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The Mekong River Commission would like to express its gratitude to the Ministry of Agriculture, Forestry and Fisheries, Japan for its support of the Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project and for supporting this workshop

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REPORT OF FIRST REGIONAL WORKSHOP

Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project (IIEPF)

(3-4 May 2006, Mekong River Commission Secretariat, Vientiane, Lao PDR)

1. Background

The Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project (IIEPF) aims to improve irrigation efficiency through the introduction of guidelines which cover technical, institutional and managerial aspects of irrigation scheme and facilities operation.

This project is funded by the Ministry of Agriculture, Forestry and Fisheries, Japan under the framework of "Programme to analyse and evaluate water and ecosystems in Asian paddy fields". The project is implemented by the Mekong River Commission Secretariat (MRCS) in close consultation and cooperation with the National Mekong Committees (NMCs) and their relevant Line Agencies.

The project funding was made in June 2005 based on the submission of the project document. However the present version of the project document covers only the outline of the project concept and leaves the formulation of a detailed action plan as the major activity at the initial stage of the project implementation.

The second half of 2005 was spent restructuring the project concept and logical framework and identifying detailed activities under the project. Based on the first draft of the amended project document, national consultation meetings with four member countries were conducted from December 2005 to January 2006, followed by another consultation meeting with the Food and Agriculture Organization Regional Office for Asia and the Pacific (FAO-RAP).

Further improvement of the project document was made in order to incorporate the inputs made through the above consultations. The FAO consultant supported this improvement.

This first regional workshop was organised in order to

- Finalise the project document, and
- Discuss the outline of the forthcoming activities under the project.

The Workshop Programme is attached as Annex 1.

The following documents were made available in advance to participants of the Workshop.

- (Draft) Project document
- Annex-1 (1) Detailed work plan
  (2) Breakdown of activities
  Annex-2 DRAFT outlines of the Guideline

- (Working draft of) Terms of Reference
- Technical guidance for implementation of the field programme (first draft)[1]

These documents are attached as Annex 3.

2. Organisation

2.1 Participants

A total of 31 participants attended the Workshop. These included five (5) participants each from Cambodia and Vietnam, seven (7) participants from Lao PDR, six (6) participants from Thailand, one (1) resource person from FAO-RAP, one (1) diplomat from the Embassy of Japan, Lao PDR and five (5) professional staff and one (1) support staff from the MRC secretariat.

List of the participants is given in Annex 2.

2.2 Opening Remarks

The Workshop started at 9:00 on Wednesday, 3 May 2006, in the MRC conference room, Vientiane, Lao PDR with an opening address by Dr Dao Trong Tu, OPD Director of the MRC followed by an address by Mr Nakamura Ken, second secretary of the Embassy of Japan to Lao PDR

These speeches by Dr Tu and Mr Nakamura are in Annex 4.

The statements made by Dr Tu and Mr Nakamura emphasised the importance of efficient water use for paddy cultivation in the basin.

Dr Tu stressed that enhancement of irrigated agriculture is the key factor of the regional development, and pointed out that low performance of irrigation schemes caused by deterioration and poor management leads to inefficient water use and becomes an obstacle for timely water supply and equitable allocation. He followed by stating that the project was aiming to improve irrigation efficiency by the introduction of some guidelines to improve irrigation scheme management. Dr Tu emphasised that involvement of National Mekong Committees and relevant Line Agencies was essential for smooth implementation of projects. He also expressed his appreciation to the FAO for its collaboration and said he expected this collaboration to be fruitful and bring about good results. Dr Tu closed his speech with thanks to all those present for their participation in the Workshop.

Mr Nakamura emphasised Japan's continuous support in the field of agriculture and rural development through the MRC's Agriculture, Irrigation and Forestry Programme

[1] Written by Dr Robina Wahaj, Consultant, Water Management, with Agriculture Land and Water Management Divisions (AGL) and Investment Center (TCI), FAO

and other international initiatives such as the International Network for Water and Ecosystem in Paddy Fields (INWEPF). Mr Nakamura also supported the idea that collaboration between FAO and MRC will lead to fruitful results from the project and will become pave the way for further cooperation between the two organisations in the future.

3. Presentations and discussions

3.1 Project concept and Project document

Mr Okudaira Hiroshi, Senior Advisor, AIFP/OPD presented the outline of the final draft of the project document. His presentation covered:

1. The review of comments made at national consultation meetings; and
2. The clarification on how the inputs from the said meetings were reflected in the final draft of the project document.

His presentation put emphasis on the changes between the previous version and the final version of the project document.

Responding to very active discussion on the project document, Mr Okudaira provided a supplementary presentation on the morning of Day 2 followed by further discussion with the Workshop participants. His second presentation covered:

1. The proposed changes on the project document reflecting the first day's discussion; and
2. The project budget plan.

Presentation handouts by Mr Okudaira are attached as Annex 5.

A summary of the discussion, which is composed of recommendations, questions and clarifications by the Workshop participants and their responses by the MRCS, is as follows.

Recommendations, questions and clarifications

The following recommendations were made in order to improve the project document.

1. ***Justification needs to be improved.***
   Even though the project incorporates a modern concept of water balance, the project concept to focus on irrigation efficiency improvement is not new. Thus emphasis should be put on why irrigation efficiency needs to be improved. Justification should refer to the severe droughts experienced in the past and also refer to the attempt to formulate a Drought Management Programme under the

MRC. There was a recommendation to link the project with the MRC Strategic Plan 2006-2010 and other MRC Programmes.

2. ***Beneficiaries should be clearly stated in the document.***
   Who will benefit from the project and its product – the guidelines – is also an important part of justification.
3. ***The guidelines should be suitable for regional projects.***
   As this project is a regional project covering the four member countries, guidelines produced must have some added value which can reflect the outcomes of a regional project rather than a project conducted within only one country.
4. ***Immediate objectives No. 2 and No. 4 are overlapping***
   Both immediate objectives No. 2 and No. 4 are focusing on capacity building issues, this structure is misleading and needs to be reconsidered.

Many questions and suggestions were made on the budget allocation. Below is the summary of them.

5. Compared with the complexity of the fieldwork and its vast workload, the allocated budget for the sub-contracts with line agencies seems to be too limited.
6. Local or regional consultants can take over the tasks assigned to international consultants.
7. What kind of equipment will be procured by the project?

Other issues need to be clarified on the project document were as follows:

8. As line agencies are the part of (or members of) the National Mekong Committees, the terminology of "line agency (agencies)" should be used carefully.
9. Lao PDR has already started water balance analysis at country scale, so there needs to be clarification on what kind of water balance assessment the project will conduct.
10. The tasks of the programme officer and line agencies seem to be overlapping. Both the programme officer and line agencies are responsible for field observation, according to section 7 of the project document; however field observation can be conducted by line agencies but not by the programme officer.

Responses

Responses to each suggestion, question, clarification etc. are as follows:
(For 1 and 2) The three items below will be added as a part of the justification of the project document.

- Related activities done in the past including the MRC Strategic Plan 2006-2010, other MRC programme such as Project to Demonstrate the Multifunctionality of the Paddy Fields, Water Utilisation Programme, Environment Programme and the formulation of the Drought Management Programme

- References to past experience, such as the severe drought in 2004
- Beneficiaries the project is targeting both direct and indirect

(For 3) The two options below will be kept in mind for the structure of the guidelines.

- One common guideline for general use, or
- Four sets of guidelines based on the observations from four different schemes, which are applicable to similar types of irrigation schemes

Choices will be made when the project is implemented.

Once the guidelines are completed, AIFP will consider whether to submit them to the Joint Committee (JC) for their approval.

(For 4) The immediate objective #4 "to identify capacity development requirement…" will be deleted. Output and activities under objective #4 will be merged under objective #2.

(For 5) AIFP requests NMCs/LAs to keep to the required fieldwork tasks and budget limits for this work and carefully prepare their work plan based on these two conditions. On the other hand, even though the budget allocation plan has been based on firm estimation and there little space to reconsider, AIFP promised to review the estimates and current status of expenditure and make as many adjustments for sub-contracts as possible.
Apart from the overall budget allocation through the entire project period, AIFP also explained how budget allocation within each fiscal year was adjusted annually to minimise over-spending (and under-spending) on each budget line.

(For 6) Consultancy services to draft the guidelines are not limited to international consultants only. Any suitably qualified local (regional) consultants are welcome to apply.

(For 7) Only the equipment needed for fieldwork (and not available in line agencies) will be provided by the project. For example, current meters are one of the high priorities as line agencies cannot conduct the fieldwork without them. But the project does not plan to procure any computers under the project, because they are already available in most line agency offices and are not considered as special equipment for the fieldwork the project requires.

(For 8) Since the structure of National Mekong Committees and the relationship with NMCs and line agencies varies among the countries, uniform expression for NMCs and line agencies is sometimes not appropriate. AIFP will once again review the description of the project document and use "relevant line agency (ies)" if needed.

(For 9) The water balance analysis to be conducted under the project is irrigation scheme water level accounting. This analysis will reveal irrigation efficiency at scheme level, but does not directly link to water resources potential analysis at national level.

(For 10) Fieldwork is the responsibility of line agencies. The task of the programme officer on fieldwork is technical backstopping. This means the programme officer visits the field from time to time with line agency staff and provides support through fieldwork. Thus there is no overlapping of the two groups' tasks.

3.2 Rapid appraisal process and FAO's collaboration

Mr Thierry Facon, Senior Water Management Officer, FAO-RAP, gave a presentation on how to assess the performance of irrigation schemes by using a Rapid Appraisal Process (RAP). He also explained FAO's collaboration with MRC under the project. His presentation covered:

1) Changes of surrounding circumstances on water management services
2) Analysis of the past failures
3) The necessity of irrigation scheme appraisal
4) FAO's approach
5) A detailed explanation of Rapid appraisal process.

Mr Facon's presentation handout is attached as Annex 6.

Clarifications by the Workshop participants and their responses are as follows.

Clarifications

Clarification on two minor points below was requested after the presentation.

1. The presentation showed RAP training has been conducted in various countries including Vietnam and Thailand. Why has RAP training not been done in Lao PDR?

2. Is the irrigation scheme diagnosis shown in the diagram on page 11 applicable to every developing country?
   Countries have different constraints depending on their own development levels. Application of uniform diagnosis tool is questionable.

Responses

AIFP/MRC and FAO replied jointly to the questions:

(For 1) As RAP is developed to assess large-scale irrigation schemes, priority has been put on the countries with large-scale schemes. In this sense Lao PDR does not have such a need to conduct RAP training. The project plans to conduct a RAP training workshop for the four member countries as a part of its project activities in Vientiane.

(For 2) Diagnosis will be made based on "ranking criteria" on page 12. Application of these criteria can realise neutral assessment which is unaffected by the stage of a country's development.

3.3 Field observation and Analysis work and its Working Agreement

Mr Fongsamuth Phengphaengsy, Programme officer, AIFP/OPD explained in detail what tasks were expected of the relevant line agencies under the working agreement, followed by a quick review of the Terms of Reference (TOR) of the working agreement. His presentation covered:

6) the concept of water balance;
7) definition of inflow and outflow;
8) practical method of flow measurement;
9) analysis of crop water requirement; and,
10) irrigation efficiency assessment.

Mr Fongsamuth's presentation handout is attached as Annex 7.

Questions and answers for this session are summarised below.

Questions

Questions and clarifications raised relating to the fieldwork and its TOR are as follows.

1. Does observation work cover the whole scheme or a selected area?
   If a selected area, how should the area be selected? Does MRCS have some criteria? Since the TOR requires a vast workload, covering the whole scheme might be impossible if the scheme covers a huge command area.
2. How frequently should measurements be made?
3. Does MRCS provide a standard format for data collection?
   If the format is not unified, data collected from four different countries will not be compatible.
4. What kind of equipment will be provided by the project?
   The TOR requests measurements of ETo (evapotranspiration). This requires appropriate equipment.
5. What kind of formula will be used to analyse water requirement?
   There are various formulae and theories to analyse water requirement.
6. The time the project proposes to start observation, from October, is not appropriate. In Cambodia, transplanting starts in May. This means October is too late. In Vietnam, cropping in autumn is from November to April.

Answers

Responses to each question, clarification etc are as follows:

(For 1) Observation of the entire scheme only can identify the efficiency of an irrigation scheme and its management. Using a selected area cannot guarantee representation of the whole scheme. This could mean a selection will mislead the scheme assessment. Observation and measurement throughout the whole scheme does not bring with it a huge amount of work according to FAO.

(For 2) Appropriate frequency of observation varies as it is dependent on the features of the scheme. Thus it will be determined through further discussion with AIFP and line agencies after the site is selected.

(For 3) As the format of data collection sheet will vary depending on the features of the scheme, a uniform format cannot be provided at this stage. However the AIFP promises to provide an appropriate format or support its creation if line agencies need this.

(For 4) As mentioned above, a current meter is one item on the short list. For ETo, the project does not provide equipment but suggests referring to existing meteorology data from the nearest station.

(For 5) FAO's formula is recommended by technical backstopping note.

(For 6) The project expects observation will commence from the coming dry season. "October" provides uniform guidance for all four countries, but exact timing should be decided based on actual cropping practice in the field.

3.4 Introduction of candidate pilot project sites

Representatives from the four MRC member countries presented the outlines of their own candidate pilot project sites respectively. Presenters were Dr Theng Tara from Cambodia, Mr Somnuck Chathaseth from Lao PDR, Mr Suvech Kitchakarn from Thailand and Mr Nguyen Ngoc Anh from Viet Nam. The presentation by Mr Somnuck was made on Day 1 of the workshop, prior to the field visit, and the remainder of the presentations were made on Day 2.

These presentation handouts are made available in Annex 8.

3.5 Working session on the Terms of Reference

The second half of Day 2 was spent discussing the Terms of Reference following detailed explanation. After individual discussion with each National Mekong Committee and relevant Line Agency(ies) and the MRCS, each NMC and LA(s) agreed

to the Terms of Reference and confirmed they would accept invitation letters to call for the working agreement for the field work.

3.6 Preparation of the RAP Workshop

As the last activity of the Workshop, Mr Okudaira made a short presentation outlining the RAP Workshop and facilitated consultation to fix arrangements for this workshop. After the consultation, the venue, date and participants' qualification were confirmed as below.

Date;	18 to 21 July 2006
Venue:	MRC Conference Room
Participants:	Leader of the fieldwork team
	One or two other team members
	One engineer who has already received RAP training is also welcome

Mr Okudaira's presentation handout is attached as Annex 9.

4. Conclusions

Mr Okudaira wrapped up the one-and-a-half-day Workshop, followed by a closing address from Dr Tu.

According to Mr Okudaira's summary:

1. the project document would be submitted to the donor after clarification and amendment of the points raised during discussions (described 3.1 above);
2. terms of reference confirmed by both sides and would be sent to NMCs soon together with an invitation letter calling for contract procedures; and,
3. an RAP workshop would be conducted as agreed.

Dr Tu appreciated the active participation through discussion by the member countries' delegates. He expressed his appreciation for the substantial contribution made by Mr Facon of FAO-RAP. He concluded by encouraging further effort by AIFP staff for smooth implementation of the project.

Dr Tu's address is contained in Annex 10.

5. Social activity

A dinner to honour the participants was hosted by the MRCS on the evening of 3 May 2006, at the Don Chanh restaurant in Vientiane. This gave the workshop participants the opportunity for informal discussion and an exchange of views on various aspects of the basin development.

ANNEXES

Annex 1

Programme

First Regional Workshop:
Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project
Workshop Programme (Revised)

Day 1: Discussion on Project concept & Field trip

Time	Sessions
08:30-09:00	**Registration**
09:00-09:10	**Opening Address** Dr Dao Trong Tu (Director, Operations Division, MRCS)
09:10-09:20	**Address** Mr Nakamura Ken (Second Secretary, Embassy of Japan)
09:20-09:25	**Outlining Workshop Agenda** Dr Vitoon Viriyasakultorn (AIFP Programme Coordinator, MRCS)
09:25-09:40	**Introduction of Participants**
09:40-10:10	**Presentation on Revised Project Document** **- Reflection from the National Consultation Meeting -** Mr Okudaira Hiroshi (AIFP Senior Advisor, MRCS)
10:10-10:30	Coffee break
10:30-11:00	**Rapid Appraisal Process -FAO's input to IIEPF** Mr Thierry Facon (Senior Water Management Officer, FAO RAP)
11:00-11:30	**Q&A on Project Document** facilitated by Dr Vitoon
11:30-11:40	**Consultation of Project Document** by participants
11:40-12:00	**Outline of Field Trip (Schedule & Outline of the Scheme)** by Lao National Mekong Committee
12:00-13:00	Lunch at MRC courtyard
13:00-17:00	**Field Trip to Nam Houm Project**
	back to the hotel
18:30-	**Welcome dinner at Don Chanh restaurant**

Day 2: Discussion on Implementation modality

Time	Sessions
08:30-09:30	**Follow-up of the first day's discussion** facilitated by Dr Vitoon (short presentation by Okudaira)
09:30-10:00	**Presentation on TOR for field observation and analysis** Mr Okudaira & Mr Fongsamuth Phengphaengsy (AIFP Programme officer, MRCS)
10:00-10:15	**Q&A on TOR** facilitated by Dr Vitoon
10:15-10:45	**Consideration of TOR** Separate group discussion, country by country
10:45-11:00	Coffee break
	Outline of candidate pilot project sites
11:00-11:15	by Cambodia National Mekong Committee
11:15-11:30	by Thai National Mekong Committee
11:30-11:45	by Viet Nam National Mekong Committee
11:45-12:00	**Q&A on candidate sites** facilitated by Dr Vitoon
12:00-12:20	**RAP workshop** by Mr Okudaira
12:20-12:30	**Wrap-up** by Mr Okudaira
12:30-12:40	**Closing address** Dr Dao Trong Tu
12:40-13:40	Lunch at MRC courtyard

Annex 2

List of Participants

The 1st Regional Workshop on
Improvement of Irrigation Efficiency on Paddy Fields
in the Lower Mekong Basin project (IIEPF)
3-4 May 2006, Vientiane, Lao PDR

LIST OF PARTICIPANTS

Cambodia

1.	Dr. Theng Tara	Director of Department of Water Resources Management and Conservation (MOWRAM) and Focal point of IIEPF
2.	Mr. Yim Savuth	Technical Officer of Hydrology and River Works Department, (MOWRAM)
3.	Mr. Meas Peov	Technical Officer of Agronomy and Agriculture Land Improvement Department, Ministry of Agriculture, Forestry and Fisheries (MAFF). Focal point of IIEPF
4.	Mr. Op Pech	Technical Officer of Agronomy and Agriculture Land Improvement Department, MAFF
5.	Mr. Sok Khom	National AIFP Coordinator, Cambodia National Mekong Committee

Lao PDR

6.	Mr. Sourasay Phoumavong	Deputy Director of Lao National Mekong Committee Secretariat
7.	Mr. Somnuck Chathaseth	Chief of Planning and Cooperation Division Irrigation Department, Ministry of Agriculture and Forestry (MAF)
8.	Mr. Saykham Phengkhammy	Deputy Head of Irrigation Section, Department of Agriculture and Forestry, Vientiane Capital
9.	Mr. Souksavanh Intharack	Senior Officer, Planning Division, Irrigation Department, MAF
10.	Mr. Phouthone Siriphanthong	Deputy Chief, O&M Division, Irrigation Department, MAF
11.	Mr. Phonepaseuth Phouliphanh	National Programme Coordinator, Lao National Mekong Committee Secretariat
12.	Mr. Bounehab	Nam Houm Project Manager

Thailand

13.	Mr Chatchai Boonlue	Director, Foreign Financed Projects Administration Division, Royal Irrigation Department (RID)
14.	Mr Suvech Kitchakarn	Chief of Contracts Administration Branch, RID
15.	Mr Sathaporn Namamnat	Chief of O&M Branch, Huay Luang Project, RID
16.	Mr Pramote Phuengphain	O&M Branch, Huay Luang Project, RID
17.	Ms Pakawan Chufamanee	Director of Mekong Affairs Branch, Thai National Mekong Committee Secretariat
18.	Mr Satit Sueprasertsuk	Department of Water Resources

Viet Nam

19.	Mr Nguyen Hong Toan	Secretary General, Viet Nam National Mekong Committee (VNMC)
20.	Mr Do Manh Hung	Chief of Planning and Programme Management Division, National AIFP Coordinator, VNMC
21.	Dr Nguyen Van Nhan	Director of NRMC, Sub-NIAPP (National Institute of Agricultural Planning and Projection)
22.	Mr Nguyen Ngoc Anh	Deputy Director, Sub-IWRP (Institute of Water Resources and Planning)
23.	Dr Le Van Khoa	Head of Department, Can Tho University

Resource Persons

24.	Mr Thierry Facon	Senior Water Management Officer, FAO RAP

Donor representative

25.	Mr Nakamura Ken	Second Secretary, Embassy of Japan

MRC Secretariat

26.	Dr Dao Trong Tu	Director, Operations Division
27.	Dr Vitoon Viriyasakultorn	Programme Coordinator, AFIP/OPD
28.	M. Okudaira Hiroshi	Senior Advisor, AIFP
29.	M. Cao Tuan Minh	Programme Officer, AIFP
30.	M. Fongsamuth Phengphaengsy	Programme Officer, AIFP
31.	Ms Manosouk Muongmany	Secretary, AIFP

Annex 3

Distributed documents

Mekong River Commission

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10th Anniversary
5 April 1995 - 5 April 2005

Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project (IIEPF-AEWEPF)

(Draft) Project document

This project is funded by the Ministry of Agriculture, Forestry and Fisheries of Japan under the framework of "Programme to analyze and evaluate water and ecosystem in Asian paddy fields (AEWEPF)." AEWEPF has two components; 1) "Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project (IIEPF-AEWEPF or simply IIEPF)" which is carried out by the MRC and 2) "Evaluation Study of Paddy Irrigation under Monsoon regime (ESPIM)" that is carried out by FAO.

1. Background and Justification

The Mekong River is the biggest international river in Southeast Asia. The Mekong River Basin has high development potential because of its ecological diversity such as climate, land, flora and fauna, soil and water resources. Water resources are widely used for agriculture, hydropower generation, navigation, fisheries, industries, tourism, domestic use, etc. and contribute to economic development and well-being of the population in the region.

Agriculture is the predominant economic sector of the Lower Mekong Basin (LMB), which employs 85% of the population of about 60 million. Further agricultural development is required to feed rapidly growing population of the region. Therefore agriculture sector is high on the agenda of each riparian country's development strategy.

With the growing population and industry in the region, the competition for water between different sectors (domestic, industrial, agriculture) and even among different crops (rice versus industrial crops) is also growing and the situation calls for Integrated Water Resources Management (IWRM) at the irrigation system, national and basin levels.

Rice is dominant crop of the Lower Mekong Basin. As it allows short-term inundation caused by intensive rainfall, it suits the climate of the region. Inundation on paddy fields prevents soil erosion and replants failure, and contributes to removing salinity. In addition it also plays an important role in the maintenance of rural traditions and communities. There is a growing realization of the multi-functionality of the paddy rice systems.

On the other hand, rice is the single biggest user of fresh water in the region, although lack of rainfall in the dry season and dry spells in the rainy season are among

the major constraints to rice production, particularly in rainfed areas, and water productivity in paddy fields remains low in both rainfed and irrigated rice. For further development of water resources in the region and investments in irrigation, it is important to increase efficient use of water in paddy fields.

Not many irrigation schemes in the LMB countries shows high performance in terms of efficient water use. Irrigation efficiency, which is an indicator of effective water resources management, of these schemes varies between countries but is low in general. These low efficiencies lead to water shortages within the command area of irrigation schemes particularly in the dry season or dry spells during the rainy season.

Improvements in irrigation efficiency will lead to improved equity in water distribution and minimize the gap between potential crop water requirement and actual water use. There is not enough information available in the region on reliable estimates of irrigation efficiencies and actual water use. Previous studies that provide some kind of estimates mainly analyze field level efficiencies and lack the use of modern and up-to-date concepts of irrigation efficiencies and water balance.

Assessment of irrigation efficiencies alone does not provide insights into how these could be improved. An appraisal of selected paddy field irrigation scheme as a whole and at different levels: main system level, distributional level, tertiary level, and field level; and assessment of different components of irrigation system management will provide insights into the constraints causing the low efficiency levels. These components include: water delivery at different levels, water requirement, allocation and distribution practices, operation of the scheme, physical infrastructure (this includes efficiencies) and stakeholders' participation into the decision making. Furthermore irrigation schemes, that are predominantly designed and constructed for rice paddy irrigation, provide water also for other uses, such as fish farming, domestic water supply, etc. Hence, while considering water requirements for multiple uses of the scheme, their requirements should also be considered. Once the constraints and the bottlenecks are known only then the improvements for increasing water use efficiency could be identified.

Rigorous analysis of water use situation in an irrigation system using up-to-date concepts and tools will allow the managers and decision makers to plan targeted improvements in order to improve irrigation efficiencies, which is the main goal of this project. Modern methodologies to appraise irrigation projects provide insights in the bottlenecks and help to identify potentials for improvements and must be used in order to successfully embark upon the improvements. One such methodology is Rapid Appraisal Process (RAP), which has been widely used by Food and Agriculture Organization of the United Nations (FAO) and the World Bank for evaluating irrigation system performance and prioritizing improvements for modern management of the systems.

The use of modern concepts in assessing the current situation and introduction of improved and modern techniques to manage water resources efficiently are vital for improving irrigation efficiencies, sustainability and productivity of irrigated agriculture in the LMB countries.

2. Objectives

As described in the background, improvement in irrigation efficiency is one of the key factors in optimizing water use at the basin level and to utilize limited water resources effectively. In this context, IIEPF sets overall objectives as below:

Overall objective:

To improve irrigation efficiency on paddy fields in the Lower Mekong Basin

Immediate objectives:

1. to appraise irrigation efficiencies and the irrigation system based on the modern concepts in the selected irrigation schemes;
2. to develop capacity of the line agencies in using up-to-date concepts of irrigation efficiencies and water balance and modern tools and procedures for their assessment;
3. to produce guidelines for improving irrigation efficiency on paddy field based on actual water use conditions in the member countries;
4. to identify capacity development requirement of line agencies for better adoption of the guidelines in the member countries;

3. Outputs and activities

3.1 **To meet the objective 1**: to appraise irrigation efficiencies and the irrigation system based on the modern concepts in the selected irrigation schemes, the following outputs are planned;

Output 1.1: Establishment of minimum set of data to evaluate irrigation efficiencies and irrigation system

Activity 1.1.1: Identifying and selecting the main diversion structures and canal sections for flow measurement, calibration, and monitoring

Activity 1.1.2: Measuring and monitoring flows at the selected points

Output 1.2: Assessment of water balance, irrigation efficiencies and water productivity

Activity 1.2.1: Measuring conveyance efficiencies

Activity 1.2.2: Gathering information and conducting measurements on parameters required to assess water balance and crop water requirement – ETo, Rainfall, Deep percolation of rice;

Activity 1.2.3: Calculating crop water requirement

Activity 1.2.4: Conducting water balance analysis based on the modern concepts

Activity 1.2.5: Assessing irrigation efficiencies on the modern concepts

Activity 1.2.6: Assessing crop water productivity (yield per unit of water consumed, and yield per unit of water diverted)

Output 1.3: Appraisal of scheme management

Activity1.3.1: Reviewing official and actual rules, principles and practices of water allocation, distribution and operation

Activity 1.3.2: Reviewing stakeholders' participation in decision-making regarding the water allocation and distribution

Output 1.4: Rapid Appraisal Process
Activity 1.4.1: Organizing data required to conduct RAP
Activity 1.4.2: Conducting RAPs in the selected irrigation schemes

3.2 **To meet the objective 2**: to develop capacity of the line agencies in using up-to-date concepts of irrigation efficiencies and water balance and modern tools and procedures for their assessment, the following outputs are planned;

Output 2.1: Backstopping note for the implementing agencies
Activity 2.1.1: Drafting the backstopping note including an overview of the modern concepts, and notes on field and secondary data collection and analysis
Activity 2.1.2: Backstopping the implementing agencies during the entire project implementation period, particularly during the data collection and analysis phase.

