

Regional Workshop

on

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

Cambodia Study Team

Background

❖ The project was funded by the MRC under the Framework of Program to analyze and evaluate water and ecosystem in Asia paddy fields.

❖ **Period** : One year from February 2007 to February 2008

❖ **Team members:**

- **Dr. Theng Tara** (Team leader, MOWRAM)
- **Mr. Thach Sovanna** (Report assistance, MOWRAM)
- **Mr. Meas Peov** (Field assistance, MAFF)
- **Mr. Sao Sam Phors** (Field assistance, MOWRAM)
- **Mr. Hong Kim San** (Field work, Battambang PDOWRAM)
- **Mr. Sok Khom** (Facilitator, CNMC)

has two teams: Field Team and Management team

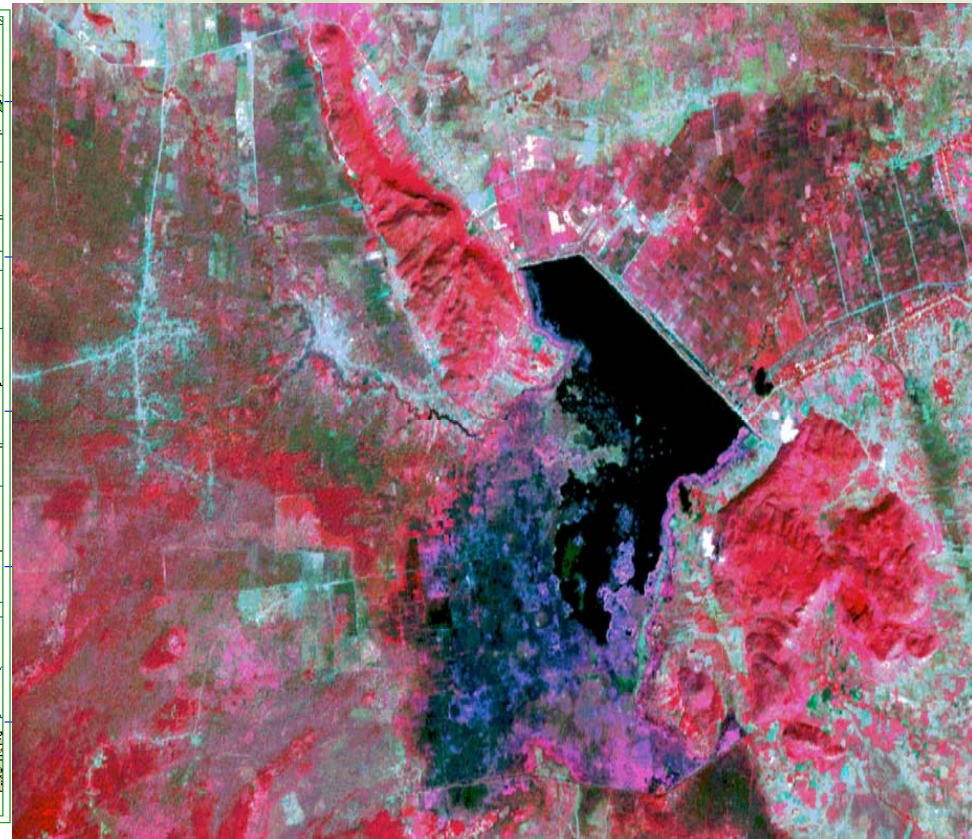
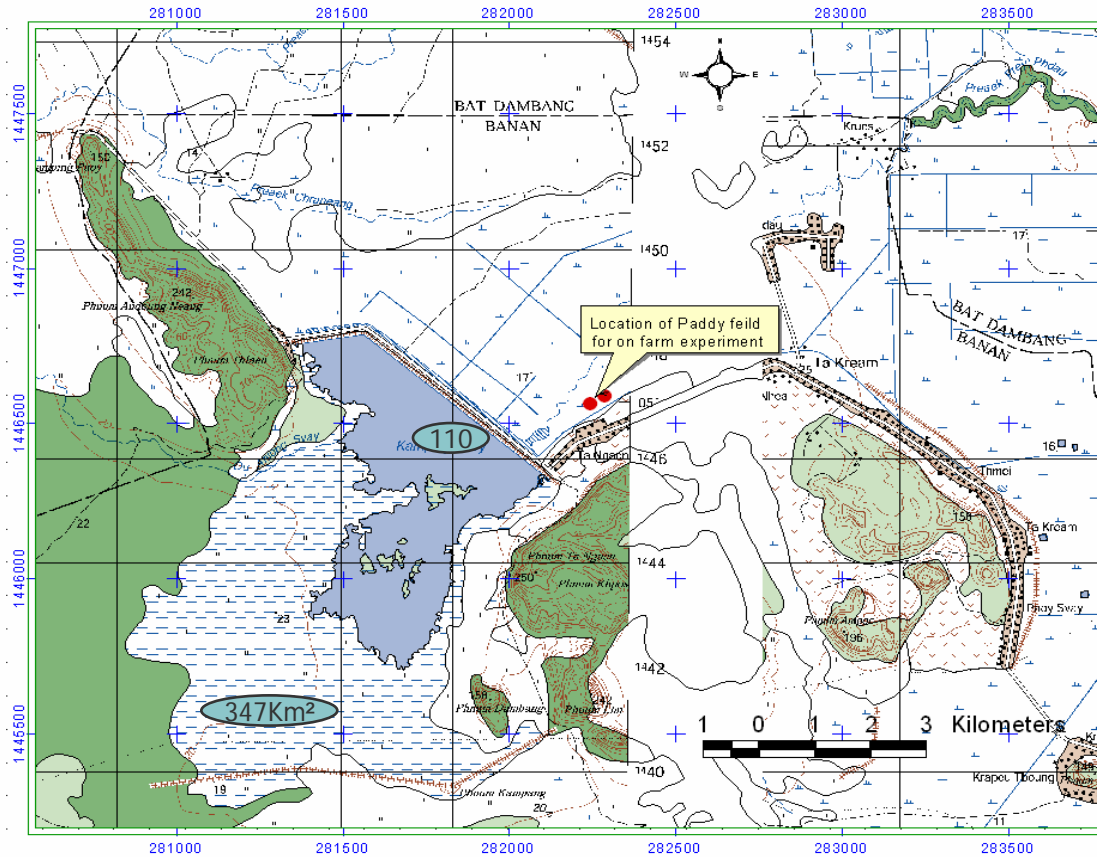
❖ ***overall objective***

is to extract information on water demand for rice plants and to improve irrigation efficiency on paddy fields.



