ANNEXES

Annex 1
Workshop agenda

ANNOTATED AGENDA

Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong River Basin project (IIEPF)
---- Training Workshop on Rapid Appraisal Process (RAP) -----
MRCS, Vientiane, 18-21 July 2006

Day 1: Tuesday, 18 July 2006			
08.30	09.00	Registration	
09.00	09.10	Opening Remarks	MRCS staff
09.10	09.30	Introduction of participants	
09.30	10.00	Introduction and Overview of Workshop Purposes	Mr. Thierry Facon, Senior Water Management Officer, FAO
10.00	10.30	*Coffee Break*	
10.45	12.00	Evolution of Modern Irrigation Systems	Dr. Zhijun Chen, Water Resources Development and Conservation Officer FAO
12.00	13.30	*Lunch*	
13.30	15.00	Lessons learned from previous RAP activities in the region	Mr. Thierry Facon,
15.00	15.15	*Coffee Break*	
15.15	16.30	Irrigation project Modernization	Mr. Thierry Facon
18.00	19.30	*Welcome diner*	
Day 2: Wednesday, 19 July 2006			
08.30	10.00	The Concept of Service - Equity, reliability and flexibility	Mr. Thierry Facon
10.00	10.15	*Coffee Break*	
10.15	12.00	Water measurement and control - Hydraulic Principles: the need to control levels and flows - System design: Upstream and downstream control - Basic structures: orifice and overflows sensitivity	Mr. Thierry Facon
12.00	13.30	*Lunch*	
13.00	*13.30*	*Confirmation of arrangement for conducting RAP with Lao team*	*Mr. Facon and MRCS staff*
13.30	15.00	Water balance	Mr. Thierry Facon
15.00	15.15	*Coffee Break*	
15.15	16.30	Irrigation efficiency and productivity	Mr. Thierry Facon
16.30	*17.00*	*Confirmation of arrangement for conducting RAP with Vietnamese team*	*Mr. Facon and MRCS staff*

Day 3: Thursday, 20 July 2006			
08.30	10.00	Evaluation of performance of irrigation projects (RAPs) - Performance assessment and Benchmarking - Rapid Appraisal Process - External Indicators - Internal Indicators	Dr. Zhijun Chen
10.00	10.15	*Coffee Break*	
10.15	12.00	Details review of the RAP worksheets	Dr. Zhijun Chen
12.00	13.30	*Lunch*	
13.00	*13.30*	*Confirmation of arrangement for conducting RAP with Cambodia team*	*Mr. Facon and MRCS staff*
13.30	15.00	Details review of the RAP worksheets (continued)	Dr. Zhijun Chen
15.00	15.15	*Coffee Break*	
15.15	16.30	Interpretation of indicators	Dr. Zhijun Chen
16.30	*17.00*	*Confirmation of arrangement for conducting RAP with Thai team*	*Mr. Facon and MRCS staff*
Day 4: Friday, 21 July 2006			
08.30	10.30	Group discussion (Q&A) by participants & trainers	Mr. Thierry Facon / Dr. Zhijun Chen
10.30	10.45	*Coffee Break*	
10.45	12.00	Review of data collection for the next conducting RAP	Dr. Zhijun Chen
12.00	13.30	*Lunch*	
13.30	14.30	Discussion on preparation of the next conducting RA P	Mr. Thierry Facon / Dr. Zhijun Chen MRCS staff
14.30	15.00	*Closing Workshop*	MRCS staff

Annex 2
List of participants

The Training Workshop on Rapid Appraisal Process (RAP)
18-21 July 2006 at MRCS, Vientiane, Lao PDR

LIST OF PARTICIPANTS

Cambodia

1.	Mr. Thach Sovanna	Deputy Director of Water Resources Management and Conservation, MOWRAM
2.	Mr. Sao Samphois	Deputy Director of Administrator and Human Resources Department, MOWRAM
3.	Mr. Hong Kimsan	Deputy Director, Department of Water Resources and Meteorology of Battambang Province
4.	Mr. Meas Peov	Technical Officer of Agronomy and Agriculture Land Improvement Department, MAFF