Output 2.2: Training workshop on RAP
Activity 2.2.1: Organizing and conducting RAP workshop

Output 2.3: National workshops in the project countries
Activity 2.3.1: Organizing national workshops in the member countries to discuss the outcomes of the data analysis

3.3 **To meet the objective 3:** to produce guidelines for improving irrigation efficiency based on actual water use conditions in the member countries

Output 3.1: Guidelines to improve irrigation efficiency
Activity 3.1.1: Reviewing the analysis data and relevant documents
Activity 3.1.2: Consulting with the relevant national and international organizations
Activity 3.1.3: Drafting the guidelines
Activity 3.1.4: Regional workshop to discuss and introduce the guidelines

3.4 **To meet the objective 4**: to identify capacity development requirement of the line agencies for better adoption of the guidelines in member countries

Output 4.1: Report on assessment of existing capacity and recommendations for capacity development training of the line agency staff
Activity 4.1.1: Reviewing the guidelines, backstopping and other relevant reports
Activity 4.1.2: Interviewing the line agency personnel
Activity 4.1.3: Consulting with the relevant national and international organizations

4. Implementation arrangement

4.1 Under the framework of the MRC

The project and MRC's vision

IIEPF is implemented under the framework of the MRC, more specifically IIEPF manages a part of Sub-component #1 "Water Use Efficiency in Paddy Irrigation System" of the Agriculture, Irrigation and Forestry Programme (AIFP) (2001-2005) of the MRC. IIEPF will contribute the Mission of the MRC, that is "To promote and coordinate sustainable management and development of water and related resources," through achieving immediate and overall objectives.

MRC Secretariat

Senior advisor on Irrigation/AIFP is responsible for day-to-day management of project implementation under the supervision on the AIFP Programme Coordinator and the OPD Director. Programme officer is recruited to support Senior advisor mainly on filed observation and related activities.

National Mekong Committees & Line agencies

Involvement of NMCs as representatives of its member countries is the essential approach of the MRC activity. Through utilization of knowledge and experience of member countries, this approach is advantageous in some aspects such as 1) smooth coordination of the project implementation, 2) prioritization of specific subjects to be analyzed through the project and 3) implementation of practical activities.

Moreover, involvement of line agencies responsible for water issues, such as irrigation planning and/or water resources management is crucial to conduct filed observation and to finalize guidelines on effective water use appropriately, reflecting real needs of each country.

This project also provides some opportunities for capacity building of the relevant officers in the related fields. In other word, roles and responsibilities of relevant line agencies should be carefully determined in accordance with their existing capabilities and target level of capacity building.

4.2 Collaboration with the Food and Agricultural Organization of the United Nations

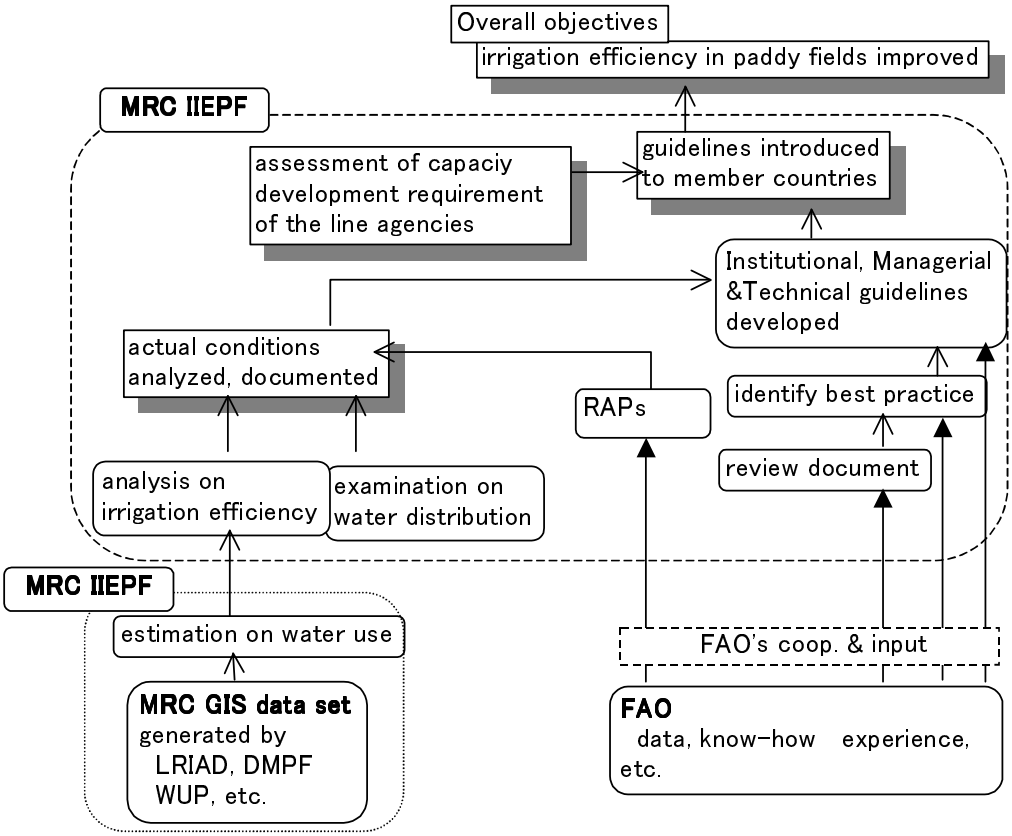
Collaboration with international organizations specialized in agriculture and irrigation will contribute to reinforce outputs of this project. Among UN agencies, with the reasons below, FAO is one of the most significant organizations to collaborate for implementation of this project.

- FAO is the only UN technical organization specialized in agriculture development including irrigation
- FAO has broad knowledge, experience, know-how and remarkable history on agricultural and irrigation development all over the world
- FAO is implementing the project "the Evaluation Study for Paddy Irrigation in Monsoon areas (ESPIM)" which is funded by the Government of Japan

Thus IIEPF will be implemented by the MRC in close collaboration with FAO. ESPIM/FAO provides technical advice on drafting and finalizing the project document to improve its quality. Furthermore Outputs 1.4, 2.1, 2.2, 3.1, and 4.1 of the project, in particular, will benefit from collaboration and input from FAO.

FAO will make available to MRC relevant data and documents to identify best practices for improving water management. FAO will also help the project to conduct RAPs. In addition FAO will provide feedback on the draft of the guidelines.

Schematic diagram of implementation arrangement is shown below:



Rapid Appraisal Process

The Rapid Appraisal Process (RAP) was jointly developed by the Irrigation Training and Research Centre (ITRC) of California Polytechnic University and FAO in late 90's and since then has been successfully used by FAO and the World Bank in various Asian countries to appraise several irrigation projects.

The methodology uses modern concepts of canal operation and water use efficiencies and is based on the understanding that the irrigation systems operate under a set of physical and institutional constraints and with a certain resource base. The systems are analyzed as a series of management levels, each level providing water delivery service through the system's internal management and control processes to the next lower level, from the bulk water supply to the main canals down to the individual farm or field.

With the service quality delivered to the farm and under economic, agronomic constraints, system and farmers' management produces results (crops yields, irrigation intensity, water use efficiency etc.), while symptoms of poor system performance and institutional constraints are manifested as social chaos (water thefts, vandalism), poor condition of infrastructure, poor cost recovery and weak water users associations.

The RAP allows qualified personnel to systematically and quickly determine key indicators of irrigation projects. The RAP can generally be completed with two weeks or less of field and office work provided that some readily available data on the project have been organized by the project authorities in advance.

Key performance indicators from RAP help to organize perceptions and facts, hence facilitate informed decision regarding

- The potential for water conservation within a project
- Specific weakness in project operation, management, resources, and hardware
- Specific modernization actions that can be taken to improve project performance

Furthermore, it also provides initial indicators that could be used as benchmarks in order to compare the improvements in the performance of the system once the modernization plans are implemented. A good assessment of the current situation gives a clear idea on where situation must be improved and helps in prioritizing the areas for improvements. The RAP could also be used to compare the performance of the different projects.

The RAP is considered useful for IIEPF as it provides good indication, in relatively short time, of the constraints and bottlenecks in the system and thus helps in identifying options for improvements at different levels of the irrigation system. Among other things, it gives information on the following:

- water allocation and distribution practices;
- operation rules and procedures;
- irrigation efficiencies (conveyance, field, overall project efficiencies);
- physical infrastructure (hardware) of the system;
- involvement of water users in the decision making process (stakeholders involvement);

All the above mentioned information is part of the detailed data collection work of IIEPF, thus the information from RAP will compliment the data collection and measurement work of IIEPF. RAPs will be conducted in each selected irrigation scheme twice during the project's life.

- once at the beginning of the project, before the field data measurement work starts; and
- second time when field data measurement work ends.

5. Work plan

Project period is three (3) years, commencing in June 2005 and to be completed in June 2008.

Work plan will be revised yearly responding to the progress of the project. This work plan shows outline of year-by-year schedule for project implementation at the beginning stage. Detail time frame for each activity is shown as Annex-1.

5.1 Activities planned in the 1st year (June 2005 to June 2006)

Most of the time of the year 1 is spent in preparation. There is a gap between the funding and implementation of the project. The project started in the June 2005, when budget was transferred from the donor to the MRC bank account, and officer in charge of the project implementation assigned to the MRCS in the middle of July 2005. Then the project document was revised. This revised project document will now be shared by the four member countries and will be submitted to the donor for approval.

Planned major activities in this period are as below:

1. Discussion with the FAO for collaboration
2. Series of discussions and national consultation meetings with four National Mekong Committees and other relevant line agencies to reach consensus on content of the project
3. Revision of the project document
4. Drafting backstopping note for field observation and analysis work of the project
5. Regional workshop to officially inaugurate the project
6. Preparation of sub-contract with line agencies

5.2 Activities planned in the 2nd year (June 2006 to June 2007)

Field observation by line agencies will start in the year 2 of the project implementation and will continue to the third year. Work for drafting guidelines to improve irrigation efficiency will be sub-contracted in the second half of the year 2.

Planned major activities in this period are as below:

1. Preparation of detail work plan for field observation
2. RAP training workshop
3. RAPs in the member countries
4. Measurements, data collection and analysis

5.3 Activities planned in the 3rd year (June 2007 to June 2008)

Field observation will continue in the first half of year 3 by line agencies. An international consultant will be hired to review existing documents, identify best practices for improved water management, and draft institutional, managerial and technical guidelines for efficient water use. A regional workshop will be organized to propose draft guidelines. Final report will be produced based on the result of all the activities. Major activities planned for the last year of the project are:

1. RAPs by the implementing agencies
2. Drafting the guidelines
3. Assessment of the capacity building requirement of the line agencies
4. National workshops to discuss results of the analysis
5. Regional workshop to introduce the draft guidelines
6. Final report of the project

6. Cost breakdown

Total budget is approximately one (1) million USD. Details with breakdown are described below.

BL	Item	1st Year	2nd Year	3rd Year	Total
12	International staff	135,000	120,000	125,000	380,000
15	Official travels	14,350	16,600	26,200	57,150
11	International Consultant	6,000		82,000	88,000
18	Riparian Professional staff	17,200	40,000	40,000	97,200
21	Sub-contract with line agencies	60,000	100,000		160,000
30	Workshop	23,800	22,900	21,800	68,500
42	Equipment	43,500	500	500	44,500
52	Reporting cost	1,000	1,000	2,000	4,000
53	Miscellaneous	1,453	1,303	4,803	7,559
70	Secretariat support cost	39,299	39,299	39,299	117,897
	Total	341,602	341,602	341,602	1,024,806

7. Roles and responsibilities

The project implementation is managed by MRC (i.e. by MRCS in close cooperation with NMCs/Line agencies.) In addition involvement of FAO as a collaboration partner is expected. Roles and responsibilities of related persons are as follows.

7.1 Senior advisor

Senior advisor has overall responsibility for project implementation in cooperation with Programme officer, International consultant and NMCs/Line agencies. Roles are shown below.

- Overall management of the project
- Coordination with NMCs/Line agencies
- Organizing collaboration with the FAO
- Organizing national and regional workshops
- Making sub-contract with NMCs/Line agencies and International consultant
- Managing consultancy services
- Conducting supplement backstopping to NMCs/Line agencies
- Reporting to AIFP coordinator/OPD director and the donor

7.2 Programme officer

Programme officer is mainly responsible for monitoring and technical backstopping of field observation and related activities conducted by NMCs/Line agencies.

Specific items for technical backstopping are as below.

- Introduction of modern and up-to-date concepts of irrigation efficiencies and water balance to line agency staff
- Establishment of detailed work plan for field observation including preparation of quotation
- Selection of measurement points within the irrigation scheme
- Field observation on
  flow measurement,
  identification of actual irrigated area,

water requirement measurement and other relevant data collection
water allocation and distribution practices

- Assessment of water balance, irrigation efficiencies and water productivity
- RAPs conducted at the end of the data collection period
- Finalization of country reports

Other roles of Programme officer are to assist Senior advisor's task in particular items listed below.

- Organizing national and regional workshops
- Managing consultancy services
- Reporting to the MRCS and the donor

In addition the Programme Officer will participate in the following:

- Training workshop on RAP, and
- RAPs conducted by FAO in the member countries

7.3 International consultant

International consultant will mainly be responsible to draft institutional, managerial and technical guidelines for efficient water use and to assess capacity development requirement of the managers/line agencies in order to effectively utilize these guidelines. These activities are undertaken in close collaboration with and input from FAO. In order to achieve this purpose, the consultant will be expected to undertake activities mentioned below.

- Review of existing documents
- Identify best practices
- Drafting institutional, managerial and technical guidelines
- Capacity development requirement assessment of the managers in order to be able to use the guidelines
- Presentation of draft guidelines at regional workshop
- Finalization of guidelines
- Reporting to AIFP

7.4 NMCs & Line agencies

NMCs/Line agencies are responsible for data collection in the fields and other related activities with technical backstopping by Programme officer on their demand. Items responsible for are below.

- Selection of the pilot project site
- Measurement and calculation of in flow and out flow of the selected site over time
- Assessment of water balance
- Identification of actual irrigated area over time
- Assessment of water requirement including the measurement and/or collection of necessary data and parameters
- Calculation and analysis of irrigation efficiency
- Assessment of water productivity
- Analysis and documentation of water allocation and distribution practices
- Participation of selected members in the training workshop on RAP
- Conducting RAP at the end of the data collection period

- Taking part in national and regional workshops organized by MRC
- Reporting to AIFP

7.5 FAO

In addition to the said framework of MRC, FAO is expected to be involved in project implementation as a collaboration partner. Expecting collaboration partners are the Land and Water Management Division of the FAO headquarters and the FAO Regional Office for Asia and the Pacific (FAO-RAP). Expected contributions made by the FAO are as below.

- Providing existing information, knowledge, know-how and other resources including human resources related to water management and its best practices in order to improve project document and to enhance project outputs
- Participating in the inception workshop to provide comment to update project concept including the introduction of FAO's input toIIEPF
- Conducting training workshop on RAP in order to contribute to capacity building of line agencies
- Conducting RAPs in the project countries in order to contribute to assess irrigation system performance
- Participating in the national and regional workshops organized by MRC to 1) discuss results from the field data analysis and 2) introducing the guidelines to the project countries in order to review and provide feedback on draft guidelines

8. Other relevant information

8.1 Achievements under AIFP and others

Through past activities including LRIAD[1], the MRC has generated and stores various GIS data sets. Data sets relevant to water use are as follows:

- Topography
- District boundary
- Catchment boundary
- River Network
- Soil (by LRIAD)
- Population density
- Irrigation Scheme (by LRIAD)
- Isohyets
- Maximum flood extend (by LRIAD)
- Forest cover

Through implementation of DMPF[2], the MRC has also produced supplementary GIS data sets related to paddy rice farming and rainfall. Details are as follows:

- Rice farming statistics at district, which are composed of
  1) planted area, 2) harvested area, 3) production and 4) yield of rainy and dry

[1] LRIAD is "Land Resources Inventory for Agricultural Development project" conducted from 1998 to 2001 as one of AIFP projects.

[2] DMPF is another AIFP project, namely "Project to Demonstrate the Multi-functionality of the Paddy Fields over the Mekong River Basin."

seasons respectively,
6) planted area, 7) production, 8) yield of whole year, and
9) population, 10) per capita production.

- Rice cropping area in each month
- Fertilizer use
- Rainfall in time series, which are composed of
  1) monthly, 2) rainy and dry season, 3) annual of average of 1985 to 2000.
- Land use map, which reclassifies agricultural land and focuses on paddy field.

DMPF also estimated actual condition of water use. The output is estimation of irrigation water use, which is mapped in GIS data sets and is composed of

- Rainfed and irrigated paddy rice areas
- Monthly water requirement and estimated water use

Since this work was conducted based on existing data, result is based on a lot of approximations and assumptions.

8.2 Linkage with DMPF

IIEPF and DMPF cover some part of sub-component #1 and #4 of AIFP (2001-2005) respectively. In this sense, IIEPF is positioned parallel with DMPF under AIFP framework.

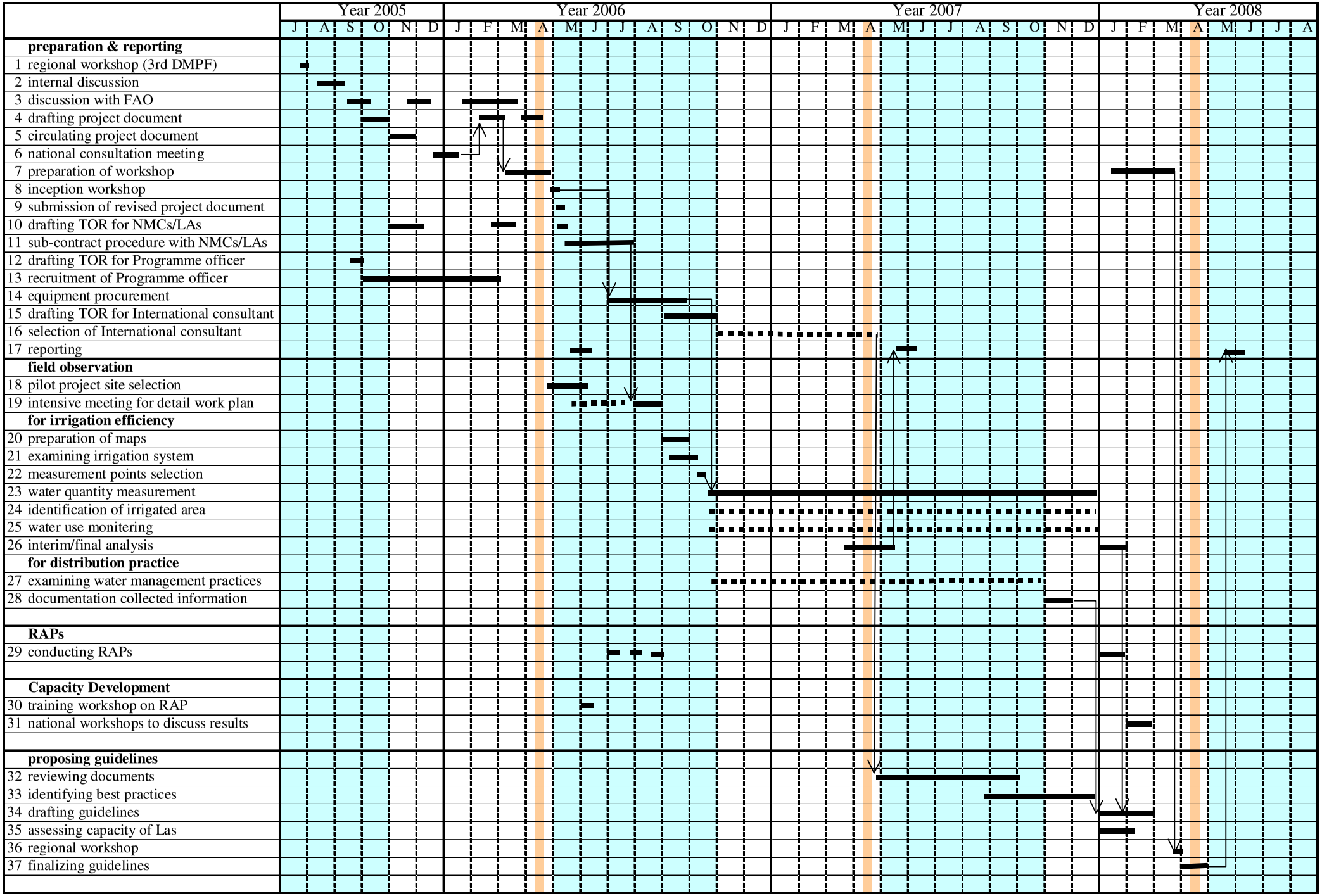
DMPF is conducting estimation of irrigation water use based on dataset presently available at the MRC. In this process, DMPF pointed out that the reliability of some data needed to be improved for more accurate estimation. Irrigation efficiency is one of those data. Unlike other data needed reliability improvement, irrigation efficiency is a factor, which is affected by aspects on structure and management. This means improvement of irrigation efficiency can be expected by counter-measures on structure or management and leads to effective water use. In this context, awareness of the issues for IIEPF comes up from DMPF.

Furthermore DMPF produced vast data of both basinwide and one plot of paddy field level. IIEPF reviews those and identifies effective or useful date for IIEPF implementation, if any, and utilizes or incorporates those as reference

8.3 Multi-functionality

Multi functional roles are secondary functions, which are generated naturally and additionally in process of water use for agricultural production. In this sense, aiming to generate multi functional roles cannot be principle objective of water use. Thus, proposed guidelines consider improvement of irrigation efficiency as priority objective and also pay maximum attention to maintain multi functional roles, especially multiple use of irrigation water such as for fish farming, domestic water supply etc.

ANNEX-1 (1) **Detail work plan**



ANNEX-1 (2) Breakdown of activities

This section provides a brief explanation of the activities and events that are presented in the detailed work plan in Page 1 of Annex 1. The number in the brackets corresponds to the number given to the activity in the work plan.

Regional workshop [1]

Senior advisor introduces tentative concept and time frame of IIEPF to member countries on the occasion of the 3rd DMPF regional workshop. Purpose of this activity is to share basic concept of the project with member countries, to retrieve ideas, demands, comments and expectations etc. on the project in order to reflect those into draft project document.

Internal discussion [2]

Senior advisor prepares a concept note of the project and organizes a series of discussions among AIFP team, with OPD director and with CEO to share common understanding and to establish basic concept of the project.

Discussions with FAO [3]

Based on drafted concept note, Senior advisor discusses with FAO potential collaboration between IIEPF and FAO. A letter of agreement will later be signed between FAO and MRC for this collaboration.

Drafting project document [4]

Senior advisor drafts project document. Project document includes basic concept, detail work plan, implementation arrangement, budget allocation and agreed collaboration with the FAO.

The Project document is improved to incorporate comments from the national consultation meetings [6] and FAO [3]. This work is undertaken with the input from FAO.

Circulating project document [5]

MRCS distributes draft project document to relevant authorities of member countries prior to the national consultation meetings.

National consultation meeting [6]

Senior advisor holds national consultation meeting in each member country respectively. Purpose of the meeting is to get feedback on the project concept. Comments are used to improve project document.

Preparation for the workshop and Inception workshop [7& 8]

The AIFP organizes inception workshop to officially commence the project. Member countries participate in the workshop. FAO is also invited to participate.

At workshop, Senior advisor reviews draft project document, addresses member countries' comments made through national consultation meetings and their reflections and/or reactions into project document and its implementation. Agenda of the workshop includes field trip followed by the discussion on site selection.

Forthcoming activities and their necessary arrangement are to be discussed at this workshop in detail. Roles and responsibilities with time frame of NMCs/Line agencies are one of the most important issues to be clarified at the workshop.

Submission of revised project document [9]

The MRCS submits revised project document to the donor for the approval.

Drafting TOR for NMCs/Line agencies and
Sub-contract procedure with NMCs/Line agencies [10 &11]

Senior advisor prepares TOR for subcontract with NMCs/Line agencies. TOR is finalized reflecting on outputs of the workshop [8]. Contracts need to be made at the end of 1st year of the project (by June 2006) or the early beginning stage of the 2nd year.

Drafting TOR for Programme officer and
Recruitment of Programme officer [12 & 13]

Programme officer, who is mainly responsible for technical backstopping to NMCs/Line agencies, is recruited.

Equipment procurement [14]

Based on comments from national consultation meetings, Senior advisor procure the necessary equipment following the regulation of MRC. Four sets of electromagnetic current meter are on the short list.

Drafting TOR for sub-contract and Selection of International consultant [15 & 16]

Senior advisor prepares TOR of international consultant, and recruits him/her in cooperation with FAO. Contract needs to be made before the end of the 2nd year of the project (April 2007).

Reporting [17]

Senior advisor prepares project's yearly progress and final reports. The final report covers field observation activities, analysis of observations and proposed guideline for efficient water use. The deadlines for the yearly progress reports are June 2006 and June 2007 and the one for the final report is June 2008.

Pilot project site selection [18]

NMC/Line agencies of each country determine one (1) appropriate pilot project site (irrigation scheme) to conduct field observation respectively with close consultation with the MRCS. Senior advisor and Programme officer are to be involved in this activity.

Tentative criteria of selection are 1) representativity of agro-ecosystem and irrigation typology of the basin, 2) accessibility, 3) appropriate size, 4) availability of relevant information. Expected representativity for each site of the country is as follows.

Lao	paddy field in hilly area, pump irrigation
Thailand	gravity irrigation, with PIM approach
Cambodia	wet low land around the Great Lake or other sub-basin
Vietnam	irrigation in low land delta, tidal irrigation

Another set of criteria for the representativity that could be used for selecting project sites is to select only gravity irrigation systems (with or without reservoir) with different management strategies, e.g. Public managed, Jointly managed, etc.

Intensive discussions for detail work plan [19]

A series of discussion sessions is to be held to support NMCs/Line agencies in establishing their detailed work plan including quotation. Senior advisor and Programme officer provide necessary backstopping for this activity, if required.

Preparation of maps [20]

NMC/Line agencies of each country prepare schematic plan of irrigation system and appropriate scaled command area map of the selected pilot project.

Examining irrigation system [21]

NMC/Line agencies of each country examines irrigation system of the pilot project site and draw schematic plan of irrigation system, which includes command area and planed water quantity of each secondary canal. This activity is conducted with backstopping by Programme officer on their demand.

Selection of measurement points [22]

NMC/Line agencies of each country determine measurement points for both current speed and water requirement with close consultation with Senior advisor and Programme officer.

Number of measurement points for current speed is determined according to the size of the pilot project site, but measurement points should basically cover from intake to paddy fields.

Measurement points for water requirement are determined by representing water use of the pilot project site and to try to cover all the classification of soil in the pilot project site. Outputs of [20] and [21] are referred for this activity.

Water quantity measurement [23]

NMC/Line agencies of each country measure water flow at selected points. The detailed information on how to conduct these measurements is explained in the backstopping note. Programme officer provides technical backstopping for discharge measurement on their demand.

