5.2.5 Environment Issues

(1) Soil and Water Quality

Soil Sampling

Soil analysis was carried out by means of collecting 4 soil samples at the downstream part of the scheme for checking sea water intrusion. Soil samples were taken from surface soil (depths of 0 - 15 cm) to represent cultivated paddy area. The checked items are:

1) pH;
2) Electric Conductivity (EC);
3) Saline contents (NaCl);
4) Hydrogen sulfide (H_2S);
5) Ammonium nitrogen (NH_4);
6) Available phosphate (P_2O_5); and
7) Available potassium (K_2O).
(*Note: Same methods were used for sampling and analysis in each scheme.)

Location of sampling sites and results of analysis are given in Fig.5.2.5-1 (5/6) and Table 5.2.5-1.

As a result of the analysis, the influence of sea water intrusion in the soils was not observed in the scheme. Also, other items were found to cause no problems for cultivation and Hydrogen sulfide was not shown.

Water Sampling

Water sampling analysis was carried out for checking quality of irrigation water. Water sample was collected at the Lidiyagama reservoir and examined. The checked items are:

1) Temperature;
2) pH;
3) EC; and
4) Saline contents (NaCl).
(*Note: Same methods were used for analysis in each scheme.)

Location of sampling site and results of analysis are given in Fig.5.2.5-1 (5/6) and Table 5.2.5-2.

As a result of the analysis, the values are found to be within the permissible ranges, and water quality of the Lidiyagama reservoir is proven to be suitable for cultivation.

(2) Flood Damage

Since the mouth of the Walawe Ganga is almost completely blocked by sandbars during dry season, area farmers excavate a channel through these from September each year to allow flood runoff during the monsoon. Flood damage appears to be limited to lowland along the coast line and occur more than 10 times for 2 weeks to 1 month by waterlogging.

(3) Wildlife

Mangrove forests and some wild animals such as crocodiles are found along the Walawe ganga estuary of lower part of the Scheme.

Flora and fauna species expected to inhabit around there by the investigation in the Udawalawe Left Bank Scheme includes 12 species of fish, 6 species of amphibian, 40 species of reptile (including 5 endemic species), 96 species of bird (including 4 endemic species). From 50 to 75 heads of Elephants are identified to move by group of 10 to several 10 heads around Ridiyagama-Badagiriya Reservoir, and troubles are increasing between local farmers and elephants in according with rural developments.

(4) Fisheries

At Ridiyagama reservoir, approximately 150 fishermen (120 families) are engaged in fishery. Monthly catch for the entire reservoir is 2,030 kg. It should be noted that these fishermen are also engaged in farming as well. Species fished are fresh water; however, catches have declined in recent years due to privatization of fish farms downstream of Muruthawela Wewa and the resultant halt in release of fingerlings.

According to in-situ interview survey, around 10 fishermen are presently fishing the waters of Walawe Ganga Estuary

(5) Diversion for Domestic Water Supply

Under the Ambalantota-Hambantota water supply scheme, water for domestic use has been diverted directly from the Walawa Ganga since 1982, first at Ambalantota and now from Bolana. Design supply population is 52,000 people and design diversion discharge is 5,600m^3/day. Water guality is examined by turbidity, pH and Water Colour, ect. When black liquor is discharged from the paper mill upstream near Chandrika Wewa, diversion under the scheme is not possible for 1~2 weeks. And under the Ridiyagama water supply scheme, design supply population is 1,800 and design diversion discharge is 290 m3/day, wwhich is diverted directly from Ridiyagama Reservoir.

(6) Paper Mill

The Embilitiya paper mill commenced operation in 1978, and is a foremost producer of paper, supplying roughly one fourth of all domestic consumption. However, at present the chemical recovery plant to remove harmful chemical wastes is not at full operation. The mill diverts water from Chandrika reservoir and discharges industrial waste into Walawe Ganga via pipeline of 8 km length.

Waste comprises mainly so called "brown liquor", a weak concentrate containing corrosive sodium lignite and a thicker concentrate referred to as "black liquor". Brown liquor is discharged from the mill daily; however, farmers along the pipeline illegally tap the line for irrigation water creating a health hazard concern.

Black liquor contains caustic soda, and is the result of boiling straw. pH is around 10. The substance is first stored in a tank inside the mill compound, where volume is allowed to decrease through natural evaporation. It is then discharged into Walawe Ganga at such times as to coincide with water release from Uda Walawe dam. Such discharge of black liquor is in restricted amounts to allow mixing at 1 by 15,000 with river water to reduce adverse impacts. Periods of discharge from the mill last for several days, during which an estimated 10,000 m3 of black liquor is released daily. Although frequency of discharge of black liquor fluctuates subject to stored quantity at the mill tank and frequency of release occurring at Uda Walawe, the average is 1~2 times per year. Prior to such discharge, the mill reportedly contacts the National Water Supply and Drainage Board, the Mahaweli Communicate Agency, Hambantota Provincial Council, AGA oddice of Hambantota and the District Secretariat of the Irrigation Department. After release of the effluent, color of river water changes at the mouth of the Walawe Ganga, fish are seen floating on the surface, and diversion of domestic water from the river is suspended for one week. Some farmers divert the effluent to fields in place of insecticide. The NWS&DB carries out only pH, turbidity, and color monitoring of diverted water; data is not available for the status of river water when diversion for water supply is not being done. There are instances of allergies among local residents to the black liquor.

The paper mill carries out water quality monitoring at 8 sites every month on the Walawe Ganga, but no particular problems in water quality.

Nevertheless, the Environmental Report of the Hambantota District IRDP recommends the following measures:

- Repairs to the chemical recovery plant
- Minimizing periods of effluent discharge
- Effluent discharge to the sea

(7) Illegal Gem Mining

Small scale gem mining is illegally being carried out and left along the Walawe left bank channel in the vicinity of Ridiyagama reservoir. Mine shafts are 1 m square in cross-section and about 2 m deep, and are located at scattered locations along the channel road. Some shafts have been dug right next to the channel, causing concern for impact on channel cross-section and as breeding grounds for mosquitoes following rainfall.

Table 5.2.5-1 Results of Soil Analysis

SAMPLE NO.	pH (H_2O)	EC (mS/cm)	NaCl (%)	H_2S (ppm)	NH_4-N (mg/100g)	P_2O_5 (mg/100g)	K_2O (mg/100g)	Remarks
BT-1	4.9	8.0	0.16	Nil	<1	<5	20	Benthara
BT-2	5.1	5.9	0.13	Nil	<1	<5	35	Benthara
BT-3	4.5	3.1	0.00	Nil	<1	<5	20	Benthara
BT-4	5.1	12.9	0.19	Nil	<1	<5	35	Benthara
BT-5	6.4	50.8	0.81	Nil	1	<5	35	Benthara (non-cultivated)
P-1	6.7	14.1	0.18	Nil	<1	>150	35	Polwatte
P-2	4.7	2.8	0.00	Nil	<1	10	10	Polwatte
P-3	5.0	1.2	0.00	Nil	<1	10	20	Polwatte
P-4	5.4	1.1	0.04	Nil	<1	150	20	Polwatte
P-5	5.0	1.5	0.00	Nil	<1	5	10	Polwatte
P-6	5.8	2.6	0.00	Nil	1	5	20	Polwatte
P-7	4.9	1.5	0.00	Nil	<1	5	1	Polwatte
P-8	4.8	0.8	0.00	Nil	<1	10	10	Polwatte
P-9	4.9	0.8	0.00	Nil	<1	10	1	Polwatte
P-10	4.8	1.4	0.00	Nil	<1	10	1	Polwatte
P-11	5.7	2.9	0.00	Nil	<1	5	20	Polwatte
T-1	6.2	1.2	0.00	Nil	<1	150	10	Tangalu
T-2	5.9	2.2	0.00	Nil	<1	>150	<1	Tangalu
T-3	6.4	4.9	0.04	Nil	1	5	35	Tangalu
T-4	7.4	6.8	0.04	Nil	<1	50	35	Tangalu (non-cultivated)
T-5	6.7	4.8	0.07	Nil	1	150	20	Tangalu
M-1	6.2	2.8	0.00	Nil	<1	100	35	Muruthawela (Urubokka)
M-2	6.6	3.1	0.00	Nil	<1	5	10	Muruthawela (Urubokka)
M-3	7.3	2.5	0.00	Nil	<1	75	10	Muruthawela (Urubokka)
K-1	7.5	2.0	0.00	Nil	<1	10	10	Kachigala
K-2	6.7	13.8	0.13	Nil	<1	>150	35	Kachigala (non-cultivated)
K-3	7.0	11.4	0.09	Nil	1	>150	35	Kachigala (non-cultivated)
L-1	7.3	2.5	0.00	Nil	1	150	20	Liyangastota
L-2	6.8	4.3	0.00	Nil	<1	10	35	Liyangastota
L-3	6.5	2.6	0.00	Nil	<1	75	10	Liyangastota
L-4	7.3	3.8	0.00	Nil	<1	75	20	Liyangastota
B-1	7.6	4.1	0.03	Nil	<1	10	10	Badagiriya
B-2	7.1	2.0	0.00	Nil	<1	5	20	Badagiriya
B-3	7.8	1.8	0.00	Nil	<1	5	20	Badagiriya
B-4	6.6	0.9	0.00	Nil	<1	5	35	Badagiriya (non-cultivated)