03.04.2007

Location of Study Areas

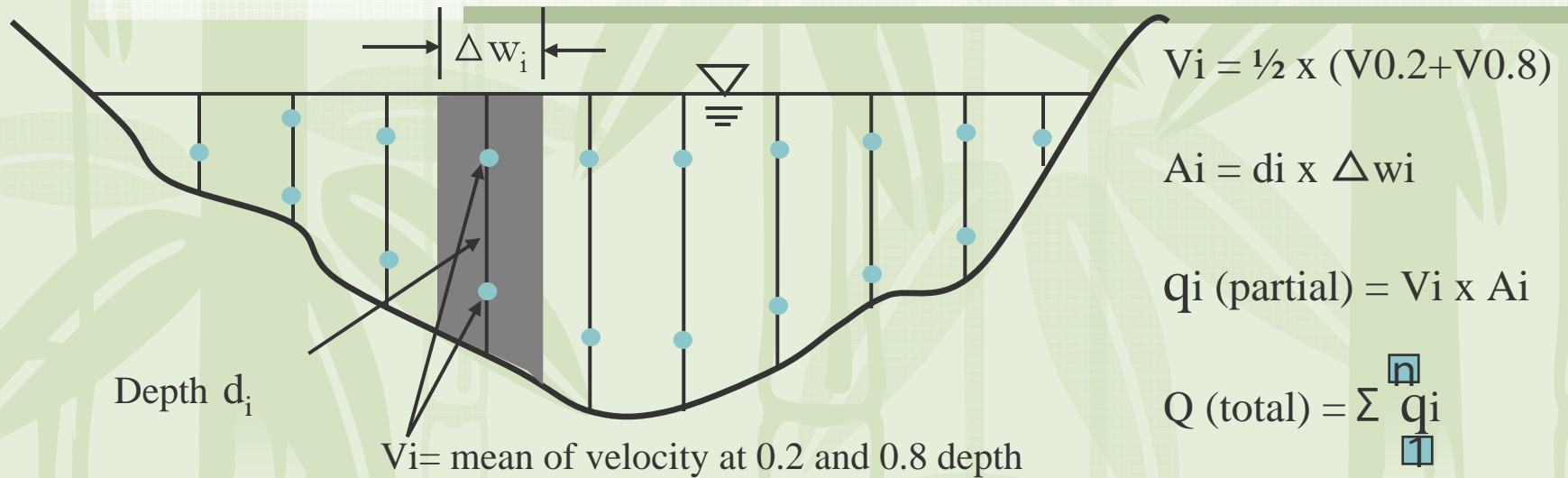


- ❖ Kamping Puoy scheme is one gravity type of irrigation system.
- ❖ located in Banan district, about 25 Km from Battambang province.
- ❖ Catchment area $A = 347 \text{ km}^2$, $W = 110,000,000\text{m}^3$,
- ❖ Total Irrigated area 1,1000 Ha
- ❖ has two main dams with the length of about 14 Km and some intakes structure
- ❖ The irrigation canal network consists of:
 - one main canal 9Km
 - three secondary canals 27Km
- ❖ Only Rice is growing in the scheme wet and Dry seasons.



1- Conducting inflows and outflows measurements
















23 points inflows and 18 outflows (dry), 25 inflow+20 outflow (wet)





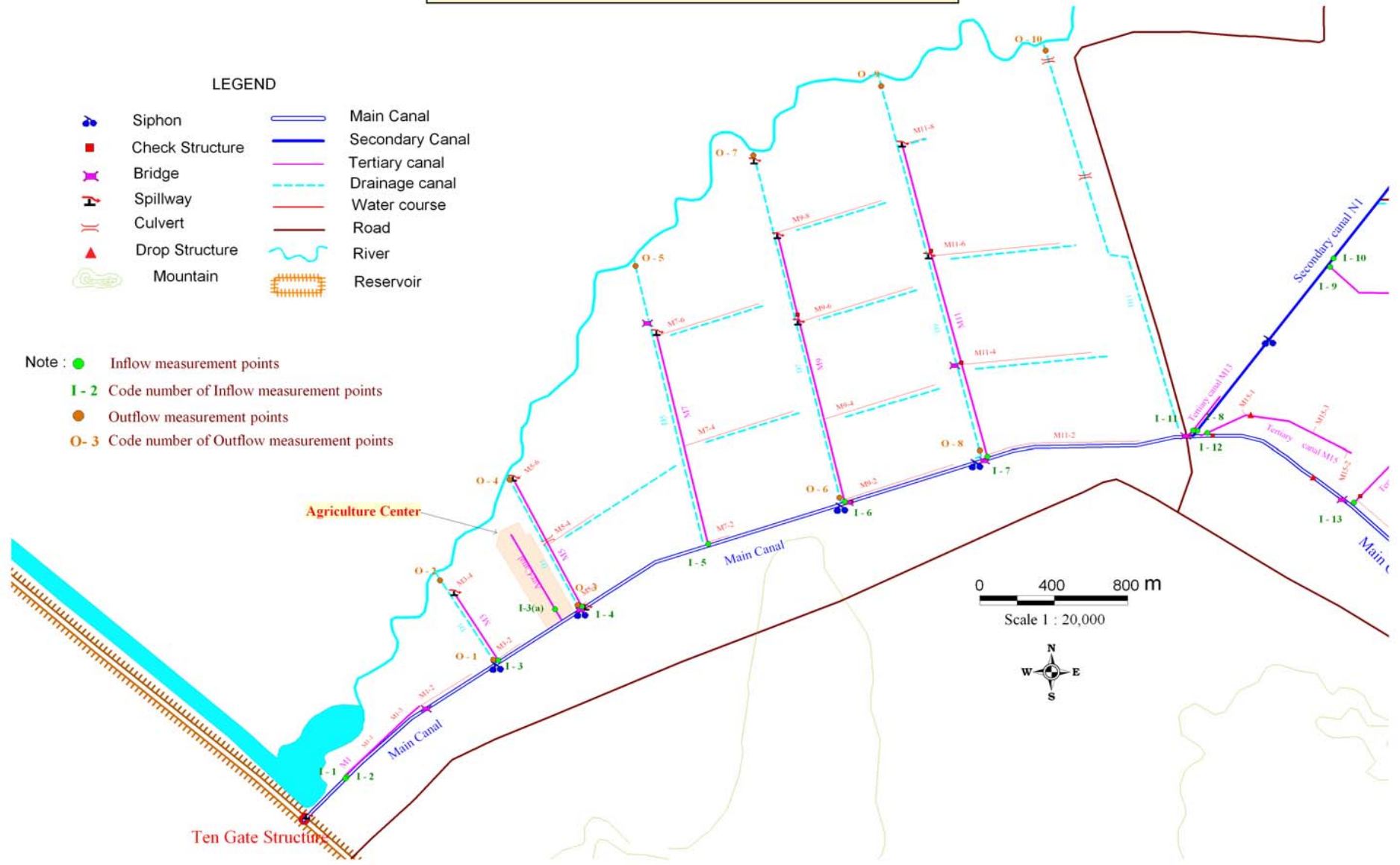
- ❖ Measuring flow with current meter at a selected location in the canal,
- ❖ cross section is divided vertically into sub segment
- ❖ Total discharge is attained by summarizing of partial discharges