Identification of irrigated area [24]

NMC/Line agencies of each country identify actually irrigated area. A combination of interviews with water users and members of water users association and observation will be used to collect this information. Programme officer provides technical backstopping for this activity on their demand.

Water use monitoring [25]

NMC/Line agencies of each country monitor water use in paddy fields at the selected points of the pilot project site. Programme officer provides technical backstopping for this activity on their demand.

Interim and final analysis [26]

NMC/Line agencies of each country conduct analysis and draft an interim report. The deadline for the report is May 2007.

At the end of field observation (planned for January 2008), NMC/Line agencies of each country perform final analysis of irrigation efficiencies and submit

the draft report to the MRCS. Programme officer provides technical backstopping on their demand.

Examining water management practices [27]

NMC/Line agencies of each country examine actual water management procedure at the pilot project site from head works, main to tertiary canals up to paddy fields. Field observations and interviews with farmers are used to collect the information. Programme officer provides technical backstopping for this activity on their demand.

Documentation of collected information [28]

NMC/Line agencies of each country document information regarding water management practices at the pilot project site. Programme officer provides technical backstopping for this activity on their demand.

RAPs [29 & 30]

The information from RAP will compliment the data collection and measurement work of IIEPF. RAPs will be conducted in each selected irrigation scheme twice during the project's life.

- once at the beginning of the project, before the field data measurement work starts; and
- second time when field data measurement work ends.

The first set of RAPs will be conducted by FAO Office for Asia and the Pacific (FAO-RAP), Bangkok and the second by the NMCs/Line agencies. A 4-5 days training workshop will be organized in collaboration with FAO-RAP to train the line agencies in conducting RAPs and to introduce to them the concepts on which RAP is based on.

The Programme officer of the project, who is responsible for backstopping the NMCs/Line agencies in data collection, will also join the training and the RAP exercises. The Programme officer together with the NMCs/Line agencies will be responsible for organizing the required data before the exercise will begin. FAO-RAP will provide a list of the data requirement well in advance to allow the Programme officer and NMCs/Line agencies to gather the relevant documents and data.

National Workshops [31]

To discuss the results of data collection, analysis and RAPs and to introduce the new concepts for assessing irrigation efficiencies, 1-2 days workshops will be organized in each member country after the analysis is completed. Managers from different irrigation schemes will participate in the workshop. The methodology used for the data collection and analysis and the results of the analysis will be presented and discussed during the workshop.

Reviewing project reports, other documents and identifying best practices [32 & 33]

International consultant reviews project reports (including project data analysis, and RAP), other existing documents and relevant information and identifies best practices related to efficient water use and irrigation management. Inputs from FAO headquarters and FAO-RAP are taken into account.

Drafting guidelines [34]

International consultant drafts institutional, managerial and technical guidelines, which aims at improving irrigation efficiency and to enhance multi-function of rice cultivation and paddy field irrigation.

On the occasion of drafting, consultant examines observed and analyzed irrigation efficiency of the pilot project sites obtained through [23] to [26], analyzes relationship between irrigation efficiency and water distribution practices obtained through [26] to [28] and takes that information into account. This activity is also reinforced by inputs from the FAO.

Capacity Requirement Assessment of the line agencies [35]

Capacity building and training requirement of the line agencies are assessed to investigate their ability to effectively use the proposed guidelines. The international consultant will be responsible for this activity.

Regional workshop [36]

The MRCS organizes regional workshop to discuss institutional, managerial and technical guidelines for efficient water use and management. Relevant staff of MRC, NMCs/Line agencies from its member countries and relevant international organization will participate in the workshop.

Consultant presents draft guidelines with their process of drafting and expected benefits.

The MRC invites official(s) from Headquarters and/or FAO-RAP as resource person(s). The FAO official(s) is (are) expected to provide recommendations based on their output of Japanese funded project (ESPIM) and other existing knowledge and experience, etc.

Finalizing guidelines [37]

International consultant finalizes the guidelines, in close cooperation MRCS, taking into account recommendations made at the regional workshop [36].

ANNEX-2

DRAFT Outlines of the Guidelines for improving irrigation efficiencies/water productivity in Lower Mekong Basin Countries

The proposed guidelines seek to provide the managers of the irrigation schemes in Lower Mekong Basin (LMB) countries with a framework to improve irrigation efficiencies and water productivity through improved irrigation management.

The proposed guidelines[1] are divided into three parts:

- **Part A - Introduction**: This part contains information on 1) the issues such as background, objectives, relevance of these guidelines for LMB countries, scope of the guidelines; and 2) modern concepts relevant to the water resources management in LMB countries.

- **Part B - Assessmen**t: This part introduces the relevant diagnosis tools for scheme appraisal and assessment of irrigation efficiencies. A sound diagnosis should reveal constraints and bottlenecks and provides insights into the opportunities for improvements.

- **Part C - Improvements**: This part proposes options for improvements with relevance to LMB countries. Issues such as improvements in different component of an irrigation scheme (management, physical, institutional) and the scale of intervention (main system level, field level) are addresses here.

PART A: INTRODUCTION

1 Introduction: Scheme management for improving irrigation efficiencies and water productivity

- Background
- Rationale
- Objectives
- Relevance to LMB countries
- Limitation

    - growing competition between Riparian countries (upstream downstream problems)
    - shrinking water resources, increasing competition between different sectors and different crops)

[1] These guidelines draw heavily upon FAO's forthcoming publication "*Canal Operation Modernization for Medium & Large Irrigation Systems*". But these are tailored to meet their own objective and are adapted to suit conditions in LMB countries.

2 Concepts

- Water Loss: Irrigation efficiencies versus Water productivity
- Water Balance
- Multiple uses of water
- Service Oriented Management (service to users is central at management level)
- Integrated Water Resources Management

PART B: ASSESSMENT

3 Mapping Water Network

- Assessment of hierarchal structure and the main features of irrigation and drainage network

4 Scheme Management Appraisal: Rapid initial assessment

- Diagnosis: how the system is being operated and managed
- Capacity and physical condition of the system
- RAP

    - What is the physical condition of the system
    - How is the system being managed
    - What are the constraints and opportunities for improvements

5 Water Balance

- Getting to know the system better: what happens to the water entering the system - water use, reuse, return flows
- What are the existing level of efficiencies and productivity

    - Identify and quantify all flows, highlighting and categorising losses

PART C: IMPROVEMENTS

6 Improvements

- What level of efficiencies and productivity are desired and what levels are possible to achieve in the current & given physical network system
- Physical improvements versus managerial improvements
- Improving existing system and managerial procedures by incremental steps
- Abrupt changes either in the systems and/or in the procedures
- Proper scale for intervention: Main system versus field level (or a combination)

7 Improving irrigation management with Users: Involvement of stakeholders in the decision making

- Service Oriented Management
- Information sharing: better information sharing between managers and water users increases the predictability of the system, hence improves efficient water use
- Discuss the present, desired and planned levels of efficiencies, constraints and options for improvements,
- Service demands: taking into account multiple water use
- Coming up with feasible agreements and understanding

8 Information System

- Establishing minimum set of data to evaluate irrigation efficiencies and irrigation system
- Key water variables along the canal, water delivery service to users, water streams, rainfall, etc

9 Monitoring and evaluation

- Monitoring and evaluation of the scheme management and efficiencies and productivity levels of the schemes is a must for sustained improvements
- Minimum set of indicators required for assessing the performance or achievements

Improvement of Irrigation Efficiency on Paddy Fields
In the Lower Mekong Basin project (IIEPF)

(Working draft of) Terms of Reference for the Working Agreement between IIEPF and ---------- for the Field Observation and Data Analysis for Irrigation Efficiency on IIEPF

1. Project Title
Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project (IIEPF)

2. Title of the Working Agreement
Field Observation and Data Analysis for Irrigation Efficiency on IIEPF

3. Implementing Agency (tentative)
Ministry of Water Resources and Meteorology, Phnom Penh, Cambodia,
Ministry of Agriculture and Forestry, Vientiane, Lao PDR,
Royal Irrigation Department, Bangkok, Thailand, or
Ministry of Agriculture and Rural Development, Hanoi, Vietnam

4. Duty Station (tentative)
*****, Cambodia
Nam Houm project, Lao PDR,
Huay Loung project, Thailand, or
*****, Vietnam

5. Duration
The tasks under this working agreement are expected to be conducted from the beginning of August 2006 to the end of January 2008 with the following deadlines:

- Preparation to start field work should be completed not later than the middle of October 2006.
- Measurements and field observation for irrigation efficiency should start following the preparation and continue until the end of December 2007.
- Water distribution practice should be monitored and examined following the preparation and continued for 12 months from the starting date.
- Rapid Appraisal Process should be completed not later than 15 January 2008.

6. Background and Objective of the Working Agreement
The Mekong River Commission (MRC) is implementing the project “Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin” (IIEPF) in order to contribute to improvements in irrigation efficiencies in the irrigation schemes through

introduction of guidelines covering institutional, managerial and technical aspects of irrigation facilities operation.

In this regard, the MRC Secretariat (MRCS) is entrusting "field observation and data analysis work" to National Mekong Committee (and/or Line Agencies) of each member country. This work aims to analyze and document actual conditions regarding water use in selected irrigation schemes representing irrigation typology of the basin.

7. Expected Outputs

Three major outputs below are expected through implementation of this working agreement.

1. Assessment of irrigation efficiencies of the selected irrigation schemes
2. Scheme management appraisal
3. Rapid Appraisal Process

For irrigation efficiencies, items below shall be included as a part of output 1.

i. Detailed map of the irrigation system with the selected locations for measurements
ii. Water flow quantity at selected points over time
iii. Infiltration/Seepage/Percolation rate at selected points over time
iv. Irrigation efficiencies based on above observation
v. Cropping pattern and crop calendars
vi. Water requirement for different water uses within the command area of the selected irrigation scheme
vii. Precipitation and Evapotranspiration (either measured or obtained from the closest meteorological station) over time (this must correspond with the time period of field data collection)
viii. Crop water productivity (yield per cubic meter of water diverted) values of rice paddy

For scheme management appraisal, the documented output shall include items below.

ix. Organizational structure (be it formal or informal) of the different stakeholders (for example Department of Irrigation and Water Users Association)
x. A document describing users and other stake holders' participation in the decision making of water allocation and distribution
xi. Mechanism to decide water allocation and to put it into practice
xii. Procedures and rules for operating the system

For RAP, the output shall include the following items:

xiii. Filled RAP sheets

8. Links of the Expected Outputs of this working agreement with the Expected output of the project

The outputs of this working agreement will directly contribute to the immediate objective 1 of the project, i.e.: "to appraise irrigation efficiencies and the irrigation system based on the modern concepts in the selected irrigation schemes" and planned outputs to achieve the objective. The following four outputs are planned under the objective 1 of the project:

Output 1.1: Establishment of minimum set of data to evaluate irrigation efficiencies and irrigation system
Output 1.2: Assessment of water balance, irrigation efficiencies and water productivity
Output 1.3: Appraisal of scheme management
Output 1.4: Rapid Appraisal Process

The expected outputs of this working agreement will mainly be related to the Output 1.1 to 1.3 and to a lesser extent to the output 1.4.

9 Reporting

The implementing agency will submit to the MRCS through relevant NMC an interim and a final report. The interim report should be submitted no later than May 2007 and the final report should be submitted no later than 31 January 2008.

All the above mentioned outputs (see section 7) should be part of the Interim and Final reports.

10. Responsibilities and Tasks of Implementing Agency under this working agreement.

The concerned Implementing Agency shall perform the tasks listed below in close consultation with the Senior Advisor and Programme Officer, AIFP of the MRCS. The specific tasks will include;

10.1. Preparation for data collection

(1) identify appropriate pilot project sites (irrigation schemes)
(2) prepare schematic plan of irrigation system
(3) prepare scaled command area map of the irrigation scheme

10.2. Assessment of Irrigation Efficiencies

Conducting Water Balance:

(4) inflow and outflow measurements:
- identify flow measurement points covering all inflows and outflows for selected command area
- conduct measurement and calculate flow quantity based on selected points

Assessment of Water Requirement:

(5) obtain rainfall and other climate data from the nearest meteorological station
(6) calculate or obtain potential (reference) evapotranspiration (ET_o) and crop coefficient values (K_c) for paddy, fishponds, and other crops
(7) calculate crop evapotranspiration (ET_c) based on (ET_o) and (K_c) obtained
(8) identify actual irrigated areas
(9) record cropping pattern and crop calendar for different crops
(10) record multiple use of irrigation water quantity (e.g. water use for fishpond etc.)
(11) record water level changed in paddy fields and fishponds
(12) calculate total scheme water requirement

Calculate Irrigation Efficiencies:

(13) conduct conveyance losses test and calculate conveyance efficiency
(14) calculate command areas efficiency based on water balance concept

10.3. Assessment of water productivity

(15) obtain yield of paddy
(16) calculate crop water productivity (yield per cubic meter of water diverted, and water consumption)

10.4. Scheme management appraisal

(17) identify stakeholders for decision making on distribution of irrigation water within the scheme
(18) draw organisational charts of stakeholders (irrigation managers, water users, others) involved in the decision making of the scheme management
(19) document procedure of decision making for water allocation and distribution
(20) document operational rules and actual practices to ensure delivery of the above allocated and planned water to the users

10.5. RAPs

(21) conduct RAP, at the end of data collection period, based on the training provided by IIEPF during the field data collection period

10.6. Others

(22) facilitate technical backstopping by the MRCS made on demand by implementing agency
(23) take part in the training workshops organized by MRCS within the framework of IIEPF
(24) assist Programme Officer in collecting any other information required for analysis within the framework of IIEPF

(25) assist MRCS in organizing national workshops planned to be conducted in January 2008.

11. Itinerary

Commencement of field observation: October 2006
Submission of Interim report: May 2007
Submission of Draft Final report: November 2007
Submission of Final report: January 2008

12. Working Principles

The team of the Implementing agency will work under supervision of MRCS (Senior Advisor and Programme Officer of AIFP) and NMC.

13. Composition of Implementing Agency teams

The team of the implementing agency that will implement this field data collection and analysis work should be composed of minimum 3 and maximum 5 members depending on the size of the selected irrigation scheme.

14. Qualifications

Team members should be willing to work in the field for long hours, and must be willing to learn new concepts and tools.

Head of the Implementing Agency's team should hold master degree or equivalent with minimum 7 years of experience in irrigation planning, water resources development or other relevant fields.

Other team members should have educational and practical background of at least one of the following:

- water resources development and management,
- irrigation project appraisal and survey,
- irrigation or water resources development project planning,
- hydrological observation and analysis.

The team as a whole should cover all the above mentioned expertise.

15. Condition of Payment

Payment is made in three parts.
(1) 40% of the Contract value, after signing of the Agreement.
(2) 30% of the Contract value, upon submission and acceptance of the Interim report.
(3) 30% of the Contract value, upon submission and acceptance of the Final report.

Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project (IIEPF)

Technical guidance for implementation of the field programme (first draft)

Some Technical Backstopping For Implementation of the Programme

1 Introduction

The main objective of this project is to increase irrigation efficiencies in paddy fields. This could only be done if we know current irrigation efficiencies and the factors influencing these efficiencies. These factors may be related to a combination of constraints in infrastructure, management, and institutional set-up of the system. Therefore to improve irrigation efficiencies in the paddy fields, we need to answer the following questions:

- How well the system is currently performing and what are the existing levels of efficiencies?
- How the system is managed and efficiencies are assessed?
- What are the constraints and bottlenecks in different components (physical infrastructure, management, operation, etc.) of the system that causes these efficiency levels?
- What are the opportunities in different component of the system to improve the efficiencies?
- What simple improvements in different components could make a significant difference in improving irrigation efficiencies?
- What medium to long-term actions could be taken to significantly improve irrigation efficiencies?
- How these improvements will be implemented?

To be able to answer these questions one needs to look at the following:

- Present irrigation efficiencies: conveyance, distribution, field and overall project efficiency;
- Water Balance: all inflows, outflows, water use within the command area of the irrigation scheme.
  - surface inflow into the system and diversions within the system
  - groundwater use within the scheme,
  - recirculation and reuse of the drainage water
  - crop water requirement within the scheme
  - water requirement by the other uses of water
  - rainfall within the command area of the scheme
  - potential evapotranspiration (ETo)
  - cropping pattern and crop calendar;
- Multiple uses of water: what are uses other than planned farming (fish and crop) for which water is used within the system; for example, trees, orchards, domestic uses.
- Water allocation, distribution and Operation formal rules and actual practices;
- Stakeholders participation in the decision making processes of water allocation and distribution

Once the current level of efficiencies and the constraints in different aspects of the system (operation al and institutional) irrigation are identified, appropriate actions on short, medium and long terms could be planned and taken to address these constraints in order to achieve higher efficiencies.

This backstopping note first briefly presents concept of irrigation efficiencies, the scale at which these efficiencies should be assessed, and approaches to assess the efficiencies and system management performance; and then addresses some practical points on technical backstopping for appointed consultant team/line agency team to successfully implement their data collection, measurement and analysis programme. This note is also meant to provide some guidance to the Programme Officer of the project, who will be responsible for backstopping the implementing teams.

2 Concepts and Approaches for Assessing Irrigation Efficiencies and System Management

2.1 Water Balance and Irrigation Efficiencies

Conventionally, irrigation efficiencies are defined as ratios between the actual volume of water used for a specific purpose and the volume extracted or derived from a supply source for that same purpose. These efficiencies are assessed in terms of storage (Es), conveyance (Ec), distribution (Ed), and application (Ea). The overall project efficienscy would thus be a product of these efficiencies (Ep = Es.Ec.Ed.Ea). So, basically these efficiencies are keeping an account for water at different level of an irrigation system based on water lost, i.e, not used for the purpose it was delivered. For example seepage from the canals, deep percolation (water that percolates below the root zone) from fields, drainage water that leaves the boundary of the irrigation scheme, and water used by other vegetation than crops (for example trees within the command area) is considered lost while assessing efficiencies in the classical manner.

Water that is apparently lost is often not wasted and is rather beneficially used by other vegetation (for example trees), for irrigation downstream of the irrigation system or other purposes. For example seepage from canals and also deep percolation from fields recharge ground water and could be made available downstream either within the irrigation scheme (through pumping) or outside the command area of the irrigation scheme. Similarly drainage water that leaves the command area of an irrigation scheme is available for irrigation and other uses of water somewhere else. Water used by trees within the command area is an example of beneficial use of water. Thus these are not real water losses unless this water could not be used any further. For instance it flows into i) bad quality ground water; or ii) bad quality surface water or in the sea (although there must be some allowance for environmental flows).

New concepts and updated approaches to assess efficiencies have tried to address these issues of “water loss” and “beneficial use” of water, specifically from the non-crop use of water.

Water provided by the canal network in irrigation schemes is often used for other purposes than crop production, which results in the competition between different uses of water. Competition for irrigation water is also growing between different crops,

for example rice crop versus industrial crop (like coffee). This growing competition calls for improved water productivity (output per unit of water consumed and diverted) and Integrated Water Resources Management (IWRM). Improving irrigation efficiencies is one way of improving water productivity.

In order to improve irrigation efficiencies it is very important for managers of an irrigation scheme to keep track of where the water is going within the gross command area or boundaries of the scheme. Water balance or water accounting could help the managers understand where the water within the command area of the scheme is actually going, which helps in correcting the management strategies.

Water balance provides information about all inflows and outflows within a defined boundary. It also provides different water efficiencies - such as conveyance efficiency, delivery efficiency, and application efficiency, while taking into account the multiple uses of water within the scheme. Thus it gives good assessment of constraints and opportunities for improvements. The defined boundary here refers to a physical boundary, for example a field, a farm, an irrigation scheme, or a river basin. Water balance of at least one full year allows analysing the situation during the different seasons - for example dry season and wet season. The resulting strategy for water management and improving efficiencies might then differ from one season to the other.

Figure 1 gives an example of different flows within a defined boundary and potential water use within the boundary. The definitions of the terms used are given below:

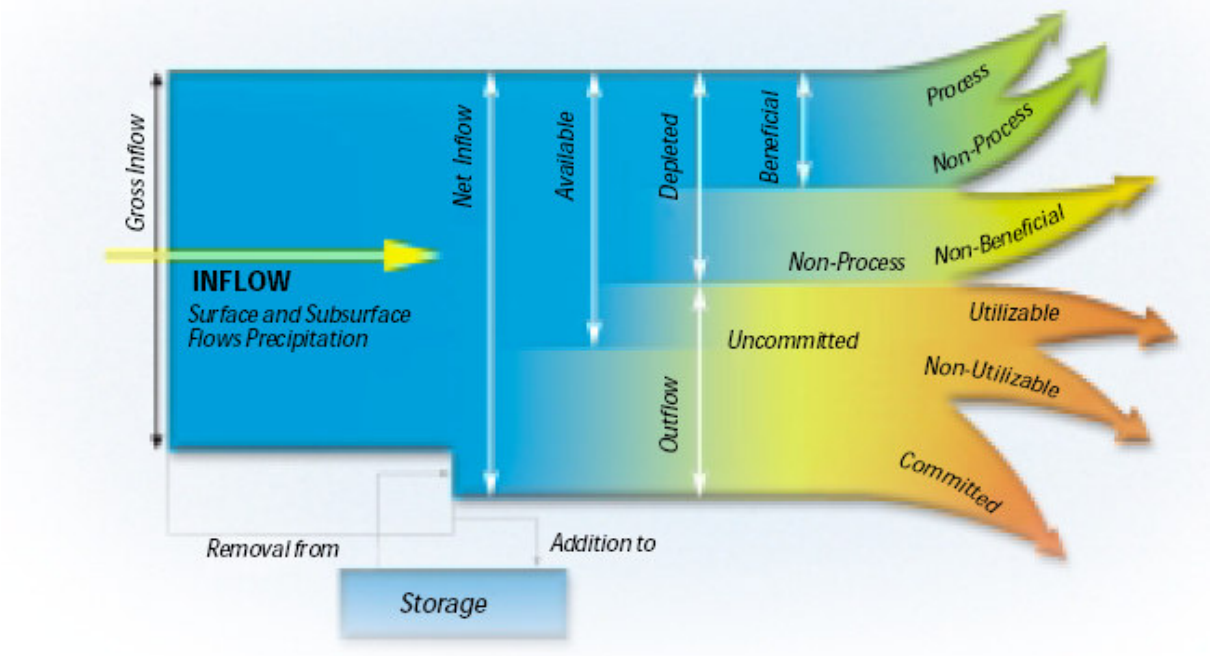


Figure 1: Water accounting for integrated water resources management
Source: IWMI, ????. Water accounting for integrated water resources management.

Gross Inflow:	Total surface inflow including, plus what goes into ground water
Storage:	Ground water storage
Net Inflow:	Total surface water plus any changes in storage
Available water:	Amount of water that is available for use.
Water depletion:	It is the use or removal of water from a water basin in such a way that makes it unavailable for further use, for example water that has been evapotranspired.
Process depletion:	Water that is depleted for intended use: for example crop evapotranspiration
Non-process depletion:	Water that is depleted but not by human intended process. This could be either beneficial or non beneficial. or example evapotranspiration from fallow land is non beneficial but evapotranspiration from forests is beneficial.
Committed water:	Amount of outflow that is committed to other uses downstream, such as environmental flows to the sea
Uncommitted water:	That water which is neither depleted nor committed and therefore is available for use within the boundary. This water could be either utilizable or non utilizable. This flow is considered utilizable if it could be used by improved management facilities.

Based on their water accounting approach IWMI (2003) has proposed the following way of calculating Basin and sub-basin efficiencies:

$$BE = \frac{Eb + Sb}{AWS}$$

Where

BE = Basin Efficiency
Eb = beneficial evaportanspiration
Sb = beneficial flows to sink
AWS = Available water supply

$$AWS = \left(P + T - CS\right) - N$$

Where

P = Total precipitation
T = interbasin transfers (into the basin is positive and out of the basin is negative)
CS = changes in storage in the basin (increase in storage is positive)
N = non- utilizable water supply. For example flood water to sinks.

For sub-basin or let's say an irrigation system the efficiencies would be calculated as follows:

$$SBE = \frac{Eb + Sb}{AWS_{sb}}$$

Where

SBE = Sub-basin Efficiency
Eb = beneficial evaportanspiration
Sb = beneficial flows to sink
AWS_{sb} = Available water supply within the sub-basin

$$AWS_{sb} = (P + DIV - CS) - (N + C)$$

Where

P = Total precipitation
DIV = diversions or inflows into the sub-basin
CS = changes in storage in the sub-basin (increase in storage is positive)
N = non- utilizable water supply. For example flood water to sinks.
C = Committed flows to the other areas, for example legally or conventionally committed outflows from upper to the lower riparian states, or between the other sub-units within the sub-basin.

This approach assessing efficiencies is different than the classical efficiency approach in the sense that this considers water as "lost" only when it is not used for beneficial evapotranspiration or it flows to the sink and could not be of any use even to the sink.

2.1.1 Approach adopted by the Project

Having briefly outlined irrigation efficiency concepts and while keeping in mind the limitation of the project scope and capacity of the line agencies, who will be conducting this work, the project has decided to adopt the following approach:

Selected irrigation systems's gross command area will be set as the boundary for efficiency analysis. Within the system the inflows and the outflows will be measured and monitored over a period of one year which will cover two crop seasons: rainy season and dry season. Inflows will include, amount of surface water diverted into the system through regular canals, precipitation, amount of surface water used within the command area that is not supplied by the regular canal systems (e.g., river or streams flowing into the command area) and ground water use within the command area.

Outflows will include 1) the amount of water beneficially depleted within the system (for example evapotranspiration by different crops within the selected boundary and also keeping in mind any other water use), and 2) the amount of water that leaves the system (for example through drainage) or flows to the sink (for example lakes, river).

The project will conduct simple water accounting based on the inflow, outflow data. As the information on the changes in the storage is difficult to obtain in the project countries, it will be taken into account through monitoring of any ground water extraction and use within the command areas.

In the absence of any established values for conveyance efficiency and distribution efficiencies, they will be assessed based on the data gathered.

The way inflows and outflows will be measured; other data to assess efficiencies and finally the method to calculate efficiencies is explained in the section 3 of this document.

2.2 Rapid Appraisal Process

The Rapid Appraisal Process (RAP) was jointly developed by the Irrigation Training and Research Centre (ITRC) of California Polytechnic University and FAO in late 90's and since then has been successfully used by FAO and the World Bank in various Asian countries to appraise several irrigation projects.

The methodology uses modern concepts of canal operation and water use efficiencies and is based on the understanding that the irrigation systems operate under a set of physical and institutional constraints and with a certain resource base. The systems are analyzed as a series of management levels, each level providing water delivery service through the system's internal management and control processes to the next lower level, from the bulk water supply to the main canals down to the individual farm or field.

With the service quality delivered to the farm and under economic, agronomic constraints, system and farmers' management produces results (crops yields, irrigation intensity, water use efficiency etc.), while symptoms of poor system performance and institutional constraints are manifested as social chaos (water thefts, vandalism), poor condition of infrastructure, poor cost recovery and weak water users associations.

The RAP allows qualified personnel to systematically and quickly determine key indicators of irrigation projects. The RAP can generally be completed with two weeks or less of field and office work provided that some readily available data on the project have been organized by the project authorities in advance.