Table 5.2.5-2 Results of Water Quality Analysis

Sample No.	Temp. (℃)	pH (H_2O)	EC (μS/cm)	NaCl (%)	Remarks
①	31.2	6.9	12,100	0.47	Benthara
②	31.9	7.3	12,900	0.53	Benthara
③	-	6.9	33,600	1.40	Benthara
④	29.2	6.8	6,050	0.16	Polwatte
⑤	-	7.1	1,290	0.05	Polwatte
⑥	-	7.9	9,400	0.38	Polwatte (Ilwatta Anicut)
⑦	-	8.0	130	0.00	Polwatte
⑧	29.2	7.3	270	0.00	Tangalu (Maha Anicut)
⑨	30.8	7.3	1,550	0.04	Tangalu (Danketiya Anicut)
⑩	32.4	6.9	2,760	0.07	Tangalu (Cultivated Paddy Field)
⑪	32.4	6.8	4,800	0.13	Tangalu (Abandoned Paddy Field)
⑫	29.5	7.7	90	0.00	Muruthawela (Muruthawela Tank)
⑬	29.0	7.3	100	0.00	Muruthawela
⑭	28.1	7.3	110	0.00	Muruthawela (Udukiriwela Tank)
⑮	27.7	7.6	640	0.01	Kachigala (Mahabenmma Anicut)
⑯	31.5	7.6	450	0.00	Liyangastota (Lidiyagama Tank)
⑰	29.4	7.8	910	0.03	Badagiriya (Badagiriya Tank)

Table 5.2.5-3 Approximate Limits of Salinity Classes for Soil

Class	EC (mS/cm)	Characteristics
Class 0	0-4	free
Class 1	4-8	slightly affected
Class 2	8-15	moderately affected
Class 3	more than 15	strongly affected
Source:	Panakokke, C.R. (1992). Brief Note on Soil and Water Salinity and Reclamation Measures. - IIMI/SLFO - Colombo.	

Table 5.2.5-4 Classification of Irrigation Water Quality

Class	EC (μS/cm)	Characteristics
Class 1	100-250	Low salinity hazard. Water can be used on most soils.
Class 2	250-750	Moderate salinity hazard. Water con be used with moderat leaching for most crops and on most soils.
Class 3	750-2250	Medium to high salinity hazard. Water can be used on soils of moderate slat tolerance. Leaching is required.
Class 4	2250-4000	High salinity hazard. Water can be used on permeable soils with salt tolerant crops. Special leaching requirements.
Class 5	4000-6000	Very high salinity hazard. Water generally unsuitable for irrigation.
Class 6	above 6000	Excessive salinity hazard. Water unsuitable even on permeable soils.
Source:	Panakokke, C.R. (1992). Brief Note on Soil and Water Salinity and Reclamation Measures. - IIMI/SLFO - Colombo.	

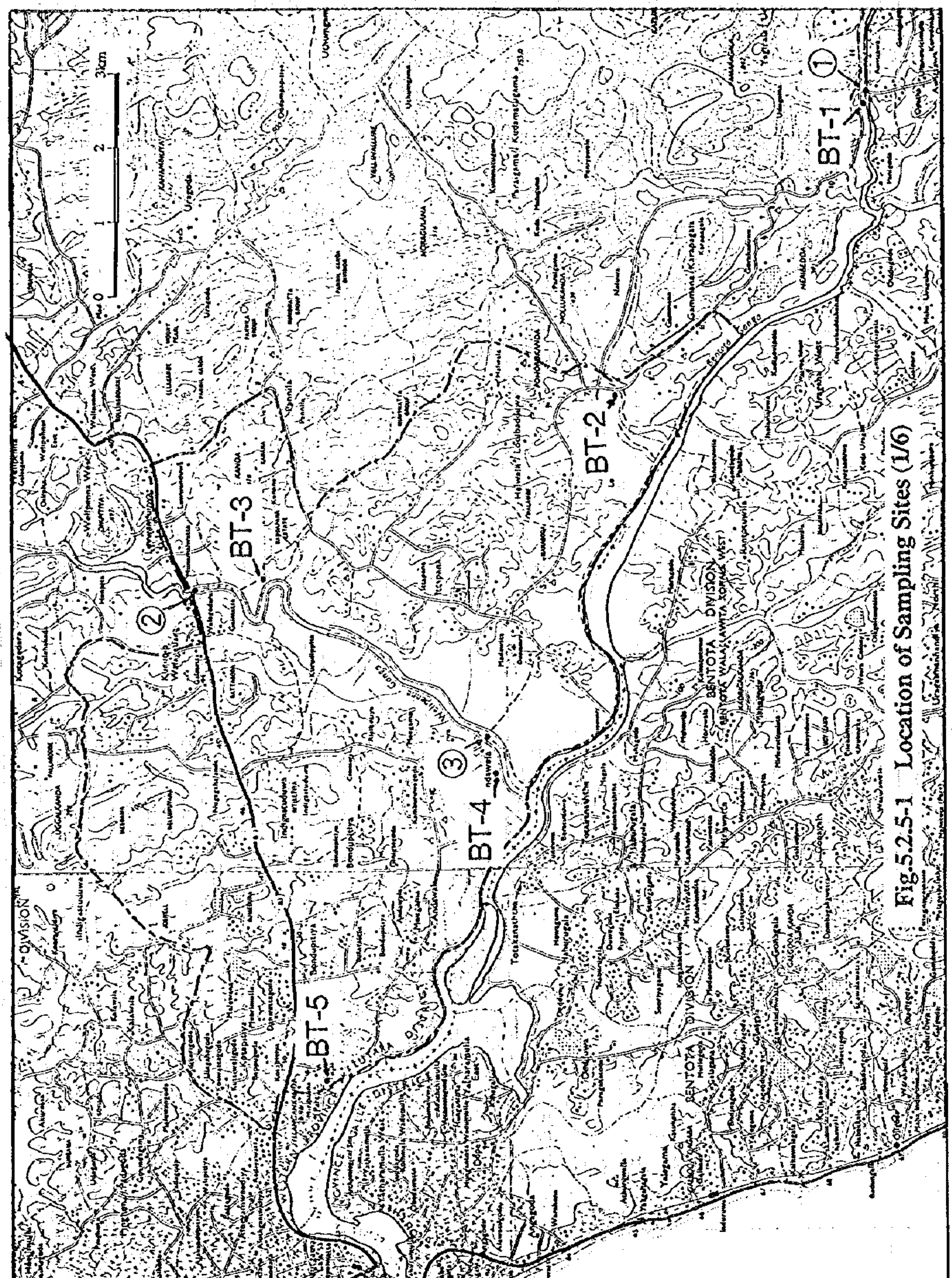


Fig.5.2.5-1 Location of Sampling Sites (1/6)

Fig.5.2.5-1 Location of Sampling Sites (2/6)

