# Annex 8
# A case study in China

## Issues of scales in water productivity

*A case study of Zhanghe Irrigation System, China*

## Brief introduction of water saving irrigation practices in China

"Water saving irrigation" is a general term.
For paddy rice, there are different forms of WSI practices in different parts of China.

- In Guangxi Province (South of China) ---- "Thin- Shallow- Wet - Sundrying"
- In Shandong Province (East of China) ---- "Control Irrigation"
- In Zhejiang Province (East of China) ---- "Thin- Exposure"
- In Hubei and Hunan Provinces (Centre China) ---- "Intermittent Submerged Irrigation"

Actually, they are similar but not the same

## Questions

1. How the on-farm WSI techniques save water?
   Reducing in the application of irrigation water to the field allows reduction in field water input and reduction in percolation and seepage (S&P).

2. What's the impact to overall system?
   Less well understood. Because the S&P flowing out of the farm without being depleted by rice can be recovered and reused at some points in the irrigation system

3. In order to understand if and how farm-level WSI techniques scale up basin-level savings, a case study was conducted in a typical large-size irrigation system with intensive rice area, Zhanghe Irrigation System (ZIS).

## Introduction of Zhanghe Irrigation System

### Zhanghe Reservoir

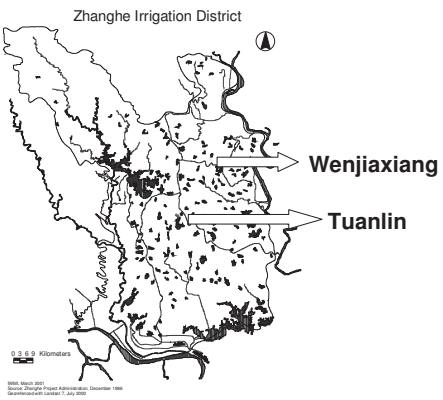
Located about 200 km west of Wuhan, Central China
Catchment area 2212km$^2$
Total storage capacity 2.035 billion m$^3$

### Zhanghe Irrigation System

Total area 5540km$^2$; irrigated area 160,000ha
Tens of thousands of medium & small-size reservoirs, ponds and pump stations
Annual average precipitation 960 mm
Main crops: rice and wheat/rapeseed

## Project Location

Zhanghe Irrigation District

# Methodology

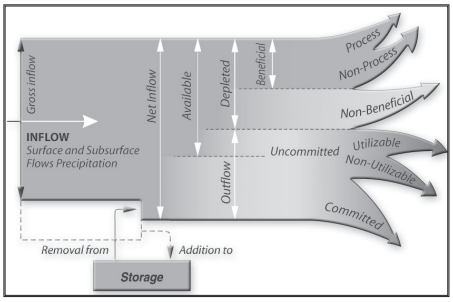
**Site selection**

- Sub-basin scale: Zhanghe Irrigation System
- Main canal command scale:
- Mezzo sites and field scale:
  - Tuanlin (TL): 3 micro sites with WSI
  - Wenjiaxiang (WJX): 3 micro sites without WSI

**Performance indicators** (*Water accounting*)

- PW $_{inflow}$ = Productivity / Net inflow
- PW $_{ET}$ = Productivity / ET
- PW $_{irrigation}$ = Productivity / Irrigation

## Water accounting developed by IWMI



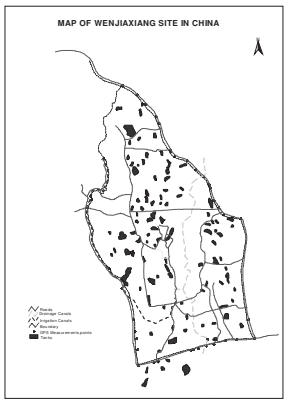

# Methodology

**Data collection**

During the rice-growing season from May to September, the six micro-sites were monitored everyday.

The observations and measurements included:

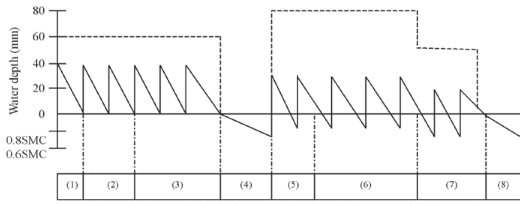
- Daily water levels in lysimeters, plastic tubes and wooden sticks
- Discharges of irrigation and drainage
- Yield


## Water Saving Irrigation Practices in ZIS

- Water saving irrigation practices in ZIS: intermittent submerged irrigation
- What is ISI
- Now Intermittent Submerged Irrigation has been spread in ZIS

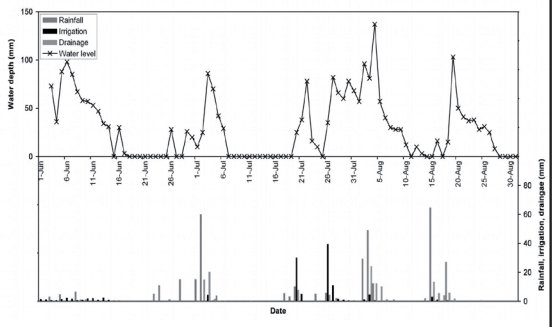
## Water Saving Irrigation Practices in ZIS

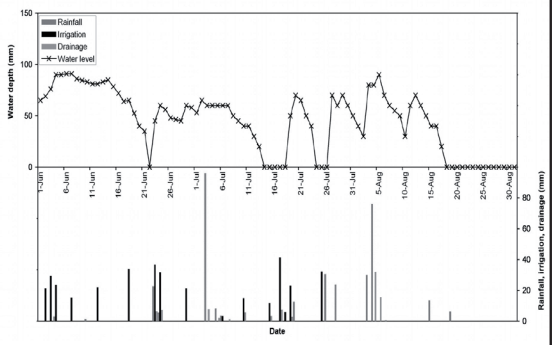



(1) Transplanting, (2) Revival of green, (3) Early & middle stages of tillering, (4) Late stage of tillering, (5) Elongating & booting, (6) Heading & flowering, (7) Milk ripening, (8) Yellow ripening (SMC = Saturated Moisture Content)

## How do the farmers practice ISI?

- Water levels measured at field level to asses the actual farmer practice
- WSI practices at field level; to what extent do farmers practice ISI?




## On-farm Water Productivity

Water accounting at field scale in Tuanlin and Wenjiaxiang

## On-farm Water Productivity

## On-farm Water Productivity

**Conclusion**

1. The farmers used water (irrigation + rainfall) carefully: high depleted fraction
2. Farmers' practices were similar to ISI,but not the exacly the same
3. Farmers captures most rainfall
4. Water productivity per unit irrigation water is higher for ISI than traditional practice
5. No significant yield difference between WSI and traditional irrigation, but higher water productivity

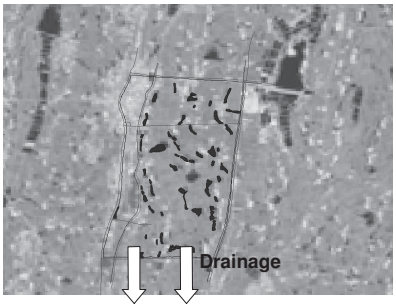
## Water Productivity at Mezzo Scale

## Water Productivity at Mezzo Scale

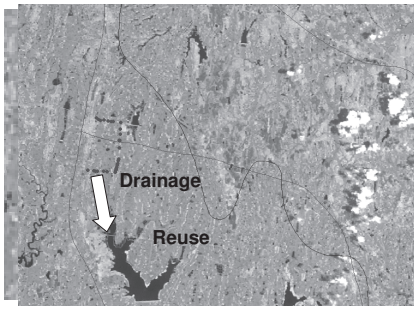
**conclusion**

- The depleted fraction of gross inflow ranges from 0.09 to 0.20, much lower than that at the field scale
- Water productivity of irrigation water dropped sharply
- Other factors become important, such as water storage and other non-rice land uses (roads, houses, trees)
- What happens to the drainage water?

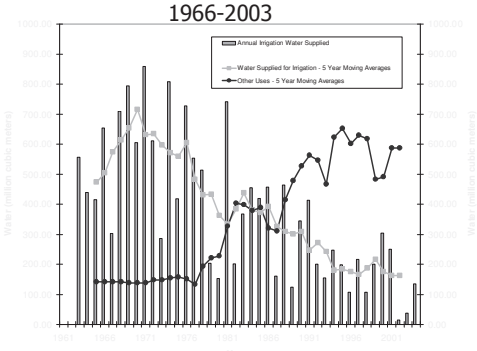
## Water Productivity at Mezzo Scale




## Water Productivity at Mezzo Scale




## Zhanghe Reservoir, Hubei, China Water allocation for irrigation and other uses, 1966-2003

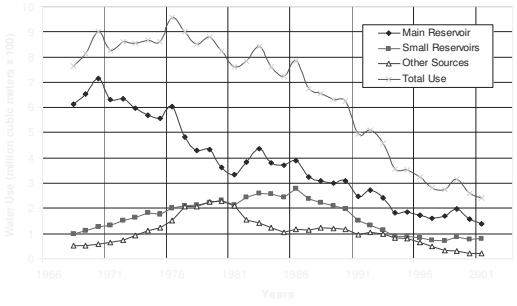


## Water inflow and releases from Zhanghe reservoir

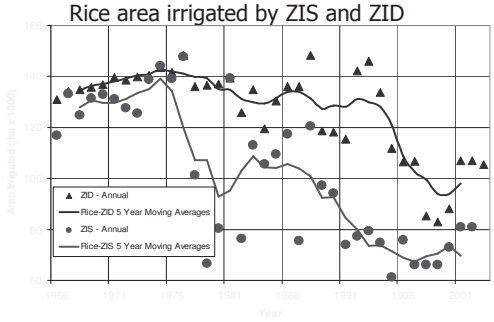
**Average Water Uses (10000 m^3)**

| Period | Irrigation | Industrial | Municipal | Hydro-electric | Flood control | Evaporation | Inflow | Rainfall (mm) |
|---|---|---|---|---|---|---|---|---|
| 1966-78 | 60325 | 518 | 0 | 1135 | 113 | 12434 | 69387 | 952 |
| 1979-88 | 36245 | 3659 | 93 | 5277 | 11358 | 11943 | 75275 | 967 |
| 1989-01 | 22077 | 4789 | 1647 | 27596 | 15260 | 12171 | 88162 | 945 |
| 2002-04 | 6235 | 6348 | 2622 | 42760 | 3337 | 7953 | 78613 | 868 |