MEASUREMENT POINT OF INFLOW AND OUTFLOW
OF WET SEASON 2006 - 2007

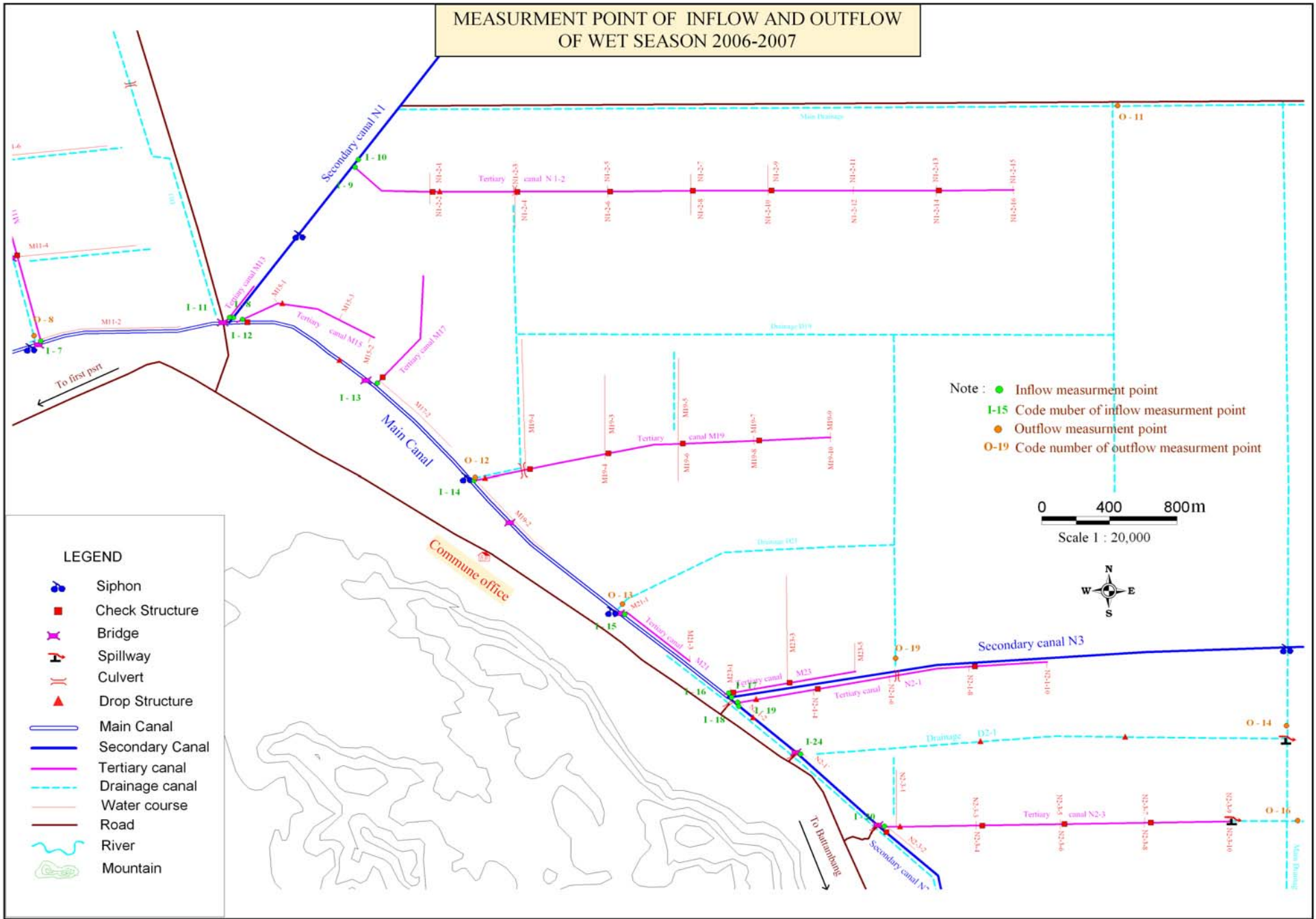
LEGEND

- | | | | |
|---|-----------------|---|-----------------|
|  | Siphon |  | Main Canal |
|  | Check Structure |  | Secondary Canal |
|  | Bridge |  | Tertiary canal |
|  | Spillway |  | Drainage canal |
|  | Culvert |  | Water course |
|  | Drop Structure |  | Road |
|  | Mountain |  | River |
| | |  | Reservoir |

- Note :
-  Inflow measurement points
 - I - 2** Code number of Inflow measurement points
 -  Outflow measurement points
 - O - 3** Code number of Outflow measurement points



MEASUREMENT POINT OF INFLOW AND OUTFLOW OF WET SEASON 2006-2007



Note : ● Inflow measurement point
 I-15 Code number of inflow measurement point
 ● Outflow measurement point
 O-19 Code number of outflow measurement point

0 400 800m
 Scale 1 : 20,000

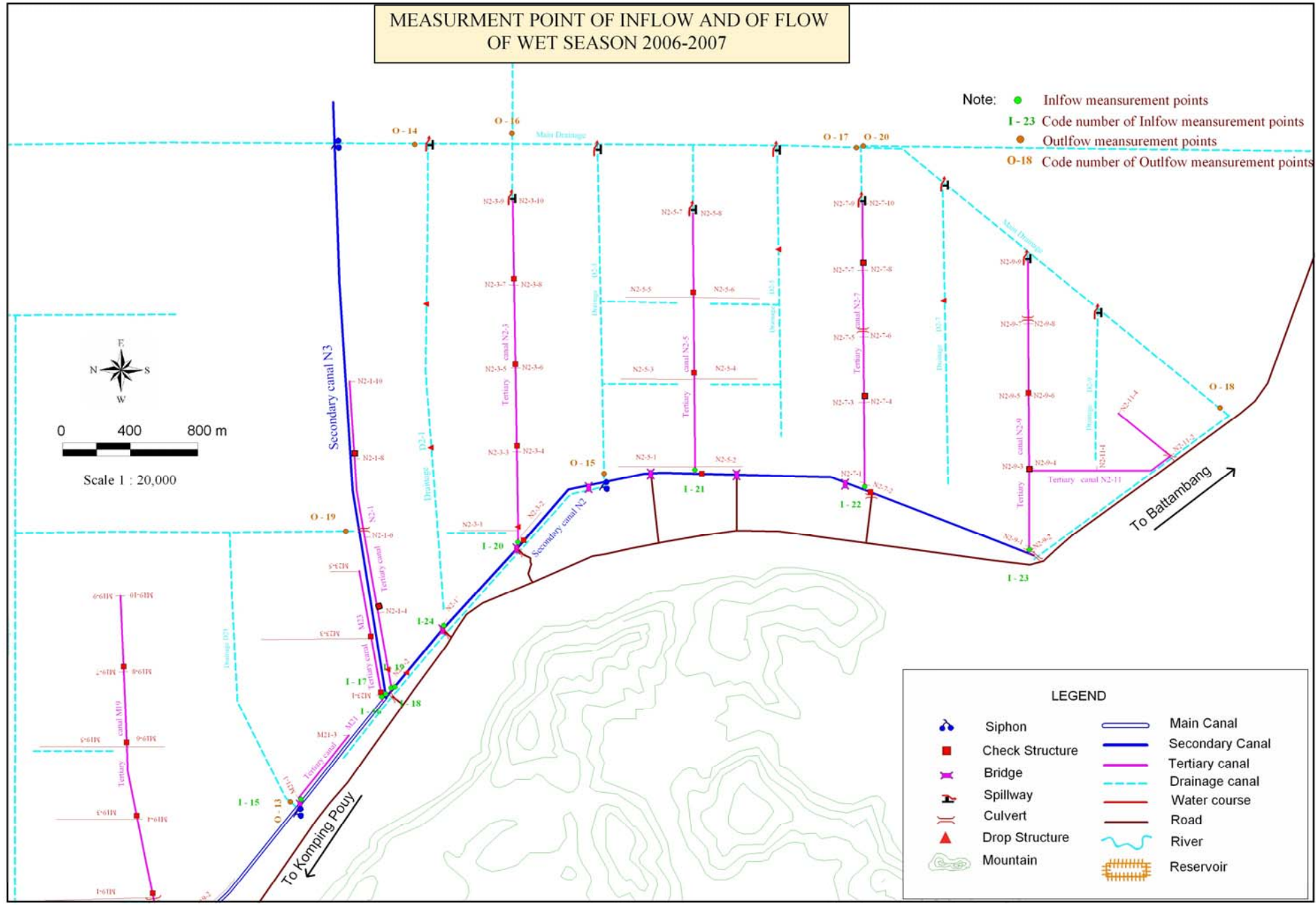
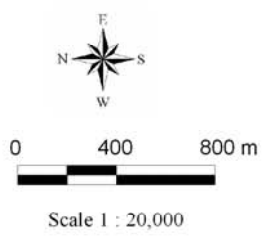


LEGEND

- Siphon
- Check Structure
- Bridge
- Spillway
- Culvert
- Drop Structure
- Main Canal
- Secondary Canal
- Tertiary canal
- Drainage canal
- Water course
- Road
- River
- Mountain

MEASUREMENT POINT OF INFLOW AND OF FLOW OF WET SEASON 2006-2007

Note: ● Inflow measurement points
 I-23 Code number of Inflow measurement points
 ● Outflow measurement points
 O-18 Code number of Outflow measurement points



LEGEND

	Siphon		Main Canal
	Check Structure		Secondary Canal
	Bridge		Tertiary canal
	Spillway		Drainage canal
	Culvert		Water course
	Drop Structure		Road
	Mountain		River
			Reservoir



2- Record water level in rice paddy field

Locations:	Coordinate (X, Y)	
W.L 1 : In Agriculture center	282688	1447120
W.L 2 : In M9-2 rice field	284462	1447838
W.L 3 : In M19-1 rice field	287976	1447377
W.L 4 : In N2-3-2 rice field	290300	1444956
W.L 5 : In N2-5-1 rice field	290576	1444112
W.L 6 : In M23 rice field	289567	1446009

Tank with bottom with rice	E + T + R
Tank without bottom with rice	E + T + P + R
Wooden Staff gate with scale	E + T + P + S + R
Tank with bottom without rice	E + R
Rainfall recorder	R



29.03.2007

3- (ETc) was calculated by two methods:

- 1- Averaging from field measurement and
- 2- FAO formula

ETc = ETo x Kc, Where:

ETc : crop water requirement or Evapo-transpiration requirement
mm/day

ETo : reference crop Evapo-transpiration mm/day

Kc : Crop coefficient

4- The percolation is determined by using the percolation apparatus

Percolation = Water loss in depth – Evapotranspiration

5- Effective rainfall for rice crop was calculated following by the method that was use by FAO.