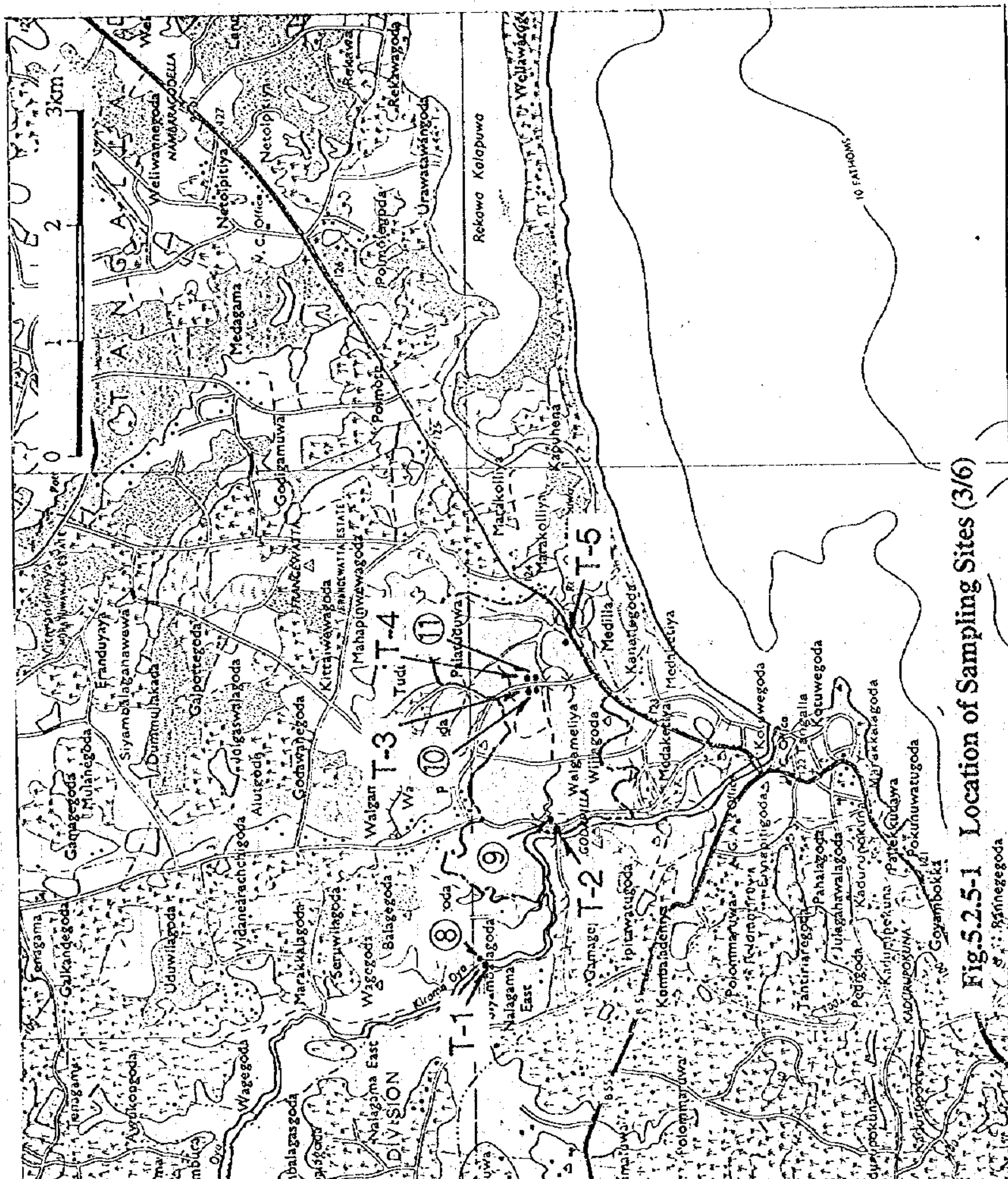


Fig.5.2.5-1 Location of Sampling Sites (3/6)

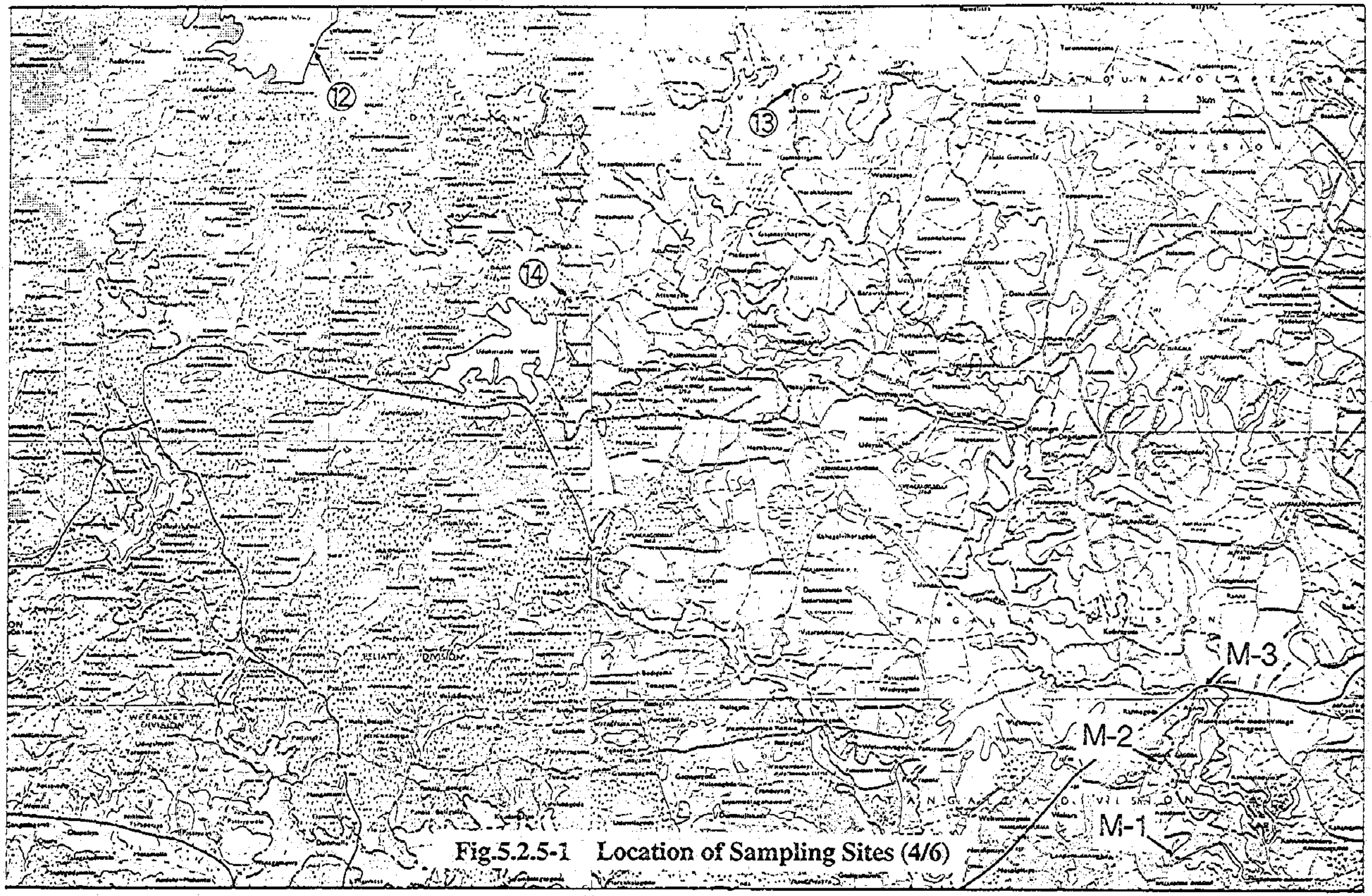


Fig.5.2.5-1 Location of Sampling Sites (4/6)

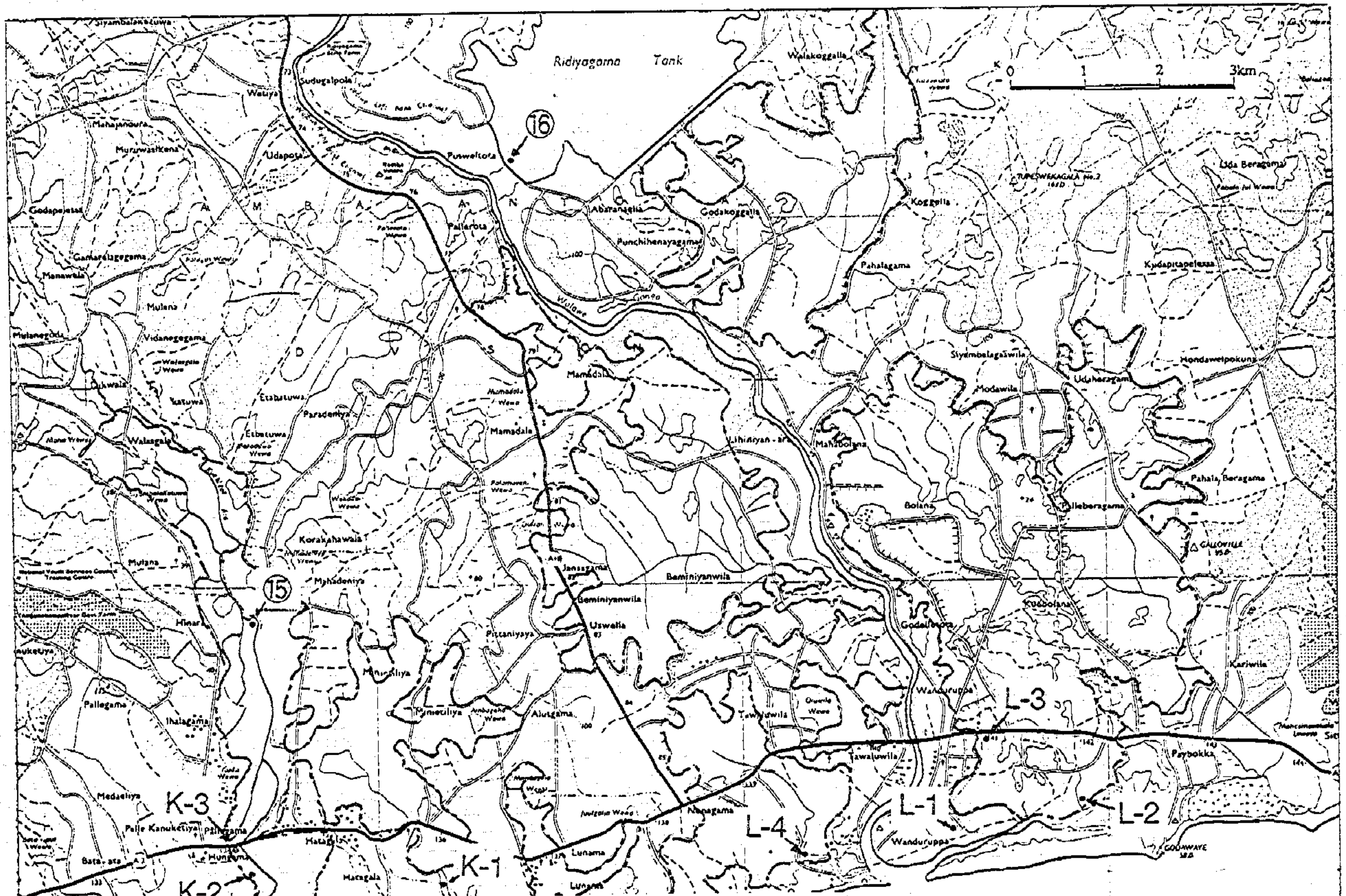


Fig.5.2.5-1 Location of Sampling Sites (5/6)