## Zhanghe Irrigation District, Hubei, China
## Water supplied for irrigation by source



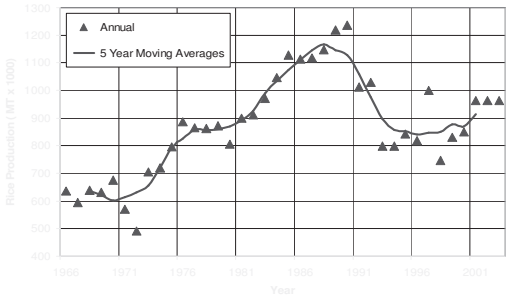

## Rice area irrigated by ZIS and ZID




## Command area irrigated by ZID and ZIS (1000 ha units)

| Period | Command area | | Area irrigated in ZID | | Area irrigated by ZIS | |
|---|---|---|---|---|---|---|
| | Total | Rice | Total | Rice | Total | Rice |
| 1966-78 | 150 | 138 | 143 | 138 | 134 | 130 |
| 1979-88 | 156 | 142 | 140 | 134 | 103 | 100 |
| 1989-01 | 143 | 125 | 126 | 112 | 82 | 76 |
| 2002-04 | 123 | 113 | 85 | 82 | 40 | 40 |

## Annual rice production in Zhanghe Irrigation District (1966-2001)




## Command area irrigated by ZID and ZIS (1000 ha units)

| Period | Command area | | Area irrigated in ZID | | Area irrigated by ZIS | |
|---|---|---|---|---|---|---|
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| 1966-78 | 150 | 138 | 143 | 138 | 134 | 130 |
| 1979-88 | 156 | 142 | 140 | 134 | 103 | 100 |
| 1989-01 | 143 | 125 | 126 | 112 | 82 | 76 |
| 2002-04 | 123 | 113 | 85 | 82 | 40 | 40 |

Changes in irrigated area, planted area, production and yield in ZID and productivity of ZIS irrigation water

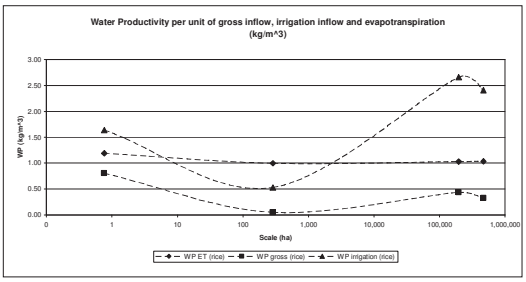
| Period | Irrigated area ha X 1000 | Rice area ha X 1000 | Rice production Mt x 1000 | Rice yield t/ha | Water supplied MmcmX100 | Yield kg/cubic |
|---|---|---|---|---|---|---|
| 1966-78 | 138 | 173 | 698 | 4.04 | 8.50 | 0.82 |
| 1979-88 | 134 | 149 | 1001 | 6.72 | 7.74 | 1.29 |
| 1989-01 | 112 | 118 | 934 | 7.88 | 3.96 | 2.35 |
| 2002-04 | 107 | 107 | 894 | 8.33 | 2.13 | 4.20 |

## Sub-basin scale

### Conclusion

- Water productivity of reservoir water increased over time
- The increase in WP has been due to several factors:
  - Economic and institutional reforms initiated in 1978
  - Shift in cropping pattern from two to one crop of rice
  - Volumetric pricing of water
  - On-farm and system WSI practices, such as ADWI
  - Development of alternate sources of water (reservoirs, ponds)
  - Recapture and reuse of return flows
- Real water savings took place

## WP Trends over Scales



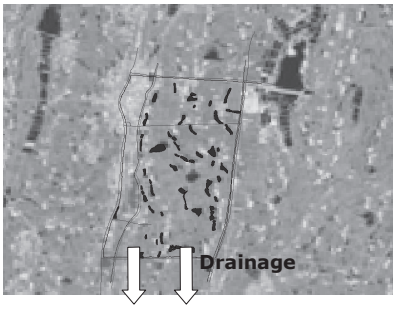

## Scaling Up – Field Scale

- Water saving techniques reduce water deliveries to the field, without significantly changing yield resulting in higher water productivity per unit irrigation water
- Farmers use water (irrigation + rainfall) carefully
- Farmers capture most rainfall

## Scaling Up – Mezzo Scale

- Water productivity per unit irrigation water is consistently higher under water saving techniques, however much lower than at field scale
- The total water consumed was only 9 to 20% of the total inflow, much lower than at field scale
- Other factors such as considerable drainage outflow, water storage and other non-rice land uses (roads, houses, trees) play an important role

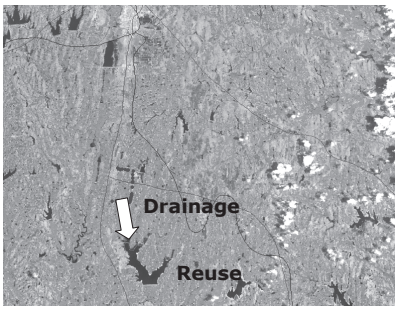
## Scaling Up – Mezzo Scale



## Scaling Up - Main Canal Command Scale

- Water productivity per unit of irrigation water increased dramatically (3 to 6 times)
- Water recapturing and reuse is reflected
- Other land uses gain importance at this scale

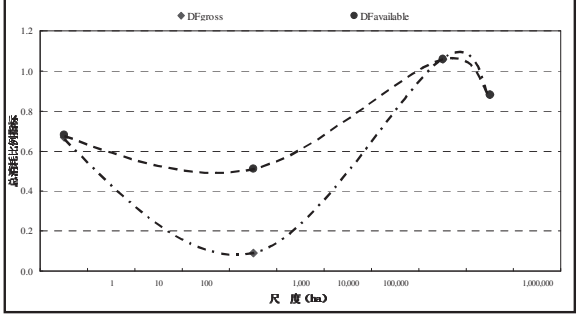
## Scaling Up - Main Canal Command Scale




## Scaling Up - Sub-Basin Scale

- Water productivity per unit of irrigation water decreased
  - However some data uncertainty about volume of irrigation water

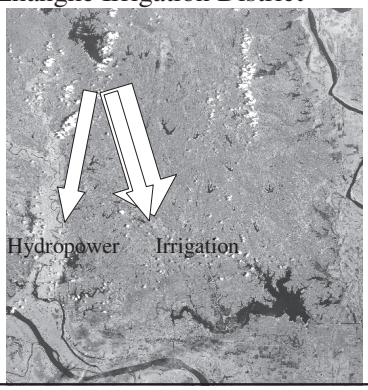
## Depleted fraction trend over scales




## Water Savings vs. Water Productivity

- The depleted fraction of inflow: **0.88** meaning only **12%** of irrigation and rainfall is flowing out of the basin!
- Can we still save water?
- Can we increase the water productiviy?
- Change of Flow Paths
  - From less to more beneficial, lower to higher valued

Zhanghe Irrigation District



Thank You!

# Annex 9
# List of members conducting RAP

# The initial of RAP Field Work Assessment
***24 July – 26 August 2006***

## LIST OF PARTICIPANTS

### Cambodia

Facilitators:

| | | |
|---|---|---|
| 1. | Dr. Zhijun Chen | Water Resources Development and Conservation Officer, FAO |
| 2. | Mr. Fongsamuth Phengphaengsy | Program Officer of Irrigation, AIFP/MRCS |

Coordinator:

| | | |
|---|---|---|
| 3. | Mr. Sok Khom | AIFP coordinator, Cambodian National Mekong Committee (CNMC) |

Implementing Team:

| | | |
|---|---|---|
| 4. | Dr. Theng Tara | Director of Water Resources Management and Conservation, MOWRAM |
| 5. | Mr. Thach Sovanna | Deputy Director of Water Resources Management and Conservation, MOWRAM |
| 6. | Mr. Sao Samphois | Deputy Director of Administrator and Human Resources Department, MOWRAM |
| 7. | Mr. Hong Kimsan | Deputy Director, Department of Water Resources and Meteorology of Battambang Province |
| 8. | Mr. Meas Peov | Technical Officer of Agronomy and Agriculture Land Improvement Department, MAFF |

### Lao PDR

Facilitators:

| | | |
|---|---|---|
| 1. | Dr. Zhijun Chen | Water Resources Development and Conservation Officer, FAO |
| 2. | Mr. Okudaira Hiroshi | Senior Advisor of AIFP/MRCS |
| 3. | Mr. Fongsamuth Phengphaengsy | Program Officer of Irrigation, AIFP/MRCS |

Implementing Team:

| | | |
|---|---|---|
| 4. | Mr. Khammay Vongsathiane | Deputy Director, Technical Division, Irrigation Department, MAF |
| 5. | Mr. Phouthone Siriphanthong | Deputy Director, Operation and Maintenance Division, MAF |
| 6. | Mr. Saykham Phengkhammy | Deputy Chief, Irrigation Section, Vientiane Capital |
| 7. | Mr. Bounhab Vongvichith | Project Director, Nam Houm Irrigation Project |

## Thailand

Facilitators:

| | | |
|---|---|---|
| 1. | Mr. Thierry Facon | Senior Water Management Officer, FAO |
| 2. | Mr. Okudaira Hiroshi | Senior Advisor of AIFP/MRCS |
| 3. | Mr. Fongsamuth Phengphaengsy | Program Officer of Irrigation, AIFP/MRCS |

Coordinator:

| | | |
|---|---|---|
| 4. | Mr. Satit Sueprasertsuk | Coordinator of AIFP, Department of Water Resources, Thai National Committee (TNMC) |

Implementing Team:

| | | |
|---|---|---|
| 5. | Mr. Chatchai Boonlue | Director, Foreign Financed Project Administration Division, Royal Irrigation Department (RID) |
| 6. | Mr. Sathaporn Namamnath | Chief of O&M Branch, Huay Luang O&M Project, Royal Irrigation Department (RID) |
| 7. | Mr. Suvech Kitchakarn | Chief of Contracts Administration Branch, Foreign Financed Project Administration Division, Royal Irrigation Department (RID) |
| 8. | Mr. Somsak Vivithkeyoonvong | Engineer Grade 6, Foreign Financed Project Administration Division, Office of Project Planning, Royal Irrigation Department (RID) |
| 9. | Mr. Pramote Phuengphian | Irrigation Technician Grade 6, Chief of Operation and Maintenance Zone 3, Huay Laung O&M project, Royal Irrigation Department |
| 10. | Mr. Sathapat Hansakunathai | Irrigation Engineer, Royal Irrigation Department |
| 11. | Mr. Pordee Hunsondnoen | Head of Water User Association, Huay Laung O&M project, Royal Irrigation Department |