Pe = P*0.6-10 if P<75mm and Pe = P*0.8-25 if P>25mm

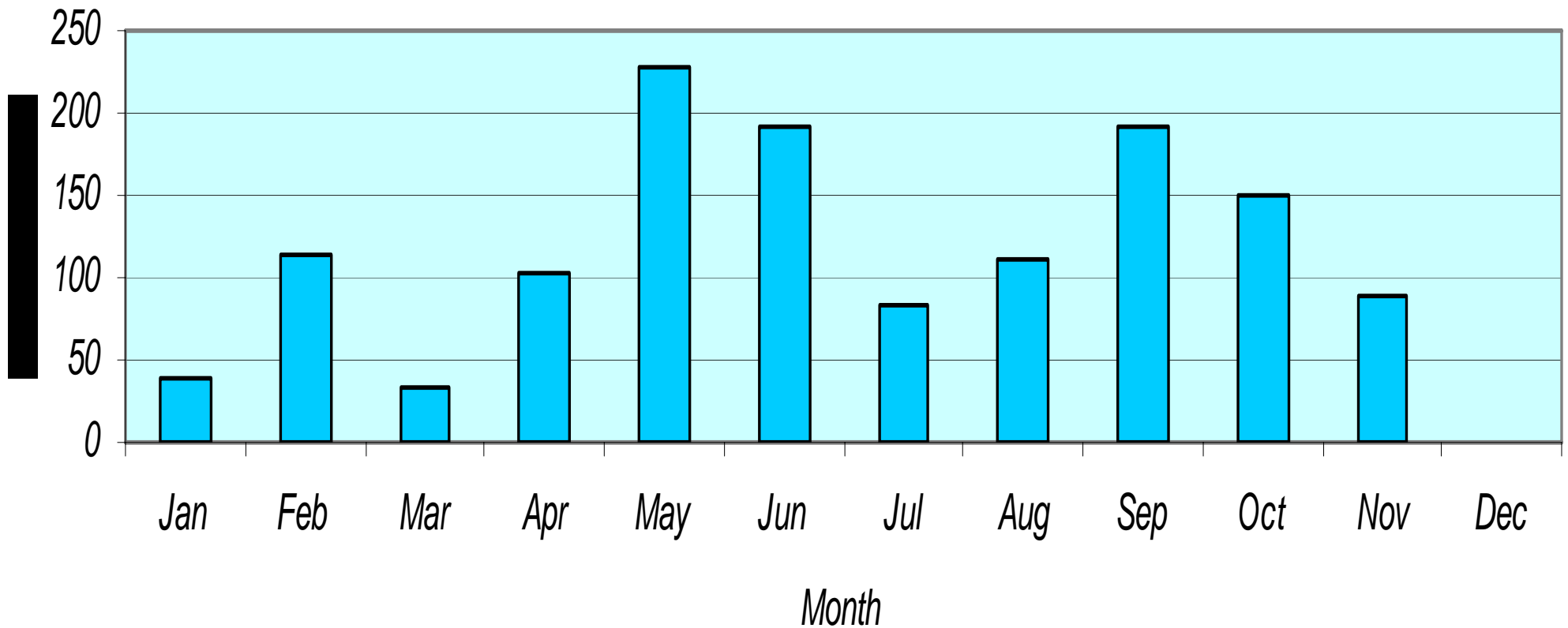
6- Record cropping pattern and crop calendar

10 days in one time by the farmer

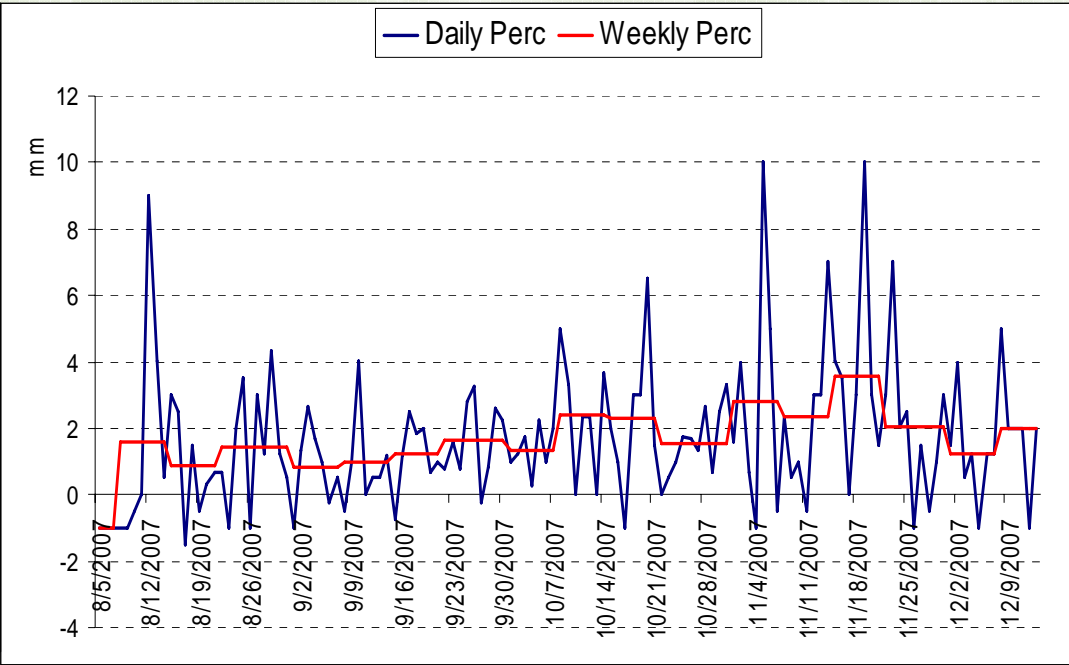
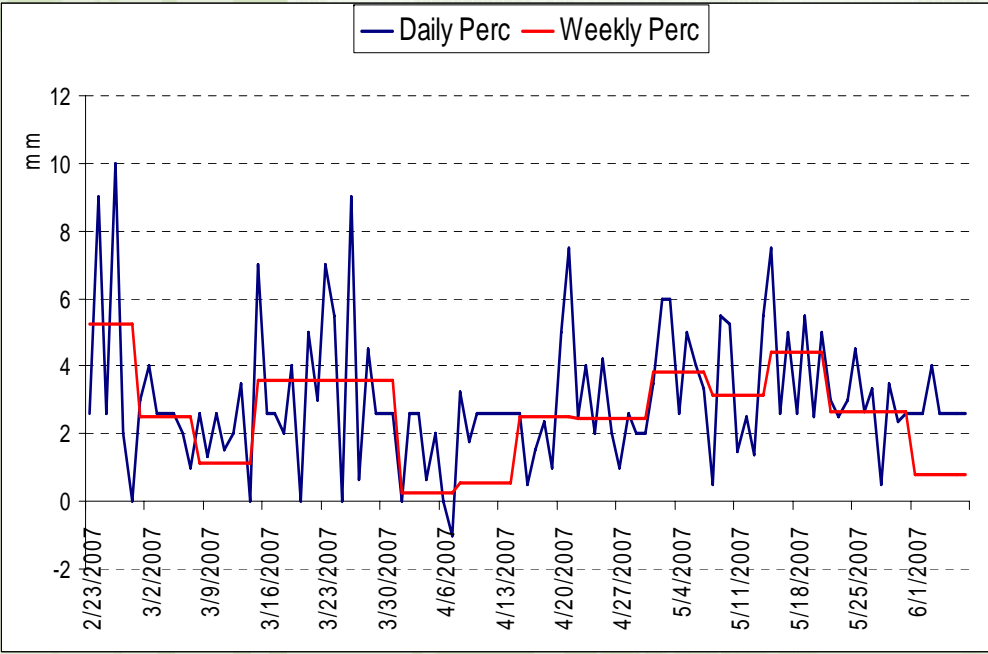
RAINFALL

RAIN FALL (mm)