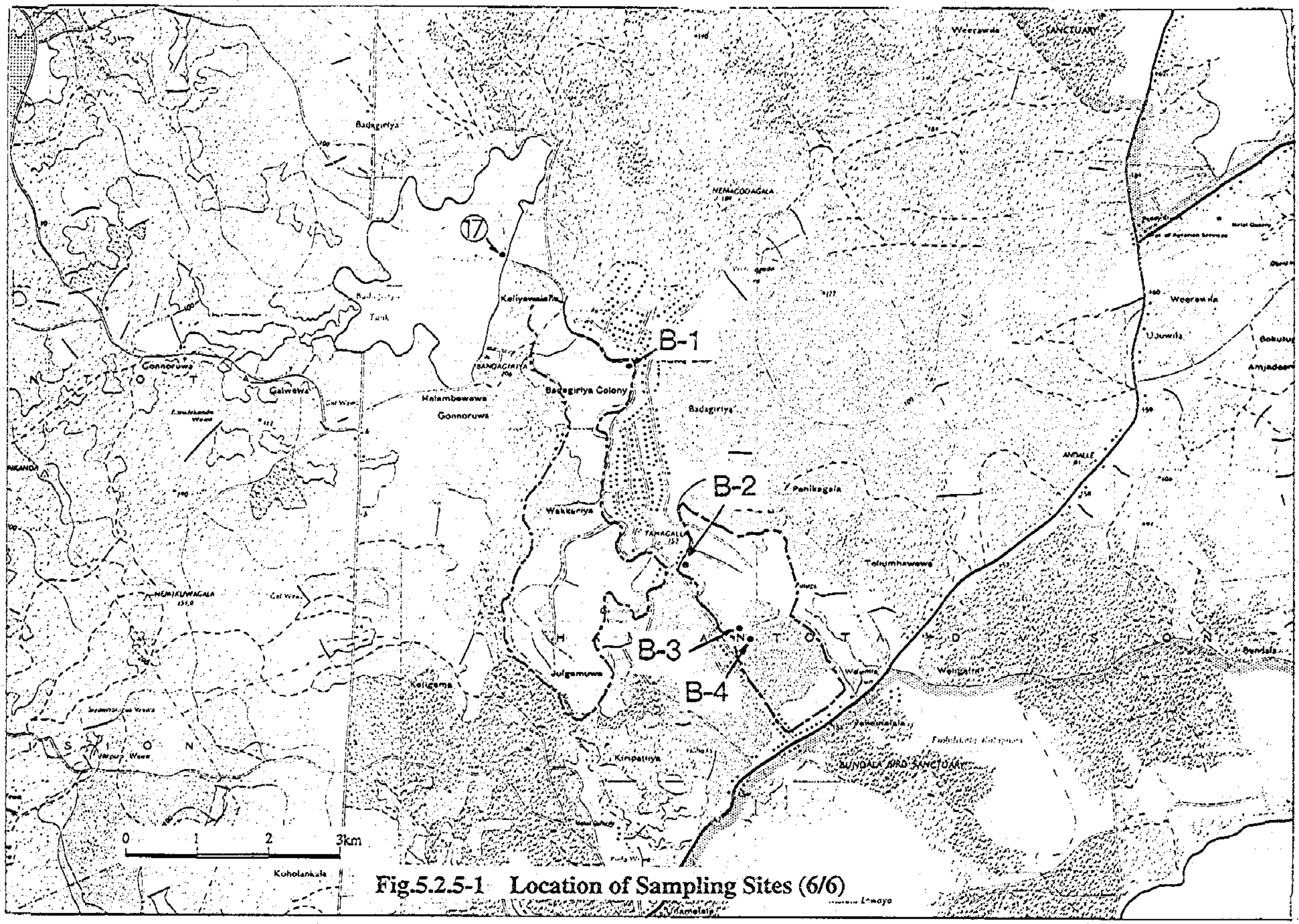


Fig.5.2.5-1 Location of Sampling Sites (6/6)

5.3 Muruthawela Reservoir Scheme

5.3.1 Irrigation and Drainage System

(1) Location and Basin Description

This scheme is located in Hambantota district, and comprises paddy field of 6,149 ha along Urubokka Oya flowing south through Ranna city being accessible by national road A-2. The Urubokka Oya basin, within which Muruthawela Reservoir is located, has a catchment area of 348 km^2. There are four major irrigation projects in the basin, and the scheme as included under this Study comprises the areas served by Muruthawela and Udukiriwala reservoirs.

The Urubokka Oya area, including Muruthawela Reservoir, is essentially representative of the range of problems affecting irrigation/drainage projects in the Southern Province. These include: water shortage at Muruthawela Reservoir, upset water balance, lack of effective water distribution system, drainage problems, inefficient irrigation systems from old anicuts constructed downstream of reservoirs, inundation of low-lying paddy field, as well as saline intrusion from the lagoon where the river enters the Indian Ocean.

(2) Relationship of Muruthawela Reservoir Scheme and Urubokka Old Agricultural System

Prior to the inauguration of the Muruthawela scheme, traditional farming had been practiced for more than a hundred years along the Urubokka Oya from its upper reaches to its mouth at the Indian Ocean. Accordingly, the area served with irrigation water from the Muruthawela Reservoir must be identified in terms of the entire basin. The Urubokka Oya irrigation system also relates to the Kirama Oya basin (Maha Ela basin) which is fed with discharge from the right bank of the Muruthawela Reservoir. The Urubokka Oya comprises 8 anicuts, 6 small tanks, 1 medium sized tank, and a network of canals and myriad field canals. However, leakage occurs both upstream and downstream portions of anicut structures; gates have been damaged by flooding; and water distribution works, bank revetment and spillway facilities have deteriorated. Currently the irrigable area in the Urubokka Oya is supplied with water more or less twice a year under the Muruthawela Reservoir scheme, and the area is a major producer of vegetables, and seasonal grains in addition to paddy. The Irrigation Department recognizes that deterioration of the anicut and irrigation facilities has caused drastic drop in functions of the system, and is eager to establish a proper water management system through rehabilitation of anicuts and irrigation/drainage system servicing paddy field of the area.

(3) Present Status of Irrigation in the Study Area

a) Command Areas

The main water source under this scheme is the Muruthawela Reservoir on the Urubokka Oya, with storage capacity of 48 million m^3. The whole project area comprises 4 sub-areas and benefitted areas are identified by the Study Team using Water Issue Tree prepared by Department of Irrigation as follows:

Irrigation Sub-areas		Command Areas (ha) Identified
1) LB Main Scheme		
	Tract II :	614
	Tract III :	669
	Tract I :	N.A. (415)
2) Urubokka Oya Scheme		2,175
3) Kirama Oya Scheme		2,001
4) 8 Village Tanks (from RB Main Canal)		275
	Total :	6,149

Note: N.A. means that Engineering Survey Sheet is not available. 415 Acs. will be adopted as provisional benefitted area for Phase II (stage 2).

b) Schematic Diagram

The Schematic Diagram of Muruthawela Reservoir Scheme is shown in Fig. 5.3.1-1.

c) Parameters of Irrigation Systems

Parameters in the Muruthawela Reservoir are shown in Table 5.3.1-1.

d) Years of Completion of Main Structure in the Schemes

Years of Completion of the main structures in the Muruthawela Scheme are as follows:

Name of Scheme	Year of Completion of Rehabilitation		
	Reservoir/Tank	Anicut	Canal System
	Muruthawela-Rc		
LB Main Scheme	1971		1971's
Urubokka Oya Scheme	1787		
	(Restored 1859)		
Kirama Oya Scheme	1805-1812		
	(1980-84)	(1980-86)	(1980-86)
8 Village Tanks			

e) Allocation of Irrigation Water in Muruthawela Reservoir

The first priority in receiving water from Muruthawela Reservoir is given to Urubokka Oya Anicut Scheme because this area of 5,374 Acs. (2,175 ha) was cultivated before the construction of Muruthawela Reservoir. The second is Tract II and Tract III of 1,518 Acs. (614 ha) and 1,654 Acs. (669 ha). Tract I of 1,025 Acs. (415 ha) is not authorized to receive water. The lowest priority is for Kirama Oya Anicut Scheme, through RB main canal, in addition there are 8 minor tanks which are also fed from this RB canal before it reaches Kirama Oya Schemes.

f) Water Shortage in the Systems

Muruthawela Reservoir is designed to provide irrigation water to Urubokka Oya Anicut Schemes, Tract II, III and supplementary irrigation to Kirama Oya Scheme.

