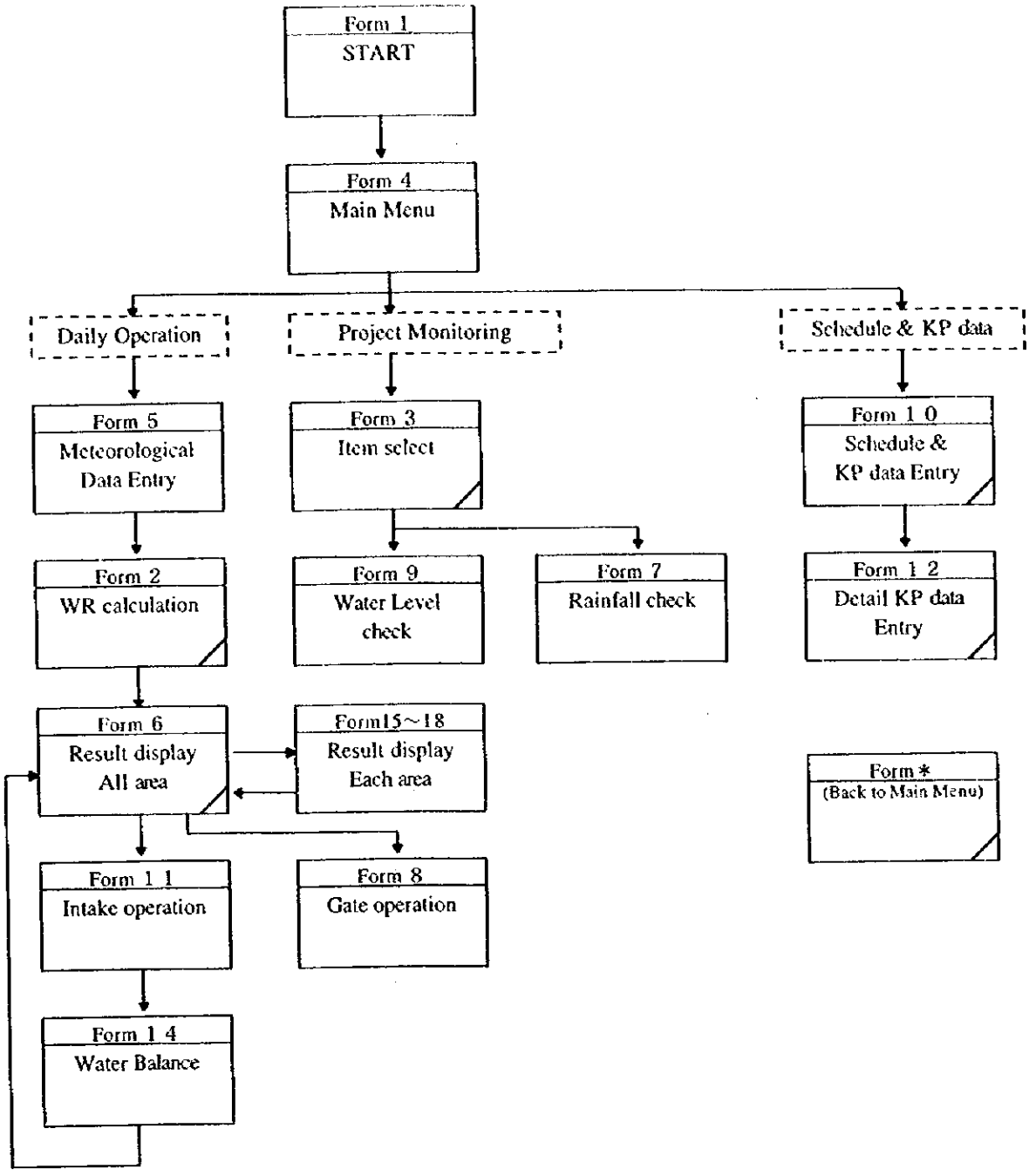
ATTACHMENT-3

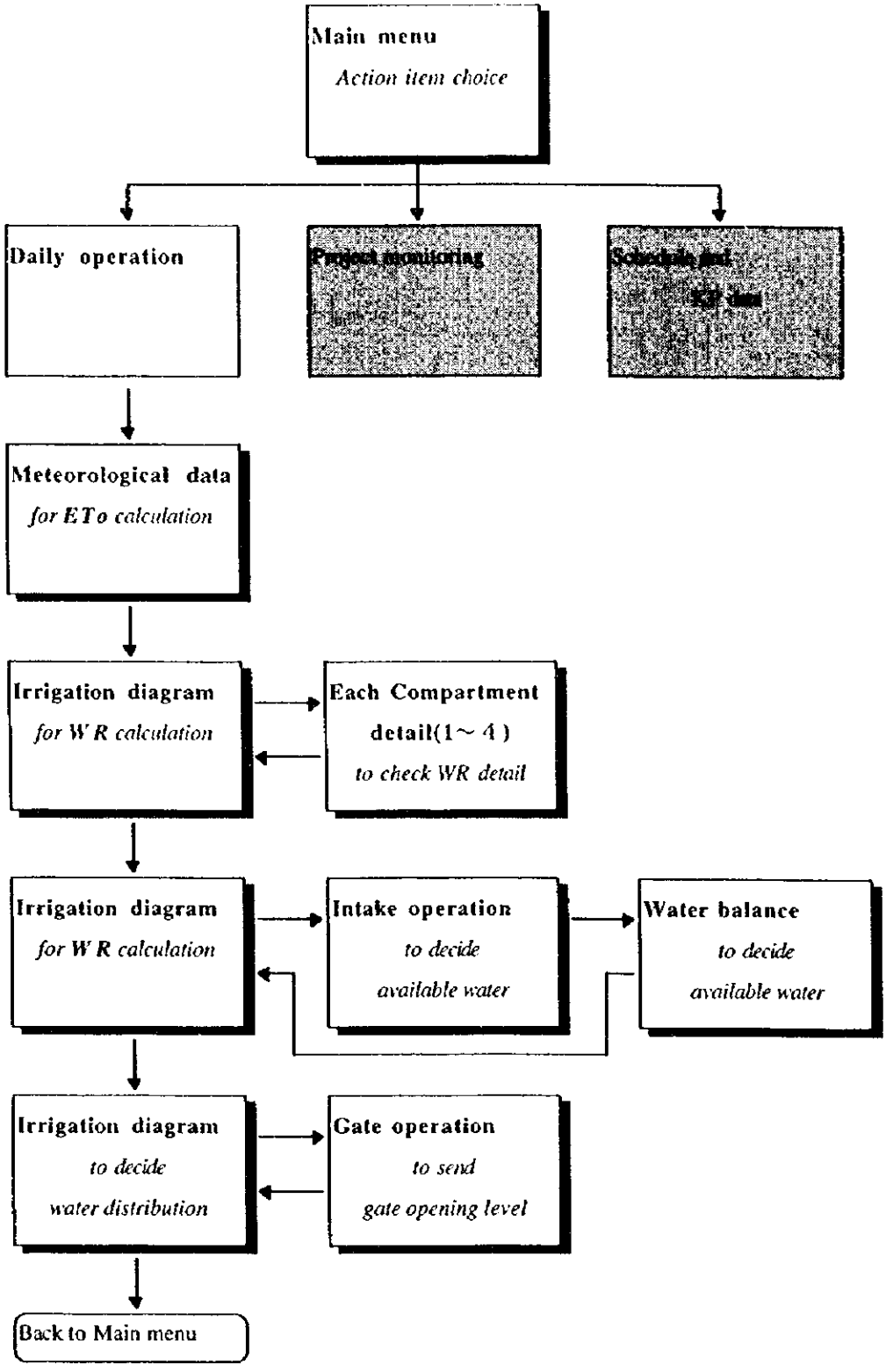
DESIGN SHEET OF THE IRRIGATION WATER MANAGEMENT SYSTEM

Water Management System

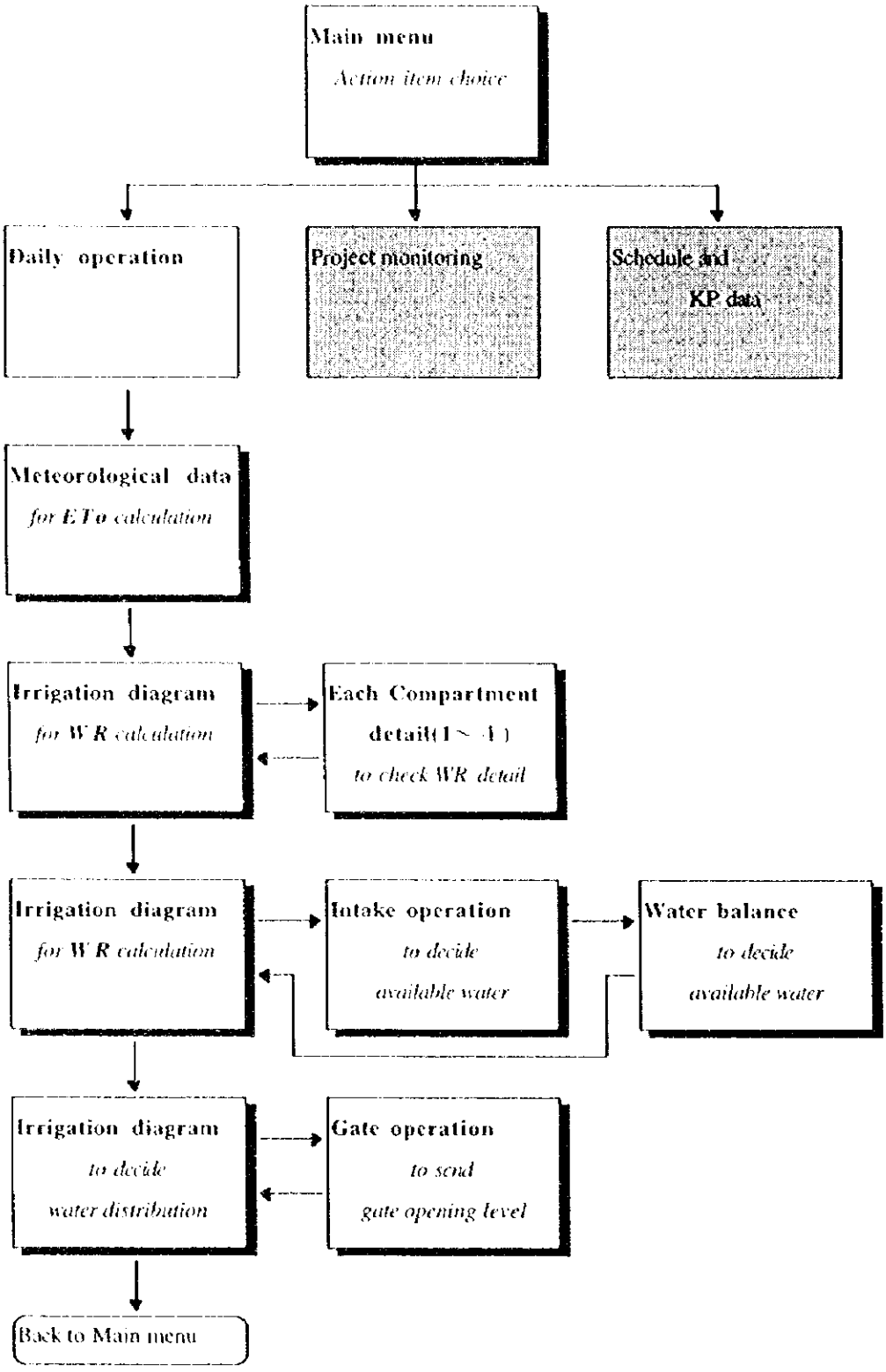
~ All screen connection ~



