b) Cropping Pattern and Intensity - Rice-based cropping system with upland crops - Crop intensity: 101% - 114%

Scope Proposed by MOWRAM in M/D ^{*1}	Examined Scope of RCHRSP
c) Hardware Components	
<ul style="list-style-type: none"> - Rehabilitation of Rolcang Chrey Headworks 	<p>The rehabilitation works of the regulator gates are urgently required as the top priority of RCHRSP, aiming at restoration of the appropriate function of the gates so as to maintain or increase the present production level by preventing further deterioration of the function. Based on the Survey, the following work items are highly required;</p> <ul style="list-style-type: none"> a) Renewal/construction of regulator gates such as <ul style="list-style-type: none"> - Renewal of all gate leaves, - Renewal of all hoist system with local control panels, - Renewal of all hoist decks with staircase, and - New construction of remote control panel, b) New construction of river outlet structure gate with guide frames and manually operated hoists, c) New construction of inlet and outlet fixed trash racks, d) New provision of downstream protection works, e) New provision of retaining wall, and f) New construction of by-pass for releasing low water to the downstream reach.
<ul style="list-style-type: none"> - Rehabilitation of Andong Sla Intake including Replacement of Radial Gate 	<p>The results of the review showed the urgent necessity of reconstruction of gates and related facilities. The proposed works are:</p> <ul style="list-style-type: none"> a) Renewal/provision of intake gates, <ul style="list-style-type: none"> - Renewal of gate leaves, - Renewal of guide frames, - Renewal of electrically driven hoists, - New provision of gate remote control operation, - Renewal of manually driven hoists, b) New construction of gate piers, c) New construction of downstream protection, and d) Partial rehabilitation of approach channel.
<ul style="list-style-type: none"> - Rehabilitation of Vat Krouch Intake Structure 	<p>Through the review, it was confirmed that the following are needed urgently:</p> <ul style="list-style-type: none"> a) Renewal of intake gates, <ul style="list-style-type: none"> - Renewal of gate leaves, - Renewal of guide frames, - Renewal of electrically-driven hoists, - Provision of gate remote control operation, and - Renewal of manually driven hoists, b) Partial improvement of supply canals*², and c) New construction of structures on supply canals*².
<ul style="list-style-type: none"> - Rehabilitation of NMC and SMC with related structures, of which the length is 10.0 km, respectively 	<p>After site investigation, length of NMC and SMC to be rehabilitated are determined at 9.1 km and 9.8 km, respectively. Required rehabilitation works on NMC and SMC are identified in the Survey, most of which need urgent improvement to ensure the water supply to the downstream part of the irrigation system. The works required under RCHRSP are:</p> <ul style="list-style-type: none"> a) Partial improvement of canal embankment, b) Partial enlargement of canal section, c) Partial improvement of bank of canal crossing reservoir, d) Replacement or partial improvement of structures on main canals, and e) Additional construction of structures on main canals.
<ul style="list-style-type: none"> - Rehabilitation of secondary canals with related structures related to NMC and SMC of which the length is 10.0 km respectively 	<p>In connection with the rehabilitation for upstream 9.1 km of NMC and 9.8 km of SMC, MOWRAM, and PDOWRAM requested to include improvement of relevant secondary canals and their related structures in the scope because of urgent and higher necessity and also accruing the benefits from the irrigated fields. It is deemed that this request is appropriate from technical viewpoint. The works to be additionally requested consist of</p> <ul style="list-style-type: none"> a) Partial rehabilitation, improvement, and repair of canals section, and b) Partial rehabilitation and new construction of related structures.
<ul style="list-style-type: none"> - Development of Tertiary Canal System in Model Area 	<p>MOWRAM requested to include the model area development proposed in M/P in the area of upstream part (up to 7.8 km) of SMC.</p> <ul style="list-style-type: none"> a) Partial rehabilitation and improvement tertiary canal system.

Scope Proposed by MOWRAM in M/D*1	Examined Scope of RCHRSP
d) Software Components	
- Capacity development for MOWRAM and PDOWRAM staff on O&M	In order to keep the sustainability of RCHRSP, these are indispensable thus be included in the scope of RCHRSP.
- Strengthening of FWUC not proposed	To execute proper water management and O&M at tertiary canal system level, strengthening of FWUC is essential thus be included in scope of RCHRSP.
- Strengthening of agricultural extension services	In order to attain the improvement of agricultural productivity, this is needed, thus be included in scope of RCHRSP.

*1; Minutes of Discussions on Preparatory Survey for Irrigation and Drainage System Rehabilitation and Improvement Project, signed on February 25, 2011

*2; Supply canal; canals directly branched from approach channels between the regulator and intakes

Source: JICA Survey Team

Upper Slakou Irrigation System Rehabilitation Sub-project

Basic Concept

- (63) The scope of USISRSP proposed by MOWRAM was examined using the basic concepts such as (i) harmonization of hardware and software components, (ii) determination of Sub-project scale through water balance study using updated relevant data, (iii) full utilization of existing facilities, and (iv) priority ranking of each work included in USISRSP scope. (P II-2-19 and II-2-20)

Agricultural Development Plan

- (64) It was found through site visits that double cropping of paddy has been applied to about 150 ha because certain irrigation water becomes available due to the rehabilitation of Kpob Trobek Reservoir by MOWRAM in 2005. It was also found that in spite of the proposal for the introduction of diversified crops in F/S, the planted area is still inadequate. Taking into consideration such current cropping pattern, the double cropping of paddy was proposed. The target yields of paddy proposed in F/S were re-estimated based on the current statistical data and also by referring to the results of the verification study executed in the *Study on Comprehensive Agricultural Development of Prek Thnot River Basin* (P II-2-20 and II-2-21)

Water Balance Study

- (65) In the review, the water balance calculation was made for 30 years by adding 10 years more from 2001 to 2010. As for water resources, 2 reservoirs of Turnup Lok on the Slakou River and Kpob Trobek on the Don Phe River were considered and these reservoirs are connected by the diversion canal. Possible irrigation area was estimated using the irrigation water demand, river maintenance flow, river runoffs, and storage effects of reservoirs. Based on the result, the following extent of crops could be realized with 80% dependability. (P II-2-21 and II-2-22)

Results of Water Balance Study

Stage	Medium Paddy (RS)	HYV-1 Paddy (RS)	HYV-2 Paddy (Early RS)	Diversified Crop-1 (Early RS)	Diversified Crop-2 (Early RS)	Crop Intensity Per Year
F/S in 2002	2,400	1,100	-	500	550	130%
Review in 2011	2,400	1,100	200	-	200	111%

Source: JICA Survey Team

Note: RS means Rainy Season.

Scope of Sub-project

- (66) The works proposed by MOWRAM and F/S were examined from technical and economical viewpoints and also considering the application for Japanese loan, through the review of M/P

and F/S, site visits, consultations with farmers, and a series of discussions with MOWRAM and PDOWRAM. The results of the examination compared with the works proposed by MOWRAM are shown in the following table, (P II-2-30 and II-2-31)

Examined Scope of USISRSP

Scope Proposed by MOWRAM in M/D*	Examined Scope by JICA Survey Team	Remarks
a) Irrigation Development Area		
- 3,500 ha	- 3,500 ha	Justified through water balance study.
b) Cropping Pattern and Crop Intensity		
- Paddy-based cropping system with upland crops. - Crop intensity: 130%	- Rice-based cropping system with upland crops. - Crop intensity: 111%	Application of double cropping of paddy in view of present cropping pattern.
c) Hardware Components		
- Rehabilitation of two reservoirs including spillway, outlet structures, and a diversion canal between the two reservoirs with related structures Tumnup Lok Reservoir Kpob Trobek Reservoir	- Tumnup Lok Reservoir Partial rehabilitation of the existing dike (2.3 km), and new construction of the reservoir facilities including over-flow type spillway of 230 m, one maintenance gate, and two intakes for diversion canal. - Kpob Trobek Reservoir Partial minor repairs of flap gates on spillway (6 nos.) and new provision of slope protection for dike (3.3 km).	- Construction of tertiary canals for 15 ha is not included in scope of USISRSP.
- Rehabilitation of diversion canal	- Full reshaping and lining of existing canal section (9.4 km), including new construction of two bridges, one cross drain and one siphon (75 m long) crossing the Krouch River.	
- Rehabilitation of main canal with related structures	- Partial rehabilitation of Main Canal 33 (7.3 km) including new construction of related structures.	
- Rehabilitation of secondary canals with related structures	- Partial rehabilitation of seven secondary canals (44.7 km in total) including new construction of related structures.	
- Construction of tertiary canals and related structures	- New construction of tertiary canals for 110 km and related structures with condition that MOWRAM will provide special arrangement for acquiring land for tertiary canals.	Development plan and design for tertiary canals and related structures will be made by employing national consultants. Construction of tertiary canals and related structures will be carried out by local contractors to be selected through LCB. All of the works will be under the responsibility of PMU Japan Support Fund.
	- New provision of O&M facility and equipment.	FWUC office is included, while heavy construction equipment is not included.
d) Software Components		
- Capacity development for MOWRAM and PDOWRAM staff on O&M.	In order to keep the sustainability of USISRSP, these are indispensable, thus should be included in scope of USISRSP.	
- Strengthening of FWUC not proposed.	To execute proper water management and O&M at tertiary canal system level, strengthening of FWUC is essential, thus should be included in scope of USISRSP.	
- Strengthening of agricultural extension services.	In order to attain the improvement of agricultural productivity, this is needed, thus should be included in scope of USISRSP.	

*: Minutes of Discussion dated February 25, 2011
Source: JICA Survey Team

Kandal Stung-Bati Irrigation System Rehabilitation Sub-project

Basic Concept

(67) The Sub-project works planned in M/P and F/S in 1995 were reviewed using basic concepts such as (i) integrated approach of hardware and software components, (ii) consideration of new water source, (iii) determination of project scale through water balance study, (iv) full utilization of existing canal system, (v) application of concrete lining to main canals, (vi) use of part of Pol Pot canals as main drains, and (vii) priority ranking on Sub-project scope by criteria. (P II-2-32 and II-2-33)

Agricultural Development Plan

(68) Through site visits and discussions with PDA, it was found that some areas in the KSBISRSP Area were already cultivated with double cropping or triple cropping of paddy and most farmers preferred to cultivate paddy instead of diversified crops if water is available. Taking into consideration the present cropping pattern, it was proposed to introduce double cropping of paddy into the KSBISRSP Area. Target yield of paddy was set at 4.0 ton/ha for early rice and 3.5 ton/ha for medium rice based on the current statistics data and also by referring to the promising results of the verification study executed in the *Study on Comprehensive Agricultural Development of Prek Thnot River Basin*. (P II-2-33)

Water Balance Study

(69) Water balance study was carried out for 2 cases, namely, *without dams* and *with dams*. In case of *without dams*, which was conducted in the previous studies, the Prek Thnot River system, without any artificial flow control, is a water source for irrigation. Based on the results of the water balance study, the following crop intensity and dependability were confirmed: (P II-2-36)

Results of Water Balance Simulation Without Dams

Item	Roleang Chrey (Zone-I)	Roleang Chrey (Zone-II)	Dangkor System	Kandal Stung (Grant)	KSBISRSP Area	
					Kandal Stung (Extension)	Bati Area
Total Irrigation Area (ha)	5,660	11,040	300	1,950	0	1,600
Early Rice-1	500	975	42	975	0	800
Medium Rice	5,162	10,069	258	975	0	800
Early Rice-2	500	975	42	900	0	800
Upland Crop	280	546	0	540	0	480
Crop Intensity	114%	114%	114%	174%	0%	180%
Dependability	80%	57%	80%	83%		100%

Source: JICA Survey Team

As can be seen in the above table, the Kandal Stung (extension) Area could not be irrigated without any new water source. On the other hand, in case of *with dams*, the water balance study was carried out for the following 5 cases: (P II-2-34 to II-2-36)

Results of Water Balance Simulation With Dams

Case	Combination of Proposed Dams
Case-1	with Stung Tasal Dam only
Case-2	with Stung Tasal Dam + K-water 3 Dams
Case-3	with Stung Tasal Dam + K-water 3 Dams + Stung Sva Slab Dam
Case-4	with Stung Tasal Dam + K-water 3 Dams + Stung Khleach Dam
Case-5	with Stung Tasal Dam + K-water 3 Dams + Stung Sva Slab Dam + Stung Khleach Dam

Source: JICA Survey Team

The results of water balance study for these five cases are shown in the following table.