Total=1310mm



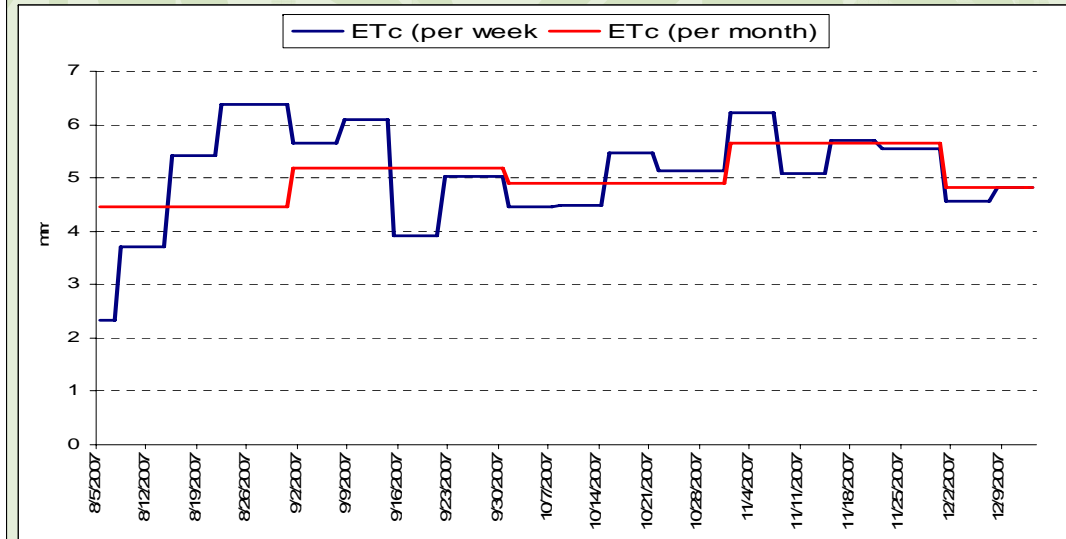
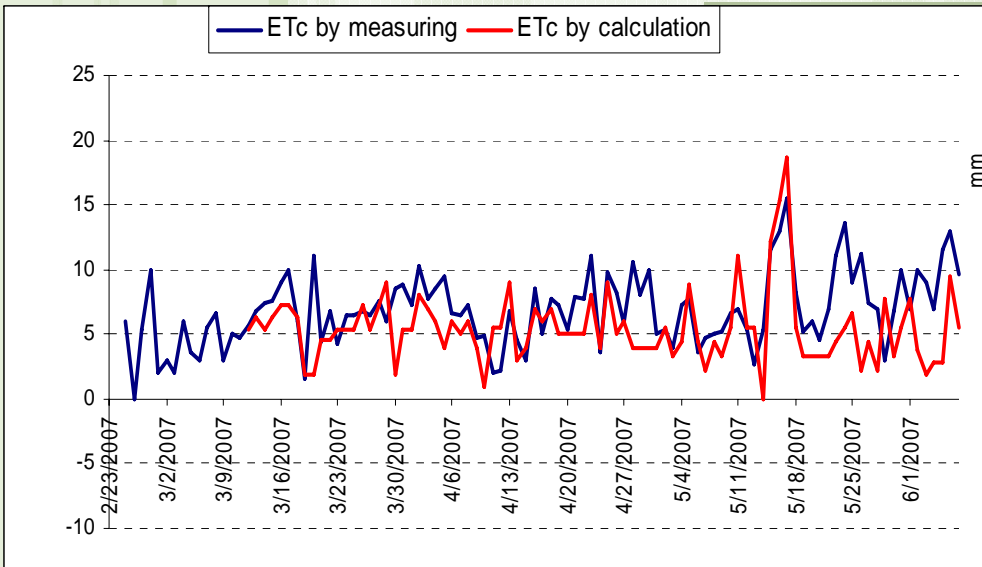
Percolation



2.12 3.94 1.85 3.52 2.14 3.06 2.61

1.80 1.02 2.03 2.91 0.89 2.01 1.71

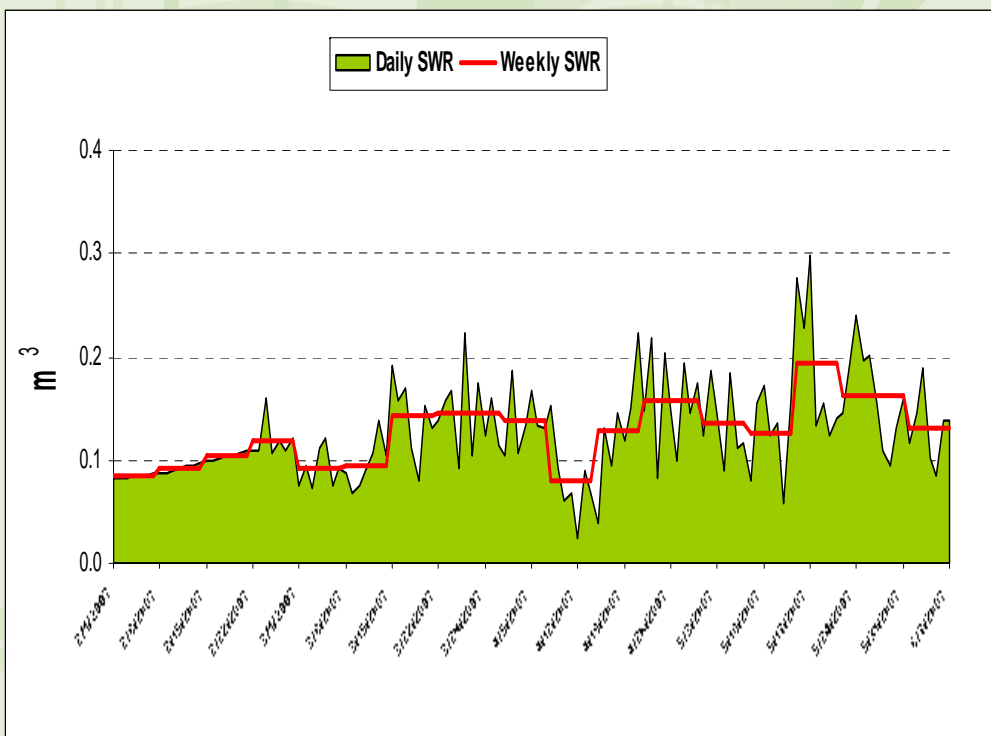
Crop Water Requirement



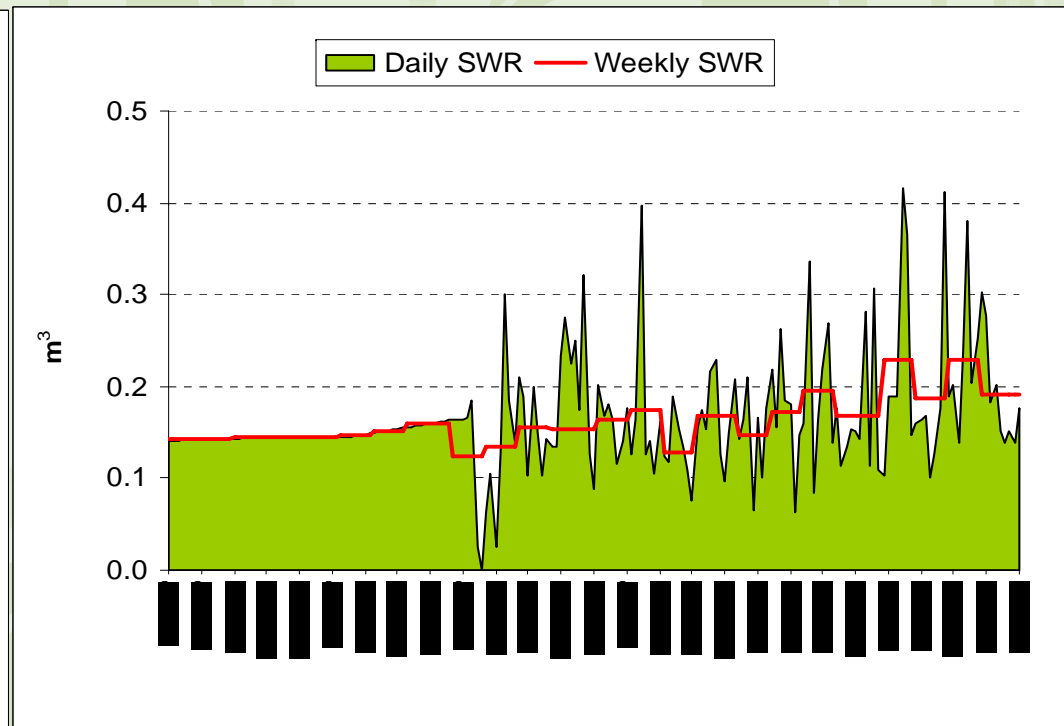
6.44 6.27 7.13 7.86 6.61 6.84 **6.87**

4.91 5.73 4.82 5.62 5.31 4.89 **5.11**

Total Scheme Water Requirement



Dry = 16,12 MCM



Wet = 30.15 MCM

RICE CROP CALANDAR

Nº	Rice	2007																																				2008					
		Jan			Feb			Mach			Apr			May			Jun			July			Aug			Sep			Oct			Nov			Dec			Jan					
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3						
1	Seedling				66 ha												72 ha																										
2	Braodcasting				938 ha												1894.5 ha																										
3	Planting							514.5 ha															623.87																				
4	Harvesting																1452.5															2518.37h											