## Viet Nam

Facilitators:

| | | |
|---|---|---|
| 1. | Mr. Thierry Facon | Senior Water Management Officer, FAO |
| 2. | Mr. Fongsamuth Phengphaengsy | Program Officer of Irrigation, AIFP/MRCS |

Implementing Team:

| | | |
|---|---|---|
| 3. | Dr. Vo Khac Tri | Division Chief –Southern Institute for Water Resource Research, Ho Chi Minh City |
| 4. | Mr. To Quang Toan | Senior staff, Southern Institute for Water Resources Research |
| 5. | Mr. NPham Duc Nghia | Senior staff, Southern Institute for Water Resources Research |
| 6. | Mr. Ung Hong Nghi | Deputy Director, Company for hydraulic construction exploitation, Tien Giang Province |
| 7. | Mr. Nguyen Xuan Truong | Senior staff of sub-national institute for agriculture planning & projection, Ho Chi Minh City |
| 8. | Mr. Truong Van Phuong | Technical Officer, department of Agriculture and Rural Development, Bac Lieu province |

| | | |
|---|---|---|
| 9. | Ms. Huynh Dang Ngoc Lan | Technical Officer, Southern Institute for Water Resources Research, Ho Chi Minh city |
| 10. | Ms. Vu Nguyen Hoang Giang | Technical Officer, Southern Institute for Water Resources Research, Ho Chi Minh city |
| 11. | Mr. Ung Hong Nghi | Deputy Director of the Company of Hydraulic Construction Exploitation, Tian Giang province |
| 12. | Mr. Do Thanh Son | Chief of Go Cong irrigation project, Company of Hydraulic Construction Exploitation, Tian Giang province |
| 13. | Mr. Huynh Hai | Director of Department of Agriculture and Rural Development, Tien Giang province. |

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# Annex 10
# Procedure of field work

# Outline of Conducting RAP

*21 June 2006*

**1. Introduction**

The Mekong River Commission Secretariat (MRCS) 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 of the schemes through introduction of basic guidelines covering institutional, managerial and technical aspects of irrigation facilities operation. Rapid Appraisal Process (RAP) is proposed for evaluating irrigation system performance as one of the specific inputs provided by FAO under collaboration framework between MRCS and FAO.

Following to the RAP training workshop on 18-21 July 2006 in Vientiane, RAP is going to be conducted at the proposed pilot project site in each member country. The detailed information is described as follows.

**2. Purposes of RAP conducting at initial stage of field observation**

- On the job training : follow-up of RAP training workshop on 18-21 July 2006
- Initial assessment by RAP: estimating performance level of the pilot scheme based on available data and identify options for improvement

**3. Date and Duration**

RAP is to be conducted with 5 or 6 days (including traveling days) each in every member country. The date and duration of conducting RAP in tentative is scheduled as follows:

| | | |
|---|---|---|
| Lao PDR | : 24-28 July 2006 | (5 days) |
| Cambodia | : 31 July - 5 August 2006 | (6 days) |
| Thailand | : 07 - 12 August 2006 | (6 days) |
| Vietnam | : 21-26 August | (6 days) |

**4. Participants**

- The participants of RAP training workshop plus other field observation work team members
- One or two staff from MRCS, and
- One instructor from FAO

**5. Venue**

The RAP conducting will be held at the project site of each member country

**6. Implementing Agency**

MRCS with collaboration of FAO

**7. Instructors**

| | |
|---|---|
| In Laos and Cambodia | : Dr. Zhijun Chen (Water Resources Development and Conservation Officer, FAO) |
| In Thailand and Vietnam | : Mr. Thierry Facon (Senior Water Management Officer, FAO) |

**8. Materials and Preparation**

The participants are expected to bring their own personal computers (1 or 2 computers should be enough to share for the whole team members), and the training material or related handouts which provided in the training workshop on 18-21 July 2006 for reference when conducting RAP.

**9. Issues to be clarified in advance**

*For RAP:*

1. ~~Project site of Cambodia & Vietnam~~
2. ~~Traveling duration from city to project site~~
3. Appointment with WUGs, gate operators, and farmers on the field observation days
4. Points to be observed ( shown by Map)
5. etc

*For other logistics:*

6. Minibus/cars service arrangement
7. Flight time ( arrive & departure time) for participants & trainers
8. Training facilities at discussion venue (including projector, whiteboard and markers)
9. Accommodation arrangement
10. Lunch and other payment arrangement
11. etc

**10. Prior data collection**

Each pilot project shall select and analyze below basic information and data, and enter into the electric RAP worksheets before *RAP training workshop on 18-21 July 2006*, prior to the conducting of RAP:

**1) Sheet 1-Sheet 3, for input year1-input year 3 (enter data for at least one year);**
**2) Data for line 3 to 77, and line 218 to 225 in sheet 5, project office questions;**
**3) Data for line 2 to 94 in sheet 7, WUA questions.**

Attention:

* Make a blank copy before data entry;
* Only enter data into blank cells; don't touch red and blue figures and values in the sheets;
* Don't touch the calculation zones at the far right side of each sheet

## Tentative Program for Conducting RAP in Lao PDR

Day 1: Monday (24 Jul. 2006)

| | |
|---|---|
| 08: 00 - 09: 00 | Vientiane City → NumHum project |
| 09: 00 - 10: 30 | Meet project officers for general information and checking available data |
| 10: 30 - 12: 00 | Visit headwork: Reservoir, spillway and head regulators |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 17: 00 | Observe main and secondary canals: travel to down stream areas and stop at all cross regulators |
| | Interview gate operators/water masters |
| 17:00 - 18:00 | NumHum project → Vientiane City |

Day 2: Tuesday (25 Jul. 2006)

| | |
|---|---|
| 08: 00 - 09:00 | Vientiane City → NumHum project |
| 09: 00 - 12:00 | Observe tertiary canals and field distribution systems |
| | Interview gate operators and farmers |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 17: 00 | interview heads of WUGs |
| 17: 00 - 18:00 | NumHum project → Vientiane City |

Day 3: Wednesday (26 Jul. 2006)

| | |
|---|---|
| 08: 00 - 12: 00 | Fill RAP worksheets (computer entry) at MRCS meeting room |
| 12: 00 - 13: 00 | Lunch in Vientiane City |
| 13: 00 - 17: 00 | Continue filling RAP worksheets |
| | Question and Answers |

Day 4: Thursday (27 Jul. 2006)

| | |
|---|---|
| 08:00 - 09:00 | Presentation and general discussion of indicator results at MRCS meeting room |
| 09:00 - 09:30 | Instruction on system improvement planning |
| 09:30 - 12:00 | Plan system improvement |
| 12:00 - 13:00 | Lunch in Vientiane City |
| 13:00 - 17:00 | Continue to plan system improvement |
| | Presentation of system improvement plan |
| | Closing of RAP |

Day 5: Friday (28 Jul. 2006)

| | |
|---|---|
| AM | Vientiane → Bangkok (only FAO participant - Dr. Chen) |

## Tentative Program for Conducting RAP in Cambodia

Day 1: Monday (31 Jul. 2006)
08:15- 09:30 Bangkok (FAO) → Phnom Phenh; ? - ? Phnom Phenh → Battambang
10:10- 12:00 Vientiane (MRCS) → Phnom Phenh; 12:00-17:00 Phnom Phenh → Battambang

Day 2: Tuesday (1 Aug.2006)

| | |
|---|---|
| 08: 00 - 09:00 | Battambang town → Komping Pouy Project |
| 09: 00 - 10:00 | Meet project officers at Community Office for general information, and checking available data |
| 10: 00 - 12: 00 | Visit headwork: reservoir and head regulators<br>Observe main canal: travel to down stream areas and stop at all cross regulators<br>Interview gate and zone-man operators |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 16: 00 | Continue observing main canal and secondary canals<br>Interview gate operators/water masters |
| 16: 00 - 17: 00 | Komping Pouy Project → Battambang town |

Day 3: Wednesday (2 Aug.2006)

| | |
|---|---|
| 08: 00 - 09:00 | Battambang town → Komping Pouy Project |
| 09: 00 - 12: 00 | Continue observing tertiary canals and related structures<br>Interview gate operators/water masters |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 16: 00 | Continue observing quaternary canals and field distribution systems<br>Interview farmers and Heads of WUAs |
| 16: 00 - 17: 00 | Komping Pouy Project → Battambang town |

Day 4: Thursday (3 Aug.2006)

| | |
|---|---|
| 09: 00 - 12: 00 | Fill RAP worksheets (computer entry) at irrigation provincial office in Battambang town |
| 12: 00 - 13: 00 | Lunch at Battambang town |
| 13: 00 - 17: 00 | Continue filling RAP worksheets<br>Question &Answer |

Day 5: Friday (4 Aug.2006)

| | |
|---|---|
| 09: 00 -10: 00 | Presentation and general discussion of indicator results at irrigation provincial office in Battambang town |
| 10: 00 -10: 30 | Introduction on system improvement planning |
| 10: 30 -12: 00 | Plan system improvement |
| 12: 00 -13: 00 | Lunch at Battambang town |
| 13: 00 -17: 00 | Continue to plan system improvement<br>Presentation of system improvement plan<br>Closing of RAP |

Day 6: Saturday (5 Aug.2006)
? - ? Battambang → Phnom Phenh; 10:30-11:35 or 20:25-21:30 Phnom Phenh→ Bangkok (FAO)
09:00-14:00 Battambang → Phnom Phenh; 15:30-16:45 Phnom Phenh → Vientiane (MRCS)

## Tentative Program for Conducting RAP in Thailand

Day 1: Monday (7 Aug. 2006)

| | | | |
|---|---|---|---|
| AM-PM | Bangkok (FAO & RID) | → | Udon City |
| | Vientiane (MRCS) | → | Udon City |

Day 2: Tuesday (8 Aug.2006)

| | |
|---|---|
| 08: 00 - 09: 00 | Udon City → Huay Luang project |
| 09: 00 - 10: 30 | Meet project officers for general information, and checking available data |
| 10: 30 - 12: 00 | Visit headwork: reservoir, spillway and head regulators |
| | Observe left main canal: travel to down stream areas and stop at all cross regulators |
| | Interview gate operators/ water masters and zone-man operators |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 16: 00 | Continue observing secondary and tertiary canals and on-farm level |
| | Interview gate operators, head of WUAs, and farmers |
| 16: 00 - 17: 00 | Huay Luang project → Udon City |