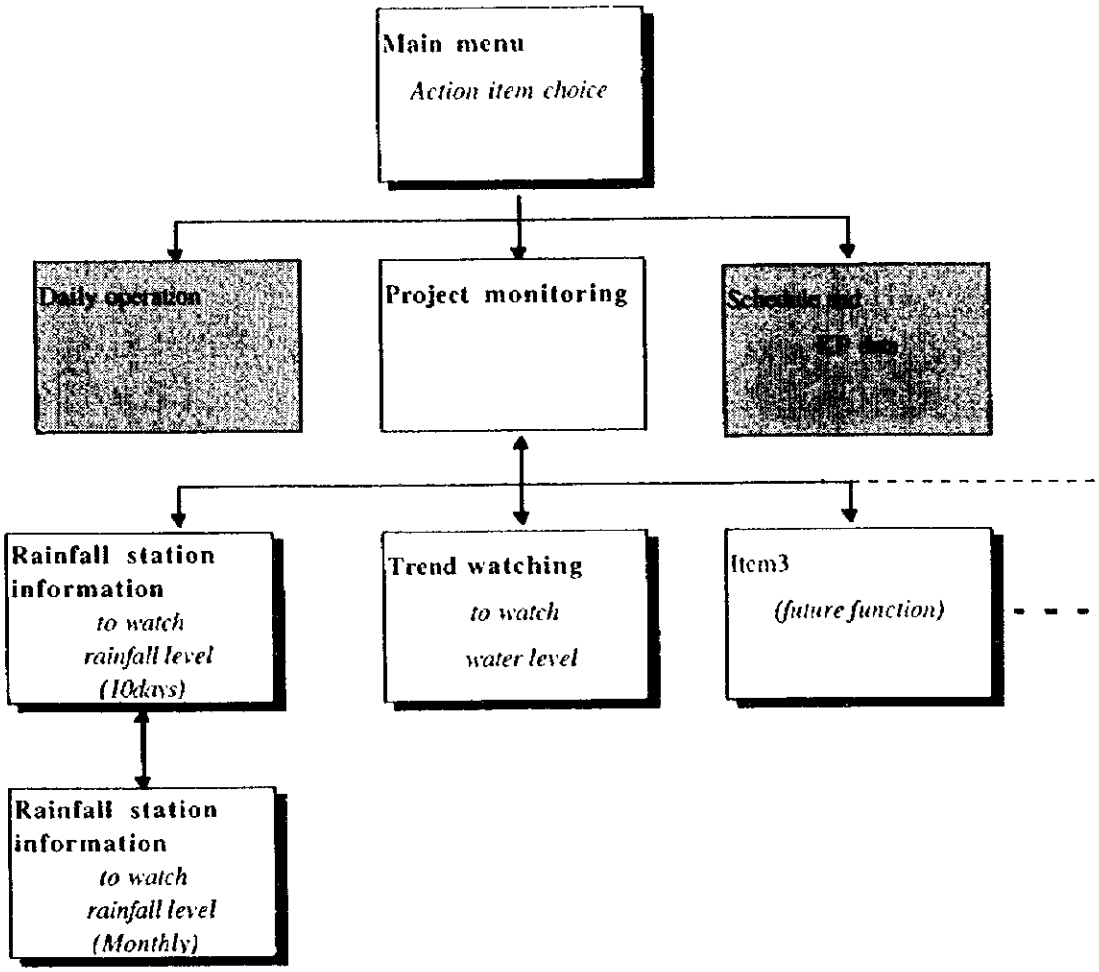
Screen connection 1 : Daily operation



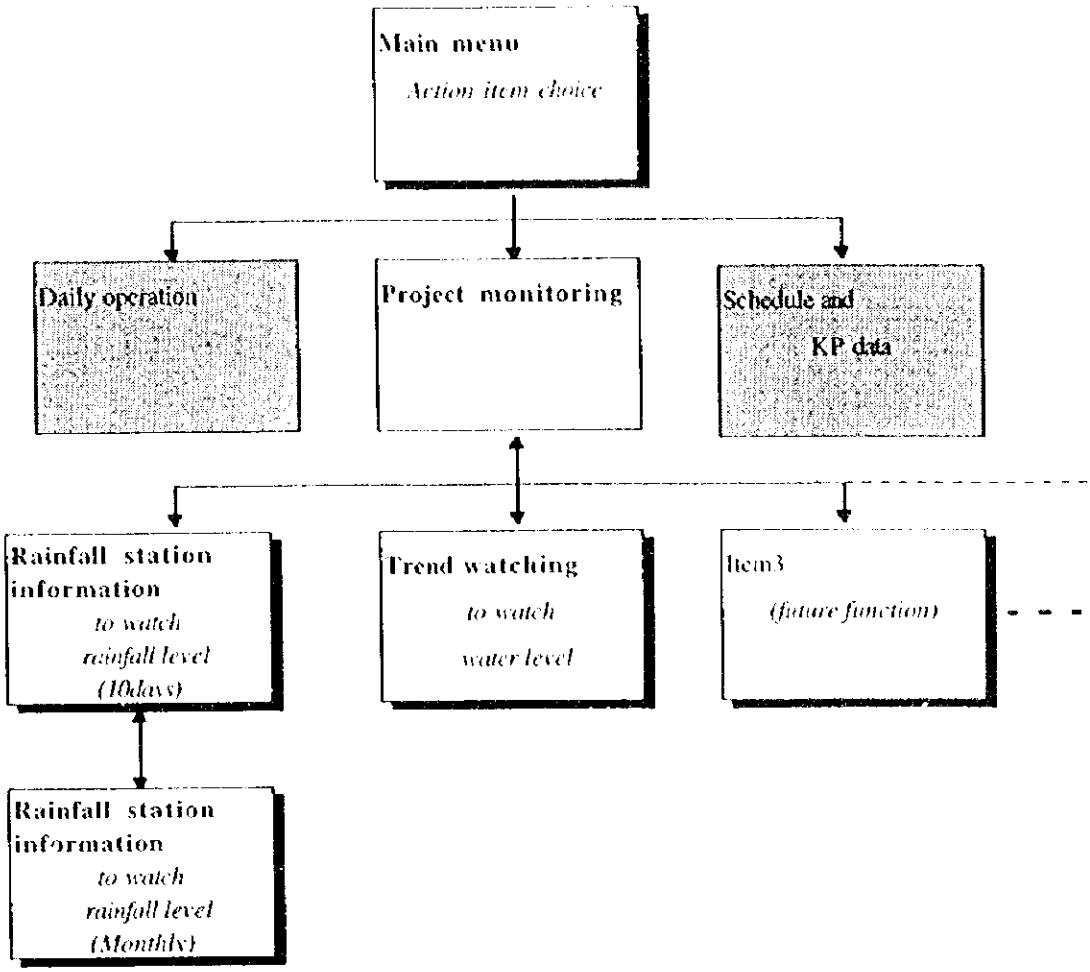
Screen connection 1 : Daily operation



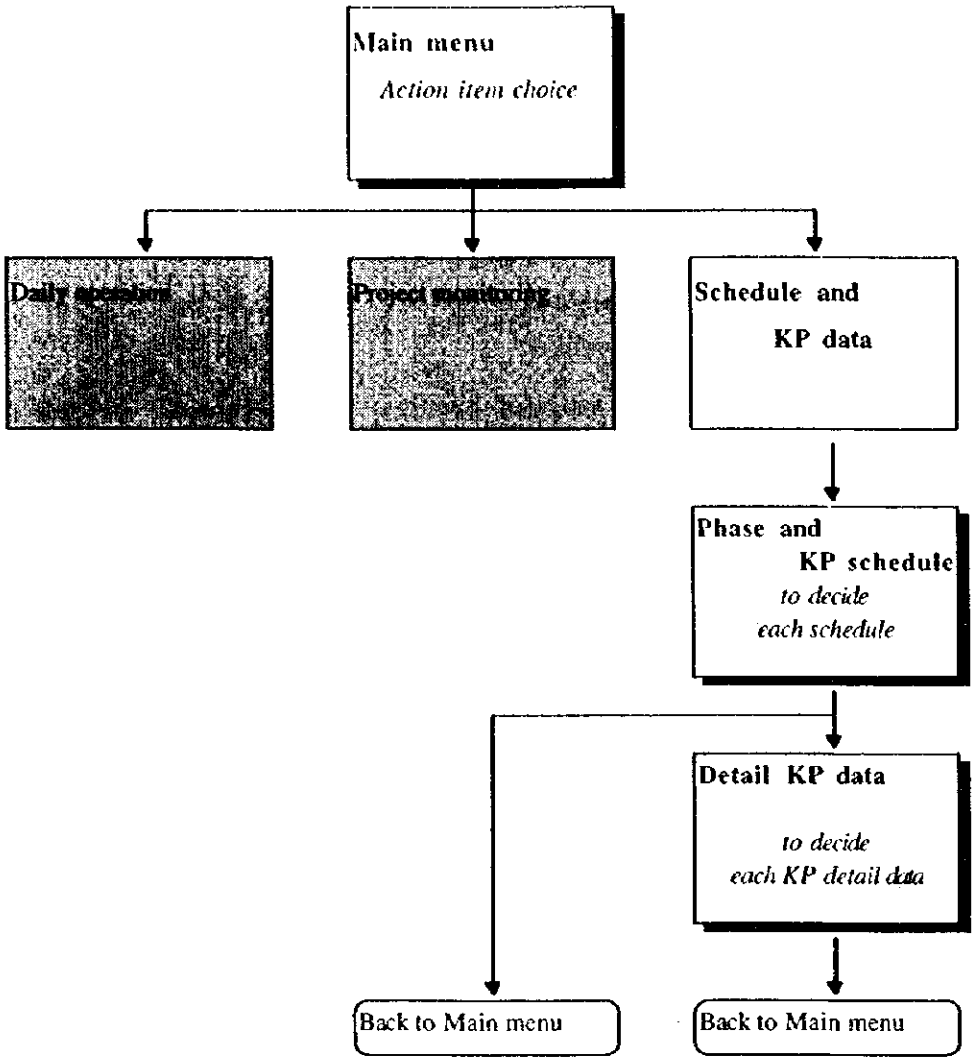
Screen connection 2 : Project monitoring