Summary of Case Study of Water Balance Simulation with Dams (Unit of area: ha)

Case No.	Kandal Stung Area (Grant)			Kandal Stung Area (Extension)			Tonle Bati Area			Total Area
	Total Area	Crop Intensity	Dependability	Total Area	Crop Intensity	Dependability	Total Area	Crop Intensity	Dependability	
Case-1	1,950	180%	97%	1,800	180%	93%	4,200	180%	80%	7,950
Case-2	1,950	180%	97%	1,750	180%	93%	4,200	180%	80%	7,900
Case-3	1,950	180%	100%	4,200	180%	93%	6,000	180%	83%	12,150
Case-4	1,950	180%	100%	2,940	180%	93%	6,000	180%	80%	10,890
Case-5	1,950	200%	100%	4,200	200%	93%	6,000	200%	80%	12,150

Source: JICA Survey Team

As can be seen in the above table, it was clarified that the Kandal Stung Area (Extension: 1750 ha) could be irrigated with crop intensity of 180% for any case at least. (P II-2-36 and II-2-37)

Scope of Sub-project

(70) The works proposed in MOWRAM and F/S were examined from technical and economical viewpoints and also considering the application of Japanese loan, through the review of previous studies such as M/P and F/S, site visits, consultations with the farmers, and a series of discussions with MOWRAM and PDOWRAM. The following table shows the results of the examination. (P II-2-46)

Examined Scope of KSBISRSP

Scope Proposed by MOWRAM in M/D*	Examined Scope by JICA Survey Team	Remarks
a) Irrigation Development Area		
Not specified	3,350 ha in total, consisting of 1,750 ha in the Kandal Stung Area and 1,600 ha in the Bati Area.	The extent of irrigation area is confirmed through basin wide water balance study on Prek Thnot River although Stung Tasal Dam should be implemented as planned.
b) Cropping Pattern and Crop Intensity		
Not specified	- Paddy-based cropping system with upland crops. - Crop intensity: 180%	Application of double cropping of paddy considering present cropping pattern
c) Hardware Components		
Rehabilitation of main canals and secondary canals including related structures.	<u>Kandal Stung Area</u> : Full rehabilitation of two main canals of 11.3 km and two secondary canals of 5.0 km long <u>Bati Area</u> : Full rehabilitation of two main canals of 7.6 km and six secondary canals of 8.6 km long.	Concrete lining of 75 mm thick with wire mesh of D 10 mm @ 25 cm grid is provided for the main irrigation canals of 18.9 km.
Rehabilitation of third canals including related structures.	New construction of tertiary irrigation canals of 53 km for the Kandal Stung (1,750 ha) and 48 km for the Bati Area (1,600 ha).	No tertiary drainage canal is planned due to difficulty in land acquisition.
Gate installation for diversion works, intakes, and checks	New construction of one new diversion weir and rehabilitation of one gated weir, and replacement of three intakes on the Stung Touch River. New construction of check and turnout structures on main and secondary canals replacement of Daeum Rues Regulator on the Prek Thnot River for supplying water to the Stung Touch River.	Three intakes for EW-60, EW-58 and NS-82
Rehabilitation of intake, pumping station, spillway, embankment etc. around Lake Tonle Bati	Full replacement of intake structure and pump station for the Bati Area on Lake Tonle Bati, Kampong Daungkar spillway, and heightening of flood dike for 2.7 km.	
Rehabilitation of Stung Touch Gate and NS-78* Canal *: NS87 in MD is clerical error.	Full enlargement of NS-82 as a connection canal for future development of the Bati Area, and construction of new diversion weir on the Stung Touch River	Through comparative study between NS-78 and NS-82, NS-82 was selected due to less construction cost; same diversion weir for the main canal EW-58 can be used.

Scope Proposed by MOWRAM in M/D*	Examined Scope by JICA Survey Team	Remarks
d) Software Components		
- Capacity development for MOWRAM and PDOWRAM's staff on O&M.	In order to realize the sustainability of KSBISRSP, these are indispensable, thus be included in scope of KSBISRSP.	
- Formation and strengthening of FWUC not proposed	To execute appropriate water management and O&M at tertiary canal system level, strengthening of FWUC is essential, thus be included in the scope of KSBISRSP.	
- Strengthening of agricultural extension services	In order to fulfill the improvement of agricultural productivity, this is needed, thus be included in the scope of KSBISRSP.	

*: Minutes of Discussion dated February 25, 2011
Source: JICA Survey Team

Main Canal 35 Rehabilitation Sub-project

Basic Concept

(71) The Sub-project works proposed were reviewed using the basic concepts paying attention to the following current conditions of MC35RSP; (i) integrated approach of hardware and software components, (ii) priority area proposed by MOWRAM/PDOWRAM, (iii) determination of sub-project scale through water balance study, (iv) utilization of existing canal system, and (v) priority ranking on Sub-project scope by criteria. (P II-2-47 and II-4-48)

Agriculture Development Plan

(72) The agricultural development plan proposed in 2009 was reviewed through site visits, analysis of collected latest data and information from the relevant institutes, and discussion with PDA and DAO staff to determine the water demand for the water balance study, and also to contribute in the preparation of the appropriate scope of MC35RSP. In particular, it is noted that the proposed area of 3,018 ha was changed into 1,935 ha (Zone-A) through discussion with MOWRAM/PDOWRAM. As for the cropping calendar, it was proposed to introduce early rice and medium rice based on the results of the review mentioned above if water is available. (P II-2-48 and II-2-49)

Water Balance Study

(73) The water balance simulation was conducted for the MC35RSP Area, say Zone-A (1,935 ha) using estimated discharge of 20 years from 1992 to 2011 and irrigation water requirement at each command area by half monthly steps. Based on the result of the water balance simulations, it was confirmed that 850 ha out of 1,935 ha with average crop intensity of 115% can be irrigated with 80% dependability. (P II-2-50 and II-2-51)

Results of Water Balance Study of MC35RSP Area

Zone	Max. Irr. Area	Total Irr. Area	Early Rice (Early Rainy)	Mid Paddy	Early Rice (Early Dry)	Crop Intensity	Dependability	Deficit Year (times)
A	1,935 ha	850 ha	125 ha	850 ha	0 ha	115%	80%	4

Source: JICA Survey Team

Scope of Sub-project

(74) Based on the investigation, the proposed works and scope of the rehabilitation works under MC35RSP were examined as shown in the following table. (P II-2-56 and II-2-57)

Examined Scope of MC35RSP

Proposed by MOWRAM*	Examined Scope by JICA Survey Team	Remarks
a) Irrigation Development Area		
- 2,648 ha in the rainy season - 120 ha in the early rainy season - 250 ha in the dry season (with three reservoirs)	- 850 ha in the rainy season - 130 ha in the early rainy season (with one reservoir only)	Justified through water balance study
b) Cropping Pattern and Crop Intensity		
- Rice Cropping System - Crop Intensity: 116%	- Rice Cropping System - Crop Intensity: 115%	Determined based on the present cropping pattern
c) Hardware Component		
1) Khpob Krous Reservoir - Dike, spillway, intake not proposed	1) Khpob Krous Reservoir - Dike, spillway, intake not proposed	Reservoir related to MC35RSP has been rehabilitated in 2009.
2) Main Canal 35 and related structures - Main canal Reshaping of existing canal section for whole main canal (25,299 m)	2) Main Canal 35 and related structures - Main canal Rehabilitation of existing canal for Zone-A (12,800 m out of 25,299 m) and construction of new canal (1,200 m)	It is judged that the rehabilitation of the whole main canal section is unsuitable for SISIP.
- Related structures (New Construction) Check structure: 19 nos. Culvert: 1 no. Spillway: 1 no. Water gate: 7 nos.	- Related structures Check structure: 9 nos. Turnout: 16 nos. Culvert: 8 nos. Drain inlet: 10 nos. Drop: 5 nos. Cross Drain: 1 no. Road Bridge: 1 no. Footpath Bridge: 9 nos.	
3) Secondary canals and related structures not proposed	3) Secondary canals and related structures - Secondary canals Rehabilitation of existing secondary canals (5 nos., 9,250 m) and construction of a new canal (1 no., 2,150 m) - Related structures Check Structure: 20 nos. Turnout: 35 nos. Culvert: 26 nos. Drop: 1 no.	Rehabilitation of only the main canal is insufficient to realize efficient irrigation system.
4) Drainage system not proposed	4) Drainage system (included above scopes of main/secondary canals)	Rehabilitation/ construction of drain is not proposed
5) Tertiary canals not proposed	5) Tertiary canals - Tertiary system development: 26 km (850 ha)	MOWRAM will provide special arrangement for land acquisition for tertiary canals. Tertiary canals will be constructed by local contractors to be selected through LCB
6) Construction of Project Office not proposed	6) Construction of Project Office - Office building (300 m ²) - Parking shed, gate, and fencing - Well drilling and electric works	
d) Software Component		
1) Capacity development for MOWRAM and PDOWRAM staff on O&M not proposed.	In order to realize the sustainability of MC35RSP, these are indispensable, thus should be included in the scope of MC35RSP	
2) Formation and strengthening of FWUC not proposed.	To execute appropriate water management and O&M at tertiary canal system level, formation and strengthening of FWUC is essential, thus should be included in the scope of MC35RSP	
3) Strengthening of agricultural extension services not proposed.	In order to fulfill the improvement of agricultural productivity, this is needed, thus should be included in scope of MC35RSP	

Source : Project Proposal Document prepared by PDOWRAM (2009)

*: JICA Survey Team

Srass Prambai Water Recession Rehabilitation Sub-project (SPWRRSP)

Basic Concept

- (75) The SPWRRSP works proposed by PDOWRAM/MOWRAM were reviewed using the basic concepts paying attention to the following current conditions of SPWRRSP; (i) integrated approach of hardware and software components, (ii) appreciating present irrigation system under the recession cultivation, (iii) determination of the sub-project scale through water balance study, and (iv) priority ranking on Sub-project scope by criteria. (P II-2-57 and II-2-58)

Agriculture Development Plan

- (76) The agricultural development plan proposed in 2009 was reviewed through site visit, analysis on collected latest data and information from relevant institutes, discussion with PDA and DAO staff, to determine the water demand for water balance study, and also to contribute to the preparation of the appropriate scope of SPWRRSP. As for the proposed cropping pattern, early rice in the dry and rainy seasons was introduced considering the results of the above activities. (P II-2-58 and II-2-59)

Water Balance Study

- (77) SPWRRSP is planted with recession irrigation crop during the dry season. Water balance study was conducted by considering the flood water level of the Tonle Bassac River. During the flood season, river water from the Tonle Bassac River is channeled to the Srass Prambai Reservoir. After the flood season, inundation area will dry, and then will be cultivated with recession rice crop. The water in the Srass Prambai Reservoir will be used for irrigation. Water balance simulation was conducted using storage capacity curve of the Srass Prambai Reservoir and the estimated irrigation water requirement for the proposed cropping patterns. According to the water balance simulations of 20 years from 1991 to 2011 for SPWRRSP, a total 1200 ha with crop intensity of 106% can be irrigated with 80% dependability. (P II-2-59 to II-2-61)

Results of Water Balance Study SPWRRSP Area

Max. Command Area (ha)	Available Total Irrigation Area	Early Rice (Dry)	Early Rice (Recession)	Crop Intensity	Dependability	Deficit Year (times/20years)
2,500 ha	1,200 ha	70 ha	1,200 ha	106%	80%	4