Key performance indicators from RAP help to organize perceptions and facts, hence facilitate informed decision regarding

- The potential for water conservation within a project
- Specific weakness in project operation, management, resources, and hardware
- Specific modernization actions that can be taken to improve project performance

Furthermore, it also provides initial indicators that could be used as benchmarks in order to compare the improvements in the performance of the system once the modernization plans are implemented. A good assessment of the current situation gives

a clear idea on where situation must be improved and helps in prioritizing the areas for improvements. The RAP could also be used to compare the performance of the different projects.

2.2.1 RAP within the framework of IIEPF project

The RAP is considered useful for IIEPF as it provides good indication, in relatively short time, of the constraints and bottlenecks in the system and thus helps in identifying options for improvements at different levels of the irrigation system. Among other things, it gives information on the following:

- water allocation and distribution practices;
- operation rules and procedures;
- irrigation efficiencies (conveyance, field, overall project efficiencies);
- physical infrastructure (hardware) of the system;
- involvement of water users in the decision making process (stakeholders involvement);

All the above mentioned information is part of the detailed data collection programme of the current project, thus the information from RAP will compliment the data collection and measurement programme of the project.

Although, the RAP is very useful in appraising a project, it is acknowledged here that it is to be used by qualified personnel who are aware of the modern concepts of irrigation efficiencies and canal operation. Therefore a 4-5 days training workshop will be organized in collaboration with FAO Regional Office for Asia and the Pacific (FAORAP), Bangkok for implementing agencies to 1) introduce modern concepts in irrigation management, and 2) training on conducting RAP.

The Programme Officer (PO) of the project, who is also responsible for backstopping the country teams in data collection, will also join the training and the RAP exercises. The PO together with the implementing agencies will be responsible of organizing the required data before the exercise will begin. FAORAP will provide a list of the data requirement well in advance to allow the PO and implementing agencies to gather the relevant documents and data.

The RAPs will be conducted in each selected irrigation scheme twice during the project's life

- once at the beginning of the project, before the field data measurement programme starts; and
- second time when field data measurement programme ends.

The first set of RAPs will be conducted by FAO Office for Asia and the Pacific (FAORAP), Bangkok and the second by the implementing agency.

The programme manager of the project will be responsible to organize the required data before the exercise will begin. He will do this with the line agencies. FAO will provide a list of the data requirement well in advance to allow the programme officer and line agencies to gather the relevant documents and data.

3 Technical aspects of Data Collection and Analysis

This section of technical guidance note outlines the data that needs to be collected, method of data collection and finally the analysis of irrigation efficiencies. Which will help appointed implementing agency team to successfully implement their data collection, measurement and analysis programme. Moreover, it will be used as a reference material by the Programme Officer for backstopping.

The topics covered and information included here corresponds to the items nos. 7 and 10 of the Terms of Reference of implementing agencies: "*7: Expected outputs"* and "*10: responsibilities and Tasks of Implementing Agencies under this contract*". This section is split in 3 sub-sections to cover the three important blocks of activities. RAP is not covered here as there is a training workshop planned for this. The three sections are related to:

1. Preparation for data collection
2. Irrigation efficiencies and water productivity
3. Scheme management appraisal

3.1 Preparation for data collection

3.1.1 Site selection

For the selection of appropriate project site following factors should be taken into account.

- Representativity of agro-ecosystem within the country and irrigation system type of the basin
- Accessibility
- Appropriate size
- Availability of relevant information

Representativity

Selected site should represent agro-ecosystem of the country and featuring typical irrigation type of the countries of the Lower Mekong Basin. Examples of representing feature of the countries are as follows:

Lao	paddy field in hilly area, pump irrigation
Thailand	gravity irrigation, with PIM approach
Cambodia	wet low land around the Great Lake or other sub-basin
Vietnam	irrigation in low land delta, tidal irrigation

Accessibility

Accessibility is one of the important criteria to select project site. Field observation requires frequent visits to the selected sites. Hence, it is important that all the selected locations and measurement points within the selected site are reachable at any time of the year without any serious constraint.

Appropriate size

Field observation will be conducted at all the hydraulic levels of irrigation scheme covering: from main to secondary to tertiary canal up to paddy field level. Therefore size of the selected site is also crucial factor for field observation and data analysis. It is advisable to select a medium scale scheme (not too large that it requires a team of 20 people for measurements to cover all the levels of the scheme and not too small that irrigation efficiencies analysis becomes meaningless).

Data availability

For efficient implementation of the field observation, existing data and document should be utilized as much as possible in order to minimize preparation work, such as command area survey. Example of effective data is as follows:

- Schematic plan of irrigation system
- Scaled command area map of the irrigation scheme
- Planned water allocation and distribution and actual water distribution practice & organization
- Planned or designed irrigation efficiency and other related factors
- Water flows into the system and within the system

3.1.2 Schematic plan of irrigation system

Schematic plan of the irrigation and drainage system will be used to identify the appropriate locations for water measurements, monitoring (with current meter or other method) and data collection. If there is no existing schematic plan of selected irrigation scheme that is effective for the purpose described above, then it should be drawn based on existing scaled maps and/or other relevant information. In case no data available to draw schematic plan, basic survey should be conducted under this project.

Figure 2 provides an example of schematic plan of an irrigation scheme. The schematic plan basically presents the layout of the irrigation system and should include the following items:

- Alignment of irrigation canals and diversion structures
- Distance of the diversion structures and offtakes from the head of their parent canal;
- Command area under each diversion work and planned water allocation (for example amount of water per ha), and design discharge (e.g., m^3/s) or volume (e.g. cubic meters or m^3).

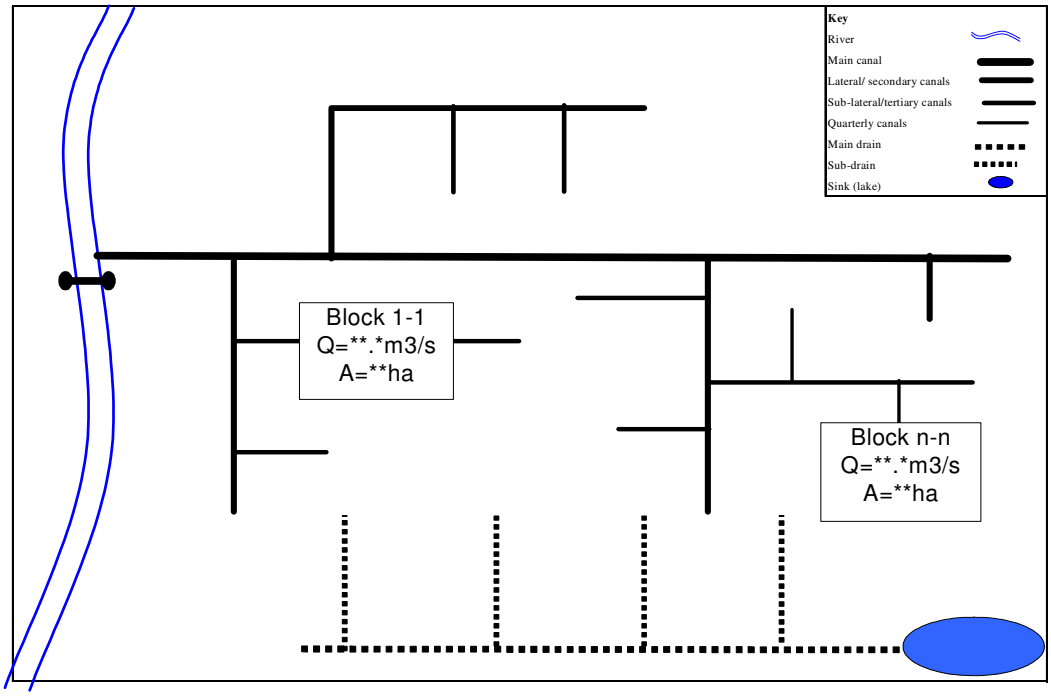


Fig.2. Example of schematic plan of irrigation system

3.1.3 Command Area map of the irrigation scheme

Command area map (see figure 3 as an example) of the selected irrigation scheme will be used for two purposes 1) to draw schematic plan of irrigation system described above (see section 3.1.2); and 2) to identify actual irrigated area described below in section 3.2.5: Identification of Irrigated Area.

If good command area map with appropriate scale is not available, then it should be drawn under this project using the existing information. In case enough information to draw such a map is not available, a survey should be conducted to collect this information. Command area map with appropriate scale is needed to identify irrigated area. Appropriate scale depends on the size of irrigation scheme and its complexity of canal and command area alignment. Scale should be decided in consultation with MRCS.

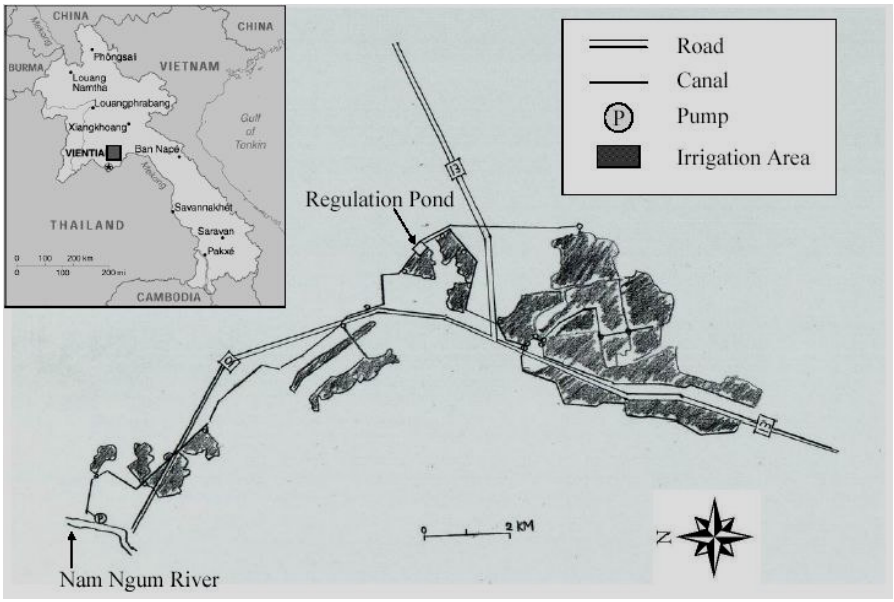


Fig.3. Example of schematic ground plan of irrigation scheme

3.2 Irrigation efficiencies and water productivity

3.2.1 Identification of flow measurement and monitoring points

Schematic plan and the Command area map of the system should be used to identify measurement points for efficiencies and water use.

For an in-depth and detailed analysis of the irrigation efficiency and water productivity of the entire irrigation scheme, flow rate at the downstream of every diversion structure and discharge of every off take should be known. However, if there is no monitoring system already in place, it will be difficult and laborious to measure discharge at every diversion point and offtake for one complete year. Therefore, in such cases appropriate measurement points should be selected. The number of measurement points would be different for assessing different efficiencies and productivity. Following are the main activities and minimum points for flow measurements and/or monitoring.

i. **Conveyance losses**: In case of no reliable designed and/or actual figures available on conveyance efficiencies, conveyance losses tests should be conducted in different canals up to the point where project authority delivers water to farmers. If the project authority delivers water to agroup of farmers at the intake of tertiary canal then the conveyance losses tests should be conducted in the main canal and selected secondary canal (if time and resources allow). For conveyance losses total inflow and the amount of water diverted along the canal must be known. Thus for this activity all the flow measurement at all diversion structures and offtakes

must be done. Figure 4 (which is the same system as presented in Figure 2) presents an example of measurement points (red boxes) on the main canal. However, conveyance losses tests will not be a regular flow measurement exercise and a few tests will be enough to assess conveyance efficiency. Section 3.2.3 provides information on how to conduct conveyance losses tests and calculate conveyance efficiency.

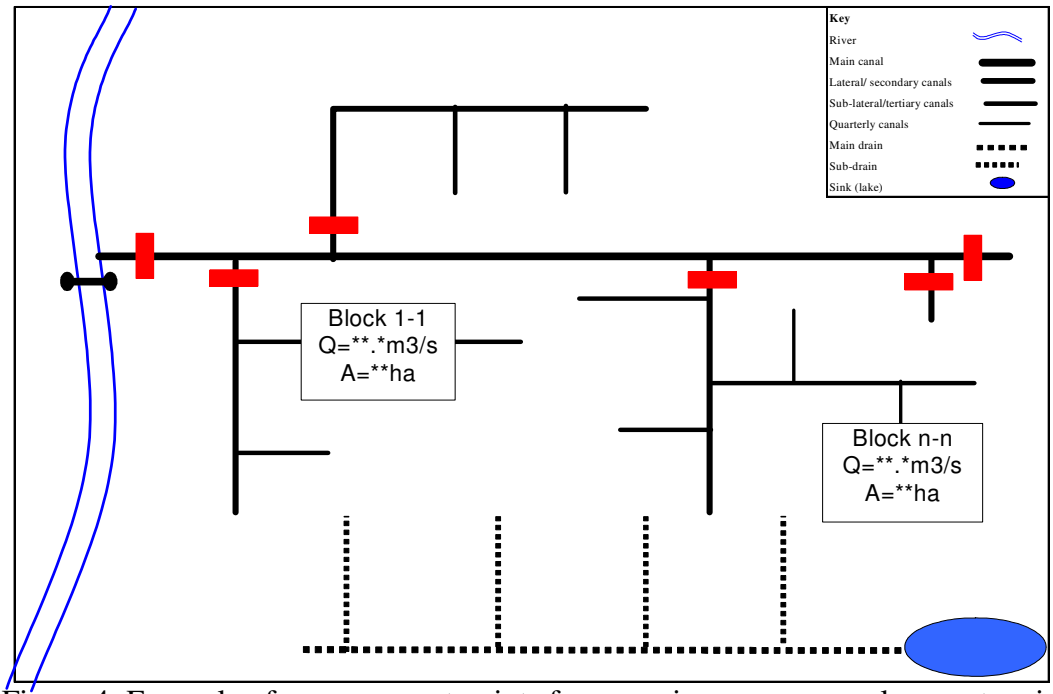


Figure 4: Example of measurement points for assessing conveyance losses at main canal.

ii. **Flow monitoring**: To assess different efficiencies and in order to be able make decisions on water distribution and operation of the irrigation facilities managers of the irrigation scheme need to know not only all the inflows and outflows but also diversions within the irrigation scheme. Thus flow monitoring at different points is very important for effective decision making and management. Ideally flow should be monitored at every bifurcation, diversion, offtake, etc. However, it is often neither practical nor desirable to measure flows at every offtake. In this project the potential flow measurement (or monitoring) points (see figure 5: all the coloured boxes: the red, the green, the violet, and the pink) are the following:

a) intake (head of the main canal) – daily or weekly discharges or whenever the inflow is changed (increased or decreased)
b) diversion points along the main canal (weekly discharges or whenever gate settings change)
c) offtakes along the secondary canal or laterals
d) canal water leaving the scheme boundary and flowing to the sink or back into the river.

In case the selected irrigation scheme already has a reliable ongoing flow monitoring programme there is no need to measure discharges again.

However, proper monitoring of discharges at these points is required for the study period. In case these selected sites do not have any ongoing flow measurement programme then it is advisable to a sub-command area for flow monitoring and data analysis (this should be done in combination with the points selected for measurements for water use. See below number iii). Criteria for choosing sub-command area for measurement and analysis could include one or two lateral canals or a management sub-unit. For example consider the command area of same irrigation scheme as presented in figure 2. If a subcommand area of this scheme is selected (area inside yellow dotted line in figure 5) for analysis then the following are the main points where flows must be measured and monitored:

a) intake (head of the main canal) and water flowing out of the command area (red boxes in figure 5) – daily or weekly discharges or whenever the inflow is changed (increased or decreased)
b) main diversions along the lateral, or within the sub-command area selected for analysis, and the water flowing out of this sub-command area;
c) at the point of management change: for example at the point where farmers or Water Users Association takes charge of water (for example violet colour boxes in figure 5).
d) water leaving the selected sub-command area through drains (green boxes of the drainage canals in figure 5)

To summarise flows at the points represented with boxes of red, green and violet colours should be measured and monitored over time for the duration of data collection and analysis programme.

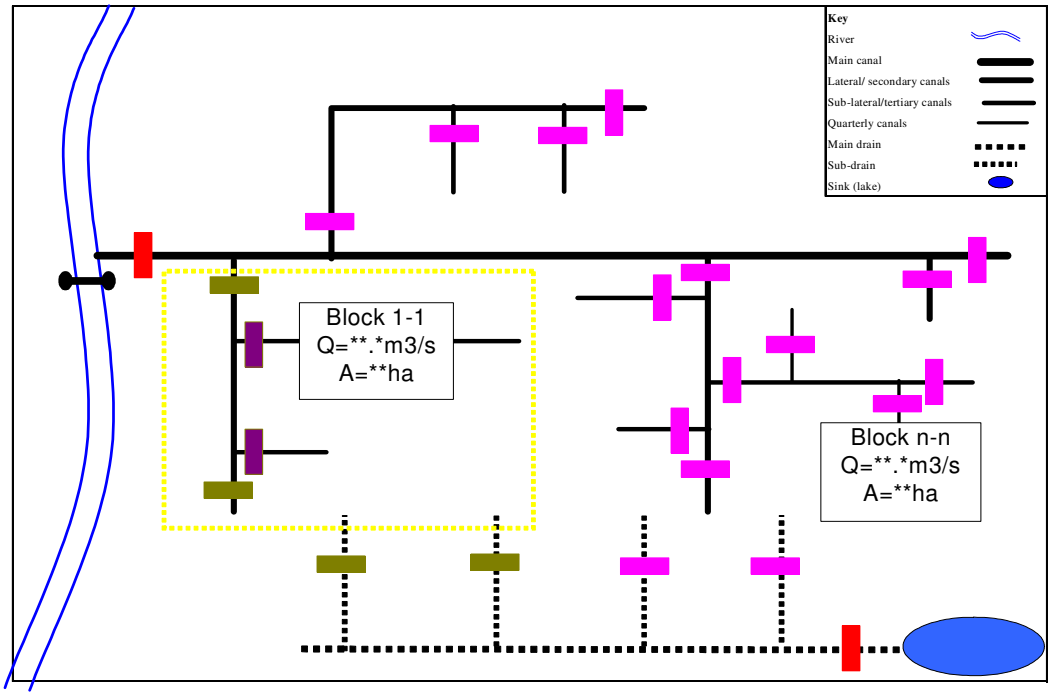
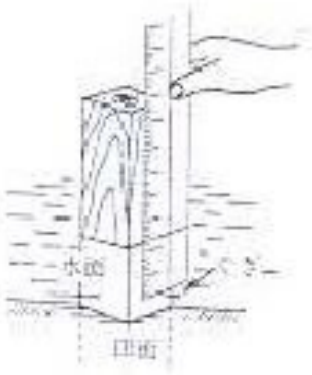


Figure 5: Example of potential measurement points for flow monitoring.

iii. **observation and monitoring for water use at the field level**: Precise assessment of crop water requirement and use requires measuring rainfall, evaporation, transpiration, percolation and seepage, and it needs complicated measurement system composed of combination of water level gauge, rain gauge and other special apparatus for each items. Avoiding undesirable result caused by this complicated operation, this project simplifies measurement method to assess use of crop water by paddy rice as described in this section.

Water level observation should be conducted to measure daily change of water depth at the selected points in paddy fields as follows:

a) install a wooden log/pole with stopper vertically on the paddy field (see picture)
b) observe and record water depth from stopper to water surface by putting gauge along the pole. This gauge could also be fixed with the wooden log/pole in which case the readings could be directly taken from the installed gauge/wooden pole. Consideration should be given to the initial water level and the water used for land preparation
c) measure and record again after 24 hours from the \



previous measurement. Any positive changes in water level (due to irrigation application or rainfall) should be recorded carefully and taken into account while calculating total amount of water applied.

Obtained value in this way is a combination of evapotranspiration and infiltration and provides information on water used by farmers to irrigated paddy rice. Infiltration (percolation plus seepage) widely depends on soil condition and field layout, thus careful selection of water level observation points is required. Ideally all the combinations of soil classification and ground water level (high, middle or low) should be taken into consideration while selecting location for infiltration observation. However because of practical reasons this project considers that observation point in one field should be enough for the purpose to roughly assess the actual water applied on the rice paddy fields. In this regard, it is recommended to install a few such gauges/wooden poles in a block of fields instead of one paddy field to take into account lateral seepage and field to field irrigation. An example of a block of fields could be the area irrigated by a sub-lateral or tertiary canal or area downstream of the point of change (for example area downstream of violet box in figure 5).

It is advisable to observe and monitor water applied in a fish pond in the same manner as described above.

The field(s) selected for monitoring of irrigation water applied to paddy fields and fish pond must be within the same sub-command area that is selected for flow monitoring.

While selecting the exact location for flow measurement for conveyance losses tests and discharges following factors must be considered:

- stable flow without turbulence,
- stable cross section and,
- easy access

3.2.2 Flow measurement devices and methods

Several flow measurement devices could be used to measure discharge in open channels. Although most devices measure flow indirectly by measuring velocity V, head h, or pressure p to determine discharge Q. In this project following devices or methods to obtain discharge could be considered, if there is no flow measuring devices already installed or permanently constructed in the selected irrigation schemes:

- Current meter
- Flumes
- Rated section of the canal

Current meter

Current meters are velocity measuring devices that sample at a point. Each point measurement then is assigned to a meaningful part of the entire cross section passing flow. The velocity-area method is then used to determine the partial discharge. Total discharge is attained by summation of partial discharges.

To measure flow with current meter at a selected location in the canal, cross section is divided vertically into sub segment (hatched part of Fig.6.) with equal width, Δwi in Figure 6. Number of sub segment depends on the total width of the canal section however minimum number of sub-segments is three. A single vertical reading is used if the distance between the vertical sub-sections is less than 1 ft. Otherwise measurement should be conducted at 0.2 and 0.8 depths along centre vertical line of each sub segment.

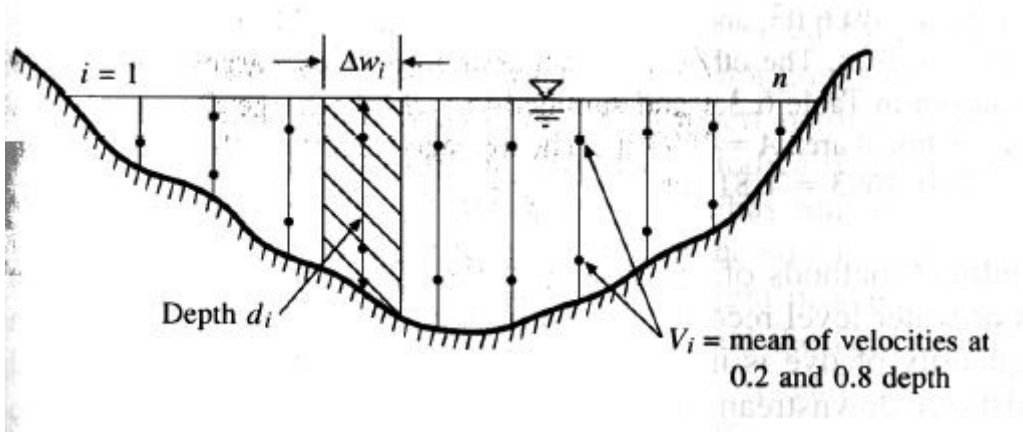


Figure 6: Typical canal cross section and vertical velocity profile

Measurement should be conducted twice consecutively on each depth (0.2 or 0.8) for longer than twenty (20) seconds. If the difference between the two observed values is significant (more than 10% of difference) another measurement should be taken for confirmation. Otherwise, simple average of the two measurements should be recorded as observed value of velocity at each depth. The mean velocity of vertical readings for partial area ai of a subsection with width Δwi and depth di would be:

$$Vi = 1/2 \times (Vi0.2+Vi0.8)$$
$$ai = di \times \Delta wi$$

The partial and total discharges could be computed as follows:

Partial discharge:

$$q_n = V_n a_n$$

where
q = the discharge for a partial area
V_n = mean velocity associated with the partial area
a = partial area of total cross section

The total discharge, Q, is then

$$Q = \sum_{1}^{n} V_n a_n$$

OR

$$Q = \sum_{1}^{n} q_n$$

Flumes

Flumes, particularly long throated flumes require small head loss to obtain a unique relationship between the upstream sill-referenced head and the discharge. Moreover, they can nearly have any desired cross sectional shape and can be custom fitted into most canal-site geometries.

They could be permanently constructed in the canals, provided that the conditions in the canal allow it, or made as portable devices. Permanent flumes could solve the problem of having to physically do the field measurement with current meter to calculate discharge. However careful considerations are required for design and construction of permanent flumes as they require accurate workmanship for satisfactory performance.

Project should opt for constructing permanent flumes as water measuring devices as part of regular monitoring of flow discharges if the conditions in the field allow and a good consultant/company is identified that could satisfactorily design and construct flumes.

Rated canal sections and calibration of gates and sluices

Rated canal sections and calibration of gates and sluices are often used in many irrigation distribution systems for computing discharges. This also reduces the need to practically measure the discharge every time in the field.

Stable canal sections could be calibrated based on head discharge relationship. Measurements need to be made at wide range of discharges to be able to produce a good rating table. However in case the area of the calibrated canal section changes (for example as a result of sedimentation or cleaning) the rating curve will change and so re-calibration of the section will be required.

Similarly, calibrated gates and sluices could be used for computing and monitoring discharges. In calibrating an individual gates discharge could be measured using any method, for example by current meter. A series of discharge measurements covering a range of gate openings is made, and then the operating heads upstream and downstream from the gate are recorded for each measurement. Rating curves can then be compiled using these data.

3.2.3 Conveyance losses tests

An estimate of the amount of water that is "lost" or mismanaged in conveyance system is required for effective management decisions and equitable water distribution. Thus for managers it is important to know where the water is going within the conveyance system. Major sources of conveyance losses include:

- Evaporation from the water surface
- Deep percolation to soil layers underneath the canals (some deep percolation may be desirable for ground water recharge in the area)
- Leakage through the bunds of the canals (it threatens safety of the canal)
- Overtopping the bunds (it threatens safety of the canal)
- Bund breaks (it threatens safety of the canal)
- Rat holes in the canal bunds (it threatens safety of the canal)

The simplest way to assess conveyance losses in a canal is inflow – outflow measurements of discharges. Inflow-outflow tests are conducted using long reaches of a canal. For example inflow-outflow tests in the main canal in figure 4 would mean that the discharge should be measured at all the points represented by the red boxes. Conveyance losses will then be computed as follows:

$$CL = Q_{in} - Q_{out}$$

and

$$Q_{out} = \sum_{1}^{n} q_n + Q_{outflow}$$

where
q = water diversions to offtaking canals.
$Q_{outflow}$ = water flowing out of the canal section on which conveyance losses tests are conducted

Conveyance losses tests should be conducted for a range of discharges: maximum flow, minimum flow and average flow. While conducting inflow-outflow tests time lag should be taken into account during the measurements. Time lag is the travel time requires for water to flow from point A to B (see Figure 7).

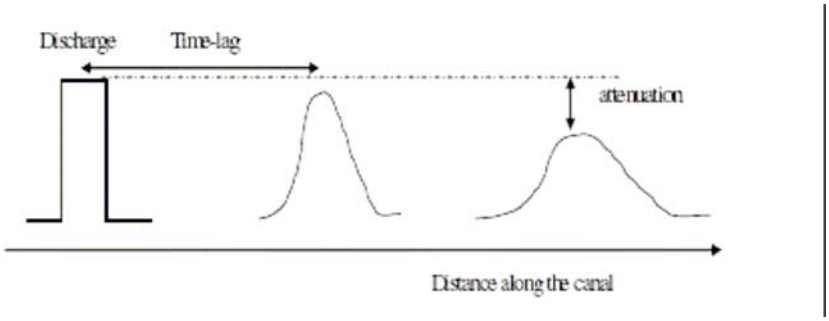


Figure 7: Time lag between the two points along a canal.
Source: FAO, 2006. Canal Operation Modernization for Medium & Large Irrigation Systems. Forthcoming

If the measurement points are close and the time lag is less than the time required to conduct current metering at point A and reach the point B. More than one team could be deployed in the field to do the measurement. However, the time lag should still be taken into account.