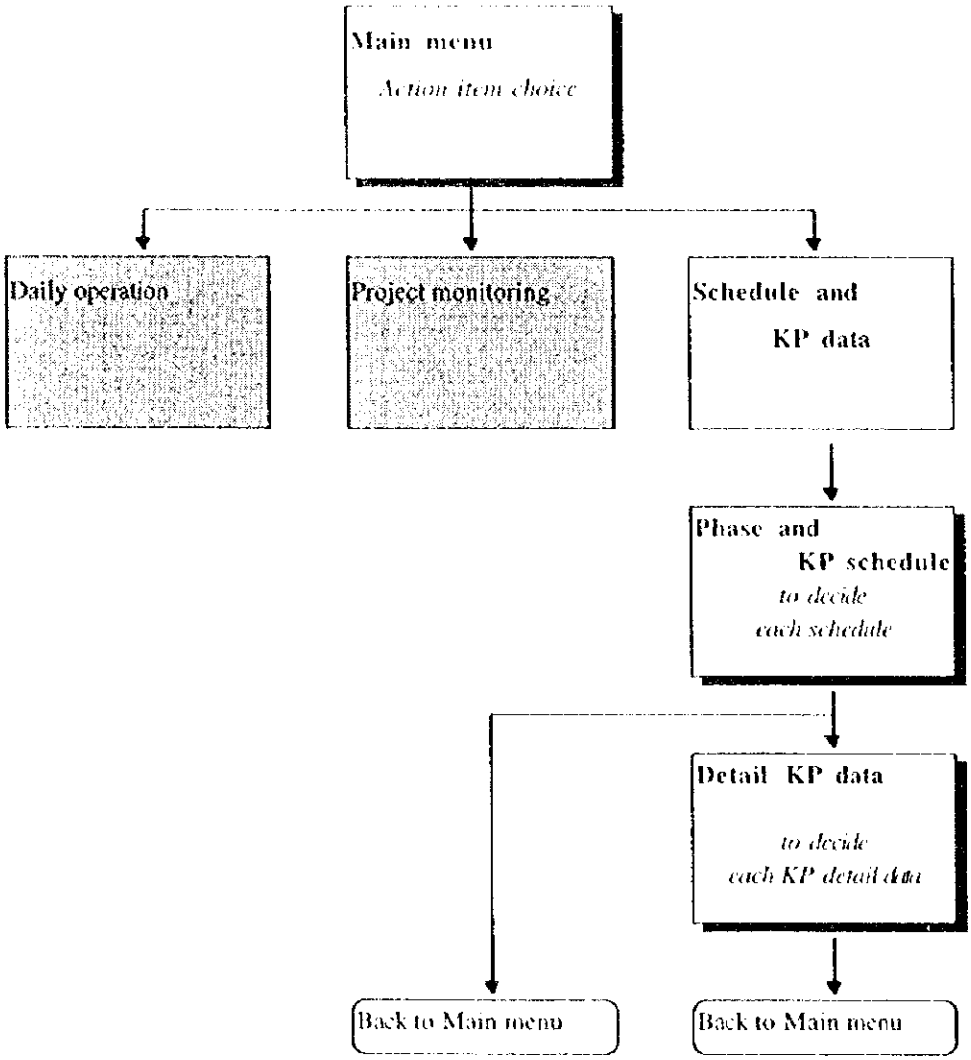
Screen connection 2 : Project monitoring



Screen connection 3 : Schedule and KP data

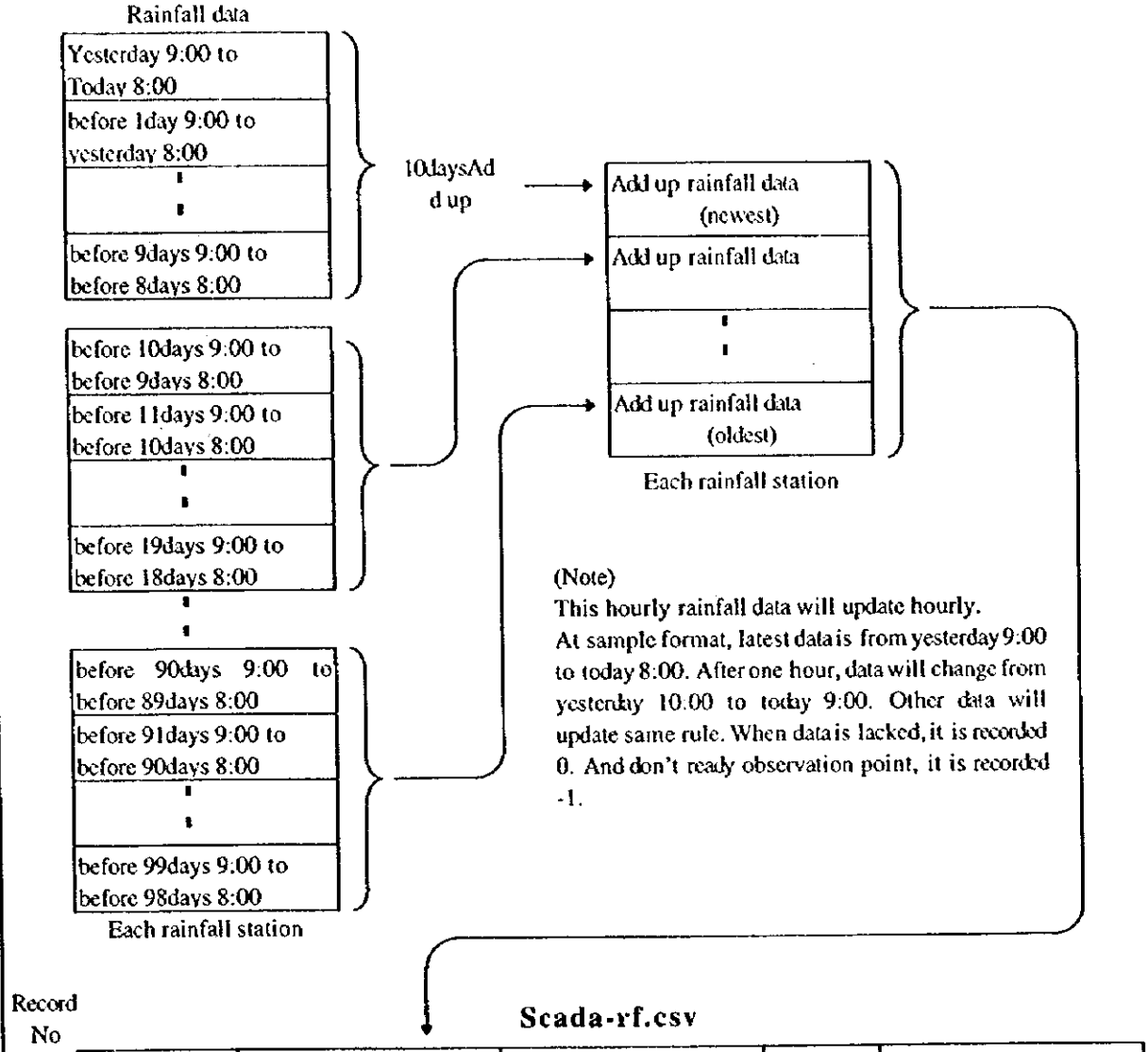


Screen connection 3 : Schedule and KP data



File Design for Water Management system

Name	Scada-rf.csv	Format	CSV
Directory	c:¥wms-data¥	System	SCADA



Scada-rf.csv

Record No					
0	9 (constant)	Rainfall station name R1	Rainfall station name R2		Rainfall station name R5
1	Collect date	Add up rainfall1 data (newest)	Add up rainfall2 data (newest)		Add up rainfall5 data (newest)
	Collect date	Add up rainfall1 data	Add up rainfall2 data		Add up rainfall5 data
	⋮	⋮	⋮		⋮
10	Collect date	Add up rainfall1 data (oldest)	Add up rainfall2 data (oldest)		Add up rainfall5 data (oldest)

File Design for Water Management system

Name	Scada-rfm.csv	Format	CSV
Directory	c:¥wms-data¥	System	SCADA

Scada-rfm.csv

Record No					
0	9 (constant)	Rainfall station name R1	Rainfall station name R2		Rainfall station name R5
1	Last month	Monthly accumulation rainfall(previous)	Monthly accumulation rainfall(previous)		Monthly accumulation rainfall(previous)
2	Last month-1	Monthly accumulation rainfall(2 months ago)	Monthly accumulation rainfall(2 months ago)	- - -	Monthly accumulation rainfall(2 months ago)
	⋮	⋮	⋮		⋮
9	Last month-8	Monthly accumulation rainfall(9 months ago)	Monthly accumulation rainfall(9 months ago)		Monthly accumulation rainfall(9 months ago)

(Note)
This monthly rainfall data will update monthly.
At sample format, latest data is last months.
This data will update at 1st day of latest month.
When don't ready observation point, it is recorded -1.

File Design for Water Management system

Name	Scada-wl.csv	Format	CSV
Directory	c:¥wms-data¥	System	SCADA

Data item
1.Q1 water level
2.Q2 water level
3.Q3 water level
:
33. Q33 water level
34. Q34 water level
(dimension :meter)

Each data

Today 8:00
Today 7:00
:
3days before 10:00
3days befor 9:00

72hours data/h

(Note)
This hourly water level data will update hourly. This hourly record is every water level observation point. Latest data is recorded top record. When data is lacked or don't ready observation point, it is recorded -1.

Scada-dt.csv

Record No					
0	72 (constant)	Item Number Q1	Item Number Q2		Item Number Q34
1	Collect time (latest)	Hourly data1 (latest)	Hourly data2 (latest)		Hourly data34 (latest)
2	Collect time	Hourly data1	Hourly data2	- - - - -	Hourly data34
	:	:	:		:
72	Collect time (oldest)	Hourly data1 (oldest)	Hourly data2 (oldest)		Hourly data34 (oldest)

Collect time : serial value

File Design for Water Management system

Name	Scada-gt.csv	Format	CSV
Directory	c:¥wms-data¥	System	SCADA

Each data

Today 8:00
Today 7:00
⋮
Yesterday 10:00
Yesterday 9:00

Data item

1.G1 Gate Up stream water level
  G1 intake No.1 gate level
  G1 intake No.2 gate level
  G1 intake No.3 gate level
2.G2 Gate Up stream water level
  G2 intake gate level (3 item)
3.G3 Gate Up stream water level
  G3 intake gate level (3 item)
4.G4 Gate Up stream water level
  G4 intake gate level (3 item)
5.G5 Gate Up stream water level
  G5 intake gate level (3 item)
6.G6 Gate Up stream water level
  G6 intake gate level (3 item)
7.G7 Gate Up stream water level
  G7 intake gate level (3 item)

(Note)
This hourly water level and gate opening level data will update hourly.
This hourly record is every observation point data. Latest data is recorded top record. When data is lacked or don't ready observation point, it is recorded -1.
We suppose that maximum gate count is 3 each point.

.....Continued on next sheet

File Design for Water Management system

Name	Scada-gt.csv	Format	CSV
Directory	c:¥wms-data¥	System	SCADA

Scada-gt.csv

Record No					
0	24 constant	Item Number **WL1**	Item Number **G1-1**	Item Number **G1-2**	Item Number **G1-3**
1	Collect time	Hourly data1 (latest)	Hourly data2 (latest)	Hourly data2 (latest)	Hourly data2 (latest)
2	Collect time	Hourly data1	Hourly data2	Hourly data2	Hourly data2
	⋮	⋮	⋮	⋮	⋮
24	Collect time	Hourly data1 (oldest)	Hourly data2 (oldest)	Hourly data2 (oldest)	Hourly data2 (oldest)

Collect time : serial value

	Item Number **WL7**	Item Number **G7-1**	Item Number **G7-2**	Item Number **G7-3**
- - - -	Hourly data13 (latest)	Hourly data14 (latest)	Hourly data13 (latest)	Hourly data14 (latest)
	Hourly data13	Hourly data14	Hourly data13	Hourly data14
	⋮	⋮	⋮	⋮
	Hourly data13 (oldest)	Hourly data14 (oldest)	Hourly data13 (oldest)	Hourly data14 (oldest)

Gate opening level (G＊)
dimension :meter

Water level (WL＊)
dimension :meter

File Design for Water Management system

Name	River.csv	Format	CSV
Directory	c:¥wms-data¥	System	SCADA

Record No

river.csv

No	
0	3 0 (constant)
1	Water level latest 8:00
2	Water level yesterday 8:00
	⋮
30	Water level oldest 8:00

Item

○Besut intake point daily water level

○last 30 days, daily data

(Note)

This daily water level data will update hourly. This data is recorded same time last 30 days.