7- Identify actual irrigated area

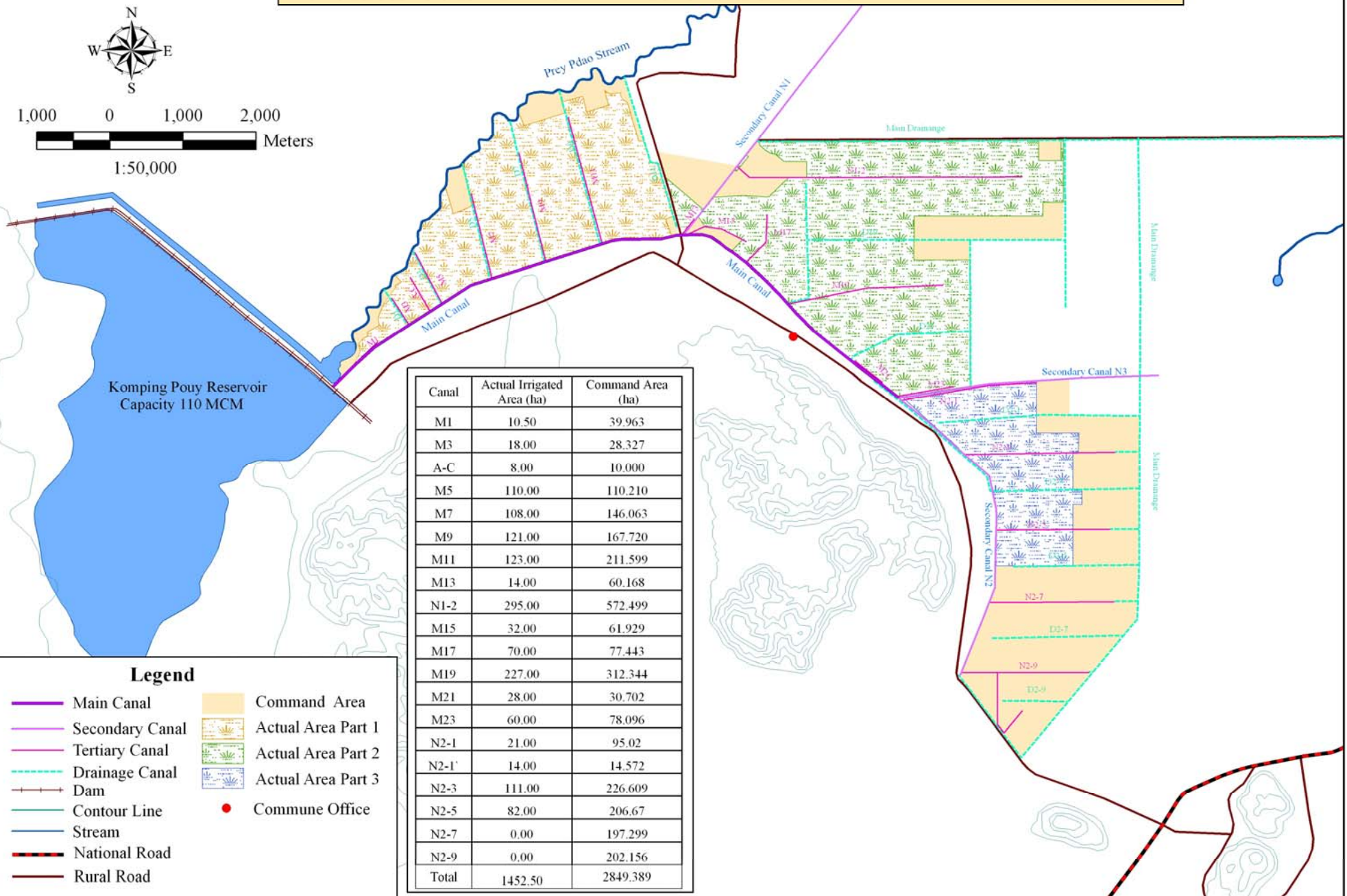
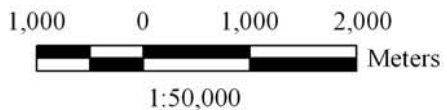
- a) Provided by the farmer
 - b) GPS equipment to record the points and boundaries
-

8- Conduct conveyance lost test along the canals

On main Canal, secondary canal N2 and tertiary canal

- ❖ Prepare table for recording data
- ❖ Select measurement point
- ❖ Draw cross section of canal
- ❖ Define depth point of canal from left to right
- ❖ Define point to measure water velocity
- ❖ Measure depth of canal from bridge to bottom
- ❖ Draw cross section of canal by AUTO CAD software
- ❖ Equipments preparation (Current meter instrument)