At present, paddy fields under Urubokka Oya Anicut Scheme are cultivated fully in Maha and 50% in Yala season, while Tract II and Tract III are cultivated alternately in Yala and Maha due to shortage of water and constraints of irrigation system. Kirama Oya area commanded by 18 anicuts have faced frequent water shortages. These anicuts supply water to the paddy lands only for Maha season. Yala cultivation has been limited to the area irrigated by the Kirama tank and the five anicuts located in lower reaches of the Kirama Oya systems.

According to the preliminary water balance study done by Irrigation Dept., there is a deficit of about 39,000 Acs.ft (48 MCM) annually to meet the irrigation requirements of paddy fields in Urubokka Oya basin and Kirama Oya basin under the command of Muruthawela Reservoir. With regard to this matter, it is described in the latter paragraph of water balance calculation.

(4) Muruthawela LB Scheme

Muruthawela LB Scheme consists of the specified command areas called Tract-II and Tract-III, and Tract-I which was not specified as command area of this Scheme from the design stage. Area of Tract-II and Tract-III are irrigated through the authorized pipe outlets on 9 Distributary Canals (D-1~9) in each Tract respectively. At present, a small area of Tract-I is irrigated through 6 authorized pipe outlets on LB Main Canal directly. Most part of the other Tract -I area, however, have been cultivated by unauthorized pipe siphoning in diameter 2~3" to get water from LB Main Canal directly.

In the original plan, Tract I areas were designed along the LB main canal from the downstream point of the Muruthawela Reservoir extending up to about 13 km. However, due to some controversy in this tract, it has been decided to exclude the lands in this tract form the Muruthawela project.

At the first WLAC Meeting on Feb. 20, 1995, Tract I farmers expressed their opinion that an irrigation system be provided and water issues regularized. Farmer in Tract II and III agreed to this request provided they adhere to the present area and don't expand. Tract I farmers agreed to follow Project Committee and Kanna meeting decisions if they are brought into the system.

The schematic Diagram of Muruthawela LB Scheme is shown in Fig. 5.3.1-2.

a) Present Conditions of Irrigation Facility

i. parameters of Muruthawela Reservoir, Spillway and Intake Gate

Facility		Design features	Design value
Reservoir		Dam Type	Earth dam
		Storage volume	48 million m^3
		Crest length, width	L=164m, B=6.0m
		Embankment slope gradient	1:2.75(upstream & downstream)
		Base elevation	61.0m MSL
		Dam height	H=31.5m
Spillway		Gate type	5 spans, radial gate L=30.5m (B=6.1m x H=3.8m)
		Spillway	3.8m
		Design flood discharge	$625m^3/s$
		Spillway elevation	85.5m MSL
		H.F.L	90.2m MSL
Intake Gate	Left bank (L/B)	Intake facility	PC; intake tower; intake culvert (W=1.1mxH=11.5mx 2spans)
		Design discharge	$Q=7.0m^3/s$
		Base elevation	74.4m MSL
		Maximum depth	H=15m
	Right bank (R/B)	Intake facility	Same as L/B
		Design discharge	$Q=3.5\ m^3/s$
		Base elevation	Same as L/B

ii. Parameters of L/B Main, Branch and D,F Canals

Facility	Design features	Design value
Main canal	Design discharge	Q=2.1m3s (for Tract II, Tract III)
	Canal gradient	i= 0.003 (approx. 1/3,300)
	Canal base width	B = 3.66 m
	Design depth	H = 0.85 m
	Side slopes	n = 1:1.0
	Canal freeboard	Fb = 0.9 m
	Canal length	L_1 = 15.3 km
Branch canal	Canal length	L_2 = 5.0 km
Tract II	D-Canal F-Canal	L_3 = 14.3 km L_4 = 47.8 km
Tract III	D-Canal F-Canal	L_5 = 11.2 km L_6 = 50.8 km
	Total	$\sum L_{1\text{-}6}$ = 144.4 km

iii. measuring of Current Flow on Main Canal

On 9th March, 1995 the Study Team measured the current flow of upper reaches of LB main canal and checked existing Parshall Flumes functioning. Discharges measured by using Current Meter, are identified as follows:

Observed Point	Observed Discharge (cumecs)	Ref.
about 0.2 km D/S of Parshall Flumes	2.75	d≒0.8m, V≒0.56 m/s
Concrete Traf	2.33	d=1.50m, V=1.08 m/s

Existing Parshall Flumes (W=7' type) is not functioning due to damaged portion of invert and side wall concrete. Incidentally, measured value Ha (3') of this Parshall Flumes will be over 4.5 cumecs by a conversion discharge formula.

iv. parameters of R/B Main Canals

Facility	Design features	Design value / condition
Main canal	Design discharge	Q = 3.50 m3/s
	Canal gradient	i = 0.003 (approx. 1/3,300)
	Canal base width	B = 3.66 m
	Design depth	H = 1.20 m
	Side slopes	n =- 1:2.0
	Freeboard	Fb = 0.9 m
	Canal length	L = 7.2 km
	Benefit area	8 village tanks (from 6 gates); Kirama Oya

b) Survey on Degree of Facility Deterioration

Total length of Main, Branch, Distributary and Field Canals, which all are unlined, under Tract-II and Tract-III are summarized below from Table 5.3.1-1:

Name of Canal	Total Length
Main Canal	15.3 km
Branch Canal	5.0 km
Tract-II	
D-Canal	14.3 km
F-Canal	47.8 km
Tract-III	
D-Canal	11.2 km
F-Canal	50.8 km
Total	144.4 km

Bottom width of the present typical section of Main Canal upper section is identified 7~10 m in banking section and 4~5 m in cutting section according to the field survey. The unlined canals have become quite widened from the original design section (W=3.66 m) due to erosion of canal bunds and scouring. This makes water management difficult because of having maintain the design level. Most of the canal bunds in banking section have become thin and unsteady due to overflowing. In case of the Main Canal, about 7 km out of total length of 15.3 km is banking section. Retaining walls of rubble masonry are adopted for protection in some of such places including in Distributary Canals, however, these are not effective.

263 Field Canals with a total length of 47.8 km in Tract-II and 50.8 km in Tract-III are identified in the Scheme according to the issue tree data prepared by ID. Some canals, however, are not functioning or are abandoned due to poor maintenance, and most of the canals are in bad conditions. These conditions make it difficulty to convey water to the tail end areas.

All canals mentioned in the above table are should be totally rehabilitated.

(5) Urubokka Oya Scheme

a) Distribution System

This system along the Urubokka Oya up to the sea has existed for 100 years since Muruthawela Scheme was inaugurated and has never been rehabilitated. This irrigation system is connected to Kirama Oya basin at the upper reaches called Maha Ela and directs water into saved in Muruthawela Reservoir LB and RB main canal. Urubokka Oya Scheme consists of 8 anicuts, 6 minor tanks and 1 medium Udukiriwela tank, with storage capacity of 3.84 million m3. From the Udukiriwela anicut, water is being diverted to Udukiriwela Tank, which is the first in the chain of 7 tanks. These down stream tanks get a water through the High Level Canal which starts Udukiriwela Tank.

The area covered by 8 anicuts (refer to Table 5.3.1-2) under Urubokka oya is considered as one scheme in the Urubokka basin. Drainage water from the upper anicut is re-used at the lower anicuts. The Urubokka Oya distribution system is divided into 5 blocks according to their related system of irrigation and drainage as below:

Name of Anicut	Distance from Reservoir	Anicut Sill Level	Command Area
Muruthawela Reservoir	0.0 km	73.8 m	
Block-1			
Raluwa Nawarathe	2.7 km	56.9 m	101 ha
Kinchigune	4.8 km	48.5 m	107 ha
Block-2			
Udukiriwela	10.5 km	37.2 m	182 ha
High Level Chl.(7 tanks)			405 ha
Block-3			
Wakamulla	13.9 km	29.3 m	248 ha
Hunnakumbura	16.9 km	24.5 m	169 ha
Block-4			
Hakuruwela	19.4 km	20.5 m	396 ha
Andupelena	27.2 km	9.2 m	375 ha
Block-5			
Ranna	35.0 km	1.8 m	192 ha
Total			**2,175 ha**

Depending on stream flow of the Urubokka Oya and rainfall in each season, time of land preparation and cropping calendars are decided in each block. Usually, cultivation starts from upstream to downstream areas to utilize return flows effectively.