This data is Besut river observation point data. Latest data is recorded top record. When data is lacked or don't ready observation point, it is recorded -1.

File Design for Water Management system

Name	Gt-level.csv	Format	CSV
Directory	c:¥wms-data¥	System	SCADA

Record No

Gt-level.csv

0	Data count **7 constant**	Data send time serial value	none	none
1	**GT1** constant	**GT1-1** opening level	**GT1-2** opening level	**GT1-3** opening level
2	**GT2** constant	**GT2-1** opening level	**GT2-2** opening level	**GT2-3** opening level
3	**GT3** constant	**GT3-1** opening level	**GT3-2** opening level	**GT3-3** opening level
4	**GT4** constant	**GT4-1** opening level	**GT4-2** opening level	**GT4-3** opening level
5	**GT5** constant	**GT5-1** opening level	**GT5-2** opening level	**GT5-3** opening level
6	**GT6** constant	**GT6-1** opening level	**GT6-2** opening level	**GT6-3** opening level
7	**GT7** constant	**GT7-1** opening level	**GT7-2** opening level	**GT7-3** opening level

Gate opening level : dimension :meter

(Note)
This gate opening level data will update sometime by Water Management System.
There are all gate data whole this area included future target position.
Future observation point and the gate out of object, it is recorded -1.

File Design for Water Management system

Name	Basic-eto.txt	Format	TEXT
Directory	e:¥ data ¥	System	Water Management system

○This file is basic data for ETo calculation.

Monthly average of ETo.

Basic-eto.csv

Record No	
0	**12** (constant)
1	**4.5** January average data
2	**5.0** February average data
3	**5.2** March average data
4	**5.2** April average data
5	**4.8** May average data
6	**4.6** June average data
7	**4.6** July average data
8	**4.5** August average data
9	**4.4** September average data
10	**4.2** October average data
11	**3.9** November average data
12	**4.2** December average data

File Design for Water Management system

Name	Rh-conv.txt	Format	TEXT
Directory	c:¥ data ¥	System	Water Management system

○This file is basic data for ETo calculation.

Saturation Vapor Pressure

Record No — **Rh-conv.csv**

No		
0	**40** (constant)	(none)
1	**0**℃	**6.1** 0℃ conversion data
2	**1**℃	**6.6** 1℃ conversion data
3	**2**℃	**7.1** 2℃ conversion data
4	**3**℃	**7.6** 3℃ conversion data
5	**4**℃	**8.1** 4℃ conversion data
	5℃:**8.7**, 6℃: **9.3**, 7℃: **10.0**, 8℃: **10.7**, 9℃: **11.5**, 10℃: **12.3**, 11℃:**13.1**, 12℃:**14.0**, 13℃:**15.0**, 14℃:**16.1**, 15℃:**17.0**, 16℃:**18.2**, 17℃:**19.4**, 18℃:**20.6**, 19℃:**22.0**, 20℃:**23.4**, 21℃:**24.9**, 22℃:**26.4**, 23℃:**28.1**, 24℃:**29.8**, 25℃:**31.7**, 26℃:**33.6**, 27℃:**35.7**, 28℃:**37.8**, 29℃:**40.1**, 30℃:**42.4**, 31℃:**44.9**, 32℃:**47.6**, 33℃:**50.3**	
35	**34**℃	**53.2** 34℃ conversion data
36	**35**℃	**56.2** 35℃ conversion data
37	**36**℃	**59.4** 36℃ conversion data
38	**37**℃	**62.8** 37℃ conversion data
39	**38**℃	**66.3** 38℃ conversion data
40	**39**℃	**69.9** 39℃ conversion data

File Design for Water Management system

Name	Wd-conv.txt	Format	TEXT
Directory	c:¥ data ¥	System	Water Management system

○This file is basic data for ETo calculation.

Value of Wind Function

Record No — **wd-conv.csv**

No		
0	**40** (constant)	(none)
1	**2**℃	**0.43** 2℃ conversion data
2	**4**℃	**0.46** 4℃ conversion data
3	**6**℃	**0.49** 6℃ conversion data
4	**8**℃	**0.52** 8℃ conversion data
5	**10**℃	**0.55** 10℃ conversion data
	12℃:**0.58**, 14℃: **0.61**, 16℃: **0.64**, 18℃: **0.66**, 20℃:**0.69**, 22℃: **0.71**, 24℃:**0.73**, 26℃:**0.75**, 28℃:**0.77**	
15	**30**℃	**0.78** 30℃ conversion data
16	**32**℃	**0.80** 32℃ conversion data
17	**34**℃	**0.82** 34℃ conversion data
18	**36**℃	**0.83** 36℃ conversion data
19	**38**℃	**0.84** 38℃ conversion data
20	**40**℃	**0.85** 40℃ conversion data

File Design for Water Management system

Name	Ra-conv.txt	Format	TEXT
Directory	c:¥ data ¥	System	Water Management system

○This file is basic data for ETo calculation.

Extra Terrestrial Radiation

Ra-conv.csv

Record No		
0	**12** (constant)	(none)
1	**1** January	**14.1** January conversion data
2	**2** February	**14.9** February conversion data
3	**3** March	**15.5** March conversion data
4	**4** April	**15.5** April conversion data
5	**5** May	**15.0** May conversion data
6	**6** June	**14.6** June conversion data
7	**7** July	**14.8** July conversion data
8	**8** August	**15.2** August conversion data
9	**9** September	**15.3** September conversion data
10	**10** October	**15.1** October conversion data
11	**11** November	**14.4** November conversion data
12	**12** December	**13.9** December conversion data

File Design for Water Management system

Name	n-conv.txt	Format	TEXT
Directory	c:¥ data ¥	System	Water Management system

○This file is basic data for ETo calculation.

Mean Daily Duration of Maximum Possible Sunshine Hours

Record No	n-conv.csv	
0	**12** (constant)	(none)
1	**1** January	**11.8** January conversion data
2	**2** February	**11.9** February conversion data
3	**3** March	**12.0** March conversion data
4	**4** April	**12.2** April conversion data
5	**5** May	**12.3** May conversion data
6	**6** June	**12.4** June conversion data
7	**7** July	**12.3** July conversion data
8	**8** August	**12.3** August conversion data
9	**9** September	**12.1** September conversion data
10	**10** October	**12.0** October conversion data
11	**11** November	**11.9** November conversion data
12	**12** December	**11.8** December conversion data

File Design for Water Management system

Name	Ft-conv.txt	Format	TEXT
Directory	c:¥ data ¥	System	Water Management system

○This file is basic data for ETo calculation.

Effect of Temperature

ft-conv.csv

Record No		
0	**19** (constant)	(none)
1	**0**℃	**11.0** 0℃ conversion data
2	**2**℃	**11.4** 2℃ conversion data
3	**4**℃	**11.7** 4℃ conversion data
4	**6**℃	**12.0** 6℃ conversion data
5	**8**℃	**12.4** 8℃ conversion data
	10℃: **12.7**, 12℃: **13.1**, 14℃: **13.5**, 16℃: **13.8**, 18℃: **14.2**, 20℃: **14.6**, 22℃: **15.0**, 24℃: **15.4**,	
14	**26**℃	**15.9** 26℃ conversion data
15	**28**℃	**16.3** 28℃ conversion data
16	**30**℃	**16.7** 30℃ conversion data
17	**32**℃	**17.2** 32℃ conversion data
18	**34**℃	**17.7** 34℃ conversion data
19	**36**℃	**18.1** 36℃ conversion data

File Design for Water Management system

Name	crop.csv	Format	CSV
Directory	c:¥ data¥	System	Water Management system

Record No

crop.csv

0	**165** (constant)	**crop** data*.1	**Coefficient** data*.2
1	**1** (date)	Data1.1	Data1.2
2	**2** (date)	Data2.1	Data2.2
	⋮	⋮	⋮
165	**165** (date)	Data165.1	Data165.2

Item

○DATA*.1

1～14	19.87
15～21	-1(calculation)
22～30	0
31～44	11.92
45～139	-1(calculation)
140～165	0

○DATA*.2

1～35	1
36～85	1.1
86～135	1.2
136～165	1

File Design for Water Management system

Name	Kp-alloc.csv	Format	CSV
Directory	c:¥ data ¥	System	Water Management system

Record No

Kp-alloc.csv

0	3 0 (constant)	Q1		Q44
1	KP1	Distribution ratio(%)		Distribution ratio(%)
2	KP2	Distribution ratio(%)	- - - - - -	Distribution ratio(%)
	⋮	⋮		⋮
30	KP30	Distribution ratio(%)		Distribution ratio(%)

Item

○Q 1 ～Q 4 4 (Intake Point No.: constant)

○K P 1 ～K P 3 0 (KP No.: constant)

○Distribution ratio (%): 0(min) to 100(max),each KP total 100%

File Design for Water Management system

Name	Canal-dt.csv	Format	CSV
Directory	c:¥ data¥	System	Water Management system

Record No

Canal-dt.csv

0	3 4 (constant)	n1	l1	m1	b1	Sea level revision
1	Q1	Data1.1	Data1.2	Data1.3	Data1.4	Data1.5
2	Q2	Data2.1	Data2.2	Data2.3	Data2.4	Data2.5
	⋮	⋮	⋮	⋮	⋮	⋮
34	Q34	Data34.1	Data34.2	Data34.3	Data34.4	Data34.5

Item (no data : -1)

○Q 1 ~Q3 4 (Intake Point No.: constant)

○n:0.015 (constant)

○l

○m

○b(m)

○sea level revision(m)

File Design for Water Management system

Name	Gate-dt.csv	Format	CSV
Directory	c:¥ data ¥	System	Water Management system

Record No

Gate-dt.csv

0	7 (constant)	b	c1	c2
1	G1	G1.1 data **5.4864**	G1.2 data **0.7**	G1.3 data **-1**
2	G2	G2.1 data **-1**	G2.2 data **-1**	G2.3 data **-1**
3	G3	G3.1 data **1.524**	G3.2 data **0.7**	G3.3 data **-1**
4	G4	G4.1 data **-1**	G4.2 data **-1**	G4.3 data **-1**
5	G5	G5.1 data **-1**	G5.2 data **-1**	G5.3 data **-1**
6	G6	G6.1 data **-1**	G6.2 data **-1**	G6.3 data **-1**
7	G7	G7.1 data **-1**	G7.2 data **-1**	G7.3 data **-1**

Item (no data : -1)

○G 1 ～G7 (Gate No.: constant)

○None data : -1

File Design for Water Management system

Name	Kp-data.csv	Format	CSV
Directory	c:¥ data ¥	System	Water Management system

Record No

Kp-alloc.csv

0	3 0 (constant)	Phase	Rainfall	Area (ha)	Name	pl
1	KP1	Data1.1	Data1.2	Data1.3	Data1.4	Data1.5
2	KP2	Data2.1	Data2.2	Data2.3	Data2.4	Data2.5
	⋮	⋮	⋮	⋮	⋮	⋮
30	KP30	Data30.1	Data30.2	Data30.3	Data30.4	Data30.5

lp	Ec	Ea	Res1	Res2
Data1.6	Data1.7	Data1.8	Data1.9	Data1.10
Data2.6	Data2.7	Data2.8	Data2.9	Data2.10
⋮	⋮	⋮	⋮	⋮
Data30.6	Data30.7	Data30.8	Data30.9	Data30.10