ACTUAL IRRIGATED AREA MAP AND COMMANDED AREA MAP IN DRY SEASON

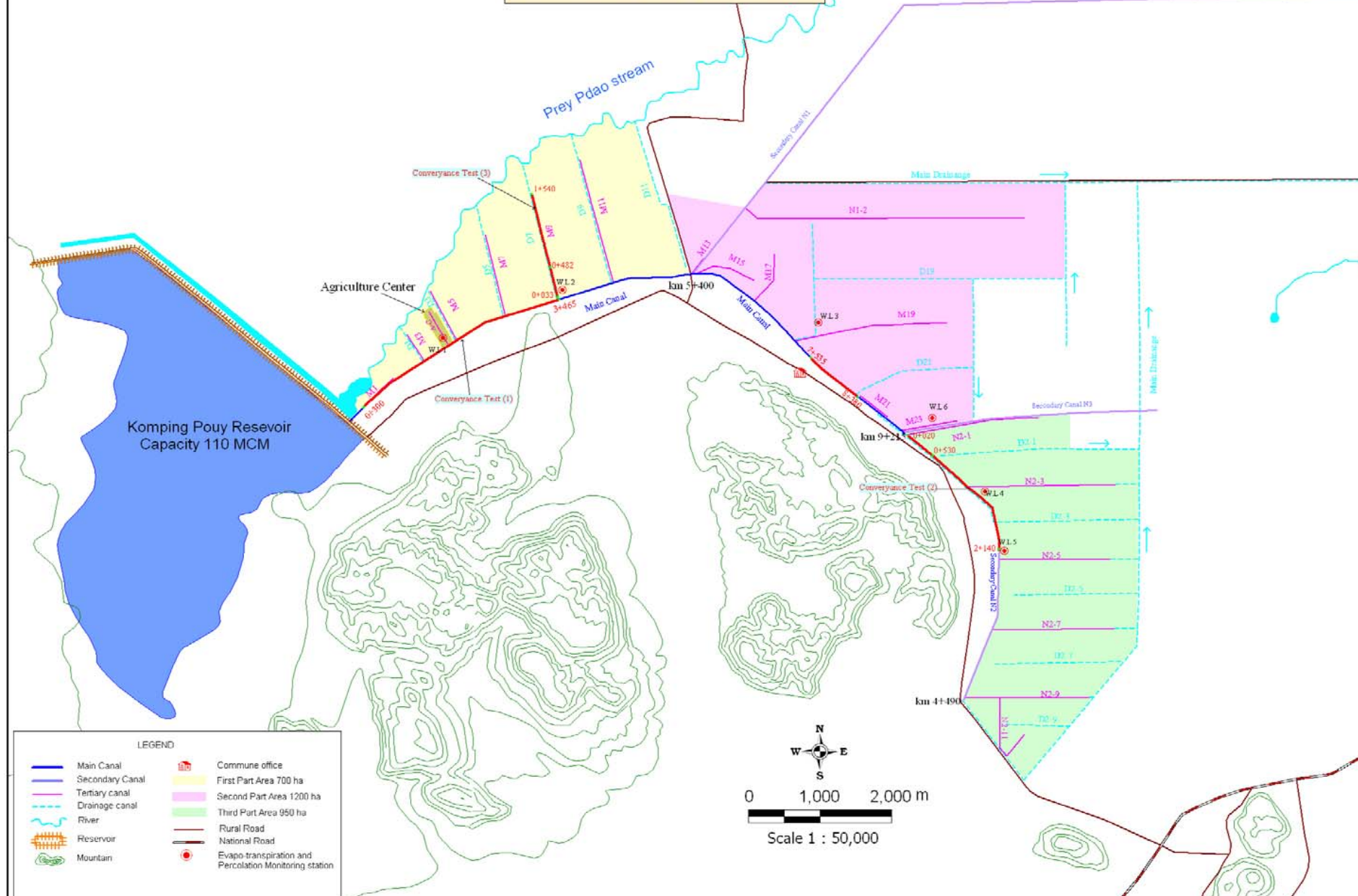


Canal	Actual Irrigated Area (ha)	Command Area (ha)
M1	10.50	39.963
M3	18.00	28.327
A-C	8.00	10.000
M5	110.00	110.210
M7	108.00	146.063
M9	121.00	167.720
M11	123.00	211.599
M13	14.00	60.168
N1-2	295.00	572.499
M15	32.00	61.929
M17	70.00	77.443
M19	227.00	312.344
M21	28.00	30.702
M23	60.00	78.096
N2-1	21.00	95.02
N2-1'	14.00	14.572
N2-3	111.00	226.609
N2-5	82.00	206.67
N2-7	0.00	197.299
N2-9	0.00	202.156
Total	1452.50	2849.389

Legend

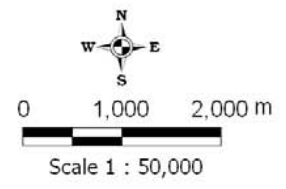
- Main Canal
- Secondary Canal
- Tertiary Canal
- - - Drainage Canal
- Dam
- Contour Line
- Stream
- National Road
- Rural Road
- Command Area
- Actual Area Part 1
- Actual Area Part 2
- Actual Area Part 3
- Commune Office

CONVEYANCE TEST MAP



LEGEND

- | | | | |
|--|-----------------|--|--|
| | Main Canal | | Commune office |
| | Secondary Canal | | First Part Area 700 ha |
| | Tertiary canal | | Second Part Area 1200 ha |
| | Drainage canal | | Third Part Area 950 ha |
| | River | | Rural Road |
| | Reservoir | | National Road |
| | Mountain | | Evapo-transpiration and Percolation Monitoring station |



1- CONVEYANCE LOSSE ON MAIN CANAL

N°	Name Canal	Station	Discharge (m ³ /s)	Lose (m ³ /s)	Length (Km)	Lose/km (m ³ /s)	Remake	Condition
1	M.C	I-1 ----- Pk 0+300	4.508	0.574	3.165	0.181	Have 5 Structure	Structure
2	M.C	Br-M9 ----- Pk 3+465	3.934					
3	M.C	Br-M19 ----- Pk 7+535	0.957	0.108	0.845	0.128		Non Structure
4	M.C	Br-M21 ----- Pk 8+380	0.849					

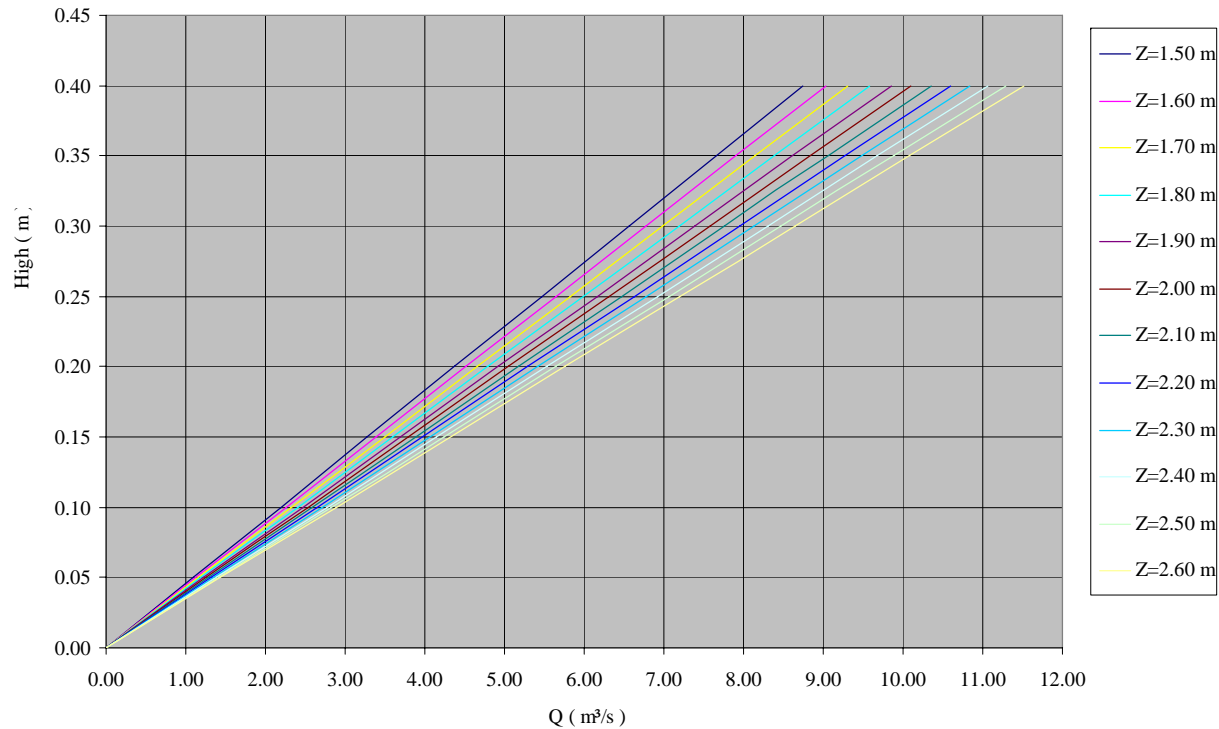
2- CONVEYANCE LOSSE ON SECONDARY CANAL

8	N2	I-18	0.576	0.039	0.510	0.077	Non Structure
		Pk 0+020					
9	N2	Br N2-1`	0.537	0.039	0.510	0.077	Non Structure
		Pk 0+530					
10	N2	Br N2-5	0.371	0.205	2.120	0.097	Have 2 Structure
		Pk 2+140					

3- CONVEYANCE LOSSE ON TERTIARY CANAL

5	M-9	I-6	0.353	0.032	0.449	0.071		Non Structure
		Pk = 33						
6	M-9	Pk = 4 82	0.321					
7	M-9	Pk = 1+540	0.049	0.304	1.507	0.202	Have 5 Structure	Structure