Most areas in the same block of anicuts are irrigated through the same Main Canal, on right and left bank respectively. Upper anicut diverts water to its command areas, and also release surplus water to the lower anicut. Lower anicut replenishes water to the Main Canal which come down from upper anicut and irrigate its own command area.

Out of 6 small tanks (Tank Data is shown in Table 5.3.1-11) supplied from the right bank sluice of Udukiriwela Tank through the High Level Canal, 2 tanks involving Pattiyapola Wewa were rehabilitated under IRDP recently. However, this area can be cultivated only once a year successfully, farmers request to release more water from Udukiriwela Tank, by making lower at bottom level of the High Level Canal.

b) Water Issuering Duty by Irrigation Department

ID has been made themselves responsible for issuering irrigation water for the Urubokka Oya Command area as follows:

Name of Anicut	Command Area (ha)	Yala Season	Maha Season
Raluwa Nawarathe	101	Full	Full
Kinchigune	107	do	do
Udukiriwela	183	do	do
Wakamulla	248	half of command area	Full
Hunna Kumbura	169	do	do
Hakuruwela	396	do	do
Andupelena	375	do	do
Rana	192	do	do
High Level Canal Command Area	405	0	Full

c) Survey on Degree on Facility Deterioration

The irrigation canal system mentioned above is not functioning well at present. Many sections of the canal bunds are broken where stream enter into the command areas. And also erosion, silting and weed growth can be seen due to lack of maintenance in many sections.

Anicuts in each of the schemes were mostly constructed in 1940' nevertheless the main structures of anicuts seem to be deteriorated slightly at the first sight. But most of anicut gates are so bad that they cannot maintain the FSL during dry season except for ones of Udukiriwela Anicut. Absence of poor condition of gates at the intake lease to flow excess water into canals.

(6) Kirama Oya Scheme

a) Project History and Extent of Cultivated Land

Kirama Oya drains a catchment of 225.3 sq.km. In the upper reaches, Kirama tank was constructed in 1805 - 1812 to irrigate 400 Acs. The lands on either side of the Oya have been exploited for paddy cultivation by 18 anicuts and Kirama tank. At present, the area commanded by the 18 anicuts is 4,945 Acs (2,001 ha). identified by the Study Team (refer to Table 5.3.1-3).

The 18 anicuts constructed by the Irrigation Department have faced many problems of water shortages in Yala and floods in Maha. The cultivation ratio in Maha and Yala season from 1986 to 1993 is shown as follows :

Year	Season	Cultivation Ratio (%)
1986/87	Maha	96
1987	Yala	47
1987/88	Maha	N.A.(Not Available)
1988	Yala	50
1988/89	Maha	96
1989	Yala	41
1989/90	Maha	97
1990	Yala	N.A.
1990/91	Maha	N.A.
1991	Yala	N.A.
1991/92	Maha	N.A.
1992	Yala	48
1992/93	Maha	97
1993	Yala	58

source:Final Report Oct. 1993 (Study on the Present State and Development Potential of Thangalu Welyaya and Rekawa Lagoon)

b) Works implemented by Hambantota Integrated Rural Development Project (HIRDP)

The GOSL has given the priority for irrigation water management in existing schemes, through farmer participation, increasing the productivity through crop diversification and systematic water management. For this policy, HIRDP initiated these programs about a decade ago, thus Kirama Oya Irrigation Project was undertaken as HIRDP from 1980 to 1986 (this project was approved in 1978 and reviewed in 1981 by NORAD).

An approved cost estimate of Rs. 10.5 million for Kirama Oya Project was one of the foremost projects authorized for implementation under IRDP.

The improvement works proposed in this project were the construction of 3 new anicut structures along the Kirama Oya and rehabilitation of the existing anicuts, access roads and delivery systems. About Rs. 14.0 million was spent for the related 12 anicut schemes covering commanded area 3,230 Acs. (1,300ha).

This project cost corresponding to Rs. 1,077/ha seems to be not enough amounts in comparison with the other similar rehabilitation projects.

Annual expenditure and the related 12 anicuts of Kirama Oya Scheme under IRDP are shown in the Table 5.3.1-3 and 5.3.1-4.

c) Distribution System

Kirama Oya Scheme is almost the same system as the Urubokka Oya basin. 18 anicuts under Kirama oya can be attributed to one scheme in the Kirama basin. Kirama Oya Scheme is divided 5 blocks as shown in below table:

Name of Anicut	Station	Sill Level	Command Area
Kirama Tank	0.0 km	85.5 m	
Block-1			
Hammbumandiya	7.9 km	63.0 m	101 ha
Ethpitiya	9.5 km	57.4 m	79 ha
Uda Debarawa	13.6 km	39.7 m	44 ha
Block-2			
Arachchi	14.7 km	37.8 m	134 ha
Wijerathne	17.3 km	28.8 m	34 ha
Wauwa	18.9 km	26.0 m	117 ha
Block-3			
Okewela	21.5 km	20.4 m	142 ha
Pansala	24.2 km	16.3 m	42 ha
Block-4			
Pattiyawela	25.7 km	14.3 m	143 ha
Unnansege	27.4 km	11.4 m	89 ha
Block-5			
Kahawatta	28.7 km	8.8 m	89 ha
Pingoda	30.4 km	7.5 m	55 ha
Liyanagedeniya	30.5 km	N.A.	105 ha
Nalagama	32.9 km	5.6 m	322 ha
Daranda	34.5 km	3.4 m	73 ha
Wile	35.5 km	2.5 m	40 ha
Maha	38.3 km	0.9 m	190 ha
Danketiya	40.5 km	0.0 m	202 ha
Total			**2001 ha**

In case of Kirama Oya Scheme also, time of the land preparation is decided under agreement among the above blocks and cropping calendars are selected in each block as well as Urubokka Oya Scheme.

Water issuering duty by ID in this scheme included 8 village tanks are as follows:

Name of Scheme and Anicut	Command Area (ha)	Yala Season	Maha Season
8 Village Tanks	275	0	Full
From Hambumandiya to Pinoda Anicut (12 Anicuts)	1,068	Full	Full
From Liyangedeniya to Danketiya Anicut (6 Anicuts)	933	0	Full

d) Survey on Degree of Facility Deterioration

In the irrigation canal system, many sections of the canal bunds are broken where stream enter into the command areas, specially downstream of Kirama Oya below Kahawatta Anicut. Drainage water concentrates in these sections during flood and damaged canal systems and the revetments of anicuts at the same time. The revetments of the Maha Anicut is now under repair by ID.

(7) Water Balance Analysis of LB Main and Urubokka Oya Scheme

a) Precondition of Analysis

i. Existing Field Water Requirement (FWR)

In this analysis, main crops are set for both seasons as paddy (105 days varieties) and OFC (Soya Beams 105 days type adopted) which are using in the design standard of ID for estimating unit water requirement (reter to Fig.5.3.1-6,7).
P
ii. Target Crops

This analysis adopted following crops in each seasons according to Phase I data collections.

Name of Scheme	Command Area (ha)	Yala Season	Maha Season
1) LB Main Scheme			
Tract II	614	Paddy	
Tract III	669		Paddy
Tract I	415	Paddy	Paddy
2) Urubokka Oya	2,175	Paddy	Paddy
3) Kirama Oya	2,276	Paddy	Paddy

iii. Inflow Data

Muruthawela Tank Water Issue Record (1984 Sep. to 1995 Feb.) is adopted as inflow data.

iv. Analysis Period

20 cases, from 1984/85 Maha to 1994 Yala, are set for calculation period.

v. Case Studies

Following 3 case studies were set for the estimate of water balance study using present water distribution systems which obtained from ID during Phase I Field Survey.

3 case studies are based on following condition. Kirama Oya and 8 village tank scheme are not included in these studies.

	Comprised Scheme	Cropping Pattern and Intensity	Water Issue	Remarks
Case I (present)	Tract II, III and Urubokka Oya	Same as present pattern (see next Table)	L/B Sluice Water Issue Record	Present water Utilization,
Case II (proposed)	Tract I, II, III and Urubokka Oya	Paddy (90%) and OFC (10%) for Yala, Paddy for Maha	Same as above	under Proposed cropping pattern and Intensity. Water utilization is same as Case I.
Case III	Same as Case II	do	L/B, R/B Water Issue Record and Tank volume	new water utilization by Tank volume.