It is important that the inflow into the canal be stable during the entire exercise of inflow-outflow tests (that is from the head until the last measurement point).

Conveyance loss measurements should be done as soon as preparation for field data monitoring are completed.

3.2.4 Discharge data monitoring

As described earlier that for effective water management and improved irrigation efficiencies it is important to know the amount of water entering the command area of an irrigation scheme, being diverted within the different parts of the command area schemes and flowing out of the scheme boundaries. The discharge needs to be monitored at the selected points (see section 3.2.1) over time. For this project the discharge will be monitored daily or weekly (depending on the existing practices of the selected irrigation schemes) over one year (over the entire period of data measurement and collection programme).

3.2.5 Identification of actual irrigated area

This activity aims to identify the gap, if any, between planned and actual irrigated area. For example, consider a diversion structure that is designed to divert water to 1000 ha with a discharge of 1.5m^3/s. Even if exact design amount of 1.5m^3/s water is diverted to the command area under the diversion structure, it does not guarantee that the 1000 ha are securely irrigated. Thus it is important to important to identify the actual irrigated area of the irrigation scheme.

This data could be collected through interviews with farmers and cross checking in the field. These interviews and cross checking should be done periodically, for example once in a month. However additional interviews and measurement is required when water distribution is changes significantly (i.e. transition between rainy and dry season, stage of crop growing cycle.)

If possible collected information of actual irrigated area should be plotted into schematic ground plan of irrigation scheme.

3.2.6 Rainfall and Evaporation data

In the irrigation schemes where it is possible (and already an existing practice) rainfall and evaporation data should be collected. Otherwise these data should be acquired from the nearest meteorological station. Weather data from meteorological stations could be used to assess potential evapotranspiration rate. In case this data is to be aquired from met station, it is advisable that the Programme Officer of the project calculates potential evpotranspiration rate for the selected irrigation schemes. This data is required for assessment of crop water requirement.

3.2.7 Water requirement

Crop water requirement

Crop water requirement is the amount of water that a particular crop needs to evapotranspire (for its growth) without any stress from planting to harvest. Evapotranspiration (ET) requirement of different crops are different. Climate regimes also have an influence on the ET requirement of a crop.

Crop water or evapotranspiration requirement (ETc) of a crop (see figure 8) could be calculated as follows:

$$ETc = ETo \times Kc$$

where

ETo = Potential or reference evapotranspiration in mm/day, and
Kc = Crop coefficient (dimensionless)

ETo is the reference evapotranspiration that is defined as the ET from an extensive surface of clipped grass or alfalfa that is well-watered, and fully shades the ground (see figure 8).

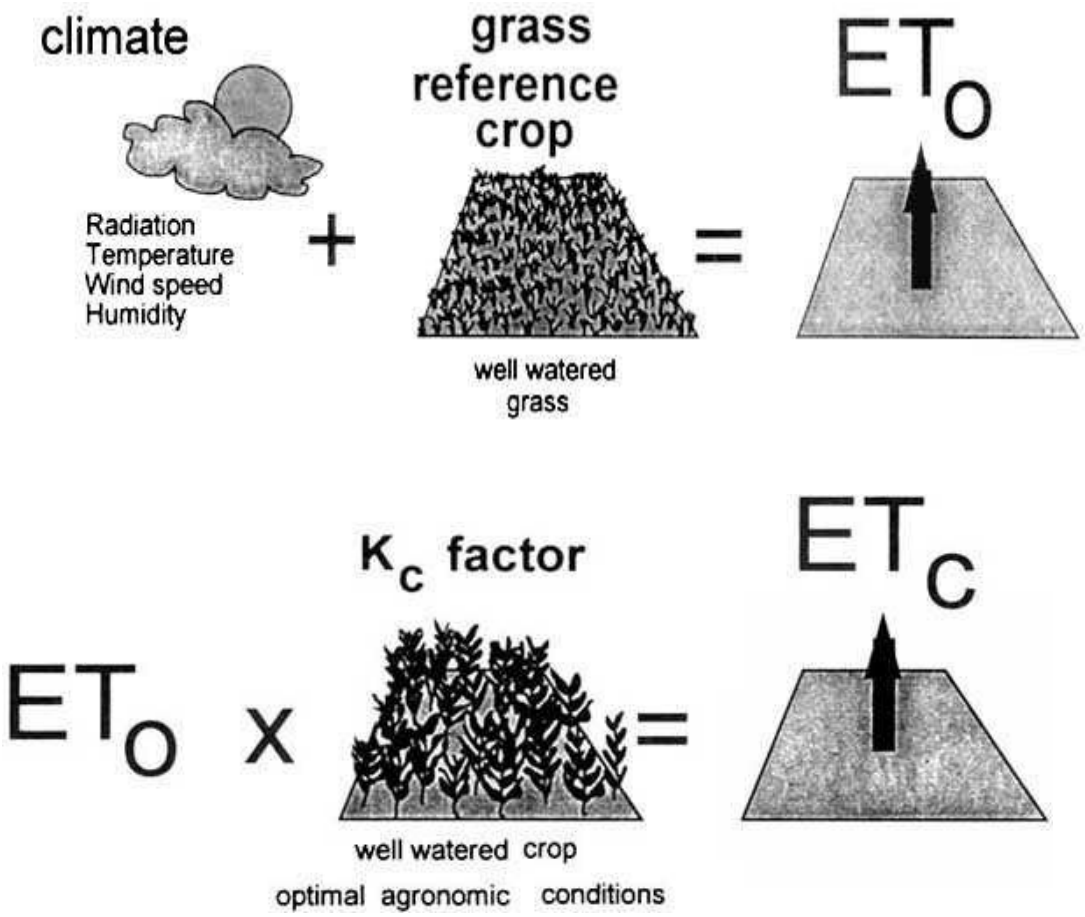


Figure 8: Reference Evapotranspiration and Crop evapotranspiration
Source: FAO 1998. Crop evapotranspiration - Guidelines for computing crop water requirements - FAO Irrigation and drainage paper 56.

As shown in figure 8, ETo can be calculated with climate data. It is advisable that the Programme officer calculates the ETo and provides the calculated values to the Implementing Agency.

Kc is the crop coefficients which incorporates crop characteristics and averaged effects of evaporation from the soil. Kc is crop and crop growth stage specific. Standard Kc values for different crop growth stages are available in FAO's publication "Crop evapotranspiration - Guidelines for computing crop water requirements - FAO Irrigation and drainage paper 56". It is advisable that the Programme officer provides these values for different crops to the implementing agency.

While computing crop water requirement of paddy rice special requirement for the following should also be considered:

- land preparation: saturation of the soil before planting
- percolation and seepage
- establishment of a water layer

The percolation and seepage depends on the type of soil. They will be low in very heavy, well-puddled clay soils and high in the case of sandy soils. The percolation and seepage usually vary between 4 and 8 mm/day (FAO, 1986 Irrigation Water Management: Training manual no. 3).

for heavy clay: PERC = 4 mm/day
for sandy soils: PERC = 8 mm/day
on average: PERC = 6 mm/day

Once crop water requirement of a particular crop is computed, it could be extrapolated for the whole scheme as follows:

$$\text{CWR of paddy rice in the entire command area} = \text{CWR in m}^3 \times \text{area planted under rice in m}^2$$

Total crop water requirement of the scheme will then be computed as:

$$\text{CWR of the scheme} = (\text{CWR of crop1} \times \text{area planted under crop1}) + (\text{CWR of crop2} \times \text{area planted under crop2}) + (\text{CWR of cropn} \times \text{area planted under cropn})$$

Water requirement for fish ponds

For practical purposes water requirement for fish ponds are calculated in the same way as water requirement for crops. A fish pond is comparable with an evaporation pan therefore one kc value should be used throughout the year. It is recommended to use a kc value of 1.2 for calculating requirement for fish pond. Moreover, the seepage and percolation requirement should be considered in the same way as for paddy rice when computing water requirement for fish ponds.

Total water requirement of the scheme

Once all the water requirement of main uses of water are calculated, total water requirement of the scheme could be computed by adding all the requirements

$$\text{Total water requirement of the sceme} = \text{CWR} + \text{fishpond water requirement}$$

3.2.8 Cropping pattern, crop calendar and crop yield

Cropping pattern and crop calender

Information about cropping pattern and crop calendar is useful in assessing and extrapolating water requirement from a field to the whole irrigation scheme. Thus it also helps in assessing project efficiency.

The cropping pattern of an irrigation area provides information, for a period of at least one season, on three important elements:

  - which crops are grown
- how many hectares of each crop are grown.

Crop calendar would reveal:

- sowing date of a crop; in case of rice, it should also indicate the timing for nursery sowing and transplanting
- harvesting date of a crop

To make things easier, the following table could be used to record information regarding cropping pattern for the scheme.

No	Crop	Ha. of crop in each months for the year 2006												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	Paddy Rice number 1													
2	Paddy Rice number 2													
3	Paddy Rice number 3													
4	Cucumber													
5	Banana													
6														
n														

Crop yield

Information on crop yield is important to assess crop water productivity. This information should be collected through farmers interviews once a season for major crops in the selected irrigation scheme.

3.2.9 Computation of irrigation efficiencies

Once the conveyance losses are known and discharge is monitored conveyance efficiency is computed as follows:

$$\text{Conveyance Efficiency} = \frac{\text{Volume of water delivered by the system}}{\text{Volume of water diverted into the system}} \times 100$$

Overall Project Command Area Efficiency will be calculated as:

$$\text{Overall Project Command Area Efficiency} = \frac{\text{Total scheme water requirement - effective rainfall}}{\text{total water delivered to users}} \times 100$$

See section 3.2.7 for computation of total scheme water requirement

Total water delivered to farmers = (total inflow * conveyance efficiency) – Committed flows downstream – flows to sink

Committed flows are considered if the conveyance network of the selected irrigation scheme is transporting water to downstream of the irrigation scheme command area.

It is recommended that the details of analysis should be determined in consultation with the MRC.

3.2.10 Computation of water productivity

Water productivity of paddy rice will be assessed as yield per unit of water diverted. As we the information on total water delivered to farmers and yield it will not be difficult to do this simple computation.

3.3 Scheme management appraisal

3.3.1 Identification of stakeholders

Management of an irrigation scheme requires decision making on water allocation, distribution, resource mobilization, etc. Different organization and/or individuals are usually involved in making decisions regarding water allocation, distribution and operation of irrigation facilities. In order to be able to understand different processes of scheme management and later for implantation of improvement plans it is import to identify key players and stake holders in an irrigation scheme.

All the stakeholders (for example project authority, water users association, individual water users, etc) should be identified at different levels of canal system (main, secondary, tertiary), and their involvement in the decision making should be documented.

3.3.2 Organizational charts of stakeholders

Structure of identified stakeholders' formal or informal organizations, for example Project authority, Water Users Association, etc. helps to identify the right level for intervention in terms of 1) capacity development, and 2) implementation of improvements plans. Thus, organogram of these formal or informal organizations should be documented. Figure 5 gives an example of simple organizational diagram.

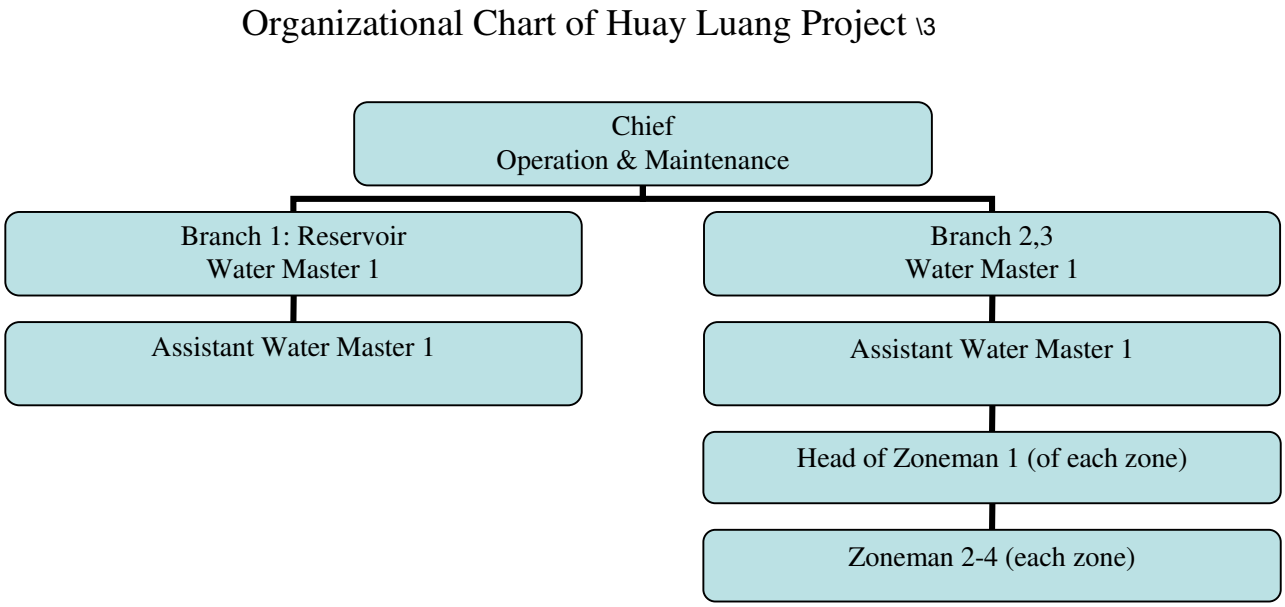


Fig.5. Example of a simplified Organizational chart

3.3.3 Water allocation rules

Rules, regulations and guidelines regarding water allocation facilitate the decision making process for allocating water for different uses and users within the irrigation scheme. These rules, formal or informal, provides the basis for water distribution practices, thus to a certain extent, influences irrigation efficiencies. The way water is allocated over time and in different seasons (for example in rainy season and in dry season) could provide an opportunity for improvements in water use and water productivity.

Therefore, the official rules and actual procedures followed by the project authorities to allocate water need to be documented as part of the data collection programme.

Main questions that need to be answered in this document are:

- What criteria are used by the project authorities to allocate water to different uses/ users (for example to fish pond versus paddy fields, versus other crops)
- Do project authorities allocate water differently to different parts of the command area (for example along the head reaches and the tail reaches)?
- Is the criteria used by the project authorities in practice differ from the official criteria (or official rules)? If yes than what are the official criteria for water allocation?
- Is water allocated differently over time (for example in dry season and in rainy season or within the rainy season when there is not enough water available)?

3.3.4 Water distribution practice and operation of irrigation facilities

An in-depth analysis of the way water is practically distributed within the irrigation scheme and the way irrigation facilities are operated will provide insights into the constraints and opportunities for improving scheme management and irrigation efficiencies. Therefore, it is important to document the following as part of the data collection programme:

1. official water distribution rules (any available official documents should be consulted and made available);
2. actual water distribution practices;
3. official rules and procedures to operate irrigation facilities (any available official documents should be consulted and information made available);
4. actual operation of the irrigation facilities

Annex 4

Opening Addresses

Opening Address by Dr Dao Trong Tu
Director Operations Division, Mekong River Commission Secretariat
1st Regional workshop on Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin Project
3-4 May 2006
MRC Secretariat, Vientiane, Lao PDR

Mr Nakamura, Second Secretary, Embassy of Japan in the Lao PDR,
Mr Facon, Senior Water Resources manager, Food and Agriculture Organisation
Distinguished participants,
Ladies and Gentlemen,

I have the honour, on behalf of Dr Olivier Cogels, CEO of MRCS, to make this opening speech at the first regional workshop for "Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project." This project is supported by the Ministry of Agriculture, Forestry and Fisheries, Japan. First of all, I would like to express my sincere thanks to the MAFF and the Government of Japan for their continuous support to MRC in general and the Agriculture, Irrigation and Forestry Programme (AIFP) in particular.

As you may well know, agriculture is the biggest industry in the region. Development in agriculture is vital for regional development and enhancement of irrigated agriculture is the key factor of development, particularly because agriculture in the region faces difficulty in ensuring a stable water supply in both the dry season and during dry spells of the rainy season.

In this context, there have been numerous schemes to invest in irrigation in the past, but many of these have had problems in their performance. This has been caused by deterioration of the facilities and poor management.

Low performance leads to inefficient water use and becomes an obstacle for timely water supply and its equitable allocation. This, in turn, means irrigation efficiency is kept low.

This project focuses on irrigation efficiency. Based on scheme performance appraisal and irrigation efficiency observation, the project is aiming to propose some guidelines to improve its performance. I believe the output of this project will contribute to effective irrigation water use and lead to an extension of the possibilities of development of irrigated agriculture.

In order to fulfill the needs for a successful result of the project, I expect deep involvement from the National Mekong Committees and Line Agencies of each member country, especially in terms of fieldwork, where the project cannot be conducted smoothly without strong participation from Line Agencies.

In addition to the project implementation, we also need member countries' continuous support to apply the outputs of the project, (i.e. the guidelines) once they are produced in order to contribute to the improvement of irrigation performance in the basin. As the project budget is limited, IIEPF itself cannot cover either the application of the produced guidelines or rehabilitation of infrastructure. I expect countries' continuing effort to utilise the guidelines in order to contribute to irrigation development in the Basin.

One remarkable arrangement for this project implementation is our collaboration with the Food and Agriculture Organisation. FAO has access to vast experience, knowledge and human resources regarding agricultural development. The organisation has agreed to collaborate with MRC for this project implementation. The project will incorporate a lot of input from FAO especially in terms of scheme performance appraisal in theory and practice.

This collaboration will produce more a fruitful result for the project. I also expect this project level collaboration will be the first step for a wider and broader collaboration between FAO and MRC.

Lastly, I would emphasise the need for full cooperation and contribution from all the National Mekong Committees and Line Agencies. This is essential for smooth implementation of this project and good results. I appreciate your participation today and expect your active involvement in both the workshop and forthcoming activities.

Thank you very much.

Speech by Mr Ken Nakamura,
Second Secretary, Embassy of Japan in the Lao PDR
1st Regional Workshop on Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project
3-4 May 2006
Mekong River Commission Secretariat, Vientiane

Dr Dao Trong Tu, Director of Operations Division, MRC Secretariat,
Mr Thierry Facon, Senior Water Management Officer, Food and Agriculture Organisation,
Representatives of the MRC member countries,
Ladies and Gentlemen,

I feel most honoured to be here with you today at the 1st Regional Workshop on the "Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project." This project is funded by the Government of Japan under the framework of "Programme to Analyse and Evaluate Water and Ecosystems in Asian Paddy Fields." On behalf of the Government of Japan, I would like to make a few remarks.

As you know, Japan, as one of the major donors, is cooperating in the field of sustainable development and management of the water and related resources of the Mekong basin through contribution to the Mekong River Commission and by other ways. Now Japan is contributing this project, which aims to realise efficient and equitable irrigation water use which will lead to sustainable agricultural and rural development. As paddy field irrigation is the biggest single user of fresh water, its appropriate use is vital for both this region and world wide. In this context, Japan is contributing to international initiatives such as the International Network for Water and Ecosystems in Paddy Fields and the International Flood Network. This is an initiative to discuss broad issues related to paddy fields and their water use concerning production functions and environmental aspects.

I recognise that the MRC is the sole international organisation handling sustainable development, utilisation, management and conservation of the water and related resources of the Mekong basin. Thus I fully expect the MRC to play a remarkably important contribution to the sustainable development of the agricultural and rural areas in the basin.

In this context, it is expected that the MRC will analyse the actual conditions of water use and related development policies of riparian countries and draft some model plans for effective water use for the Basin.

I understand that this project will be implemented in collaboration with FAO. I believe FAO's involvement will lead to efficient and effective project implementation. Even although this arrangement is initiated by the Government of Japan, I strongly expect this will be a good step to set up and strengthen the relationship with these two organisations and lead to further cooperation in development of the region.

Finally, I would like to thank all of you once again and I wish you all great success with this project.

Thank you very much.

Annex 5

Presentations on the Project concept and the Project document

Introduction of Revised Project Document

Okudaira Hiroshi
AIFP, MRCS

Content

1. Consultation Meetings & their comments
2. Reflection to the Project Document
   Outline of revised document
   Other reflections
3. Project document to Field work (TOR)

1. National Consultation Meetings

- Laos, Cambodia, Vietnam & Thailand
  Dec 2005 to Jan 2006
- FAO RAP
  Jan 2006

Major comments (1)

- Concept of irrigation efficiency needs "updated"
- Focusing on canal system or field level
- Either "guideline" or "manual"
- Structure of guideline requested
- Trial application of guideline proposed

Major comments (2)

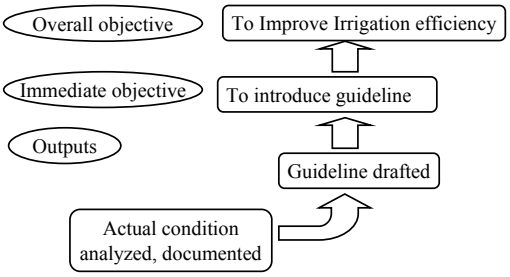
- Site selection needs discussion at W.S.
- Selected sites
  → covering basin's feature
  → representing crop pattern & soil type
- Site visit at W.S. proposed
- Water productivity analysis requested
- Crop requirement analysis requested

2. Outline of the revised document

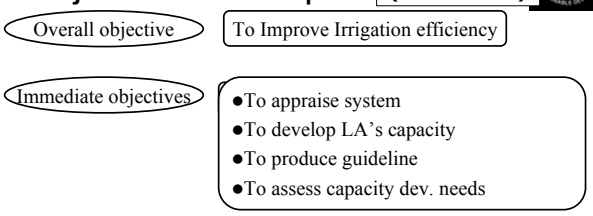
2-1. Major revisions

- Improvement of Logical Framework
  – objectives, outputs & activities –
- Incorporation of up-to-date concept
- Collaboration with FAO
  – reinforcement of implementation –

Objectives & Outputs (1st draft)



Objectives & Outputs (revised)



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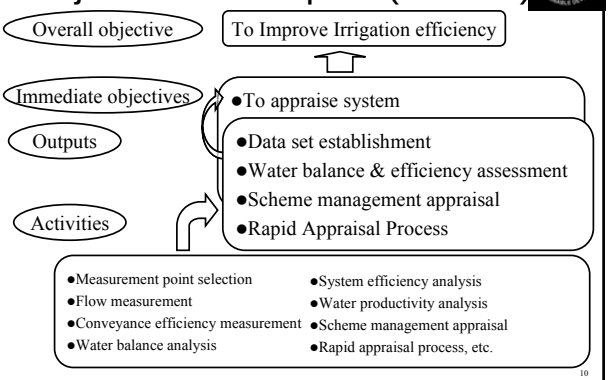

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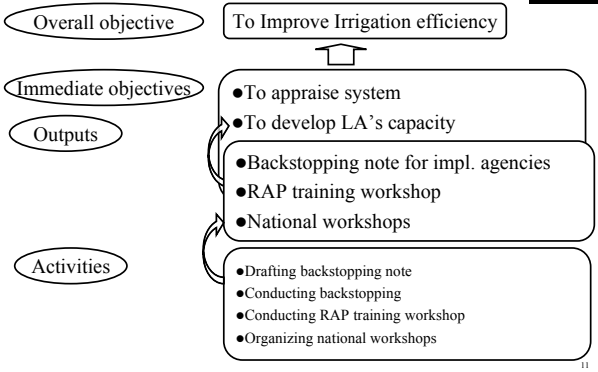

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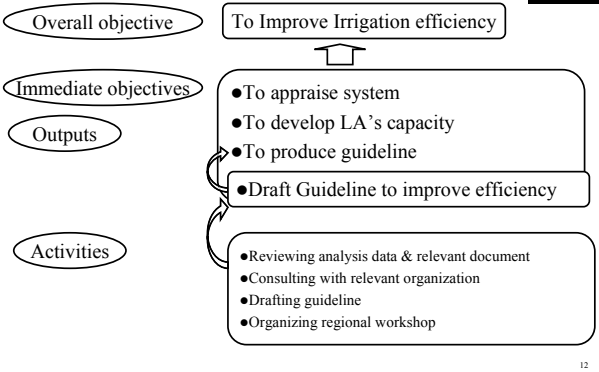
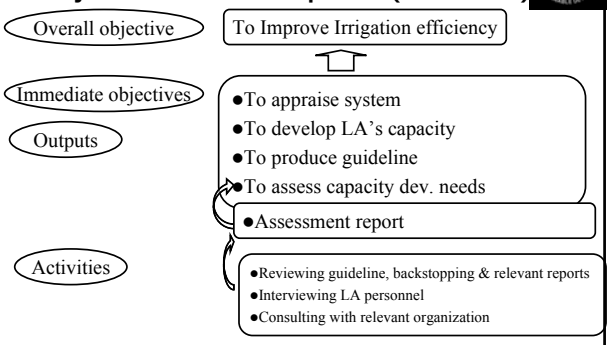


Objectives & Outputs (revised)



Overall objective

- To improve irrigation efficiency on paddy fields in the Lower Mekong Basin

  → NO change

Immediate objectives

(1st draft)	(revised)
● Introduce guideline	● Appraise efficiency & system ● Capacity development ● Produce guideline ● Identify capacity dev. requirement

Outputs (1,2)

(1st draft)	(revised)
● Actual condition analyzed, documented	● Mini. Data set established ● Water balance, efficiency, productivity assessed ● Scheme management appraised ● Rapid Appraisal Process (RAP) ● Backstopping note for LA ● RAP training workshop ● National workshops

Outputs (3,4)

(1st draft)	(revised)
● Guidelines drafted	● Guidelines to improve efficiency ● Capacity building assessment report

Activities

- Activities reinforced according to the changes of outputs

  Detail shown on comparison table

Updated concept (1)

- seepage
  deep percolation
  drainage water
  water used for other vegetation, etc.
- "LOSS" in classical manner

Updated concept (2)

- seepage & deep percolation
  → recharge ground water
- drainage water
  → reused downstream
- for other vegetation
  → beneficial use
- NOT Loss but "Multiple USE"

Updated concept (3)

Project incorporates modern concept as

- Interaction with ground water storage
- Committed flow & other outflow
- Other use – fish pond

(pls. see TOR & backstopping note)

FAO collaboration

- Improvement of project concept, doc.
- Participation to the W.S.
- RAP training W.S & initial appraisal
- Comments & feedback on guideline

Rapid Appraisal Process (RAP)

- Jointly developed by FAO
- Tools to assess irrigation scheme systematically and quickly
- Compliments IIEPF data collection
- Training W.S and
  initial & conclusion RAPs planned

more info, pls. see next presentation

2-2. Other reflections into project document

Reflections of comments (1)

- Concept of irrigation efficiency
  → Revised project document
  TOR & backstopping note
  Rapid Appraisal Process
- Canal system or field level
  → both
  along the canal → conveyance
  selected area → field application

Reflections of comments (2)

- Guideline or manual
  → "Guideline" – more in general
- Trial application
  → difficult within limited time frame
  → To assess capacity dev. needs
  as output 4

Reflections of comments (3)

Structure of Guideline: Annex-2

- Introduction & Concept
- Mapping Water Network
- Scheme Management Appraisal
- Water Balance
- Improvements
- Improving manage. with users
- Information system
- Monitoring & evaluation

Reflections of comments (4)

- Site selection
  (1) 4 types covering basin's features
  (2) same kind of system
  with different management

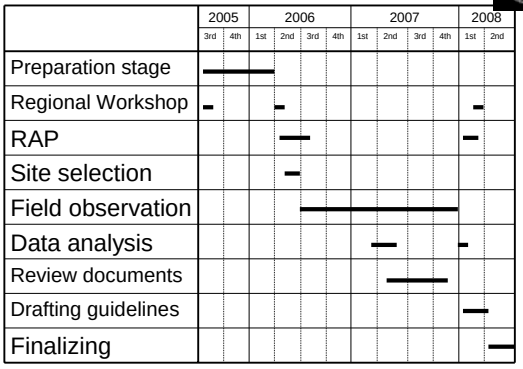
  → to be discussed on DAY2
- Site visit
  → planed to visit Nam Houm on DAY 1

Reflections of comments (5)

- Crop water requirement
  → add as "activity 1.2.3"
- Water productivity
  → add as "activity 1.2.6"

(P3 of project document)

Time Frame



3. Project document to Field work

Project Doc. & Field work

Overall objective: To Improve Irrigation efficiency

Immediate objectives:
- To appraise system
- To develop LA's capacity
- To produce guideline
- To assessment capacity dev. needs

Project Doc. & Field work

Overall objective: To Improve Irrigation efficiency

Immediate objectives:
- To appraise system

Activities:
- Measurement point selection
- Flow measurement
- Conveyance efficiency measurement
- Water balance analysis
- System efficiency analysis
- Water productivity analysis
- Scheme management appraisal
- Rapid appraisal process, etc.