Item (All item updatable from screen)

- ○Phase: PHASE1 or PHASE2
- ○Rainfall: R1,R2,R3,R4,R5
- ○Area: ha
- ○Name
- ○pl
- ○lp
- ○Ec
- ○Ea
- ○res1: for future function
- ○res2: for future function

File Design for Water Management system

Name	phase.csv	Format	CSV
Directory	c:¥ data ¥	System	Water Management system

phase.csv

Record No					
0	2 (constant)	Q1	Q44	Q1	Q44
1	PHASE1	Data1.1 starting date	Data1.2 completed date	Data1.3 rotation	Data1.4 intensity
2	PHASE2	Data2.1	Data2.2	Data2.3	Data2.4

Item

- ○Phase: PHASE1 or PHASE2
- ○Starting date: yyyy/mm/dd
- ○Completed date: yyyy/mm/dd
- ○Rotation:
- ○Intensity: 0 to 100%

File Design for Water Management system

Name	gate.csv	Format	CSV
Directory	c:¥ data ¥	System	Water Management system

○This file saved calculated WR and available water for Besut intake point.

gate.csv

Record No		
0	**30** (constant)	
1	Oldest WR data (m^3/sec)	Oldest available water data (m^3/sec)
2	last 28 days WR data	last 28 days available water data
3	last 27 days WR data	last 27 days available water data
4	last 26 days WR data	last 26 days available water data
5	last 25 days WR data	last 25 days available water data
	⋮	⋮
25	last 5 days WR data	last 5 days available water data
26	last 4 days WR data	last 4 days available water data
27	last 3 days WR data	last 3 days available water data
28	last 2 days WR data	last 2 days available water data
29	Yesterday WR data	yesterday available water data
30	latest WR data	latest available water data

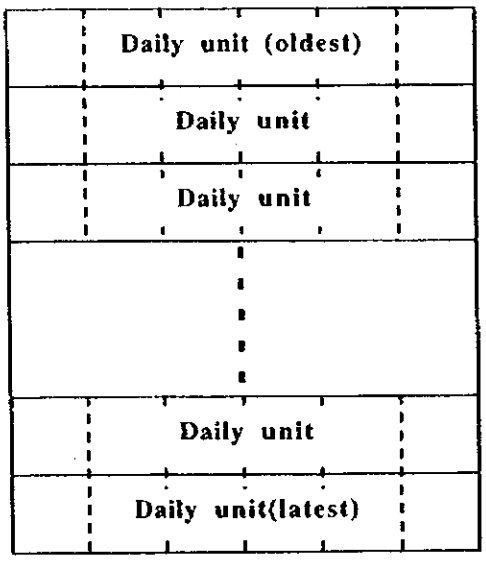
File Design for Water Management system

Name	WRreport.csv	Format	CSV
Directory	c:¥ data ¥	System	Water Management system

Record No

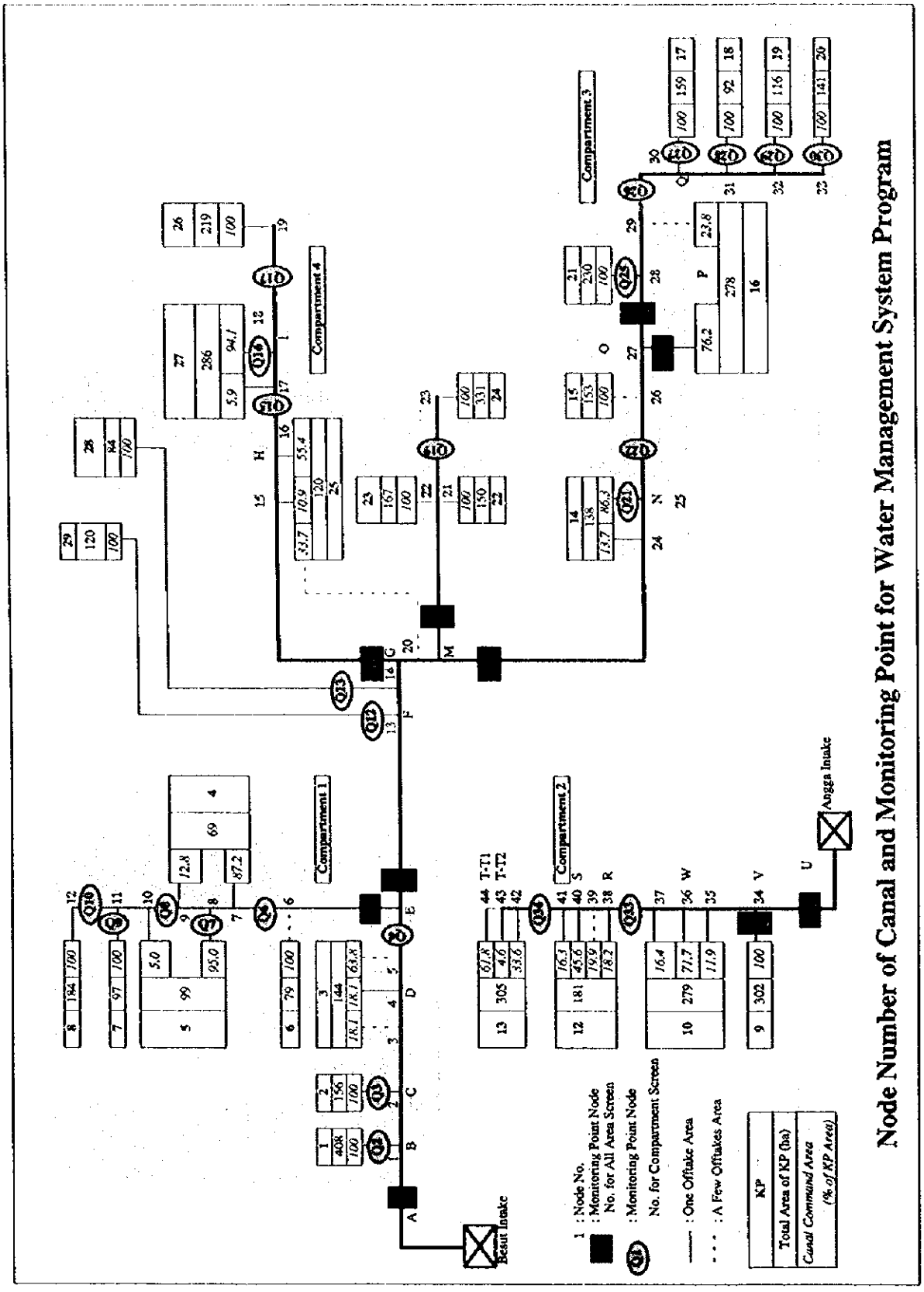
WRreport.csv

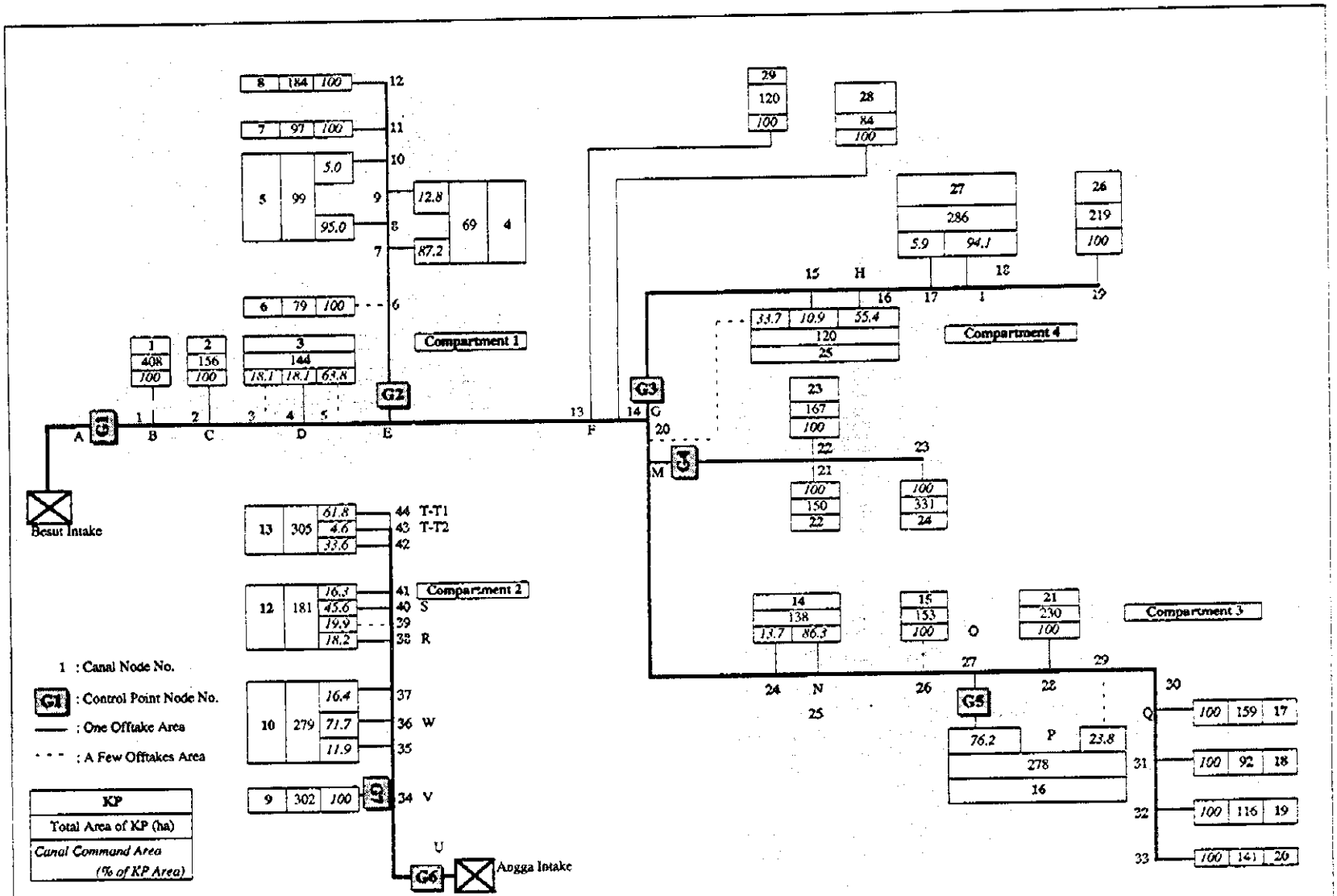
+0	Daily Report (constant)	Collect time	(none)	(none)	(none)	(none)
+1	KP number 1	WR data1	ER data1	Duty data1	Daily supply water KP1	RWS KP1
+2	KP number 2	WR data2	ER data2	Duty data2	Daily supply water KP2	RWS KP2
+3	KP number 3	WR data3	ER data3	Duty data3	Daily supply water KP3	RWS KP3
+28	KP number 28	WR data28	ER data28	Duty data28	Daily supply water KP28	RWS KP28
+29	KP number 29	WR data29	ER data29	Duty data29	Daily supply water KP29	RWS KP29



About one year(300000byte)

If file size exceeded 300000 byte, program create new file and copy old file and collect new data. All process are doing automatically.