Day 3: Wednesday (9 Aug.2006)

| | |
|---|---|
| 08: 00 - 09: 00 | Udon City → Huay Luang project |
| 09: 00 - 12: 00 | Observe right main canal: travel to down stream areas and stop at all cross regulators |
| | Interview gate operators/ water masters and zone-man operators |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 16: 00 | Continue observing secondary and tertiary canals and on-farm level |
| | Interview gate operators, head of WUAs, and farmers |
| 16: 00 - 17: 00 | Huay Luang project → Udon City |

Day 4: Thursday (10 Aug.2006)

| | |
|---|---|
| 08: 00 - 09: 00 | Udon City → Huay Luang project |
| 09: 00 - 12: 00 | Fill RAP worksheets (computer entry) at conference room of Huay Luang project office |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 16: 00 | Continue filling RAP worksheets |
| | Question & Answer |
| 16: 00 - 17: 00 | Huay Luang project → Udon City |

Day 5: Friday (11 Aug.2006)

| | |
|---|---|
| 08: 00 - 09: 00 | Udon City → Huay Luang project |
| 09: 00 - 10: 00 | Presentation and general discussion of indicator results at project office |
| 10: 00 - 10: 30 | Introduction on system improvement planning |
| 10: 30 - 12:00 | Plan system improvement |
| 12: 00 - 13:00 | Lunch at project site |
| 13: 00 - 16:00 | Continue to plan system improvement |
| | Presentation of system improvement plan |
| | Closing of RAP |
| 16: 00 - 17: 00 | Huay Luang project → Udon City |

Day 6: Saturday (12 Aug.2006)

| | |
|---|---|
| PM | Udon City → Bangkok (FAO & RID) |
| | Udon City → Vientiane (MRCS) |

## Tentative Program for Conducting RAP in Vietnam

Day 1: Monday (21 Aug. 2006)

| | |
|---|---|
| 08:55-10:25 (TG) | BKK (FAO)→ HCM; ?-? HCM → Tiengiang province (My Tho City) |
| 10:10-13:00 | VTE (MRCS)→ HCM; 13:00-17:00 HCM→ Tiengiang (My Tho City) |

Day 2: Tuesday (22 Aug.2006)

| | |
|---|---|
| 08: 00 - 09: 00 | My Tho City → Go Cong Irrigation project (Long Hai Station Office) |
| 09: 00 - 10: 00 | Meet project officers for general information, and checking available data |
| 10: 00 - 11: 00 | Long Hai Station Office → Long Hai Project areas |
| 11: 00 - 12: 00 | Visit main intake at Tien river gate and interview gate |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 16: 00 | Observe along main canal and travel to up stream areas and stop at gate of up-stream intake |
| 16: 00 - 17: 00 | Long Hai Station site → My Tho City |

Day 3: Wednesday (23 Aug.2006)

| | |
|---|---|
| 08: 00 - 09: 00 | My Tho City → Long Hai Station site |
| 09: 00 - 12: 00 | Continue observing secondary and tertiary canals and related structures |
| 12: 00 - 13: 00 | Lunch at project site |
| 13: 00 - 16: 00 | Continue observing quaternary canals and field distribution systems<br>Interview farmers and Heads of WUAs |
| 16: 00 - 17: 00 | Long Hai Station Site → My Tho City |

Day 4: Thursday (24 Aug.2006)

| | |
|---|---|
| 09: 00 - 12: 00 | Fill RAP worksheets (computer entry) at Tiengiang Irrigation Management Company (IMC) in My Thao City |
| 12: 00 - 13: 00 | Lunch at My Thao City |
| 13: 00 - 17: 00 | Continue filling RAP worksheets<br>Questions &Answers |

Day 5: Friday (25 Aug.2006)

| | |
|---|---|
| 08: 00 - 09: 00 | Presentation and general discussion of indicator results at Tiengiang IMC office |
| 09: 00 - 09: 30 | Introduction on system improvement planning |
| 09: 30 - 12: 00 | Plan system improvement & Presentation of system improvement plan<br>Closing of RAP |
| 12: 00 - 13:00 | Lunch at project site |
| 13: 00 - 17:00 | Tiengiang Province → Ho Chi Minh City |

Day 6: Saturday (26 Aug.2006)

| | |
|---|---|
| 12:35- 14:00 | HCM → BKK (FAO) |
| 14:00- 17:00 | HCM → VTE (MRCS) |

# Annex 11
# Internal indicators

**Points for understanding this Indicator Summary**

1. This spreadsheet only applies to INTERNAL indicators. A separate spreadsheet is used for EXTERNAL indicators such as Irrigation Efficiency and Relative Water Supply.
2. The majority of the values on this worksheet are automatically transferred from previous worksheets in this spreadsheet.
3. Some of the indicator values on this worksheet must be assigned by the user.
4. The organization of this worksheet is as follows:
    a. The alpha-numeric label for each indicator is found in Column A
    b. The Primary Indicator name is given in Column B
    c. The Sub-Indicator is described in Column D
    d. The assigned value for each Sub-Indicator is found in Column E. Also, computed values for each Primary Indicators are found here.
    e. The weight assigned to each Sub-Indicator is given in Column F.
    f. The original indicator labels, as found in FAO Water Reports 19, are given here.
    g. The worksheet in which the original data were entered is given.