Project Doc. & Field work

Activities:
- Measurement point selection
- Flow measurement
- Conveyance efficiency measurement
- Water balance analysis
- System efficiency analysis
- Crop productivity analysis
- Scheme management appraisal
- Rapid appraisal process, etc.

Field observation
Data analysis:
- Preparation for data collection
- Irrigation efficiency assessment
- Water productivity assessment
- Scheme management appraisal
- Rapid Appraisal Process
- Others

Thank you very much
for your attention

Comparison of the objectives, outputs and activities

	1st draft		Revised
Overall obj	To improve irrigation efficiency in paddy fields in the Lower Mekong Basin		(ditto)
Immediate obj.	To introduce guidelines to improve irrigation efficiency based on actual water use conditions to member countries		to appraise irrigation efficiencies and the irrigation system based on modern concepts in the selected irrigation schemes
			to develop capacity of the line agencies in using up-to-date concepts of irrigation efficiencies and water balance and modern tools and procedures for their assessment
			to produce guidelines for improving irrigation efficiency based on actual water use conditions in the member countries
			to identify capacity development requirement of line agencies for better adoption of the guidelines in the member countries
Outputs	Actual conditions regarding water use at specific irrigation schemes representing agro-ecosystem of the basin analysed and documented		• Establishment of minimum set of data to evaluate irrigation efficiencies and irrigation system • Assessment of water balance, irrigation efficiencies and water productivity • Appraisal of scheme management • Rapid Appraisal Process
			• Backstopping note for the implementing agencies • Training workshop on RAP • National workshops in the project countries
	Guidelines to improve irrigation efficiency drafted		• Guidelines to improve irrigation efficiency
			• Report on assessment of existing capacity and recommendations for capacity development training of the line agency staff

	1st draft		Revised
Activities	• To measure actual water quantity of flow at 1) intake, 2) main, secondary and tertiary canals, and 3) paddy fields in several pilot project sites • To identify actual irrigated area on pilot project sites • To measure water requirement in depth on pilot project sites • To examine planned irrigation efficiency if exists • To calculate and analyse irrigation efficiency based on above observation and relevant outputs from other projects • To examine water distribution practices on pilot project sites • To document collected information		• Identifying and selecting the main diversion structures and canal sections for flow measurement, calibration, and monitoring • Measuring and monitoring flows at the selected points • Measuring conveyance efficiencies • Gathering information and conducting measurements on parameters required to assess water balance and crop water requirement – ETo, Rainfall, Deep percolation of rice; • Calculating crop water requirement • Conducting water balance based on the modern concepts • Assessing irrigation efficiency on the modern concepts • Assessing crop water productivity (yield per unit of water consumed, and yield per unit of water diverted) • Reviewing official and actual rules, principles and practices of water allocation, distribution and operation • Reviewing stakeholders' participation in decision-making regarding the water allocation and distribution • Organising data required to conduct RAP • Conducting RAPs in the selected irrigation schemes
			• Drafting the backstopping note including an overview of the modern concepts, and notes on field and secondary data collection and analysis • Backstopping the implementing agencies during the entire project implementation period, particularly during the data collection and analysis phase. • Organising and conducting RAP workshop • Organising national workshops in the member countries to discuss the outcomes of the data analysis
	• To review documents related to water management • To identify best practices of water management from reviewed documents • To analyse relation between actual irrigation efficiency and water distribution practice based on Output 1 • To draft institutional, managerial and technical guidelines (manuals) for irrigation facilities operation		• Reviewing the analysis data and relevant documents • Consulting with the relevant national and international organisations • Drafting the guidelines • Regional workshop to discuss and introduce the guidelines
			• Reviewing the guidelines, backstopping and other relevant reports • Interviewing the line agency personnel • Consulting with the relevant national and international organisations

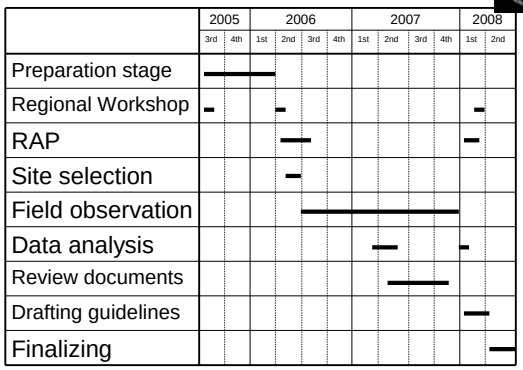
Follow-up of the first day's discussion

Okudaira Hiroshi
AIFP, MRCS

Budget allocation

	FY2005	FY2006	FY2007	Total
Int'l staff	135,000	120,000	125,000	380,000
Official travel	14,350	16,600	26,200	51,150
Int'l consultant	6,000		82,000	88,000
Riparian staff	17,200	40,000	40,000	97,200
Sub-contract	**60,000**	**100,000**		**160,000**
Workshop	23,800	22,900	21,800	68,500
Equipment	43,500	500	500	44,500
Reporting	1,000	1,000	2,000	4,000
Miscellaneous	1,453	1,303	4,803	7,559
Secretariat cost	39,299	39,299	39,299	117,897
Total	341,602	341,602	341,602	1,024,806

Time Frame



Improvement of Project Doc.

Reinforce "Justification" as;

- Related activities in the past
  including other MRC programmes
- Refer past experience
  e.g. draught in 2004
- Specify project beneficiaries

Immediate objectives

1. Appraise efficiency & system
2. Capacity development
3. Produce guideline

4. Identify capacity dev. Requirement
   → merged into "Capacity dev."

Outputs (#2,3)

[for Obj. #2]

- Backstopping note for relevant LA
- RAP training workshop
- National workshops
- Capacity building assessment report

[for Obj. #3]

- Guidelines to improve efficiency

[for Obj. #4]

Structure of Guideline

- Introduction & Concept
- Mapping Water Network
- Scheme Management Appraisal
- Water Balance (accounting)
- Improvements
- Improving manage. with users
- Information system
- Monitoring & evaluation

Structure of Guideline

2 options for final output

- Common guideline for general use
  or
- (4 sets) Specified for pilot scheme
  → applicable to similar schemes

Further consideration thru implementation

Thank you very much
for your attention

Annex 6

Presentations on the Rapid appraisal process and FAO's collaboration

RAPID APPRAISAL PROCEDURE TO ASSESS THE PERFORMANCE OF IRRIGATION SYSTEMS

AND

FAO COLLABORATION WITH MRC UNDER IIEPF

Thierry Facon

Senior Water Management Officer

FAO - Bangkok

Topics

- Introduction
- The RAP
- Some lessons
- FAO/MRC collaboration under IIERP

The need for a massive re-training of engineers and managers in irrigation agencies, consulting firms and Irrigation Service Providers in Asia

- farmers aspire to improved socio-economic well-being, evolve toward more commercial forms of agriculture and face the challenges of globalization
- water resources management is moving towards integrated water resources management in the river basins, and competition for water from other sectors is intensifying

=>knowledge and ways and means to design, manage and operate irrigation systems economically for good performance and adequate service to farmers

Why…

i/ evaluation of the performance of the introduction on modern water control and management practices

lack of knowledge of proper options a main reason for the mitigated success of irrigation modernization projects

ii/ the disappointing performance of irrigation management transfer and participatory irrigation management projects

failure of these reforms to improve service to farmers

iii/lack of attention to operation, design and other technical aspects of irrigation systems

technology matters, after all

iv/ problems with OFWM projects

the need to address all levels within the systems

An appraisal of initial conditions and performance of the systems to be transferred or improved

For:

- a definition of the service to be provided both by the irrigation service provider to water users associations (WUAs) and by WUAs to their members
- ways and means to achieve these service goals and improve them in the future
- a better design and strategic planning of physical and management improvements: formulation of objectives and plans to reach them

FAO's Regional Training Program on Irrigation Modernization, management improvement and benchmarking

- disseminating modern concepts of service-oriented management of irrigation systems
- promoting the adoption of effective irrigation modernization strategies in support of agricultural modernization, improvement of water productivity and integrated water resources management

Modernization

- "Irrigation modernization is a process of technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation schemes with the objective to improve resource utilization (labor, water, economics, environmental) and water delivery service to farms."

Since 2000

- training materials and detailed curricula
- specific tools for the appraisal of irrigation systems for benchmarking and the development of appropriate modernization plans for irrigation systems:
  Rapid Appraisal Procedure
- website: **www.watercontrol.org**

- first training workshop in Thailand in 2000
- Vietnam, Philippines, Nepal, Thailand, Indonesia, Malaysia, Turkmenistan, Pakistan, India (Andhra Pradesh), Afghanistan, China

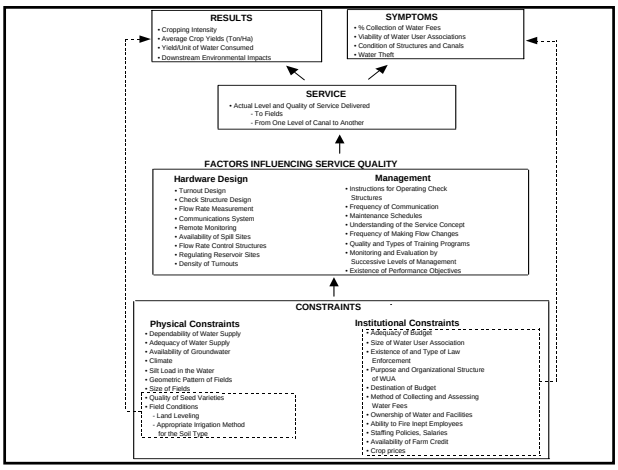
- **Thailand**

  the Royal Irrigation Department of Thailand is using the tools and methodologies introduced by the Program for the appraisal of projects (including the RAP), and has included the training workshops in its regular training program.
- **Vietnam**

  the World Bank-funded Vietnam Water Resources Assistance Project has a large irrigation modernization component based on the concepts introduced through training at project preparation stage. The RAP will be the basis for the national benchmarking system.

The Rapid Appraisal Procedure (RAP)

- Developed by the Irrigation Training and Research Centre (California Polytechnic University) for a research programme financed by the World Bank on the evaluation of impact on performance of irrigation systems of the introduction of modern control and management practices in irrigation
- Adopted for FAO's training programme
- Further developed to be more user-friendly, focus on water balance, produce IPTRID benchmarking indicators
- Adopted as one of the three tools of the World Bank's holistic benchmarking method
- available in English, Spanish, Thai, Indonesian, Vietnamese, Russian, Chinese



Primary / Sub Indicator	Ranking Criteria	W
Actual water delivery service to individual ownership units (e.g., field or farm)		
Measurement of volumes to the individual units (0-4)	4 – Excellent measurement and control devices, properly operated and recorded. 3 – Reasonable measurement and control devices, average operation. 2 – Useful but poor measurement of volumes and flow rates. 1 – Reasonable measurement of flow rates, but not of volumes. 0 – No measurement of volumes or flows.	1
Flexibility to the individual units (0-4)	4 – Unlimited frequency, rate, and duration, but arranged by users within a few days. 3 – Fixed frequency, rate, or duration, but arranged. 2 – Dictated rotation, but it approximately matches the crop needs. 1 – Rotation deliveries, but on a somewhat uncertain schedule. 0 – No established rules.	2
Reliability to the individual units (0-4)	4 – Water always arrives with the frequency, rate, and duration promised. Volume is known. 3 – Very reliable in rate and duration, but occasionally there are a few days of delay. Volume is known. 2 – Water arrives about when it is needed and in the correct amounts. Volume is unknown. 1 – Volume is unknown, and deliveries are fairly unreliable, but less than 50% of the time. 0 – Unreliable frequency, rate, duration, more than 50% of the time, and volume delivered is unknown.	4
Apparent equity to individual units (0-4)	4 – All fields throughout the project and within tertiary units receive the same type of water delivery service. 3 – Areas of the project receive the same amounts of water, but within an area the service is somewhat inequitable. 2 – Areas of the project receive somewhat different amounts (unintentionally), but within an area it is equitable.	4

The RAP Excel sheet

Objectives of RAP

- Provide a basis for making specific recommendations for modernization and improvement of water delivery service
- Provide a baseline for comparison of future performance after modernization
- Benchmarking for comparison against other irrigation projects

RAP Outputs

- External indicators
  - Examine inputs and outputs of the whole project
- Internal indicators
  - Examine processes and hardware within the project
- IPTRID Benchmark indicators
  - Mostly external indicators

External Indicators

- Ratios or percentages comparing project inputs and outputs to describe performance
- Expressions of forms of efficiencies related to budgets, water, yields, etc.
- Useful for formulating objectives
- Do not provide insight in how to improve performance

Example External Indicators

$$\frac{\text{Water Required}}{\text{Total Water Available}}$$

$$\frac{\text{Crop Yield}}{\text{Irrigation Water Delivered to the Fields}}$$

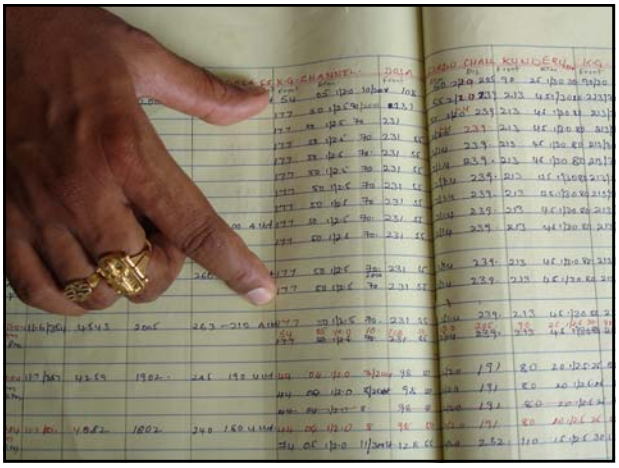
Internal Indicators

- Identify key factors related to water control throughout a project.
- Define level of water delivery service provided to users.
- Examine specific hardware and management techniques and processes used in the control and distribution of water.

- The RAP is incorporated into the training program that integrally involves local management and operation and maintenance staff.
- Staff:
  - learn the concepts of modernization and service orientation
  - are provided with a toolbox of options
  - evaluate their own project with the RAP

At the end of the training

- internal and external indicators are developed for the project and compared with other projects
- local staff develop a modernization strategy and a priority list for changes in software and hardware based on the internal process and service indicators (which appraise all factors that affect system performance and service delivery in a systematic and standardized manner) …
- to improve specific characteristics of service delivery at specific levels and address constraints …
- to achieve improvement objectives, defined by the external performance indicators …




HEAD REGULATOR

Summary findings

- high level of chaos (difference between stated policies and actual policies)
- high level of anarchy (subversion of policies) varies from system to system
- Recent investments following standard standards or investment strategies (command area development) have poor results in terms of performance, control and service.

Plans prepared by the trainees differ very significantly from their plans prior to the workshop.

- new technical options
- balanced investment in upgrading the capacity of management and farmers and in infrastructure, in infrastructure, communication and mobility for operation staff
- planned investment in infrastructure focuses much more on control and useful measurement as a priority

- Priority: changes in instructions to field staff for operation of control structures
- changes in internal organization
- improved procedures for ordering of deliveries
- an initial focus on restoring and improving water level control in the upper levels of the systems as prerequisites for further improvements and investments in the lower levels.
- the remote monitoring of spills, drains, and flow-rates at major offtakes as a basis for the establishment of feedback mechanisms, as well as for a better understanding of the water balance of the systems.

FAO Collaboration with MRC under IIEPF

FAO-RAP as the partner agency shall facilitate the implementation of IIEPF within the technical advisory function. Specific inputs by FAO-RAP, as described in the section 7.5 of Project Document, are to:

1) Dispatch one resource person to the inception workshop in order to provide comments and other related information to reinforce project concept
2) Dispatch two resource persons as lecturers to the approximately 4-day workshop on Rapid Appraisal Process (RAP) in order to contribute to capacity building of Line Agency staff
3) Dispatch one resource person for each of the four RAPs of approximately 5 days each in the MRC member countries and collaborate with MRC and Line Agency staff in order to assess the irrigation scheme performance
4) Identify an appropriate consultant to draft guideline to improve irrigation efficiency
5) Dispatch one resource person to the closing regional workshop and to each of the four closing national workshops in order to support the conclusion of the project including the comments on draft guideline

THANK YOU FOR YOUR ATTENTION

Annex 7

Presentation on the Field observation and Analysis work and its Working Agreement

Introduction of Field Observation and Data Analysis Work under IIEPF

Fongsamuth Phengphaengsy
P.O, AIFP, MRCS

Content

Part I : Expected Tasks by Line Agencies

Part II : Outline of the TOR

- Title of Working Agreement
- Implementing Agencies
- Duty Station
- Expected Outputs
- Expected Time Frame (Duration)
- Itinerary and Report
- Qualification of Implementing Team
- Responsibilities (Tasks)

2

Part I:

Expected Tasks by Line Agency

3

1. Preparation for Data Collection

(1) Identify appropriate pilot project site

(2) Prepare schematic plan of irrigation system

(3) Prepare scaled command area map of the irrigation scheme

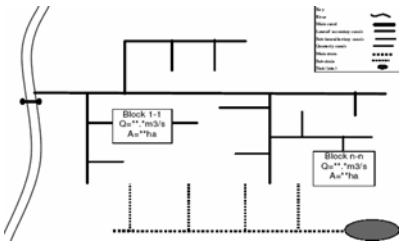
4

Site Selection Criteria

- Representation of agro-ecosystem or irrigation typology of the basin
- Accessibility
- Appropriate size
- Availability of relevant information

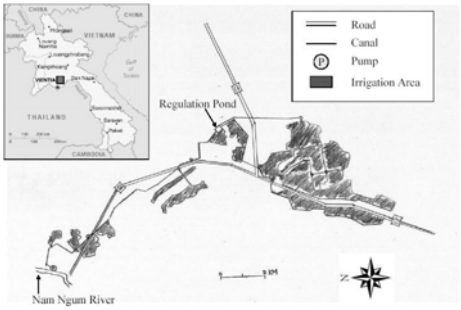
(Site selection to be discussed)

Schematic Plan of System



- Canal alignment and diversion structures
- Distance of the diversion structures and offtakes from the head of their parent canal
- Command area under each diversion work and planned water allocation (e.g. amount of water per ha), and design discharge (m3/s) or volume (m3)

Scale Command Area Map



Source : KM6 project , Laos

2. Assessment of Irrigation Efficiencies

***2-1 Conducting Water Balance*:**

***2-2 Assessment of Water Requirement*:**

***2-3 Calculation of Irrigation Efficiencies*:**

8

2. Assessment of Irrigation Efficencies

***2-1 Conducting Water Balance*:**

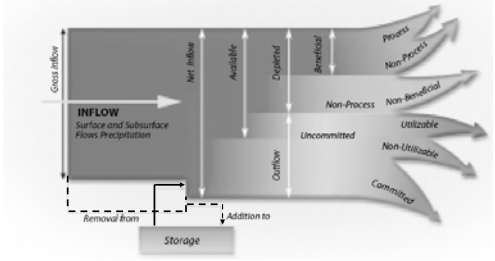
(4) Inflow & outflow measurements:

- **Identify measurement points**
- **Conduct measurement & calculate flow quantity**

9

Water Accounting Concept

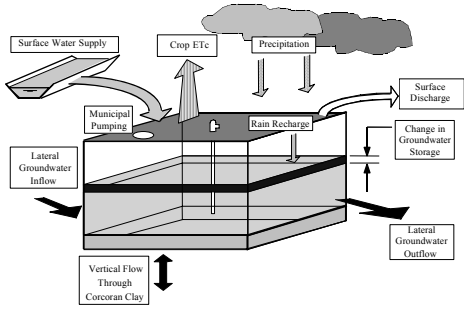
Different flow within a defined boundary and potential water use within boundary



Source: IWMI

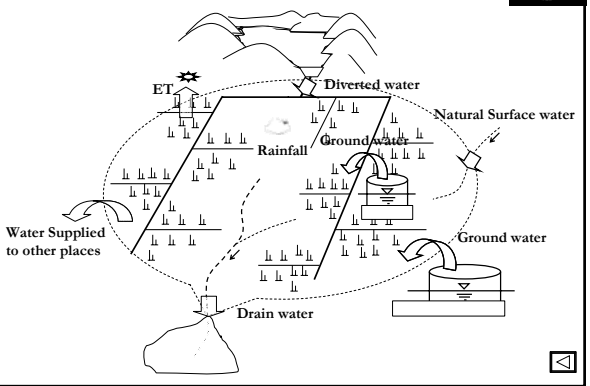
10

Water Balance Components

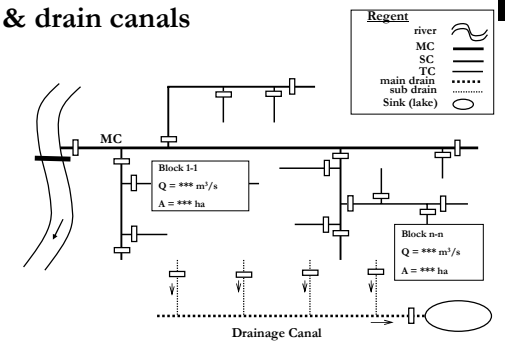


Source: FAO

Inflow & Outflow Measurements



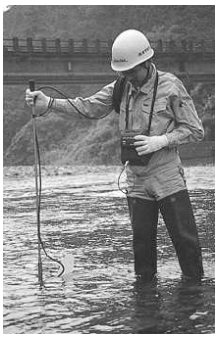
Flow measurement in irrigation & drain canals



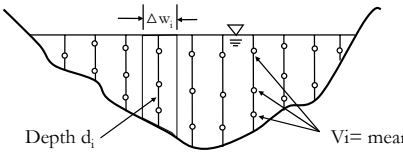
Conduct Measurement by

- **Current Meter**
  preferred method
- **Flume**
  if existing flumes are available & workable
- **Rated section of canal**
  needed to be produced to fill missing data

Measurement with Current Meter



Measurement with Current Meter



Vi= mean of velocity at 0.2; 0.6; and 0.8 depth

Calculate Flow Quantity

$V_i = 1/3 \times (V_i0.2 + V_i0.6 + Vi0.8)$

$a_i = d_i \times \Delta w_i$

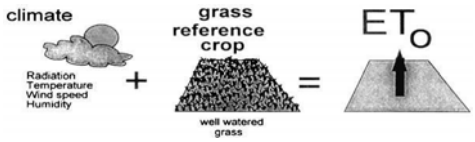
$q_n(\text{partial}) = V_n \times a_n \Rightarrow Q\ (\text{total}) = \sum_1^n V_n a_n$ OR $\sum_1^n q_n$

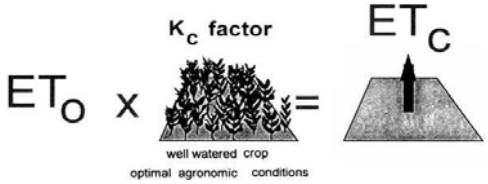
2. Assessment of Irrigation Efficiencies

2-2 Assessment of Water Requirement:

(5) **Obtain rainfall & other climate data**
(6) **Calculate or obtain ETo & Kc of paddy, fishpond, & other crops**
(7) **Calculate ETc based on ETo & Kc obtained**
(8) **Identify actual irrigated areas**
(9) **Record cropping pattern & crop calendar**
(10) **Record multiple use of irrigation water quantity (fishpond ..etc)**
(11) **Record water level changed in paddy and fishpond**
(12) **Calculate total scheme water requirement**

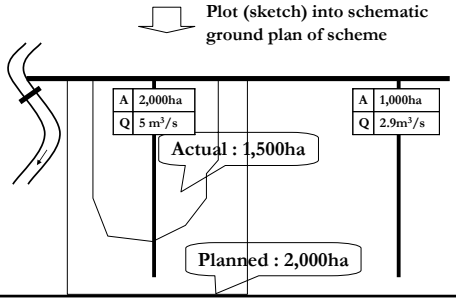
Calculate ET_C





Identify Actual Irrigated Areas

- Identify gap : planned & actual irrigated areas
- Interview gate operator, head of WUGs, water master, or farmers + cross check in the field (once a month)



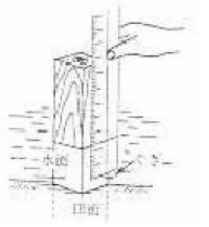
Cropping pattern and crop calendar

- Which crops are grown & how many ha ?
- Record date & period of each stage: *nursery*, *land preparation*, *transplanting*, *development*, & *harvest*

No	Crop	Ha & period of crop in command areas											
		Jan	Fab	Mar	Apr	May	Jun	Jul	Aug	Oct	Sep	Nov	Dec
1	Paddy 1						0.25 ha						
							800 ha			800 ha			
2	Paddy 2						0.3 ha						
							1000 ha			1000 ha			
3	Cucumber			10 ha									
4	Banana				10 ha								
5	Fishpond	5 ha								7 ha			

Water level in paddy field & fishpond

- Measure percolation in paddy field & fishpond
- Install a wooden log/pole in the paddy field & fishpond
- Record data water level changed every day



Crop Water Requirement

Paddy (CWR1)

$(ET_{paddy} = K_{paddy} \times ET_o) + Percolation$

Non-paddy crops (CWR2)

$(ET_{crops} = K_{crops} \times ET_o)$

Fishpond (FWR)

$(ET_{fishpond} = K_{fishpond} \times ET_o) + Percolation$

Total Water Requirement of Scheme

= CWR of scheme + Fishpond Water Requirement

2. Assessment of Irrigation Efficiencies

***2-3 Calculation of Irrigation Efficiencies*:**

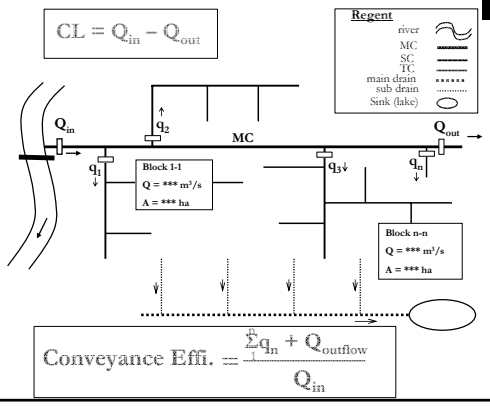
(13) Conduct conveyance losses test & calculate conveyance efficiency

(14) Calculate command area efficiency

23

Conveyance Efficiency

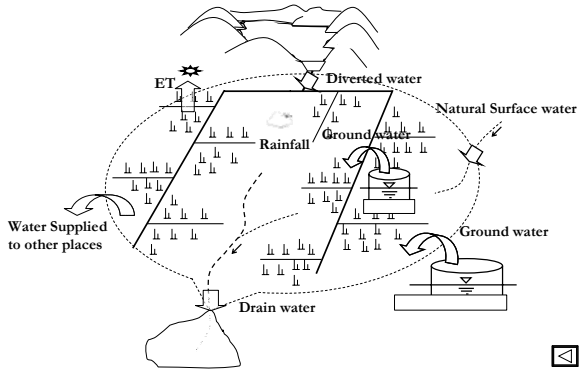
$CL = Q_{in} - Q_{out}$



$$\text{Conveyance Effi.} = \frac{\sum_i^n q_n + Q_{outflow}}{Q_{in}}$$

Overall Project Command Areas Efficiency

$$= \frac{\text{Total Water Requirement - Effective Rainfall}}{\text{Water Delivered to Users}} = \text{Inflow - Outflow}$$



3. Assessment of Water productivity

(15) Obtain yield of paddy through unit harvests & farmers interviews

(16) Calculate of water productivity
- Yield/unit of water diverted
- Yield/unit of water consumption

26

4. Scheme Management Appraisal

(17) Identify stakeholders

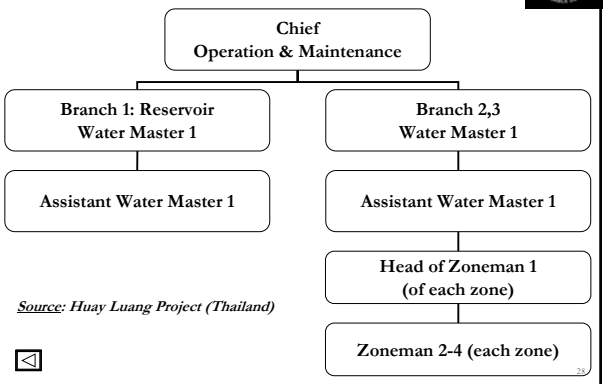
(18) Draw organisational charts of stakeholders

(19) Document procedure of decision making for water allocation

(20) Document operational rules and actual practices

27

Organization Charge of Stakeholders



Source: Huay Luang Project (Thailand)

28

5. RAPs

(21) Conduct RAPs

6. Others

(22) Facilitate technical backstopping by the MRCS made on demand provided by IIEPF project during the field observation period

(23) Take part in training workshop organized by MRCS

(24) Assist P.O. in collecting other intonation required

(25) Assist MRCS in organizing workshop in 2008

29

Part II:

Outline of TOR

30

Title of Working Agreement

Field observation and Data Analysis for Irrigation Efficiency on IIEPF

Implementing Agencies *(Tentative)*

- **Cambodia : MOWRAM / MAFF ?**
- **Lao PDR : MAF**
- **Thailand : RID**
- **Vietnam : To be discussed**

Duty Station

1 irrigation project site for each country member

31

Expected Outputs

Output 1 : Assessment of Efficiencies of the Selected Irrigation Schemes

Output 2 : Scheme Management Appraisal

Output 3 : Scheme Appraisal by RAP

32

Output 1: Ass. Irrigation effi.