Lao PDR

5.	Mr. Khammay Vongsathiane	Deputy Director, Technical Division, Irrigation Department, MAF
6.	Mr. Phouthone Siriphanthong	Deputy Director, Operation and Maintenance Division, MAF
7.	Mr. Saykham Phengkhammy	Deputy Chief, Irrigation Section, Vientiane Capital
8.	Mr. Bounhab Vongvichith	Project Director, Nam Houm Irrigation Project

Thailand

9.	Mr. Suvech Kitchakarn	Royal Irrigation Department
10.	Mr. Somsak Vivithkeyoonvong	Royal Irrigation Department
11.	Mr. Pramote Phuengphian	Royal Irrigation Department
12.	Mr. Satit Sueprasertsuk	Department of Water Resources

Viet Nam

13.	Mr. To Quang Toan	Senior staff, Southern Institute for Water Resources Research
14.	Mr. Pham Duc Nghia	Senior staff, Southern Institute for Water Resources Research
15.	Mr. Ung Hong Nghi	Deputy Director, Company for hydraulic construction exploitation, Tien Giang Province
16.	Mr. Luong Ngoc Lan	Director, Department of Agriculture and Rural Development, Bac Lieu Province

FAO

17	Mr. Thierry Facon	FAO, Bangkok, Thailand
18.	Dr. Zhijun Chen	FAO, Bangkok, Thailand
19.	Mr. Jasada Thaiying	FAO, Vientiane, Laos

MRC Secretariat

20.	Dr. Dao Trong Tu	Director, OPD
21.	Dr. Vitoon Viriyasakultorn	Programme Coordinator, AIFP/OPD
22.	Mr. Okudaira Hiroshi	Senior Advisor, IIEPF/AIFP
23.	Mr. Fongsamuth Phengphaengsy	Programme Officer, IIEPF
24.	Ms. Manosouk Muongmany	Secretary, AIFP

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Annex 3
Opening remarks

Opening Remark by Dr. Tu
Training workshop on
Rapid Appraisal Process (RAP) under IIEPF

on 18 July 2006 at MRC conference room, Vientiane

Mr. Facon and Dr. Chen, FAO,
Distinguished participants,
Ladies and Gentlemen,

I am honoured, on behalf of Dr. Olivier Cogels, CEO of MRCS, to make the opening speech at the training workshop on "Rapid Appraisal Process" under the project namely "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 express my sincere thanks to the MAFF and the Government of Japan for their continuous support to MRC in general and AIFP in particular.

This project aims to improve irrigation efficiency through the introduction of some guidelines covering technical, institutional and managerial aspects. The project organised the first regional workshop at this conference room in early May with active participation from the four member countries, and agreed upon the project concept and activities in general.

This training workshop is organised as a part of the project activities and aiming to transfer the technique to assess irrigation scheme performance. This technique is called "Rapid Appraisal Process" or RAP. I will not talk for too long about RAP, because Mr. Facon and Dr. Chen will give you more information through the training, but this is a very systematic diagnosis tool to assess the performance of the irrigation schemes. This was developed by FAO and has been widely applied to large-scale irrigation schemes.

We are conducting this training workshop with two purposes. The first purpose is to disseminate this strong tool to the irrigation engineers of the member countries and to expect them to apply RAP for their own work. The second purpose is a more direct expectation of the project. Participants of this workshop will contribute better results of the field observation work under the project.

I should emphasise my sincere appreciation to FAO. Without their active support, we could not have organised this training workshop. Mr. Facon and Dr. Chen provided a lot of useful recommendations to my staff since the project formulation stage up to now, and they also kindly accepted our invitation to participate as lecturers. Once again I appreciate FAO's cooperation in the project.

Lastly, through these four days training, I hope all the participants enjoy good health, enjoy staying in Vientiane, and of course, work hard and learn a lot, and improve your skill as irrigation engineers.

Thank you very much.

Annex 4
Development needs initial assessment

IIEPF training workshop – 18-21 July 2006
Questionnaire

Name: **Country:** **National/project:**

For those from the pilot systems, please answer the questions for your system. For those from National Committees, please answer the questions at national level for systems in the Mekong basin in your country

A. List, by order of decreasing priority, the 3 major objectives you would like to achieve by improving the performance of the irrigation system(s) and explain why.