Source: JICA Survey Team

Scope of Sub-project

- (78) Based on the basic concept for irrigation rehabilitation plan mentioned above, facilities to be rehabilitated and/or reconstructed under SPWRRSP are shown in the following table: (P II-2-63 and II-2-64)

Examined Scope of SPWRRSP

Proposed by MOWRAM	Examined Scope by JICA Survey Team	Remarks
a) Irrigation Development Area		
- 2,500 ha in the dry season	- 1,200 ha in the dry season	Justified through water balance study
b) Cropping Pattern and Crop Intensity		
- Rice Cropping System - Crop Intensity: 100%	- Rice Cropping System - Crop Intensity: 106%	Application of double cropping of rice considering present cropping pattern
c) Hardware Component		
1) Reservoir dike - Rehabilitation of the existing dike (5.0 km)	1) Reservoir dike - Rehabilitation of the existing dike (9.1 km).	Northern part of the dike was recently rehabilitated in 2008.
2) Replacement of intake	2) Replacement of intake culverts on	i. Removing existing structures;

Proposed by MOWRAM*	Examined Scope by JICA Survey Team	Remarks
culverts on reservoir dike	reservoir dike. - Replacement of seven intake culverts with provision of new slide gates	ii. Construction of new structures maintaining original capacity; iii. Installation gate and screen; and iv. Protection on both sides
3) Construction of Project Office not proposed	3) Construction of Project Office - Office building (300 m ²) - Parking shed, gate and fencing - Well drilling and electrical works	
d) Software Component		
1) Capacity development for MOWRAM and PDOWRAM staff on O&M not proposed	In order to realize the sustainability of SPWRRSP, these are indispensable, thus should be included in the scope of SPWRRSP	
2) Formation and strengthening of FWUC not proposed.	To execute appropriate water management and O&M at tertiary canal system level, formation and strengthening of FWUC is essential, thus be included in scope of SPWRRSP	
3) Strengthening of agricultural extension services not proposed	In order to fulfill the improvement of agricultural productivity, this is needed, thus should be included in scope of SPWRRSP	

Source: JICA Survey Team

Daun Pue Irrigation System Rehabilitation Sub-project

Basic Concept

(79) The Sub-project works proposed by PDOWRAM/MOWRAM will be reviewed using the basic concepts paying attention to the following current conditions of DPISRSP: (i) integrated approach of hardware and software components, (ii) determination of Sub-project scale through water balance study, (iii) utilization of existing canal system, and (iv) priority ranking on Sub-project scope by criteria. (P II-2-64 and II-2-65)

Agriculture Development Plan

(80) The agricultural development plan proposed in 2009 was reviewed through site visit, analysis on collected latest data and information from relevant institutes, discussion with PDA and DAO staff, to determine the water demand for water balance study, and also to contribute in the preparation of the appropriate scope of DPISRSP. As a result, medium rice was cultivated only in the rainy season due to availability of water source for irrigation. (P II-2-65 and II-2-66)

Water Balance Study

(81) There is no existing reservoir in the DPISRSP Area and relevant river basin. Therefore, simplified water balance study was conducted for the DPISRSP Area. According to the water balance simulations, a total 1150 ha of command area with crop intensity of 100% will be able to be irrigated with 80% dependability. (P II-2-66 to II-2-68)

Scope of Sub-project

(82) Based on the basic concept for irrigation rehabilitation plan mentioned above, the scope of DPISRSP was examined and compared with the proposal made by MOWRAM, as follows: (P II-2-73 and II-2-74)

Examined Scope of DPISRSP

Proposed by MOWRAM*	Examined Scope by JICA Survey Team	Remarks
a) Irrigation Development Area		
- 1,150 ha	- 1,150 ha in the rainy season	Justified through water

Proposed by MOWRAM*	Examined Scope by JICA Survey Team	Remarks
		balance study
b) Cropping Pattern and Crop Intensity		
- Rice cropping system - Crop intensity: 100%	- Rice cropping system - Crop intensity: 100%	
c) Hardware Component		
1) Construction of headworks a) Protection with stone pitching; b) Fixed weir with and flood gate; Flood gates: 1.5 m (H) x 1.5 m (W), 13 spans Stoplog section: 0.7 m (H) x 1.8 m (W), 8 spans each on both sides c) Construction of intake structure not proposed	1) Construction of headworks a) River training of up and down stream of proposed headworks b) Construction of regulator (2 m x 10 m x 4 sets) c) Construction of intake structure	
2) Rehabilitation of Daun Pue Main Canal a) Improvement of canal (6.0 km, only upper reach) on the existing route - New construction of canal-related structures; - Check structure 7 nos. - Culvert 3 nos. - Spillway 1 no.	2) Rehabilitation of Daun Pue Main Canal a) Improvement of canal (6.2 km from BP to P6+200, raising of embankment and/or enlargement of canal section), b) Changing route of main canal (4.9 km from P6+200 to EP, upgrading of secondary to main canal) c) Construction of canal inspection road d) Replacement or new construction of canal-related structures; - Check structure 14 nos. - Turnout 34 nos. - Culverts 13 nos.	- Section and profile of canal are designed in accordance with the designed diversion water requirement and topographic condition. - All existing structures are to be demolished and new structures.
3) Rehabilitation of secondary canals not proposed.	3) Rehabilitation of secondary canals. a) Improvement of canal (3.4 km in total); b) Construction of new secondary canal from main canal to existing secondary canal (1.2 km); c) Construction of canal inspection road; and d) Replacement or new construction of canal-related structures; - Check structure 9 nos. - Turnout 15 nos. - Culverts 8 nos.	- Section and profile of canal are designed in accordance with designed diversion water requirement and topographic condition. - All existing structures are to be demolished and new structures.
4) Rehabilitation of drains not proposed.	4) Rehabilitation of drains. -Improvement and reshaping of drains	Improvement and reshaping of existing canal sections
5) Development of tertiary canal system not proposed.	5) Development of tertiary canal system. -Development of tertiary canal system: 35 km (1150 ha).	
6) Construction of Project Office not proposed.	6) Construction of Project Office - Office building (300 m ²) - Parking shed, gate and fencing - Well drilling and electric works	
d) Software Component		
1) Capacity development for MOWRAM and PDOWRAM's staff on O&M not proposed.	In order to realize the sustainability of SPWRRSP, these are indispensable, thus be included in scope of SPWRRSP	
2) Formation and strengthening of FWUC not proposed.	To execute appropriate water management and O&M at tertiary canal system level, formation and strengthening of FWUC is essential, thus be included in scope of SPWRRSP	
3) Strengthening of agricultural extension services not proposed.	In order to fulfill the improvement of agricultural productivity, this is needed, thus be included in scope of SPWRRSP	

Source: JICA Survey Team

CHAPTER II-3 SOUTHWEST PHNOM PENH IRRIGATION AND DRAINAGE REHABILITATION AND IMPROVEMENT PROJECT

Scope and Objective of South Phnom Penh Irrigation and Drainage Rehabilitation and Improvement Project (SPPIDRIP)

Overall Goal, Objective, and Expected Output and Outcome

(83) Summary of SPPIDRIP design is tabulated as follows: (P II-3-2 and II-3-3)

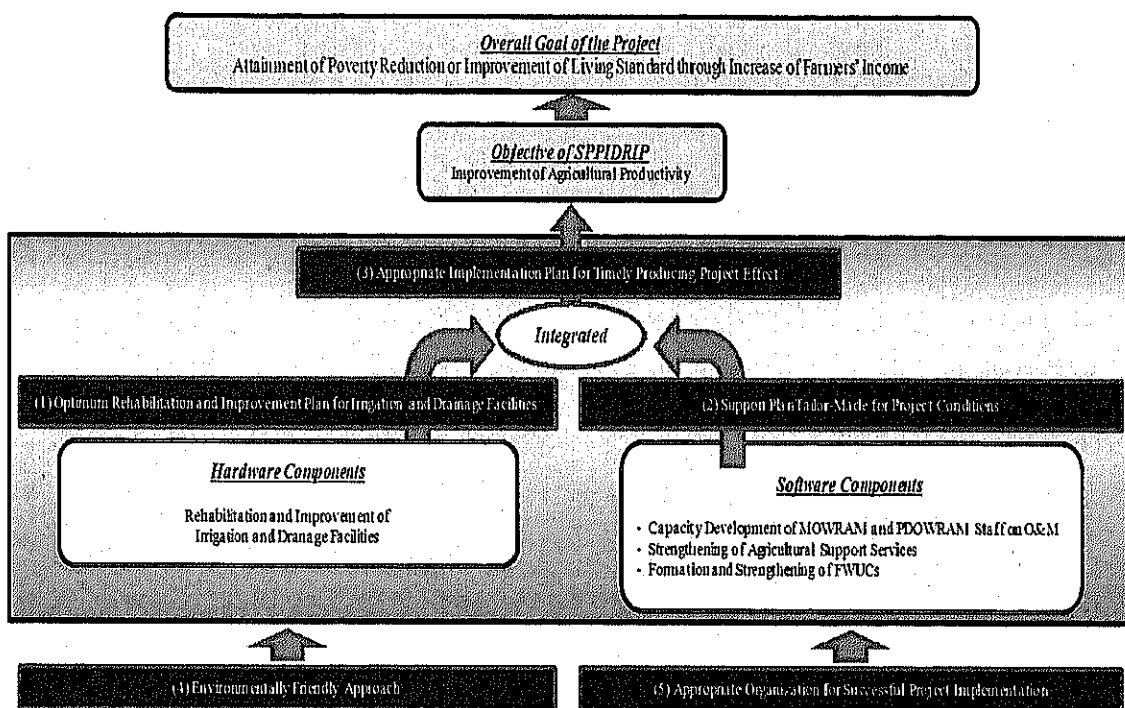
Summary of SPPIDRIP Design	
	Description
Overall Goal	To attain poverty reduction or improve the living standard through increase of farmers' income
Objective	To improve agricultural productivity by rehabilitating and improving the existing irrigation and drainage facilities, executing capacity development for MOWRAM and PDOWRAM staff on O&M, strengthening agricultural extension services, and forming and strengthening of FWUCs
Expected Output and Outcome	<p>1) RCHRSP</p> <ul style="list-style-type: none"> - Stable water abstraction from the Prek Thnot River for irrigation to the related command area - Appropriate and timely gate control of Roleang Chrey regulator at normal and flood times - Proper water supply to SMC and NMC through the rehabilitated intake structures - Realized smooth water flow to the downstream portions on SMC and NMC - Improved agricultural productivity contributing to the improvement of farmers' income. - Established O&M system by strengthening Kampong Speu PDOWRAM and FWUC <p>2) USISRSP</p> <ul style="list-style-type: none"> - Ensured water resources for irrigation to command area; - Realized smooth water conveyance to command area by rehabilitating and improving the connection canal, main canal, secondary canals, tertiary canals, and related structures; - Developed command area of 3,500ha - Improvement of agricultural productivity contributing to the improvement of farmers' income, especially by provision of agricultural extension services - Established O&M system by strengthening Takeo PDOWRAM and FWUC <p>3) KSBISRSP</p> <ul style="list-style-type: none"> - Ensured water resources for irrigation to command area of 3350 ha consisting of 1750 ha for the Kandal Stung Area and 1600 ha for the Bati Area; - Realized smooth and effective water convey to command area by rehabilitating and improving the existing irrigation canal system; - Established irrigation canal system in consideration of further development in the future; - Improved agricultural productivity to contribute to the improvement of farmers' income, especially through the provision of agricultural extension services; and - Established O&M system by strengthening Kandal PDOWRAM, and organizing and strengthening FWUC. <p>4) MC3SRSP</p> <ul style="list-style-type: none"> - Ensured water resources for irrigation to command area of 850 ha; - Realized smooth water convey to command area by rehabilitating and improving the existing reservoir and irrigation canal system; - Improved agricultural productivity to contribute to the improvement of farmers' income, especially through the provision of agricultural extension services; - Established O&M system by strengthening Kampong Spue PDOWRAM, and organizing and strengthening FWUC. <p>5) SPWRRSP</p> <ul style="list-style-type: none"> - Ensured water resources for irrigation to command area of 1200 ha by rehabilitating the existing reservoir; - Improved agricultural productivity to contribute to the improvement of farmers' income, especially through the provision of agricultural extension services; and - Established O&M system by strengthening Kandal PDOWRAM, and organizing and strengthening FWUC. <p>6) DPISRSP</p> <ul style="list-style-type: none"> - Ensured water resources for irrigation to command area of 1150 ha by newly constructing headworks; - Smooth water convey to command area by rehabilitating and improving the existing irrigation canal system; - Improved agricultural productivity to contribute to the improvement of farmers' income, especially through the provision of agricultural extension services; and - Established O&M system by strengthening Kampong Chhnang PDOWRAM, and organizing and strengthening FWUC.