- **Detailed map of system**
- **Water flow quantity at selected points**
- **Infiltration /Seepage/percolation rate**
- **Irrigation efficiencies**
- **Cropping pattern and crop calendars**
- **Water requirement for different water uses**
- **Precipitation and Evapotranspiration**
- **Crop water productivity values of paddy**

33

Output 2 : Management Appraisal

- **Organizational structure of different stakeholders**
- **Document of users' participation, decision making of water allocation**
- **Mechanism to decide water allocation and to put into practice**
- **Procedure and rules of operating system**

Output 3: Scheme Appraisal by RAP

- **Filled RAP sheets**

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Expected Time Frame *(Duration)*

Activities	2005		2006				2007				2008	
	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd
Working Duration				Aug.							Jan.	
Preparation of field work				Aug.		Mid. Oct.						
Field Measurement & Observation					Mid. Oct.						Dec.	
Data analysis						Jan.					Jan.	
RAP				Jul.	Aug.					Jan.		

35

Itinerary and Reports

Activities	Date
Commencement of working agreement	August 2006
Commencement of field observation	October 2006
Interim report	May 2007
Draft final report	November 2007
Final report	January 2008

***Note* : Reports cover Output 1; 2; and 3**

36

Composition and Qualification of Implementing Agency Teams

- **Team: 3 - 5 members**
- **Work in the field for long hours, and willing to learn new concepts and tools**
- ***Team head*: master degree or equivalent with minimum 7 years of experience**
- ***Members*: educational & practical background**
  - **water resources development and management**
  - **irrigation project appraisal and survey**
  - **irrigation or water resources development project planning**
  - **hydrological observation and analysis**

37

Tasks or Responsibilities

1. Preparation for Data Collection
2. Assessment of Irrigation Efficiencies
3. Assessment of Water Productivity
4. Scheme Management Appraisal
5. RAPs
6. Others

38

1. Preparation for Data Collection

(1) **Identify appropriate pilot project site**

(2) **Prepare schematic plan of irrigation system**

(3) **Prepare scaled command area map of the irrigation scheme**

39

2. Assessment of Irrigation Efficiencies

***2-1 Conducting Water Balance*:**

(4) **Inflow & outflow measurements:**
- **Identify measurement points**
- **Conduct measurement & calculate flow quantity**

40

2. Assessment of Irrigation Efficiencies

***2-2 Assessment of Water Requirement*:**

(5) **Obtain rainfall & other climate data**

(6) **Calculate or obtain ETo & Kc of paddy, fishpond, & other crops**

(7) **Calculate ETc based on ETo & Kc**

(8) **Identify actual irrigated areas**

(9) **Record cropping pattern & crop calendar**

(10) **Record multiple use of irrigation water quantity (e.g. fishpond …etc)**

(11) **Record water level changed in paddy and fishpond**

(12) **Calculate total scheme water requirement**

41

2. Assessment of Irrigation Efficiencies

***2-3 Calculation of Irrigation Efficiencies*:**

(13) **Conduct conveyance losses test & calculate conveyance efficiency**

(14) **Calculate command area efficiency**

42

3. Assessment of Water Productivity

(15) Obtain yield of paddy through unit harvests & farmer interviews

(16) Calculate Water Productivities:
- Yield/unit of water diverted
- Yield/unit of water consumption

43

4. Scheme Management Appraisal

(17) Identify stakeholders for decision making of water distribution practice

(18) Draw organization charts of stakeholders

(19) Document procedure of decision making for water distribution

(20) Document operation rules & actual practice of water delivery to users

44

5. RAPs

(21) Conduct RAPs

6. Others

(22) Facilitate technical backstopping by the MRCS, on demand by implementing agency during the field observation period

(23) Take part in the training workshop organized by MRCS

(24) Assist P.O. in collecting other information required

(25) Assist MRCS in organizing workshop in 2008

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Thank you for your attention

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Annex 8

Presentations on the Introduction of candidate pilot project sites

First Regional Workshop

on

IIEPF PROJECT

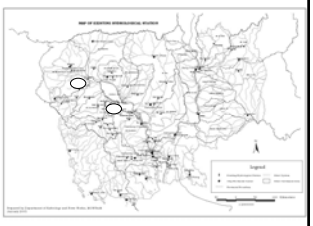
Prepared by: Dr. Theng Tara,
Ministry of Water Resources & Meteorology
Vientiane, 03 May 2006

Proposed Sites Selection for IIEPF

Two proposed sites have been selected:

- ***Kamping Puoy*** (Battambang province) is another type of irrigation system in Cambodia, water is stored in the reservoir during the wet season and it will be used for supplement irrigation in wet season and the dry season irrigation downstream of the reservoir.

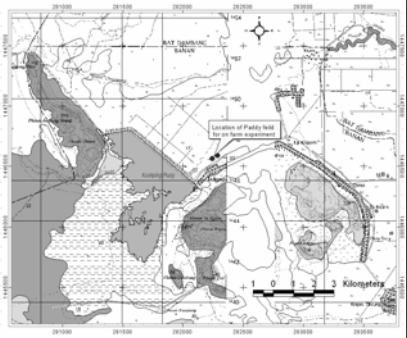
- ***Boeng Kanthor*** irrigation system (Pursat province) is a typical of the irrigation scheme that collected water from the river or stream and serves the wet and dry rice cropping in Cambodia.



1. *Kamping Puoy irrigation system*

Location

Kamping Puoy irrigation system:
Ta Kream commune, Banan district, around 32 Km from Battambang town.
-Capacity 110 mill m³
-Catchment 1347Km²
--wet 30000 ha
--dry 2000 ha
-Length of dam 4Km
-Two main gates

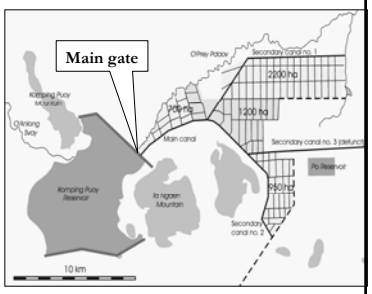


Command view of Kamping Puoy irrigation system

-1998 Italian though APS was reconstructed main gate.

-1999 was reconstructed :
1- 700ha
2- 1200ha

-2000 By Japan
1- 500ha
2- 450ha



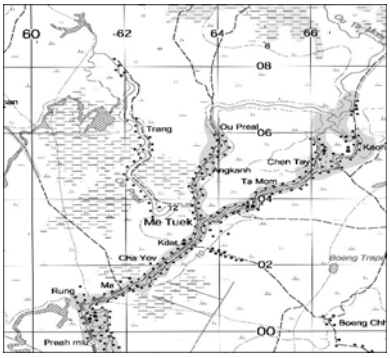
Main Canal

Reservoir

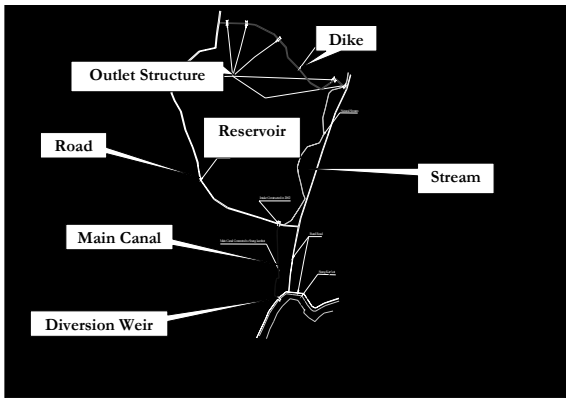
2. Boeng Kanthor Irrigation system

Location

Boeng Kanthor Irrigation system is located in Meteuk Commune, Bakan District, Pursat Province and about 39 Km from Pursat Town .It was originally constructed during the Pol Pot regime in 1978 and rehabilitated in 2002.



2. Boeng Kanthor Irrigation system



- Dyke 1,595m
- Top width 4m
- Two main structures:
  - one intake and
  - four culverts

-Wet Rice cropping 200 ha
-(May- December)
-Dry Rice cropping 30 ha
- (December - March)
-Yield 1.5T/ha- 2.5T/ha

Existing Infrastructure with 8 stop logs

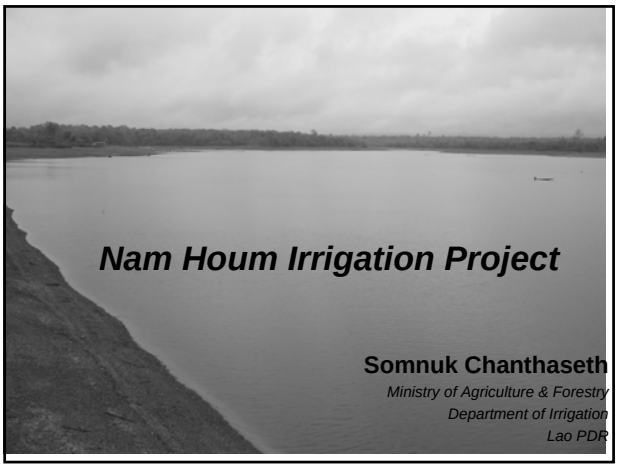
Existing Culvert

Existing Main Canal

THANK YOU

FOR

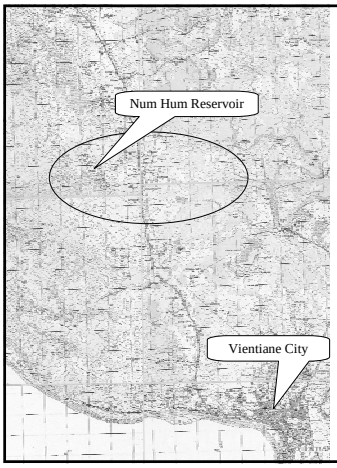
YOUR KIND ATTENTION



Nam Houm Irrigation Project

Somnuk Chanthaseth
Ministry of Agriculture & Forestry
Department of Irrigation
Lao PDR

CONTENTS



1. LOCATION

- **Located in Vientiane Capital**
- **35 Km from Vientiane Capital City by road No. 13 to the north**
- **Project areas cover two districts:**
  - **Naxaythong District**
  - **Xaythany District**

2. PPOJECT BACKGROUND

- **Project Type :**
  Gravity Basin Irrigation
- **Project objectives:**
  - **Mainly supply water for paddy rice & cash crops in dry-season**
  - **Supplementary supply water for paddy & cash crops in wet season**

2. PROJECT BACKGROUND (1)

Constructed in 3 phases:

Phase 1 : 1978 - 82
The construction works included: Dam, intake, spillway, main canal, and some on - farm canals (irrigated 150 ha) by govt. budget with loan from OPEC & grand aid from Japanese govt.

Phase 2 : 1990 - 93
N1 secondary canal (400 ha) with financial assistance from Italian govt. through interim Mekong Committee.

Phase 3 : 1997- 2000
Additional main canal (2.3 km) , secondary and the remaining canals (completed 3000ha) by govt budget.

3. PRESENT CONDITION

- Total Command Area
  - Wet Season: 3,000 ha
  - Dry Season: 2,400 ha
    (2005-06)
- Benefit families
  - 17 villages
  - 19,879 persons
- Crops
  - Paddy 98% of total areas
  - Crops 2% of total areas

3. PRESENT CONDITION (1)

Reservoir

- **Catchment area : 108 km²**
- **Annual inflow : 149.5 MCM**
- **Storage Capacity**
  - **Maximum 60 MCM**
  - **Active 54 MCM**
  - **Death 6 MVM**
- **Elevation**
  - **Maximum Flood 190.100 m**
  - **Crest of dam 192.200 m**
  - **Spillway 189.100 m**
  - **Intake 178.800 m**

3. PRESENT CONDITION (2)

On farm System

- **Canals**
  - **Total Length 60.635 km**
  - **Main L : 9.300 km**
    - **Q (design) : 6.700 m³/s**
    - **Q (actual) : 4.460 m³/s**
  - **Preliminary L : 30.014 km**
  - **Secondary L : 16.827 km**
  - **Tertiary L : 4.500 km**
- **Structures**
  - **367 structures**

3. PRESENT CONDITION (3)

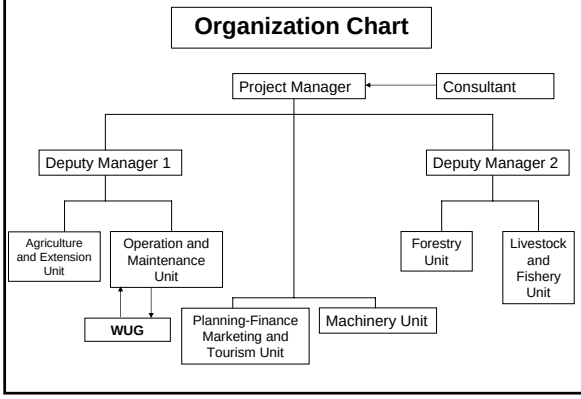
On farm System

- **Organization**
  - **No. of WUGs: 11 Groups**
  - **Members:**
  - **Permanent 960 members**
  - **Temporary 380 members**
- **Financial**
  - **ISF 150,000 Kip/ha**
  - **or 120 kg (paddy)/ha**
  - **% of collected 46% (2004 - 05)**

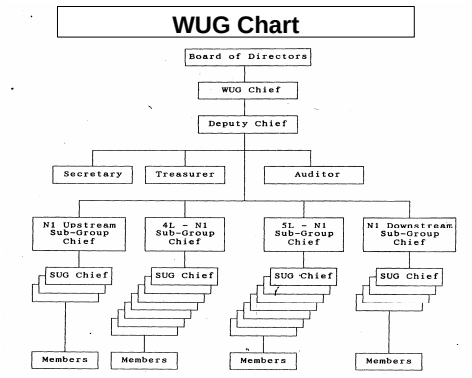
4. WATER MANAGEMENT ACTIVITIES

- Project Authority
  - Responsible for head work & main canal
  - Coordination with water user groups and other stakeholders
  - Making plan for water supply & cultivation
  - Monitoring gate operation
- Water User Group
  - Responsible for distribution from secondary canal up to farm level in their own group zone
  - Recording & checking actual irrigated or planted areas
  - Collection of Irrigation Service Fee (ISF)

4. WATER MANAGEMENT ACTIVITIES (1)



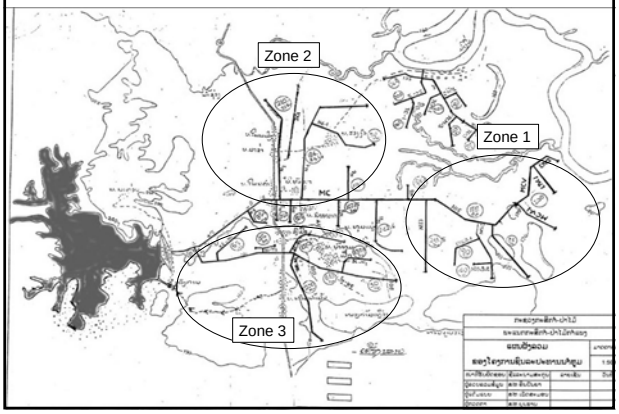
4. WATER MANAGEMENT ACTIVITIES (2)



4. WATER MANAGEMENT ACTIVITIES (3)

- Areas are divided into 3 zones for water distribution
  - Management is ranged from zone 1 to zone 3
  - Areas of 3 zone are cultivated in different time
  - Project staff closely cooperate with WUG for these activities
- In case of enough water or reservoir water level $\geq$ 189. 100m(60MCM), full areas of 2400ha are irrigated
- When water level under normal level, cultivated areas are estimated according to water storage. e.g. In 2003, water level of 186.410m (36MCM) could irrigate only1400 ha

4. WATER MANAGEMENT ACTIVITIES (4)



4. WATER MANAGEMENT ACTIVITIES (5)

Water Requirement Applied for 3 zones

Water Supply of the Nam Houm Irrigation Project at the Intake m^3/s

Month	Week	Area S1=696 ha			Area S2=1,114 ha			Area S3= 691ha			Total	Remark
		Land soaking	Land Preparation	Crop water require	Land soaking	Land Preparation	Crop water require	Land soaking	Land Preparation	Crop water require		
	1											
	2											
	3	1.93									1.93	
11	4	2.21	0.3		0.89						3.40	
	1		0.62		2.08	0.42					9.02	
	2		0.81	0.42	1.19	0.97	0.44	0.86			4.69	
	3			1.11		0.56	1.48	1.71	0.13		4.99	
12	4			1.11			2.07		0.54		4.12	
	1			1.11			2.07		0.8	0.71	4.69	
	2			1.11			2.07			1.26	4.46	
	3			1.11			2.07			1.26	4.46	
1	4			1.11			2.07			1.26	4.46	
	1			1.11			2.07			1.26	4.46	
	2			1.11			2.07			1.26	4.46	
	3			1.11			2.07			1.26	4.46	
2	4			1.11			2.07			1.26	4.46	
	1			1.11			2.07			1.26	4.46	
	2			1.11			2.07			1.26	4.46	
	3			0.69			1.63			1.26	3.60	
3	4			0			0.59			1.26	1.87	
	1						0			0.57	0.57	
	2									0		
	3											
4	4											

4. WATER MANAGEMENT ACTIVITIES (6)

Constraints

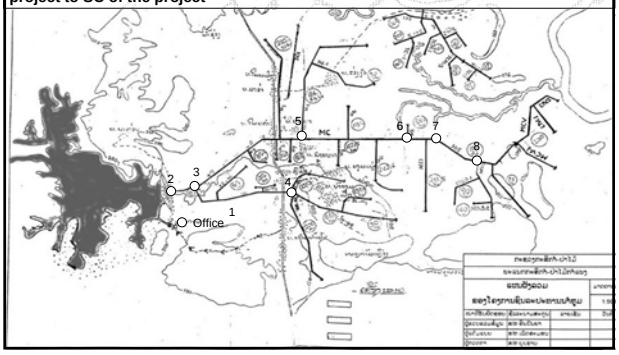
- Poor canal condition cause much water leakage
- Low skills know-how in proper management
- Lax enforcement regulation
- Difficulty of water collection from farmers due to farmers lack of responsibility and weakness scheme participatory

5. AVAILABLE DATA

- Water level of Reservoir (1993-now)
- Discharge of intake (main canal):
  - Q design : 6.7 m^3/s
  - Q actual application : 4.46 m^3/s
- Annual rainfall (1993-now)
- Evaporation rate (1993 - 94)
- Water requirement data (1994)

6. FIELD TRIP

1 : Office ;2: Dam & main intake;3: N1 intake ;4: N1- water control point ;5: N2 intake ; 6 : flooded point 7: Water control point ; 8: changed from MC of pump project to SC of the project




Thank You for your
Kind Attention
Main Canal
Check Structure

Introduction Candidate Huayluang Pilot Project

Regional Irrigation Office 5
Royal Irrigation Department
Ministry of Agriculture and Cooperatives

By Thai National Mekong Committee

May 2006

Huay Luang Project

Muang District
Udonthani Province

Large scale project with reservoir

PIM activities

Project site in phase I

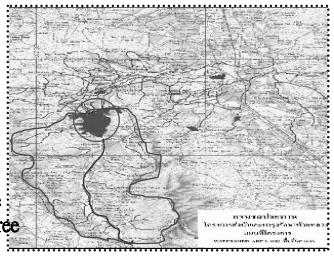
On-farm system

Availability of relevant data

Geographical Condition

Located at Ban KokSa-Ard
Tambon KokSa-Ard
Amphur Muang
Udonthani Province

Located at 48 QTE 455-222
Latitude at 17.3 North Degree
Longtitude at 120.4 East Degree



Rainfall Area 660 Km. Square
Project Area 100,595 Rai
Right side Irrigation Area 37,267 Rai
Left side Irrigation Area 49,720 Rai
Total of Irrigation Are 86,987 Rai

Project Background

Huayluang Irrigation and Maintenance Project is large earth dam in area of Irrigation Regional Irrigation Office 5 Udonthani Province

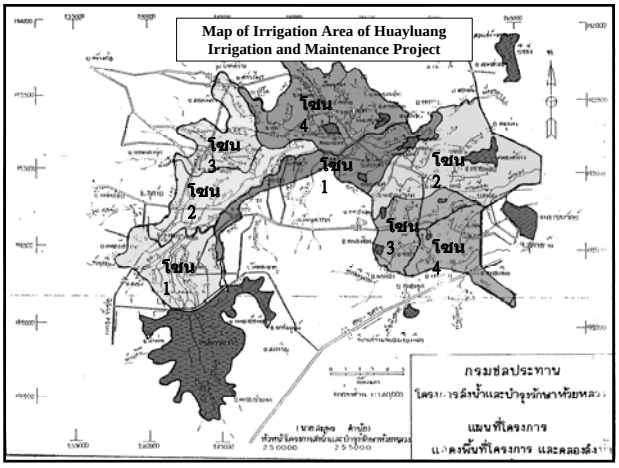
Background

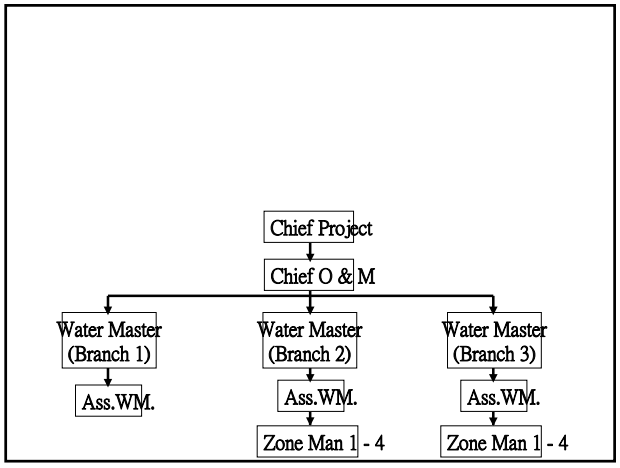
1933 Started project by investigating landscape and requested for budget of construction reinforced concrete dam at Ban HuaKua Tambon KudJab, Amphur KudJab, Udonthani

1940 Constructed drainage concrete dam with capacity 1.5 mcm. together with dredging main irrigation canal Right side long 28.500 km. Agricultural area is 40,000 rai (6,400 ha.)