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | **Komping Pouy Project** | **Num Houm Project** | **Huay Luang Project** | | **Go Cong Project/ Long Hai Sta.** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| | **SERVICE and SOCIAL ORDER** | | | | | | | |
| I-1 | **Actual** Water Delivery Service to Individual Ownership Units (e.g., field or farm) | | | **1.5** | **0.9** | **1.3** | **1.8** | **2.7** |
| I-1A | | Measurement of volumes | 1.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| I-1B | | Flexibility | 2.0 | 1.0 | 1.0 | 0.0 | 2.0 | 3.0 |
| I-1C | | Reliability | 4.0 | 1.0 | 1.0 | 2.0 | 1.0 | 2.0 |
| I-1D | | Apparent equity. | 4.0 | 2.0 | 1.0 | 1.5 | 3.0 | 4.0 |
| I-2 | **Stated** Water Delivery Service to Individual Ownership Units (e.g., field or farm) | | | **1.2** | **2.0** | **2.5** | **2.5** | **2.7** |
| I-2A | | Measurement of volumes | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| I-2B | | Flexibility | 2.0 | 0.0 | 1.0 | 2.0 | 2.0 | 3.0 |
| I-2C | | Reliability | 4.0 | 1.0 | 2.0 | 2.0 | 2.0 | 3.0 |
| I-2D | | Apparent equity. | 4.0 | 2.0 | 3.0 | 4.0 | 4.0 | 3.0 |
| I-3 | **Actual** Water Delivery Service at the most downstream point in the system operated by a paid employee | | | **0.7** | **0.9** | **1.4** | **1.4** | **2.6** |
| I-3A | | Number of fields downstream of this point | | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |
| I-3B | | Measurement of volumes | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| I-3C | | Flexibility | 4.0 | 0.0 | 1.0 | 2.0 | 2.0 | 4.0 |
| I-3D | | Reliability | 4.0 | 1.0 | 1.0 | 1.5 | 2.0 | 3.0 |
| I-3E | | Apparent equity. | 4.0 | 2.0 | 2.0 | 2.5 | 2.0 | 4.0 |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | **Komping Pouy Project** | **Num Houm Project** | **Huay Luang Project** | | **Go Cong Project/ Long Hai Sta.** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| I-4 | **Stated** Water Delivery Service at the most downstream point in the system operated by a paid employee | | | **1.7** | **1.4** | **0.8** | **0.8** | **1.4** |
| I-4A | | Number of fields downstream of this point | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| I-4B | | Measurement of volumes | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| I-4C | | Flexibility | 4.0 | 2.0 | 2.0 | 1.5 | 1.5 | 0.0 |
| I-4D | | Reliability | 4.0 | 2.0 | 2.0 | 1.0 | 1.0 | 3.0 |
| I-4E | | Apparent equity. | 4.0 | 3.0 | 2.0 | 1.0 | 1.0 | 3.0 |
| I-5 | **Actual** Water Delivery Service by the Main Canals to the Second Level Canals | | | **1.8** | **2.2** | **1.2** | **1.4** | **0.0** |
| I-5A | | Flexibility | 1.0 | 2.0 | 2.0 | 1.5 | 2.0 | 0.0 |
| I-5B | | Reliability | 1.0 | 2.0 | 2.0 | 2.0 | 2.5 | 0.0 |
| I-5C | | Equity | 1.0 | 1.0 | 3.0 | 2.0 | 2.0 | 0.0 |
| I-5D | | Control of flow rates to the submain as stated | 1.5 | 2.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| I-6 | **Stated** Water Delivery Service by the Main Canals to the Second Level Canals | | | **2.8** | **1.6** | **3.3** | **3.3** | **1.8** |
| I-6A | | Flexibility | 1.0 | 3.0 | 1.0 | 1.5 | 1.5 | 3.0 |
| I-6B | | Reliability | 1.0 | 3.0 | 2.0 | 3.5 | 3.5 | 3.0 |
| I-6C | | Equity | 1.0 | 2.0 | 2.0 | 4.0 | 4.0 | 2.0 |
| I-6D | | Control of flow rates to the submain as stated | 1.5 | 3.0 | 1.5 | 4.0 | 4.0 | 0.0 |
| I-7 | Social "Order" in the Canal System operated by paid employees | | | **2.3** | **0.0** | **2.8** | **3.0** | **4.0** |
| I-7A | | Degree to which deliveries are **NOT** taken when not allowed, or at flow rates greater than allowed | 2.0 | 2.0 | 0.0 | 2.5 | 3.0 | 4.0 |
| I-7B | | Noticeable **non**-existence of unauthorized turnouts from canals. | 1.0 | 2.0 | 0.0 | 3.0 | 3.0 | 4.0 |
| I-7C | | Lack of vandalism of structures. | 1.0 | 3.0 | 0.0 | 3.0 | 3.0 | 4.0 |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | Komping Pouy Project | Num Houm Project | Huay Luang Project | | Go Cong Project/ Long Hai Sta. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| | **MAIN CANAL** | | | | | | | |
| I-8 | Cross regulator hardware (Main Canal) | | | **1.7** | **1.9** | **3.3** | **1.9** | **Not conducted** |
| I-8A | | Ease of cross regulator operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the cross regulators to meet the targets. | 1.0 | 3.0 | 3.0 | 3.0 | 3.0 | Not conducted |
| I-8B | | Level of maintenance of the cross regulators. | 1.0 | 2.0 | 2.0 | 3.0 | 3.0 | Not conducted |
| I-8C | | Lack of water level fluctuation | 3.0 | 1.0 | 0.0 | 3.0 | 1.0 | Not conducted |
| I-8D | | Travel time of a flow rate change throughout this canal level | 2.0 | 2.0 | 4.0 | 4.0 | 2.0 | Not conducted |
| I-9 | Turnouts from the Main Canal | | | **2.7** | **1.7** | **2.8** | **2.3** | **Not conducted** |
| I-9A | | current targets are being met; rather this rating indicates how easy or difficult it would be to move the turnouts and measure flows to meet the targets. | 1.0 | 3.0 | 1.0 | 2.5 | 3.0 | Not conducted |
| I-9B | | Level of maintenance | 1.0 | 3.0 | 2.0 | 3.0 | 2.0 | Not conducted |
| I-9C | | Flow rate capacities | 1.0 | 2.0 | 2.0 | 3.0 | 2.0 | Not conducted |
| I-l0 | Regulating Reservoirs in the Main Canal | | | **0.0** | **0.0** | **0.0** | **0.0** | **Not conducted** |
| I-10A | | Suitability of the number of location(s) | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | Not conducted |
| I-10B | | Effectiveness of operation | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | Not conducted |
| I-10C | | Suitability of the storage/buffer capacities | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | Not conducted |
| I-10D | | Maintenance | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | Not conducted |
| I-11 | Communications for the Main Canal | | | **1.9** | **1.9** | **2.9** | **2.5** | **Not conducted** |
| I-11A | | Frequency of communications with the next higher level? (hr) | 2.0 | 1.0 | 1.0 | 2.0 | 2.0 | Not conducted |
| I-11B | | Frequency of communications by operators or supervisors with their customers | 2.0 | 4.0 | 1.0 | 4.0 | 4.0 | Not conducted |
| I-11C | | Dependability of voice communications by phone or radio. | 3.0 | 1.0 | 3.0 | 3.0 | 2.0 | Not conducted |
| I-11D | | Frequency of visits by upper level supervisors to the field. | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | Not conducted |
| I-11E | | Existence and frequency of remote monitoring (either automatic or manual) at key **spill** points, including the end of the canal | 1.0 | 0.0 | 0.0 | 3.0 | 2.0 | Not conducted |
| I-11F | | Availability of roads along the canal | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | Not conducted |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | **Komping Pouy Project** | **Num Houm Project** | **Huay Luang Project** | | **Go Cong Project/ Long Hai Sta.** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| I-12 | General Conditions for the Main Canal | | | **1.8** | **2.0** | **2.6** | **1.8** | **Not conducte** |
| I-12A | | General level of maintenance of the canal floor and canal banks | 1.0 | 2.0 | 2.0 | 2.5 | 1.0 | Not conducte |
| I-12B | | General lack of undesired seepage (note: if deliberate conjunctive use is practiced, some seepage may be desired). | 1.0 | 2.0 | 3.0 | 2.5 | 2.0 | Not conducte |
| I-12C | | Availability of proper equipment and staff to adequately maintain this canal | 2.0 | 1.0 | 1.0 | 2.0 | 1.0 | Not conducte |
| I-12D | | Travel time from the maintenance yard to the most distant point along this canal (for crews and maintenance equipment) | 1.0 | 3.0 | 3.0 | 4.0 | 4.0 | Not conducte |
| I-13 | Operation of the Main Canal | | | **2.1** | **2.1** | **2.3** | **2.1** | **Not conducte** |
| I-13A | | How frequently does the headworks respond to realistic real time feedback from the operators/observers of this canal level? This question deals with a mismatch of orders, and problems associated with wedge storage variations and wave travel times. | 2.0 | 1.3 | 2.7 | 1.3 | 1.3 | Not conducte |
| I-13B | | Existence and effectiveness of water ordering/delivery procedures to match actual demands. This is different than the previous question, because the previous question dealt with problems that occur AFTER a change has been made. | 1.0 | 2.7 | 2.7 | 2.0 | 1.3 | Not conducte |
| I-13C | | Clarity and correctness of instructions to operators. | 1.0 | 2.7 | 1.3 | 2.7 | 2.7 | Not conducte |
| I-13D | | How frequently is the whole length of this canal checked for problems and reported to the office? This means one or more persons physically drive all the sections of the canal. | 1.0 | 2.7 | 1.3 | 4.0 | 4.0 | Not conducte |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | Komping Pouy Project | Num Houm Project | Huay Luang Project | | Go Cong Project/ Long Hai Sta. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| | **Second Level Canals** | | | | | | | |
| I-14 | Cross regulator hardware (Second Level Canals) | | | **1.0** | **1.3** | **1.6** | **1.4** | **1.1** |
| I-14A | | that the current targets are being met; rather this rating indicates how easy or difficult it | 1.0 | 3.0 | 3.0 | 2.5 | 3.0 | 0.0 |
| I-14B | | Level of maintenance of the cross regulators. | 1.0 | 2.0 | 2.0 | 3.0 | 3.0 | 0.0 |
| I-14C | | Lack of water level fluctuation | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | FALSE |
| I-14D | | Travel time of a flow rate change throughout this canal level | 2.0 | 1.0 | 2.0 | 3.0 | 2.0 | 4.0 |
| I-15 | Turnouts from the Second Level Canals | | | **3.0** | **2.3** | **2.8** | **3.0** | **2.7** |
| I-15A | | Ease of turnout operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the turnouts and measure flows to meet the targets. | 1.0 | 3.0 | 3.0 | 2.5 | 3.0 | 4.0 |
| I-15B | | Level of maintenance | 1.0 | 2.0 | 2.0 | 3.0 | 4.0 | 2.0 |
| I-15C | | Flow rate capacities | 1.0 | 4.0 | 2.0 | 3.0 | 2.0 | 2.0 |
| I-16 | Regulating Reservoirs in the Second Level Canals | | | **0.0** | **0.0** | **0.0** | **0.0** | **3.7** |
| I-16A | | Suitability of the number of location(s) | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 |
| I-16B | | Effectiveness of operation | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 |
| I-16C | | Suitability of the storage/buffer capacities | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 |
| I-16D | | Maintenance | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| I-17 | Communications for the Second Level Canals | | | **1.6** | **2.1** | **2.5** | **2.7** | **2.8** |
| I-17A | | Frequency of communications with the next higher level? (hr) | 2.0 | 1.0 | 3.0 | 1.0 | 2.0 | 4.0 |
| I-17B | | Frequency of communications by operators or supervisors with their customers | 2.0 | 3.0 | 1.0 | 4.0 | 4.0 | 4.0 |
| I-17C | | Dependability of voice communications by phone or radio. | 3.0 | 0.0 | 3.0 | 3.0 | 3.0 | 1.0 |
| I-17D | | Frequency of visits by upper level supervisors to the field. | 1.0 | 4.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| I-17E | | Existence and frequency of remote monitoring (either automatic or manual) at key **spill** points, including the end of the canal | 1.0 | 0.0 | 2.0 | 0.0 | 1.0 | 2.5 |
| I-18B | | General lack of undesired seepage (note: if deliberate conjunctive use is practiced, some seepage may be desired). | 1.0 | 2.0 | 3.0 | 3.0 | 3.0 | 4.0 |
| I-18C | | Availability of proper equipment and staff to adequately maintain this canal | 2.0 | 0.0 | 1.0 | 0.0 | 1.0 | 2.0 |
| I-18D | | Travel time from the maintenance yard to the most distant point along this canal (for crews and maintenance equipment) | 1.0 | 2.0 | 3.0 | 4.0 | 4.0 | 3.0 |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | **Komping Pouy Project** | **Num Houm Project** | **Huay Luang Project** | | **Go Cong Project/ Long Hai Sta.** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| I-19 | Operation of the Second Level Canals | | | **2.4** | **2.1** | **2.5** | **2.3** | **1.3** |
| I-19A | | How frequently does the headworks respond to realistic real time feedback from the operators/observers of this canal level? This question deals with a mismatch of orders, and problems associated with wedge storage variations and wave travel times. | 2.0 | 2.7 | 2.7 | 2.0 | 1.3 | 0.0 |
| I-19B | | Existence and effectiveness of water ordering/delivery procedures to match actual demands. This is different than the previous question, because the previous question dealt with problems that occur AFTER a change has been made. | 1.0 | 2.7 | 1.3 | 2.0 | 2.2 | 0.0 |
| I-19C | | Clarity and correctness of instructions to operators. | 1.0 | 1.3 | 2.7 | 2.7 | 2.7 | 4.0 |
| I-19D | | How frequently is the whole length of this canal checked for problems and reported to the office? This means one or more persons physically drive all the sections of the canal. | 1.0 | 2.7 | 1.3 | 4.0 | 4.0 | 2.7 |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | Komping Pouy Project | Num Houm Project | Huay Luang Project | | Go Cong Project/ Long Hai Sta. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| | **Third Level Canals** | | | | | | | |
| I-20 | Cross regulator hardware (Third Level Canals) | | | **1.0** | **1.0** | **1.9** | **1.4** | **1.1** |
| I-20A | | Ease of cross regulator operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the cross regulators to meet the targets. | 1.0 | 3.0 | 3.0 | 2.5 | 4.0 | 0.0 |
| I-20B | | Level of maintenance of the cross regulators. | 1.0 | 2.0 | 2.0 | 3.0 | 2.0 | 0.0 |
| I-20C | | Lack of water level fluctuation | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | FALSE |
| I-20D | | Travel time of a flow rate change throughout this canal level | 2.0 | 1.0 | 1.0 | 4.0 | 2.0 | 4.0 |
| I-21 | Turnouts from the Third Level Canals | | | **2.3** | **2.0** | **2.8** | **2.7** | **2.7** |
| I-21A | | Ease of turnout operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the turnouts and measure flows to meet the targets. | 1.0 | 3.0 | 3.0 | 2.5 | 3.0 | 3.0 |
| I-21B | | Level of maintenance | 1.0 | 2.0 | 1.0 | 3.0 | 3.0 | 3.0 |
| I-21C | | Flow rate capacities | 1.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 |
| I-22 | Regulating Reservoirs in the Third Level Canals | | | **0.0** | **0.0** | **0.0** | **0.0** | **3.3** |
| I-22A | | Suitability of the number of location(s) | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 |
| I-22B | | Effectiveness of operation | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 |
| I-22C | | Suitability of the storage/buffer capacities | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| I-22D | | Maintenance | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| I-23 | Communications for the Third Level Canals | | | **1.2** | **1.5** | **2.4** | **3.1** | **2.0** |
| I-23A | | Frequency of communications with the next higher level? (hr) | 2.0 | 2.0 | 1.0 | 1.0 | 2.0 | 4.0 |
| I-23B | | Frequency of communications by operators or supervisors with their customers | 2.0 | 2.0 | 1.0 | 4.0 | 4.0 | 4.0 |
| I-23C | | Dependability of voice communications by phone or radio. | 3.0 | 0.0 | 3.0 | 3.0 | 4.0 | 0.0 |
| I-23D | | Frequency of visits by upper level supervisors to the field. | 1.0 | 3.0 | 2.0 | 3.0 | 4.0 | 2.0 |
| I-23E | | Existence and frequency of remote monitoring (either automatic or manual) at key **spill** points, including the end of the canal | 1.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 |
| I-23F | | Availability of roads along the canal | 2.0 | 1.0 | 0.0 | 2.0 | 3.0 | 2.0 |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | **Komping Pouy Project** | **Num Houm Project** | **Huay Luang Project** | | **Go Cong Project/ Long Hai Sta.** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| I-24 | General Conditions for the Third Level Canals | | | **2.8** | **2.0** | **2.0** | **2.1** | **2.0** |
| I-24A | | General level of maintenance of the canal floor and canal banks | 1.0 | 2.0 | 3.0 | 3.0 | 2.5 | 1.0 |
| I-24B | | General lack of undesired seepage (note: if deliberate conjunctive use is practiced, some seepage may be desired). | 1.0 | 1.0 | 2.0 | 3.0 | 2.0 | 4.0 |
| I-24C | | Availability of proper equipment and staff to adequately maintain this canal | 2.0 | 0.0 | 1.0 | 0.0 | 1.0 | 1.0 |
| I-24D | | Travel time from the maintenance yard to the most distant point along this canal (for crews and maintenance equipment) | 1.0 | 2.0 | 3.0 | 4.0 | 4.0 | 3.0 |
| I-25 | Operation of the Third Level Canals | | | **1.8** | **2.4** | **2.3** | **1.3** | **1.9** |
| I-25A | | How frequently does the headworks respond to realistic real time feedback from the operators/observers of this canal level? This question deals with a mismatch of orders, and problems associated with wedge storage variations and wave travel times. | 2.0 | 1.3 | 2.7 | 1.3 | 0.0 | 0.0 |
| I-25B | | Existence and effectiveness of water ordering/delivery procedures to match actual demands. This is different than the previous question, because the previous question dealt with problems that occur AFTER a change has been made. | 1.0 | 1.3 | 1.3 | 2.0 | 0.0 | 4.0 |
| I-25C | | Clarity and correctness of instructions to operators. | 1.0 | 1.3 | 2.7 | 2.7 | 2.7 | 4.0 |
| I-25D | | How frequently is the whole length of this canal checked for problems and reported to the office? This means one or more persons physically drive all the sections of the canal. | 1.0 | 4.0 | 2.7 | 4.0 | 4.0 | 1.3 |