Source: JICA Survey Team

Approach and Strategy

(84) SPPIDRIP will be implemented under the basic concept of *integrated approach of hardware and software components*, to successfully accomplish its objective mentioned above, and eventually to attain its overall goal, *attainment of poverty reduction or improvement of living*

standard through increase of farmers' income. The approach and strategy of SPPIDRIP are illustrated as follows: (P II-3-3 to II-3-7)



Source: JICA Survey Team

Approach and Strategy of SPPIDRIP

Preparatory Works

(85) In order to successfully execute the implementation of SPPIDRIP, it is crucial to carry out the preparatory works effectively prior to its commencement. The required preparatory works for the implementation of SPPIDRIP are (i) explanation of SPPIDRIP to the National Steering Committee, (ii) timely budget arrangement for smooth implementation of SPPIDRIP, (iii) prior establishment of implementation organization, (iv) land acquisition for construction of canals, and (v) execution of detailed technical ground survey for mines and UXOs. (P II-3-7 and II-3-8)

Hardware Components

Roleang Chrey Headworks Rehabilitation Sub-project

(86) The Roleang Chrey Headworks are located in the Prek Thnot River, about 100 km upstream from its confluence with Bassac River, in Samraong Tong District, Kampong Speu Province. The RCHRSP Area lies in Kampong Speu Province. RCHRSP is the top priority project in the comprehensive agricultural development scenario of the Prek Thnot River basin formulated in the M/P Study. The relation of the whole Roleang Chrey Irrigation System Area and RCHRSP Area is tabulated as follows: (P II-3-8)

Relation of Whole Roleang Chrey Irrigation System Area and RCHRSP Area

Description	Area
Roleang Chrey Irrigation System	16,910 ha for project evaluation
RCHRSP Area	350 ha excluding 220 ha to be implemented by TSC-3
South Upstream area directly benefited from the rehabilitation of upstream parts of SMC (9.8 km) and secondary canals	

Source: JICA Survey Team

- (87) Paddy production under without- and with-project conditions for IAIMP prepared in the M/P Study and the command area except IAIMP are shown below: (P II-3-9 and II-3-10)

Production under Without- and With-Project Conditions

IAIMP

Paddy	Without-project Condition*1			With-project Condition*1			Increment Production (ton)
	Area (ha)	Unit Yield (ton/ha)*2	Production (Ton)	Area (ha)	Unit Yield (ton/ha)*3	Production (Ton)	
Early Rainy Season							
Early Rice	-	-	-	285	4.00	1,140	1,140
Rainy Season							
Early Rice	-	-	-	285	4.00	1,140	1,140
Medium Rice (irrigated)	-	-	-	-	-	-	-
Medium Rice (rainfed)	580	2.12	1,230	285	3.50	998	-232
Total	580	-	1,230	855	-	3,278	2,048

Note

*1: No supply of irrigation water due to malfunction of the regulator under without-project condition, while tertiary canal system development as well as soft component activities is carried out under with-project condition. The target area for development is 570 ha (285 ha + 285ha).

*2: Unit yield under without project condition is settled, considering the results of the socio-economic survey.

*3: Unit yield under with-project condition is settled, considering the results of the verification trial, which was conducted in F/S time.

Source: JICA F/S (2002) and JICA Survey Team

Command Area except IAIMP

Paddy	Without-project Condition*1			With-project Condition*1			Increment Production (ton)
	Area (ha)	Unit Yield (ton/ha)*2	Production (ton)	Area (ha)	Unit Yield (ton/ha)*2	Production (ton)	
Early Rainy Season							
Early Rice	-	-	-	930	2.79	2,595	2,595
Rainy Season							
Early Rice	-	-	-				
Medium Rice (irrigated)	-	-	-	8,570	2.31	19,797	19,797
Medium Rice (rainfed)	16,340	2.12	34,640	7,770	2.12	16,472	-18,168
Total	16,340		34,640	17,270		38,864	4,224

Note

*1: No supply of irrigation water due to malfunction of the regulator under without-condition, while water supply condition could be recovered up to the current situation under with-project condition. The target area for development is 16,340 ha (8,570 ha + 7,770 ha).

*2: Unit yield is settled, considering the result of socio-economic survey.

Source: JICA F/S (2002) and JICA Survey Team

Thus, the target area for "without-project condition" and "with-project condition" become 16,920 ha (580 ha + 16,340 ha) and 16,910 ha (570 ha + 16,340 ha) respectively.

- (88) Irrigation water requirement based on the cropping pattern of early rice and medium rice, and upland crop in a year with overall cropping intensity of 114% with 80% dependability, which was the same with F/S, is as follows: (P II-3-11)

Irrigation Water Requirement and Design Discharge for RCHRSP

Description	Design Value
Irrigation water requirement	
- Main canals	1.60 lit/sec/ha
- Secondary canals	1.41 lit/sec/ha (=1.60 x 0.88)* ¹
- Tertiary canals	2.10 lit/sec/ha (15.7 mm/day x 10,000 / 86,400 / 0.85)* ²
Design discharge	
- NMC	10.4 m ³ /sec (1.60 lit/sec/ha x 6,500 ha)
- SMC	16.3 m ³ /sec (1.60 lit/sec/ha x 10,200 ha)
- River outlet structure	5.0 m ³ /sec* ³

Remarks: 1; Irrigation efficiencies for paddy are assumed at 66% for overall and 88% for main and secondary canals.

2; Design discharge for tertiary canal should be determined at land preparation time when more water is required for 20 days for one tertiary block.

3; Basic Design Report of Japan's Grant Aid Project 2009.

Source: The Study on Comprehensive Agricultural Development of Prek Thnot River Basin in the Kingdom of Cambodia, JICA, 2008.

- (89) Basic design values such as design flood discharge and water levels for the rehabilitation of the headworks are referred in D/D of the Japanese Grant Aid project, as summarized below. (P II-3-11)

Design Flood Discharge and Water Level of Roleang Chrey Headworks

Description	Design Value
Design flood discharge for headworks	1,600 m ³ /sec (1 in 50 years)
Water level at headworks	
- High water level	36.00 m
- Low water level at intakes	35.70 m

Source: Basic Design Report of Japan's Grant Aid Project, 2008.

- (90) Facilities to be rehabilitated and/or reconstructed under RCHRSP are tabulated below. (P II-3-12)

List of Facilities to be Rehabilitated under RCHRSP

No.	Description	Quantity
1)	Irrigation Development Area	350 ha excluding 220 ha for TSC-3 pilot area, but influences 16,920 ha for project evaluation
2)	Roleang Chrey Headworks	
	- Roleang Chrey Regulator	Regulator gates - Fixed wheel gates, five sets, 12.5 m (W) x 6.7 m (H). Civil works - Construction of the downstream river bed protection - Rehabilitation of the downstream river bank protection.
	- Andong Sla Intake	Intake gates - Radial gates, 2 sets, 4.0 m (W) x 2.7 m (H). Civil works - Construction of curtain walls and operation deck, - Protection of up & downstream of intake - Rehabilitation of approach channel.
	- Vat Krouch Intake	Intake gates - Radial gates, two sets, 4.0 m (W) x 2.7 m (H) Civil works - Construction of upstream & downstream transitions - Construction of gate pier, box culvert and protection of canal beds, - Rehabilitation of approach channel
	- River outlet structure	Inlet gates - Slide gates, 4 sets, 1.0 m (W) x 1.0 m (H). Outlet gates - Slide gates, 2 sets, 1.25 m (W) x 1.4 m (H).
3)	NMC and SMC	2 nos. Design discharge: NMC 10.4 m ³ /sec at beginning point SMC 16.3 m ³ /sec at beginning point
	- Total length	18.9 km (NMC = 9.1 km and SMC = 9.8 km)
	- Structures to be rehabilitated/ reconstructed	Check structures : 3 nos. Turnout : 18 nos. Bridge : 7 nos. Spillway : 3 nos. Drainage gate : 11 nos.
4)	Secondary canals to be rehabilitated	12 nos.
	- Total length	16.9 km
	- Structures to be rehabilitated/ reconstructed	Check structures : 45 nos. Turnout : 53 nos. Culvert : 32 nos. Drain inlet : 4 nos.
5)	Tertiary Canal System	
	- Area (length)	350 ha (11 km)

Source: JICA Survey Team

Upper Slakou Irrigation System Rehabilitation Sub-project

- (91) USISRSP is located at about 70 km southwest from Phnom Penh and extends mainly on the right bank of the Slakou River and in Tram Kak District of Takeo Province. The development area for USISRSP was estimated at 3,500 ha through water balance study between the available water with 80% dependability and water demand for crop cultivation. (P II-3-12)

- (92) Incremental production of paddy under without- and with-project conditions is shown as follows: (P II-3-13)

Incremental Production of Paddy under Without- and With-Project Conditions

Paddy	Present / Without-project Condition			With-project Condition			Increment Production (ton)
	Area (ha)	Unit Yield (ton/ha)*1	Production (ton)	Area (ha)	Unit Yield (ton/ha)*2	Production (ton)	
Early Rice	470	2.13	1,001	1,300	4.00	5,200	4,199
Medium Rice	2,800	2.09	5,852	2,400	3.50	8,400	2,548
Total	3,270		6,853	3,700		13,600	6,747

Note

*1: Unit yield under present / without project conditions is settled, considering the results of the socio-economic survey.

*2: Unit yield under with-project condition is settled, considering the results of the verification trial in the Study on Comprehensive Agricultural Development of Prek Thnot River Basin.