10 GATE DISCHARGE(3Door)

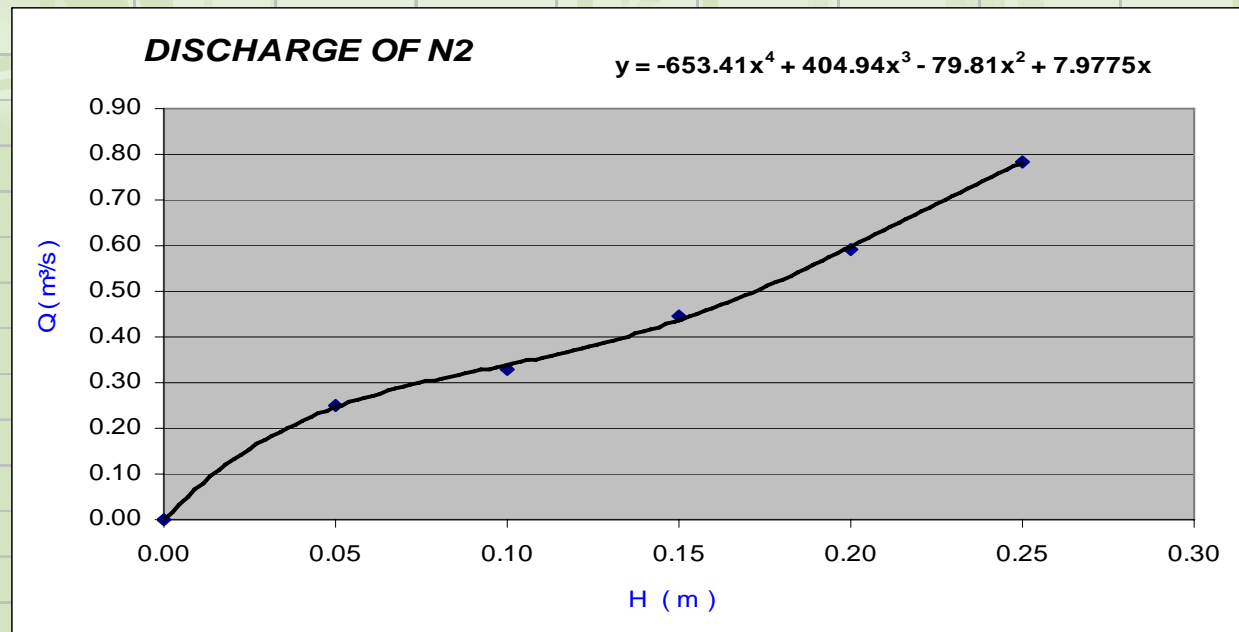
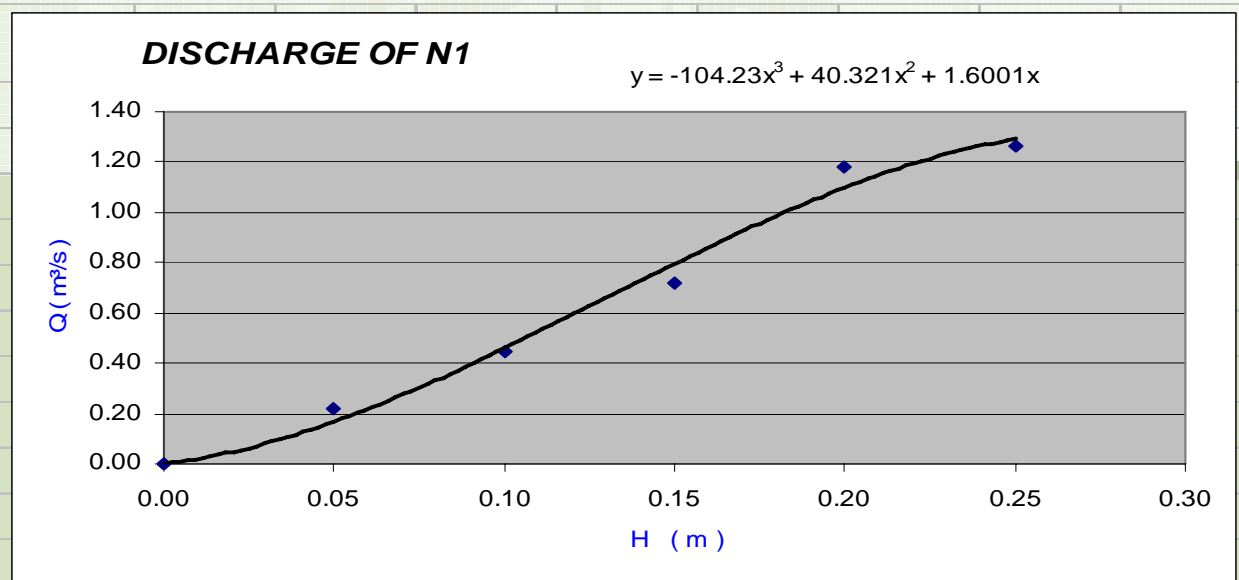


H-Q curve of 10 Gates

$$Q = \mu \cdot S \cdot \sqrt{2 \cdot g \cdot Z}$$

Q : Discharge m³/s
S : Area of opening gate
m² μ : Discharge Coefficient
g : Gravitational
Acceleration
Z : Head Loss

N1 and N2 H-Q curve



9- Water Management

- ❖ Scheme is owned by Battambang PDWRAM under supervision of the MOWRAM
- ❖ FWUC is responsible for the whole scheme management activities and plays an important role in the operation and maintenance works in consultation with PDWRAM
- ❖ Meeting of FWUC to review, prepare principle and plan for Implementation
- ❖ FWUC meets and extends on principles and plan to their members
- ❖ FWUC meet and make decision on principle and plan for implementation
- ❖ FWUC prepare water sharing and distribution calendar and submit to Battambang PDWRAM for decision
- ❖ FWUC meet and design plan to clear forest, repair and improve all canals
- ❖ FWUC meet and review water fee collection service for the season before starting implementation
- ❖ Implementation the plan

- ❖ All members shall contribute for the operation and maintenance of all facilities irrigation system,
- ❖ Secondary canal, tertiary canal and all related structures are responsible by the FWUC, but main canal and main structure are responsible by the PDWRAM or MOWRAM
- ❖ All the paddy fields in the scheme shall have sufficient water for crop production,
- ❖ Upper members should allow water flow to the lower part.
- ❖ All committees shall have a water allocation plan,
- ❖ The water allocation shall follow according to the water allocation plan and also refer to the meeting,
- ❖ The water utilization shall follow to the irrigation condition,
- ❖ If the land is not smoothly, higher and far from the water source, this land has a first priority for irrigation,
- ❖ When the gate open and water flow to the paddy field, all members should wait and see until water sufficient in the field and also look at the losing of water through the dike,
- ❖ The members do not have a right to open the water without permission from the committee

Analysis Results and Major Finding

- ❖ Total actual irrigated area: dry season is 1452.5 ha and wet season is 2,518.37ha,
- ❖ The rainfall from February-December 2007 was 1310 mm,
- ❖ The average of CWR: Dry 6.87 mm/day, Wet 5.11 mm/day,
- ❖ The average of percolation: Dry 2.61 mm/day; Wet 1.71 mm/day,
- ❖ The total of land preparation was 193.4 mm,
- ❖ The total SWR: Dry 16.12 MCM ; Wet 30.15

- ❖ The volume of water diverted to the system: Dry 23.50 MCM; Wet 29.59 MCM,

- ❖ The volume of water delivered by system: Dry 13.85 MCM; Wet 14.61 MCM,
- ❖ Conveyance efficiency: Dry 72.54% ; Wet 84.15 % ,
- ❖ Overall project command area efficiency: Dry 72.38% ; Wet 86.28% ,
- ❖ The average yield: Dry 0.371Kg/m²; Wet 0.33 Kg/m²,
- ❖ The water productivities: Dry 0.023 kg/m³; Wet 0.28Kg/m³.

Recommendation and Conclusion

- ❖ It is not expected that the data from the field observation is perfect. Many troubles happened when we took the data such as crab broke the levee or dike is made a hole, water overflow into the tank, there are too much rain etc... Therefore, in the process of calculation, we cancel some data or we do not take it.
- ❖ Based on the above research, we propose and request that the MRC should add one or 2 year more research in order to have more data for analysis and fill some gaps that we face in the previous study.

- ❖ From this research, we learnt and received a lot of data and experiences of how to conduct water use efficiency for irrigation and also this data are very useful for the operation and management of irrigation system.
- ❖ In the future, the Royal Government of Cambodia (MOWRAM) must strongly continuous this research activity from MRC and take consideration on the collection of data and information related to the water use in the irrigation systems because it is very useful for irrigation water use efficiency, preparing water use planning, and also for operation and maintenance of irrigation system.



**THANK YOU
FOR
YOUR KIND ATTENTION**