A.1.

A.1.2

A.1.3

B. List, by order of decreasing importance, the 3 main issues or problem areas related to the performance of the irrigation system(s) you need to address to reach the 3 major objectives and explain why.

B.1.

B.1.2.

B.1.3

C. List, by order of decreasing priority, the 3 priority actions you need to implement to address the main issues relate to achieving your objectives for the irrigation system(s) and explain why.

C.1.

C.1.2.

C.1.3.

HEPE Training Workshop Questionary

Fifteen responses received

A. The 3 major objectives wish to achive by improving the performamce of the irrigation systems

A1	Vietnam	Provide enough water for irrigation and water supply (3 national) Extend irrigation area (1 project)
	Thailand	Increasing income of water users (1 national) Improve reliability and equity of water supply (1 national) Improve water distribution system at farm level (1 project) Strenthen consultaion on water price and use (1 project)
	Laos	Increase irrigation area (1 national) Improve irrigation project and water management (3 national, 2 project)
	Cambodia	Increase the capacity of the reservoir (1 national)
A2	Vietname	Reduce irrigation cost (3 national) Reduce water loss (1 project)
	Thailand	Improve system efficiency at all-front (1 national, 1 project) Enhance participation of stakeholders in water resources management (1 national) Protect the environment and ecological balance (1 project)
	Laos	Improve WUGs (1 national) Strengthen farmers' participation in irrigation O&M (4 national, 1 project)
	Cambodia	Extend irrigation systems (1 national)
A3	Vietname	Reduce water pollution (3 national) Reduce irrigation cost (1 project)
	Thailand	Achieve sustainable development (1 national) Improve irrigation efficiency (1 national) Improve water measurement and monitoring (1 project) Achieve reasonable and equally water supply (1 project)
	Laos	Improve WUGs (4 national, 1 project) Realize self-financing for system O&M (1 project)
	Cambodia	Increase water delivery efficiency (1 national)

B. The 3 main issues/problems related to the perofrmamce of irrigation systems need to be addressed

B1	Vietname	Insufficient water in dry season due to sanility intrution (3 national, 1 project)
	Thailand	Incomplete irrigation systems (1 national, 2 project) NGO's opposition make large irrigation project development difficult (1 national)
	Laos	Lack of water resources (1 national) Lack of technical support to WUAs (3 national) unequally water distribution (1 project)
	Cambodia	Insufficient water resources (1 national)
B2	Vietname	Lack of forcasting for salinity intrution (2 national) Uncomplete irrigation system (1 project) System degradation (1 national)
	Thailand	Unwareness of farmers on the importance of participation (1 national) lack of operation budget for water distribution from reservior to farm plot (1 project) Lackof integrated management institution (1 project)
	Laos	Lack of irrigation systems for aquiculture (1 national) Lack of funds (3 national, 1 project) Insufficient maintenance due to low water-fee collection rate (1 project)
	Cambodia	Uncomplete irrigation system (1 national)

B3	Vietname	Lack of O&M stretegies (3 national)
		Environment pollusion (1 project)
	Thailand	Good management (1 national)
		Lack of budget and suitable policies (1 national)
		Lack of structures and equipment for water measurement and modelling (1 project)
		Lackof farmers participation (1 project)
	Laos	Limited capacity of WUGs (4 national, 1 project)
		Lack of farmers' participation (1 project)
	Cambodia	Insufficient water in the reservoir (1 national)

C. The 3 priority actions need to be taken to address the main issues

C1	Vietname	Improve irrigation system (3 national)
		Change the cropping pattern (1 project)
	Thailand	Training for participants (1 national, 1 project)
		Develop or improve the existing reservoirs to increase storage capacity (1 national)
		Increase budget for ditch and dike construction to cover all farm land (1 project)
	Laos	Strengthen technical support to WUGs (5 national)
		Improve equity of water distribution (1 project)
	Cambodia	Strengthen water resources management and conservation (1 national)