Source: JICA Survey Team

- (93) Unit irrigation water requirement for canal design was proposed to apply 110% of the average irrigation requirement of 1.0 lit/sec/ha, considering rather long calculation step of 15 days. Thus, the unit irrigation water requirement was calculated at 1.1 lit/sec/ha. Based on this unit water requirement, the diversion irrigation water requirement was estimated at 3.5 m³/sec, with irrigation efficiency of 60% for paddy field. Unit drainage requirement for paddy field was estimated at 1.6 lit/sec/ha based on (i) allowable inundation depth of 150 mm, (ii) allowable inundation period of 3 days, (iii) design rainfall of 173 mm at Takeo with 1 in 10 year 3-day rainstorm, and (iv) initial water depth in the paddy field of 50 mm. (P II-3-14)
- (94) The list of facilities to be rehabilitated under USISRSP area is as follows: (P II-3-15)

List of Facilities to be Rehabilitated under USISRSP

No.	Description	Quantity
1)	Irrigation Development Area	3,500 ha
2)	Water resource facilities	
	- Reservoir-1	Tumnap Lok Reservoir in the Slakou River (CA=332 km ²), Ve= 1.0 MCM, Re-construction of dike, spillway, intake, and maintenance facilities.
	- Reservoir-2	Kpob Trobek Reservoir in the Don Phe River (CA=137 km ²), Ve= 2.6 MCM Supplemental improvement and repair of dike and spillway gates were rehabilitated by MOWRAM in 2005.
	- Diversion canal	Connecting the above two reservoirs, 9.4 km, design discharge: 3.5 m ³ /sec.
3)	Main canal	1 no. design discharge: 3.2 m ³ /sec.
	- Length	7.3 km
	- Off-takes	6 nos.
	- Diversion structure	5 nos.
4)	Secondary canals	7 nos.
	- Total length	44.7 km
	- Off-takes	102 nos.
	- Diversion structure	66 nos.
5)	Tertiary canals	
	- Total length	110 km

Source: JICA Survey Team

Kandal Stung-Bati Irrigation System Rehabilitation Sub-project

- (95) The Sub-project Area of 3,550 ha in total consists of 2 irrigation areas, namely the Kandal Stung Area of 1,750 ha and the Bati Area of 1,600 ha. The Kandal Stung Area is situated in Kandal Stung District of Kandal Province about 20 km south of Phnom Penh. And, the Bati Area of 1,600 ha is situated in Bati District of Takeo Province about 30 km south of Phnom Penh. (P II-3-15)
- (96) Paddy production under without- and with-project conditions in KSBISRSP is shown as follows: (P II-3-17)

Incremental production of Paddy under Without- and With-Project Conditions

Paddy	Without-project Condition			With-project Condition			Increment Production (ton)
	Area (ha)	Unit Yield (ton/ha) ^{*1}	Production (ton)	Area (ha)	Unit Yield (ton/ha) ^{*2}	Production (ton)	
1) Early Rainy Season							
- Early rice	140	2.58	362	2,680	4.00	10,720	10,358
2) Rainy Season							
- Early rice (irrigated)	500	2.58	1,290	-	-	-	- 1,290
- Medium rice (irrigated)	-	-	-	3,350	3.50	11,725	11,725
- Medium rice (rainfed)	2,850	2.09	5,957	-	-	-	- 5,957
Total	3,490		7,609	6,030		22,445	14,836

Note

*1: Unit yield under present / without project conditions is settled, considering the result of socio-economic survey.

*2: Unit yield under with-project condition is settled, considering the result of verification trial conducted in F/S time of RCISRSP.

Source: JICA Survey Team

- (97) Based on the revised cropping pattern, the irrigation water requirement was re-calculated for 30 years. Result for the peak water requirement of the revised cropping pattern having 80% dependability became 1.4 lit/sec/ha that was the same in F/S. On the other hand, the unit drainage water requirement for paddy field was also estimated at 1.6 lit/sec/ha provided that 1 in 10 year 3-day rainstorm or around 165 mm is eliminated within 3 days. (P II-3-17 and II-3-18)
- (98) The list of facilities to be rehabilitated under KSBISRSP is shown in the following table. (P II-3-19)

List of Irrigation and Drainage Facilities to be Rehabilitated under KSBISRSP

No	Description	Quantity
1)	Irrigation Development Area	3,350 ha in total consisting of 1,750 ha in Kandal Stung and 1,600 ha in Bati
2)	Water resource facilities	
	- Diversion weir on Stung Touch River	2 nos. on the Stung Touch River; (one is new headworks and the other is partial improvement of spillway)
	- Intakes on Stung Touch River	3 nos. on the Stung Touch River; (full replacement for EW-60, EW-58 and NS-82)
	- Pump Station on Lake Tonle Bati	1 no. at Lake Tonle Bati (Full replacement of the existing one, four sets of 45 m ³ /min each)
	- Regulator on Prek Thnot River for Stung Touch River	1 no. (Full replacement of Daeum Rues Regulator on the Prek Thnot River)
3)	Main irrigation canal	4 canals, Q= 5.88 – 0.91 m ³ /sec
	- Length	18.9 km in total, rehabilitation of the full stretch of the canal sections consisting 11.3 km for Kandal Stung and 7.6 km in the Bati Area
	- Off-takes	71 nos.
	- Diversion structures	17 nos.
	- Road crossing	29 nos.
4)	Secondary irrigation canals	8 canals, Q=0.45 – 0.21 m ³ /sec
	- Length	13.6 km in total, rehabilitation of the full stretch of the canal sections consisting of 5.0 km for Kandal Stung and 8.6 km in the Bati Area.
	- Off-takes	36 nos.
	- Diversion structures	9 nos.
5)	Main drainage canals	4 canals, Q=2.24 – 0.88 m ³ /sec
	- Length	18.8 km in total, rehabilitation of the full stretch of the canal sections consisting of 12.1 km for Kandal Stung and 6.7 km in the Bati Area
	- Structures	73 nos.
6)	Other facilities	
	- Connection canal	3.5 km (Upgrading of NS-82 to Lake Tonle Bati, Q=5.6 m ³ /sec)
	- Spillway of Lake Tonle Bati	1 no. (Full replacement of Kampong Daungkar spillway, Q=197 m ³ /sec)
	- Flood protection dike	Heightening of the existing dike of 2.7 km and replacement of one bridge
7)	Tertiary canal system	
	- Length	101 km in total, new construction and rehabilitation of the canal system consisting of 53 km for Kandal Stung Area and 48 km in the Bati Area

Source: JICA Survey Team

Main Canal 35 Rehabilitation Sub-project

- (99) MS35RSP is located in the upstream of Slakou River basin, west of Phnom Penh. The command area of the Sub-project lies in the left bank of the Chraloy River along the provincial road, having long and narrow shape extending from west to east with gentle slope. The area is

administratively situated mainly in Basedth District, Kampong Speu Province bordering the National Road No.4, and partly extending in the western part of Takeo Province. The MS35RSP area is determined to be 850 ha based on the water balance study in Zone-A, the first priority rehabilitation area proposed by PDOWRAM/MOWRAM. (P II-3-20)

- (100) Paddy production under without- and with-project conditions is shown as follows: (P II-3-20 and II-3-21)

Production under Without- and With-Project Conditions for MC35RSP

Paddy	Present / Without-project Condition			With-project Condition			Increment Production (ton)
	Area (ha)	Unit Yield ¹ (ton/ha)	Production (ton)	Area (ha)	Unit Yield ² (ton/ha)	Production (ton)	
a) Early Rainy Season							
- Early Rice (irrigated)				130	4.0	520	520
b) Rainy Season							
- Medium Rice (irrigated)	50	2.13	107	850	3.5	2,975	2,868
- Medium Rice (rainfed)	850	2.09	1,777				-1,777
Total	900		1,884	980		3,495	1,611

Note:

*1: Considered the results of the socio-economic survey in USISRSP as well as field investigation including interviews to farmers

*2: Applied the result of verification trial, which was conducted in F/S time of RCISRSP

Source: JICA Survey Team

- (101) Irrigation water requirement was calculated based on the water balance study. As a result, unit water requirement of the main and secondary canals is set at 2.5 l/sec/ha, applying overall irrigation efficiency of 42% consisting of conveyance efficiency of 70% and application efficiency of 60%. Based on the unit water requirement, the peak diversion water requirement from the Khpob Krous Reservoir is estimated at 2.1 m³/sec. (P II-3-21)

- (102) Based on the basic concept for the rehabilitation plan, facilities to be rehabilitated, and/or reconstructed under MC35RSP are shown in the following table. (P II-3-22 and II-3-23)

List of Irrigation and Drainage Facilities to be Rehabilitated under MC35RSP

No.	Description	Quantity
1)	Irrigation Development Area.	- 850 ha in priority area (Zone-A)
2)	Main Canal 35 and related structures. - Main Canal 35 - Related structures	- Main canal Rehabilitation of existing canal section for Zone-A (12.8 km out of 25.3 km) and construction of new canal (1.2 km) - Related structures Check structure: 9 nos. Turnout: 16 nos. Culvert: 8 nos. Drain inlet: 10 nos. Drop: 5 nos. Cross Drain: 1 no. Road Bridge: 1 no. Footpath Bridge: 9 nos.
3)	Secondary canals and related structures.	Secondary canals and related structures - Secondary canals Rehabilitation of existing secondary canals (5 nos., 9.2 km) and construction of a new canal (1 no., 2.2 km) - Related structures Check Structure: 20 nos. Turnout: 35 nos. Culvert: 26 nos. Drop: 1 no.
4)	Drainage system.	Drainage system - Drain inlet: 10 nos. on main canal. - Cross drain: 2 nos. (One is on main canal and the other is on a secondary canal). - Shaping of existing drain sections.
5)	Tertiary canals.	Tertiary system development : 26 km (850 ha)
6)	Construction of the project office.	- Office building (300 m ²); - Parking shed, gate, and fencing; - Well drilling and electric works, etc.

Source: JICA Survey Team

Srass Prambai Water Recession Rehabilitation Sub-project

(103) The SPWRRSP Area is located in the flood plain between the Bassac and the Mekong Rivers. The area lies at the left side of the Bassac River in its lower reach, about 20 km from the national border of Vietnam. The area is administratively situated in Po Ti Ban Commune, Kaoh Thum District, Kandal Province. (P II-3-22)

(104) Paddy production under without- and with-project conditions is shown as follows: (P II-3-23)

Production under Without- and With-Project Conditions for SPWRRSP

Paddy	Present / Without-project Condition			With-project Condition			Increment Production (ton)
	Area (ha)	Unit Yield ¹ (ton/ha)	Production (ton)	Area (ha)	Unit Yield ² (ton/ha)	Production (ton)	
1) Dry Season							
- Early rice (irrigated)	700	3.5	2,450	1,200	5.0	6,000	3,550
2) Early Rainy Season							
- Early rice (irrigated)	-	-	-	70	5.0	350	350
Total	700		2,450	1,270		6,350	3,900

Note

*1: Considered the results of the socio-economic survey in USISRSP as well as field investigation including interviews to farmers

*2: Applied the results of the verification trial, which was conducted in F/S time of RCISRSP

Source: JICA Survey Team

(105) Irrigation water requirement was calculated based on the water balance study. As a result, unit water requirement at the main and secondary canal levels is set at 2.4 l/sec/ha, applying overall irrigation efficiency of 70%. Based on the unit water requirement, the peak diversion water requirement from the Srass Prambai Reservoir was estimated at 2.8 m³/sec. (P II-3-23)

(106) The facilities to be rehabilitated and/or reconstructed under SPWRRSP are listed in the following table. (P II-3-24)

List of Irrigation Facilities to be Rehabilitated under SPWRRSP

No.	Description	Quantity
1)	Irrigation Development Area	1,200 ha
2)	Partial rehabilitation of reservoirs dike.	Rehabilitation of the existing dike (9.1 km).
3)	Full replacement of intake culverts on reservoir dike.	Replacement of seven intake culverts with provision of new slide gates.
4)	New construction of the project office.	a) Office building (300 m ²); b) Parking shed, gate, and fencing; and c) Well drilling and electric works, etc.

Source: JICA Survey Team

Daun Pue Irrigation System Rehabilitation Sub-project

(107) DPISRSP is located in the upstream of the Chieb River basin, about 40 km from its confluence of Tonle Sap River. The irrigation command area of DPISRSP lies in the left bank of the Chieb River and along the provincial road, having long and narrow shape extending from west to east. Administratively, the area lies in Chieb, Khlong Porporok and Aphivath Communes in Teuk Phos District. (P II-3-24)

(108) Paddy production under without- and with-project conditions is shown as follows: (P II-3-25)

Production under Without- and With-Project Conditions for DPISRSP

Paddy	Present / Without-project Condition			With-project Condition			Increment Production (ton)
	Area (ha)	Unit Yield ¹ (ton/ha)	Production (ton)	Area (ha)	Unit Yield ² (ton/ha)	Production (ton)	
Rainy Season							
- Medium Rice (irrigated)				1,150	3.50	4,025	4,025
- Medium Rice (rainfed)	1,060	2.09	2,215	-			-2,215
Total	1,060		2,215	1,150		4,025	1,810

Note

*1: Considered the results of the socio-economic survey in USISRSP as well as field investigation including interviews to farmers.

*2: Applied the results of the verification trial, which was conducted in F/S time of RCISRSP.