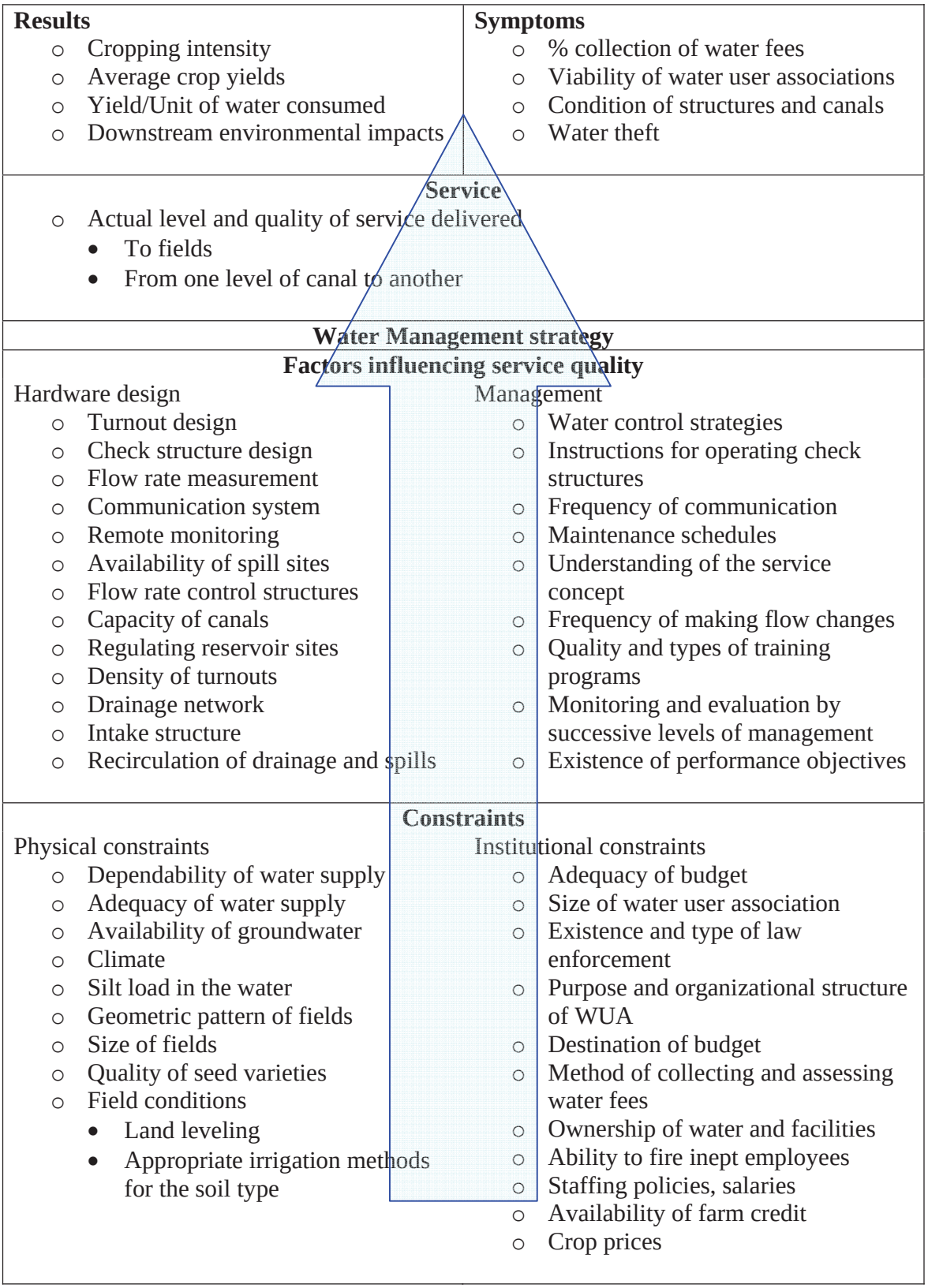
| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | Komping Pouy Project | Num Houm Project | Huay Luang Project | | Go Cong Project/ Long Hai Sta. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| | **Budgets, Employees, WUAs** | | | | | | | |
| I-26 | Budgets | | | **0.0** | **1.2** | **0.8** | **0.8** | **2.0** |
| I-26A | | What percentage of the total project (including WUA) Operation and Maintenance (O&M) is collected as in-kind services, and/or water fees from water users? | 2.0 | 0.0 | 2.0 | 0.0 | 0.0 | 2.0 |
| I-26B | | Adequacy of the actual dollars and in-kind services that is available (from all sources) to sustain adequate Operation and Maintenance (O&M) with the present mode of operation. | 2.0 | 0.0 | 1.0 | 0.0 | 0.0 | 3.0 |
| I-26C | | Adequacy of spending on modernization of the water delivery operation/structures (as contrasted to rehabilitation or regular operation) | 1.0 | 0.0 | 0.0 | 4.0 | 4.0 | 0.0 |
| I-27 | Employees | | | **2.0** | **2.4** | **2.1** | **2.1** | **2.9** |
| I-27A | | Frequency and adequacy of training of operators and middle managers (not secretaries and drivers). This should include employees at all levels of the distribution system, not only those who work in the office. | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 |
| I-27B | | Availability of written performance rules | 1.0 | 1.0 | 4.0 | 3.0 | 3.0 | 4.0 |
| I-27C | | Power of employees to make decisions | 2.5 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 |
| I-27D | | Ability of the project to dismiss employees with cause. | 2.0 | 2.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| I-27E | | Rewards for ememplary service | 1.0 | 3.0 | 1.0 | 1.5 | 1.5 | 4.0 |
| I-27F | | Relative salary of an operator compared to a day laborer | 2.0 | 2.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| I-28 | Water User Associations | | | **1.5** | **1.8** | **2.0** | **0.6** | **0.6** |
| I-28A | | Percentage of all project users who have a functional, formal unit that participates in water distribution | 2.5 | 1.0 | 1.0 | 3.0 | 0.0 | 0.0 |
| I-28B | | Actual ability of the strong Water User Associations to influence real-time water deliveries to the WUA. | 1.0 | 2.0 | 2.0 | 1.0 | 2.0 | 0.0 |
| I-28C | | Ability of the WUA to rely on effective outside help for enforcement of its rules | 1.0 | 2.0 | 2.5 | 2.5 | 1.0 | 3.0 |
| I-28D | | Legal basis for the WUAs | 1.0 | 2.0 | 3.0 | 2.0 | 1.0 | 1.0 |
| I-28E | | Financial strength of WUAS | 1.0 | 1.0 | 1.5 | 0.0 | 0.0 | 0.0 |
| I-29 | Mobility and Size of Operations Staff | Operation staff mobility and efficiency, based on the ratio of operating staff to the number of turnouts. | | **0.0** | **3.0** | **0.0** | **0.0** | **0.0** |
| I-30 | Computers for billing and record management | The extent to which computers are used for billing and record management | | **0.0** | **0.0** | **1.0** | **1.0** | **1.0** |
| I-31 | Computers for canal control | The extent to which computers (either central or on-site) are used for canal control | | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | Komping Pouy Project | Num Houm Project | Huay Luang Project | | Go Cong Project/ Long Hai Sta. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| | **INDICATORS THAT WERE NOT PREVIOUSLY COMPUTED** | **THESE INDICATORS REQUIRE THE INPUT OF VALUES (0-4) IN EACH OF THE BOXES** | | | | | | |
| I-32 | Ability of the present water delivery service to individual fields, to support pressurized irrigation methods | | | 2.5 | 2.2 | 0.0 | 0.0 | 3.3 |
| I-32A | Measurement and control of volumes to the field | 4 - Excellent volumetric metering and control; 3.5 - Ability to measure flow rates reasonably well, but not volume. Flow is well controlled; 2.5 - Cannot measure flow, but can control flow rates well; 0 - Cannot control the flow rate, even though it can be measured. | 1.0 | 2.5 | 2.0 | 0.0 | 0.0 | 3.0 |
| I-32B | Flexibility to the field | 4 - Arranged delivery, with frequency, rate and duration promised. All can be varied upon request; 3 - Same as 4, but cannot vary the duration; 2 - 2 variables are fixed, but arranged schedule; 0 - Rotation | 1.0 | 2.0 | 2.0 | 0.0 | 0.0 | 3.0 |
| I-32C | Reliability to the field | 4 - Water always arrives as promised, including the appropriate volume; 3 - A few days of delay occasionally occur, but water is still very reliable in rate and duration; 0 - More than a few days delay. | 1.0 | 3.0 | 2.5 | 0.0 | 0.0 | 4.0 |
| I-33 | Changes required to be able to support pressurized irrigation methods | | | 2.5 | 1.5 | 2.0 | 2.0 | 3.3 |
| I-33A | Procedures, Management | 4 - No changes in water ordering, staff training, or mobility; 3.5 - Improved training, only. The basic procedures/conditions are just fine, they just are not being implemented to their full extent; 3.0 - Minor changes in water ordering, mobility, training, incentive programs; 2.0 - Major changes in 1 of the above; 1 - Major changes in 2 of the above; 0 - Need to completely revamp or convert almost everything. | 1.0 | 2.0 | 1.0 | 2.0 | 2.0 | 3.5 |
| I-33B | Hardware | 4 - No changes needed; 3.5 - Only need to repair some of the existing structures so that they are workable again.; 3.0 - Improved communications, repair of some existing structures, and a few key new structures (less than US$300/ha needed), OR…very little change to existing, but new structures are needed for water recirculation; 2 - Larger capital expenditures - $US 300 - $US 600/ha; 1 - Larger capital expenditures needed (up to $US 1500/ha); 0 - Almost complete reworking of the system is needed | 1.0 | 3.0 | 2.0 | 2.0 | 2.0 | 3.0 |
| I-34 | Sophistication in receiving and using feedback information. This does not need to be automatic. | 4 - Continuous feedback and continuous use of information to change inflows, with all key points monitored. Or, minimal feed back is necessary, such as with closed pipe systems.; 3 - Feedback several times a day and rapid use (within a few hours) of that information, at major points.; 2 - Feedback once/day from key points and appropriate use of information within a day; 1 - Weekly feedback and appropriate usage, or once/day feeback but poor usage of the information; 0 - No meaningful feedback, or else there is a lot of feedback but no usage. | | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 |