C2	Vietname	Improve water management (3 national)
		Use water more economically (1 project)
	Thailand	Data collection and make datebase as the knowledge center (1 national)
		Strengthen water users' participation (1 national, 1 project)
		Provide adequet budgget for system operation (1 project)
	Laos	Provide financial support (1 project)
		Establish irrigation development fund (3 national)
		Empower WUAs (1 project)
	Cambodia	Extend irrigation system (1 national)

C3	Vietname	Improve cooperation between water managers and water users' groups (1 national)
		Improve operation schedule (1 national)
	Thailand	Provide facilities to farmland (1 national)
		Strenthen water management (1 national, 1 project)
		Provide budget for water measurement and modelling (1 project)
	Laos	Empower WUGs (3 national, 1 project)
		Facilitate sustainable irrigation O&M (1 project)
	Cambodia	Facilitate sustainable irrigation O&M (1 national)

Question A. Three (3) major objectives by improving irrigation system

			Vietnam	Thailand	Laos	Cambodia
Physical	Extend irrigation system	1st				
		2nd				1
		3rd				
Physical	Increase reservoir capacity	1st				1
		2nd				
		3rd				
Physical	Provide enough water	1st	3			
		2nd				
		3rd				
Physical	Extend irrigation area	1st	1		1	
		2nd				
		3rd				
Operation	Improve reliability and equity	1st		1		
		2nd				
		3rd		1		
Operation	Improve water distribution system/project and management	1st		1	5	
		2nd				
		3rd				
Operation	Reduce water loss/Improve system efficiency	1st				
		2nd	1	2		
		3rd		1		1
Operation	Improve water measurement and monitoring	1st				
		2nd				
		3rd		1		
Management	Reduce irrigation cost	1st				
		2nd	3			
		3rd	1			
Management	Realize self-financing system	1st				
		2nd				
		3rd			1	
Institutional	Enhance stakeholders' participation	1st				
		2nd		1	5	
		3rd				
Institutional	Improve WUGs	1st				
		2nd			1	
		3rd			4	
Pricing	Strengthen consultation on water price and use	1st		1		
		2nd				
		3rd				
Economy	Increase income of water users	1st		1		
		2nd				
		3rd				
Environment	Protect environment and ecological balance	1st				
	Reduce water pollution	2nd		1		
		3rd	3			
Others	Achieve sustainable development	1st				
		2nd				
		3rd		1		

Question B. Three (3) main issues/problems related to system performance

			Vietnam	Thailand	Laos	Cambodia
Physical	Insufficient water	1st	4		1	1
		2nd				
		3rd				1
Physical	Incomplete irrigation systems	1st		3		
		2nd	1		1	1
		3rd				
Physical	System degradation	1st				
		2nd	1			
		3rd				
Physical	Lack of measurement structure/equipment	1st				
		2nd				
		3rd		1		
Technical	Lack of forecasting for salinity intrusion	1st				
		2nd	2			
		3rd				
Management	unequal water distribution	1st			1	
		2nd				
		3rd				
Management	Lack of fund (operation budget)	1st				
		2nd		1	4	
		3rd		1		
Institutional	Lack of O&M strategy	1st				
		2nd				
		3rd	1			
Institutional	Lack of integrated management body	1st				
	Lack of management	2nd		1		
		3rd		1		
Institutional	Lack of TA to WUAs	1st			3	
		2nd				
		3rd				
Institutional	Low rate of water fee collection	1st				
		2nd			1	
		3rd				
Institutional	Unawareness of farmers' participation	1st				
	Lack of farmers' participation	2nd		1		
		3rd		1	1	
Institutional	Limited capacity of WUGs	1st				
		2nd				
		3rd			5	
Social	NGO's opposition to irrigation development	1st		1		
		2nd				
		3rd				
Environment	Environmental pollution	1st				
		2nd				
		3rd	1			