Source: JICA Survey Team

- (109) The list of facilities to be rehabilitated and/or reconstructed under DPISRSP is shown in the following table: (P II-3-26)

No.	Description	Quantity
1)	Irrigation Development Area	1,150 ha
2)	New construction of headworks	a) River training of up and down stream of proposed headworks b) Construction of regulator (2 m x 10 m x 4 sets) c) Construction of intake structure
3)	Full rehabilitation of Daun Pue Main Canal.	a) Improvement of canal (6.2 km from BP to P6+200, raising of embankment and/or enlargement of canal section), c) Changing route of main canal (4.9 km from P6+200 to EP, upgrading of secondary to main canal) d) Construction of canal inspection road e) Replacement or new construction of canal related structures - Check structure 14 nos. - Turnout 34 nos. - Culverts 13 nos.
4)	Full rehabilitation of secondary canals.	a) Improvement of canal (3.4 km in total) b) Construction of new secondary canal from main canal to existing secondary canal (1.2 km) c) Construction of canal inspection road d) Replacement or new construction of canal related structures: - Check structure 9 nos. - Turnout 15 nos. - Culverts 8 nos.
5)	Full rehabilitation of drains.	a) Improvement and reshaping of drains.
6)	Development of tertiary system.	a) New construction of tertiary canals (35 km)
7)	New construction of project office.	a) Office building (300 m ²); b) Parking shed, gate, and fencing; and c) Well drilling and electric works, etc.

Source: JICA Survey Team

Software Component

General

- (110) Three activities are proposed under the soft component of SPPIDRIP to establish organizational set-up in order to effectively utilize rehabilitated irrigation facilities as follows: (i) capacity development of MOWRAM and PDOWRAM staff on O&M, (ii) strengthening of FWUC, and (iii) strengthening of agricultural extension services. (P II-3-27)
- (111) Software component under SPPIDRIP will be conducted based on the following principles such as (i) follow-up of output of TSC-3 supported area in both Roleang Chrey and Slakou Irrigation Systems, (ii) integration of output of TSC-3 supported area and the extension area in both RCHRSP and USISRSP so as to demonstrate proper water management and increase rice production in the Model Area (570 ha) under RCHRSP and command area extending 3,500 ha under USISRSP, and (iii) extension to other Sub-projects such as KSBISRSP, SPWRRSP and DPISRSP. General framework of soft component is tabulated as follows: (P II-3-27 and II-3-28)

General Framework Software Component under SPPIDRIP

No.	Title	Activities	Implemented by	Main Target Group
1)	Capacity Development of MOWRAM and PDOWRAM Staff on O&M	- Preparation of practical O&M guidelines for rehabilitated facilities - Dissemination and training workshop - Training management - Periodical monitoring and evaluation - Follow-up workshop	Technical consultant (short-term foreign consultant) for work plan preparation and trial training. Training programs and M&E by PMU Japan Support Fund with Technical Service Center	MOWRAM and PDOWRAM Staff

No.	Title	Activities	Implemented by	Main Target Group
2)	Formation and Strengthening of FWUC	<ul style="list-style-type: none"> - Support to awareness raising - Support to establishment of FWUC - Implementation of training programs (organizational management, water management & O&M of tertiary canal systems) - Support and monitoring of water management and O&M of irrigation facilities) 	MOWRAM and PDOWRAM staff by employing national consultants	FWUCs in six sub-project irrigation systems
3)	Strengthening of Agricultural Extension Services ¹	<ul style="list-style-type: none"> - TOT for capacity development of group leaders to act as extension facilitator - Soil fertility diagnosis program - Pre-harvest technology improvement - Post-harvest technology improvement - Demonstration plots 	<p>Technical consultant (short-term foreign consultant) for work plan preparation and trial training</p> <p>PDA staff and national consultants under the control of PMU Japan Support Fund</p>	FWUCs in six sub-project irrigation systems

Source: JICA Survey Team

(112) It is proposed that software component will be generally carried out through training of trainers (TOT) approach, where trainees at one level become trainers at the other level as having been widely carried out by the previous irrigation projects with development partners and TSC of MOWRAM. (P II-3-27 and II-3-28)

Technical Assistance

Demarcation of Services

(113) The technical services consist of 2 types. One is the services of technical consultant consisting of foreign consultant and national consultant, and the other is the services of MOWRAM. The demarcation of these services is tabulated below: (P II-3-51)

Demarcation of Services of Technical Consultant and MOWRAM	
Services of Technical Consultant	Services of MOWRAM
<ul style="list-style-type: none"> - Review of previous studies - Preparation of definitive development plan - Execution of additional survey - Detailed design for large scale structures and major canal system - Preparation of prequalification documents and tender documents for construction - Execution of prequalification and tender evaluations for construction - Construction supervision for large scale structures and major canal system - Capacity development of MOWRAM and PDOWRAM staff on O&M - Training of PDA staff on agricultural extension services - Preparation of relevant reports 	<ul style="list-style-type: none"> - Development of tertiary canal system by employing national consultants - Formation and Strengthening of FWUCs by PDOWRAM trained under TOT system - Strengthening of agricultural extension services by PDA trained under coordination by MOWRAM

Source: JICA Survey Team

Outline of Consulting Services

(114) The outline of consulting services under task and assistance concepts is tabulated below: (P II-3-52)

¹ Out of 3 components proposed, "Strengthening of Agricultural Extension Services" is explained in details in Annex C: Agriculture.

Outline of Consulting Services

Concept	Description	
Task concept	All Stages	<ul style="list-style-type: none"> - Overall project management, monitoring and coordination among MOWRAM, PDOWRAM, PDA, and other agencies concerned
	Detailed Design Stage	<ul style="list-style-type: none"> - Review of previous studies - Preparation of definitive development plan - Detailed design - Preparation of prequalification and tender documents - Preparation of reports concerned
	Construction Stage	<ul style="list-style-type: none"> - Quality control - Progress control - Quantity control - Safety control - Capacity development for MOWRAM and PDOWRAM staff on O&M - Training of PDA staff on agricultural extension services - Preparation of reports concerned
Assistance Concept	All Stages	<ul style="list-style-type: none"> - To assist and advise PMU and PIUs in preparation of implementation schedule
	Detailed Design Stage	<ul style="list-style-type: none"> - To assist and advise PMU and PIUs in holding public consultation meeting
	Construction Stage	<ul style="list-style-type: none"> - To assist and advise PMU in prequalification and tender evaluation works - To assist and advise PMU in issuing variation order - To assist and advise PMU in settling contractors' claims.

Source: JICA Survey Team

Necessary Inputs of Consulting Services

(115) Technical consultants, consisting of foreign consultant and national consultant, are necessary for different special fields for the smooth implementation of the SPPIDRIP through support to PMU Japan Support Fund. Approximate man-months necessary for the implementation of SPPIDRIP are (i) for foreign consultant and (ii) for national consultant as detailed below: (P II-3-54)

Approximate Man-Months Required for Consulting Services

CHAPTER II-4 PROJECT IMPLEMENTATION AND O&M PLAN

Project Implementation Plan

Implementation Organization

(116) Three implementation organizations applied and/or proposed for recent major irrigation projects under MOWRAM were studied during the Survey: (i) NWISP (ADB), (ii) WRMSDP (ADB), and (iii) WTSIDRIP (JICA). Based on the results of the study as well as discussion with MOWRAM, the proposed implementation organization for SPPIDRIP is designed on the basis of that for WTSIDRIP. Some modifications to be applied for SPPIDRIP are (i) clear positioning of JICA in the implementation, (ii) assignment of a provincial level project manager, (iii) clear relation between PIU and PDA, and (iv) establishment of PIU Coordination Committee in case the sub-project area extends over rural provinces. (P II-4-1 and II-4-2)

Staff Required for the Design and Construction Works

(117) Smooth project implementation requires full-time professional staff from MOWRAM and PDOWRAM at the central and provincial levels, which will be directly and indirectly supported by relevant technical departments, as shown in the right table: (P II-4-3)

Staff Required for the Design and Construction Works for SPPIDRIP

Central/Province	Organization	nos.
Central Level	PMU Japan Support Fund (=1)	13
Provincial Level	PIU at Kampong Speu Province	5
	PIU at Takeo Province	16
	PIU at Kandal Province	6
	PIU at Kampong Chhnang	8
	Sub-total (Provincial Level) (=2)	35
Grand Total (1+2)		48

Source: JICA Survey Team

Construction Package

(118) As for ICB works, 6 sub-projects are divided into construction packages in consideration of the scattered location of working sites, shortening of construction period, similar works and provision of more chances to tenderers. On the other hand, LCB works like the construction of tertiary canals and related structures for 5 Sub-projects are proposed to be carried out by dividing them into packages in view of the procurement thresholds mentioned above. (P II-4-9)

Packaging for the Works of Hardware Component

Implementation Schedule

(119) Hardware components are proposed to be implemented from the beginning of 2013 after the loan agreement (L/A) until the middle of 2020, out of which the period from the beginning of D/D to the completion of construction would continue for 6.5 years. The overall schedule is illustrated as follows: As can be seen in this figure, construction works of SPPIDRIP will be

started in mid. 2016 and be completed by mid. 2020 although SPWRRSP will be completed in end of 2017. However, since the partial operation can be applied sub-project by sub-project, the project effect is expected to occur earlier, say mid. 2019 for RCHRSP, mid. 2018 for USISRSP, mid. 2018 for KSBISRSP, mid. 2019 for MC35RSP, mid. 2019 for DPISRSP (P II-4-10 to II-4-20).

Work Item	Year									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1. Loan Agreement (L/A)										
2. Procurement of Consultant										
3. Clearance of Allines and UXOs										
4. Land Acquisition										
5. Consulting Services										
5-1 Detailed design for water resources facilities and main and secondary canal system										
5-2 Assistance for procurement of ICB Contractor										
5-3 Construction supervision										
6. Rehabilitation and Construction of Roleang Chroy Headworks Rehabilitation Sub-project										
6-1 Preparatory works										
6-2 Temporary works										
6-3 Construction works										
(1) Roleang Chroy Headworks Improvement Works										
(a) Design, approval, fabrication and transportation of gates										
(b) Full improvement of hydro-mechanical works, intakes, and others										
(2) Rehabilitation works for North and South Main Canals										
(a) Partial rehabilitation works for North Main and Secondary Canals (28.35km)										
(b) Partial rehabilitation works for South Main and Secondary Canals (28.50 km)										
(c) Partial rehabilitation of drainage canals (3 km in total)										
(3) New construction of tertiary canal system in model area (350 ha)										
(4) New construction of Sub-project office										
6-4 Start of partial operation (Appearance of project effect)										
7. Rehabilitation and Construction of Upper Stakou Irrigation System Rehabilitation Sub-project										
7-1 Preparatory works										
7-2 Rehabilitation and construction works										
(1) Partial rehabilitation of Tumrup Lok Reservoir										
(2) Partial rehabilitation of diversion canal (9.4km)										
(3) Partial rehabilitation of Kpob Trobek Reservoir										
(4) Full rehabilitation of Main Canal 33 system (7.3km)										
(5) Partial rehabilitation of secondary canal system (44.7km)										
(6) Partial rehabilitation and new construction of tertiary canal system (3,500 ha)										
(7) New construction of Sub-project office										
7-3 Start of partial operation (Appearance of project effect)										
8. Rehabilitation and Construction of Kandal Stung-Batt Irrigation System Rehabilitation Sub-project										
8-1 Preparatory works										
8-2 Rehabilitation and construction works										
(1) New construction and partial improvement of diversion weirs										
(2) Full replacement of pumps and house										
(3) Full replacement of regulator for Stung Touch										
(4) Full upgrading of connection canal										
(5) New construction of Kampong Duagkar spillway										
(6) Partial rehabilitation of main canal system (18.9 km)										
(7) Partial rehabilitation of secondary canal system (13.6 km)										
(8) Partial rehabilitation of main drainage canal system (18.8 km)										
(9) New construction of tertiary canal system (3,350 ha)										
(10) New construction of Sub-project office										
8-3 Start of partial operation (Appearance of project effect)										
9. Rehabilitation and Construction of Main Canal 35 Rehabilitation Sub-project										
9-1 Preparatory works										
9-2 Rehabilitation construction works										
(1) Partial rehabilitation of Khpob Krous Reservoir and intake structure										
(2) Partial rehabilitation of main canal system (14.0 km)										
(3) Partial rehabilitation and new construction of secondary canal system (14.5 km)										
(4) New construction of tertiary canal system (850 ha)										
(5) New construction of Sub-project office										
9-3 Start of partial operation (Appearance of project effect)										
10. Rehabilitation and Construction of Sras Prambal Water Recession Rehabilitation Sub-project										
10-1 Preparatory works										
10-2 Rehabilitation and construction works										
(1) Partial rehabilitation of Sras Prambal Reservoir										
(2) New construction of intake structures (7 nos.)										
(3) New construction of Sub-project office										
10-3 Start of operation (Appearance of project effect)										
11. Rehabilitation and Construction of Daun Puc Irrigation System Rehabilitation Sub-project										
11-1 Preparatory works										
11-2 Temporary works										
11-3 Rehabilitation and new construction works										
(1) Daun Puc Headworks Construction Works										
(a) Design, approval, fabrication and transportation of gates										
(b) New construction of hydro-mechanical works and intake structure										
(2) Partial rehabilitation of main canal system (11.7 km)										
(3) Partial rehabilitation and construction of secondary canal system (5.2 km)										
(4) New construction of tertiary canal system (1,150 ha)										
(5) New construction of Sub-project office										
11-4 Start of partial operation (Appearance of project effect)										