| Indicator Label | Primary Indicator Name | Sub-Indicator Name | Weighting Factor | Komping Pouy Project | Num Houm Project | Huay Luang Project | | Go Cong Project/ Long Hai Sta. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | LMC | RMC | |
| | | **SPECIAL INDICATORS THAT DO NOT HAVE A 0-4 RATING SCALE** | | | | | | |
| I-35 | Turnout density | Number of water users downstream of employee-operated turnouts | | **20** | **15** | **12.0** | **11.0** | **1.0** |
| I-36 | Turnouts/Operator | (Number of turnouts operated by paid employees)/(Paid Employees) | | **1.8** | **40.6** | **4.7** | **4.7** | **1.5** |
| I-37 | Main Canal Chaos | (Actual/Stated) Overall Service by the Main Canal | | **0.64** | **1.38** | **0.37** | **0.43** | **n.a.** |
| I-38 | Second Level Chaos | (Actual/Stated) Overall Service at the most downstream point operated by a paid employee | | **0.41** | **0.67** | **1.71** | **1.17** | **1.88** |
| I-39 | Field Level Chaos | (Actual/Stated) Overall Service to the Individual Ownership Units | | **1.23** | **0.45** | **0.50** | **0.71** | **1.00** |

# Annex 12
# Modernisation plan – guidance of presentation

## APPRAISAL


Results
Cropping intensity
Average crop yields
Yield/Unit of water consumed
Downstream environmental impacts
Symptoms
% collection of water fees
Viability of water user associations
Condition of structures and canals
Water theft
Service
Actual level and quality of service delivered
To fields
From one level of canal to another
Water Management strategy
Factors influencing service quality
Hardware design
Turnout design
Check structure design
Flow rate measurement
Communication system
Remote monitoring
Availability of spill sites
Flow rate control structures
Capacity of canals
Regulating reservoir sites
Density of turnouts
Drainage network
Intake structure
Recirculation of drainage and spills
Management
Water control strategies
Instructions for operating check structures
Frequency of communication
Maintenance schedules
Understanding of the service concept
Frequency of making flow changes
Quality and types of training programs
Monitoring and evaluation by successive levels of management
Existence of performance objectives
Constraints
Physical constraints
Dependability of water supply
Adequacy of water supply
Availability of groundwater
Climate
Silt load in the water
Geometric pattern of fields
Size of fields
Quality of seed varieties
Field conditions
Land leveling
Appropriate irrigation methods for the soil type
Institutional constraints
Adequacy of budget
Size of water user association
Existence and type of law enforcement
Purpose and organizational structure of WUA
Destination of budget
Method of collecting and assessing water fees
Ownership of water and facilities
Ability to fire inept employees
Staffing policies, salaries
Availability of farm credit
Crop prices

**MODERNIZATION PLAN**

**VISION**

**Results/Objectives**

- Cropping intensity
- Average crop yields
- Yield/Unit of water consumed
- Downstream environmental impacts

**Symptoms**

- % collection of water fees
- Viability of water user associations
- Condition of structures and canals
- Water theft

**Service**

- Level and quality of service delivered
  - To fields
  - From one level of canal to another

**Water Management strategy**

**Factors influencing service quality**

Hardware design

- Turnout design
- Check structure design
- Flow rate measurement
- Communication system
- Remote monitoring
- Availability of spill sites
- Flow rate control structures
- Capacity of canals
- Regulating reservoir sites
- Density of turnouts
- Drainage network
- Intake structure

Management

- Water control strategies
- Information
- Instructions for operating check structures
- Frequency of communication
- Maintenance schedules
- Understanding of the service concept
- Frequency of making flow changes
- Quality and types of training programs
- Monitoring and evaluation by successive levels of management
- Existence of performance objectives

**Constraints**

Physical constraints

- Dependability of water supply
- Adequacy of water supply
- Availability of groundwater
- Climate
- Silt load in the water
- Geometric pattern of fields
- Size of fields
- Quality of seed varieties
- Field conditions
  - Land leveling
  - Appropriate irrigation methods for the soil type

Institutional constraints

- Adequacy of budget
- Size of water user association
- Existence and type of law enforcement
- Purpose and organizational structure of WUA
- Destination of budget
- Method of collecting and assessing water fees
- Ownership of water and facilities
- Ability to fire inept employees
- Staffing policies, salaries
- Availability of farm credit
- Crop prices

MODERNIZATION OPTIONS

**MODERNIZATION PLAN**

**SHORT TERM – 2004**

| **Results/Objectives** | **Symptoms** |
|---|---|
| ○ Cropping intensity<br>○ Average crop yields<br>○ Yield/Unit of water consumed<br>○ Downstream environmental impacts | ○ % collection of water fees<br>○ Viability of water user associations<br>○ Condition of structures and canals<br>○ Water theft |

**Service**

- Level and quality of service delivered
  - To fields
  - From one level of canal to another

**Water Management strategy**

**Factors influencing service quality**

| Hardware design | Management |
|---|---|
| ○ Turnout design<br>○ Check structure design<br>○ Flow rate measurement<br>○ Communication system<br>○ Remote monitoring<br>○ Availability of spill sites<br>○ Flow rate control structures<br>○ Capacity of canals<br>○ Regulating reservoir sites<br>○ Density of turnouts<br>○ Drainage network<br>○ Intake structure<br>○ Intake structure<br>○ Recirculation of drainage and spills | ○ Water control strategies<br>○ Information<br>○ Instructions for operating check structures<br>○ Frequency of communication<br>○ Maintenance schedules<br>○ Understanding of the service concept<br>○ Frequency of making flow changes<br>○ Quality and types of training programs<br>○ Monitoring and evaluation by successive levels of management<br>○ Existence of performance objectives |

**Constraints**

| Physical constraints | Institutional constraints |
|---|---|
| ○ Dependability of water supply<br>○ Adequacy of water supply<br>○ Availability of groundwater<br>○ Climate<br>○ Silt load in the water<br>○ Geometric pattern of fields<br>○ Size of fields<br>○ Quality of seed varieties<br>○ Field conditions<br>• Land leveling<br>• Appropriate irrigation methods for the soil type | ○ Adequacy of budget<br>○ Size of water user association<br>○ Existence and type of law enforcement<br>○ Purpose and organizational structure of WUA<br>○ Destination of budget<br>○ Method of collecting and assessing water fees<br>○ Ownership of water and facilities<br>○ Ability to fire inept employees<br>○ Staffing policies, salaries<br>○ Availability of farm credit<br>○ Crop prices |

MODERNIZATION OPTIONS

**MODERNIZATION PLAN**

**MEDIUM TERM – 2008**

| **Results/Objectives** | **Symptoms** |
|---|---|
| ○ Cropping intensity<br>○ Average crop yields<br>○ Yield/Unit of water consumed<br>○ Downstream environmental impacts | ○ % collection of water fees<br>○ Viability of water user associations<br>○ Condition of structures and canals<br>○ Water theft |

**Service**

- Level and quality of service delivered
  - To fields
  - From one level of canal to another