Question C. Three (3) priority actions to address the main issues

			Vietnam	Thailand	Laos	Cambodia
Physical	Water resources development	1st		1		
		2nd				
		3rd				
Physical	Improve irrigation system	1st	3			
		2nd				1
		3rd				
Physical	Budget for tertiary level development	1st		1		
	Provide facilities to farmland	2nd				
		3rd		1		
Operation	Budget for system operation/measurement and modelling	1st				
	Financial support	2nd		1	4	
		3rd		1		
Operation	Improve operation schedule	1st				
		2nd				
		3rd	1			
Operation	Facilitate sustainable O&M	1st				
		2nd				
		3rd			1	1
Management	Equitable water distribution	1st			1	
		2nd				
		3rd				
Management	Economical water use	1st				
		2nd	1			
		3rd				
Management	Improve water management	1st				1
		2nd	3			
		3rd		1		
Management	Data collection and database	1st				
		2nd		1		
		3rd				
Management	Water users' participation	1st				
	Empowerment of WUAs	2nd		1	1	
		3rd			4	
Institutional	Strengthen TA to WUGs	1st			5	
		2nd				
		3rd				
Institutional	Cooperation with water manager and water users	1st				
		2nd				
		3rd	1			
Agronomy	Change cropping pattern	1st	1			
		2nd				
		3rd				
Technical	Training	1st		2		
		2nd				
		3rd				

Annex 5
Introduction of the workshop

Training Workshop
on Rapid Appraisal Procedure

MRCS, Vientiane
18-21 July 2006

Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong River Basin Project

Financed by Gvt of Japan

Resource Persons

Thierry Facon
Senior Water Management Officer

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Context

- Agriculture is the predominant economic sector of the Lower Mekong Basin, employs 85% of the population of about 60 million.
- Further agricultural development is required to feed rapidly growing population of the region.
- 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 and even among different 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.
- rice is the single biggest user of fresh water in the region.
- 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.

- Irrigation efficiency varies between countries but is low in general.
- 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 crop water requirement 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.

- There is not enough information available in the region on reliable estimates of irrigation efficiencies and actual water use.

- 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.

- Irrigation schemes provide water also for other uses, such as fish farming, domestic water supply, etc.
- Their requirements should also be considered.
- Paddy fields also provide ecosystem services at basin level (multi-functionality).

- 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 IIEPF.
- Modern methodologies to appraise irrigation projects provide insights in the bottlenecks and help to identify potentials for improvements.

- One such methodology is the Rapid Appraisal Process (RAP), which has been widely used by FAO and the World Bank for evaluating irrigation system performance and prioritizing improvements for modern management of the systems.

Purposes of the training wokshop

- To understand the principles and process of Benchmarking and the Rapid Appraisal Process (RAP):
  - to understand the concepts and technical details of irrigation project modernization
  - to learn how to properly evaluate an irrigation project, using a systematic diagnostic procedure that includes both visits to the district office to interview project staff, and field work evaluating items such as control structures, operational strategies, communications , and water delivery service

  - to discuss more in details issues of water balance, efficiencies at different scales and multiple use of irrigation water
  - to analyze the collected data, both manually and using computers, and arrive at Benchmarking, and Rapid Appraisal indicators
  - to interpret the Benchmark and Rapid Appraisal indicators in terms of the level of water delivery service, including the strengthens and weakness in the service provided, and to identify best practices
  - to learn how to make specific recommendations and to establish priorities for modernization that will result in improved project performance.

- To prepare and confirm arrangements for the RAP of the pilot projects, which will be carried out after this workshop.

Some observations

- This workshop will be dominated by lectures, but we will try to make it participatory.
- The workshop will be followed by direct application: you will conduct the RAPs of your systems, perform the analysis and make recommendations.

- First understand the situation.
- Then define objectives.
- Then select the most simple, robust, and economical ways of meeting those objectives.

The RAP assists with this. We do not begin with solutions; we begin by understanding the situation and the objectives.

Irrigation modernization and benchmarking and management improvement training workshop

- Alor Setar and Langkawi, Kedah, 27 February-7 March 200
- FAO
- DID

Resource Person

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Context

- Need to drastically improve water resources management in the face of growing water scarcity and increasing population in order to continue on the path of socio-economic development;
- Irrigation management transfer and participatory irrigation management;
- Output and performance oriented management of public agencies;

- Agricultural modernization is one of the key objectives of the Government;
- Irrigation modernization to move towards integrated water resources management and support agricultural modernization;