Node Number of Canal and Monitoring Point for Water Management System Program
Compartment 1
Compartment 2
Compartment 3
Compartment 4
Beaut Intake
Angga Intake
T-T1
T-T2
: Node No.
: Monitoring Point Node No. for All Area Screen
: Monitoring Point Node No. for Compartment Screen
: One Offtake Area
: A Few Offtakes Area
KP
Total Area of KP (ha)
Canal Command Area (% of KP Area)



Node Number of Canal and Control Point for Water Management System Program

Default Data Used for Calculating Water Requirement

Input Data	Input Unit		Input Data		
Temperature	All Area		-		
Relative Humid	All Area		-		
Sunshine Hours	All Area		-		
Wind Speed	All Area		-		
Crop Coefficient	All Area		-		See Cropping Schedule
Percolation	KP		3.0	(mm/d)	
Effective Rainfall	KP	(Select Rainfall Sta. 1 or 2)	5 - 65	(mm/d)	Last 10 days
Field Efficiency	KP		60	(%)	
Conveyance Efficiency	KP		85	(%)	
Cropping Schedule	KP	(Select Phase 1 or 2)			See Cropping Schedule
Presaturation Water	Constant		20	(mm/d)	x 14 days
2nd Standing Water	Constant		12	(mm/d)	x 14 days
Command Area of Diversion Point	Diversion Point				See Node No. Definition

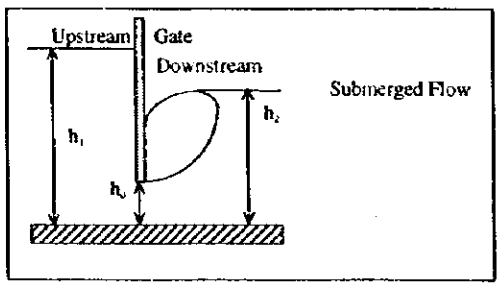
Formula Used for the Water Management System

1. Estimating Evapotranspiration
   Modified Penman Formula

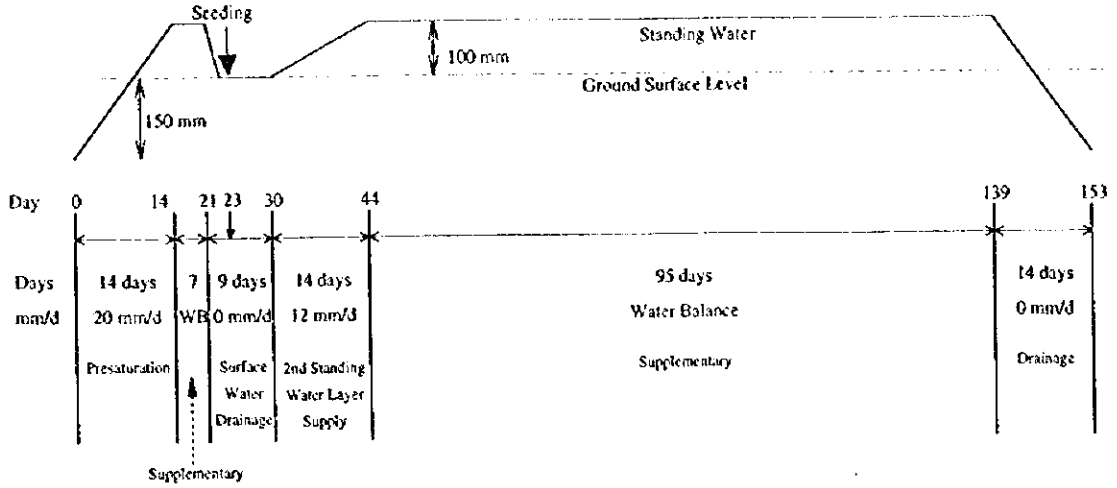
2. Water Balance Formula for Calculating Water Requirement
   $WR = (ETo \times Kc + PL - ER) / (Ec \times Ea)$
   where,
   WR : Water Requirement, ETo : Evapotranspiration, Kc : Crop Coefficient
   PL : Percolation, ER : Effective Rainfall, Ec : Conveyance Efficiency,
   Ea : Application Efficiency

3. H - Q Conversion
   Flow in canal is assumed as uniform flow.
   Manning Formula
   $v = 1/n\ (R^{2/3} I^{1/2})$
   where,
   v : Velocity, n : Roughness Coefficient, R : Hydrolic Mean Depth,
   I : Slope

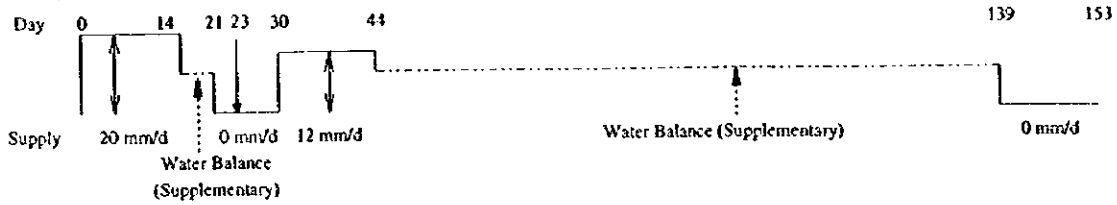
4. Gate Opening Level
   Submerged Flow
   $Q = cbh_0\{2g(h_1 - h_2)\}^{1/2}$
   where,
   Q : Discharge, c : Coefficient of Discharge, b : Gate Width,
   h_0 : Gate Opening Level, h_1 : Upstream Water Level
   h_2 : Downstream Water Level