**Water Management strategy**

**Factors influencing service quality**

| Hardware design | Management |
|---|---|
| ○ Turnout design<br>○ Check structure design<br>○ Flow rate measurement<br>○ Communication system<br>○ Remote monitoring<br>○ Availability of spill sites<br>○ Flow rate control structures<br>○ Capacity of canals<br>○ Regulating reservoir sites<br>○ Density of turnouts<br>○ Drainage network<br>○ Intake structure<br>○ Intake structure<br>○ Recirculation of drainage and spills | ○ Water control strategies<br>○ Information<br>○ Instructions for operating check structures<br>○ Frequency of communication<br>○ Maintenance schedules<br>○ Understanding of the service concept<br>○ Frequency of making flow changes<br>○ Quality and types of training programs<br>○ Monitoring and evaluation by successive levels of management<br>○ Existence of performance objectives |

**Constraints**

| Physical constraints | Institutional constraints |
|---|---|
| ○ Dependability of water supply<br>○ Adequacy of water supply<br>○ Availability of groundwater<br>○ Climate<br>○ Silt load in the water<br>○ Geometric pattern of fields<br>○ Size of fields<br>○ Quality of seed varieties<br>○ Field conditions<br>• Land leveling<br>• Appropriate irrigation methods for the soil type | ○ Adequacy of budget<br>○ Size of water user association<br>○ Existence and type of law enforcement<br>○ Purpose and organizational structure of WUA<br>○ Destination of budget<br>○ Method of collecting and assessing water fees<br>○ Ownership of water and facilities<br>○ Ability to fire inept employees<br>○ Staffing policies, salaries<br>○ Availability of farm credit<br>○ Crop prices |

MODERNIZATION OPTIONS

**Instructions for presentation**

Appraisal of present situation

Modernization plan

VISION and objectives

Modernization strategy

SHORT TERM PLAN – 2004
Budget:

Specific objectives
Service objectives
Water Management Strategy
Steps with specific improvements, actions and details
Costs and benefits

MEDIUM TERM PLAN 2005 – 2008
Budget:

Specific objectives
Service objectives
Water Management Strategy
Steps with specific improvements, actions and details
Costs and benefits

# Annex 13
# Modernisation plan – presentation handout

**5 years - Modernization Plan**
**Nam Houm Irrigation Scheme (Laos)**

**Results from July 2006**
**RAP Training Workshop**
**MRC, Vientiane**

***Prepared by Lao Participants***

## Content

1. **Vision**
2. **Objective**
3. **Strategies, options & cost estimation**

## Vision

**"Model irrigation system with complete infrastructure, effective management, and empowered WUAs"**

## Objectives

1. **To increase water use efficiency and productivity**
2. **To increase farmer's income**
3. **To achieve sustainable system operation**

## Strategies

1. **Hardware**
   1) **Rehabilitate & improve irrigation facilities e.g. canals, gates, roads…etc.**
   2) **Improve drainage**
   3) **Improve & construct field/on farm system e.g. farm ditch, farm turnouts…etc.**
   4) **Provide water measurement and monitoring devices for water distribution, spill and runoff**
   5) **Improve IT system between project and farmers level for adjustment & improvement of water delivery**
   6) **Strengthen protection of irrigation facilities**
   7) **Provide project equipments for maintenance activity**

## Strategies

2. **Software**
   1) **Improve project management plan**
   2) **Add more 3 project staff**
   3) **Strengthen WUAs : Training, strict implementing rules**
   4) **Increase collecting rate of ISF from 32% to 90%**
   5) **Improve system operation and irrigation service toward more flexible and user oriented model**
   6) **Improve monitoring and evaluation system for water distribution**

## Cost Estimation

1. **Hardware : 2,208,500**
   1) **Rehabilitate irrigation facilities + drainage : US$500/ ha**
   2) **Construct field/on farm system :US$ 300/ha**
   3) **Current Meter & Flumes: 10,000/1set**
      **Water measurement & monitoring: US$300/month/person**
   4) **Improve IT system: Phony radio: US$1500/1 set**
   5) **Improve social authority: US$0 (farmer's participation)**
   6) **Provide project equipments for maintenance activity:**
      - ***Back hoe loader* : *US$ 100,000***
      - ***Dam truck* : *US$ 40,000***
      - ***Tractor* : *US$ 40,000***

      } US$180,000

## Cost Estimation

2. **Software : US$ 41,000**
   1) **Improve project management plan : US$0**
   2) **Add more 3 project staff : US$ 0**
   3) **Strengthen WUAs : Training, strict implementing rules: US$2000/time *( 2 times a year)***
   4) **Increase amount of ISF collection of more than 90% :0US$**
   5) **Improve water delivery regulation to be more strictly and effectively: US$100/month**
   6) **Improve monitoring and evaluation for whole system for water distribution: US$3,000/time/year**

**Total Budget Required: US$ 2,249,500**

Thank you for your kind instruction

## Objective
## วัตถุประสงค์

1.ปรับปรุงประสิทธิภาพระบบการจัดการชลประทานในระดับคลองสายใหญ่และคลองสายซอย

- To improve Irrigation water management efficiency in main canal and lateral canal

2. เพื่อลดความเสี่ยงของการขาดน้ำเพื่อการปลูกพืชทั้งในฤดูแล้งและฤดูฝน

- To reduce risk of lacking water for agriculture both dry and wet season

- 3. เพื่อพัฒนาองค์กรผู้ใช้น้ำให้สามารถเข้ามามีส่วนร่วมในการตัดสินใจเชิงปริมาณ
- - To strengthen for WUG in participation of decision making in terms of amount of water
- 4. เพื่อเสริมสร้างความรู้ความสามารถในการควบคุมอาคารชลประทานของเจ้าหน้าที่โครงการฯให้ถูกต้องตามหลักวิชาการ
- - To make capacity building to the officers to control and operate the hydraulic structere according to the technical
- 5. เพื่อเพิ่มผลผลิตต่อไร่
- - To increase yield crop per rai

## Problems
## ปัญหา

1. เกษตรกรขาดความรู้ในเรื่องปริมาณน้ำตามที่เจ้าหน้าที่บอก

   - Farmers are not know the quantity of water (just know the figure)

2. ขาดเครื่องมือ อุปกรณ์ในการบริหารจัดการน้ำตามหลักวิชาการที่ต้องการความถูกต้องสูง

- Lacking of equipment to technically operate

3. ขาดงบประมาณในการบริหารจัดการน้ำ

- Lacking of budget for management

4. มีบางพื้นที่เพาะปลูกที่ไม่ได้รับน้ำตามความต้องการของพืช

-Crop water requirement couldn't meet in some areas

5. การตรวจสอบอัตราการไหลของน้ำผ่านอาคารมีความยุ่งยากเนื่องจากมีอาคารชลประทานเป็นจำนวนมาก

- Difficulty in controlling and operating amount of water through hydraulic structures because of many structures.

6. เกษตรกรบางส่วนทำการเกษตรเป็นอาชีพรอง

- Some farmers don't get main income from agriculture.

7. เกษตรกรบางส่วนไม่มีที่ดินเป็นของตนเอง ทำให้การมีส่วนร่วมของเกษตรกรทำได้ยาก

## Propose & Solution
## ข้อเสนอแนะและแนวทางแก้ไข

1.พัฒนาบุคลากรให้มีความรู้ความสามารถในการปฏิบัติงานรวมถึงจัดหาบุคลากรที่มีศักยภาพในการปฏิบัติงานให้เพียงพอ

- Capacity building to the RID officer including recruit the resource persons

2.จัดหาเครื่องมือ อุปกรณ์ในการบริหารจัดการน้ำตามหลักวิชาการที่ต้องการความถูกต้องสูง

Providing instruments for technical water management

3.จัดหางบประมาณในการบริหารจัดการน้ำ เช่น เงินค่าทำงานวันหยุด ค่าน้ำมัน

- Allocating budget for water management such as overtime, gasoline, phone card

4.แผนการส่งน้ำควรมีการสำรองน้ำไว้ในช่วงที่อาจจะขาดแคลน

- Making a plan for reserving water to use in the shortage period

5.ส่งเสริมให้มีการขุดบ่อน้ำในไร่นาเพื่อสำรองน้ำไว้ใช้ทำหน้าที่เหมือน Regulating Reservoir

- Promoting to excavate farm pond to reserve water and act as regulating reservoir

6.จัดฝึกอบรมเชิงปฏิบัติการให้กับเกษตรกรมีความเข้าใจในเรื่องน้ำเชิงปริมาณ

- Providing training and seminar to the farmers in order to understand water quantity

7.จัดอบรมเจ้าหน้าที่เรื่องการบริหารจัดการน้ำตามหลักวิชาการอย่างต่อเนื่อง

- Providing the training to officers in water management

8.จัดหาสิ่งจูงใจให้กับเจ้าหน้าที่ที่ปฏิบัติงานส่งน้ำ เช่น เงินรางวัลประจำปีให้สอดคล้องกับผลงาน

- Providing incentive and rewards to officer such as bonus and etc. as the perfomance

9.จัดหางบประมาณเพื่อมาทำงานแบบบูรณาการกับหน่วยงานอื่น เช่น กรมส่งเสริมการเกษตร กรมพัฒนาที่ดิน ในการพัฒนาเพิ่มผลผลิตและปลอดภัย

- Providing budget to respond with the other agencies such as Department of Agriculture Extension , Land Development Dept. in order to increase crop yield and food safty

**Results**

Output per cropped area per ($/ha)=368$
Output per unit irrigated supply ($/m³): 0.0664
Annual relative water supply: 6.2
Annual relative irrigation supply: 1.0
Water delivery capacity : 341%
Percentage of O&M collected (%):
Annual Project irrigation Efficiency(%): 61
Annual Command Area Irrigation Efficiency (%):40

## Major Problems

1. Uncompleted infrastructure system
2. Low field irrigation efficiency
3. Low agricultural production
4. Irrigation water drained out of the command area
5. No Regulating Reservoirs in the command area
6. Lack of communication facilities and procedure
7. Poor physical condition of lower level canal system
8. Insufficient water control and measurement

## Vision

To ensure enough water for irrigation schemes, reduce water fee for increasing income for all the farmers and be sustainable management.

## Objective

- To improve existing irrigation area
- To rehabilitate and recover irrigation area
- To empower farmer water user groups

## Strategy

- To rehabilitate existing irrigation infrastructures
- To extent irrigation areas
- To strengthen capacity building of FWUC and WUGs
- To strengthen O&M

## Cost estimation

- To rehabilitate existing irrigation infrastructures:
2,850ha x 350$= 997,500$
- To extent irrigation areas:
7,150ha x 800$=5,720,000 $
- To strengthen capacity building of FWUC and WUGs
200,000$ for 5 years
- To strengthen O&M
500,000$ for 5 years

Total: 7,417,500$