Source: JICA Survey Team

Overall Implementation Schedule of Hardware Components under SPPIDRIP

(120) Although beneficiary farmers will be provided with necessary information about SPPIDRIP in each area by means of workshops and meetings as soon as detailed design starts, substantial activities on software components are planned to be implemented from 2017 to 2020 over the four-year period in concurrence with the progress of hardware components. The overall implementation time schedule is illustrated as follows: (P II-4-20 and II-4-21)

Work Item	Year									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Hardware Components										
1. Detailed design including preparation of tender documents										
2. Tendering, evaluation, and contract										
3. Rehabilitation Works	(2.5 to 4 years)									
Software Components										
1. Capacity Development of MOWRAM and PDOWRAM Staff on O&M										
(1) Mobilization and preparatory works										
(2) Work Plan and Trial Training										
(3) Preparation of Weir Gate/Reservoir Operation Rule										
(4) Preparation of Weir Gate/Reservoir Operation Manual										
(5) Weir Gate/Reservoir Operation Training										
(6) Irrigation O&M Training										
(7) Monitoring and Evaluation										
2. Formation and Strengthening of FWUC										
(1) FWUC Formation										
(2) Organizational Management										
(3) O&M of Irrigation Facilities										
(4) Monitoring and Evaluation										
3. Strengthening of Agricultural Extension Services										
(1) Demonstration plots										
(2) Farmers / Farmers' Group Training Programme										
(3) Mass Guidance / Workshop										

Source: JICA Survey Team

Overall Implementation Schedule of Software Components under SPPIDRIP

O&M Plan

Demarcation of O&M Responsibility

(121) After completion of the rehabilitation works, the O&M responsibility for the secondary and tertiary level facilities is proposed to be transferred to FWUC in the SPPIDRIP area respectively, in accordance with Circular No. 1 on the Implementation Policy for Sustainable Irrigation Systems by gradually reducing subsidy from MOWRAM. The O&M responsibility among stakeholders for SPPIDRIP is as follows: (P II-4-22)

O&M Responsibility among Stakeholders for SPPIDRIP

Level of Facilities	Reservoir/Headworks	Main Canals	Secondary Canals	Tertiary Canals and Below
O&M Activities				
Annual O&M Planning	PDOWRAM	PDOWRAM	PDOWRAM/FWUC	Sub-FWUG
Cropping Schedule Preparation	-	-	FWUC/FWUG	Sub-FWUG
Operation	PDOWRAM	PDOWRAM	FWUC/FWUG	Sub-FWUG
Maintenance	PDOWRAM	PDOWRAM	FWUC/FWUG	Sub-FWUG

Source: JICA Survey Team

Staff Required for O&M of Rehabilitated Irrigation Systems

(122) Number of staff required for the operation and maintenance of SPPIDRIP is estimated at 21 in total as shown in the right table: (P II-4-24)

O&M Plan

(123) Tasks in O&M among stakeholders for irrigation facilities for SPPIDRIP are tabulated as follows:

Number of Staff Required for O&M of SPPIDRIP

Organization	No.
Central Level	
- PMU Japan Support Fund (=1)	2
Provincial Level	
Project Implementation Unit (PIU)	
- Kampong Speu Province	6
- Takeo Province	6
- Kandal Province	5
- Kampong Chhnang Province	2
Sub-total of Provincial Level (=2)	19
Grand Total (=1+2)	21

Source: JICA Survey Team

(P II-4-25 to II-4-27)

Job Demarcation of O&M among MOWRAM, PDOWRAM, and FWUC

Organization	Department/ Position	Job Description
Central Level		
MOWRAM	PMU Japan Support Fund	- Overall coordination with relevant technical department in MOWRAM and external organization for O&M, and monitoring and evaluation and capacity development of PDOWRAM
	Department of Engineering	- In coordination with PMU Japan Support Fund, in charge of engineering advice and instruction
	Department of FWUC	- In coordination with PMU Japan Support Fund, in charge of establishment and strengthening of FWUC
	Department of Irrigated Agriculture	- In coordination with PMU Japan Support Fund, relevant organizations within MOWRAM, MAFF, and PDA, in charge of promotion of irrigated agriculture in the command area using rehabilitated irrigation facilities
Provincial Level		
PDOWRAM	Project Manager	- Overall coordination at the provincial level - Approval of annual O&M plan prepared by engineer and district staff - Report of provincial and field level activities to MOWRAM - Budget request to MOWRAM for major repairing works based on inspection by engineers/district staff - Contract management of sublet work of local contractors
	Engineer/District Staff	- Preparation of annual O&M plan including budgetary plan - Regular monitoring and evaluation of FWUC at the field level - Instruction to FWUC based on annual O&M plan - Technical advice to FWUC - Regular inspection of irrigation facilities at the main canal level - Report preparation of facilities' conditions based on regular inspection - Report preparation of O&M activities - Operation of major facilities such as reservoir/headworks
Commune and Village Level		
FWUC	Board of FWUC	- Overall coordination of FWUC activities - Coordination with external organizations such as CCs and VDCs - Approval of annual plan prepared by FWUC - Conflict management among the group
	FWUGs	- Established for approximately 200 ha per group in charge of O&M of secondary block - Operation of turnout gate on the main canal in consultation with PDOWRAM
	Sub-FWUG	- Established for approximately 50 ha per group in charge of O&M of tertiary block - Operation of turnout gate on the secondary canal in consultation with PDOWRAM
	WUGs	- Established for approximately 5 ha per group in charge of O&M of quarterly block - Operation of division box on the tertiary canals
Others	General Meeting	- It is proposed that this organization be newly established to facilitate coordination at the community level, members of which would consist of (i) FWUC representative, (ii) CC members, and (iii). VDC members. - In charge of broad-based conflict management in the community including irrigation water management - O&M of community infrastructure such as village roads - Coordination of land acquisition within the community

Source: JICA Survey Team

CHAPTER II-5 PROJECT COST ESTIMATE**Initial Investment Cost**

(124) The initial investment cost for SPPIDRIP is estimated at US\$ _____, of which F/C and L/C portions are shown in the following table: (P II-5-1)

F/C and L/C Portions of Initial Investment Cost for SPPIDRIP

No.	Item	Total Investment Cost (US\$1,000)	F/C (JPY million)	L/C (US\$1,000)
9)	Tax & Duty	5,910	0	5,910
10)	Price Escalation	16,483	553	9,402
11)	Physical Contingencies	7,494	339	3,075
12)	Interest during Construction	25	0	25
	Total	94,045	3,839	44,049

Source: JICA Survey Team

O&M Cost

(125) Annual O&M cost includes: (i) salary and wages for staff personnel of PDOWRAM and FWUC consisting of board members of FWUC and FWUGs and (ii) direct cost for minimum office expenses and repair works. The annual O&M cost is estimated at 0.05% of direct construction cost for each sub-project. Major repairs, including replacements, will be executed every 10 years after the completion of the construction works and the cost is assumed to be 5% of the construction costs (P II-5-4 and II-5-5)

CHAPTER II-6 PROJECT EVALUATION

Economic Evaluation

(126) The economic evaluation was made in terms of net present value (NPV), benefit-cost (B/C) ratio and economic internal rate of return (EIRR) of the proposed rehabilitation plan. In addition, sensitivity analyses are done for cases such as cost increase of 10% and 20%, benefit reduction by 10% and 20%, and combination of each case. The results of the economic evaluation are summarized below. (P II-6-1 to II-6-3)

Results of Economic Evaluation

Evaluation Item	Evaluation Results			
	NPV at 12% discount rate	NPV of benefit (US\$)	41,028,255	NPV (US\$) 6,642,769
NPV of cost (US\$)		34,385,486		
B/C ratio and EIRR	B/C ratio	1.19	EIRR (%) 14.3	
		Cost normal	Cost 10% up	Cost 20% up
Sensitivity analysis (%)	Benefit normal	14.3	12.7	11.9
	Benefit 10% down	12.9	11.4	10.7
	Benefit 20% down	11.5	10.1	9.5

Source: JICA Survey Team

As shown in the above table, it was confirmed that SPPIDRIP would be economically viable with an EIRR of 14.3%. Besides, EIRR of SPPIDRIP was calculated at 17.7% provided that the released flow from the Stung Tasal dam is supplied to RCHRSP. (P II-6-2 and II-6-3)

Financial Evaluation

(127) The average planted area of paddy per 1-ha paddy field in the whole SPPIDRIP Area is anticipated to be 0.96 ha under the present/without project condition and 1.25 ha under the with-project condition. Based on such conditions, it is estimated that the annual net return per farm household growing paddy will increase by US\$825 from US\$418 to US\$1,243 on the weighted average base. According to the proposed plan, the required annual O&M cost of secondary and tertiary canal systems are estimated at US\$7.2/ha to a maximum extent. Adding an annual charge of management cost for FWUC and FWUG, every beneficiary farmer needs to pay about US\$10/ha annually. Compared with the predicted increase in farmer's capacity to pay, this allocated annual O&M cost is affordable to the respective beneficiaries. (P II-6-3 and II-6-4)

Indirect Benefits and Socio-economic Impact

- (128) Indirect benefits and socio-economic impact to be expected from SPPIDRIP are as follows:
- (i) to generate opportunities for extra cash income by temporary employment opportunities in and around the SPPIDRIP Area of about 1.3 million person-days (unskilled labor) during the four-year construction period, (ii) to enable the farmers to improve nutritionally balanced diet and primary health care conditions of their family members, (iii) to ensure the farmers' children will complete primary schooling, have access to higher education, and participate in the early childhood education program; and (iv) to enable the farmers to buy goods and services as well as luxuries for meeting family needs contributing to rural economy with positive effects. (P II-6-4)

CHAPTER II-7 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- (129) Preliminary environmental impact assessment of SPPIDRIP was carried out from the view point of 6 categories which are stipulated in the JICA guidelines for environmental and social considerations (April 2010): (i) permits and explanation, (ii) pollution control, (iii) natural environment, (iv) social environment, (v) others, and (vi) note. As the result of the assessment, no significant impact will be expected if proposed mitigation measures in the Survey are appropriately carried out. The following are summary of conclusions of examination on SPPIDRIP. (P II-7-3 to II-7-14)