Cropping Pattern and Intensity for each case studies are as follows:

Name of Scheme	Season	Case I		Case II		Case III	
		Crops	(cropping intencity)	Crops	(cropping intencity)	Crops	(cropping intencity)
L/B Main Scheme							
Tract II (A=614 ha)	Yala	Paddy	(100%)	Paddy OFC	(100%) (0%)	Same as Case II	
	Maha	OFC	(0%)	Paddy OFC	(70%) (30%)	do	
Tract III (A=669ha)	Yala	OFC	(0%)	Paddy OFC	(70%) (30%)	do	
	Maha	Paddy	(100%)	Paddy OFC	(100%) (0%)	do	
Tract I (A=415 ha)	Yala	-	(50%)	Paddy OFC	(70%) (30%)	do	
	Maha	-	(50%)	Paddy OFC	(70%) (30%)	do	
Urubokka Oya							
Ralwa Nawarathe - Udukiriwila (3 anicuts: A=391 ha)	Yala	Paddy	(100%)	Paddy OFC	(90%) (10%)	do	
	Maha	Paddy	(100%)	Paddy OFC	(100%) (0%)	do	
Wakamulla - Rana (5 anicuts: A=1,380 ha)	Yala	Paddy	(50%)	Paddy OFC	(90%) (10%)	do	
	Maha	Paddy	(100%)	Paddy OFC	(100%) (0%)	do	
High Level Canal Area (A=405 ha)	Yala	-	(0%)	Paddy OFC	(90%) (10%)	do	
	Maha	Paddy	(100%)	Paddy OFC	(100%) (0%)	do	

Command areas for each case using adopted cropping pattern and intensity are as follows:

Name of Scheme		Season	Present (ha)	Proposed (ha)	
			Case I	Case II	Case III
L/B Main Scheme		Yala	822	1,698	1,698
		Maha	877	1,698	1,698
Urubokka Oya Scheme		Yala	1,081	2,176	2,176
		Maha	2,176	2,176	2,176
	Total	Yala	1,903	3,874	3,874
		Maha	3,053	3,874	3,874

b) Results of Analysis

The results indicate that Case III would be recommended as proposed water utilization of Muruthawela Reservoir Scheme.

Result of water balance analysis is estimated as follows:

Command Area : 3,874 ha

Year	Season	Case I		Case II		Case III
		Parcentage of Irrigable Area (%)	Non-irrigable Area (ha)	Parcentage of Irrigable Area (%)	Non-irrigable Area (ha)	
1984/85	Maha	155	OK	143	OK	OK
85	Yala	117	OK	84	▲620	OK
1985/86	Maha	82	▲550	74	▲1,007	OK
86	Yala	69	▲590	49	▲1,976	OK
1986/87	Maha	59	▲1,252	53	▲1,821	OK
87	Yala	32	▲1,294	23	▲2,983	OK
1987/88	Maha	89	▲336	81	▲736	OK
88	Yala	118	OK	84	▲620	OK
1988/89	Maha	89	▲336	80	▲775	OK
89	Yala	91	OK	65	▲1,356	OK
1989/90	Maha	137	OK	123	OK	OK
90	Yala	106	OK	78	▲852	OK
1990/91	Maha	27	▲2,229	24	▲2,944	OK
91	Yala	76	▲457	54	▲1,782	OK
1991/92	Maha	84	▲488	75	▲969	deficit
92	Yala	87	▲247	62	▲1,472	deficit
1992/93	Maha	70	▲916	63	▲1,433	deficit
93	Yala	78	▲419	56	▲1,705	OK
1993/94	Maha	156	OK	141	OK	OK
94	Yala	111	OK	80	▲775	OK

Note: 1) Command area of water balance are as follows:
Case I : Maha = 3,053 ha, Yala = 1,903ha
Case II : Maha = 3,874 ha, Yala = 3,874 ha
Case III Maha = 3,874 ha, Yala = 3,874 ha

2) Over 90% of parcentage of irrigable area is shown 'OK" and below of 90% is shown "▲".

c) Water Balance Study of Kirama Oya Scheme

i. Water Source

The Kirama Oya Scheme receives supplemental water from the tributaries of Nilwala Ganga through Kirama Tank as the only source for regulation with storage capacity of 1.3 MCM. The Kirama Tank is located at the head of 18 diversion structures (Anicuts) and has a small catchment area of 15.1 km^2. A link canal was constructed to supplement to the Kirama Oya Scheme from RB sluice of Muruthawela Reservoir. However, this link canal has been silted and not been functioning at present.

ii. Tank Issue Records

According to the reports of Hydrological Study of Kirama Oya, Urubokka Oya and Muruthawela Reservoir, April 1984 described by NORAD, a gage post had been established and daily stage heights have been recorded during 1979 May to 1984 August. However, since then, no records have been identified due to damages of measurement devices by floods. Tank issue records has been observed by ID from 1993 May.

iii. Present Cropping Intensity

The Study Team applied the present copping intensity of 50 % in Yala and 90 % in Maha to assume from the Final Report of Study on the Present State and Development Potential of Thangalu Welyaya and Rekawa Lagoon (1993 Oct.), data shown in para 5.3 (6) of this Report, and also in the above mentioned NORAD Reports.

Table 5.3.1-1 Parameters of Irrigation System of Muruthawela LB Scheme

Name of D-Canals	Length of Canals			Unit Figure					Accumulated Figure					FC Density
				Commmand Area		Numbers of F-Canal	Total Length of F-Canal		Commmand Area		Numbers of F-Canal	Total Length of F-Canal		
	(chs)	(Mile)	(km)	(Acres)	(ha)		(Mile)	(km)	(Acres)	(ha)		(Mile)	(km)	(m/ha)
Muruthawela Scheme									**3,172**	**1,283**	**310**	**61.3**	**98.6**	**76.9**
LB Main Canal	**502.0**	**9.5**	**15.3**	-	-	6	-	-	3,172	1,283	310	61.3	98.6	76.9
Tract-II									**1,518**	**614**	**153**	**29.7**	**47.8**	**77.8**
D-1 Canal.	157.5	3.0	4.8	324	131	30	6.1	9.8	1,018	411	63	21.5	34.6	84.2
D-2 Canal.	49.5	0.9	1.5	90	36	9	1.5	2.4	300	121	33	7.6	12.2	100.7
D-3 Canal.	27.7	0.5	0.8	90	36	12	4.0	6.4	210	85	24	6.1	9.8	115.5
D-4 Canal.	21.2	0.4	0.6	120	49	12	2.1	3.4	120	49	12	2.1	3.4	69.6
D-5 Canal.	12.0	0.2	0.4	60	24	7	1.4	2.3	60	24	7	1.4	2.3	92.8
D-6 Canal.	38.4	0.7	1.2	160	65	16	3.1	5.0	160	65	16	3.1	5.0	77.0
D-7 Canal.	24.3	0.5	0.7	174	70	18	3.3	5.3	174	70	18	3.3	5.3	75.4
D-8 Canal.	61.8	1.2	1.9	152	62	16	2.8	4.5	152	62	16	2.8	4.5	73.2
D-9 Canal.	79.8	1.5	2.4	348	141	33	5.4	8.7	348	141	33	5.4	8.7	61.7
Tract-II Total	**472.2**	**8.9**	**14.3**	**1,518**	**614**	**153**	**29.7**	**47.8**						
Tract-III									**1,654**	**669**	**151**	**31.6**	**50.8**	**76.0**
Branch Canal	164.2	3.1	5.0	178	72	18	3.3	5.3	1,654	669	151	31.6	50.8	76.0
D-1 Canal.	88.6	1.7	2.7	352	142	36	6.6	10.6	754	304	64	13.9	22.4	73.6
D-7 Canal.	54.4	1.0	1.7	80	32	11	2.8	4.5	310	125	22	5.7	9.2	73.1
D-8 Canal.	27.5	0.5	0.8	230	93	11	2.9	4.7	230	93	11	2.9	4.7	50.1
D-9 Canal.	17.4	0.3	0.5	92	37	6	1.6	2.6	92	37	6	1.6	2.6	69.1
D-2 Canal.	80.7	1.5	2.5	290	117	35	5.8	9.3	290	117	35	5.8	9.3	79.5
D-3 Canal.	12.7	0.2	0.4	108	44	9	1.9	3.1	108	44	9	1.9	3.1	69.9
D-4 Canal.	20.0	0.4	0.6	58	24	6	1.7	2.7	58	24	6	1.7	2.7	114.0
D-5 Canal.	22.0	0.4	0.7	82	33	9	1.2	1.9	82	33	9	1.2	1.9	58.2
D-6 Canal.	41.2	0.8	1.3	184	75	10	3.8	6.1	184	75	10	3.8	6.1	81.5
Tract-III Total	**528.7**	**9.9**	**16.2**	**1,654**	**669**	**151**	**31.6**	**50.8**						
Muruthawela Sch.Total	**1,502.9**	**28.3**	**45.8**	**3,172**	**1,283**	**310**	**61.3**	**98.6**						