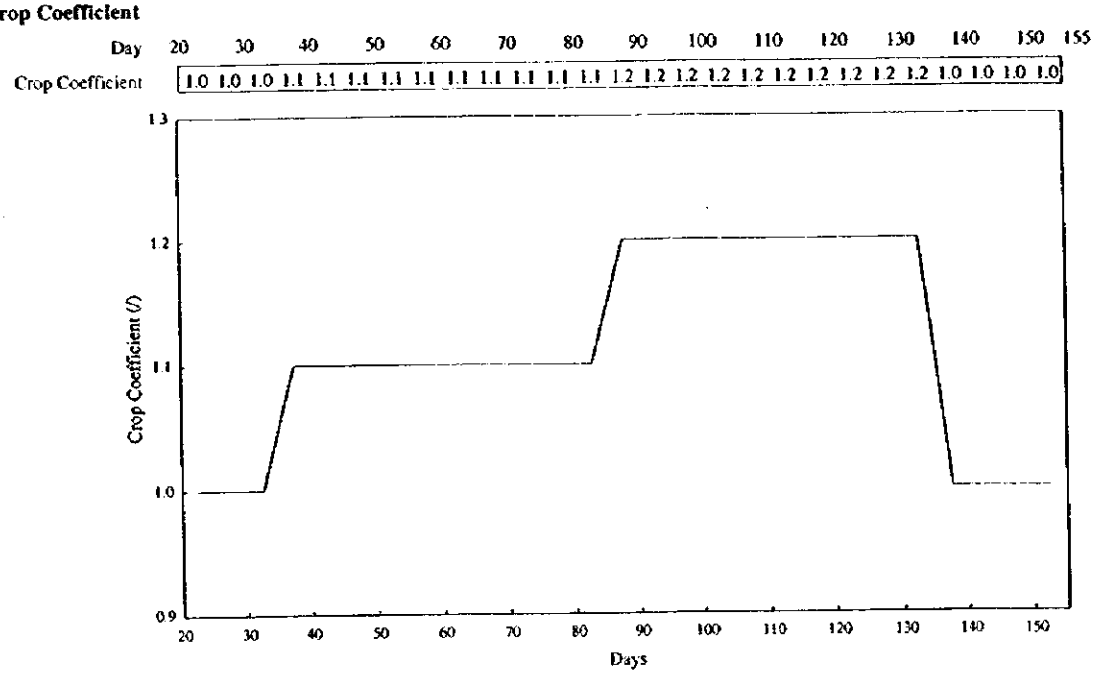
(1) Water Level in the Paddy



(2) Daily Water Supply



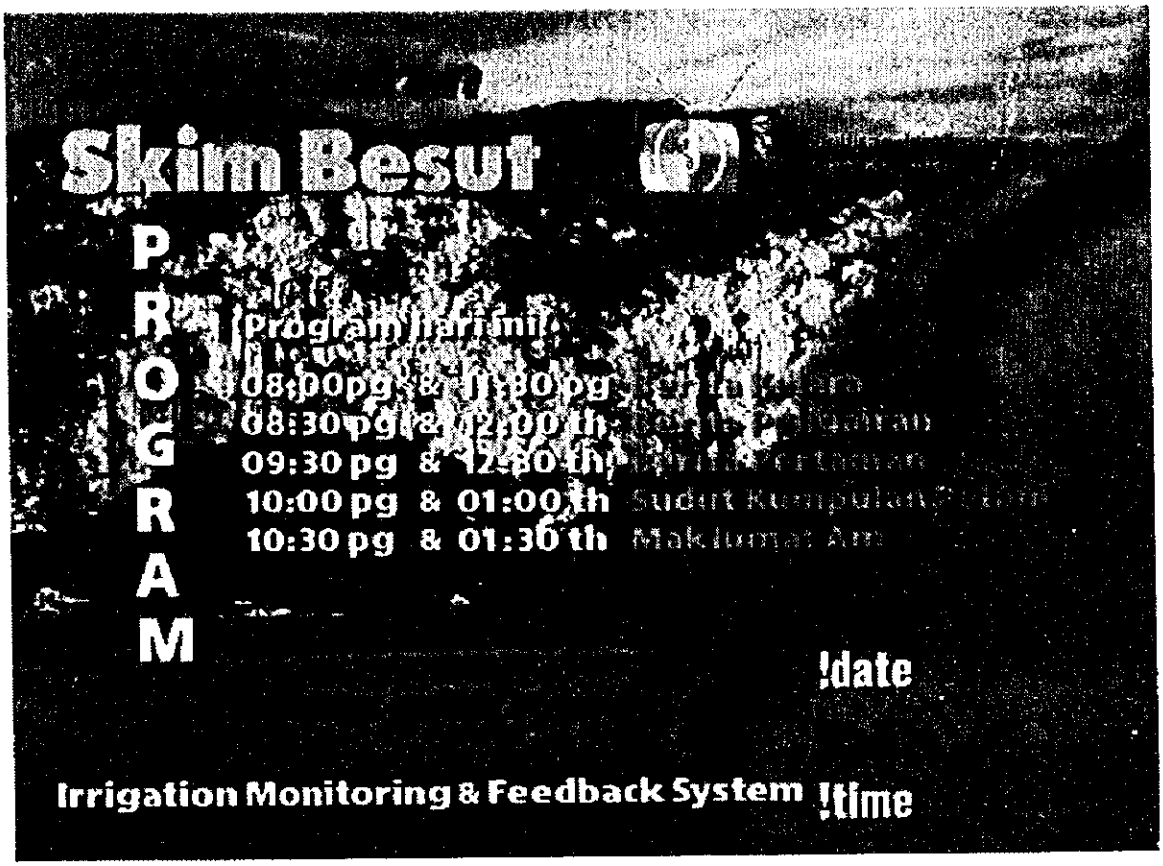
(3) Crop Coefficient



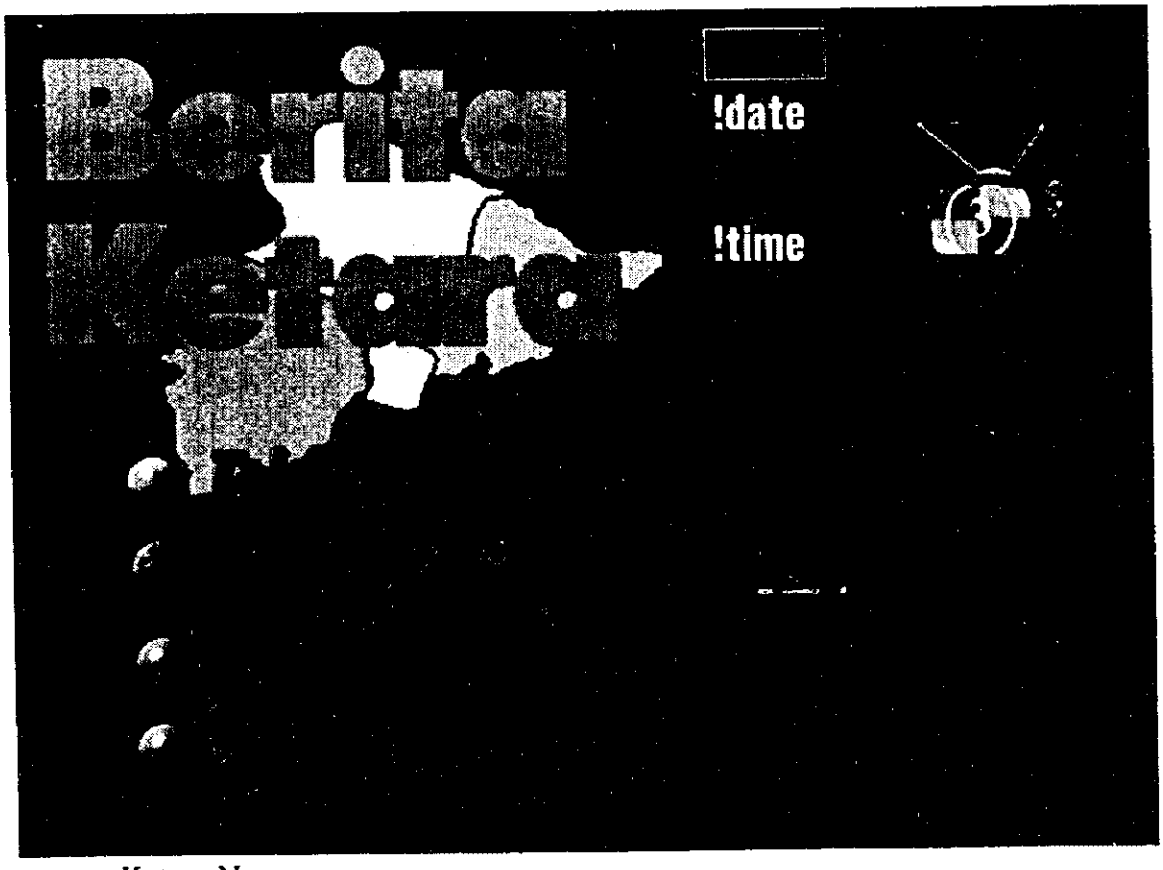
Cropping Schedule Used for the Water Management System
(All figures can be changed from "crop.csv" file)

ATTACHMENT-4

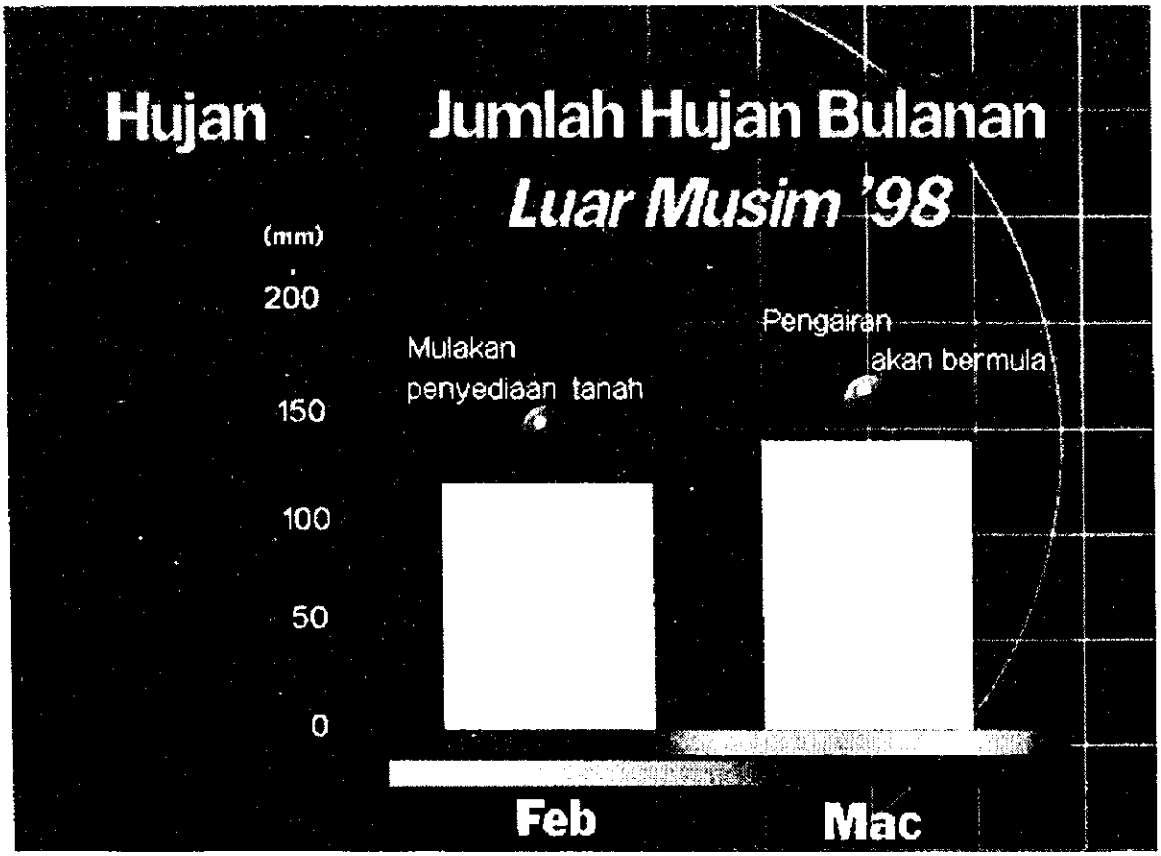
SAMPLE DISPLAY OF THE IRRIGATION MONITORING AND FEEDBACK SYSTEM



<Information Program>



<Ketara News>

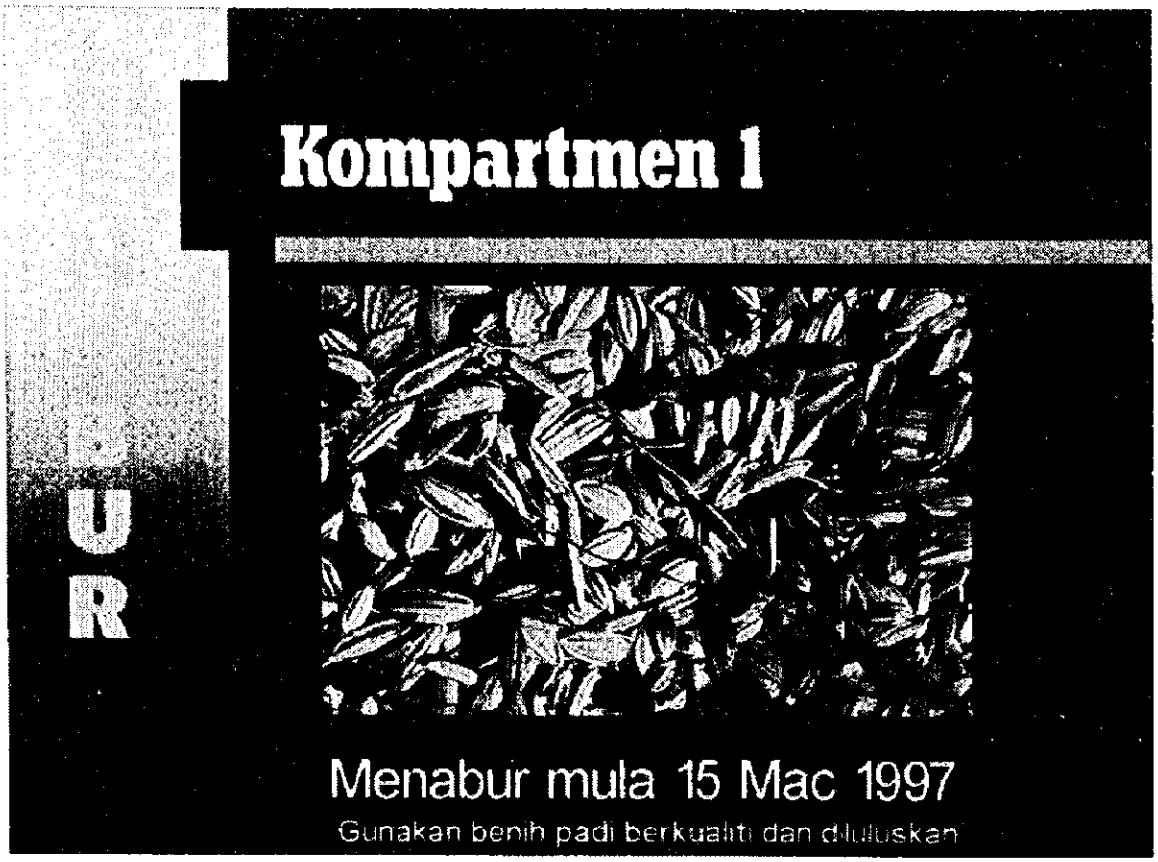


<Monthly Rainfall Information>

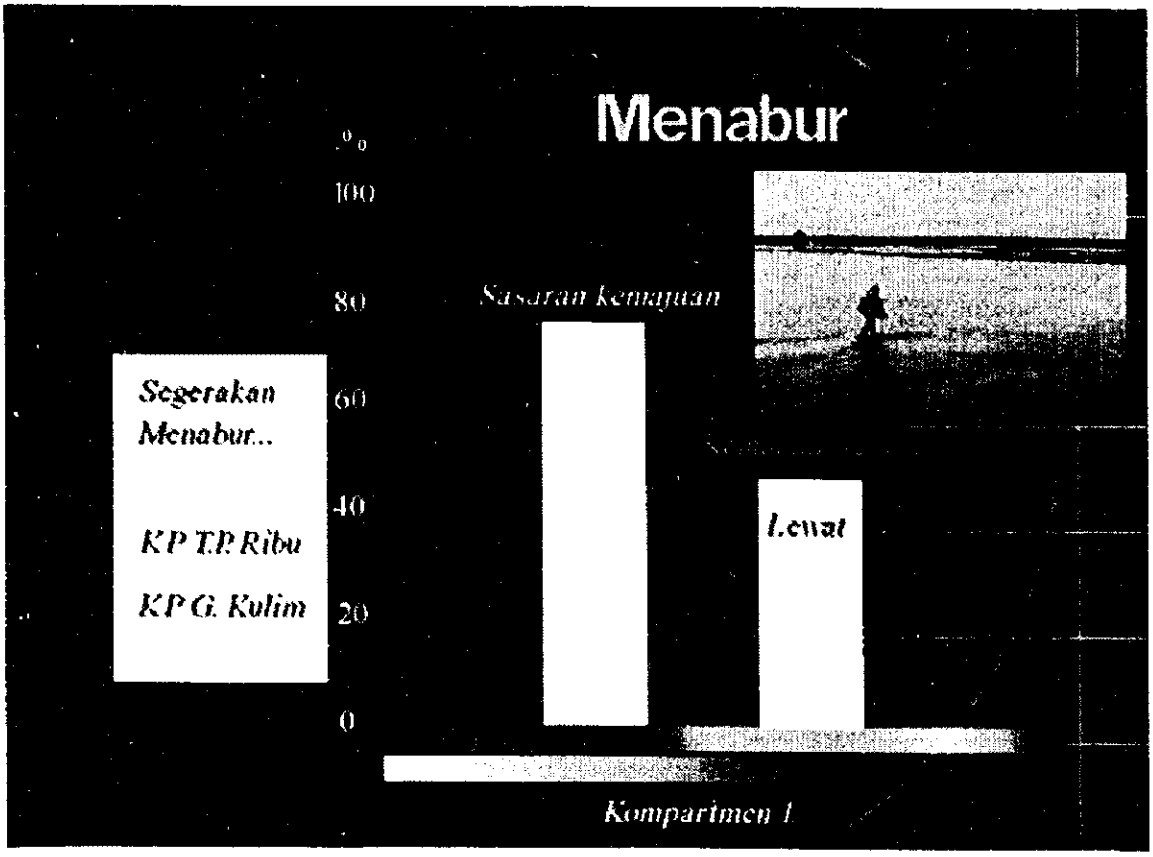
<Information on Irrigation Water Supply (Besut System)>