1970 RID considered dam construction above existing dam at Ban KokSa-Ard, Tambon KokSa-Ard, Amphur Muang, Udonthani

1984 Constructed Huayluang dam with capacity 118 mcm. with irrigation system Project area is 100,595 rai (16,095 ha.)





RMC Head regulator

- Pipe 2 x Dia 1.75 meter
- Length 26.30 meter
- Capacity 10.384 cu.m./sec.
- Pipe invert ele. 195.783 meter (msl)

LMC Head regulator

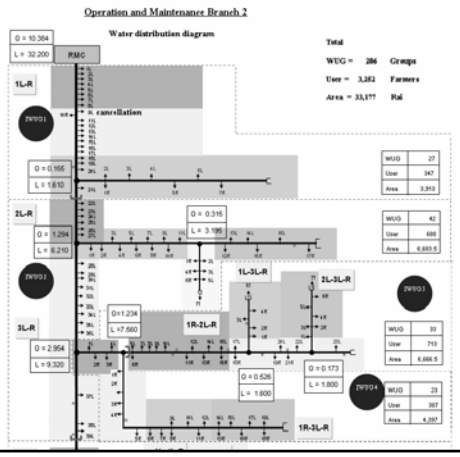
- Pipe 2 x Dia 1.75 meter
- Length 26.30 meter
- Capacity 12.105 cu.m./sec.
- Pipe invert ele. 194.834 meter (msl)

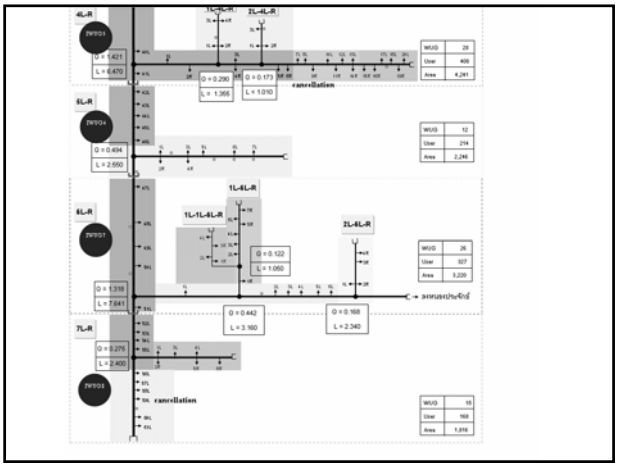
Spillway

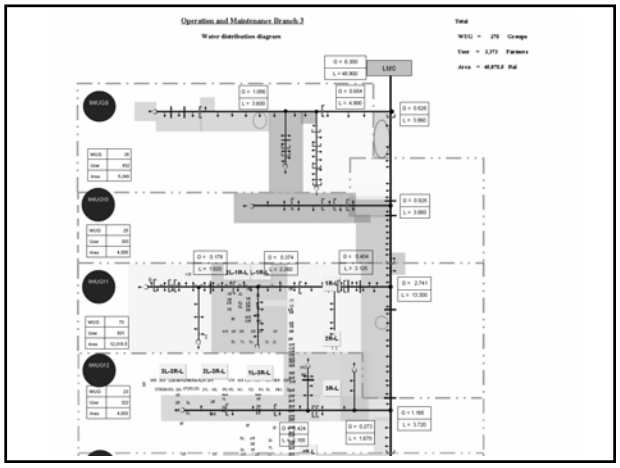
- Radial gate
- Size 3 - 5.80 x 6.00 meter
- Maximum flow 710 cu.m./sec.
- Invert elevation 195.324 meter (msl)

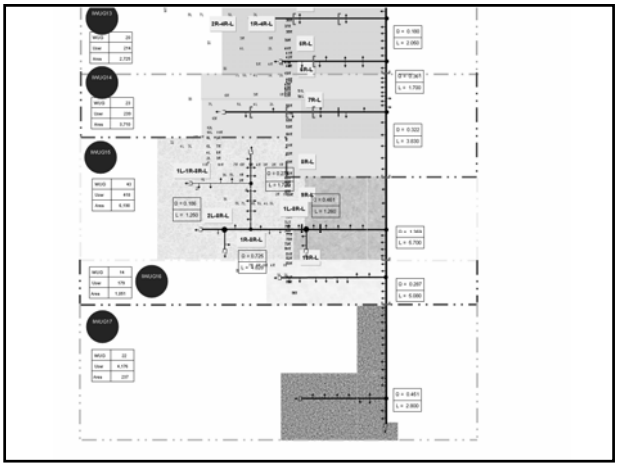
Emergency spillway

- Ogee wier width of 120 meter
- Average depth 1.20 meter
- Maximum flow 500 cu.m./sec.
- Bottom elevation 201.700









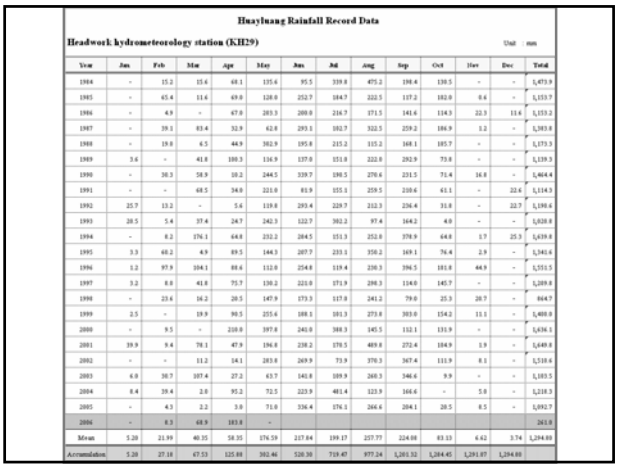
Huay Luang O&M Project

Records of crop calendar in the on-farm Huayluang project

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice Korkor 6,8												

Seedlings
Transplanting
Growth
Harvest

Remark : Dry season start form January-May (ave 619 kg/ra)
Wet season start form June - October (ave 652 kg/ra)

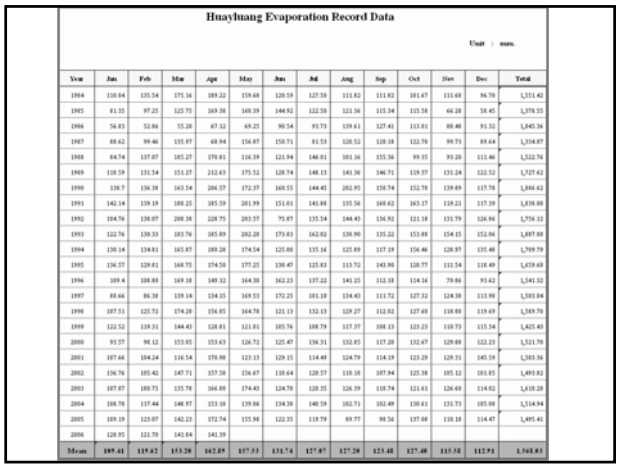


Huayluang Rainfall Record Data

Headwork hydrometeorology station (KH29)

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1984	-	15.2	15.4	68.1	135.4	95.5	339.8	475.2	198.4	130.5	-	-	1,473.9
1985	-	65.4	11.6	69.0	128.0	252.7	184.7	222.5	117.2	182.0	8.6	-	1,153.7
1986	-	4.8	-	67.0	283.3	209.0	216.7	171.5	141.6	114.3	22.3	11.6	1,153.2
1987	-	39.1	83.4	32.9	62.8	293.1	102.7	322.5	259.2	186.9	1.2	-	1,383.8
1988	-	19.8	6.5	44.9	362.9	195.8	215.2	115.2	168.1	185.7	-	-	1,173.3
1989	3.6	-	41.8	100.3	116.9	137.0	151.8	222.0	292.9	73.8	-	-	1,139.3
1990	-	36.3	58.9	10.2	244.5	339.7	190.5	270.6	231.5	71.4	16.8	-	1,464.4
1991	-	-	68.5	34.0	221.0	81.9	155.1	259.5	210.6	61.1	-	22.6	1,114.3
1992	25.7	13.2	-	5.4	119.8	293.4	229.7	212.3	236.4	31.8	-	22.7	1,190.4
1993	20.5	5.4	37.4	24.7	242.3	122.7	362.2	97.4	164.2	4.0	-	-	1,020.8
1994	-	8.2	176.1	64.8	232.2	264.5	151.3	252.0	378.9	64.8	1.7	25.3	1,639.8
1995	3.3	60.2	4.9	89.5	144.3	207.7	233.1	350.2	169.1	76.4	2.9	-	1,341.6
1996	1.2	97.9	104.1	88.6	112.0	254.0	119.4	230.3	396.5	101.8	44.9	-	1,551.5
1997	3.2	8.8	41.8	75.7	130.2	221.0	171.9	296.3	114.0	145.7	-	-	1,209.8
1998	-	23.6	16.2	20.5	147.9	173.3	117.8	241.2	79.0	25.3	20.7	-	864.7
1999	2.5	-	19.9	90.5	255.6	188.1	101.3	273.8	303.0	154.2	11.1	-	1,400.0
2000	-	9.5	-	210.0	397.8	241.0	388.3	145.5	112.1	131.9	-	-	1,636.1
2001	39.9	9.4	78.1	47.9	196.8	238.2	170.5	469.8	272.4	104.9	1.9	-	1,640.8
2002	-	-	11.2	14.1	283.6	269.9	73.9	370.3	367.4	111.9	8.1	-	1,510.6
2003	6.0	30.7	107.4	27.2	63.7	141.8	109.9	260.3	346.6	9.9	-	-	1,103.5
2004	8.4	39.4	2.0	95.2	72.5	223.9	481.4	123.9	166.6	-	5.0	-	1,218.3
2005	-	4.3	2.2	5.0	71.0	336.4	176.1	266.6	204.1	28.5	8.5	-	1,092.7
2006	-	8.3	68.9	183.8	-								261.0
Mean	5.20	21.99	40.35	58.35	174.59	217.84	199.17	257.77	224.08	83.13	6.62	3.74	1,294.80
Accumulation	5.20	27.18	67.53	125.88	392.46	520.30	719.47	977.24	1,201.32	1,284.45	1,291.07	1,294.80	



Huayluang Evaporation Record Data

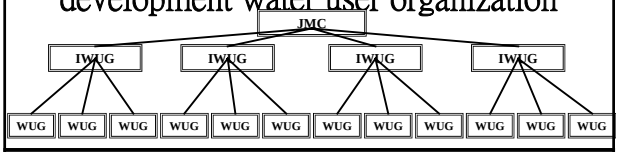
Unit : mm.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1984	110.04	135.54	175.16	189.22	159.68	120.59	127.58	111.82	111.82	101.47	111.48	96.70	1,551.40
1985	81.35	97.25	125.75	169.38	160.39	144.92	122.58	121.36	115.34	115.58	66.28	58.45	1,378.55
1986	56.83	52.86	55.28	67.32	69.25	90.54	93.73	139.61	127.41	113.91	88.48	91.32	1,045.36
1987	88.62	99.46	135.97	68.94	154.87	150.71	81.53	120.52	128.18	122.70	99.73	89.64	1,334.87
1988	84.74	137.07	185.27	170.81	116.39	121.94	146.01	101.16	155.36	99.35	93.20	111.46	1,522.76
1989	118.59	131.54	151.27	212.43	175.52	128.74	148.13	141.36	146.71	119.37	131.24	122.52	1,727.62
1990	138.7	136.38	163.54	206.57	172.37	160.55	144.45	202.95	158.74	152.78	139.89	117.78	1,894.62
1991	142.14	139.19	188.23	185.59	201.99	151.01	141.88	135.56	160.62	163.17	119.21	117.39	1,838.88
1992	104.76	138.07	208.38	228.75	203.57	75.87	135.54	144.43	136.92	121.18	131.79	126.86	1,754.12
1993	122.76	130.33	183.74	185.89	202.28	173.83	162.02	138.90	135.22	153.88	154.15	152.06	1,887.08
1994	130.14	134.81	165.87	180.28	174.54	125.00	135.16	125.89	117.19	156.46	128.97	115.46	1,709.79
1995	136.57	129.81	168.75	174.50	177.25	138.47	125.83	113.72	143.90	120.77	111.54	118.49	1,659.68
1996	109.4	108.88	169.18	149.32	164.30	162.23	137.22	141.25	112.18	114.16	79.86	93.62	1,541.32
1997	88.66	86.38	139.14	134.15	169.53	172.25	101.10	134.43	111.72	127.32	124.38	113.96	1,503.04
1998	107.51	125.72	174.20	156.85	164.78	121.13	132.13	129.27	112.02	127.68	118.80	119.69	1,589.78
1999	122.52	119.31	144.43	128.81	121.81	105.76	108.79	117.37	108.13	123.23	110.73	115.34	1,425.43
2000	93.57	98.12	153.05	153.63	126.72	125.47	136.31	132.85	117.20	132.47	129.88	122.23	1,521.78
2001	107.66	104.24	116.54	170.98	123.13	129.15	114.49	124.79	114.19	123.29	129.31	145.59	1,503.36
2002	136.76	105.42	147.71	157.58	156.67	118.64	120.57	110.18	107.94	125.38	105.12	101.05	1,493.02
2003	107.87	100.75	135.78	166.88	174.45	124.78	128.35	126.39	110.74	121.61	126.68	114.02	1,618.20
2004	108.78	117.44	148.97	153.18	139.86	134.38	140.59	102.71	102.49	130.63	131.73	105.08	1,514.94
2005	109.19	123.07	142.23	172.74	155.98	122.35	119.79	89.77	90.56	137.08	110.18	114.47	1,495.41
2006	110.95	121.70	141.64	141.39									
Mean	109.41	119.62	153.28	162.89	157.33	131.74	127.87	127.28	123.48	127.48	115.58	112.91	1,568.83

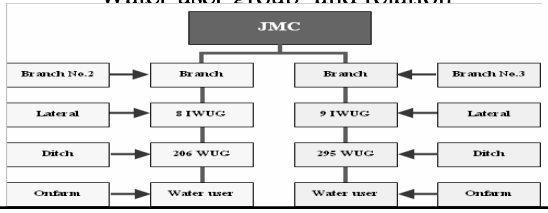
Water Requirement in Huayluang Reservio

No.	Activity	Wet Season (mcm.)	Dry Season (mcm.)	Total (mcm.)
1	Agriculture	53	30	83
2	Water Supply in Udontanee Province	12	12	24
3	Water Supply in Kud Jab District	0.12	0.12	0.24
4	Water Supply in Nong Wua Saw District	0.15	0.15	0.30
5	Water Supply in Other 60 Villages	0.30	0.30	0.60
6	Industries	0.40	0.40	0.80
7	Flood Mitigation	Depend on Flood		

Strengthening farmer groups and development water user organization



Water user group and relation



Thank you for your attention

IMPROVEMENT OF IRRIGATION EFFICIENCY ON PADDY FIELDS IN THE LOWER MEKONG BASIN PROJECT (IIEPF)

OUTLINE OF THE CANDIDATE PILOT PROJECT SITE(S) IN THE MEKONG DELTA OF VIETNAM

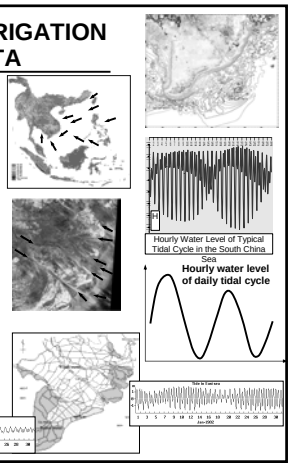
BACKGROUND ON IRRIGATION IN THE MEKONG DELTA

- The total of irrigated paddy fields is about 1,5 million ha (Winter-Spring / Summer-Autumn crops).
- Common irrigation scheme in the Mekong Delta:
  - ✓ Forming 3 levels of canals: Main/secondary/tertiary
  - ✓ Combining Irrigation and drainage purposes
  - ✓ Common area: 300-3.000 ha
- Present Irrigation practices:
  - ✓ Storing flood water
  - ✓ Pumping (small pumps, moving boats, electric pumps…)
  - ✓ Gravity (free open, sluices, culverts…)
- Almost paddy fields are affected by tide in the dry season

IIEPF

BACKGROUND ON IRRIGATION IN THE MEKONG DELTA

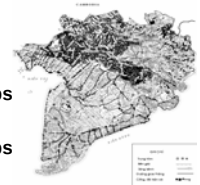
- The Mekong Delta effected by tides from South China Sea & the Gulf of Thailand.
- South China Sea: Unregular Semi-diurnal regime with amplitue 2.5-4.0 m.
- The Gulf of Thailnd: Mixed diurnal with amplitude 0.8-1.2 m.
- Tidal cyle: Daily, Hatf-lunarmonthly (15-days), yearly &multi-years.



IIEPF

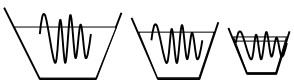
BACKGROUND ON IRRIGATION IN THE MEKONG DELTA

- Common irrigation scheme in the Mekong Delta:
  - ✓ Forming 3 levels of canals: Main/secondary/tertiary
  - ✓ Combining Irrigation & drainage purposes
  - ✓ Common area: 300-3.000 ha
- Existing crop patterns:
  - ✓ 3-rice crops / 2- rice crops
  - ✓ 2-rice crops+vegetation/upland crops
  - ✓ 2-rice crop + fish
  - ✓ 1-rice crop + vegetation/upland crops
  - ✓ 1-rice crop + fish/prown
  - ✓ Perrenial crop (Industrial tree/Fruit tree crops)



IIEPF

BACKGROUND ON IRRIGATION IN THE MEKONG DELTA



- Common sizes of canal system in the Mekong Delta:
  - ✓ Main canal:
    - Width of bottom: 25 – 40 m / Width of surface: 40 – 100 m
    - Elevation of bottom: -3.0 – -4.5 m / Depth of water: 4.0 – 6.0 m
    - Amplitute of tide at the head & the end of canal: 2.5 – 3.5 m
  - ✓ Secondary canal:
    - Width of bottom: 15 – 30 m / Width of surface: 20 – 50 m
    - Elevation of bottom: -2.0 – -3.5 m / Depth of water: 3.0 – 4.5 m
    - Amplitute of tide at the head & the end of canal: 2.0 – 3.0 m
  - ✓ Tertiary canal:
    - Width of bottom: 6 – 12 m / Width of surface: 10 – 25 m
    - Elevation of bottom: -1.0 – -2.5 m / Depth of water: 2.0 – 3.5 m
    - Amplitute of tide at the head & the end of canal: 1.5 – 2.5 m

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BACK-GROUND ON IRRIGA-TION IN THE MEKONG DELTA

- Esixting irrigation system in the Mekong Delta

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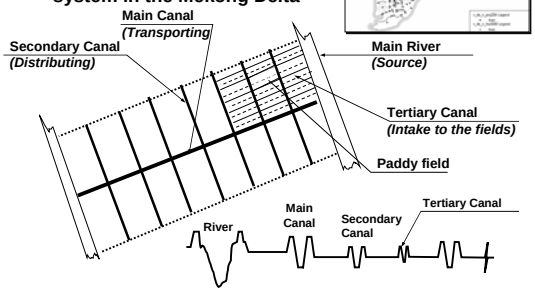
BACKGROUND ON IRRIGATION IN THE MEKONG DELTA

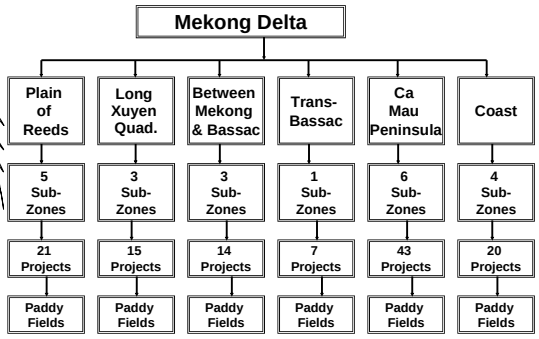
- Common irrigation & drainage system in the Mekong Delta



IIEPF

BACKGROUND ON IRRIGATION IN THE MEKONG DELTA

- Zonning Water Resources Projects and Water Balance in the Mekong Delta



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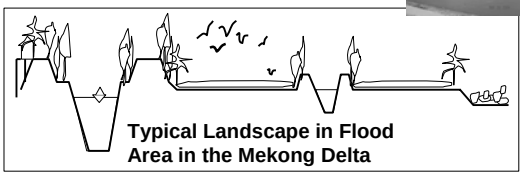
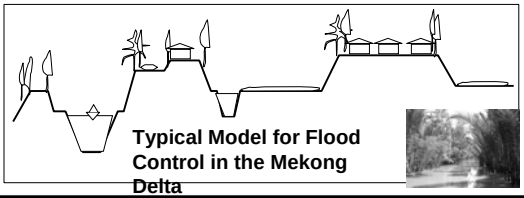
BACKGROUND ON IRRIGATION IN THE MEKONG DELTA



Typical Landscape in Flood Area in the Mekong Delta

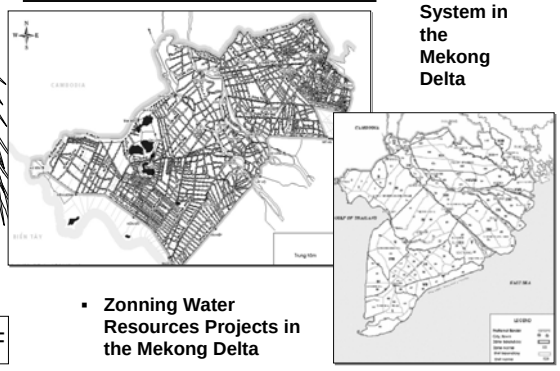


Typical Model for Flood Control in the Mekong Delta

IIEPF

BACKGROUND ON IRRIGATION IN THE MEKONG DELTA

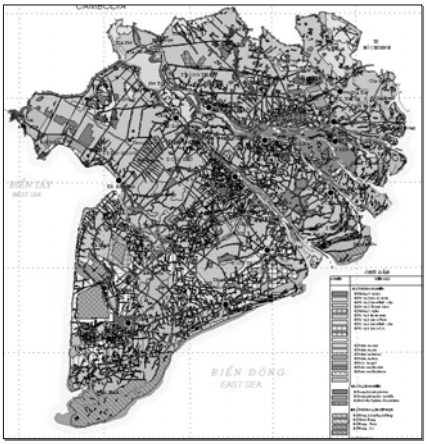
- Canal System in the Mekong Delta



- Zonning Water Resources Projects in the Mekong Delta

IIEPF

BACKG-ROUND ON IRRIGA-TION IN THE MEKONG DELTA



- Esixting Land use in the Mekong Delta

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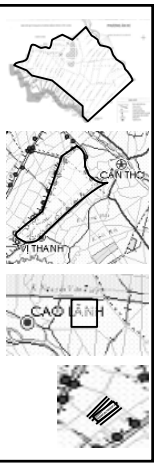
GENERAL INFORMATION ON THE PILOT PROJECTS



- What a suitable & reasonable scales for pilot projects in the Mekong Delta?

✓ Very large scale (zone): Controled by main canal, 200,000-500,000 ha (10-12 inflow canal & 12-15 outflow main canals).

✓ Lagre scale (sub-zone): Controled by main & secondary canals, 20,000-100,000 ha (2 inflow & 2 out flow main canals, 20-25 inflow & 20-25 outflow canals).

✓ Medium scale (Project): Controled by secondary canal, 5,000-30,000 ha (10-12 inflow & 10-12 outflow canals).

✓ Small scale (A part-project): Control by secondary & tertiary canals, 200-3,000 ha (2 inflow and 2 outflow secondary canals & 10-20 outflow & 10-20 outflow tertiary canals).

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GENERAL INFORMATION ON THE PILOT PROJECTS


- Number of pilot projects: 02
- Location of pilot projects:
  - ✓ Pilot No1: In the available fresh water area in Vinh Long Province
  - ✓ Pilot No2: In the salinity intrusion affected area in Tien Giang Province
  - ✓ Other one may be considered to replace for Pilot No2 in Tien Giang also.

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GENERAL INFORMATION ON THE PILOT No1

- Location: Quang Thanh Commune, Hieu Phung Village, Vung Liem District, Vinh Long Province
- Schematic plan of irrigation scheme: Including main & secondary canals
- Fresh water from Mang Thit river (linking MK&BS rivers)
- Existing irrigation system is fairly completed
- Size of the pilot project: 700 ha
- Major crops: Rice / Crop patterns: 2- rice crops
- Type of irrigation: Pumping / Gravity
- Present practice of water management: Famer groups / Rotational pumping
- Available data: No

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GENERAL INFORMATION ON THE PILOT No2

- Location: Binh Phan Village, Cho Gao District, Tien Giang Province
- Schematic plan of irrigation scheme: Including main & secondary canals
- Fresh water from Bao Dinh river
- Existing irrigation system is fairly completed
- Size of the pilot project: 2.000 ha
- Major crops: Rice / Crop pattrens: 3-rice crop
- Type of irrigation: Pumping / Gravity
- Present practice of water management: Famer groups / Rotational pumping
- Available data: No

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PROCESS OF TIDAL FLOW MEASUREMENT CALCULATION

A tidal cycle (15-day) much be completely measured to calculate accurately the real flow.

- Identify tidal cycle (from available Tidal Table)
- identify the time for velocity measurement (hourly)
- Identify corresponding water level (hourly)
- Calculate velocity of measurement points (hourly)
- Calculate mean velocity of measurement verticals (hourly)
- Calculate partly discharges (hourly)
- Calculate cross section discharge (hourly)
- Establish a correlation of water level & discharge for the positive & negative flows by the regression coeficients (for typical 3 days)
- Calculate daily discharges (daily)
- Calculate tidal cycle discharge (15 days)

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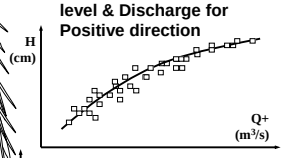
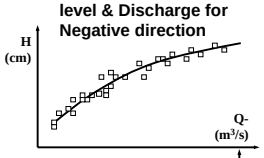
PROCESS OF TIDAL FLOW MEASUREMENT CALCULATION

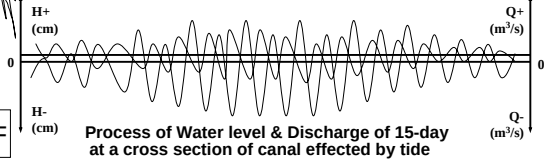
A real flow is very smaller than the tidal flow (under 10%), both positive & negative directions

- Correlation of Water level & Discharge for Positive direction



- Correlation of Water level & Discharge for Negative direction





Process of Water level & Discharge of 15-day at a cross section of canal effected by tide

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PROCESS OF TIDAL FLOW MEASUREMENT CALCULATION





IIEPF


IIEPF
Thank You for Your Attention!

Annex 9

Presentation on the Preparation of the RAP Workshop

Preparation of RAP training workshop

Okudaira Hiroshi
AIFP, MRCS

Content

1. Outline of the workshop
2. Things to be discussed

Outline of the workshop (1)

- Duration: 4 days
- Date: to be discussed (July?)
- Venue: MRC conference room

Purpose – outline (2)

- Understand concepts/technical details of irrigation modernization
- Learn how to evaluate project
  analysis of collected data
  interpretation of RAP indicators
- Learn how to make recommendation for modernization

Participants – outline (3)

- 2 to 4 persons/country
- ones directly involved in field observation & data analysis work, IIEPF

Workshop agenda

	AM	PM
Day 1	●Lessons from the past	●Evolution of Modern system ●Water manage. improvement
2	●Concept of irrigation service ●Technical items	●PIM service ●Practical considerations
3	●RAP – performance evaluation ●Water balance	●Detail review of RAP worksheet
4	●Group discussion ●Data for conducting RAP	●Preparation of conducting RAP

Things to be discussed

- Date
- Participants

Thank you very much
for your attention

Annex 10

Closing address

First Regional Workshop on Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project
Vientiane, Lao PDR
3-4 May 2006

Closing address by Dr Dao Trong Tu
Director, Operations Division, MRCS

Distinguished Delegates,
Ladies and Gentlemen,

After one and half days working hard with very active participation from all of you, the project has received much knowledgeable and constructive comment from delegates. The First Regional Workshop on Improvement of Irrigation Efficiency of Paddy Fields in the Lower Mekong Basin Project (IIEPE) has arrived at several important conclusions for its implementation without any delay.

On this occasion, once again, I would like to thank the Distinguished Delegates from NMCs and line agencies for your attendance and contribution and I look forward to receiving your cooperation, assistance and instruction for implementation of this project in the future.

I also would like to express our appreciation to Mr. Thierry Facon, FAO's Senior Expert on Irrigation, for sparing time from his busy schedule of regional activities in order to spend a lot of time here with us and for providing us with a valuable presentation on the Rapid Appraisal Procedure that will be applied during the implementation of the project. We are looking forward to receiving further cooperation and assistance from Mr. Facon in particular, and also from UNESCAP for this project.

Last, but not least, I would like to thank AIFP's staff, Mr Okudaira, Dr Vitoon, Mr Fongsamuth and Ms Manosouk for their efforts in preparing and conducting the workshop. I would request everyone to continue to put in the same effort for the implementation of the project and work in close cooperation with NMCs and line agencies in the future.

We wish all of our distinguished delegates have a good time while staying in the pleasant capital city of Vientiane and we wish you a safe trip back to your countries and look forward to seeing you again

Thank you very much.