- The performance of irrigated agriculture needs to be drastically improved:
  - if water demand for feeding the population, agricultural development and satisfying the needs of other sectors is to be met;
  - to achieve socio-economic development goals;
  - To face international competition;
  - For the viability of irrigation systems;
- Modernizing water delivery and irrigation infrastructure to enable and support the institutional change objectives and future water allocation is a priority and substantial investments which are made should serve this purpose.
- We want to know the conditions for successful improvement of OFWM in large-scale system

- Modernization of irrigation systems is a complex and far-reaching process that involves institutional, managerial and technical change and needs to be tailored to local circumstances.
- Staff are not familiar with the underlying concepts to appraise and evaluate appropriate irrigation modernization strategies and investments .
- Good knowledge of the options, tools and techniques for planning and carrying out modernization programmes will be essential during both during projects preparation and implementation.

Malaysia-DID

- Benchmarking
- International benchmarking programme IPTRID, IWMI
- Holistic benchmarking, World Bank
- Langkawi 2004
- Lodoyo, Indonesia: Daud and Anuar

Objective

On-the-job training in irrigation modernization, management improvement and benchmarking for the staff

To include the RAP as a component of benchmarking

To ensure that future irrigation modernization would:

– be effective, adapted and appropriate
– reflect modern approaches and concepts to the design, operation and management of irrigation schemes
– take stock of international experience
– Support agricultural performance

To apply the new knowledge and idea:

– On the MADA irrigation system
– To discuss application in other systems in the country

Topics (1)

- Concepts:
  - Inter-related factors within irrigation projects
  - The concept of service
  - Integrated Water Resources Management and Irrigation Modernization
  - Irrigation Management Transfer and Irrigation Modernization
  - Economic and financial evaluation
  - Water balance
  - External indicators that describe irrigation project performance

Topics (2)

- Concepts:
  - Internal indicators of irrigation projects
  - Rapid Appraisal Procedure (RAP)
  - Comparison with other international projects
  - How to develop a modernization plan
  - Typical actions taken for modernization
  - Management tools
  - Physical tools
  - Water pricing …

Topics (3)

- Field Work:
  - Complete a RAP in MADA
  - Develop internal and external indicators for the project
  - Develop a preliminary action plan for the modernization of the project
  - Discuss the applicability of irrigation modernization concepts to other projects in Nepal

Programme

- Saturday and Sunday 28-29 Feb
  Lectures, Alor Setar
- Monday to Wednesday 1-3 March
  MADA
- Thursday 4 March
  Social tour
- Friday to Sunday 5-7 March
  RAP and modenization plan, Langkawi

Some observations ...

This will need to be a truly participatory workshop.

At first, it will be dominated by lecture format, but in the end you will:

- make your own assessment of the irrigation project we visit
- develop, discuss and finalize a modernization plan

Some observations ...

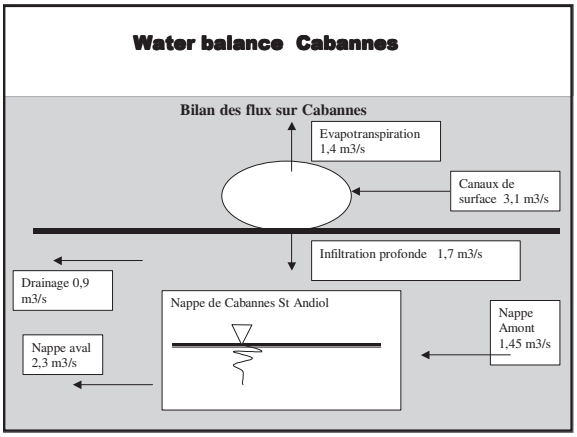
- Sometimes an evaluation sounds critical, but a main purpose of a Rapid Appraisal Process is to learn about what things can be CHANGED to improve performance.

Some observations ...

- First understand the situation
- Then define objectives.
- Then select the most simple, robust, and economical way of meeting those objectives.

The RAP assists with this. We do not begin with solutions; we begin by understanding the situation and the objectives.

This is how the RAP assists in bringins benchmarking into management processes



CONCLUSION (1981)

Surface irrigation maintained in upstream part to allow groundwater recharge

Modernization in downstream part with drip irrigation supplied by pumping from groundwater