Summary of Conclusion of Assessment for SPPIDRIP

Sub-project	Summary of Conclusion of Examination
(a) RCHRSP	
1) Land use and utilization of local resources	Land acquisition process should be conducted carefully from the design phase. The impact of temporary land acquisition also would be a sensitive issue to local people. Therefore, this matter may have a high risk of social problem for project implementation if proper measures are not carried out.
2) Water usage or water rights and rights of common	Due consideration shall be given to this issue, especially on the current use of river water during the dry season, since approximately 12,000 people are expected to be affected by the rehabilitation works of SMC as reported in the feasibility study on RCHRSP.
(b) USISRSP	
1) Land use and utilization of local resources	The process of land acquisition should be carefully and properly conducted from the design phase as USISRSP might affect more than 200 buildings/facilities, such as houses, shops, fences, and canal crossings (small bridges and landfills) on canals. Although the Land Law (2001) provides MOWRAM with legal bases for evicting encroachers without compensation or reimbursement for losses of immovable property in state lands, the JICA guidelines strongly require the recipient countries (i.e., MOWRAM) to give compensation or reimbursement to any affected families/people
2) Misdistribution of benefit and damage/local conflict of interests.	To minimize a feeling of unfairness and the potential for social conflict among community members, MOWRAM shall conduct a series of meetings with all the stakeholders, especially those affected by the sub-project, to facilitate their understanding on the positive and negative impacts of the project.
(c) KSBISRSP	
1) Involuntary resettlement	MOWRAM shall prepare an abbreviated RAP or another document similar to a simplified RAP based on the detailed socio-economic survey and stakeholder meetings.
(d) MC35RSP	
1) Land use and utilization of local resources	Land acquisition process should be conducted carefully from the design phase even though area to be acquired is small, it might not be small impact to the affected people. Therefore, MOWRAM should explain MC35RSP's benefits and anticipated negative impacts to affected people.
(d) SPWRRSP	
1) Local economy such as employment and livelihood	Official land acquisition process is not necessary to SPWRRSP since the entire reservoir area belongs to the government. However, MOWRAM should conduct a detailed socio-economic survey of local people who do farming inside the reservoir and prepare the compensation policy to avoid having critical impact to local farmers, especially vulnerable groups.
2) Land use and utilization of local resources/socially vulnerable groups	MOWRAM should conduct socio-economic survey and inventory surveys to grasp the status of vulnerable groups such as number, income, livelihood, and others. Also, MOWRAM should prepare the compensation policy through these survey results and public consultation meeting among local people.
(d) DPISRSP	
1) Flora, fauna, and biodiversity	Construction of new headworks would change downstream river water volume and affect the downstream biodiversity. However, the impact is limited in surrounding area of the headworks because another river is joining together near downstream.

2) Land use and utilization of local resources/socially vulnerable groups	The land acquisition process should be conducted carefully from the design phase, especially in the residential area. Because some affected people already have been full of doubt and fears regarding RGC projects from their previous experience. MOWRAM must conduct a detailed socio-economic survey to identify all losses from land acquisition and hold public consultation meetings at the earliest possible date.
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Source: JICA Survey Team

- (130) Main contents of Environmental Management Plan (EMP) for SPPIDRIP are: i) Water pollution, ii) Flora fauna and biodiversity, and iii) Land use and utilization of local resources. Contents of Environmental Monitoring Plan (EMoP) for SPPIDRIP are: i) Resettlement and land acquisition, ii) Water quality, iii) Soil erosion, and iv) Noise, vibration, water quality and waste during construction phase. Especially, resettlement and land acquisition will be a critical issue for SPPIDRIP. MOWRAM are thus requested to timely prepare appropriate abbreviation Resettlement Action Plan for 5 Sub-projects except USISRSP, which are RCHRSP, KSBISRSP, MC35RSP, SPWRRSP and DPISRSP. (P II-7-15 to II-7-17)

CHAPTER II-8 PRELIMINARY STUDY ON INFLUENCE OF ROLEANG CHREY COMMAND AREA WITH DAM PLAN

Dam Plans in Basin Area of Prek Thnot River

- (131) There are 6 dam development projects in the upstream basin area of Prek Thnot River. The present situation of these dam development projects is shown below:(P II-8-1 to II-8-8)

Present Situation of 6 Dam Development Projects

Dam Name	River Name	Catchment Area	Present Stage	Planned by	Expected Stage
Stung Tasal	Stung Tasal	495 km ²	Under construction	WAPCOS	-
Stung Sva Srab	Stung Sva Srab	188 km ²	Proposal	MOWRAM	F/S
Stung Khleach	Stung Khleach	125 km ²	Proposal	MOWRAM	F/S
New dam	Stung Aveang	156 km ²	F/S completed	K-water	D/D and C/W
Peam Levear	Stung Aveang	238 km ²	F/S completed	K-water	D/D and C/W
O Tang	Ou Khlong	54 km ²	F/S completed	K-water	D/D and C/W

Note:

F/S=Feasibility study, D/D=Detailed design, C/W=Construction works, WAPCOS=Indian Consultant

K-water=Korea Water Resources Corporation

Source: JICA Survey Team

Study Cases

- (132) In order to clarify the influence to the Roleang Chrey command area, the following 6 cases are studied: (P II-8-10)

Case	Combination of Proposed Dams
Case-0	Without dam (Present Condition)
Case-1	With Stung Tasal Dam only
Case-2	With Stung Tasal Dam + K-water 3 Dams
Case-3	With Stung Tasal Dam + K-water 3 Dams + Stung Sva Slab Dam
Case-4	With Stung Tasal Dam + K-water 3 Dams + Stung Khleach Dam
Case-5	With Stung Tasal Dam + K-water 3 Dams + Stung Sva Slab Dam + Stung Khleach Dam

Source: JICA Survey Team

Results of Water Balance Study of "With- and Without-" Dam Cases

- (133) The summary of case studies of water balance simulation of "with-/without-" dam scenarios is shown in the following table. (P II-8-10)

Summary of Case Study of Water Balance Simulation of "With/Without" Dam Scenarios

(Unit of area: ha)

Case No.	Dangkor Irrigation Area			Roleang Chrey-I (80% Zone-I)			Roleang Chrey-II (50% Zone-II)			RC Total Area
	Total Area	Crop Intensity	Depend-ability	Total Area	Crop Intensity	Depend-ability	Total Area	Crop Intensity	Depend-ability	
Case-0	300	114%	80%	5,660	114%	80%	11,040	114%	57%	16,700

Case-1	300	180%	90%	16,000	180%	80%	700	130%	77%	16,700
Case-2	300	180%	93%	15,400	180%	80%	1,300	130%	80%	16,700
Case-3	300	180%	93%	16,700	180%	80%	0	-	-	16,700
Case-4	300	180%	93%	16,700	180%	80%	0	-	-	16,700
Case-5	300	180%	93%	16,700	200%	80%	0	-	-	16,700
Case No.	Kandal Stung (Grant)			Kandal Stung (Extension)			Tonle Bati (Priority Area)			KSB
	Total Area	Crop Intensity	Dependability	Total Area	Crop Intensity	Dependability	Total Area	Crop Intensity	Dependability	Total Area
Case-0	1,950	174%	83%	0	-	-	1,600	180%	100%	3,550
Case-1	1,950	180%	97%	1,800	180%	93%	4,200	180%	80%	7,950
Case-2	1,950	180%	97%	1,750	180%	93%	4,200	180%	80%	7,900
Case-3	1,950	180%	100%	4,200	180%	93%	6,000	180%	83%	12,150
Case-4	1,950	180%	100%	2,940	180%	93%	6,000	180%	80%	10,890
Case-5	1,950	200%	100%	4,200	200%	93%	6,000	200%	80%	12,150

Source: JICA Survey Team

For Case-2, this is after implementation of the Stung Tasal Dam and the K-water's 3 Dam Projects case, total irrigable area of the Roleang Chrey Zone-I (80% dependable area) will be able to increase from 5,660 ha (with crop intensity of 114%) to 15,400 ha (with crop intensity of 180%). Also, the Kandal Stung (grant) Area, the crop intensity and the dependability will be increased. The Kandal Stung (extension) Area will be able to irrigate "with dam" condition. The total irrigable area of the Bati Area will be increased from 1,600 ha to 4,200 ha with crop intensity of 180% and dependability of 80%. (P II-8-10)

CHAPTER II-9 CONCLUSION AND RECOMMENDATIONS

Conclusion

(134) In the Rectangular Strategy-Phase II, RGC emphasized the improvement of agricultural productivity for economic growth as well as accelerating poverty reduction. Also, RGC focuses on water resources and irrigation management to ensure irrigation water for agricultural productivity improvement. SPPIDRIP giving focal point on development of irrigated agriculture is duly conducive to the implementation of this policy. According to the Policy Paper on the Promotion of Paddy Production and Rice Export, paddy production is planned to be increased annually from 2.6% to 6.1% for 2010 to 2015, and it is deemed that annual increasing rate would be 2.6% after 2016. Implementation of SPPIDRIP would quantitatively, to a certain extent, contribute to the implementation of the policy paper. The calculated EIRR was 14.3% for SPPIDRIP. As far as this evaluation result is concerned, it could be said that SPPIDRIP would be economically feasible. Besides, SPPIDRIP would not only contribute to the implementation of super-ordinate policies mentioned above, but also bring about socio-economic benefits such as creation of job opportunities and improvement of farm income. From the above, it is concluded that SPPIDRIP should be urgently implemented for Cambodia. (P II-9-1)

Recommendations

(135) The following items are recommended for the smooth and effective implementation of SPPIDRIP: (i) explanation of SPPIDRIP to National Steering Committee, (ii) timely budget arrangement, (iii) prior establishment of implementation organization, (iv) land acquisition for construction of tertiary canals, (v) careful gate control at Roleang Chrey Regulator, (vi) arrangement toward post evaluation to clarify project effect, (vii) execution of detailed water balance study for Prek Thnot River basin, (viii) establishment of Prek Thnot River Basin

Management Unit in MOWRAM, and (ix) execution of detailed survey for mines and UXOs.
(P II-9-1 to II-9-3)

PART III SMALL-SCALE IRRIGATION SYSTEM IMPROVEMENT PROJECT

CHAPTER III-1 PROJECT INFORMATION

(136) SISIP consisted of 84 sub-projects as of March 2012. The project proposals for these sub-projects were prepared by PDOWRAM under the direction of MOWRAM, assisted by TSC-2 in October 2009. Based on the results of the examination of current progress conditions, it was found that 17 out of the total sub-projects were already rehabilitated or committed. Thus, 67 sub-projects remained in the long list of sub-projects. (P III-1-1)

CHAPTER III-2 PREPARATION OF SHORT LIST

(137) The 67 sub-projects were prioritized using the criteria such as (i) river basin priority, (ii) suitable scale of irrigation area, (iii) effect of the sub-project, (iv) available water resource, (v) farmers' consensus, (vi) risk of land mine, and (vii) land acquisition. After prioritization, 20 sub-projects were in the short list, of which the total irrigation area came to about 19,000 ha. (P III-2-1 and III-2-2)

CHAPTER III-3 EXECUTION OF PRELIMINARY FEASIBILITY STUDY

(138) Proceeding to the next step for implementation of the sub-projects in the short list, it is expected that PDOWRAM will carry out the preliminary feasibility study under the direction of MOWRAM for implementation in the future. In order to assist PDOWRAM in the execution of the preliminary feasibility study, a manual was prepared by the JICA Survey Team. The manual briefly and practically mentions the procedure of execution of preliminary feasibility study for small-scale irrigation projects, which reflected the experiences obtained in the course of the preliminary feasibility study for the 3 selected Sub-projects. (P III-3-1)

CHAPTER III-4 RECOMMENDATIONS

(139) For smooth and effective implementation of the small-scale irrigation project, it is recommended that MOWRAM should observe the definition of small-scale irrigation project and carry out the arrangement of budget and staff for the execution of preliminary feasibility study, and to timely update the short list of sub-projects. (P III-4-1)