<Information on Irrigation Water Supply (Angga System)>

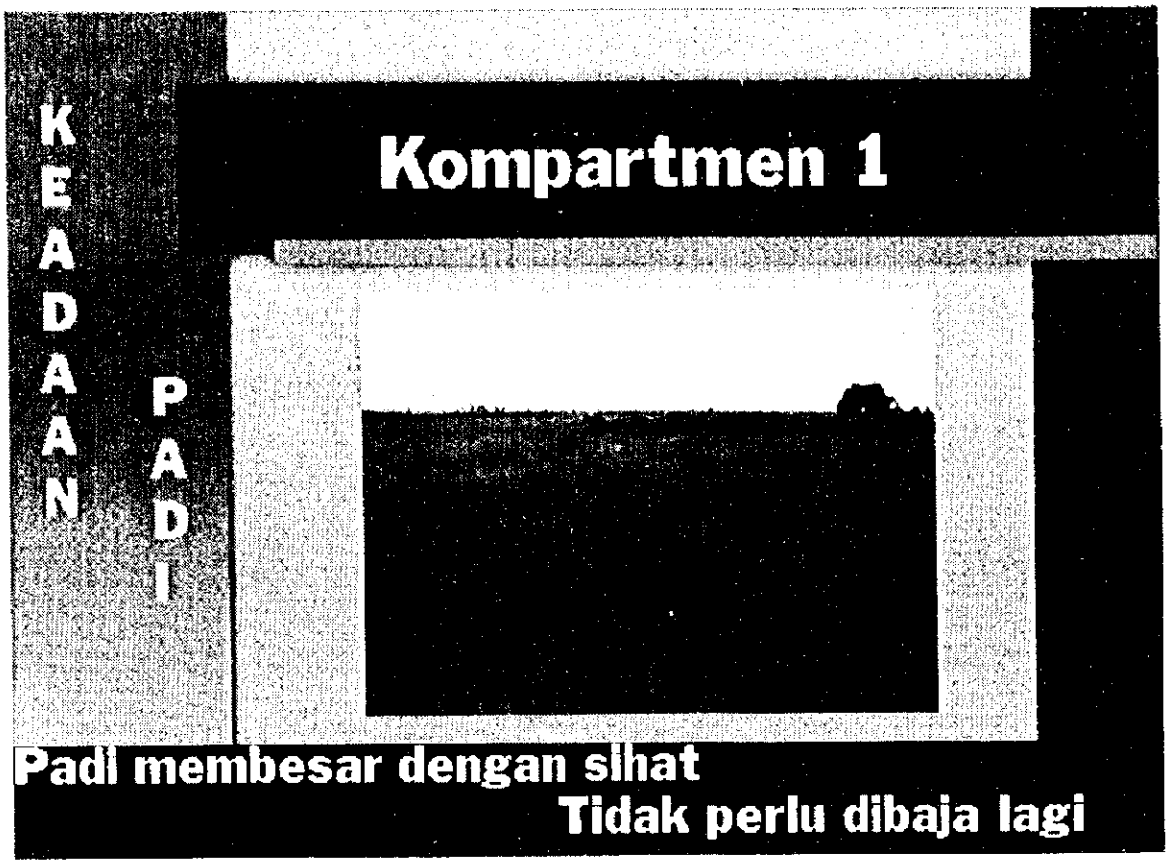
<Information on System-wise Irrigation Water Supply>



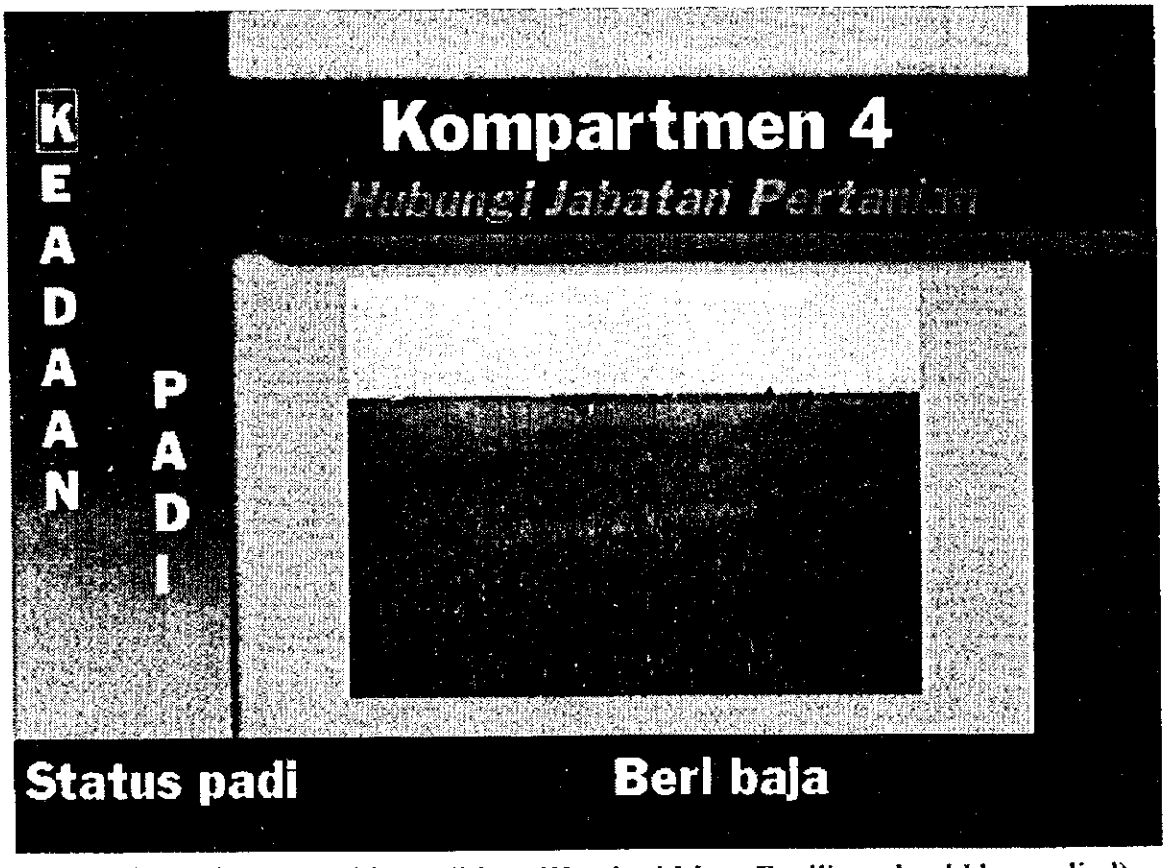
<Information on Cropping Schedule>



<Information on Progress of Seeding>



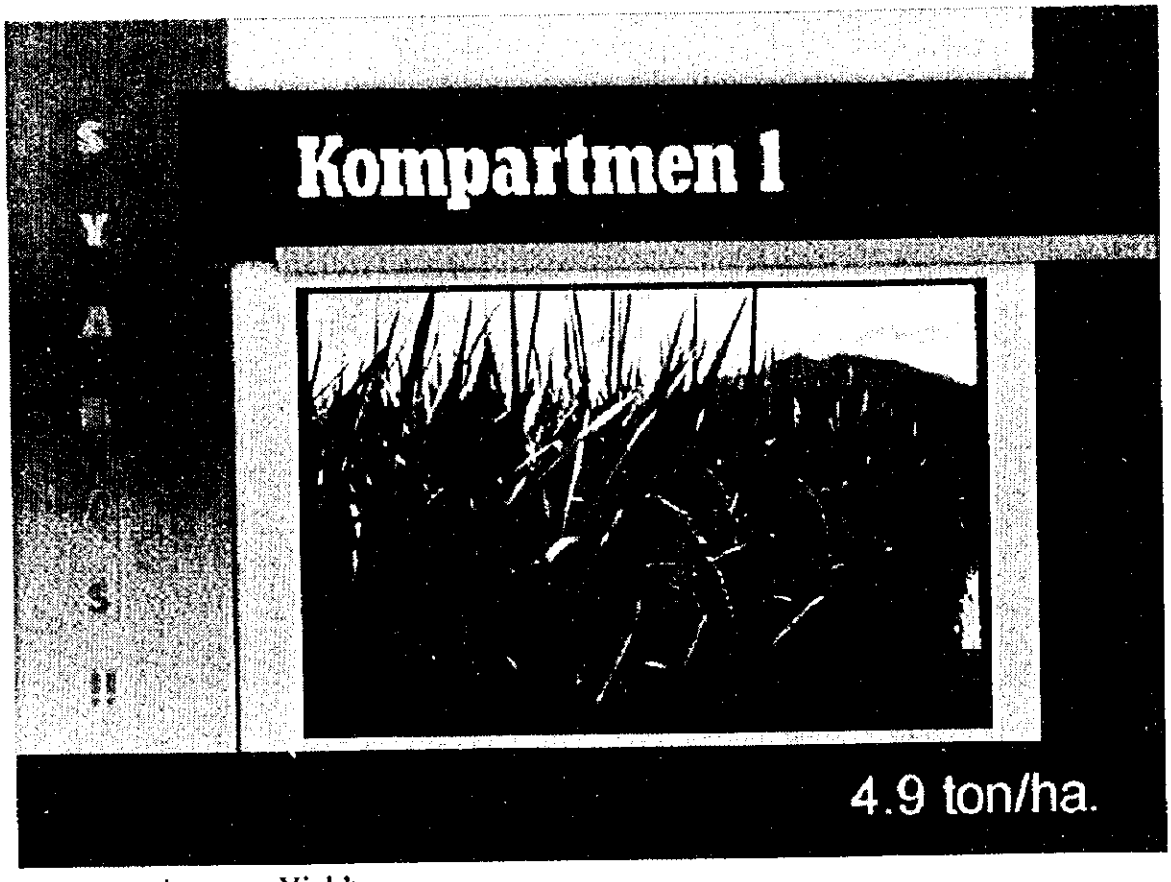
<Information on Field Condition (Good!)>



<Information on Field Condition (Warning! More Fertilizer should be applied)>

<Harvesting Schedule in Compartment 1>

<Information on Machine Trouble or Problem>



<Average Yield>

<High Yield Record Farm Group>