Table 5.3.1-2 Parameters of Anicut Scheme in Urubokka Oya

Name of Anicut	Anicut												Right Bank Sluice					Left Bank Sluice				
	Station	Crest Level		Sill Level		Nos of	Gate	Gate Size	Command Area		Main/D-Canal		Sill Level		Gate Size	Command Area		Sluice Level		Gate Size	Command Area	
	(km)	(ft)	(m)	(ft)	(m)	Gate	Material	BxH(m)	(Acs)	(ha)	(Mile)	(km)	(ft)	(m)	BxH(m)	(Acrs)	(ha)	(ft)	(m)	BxH(m)	(Acs)	(ha)
Urubokka oya																						
2 Way Head Regulator	0.0	247.0	75.3	242.0	73.8	2	Wooden	1.5x1.5	0	0.0	0.0	0.0										
Raluwa Nawarathe	2.7	188.9	57.6	186.8	56.9	2	Planks	1.5x0.6	250	101.2	4.1	6.6	187.0	57.0	1.2x0.6	250	101.2					
Kinchigune	4.8	161.7	49.3	159.1	48.5	2	Planks	1.2x0.8	264	106.8	3.1	4.9						159.6	48.7	1.4x0.8	264	106.8
Udukiriwila	10.5	127.2	38.8	122.2	37.2	3	Steel	4.6x1.5	450	182.1	2.5	4.0	123.7	37.7	3 ways	180	72.8	123.9	37.8	1.9x0.9	270	109.3
Wakamulla	13.9	103.2	31.5	96.2	29.3	5	Wooden	2.0x2.2	613	248.1	6.4	10.2	100.8	30.7	2.0x1.4	413	167.1	100.4	30.6	1.2x0.8	200	80.9
Hunnakumbura	16.9	87.5	26.7	80.3	24.5	5	Wooden	1.8x2.2	416	168.4	3.5	5.6	100.8	30.7	NA	234	94.7	NA	NA	NA	182	73.7
Hakuruwela	19.4	74.4	22.7	67.1	20.5	5	Wooden	1.9x2.2	979	396.2	8.1	13.0	NA	NA	1.7x1.7	636	257.4	NA	NA	1.7x1.0	343	138.8
Andupelena	27.2	38.1	11.6	30.3	9.2	5	Wooden	2.0x2.4	927	375.2	7.2	11.7	35.4	10.8	1.4x0.8	153	61.9	34.9	10.6	2.0x1.2	774	313.2
Ranna	35.0	13.9	4.2	5.9	1.8	5	Wooden	2.0x2.4	475	192.2	6.0	9.7	10.8	3.3	1.0x0.4	290	117.4	11.0	3.4	1.0x0.4	185	74.9
Total									4,374	1,770.2						2,156	872.5				2,218	897.6

Table 5.3.1-3 Parameters of Anicut Scheme in Kirama Oya

Name of Anicut	Anicut												Right Bank Sluice					Left Bank Sluice				
	Station	Crest Level		Sill Level		Nos of	Gate	Gate Size	Command Area		Main/D-Canal		Sill Level		Gate Size	Command Area		Sluice Level		Gate Size	Command Area	
	(km)	(ft)	(m)	(ft)	(m)	Gate	Material	BxH(m)	(Acs)	(ha)	(Mile)	(km)	(ft)	(m)	BxH(m)	(Acrs)	(ha)	(ft)	(m)	BxH(m)	(Acs)	(ha)
Kirama Oya Scheme																						
Spill cum Regulator	0.4	296.0	90.2	280.5	85.5	2	Wooden	1.8x1.7	0	0.0	0.0	0.0										
Hammbumandiya	7.9	211.7	64.5	206.7	63.0	4	Wooden	1.7x1.5	250	101.2	5.0	8.0						209.0	63.7	1.9x0.9	250	101.2
Ethpitiya	9.5	194.3	59.2	188.3	57.4	6	Wooden	1.3x1.8	195	78.9	1.6	2.6						190.2	58.0	1.3x1.3	195	78.9
Uda Debarawa	13.6	138.7	42.3	130.4	39.7	4	Wooden	1.6x2.5	108	43.7	3.0	4.8	136.7	41.7	1.2x0.9	108	43.7					
Arachchi	14.7	129.9	39.6	123.9	37.8	3	Planks	2.4x1.8	330	133.6	6.0	9.7	125.9	38.4	1.2x1.2	97	39.3	126.7	38.6	1.2x1.2	233	94.3
Wijerathne	17.3	102.4	31.2	94.4	28.8	1	Steel	4.4x2.4	84	34.0	0.9	1.4	100.9	30.8	0.9x0.9	84	34.0					
Wauwa	18.9	91.6	27.9	85.4	26.0	5	Wooden	1.5x1.9	290	117.4	2.5	4.0	88.5	27.0	1.2x1.0	200	80.9	89.2	27.2	1.4x1.2	90	36.4
Okewela	21.5	73.5	22.4	66.9	20.4	4	Wooden	1.7x2.0	350	141.6	2.7	4.3	71.4	21.7	0.6x0.8	163	66.0	71.9	21.9	0.6x0.8	187	75.7
Pansala	24.2	61.9	18.9	53.6	16.3	2	Steel	4.6x2.5	104	42.1	1.5	2.5	53.2	16.2	0.5x0.8	6	2.4	60.9	18.5	0.4x1.0	98	39.7
Pattiyawela	25.7	52.6	16.0	47.0	14.3	5	Wooden	1.7x1.7	354	143.3	3.6	5.9	50.3	15.3	1.7x0.8	197	79.7	51.1	15.6	1.2x0.9	157	63.5
Unnansege	27.4	43.6	13.3	37.3	11.4	5	Wooden	1.5x1.9	220	89.0	1.7	2.7						41.4	12.6	NA	220	89.0
Kahawatta-1	28.7	39.1	11.9	28.8	8.8	5	Wooden	1.8x3.1	220	89.0	1.7	2.7						36.9	11.2	1.1x1.4	220	89.0
Kahawatta-2	29.0	(Abandoned)				2	Wooden															
Pinoda	30.4	33.0	10.1	24.7	7.5	2	Steel	4.3x2.5	135	54.6	0.7	1.1	30.8	9.4	NA	60	24.3	30.6	9.3	1.2x1.1	75	30.4
Liyanagedeniya	30.5	NA	NA	NA	NA	4	Wooden	2.0x1.7	260	105.2	1.3	2.1	NA	NA	NA	260	105.2					
Nalagama	32.9	25.1	7.6	18.5	5.6	5	Wooden	1.8x2.0	795	321.7	3.6	5.7	21.6	6.6	0.6x0.9	330	133.6	22.3	6.8	1.2x1.1	465	188.2
Daranda	34.5	19.9	6.1	11.2	3.4	2	Steel	4.6x2.0	180	72.8	1.3	2.1	14.0	4.3	1.5x0.8	180	72.8					
Wile	35.5	16.0	4.9	8.2	2.5	2	Steel	4.7x2.4	100	40.5	1.7	2.7						15.2	4.6	0.9x0.9	100	40.5
Maha	38.3	11.1	3.4	2.8	0.9	5	Wooden	1.8x2.5	470	190.2	2.0	3.2	12.0	3.6	0.6x0.9	295	119.4	12.0	3.6	0.6x0.9	175	70.8
Danketiya	40.5	6.5	2.0	0.0	0.0	5	Wooden	1.5x2.0	500	202.4	NA	NA						5.9	1.8	1.8x1.9	500	202.4
Total									4,945	2,001.2						1,980	801.3				2,965	1,199.9

Table 5.3.1-4 Construction Cost of Kirama Oya Scheme (Annual Expenditure Statement)

Work Items	1980-81	1982	1983	1984	1985	1986	Total
1. Survey on Kirama Oya Scheme	11,274					87,800	
2. Construction of Kirama Oya Tank				822,082			
3. Construction of 3 New Anicuts	1,270,550			256,424	23,980		
4. Improvements to Existing Anicuts	2,486,148		25,312	71,708			
5. Improvements to Channel Systems	4,230,931		1,173,678			193,218	
6. Improvements to Access Road	454,309		134,348				
7. Flood Damage Repairs to Anicuts			596,094	136,452			
Total Annual Cost	8,453,212	2,025,692 (assumed)	1,929,432	1,286,666	23,980	281,018	14,000,000

Table 5.3.1-5 Implemented Anicut Scheme under IRDP in the Kirama Oya Scheme

No.	Kirama Oya Anicut Name	Command Area (Acs.)	Implemented Agency	Implemented Year
1	Hammbumandiya	250	IRDP	1981/82
2	Ethpitiya	195	- do -	N.A.
3	Uda Debarawa	108	- do -	N.A.
4	Arachchi	330	-	-
5	Wijerathne	84	IRDP	N.A.
6	Wauwa	290	- do -	1984
7	Okewela	350	- do -	1980/81
8	Pansala	104	- do -	N.A.
9	Pattiyawela	354	- do -	1980/81
10	Unnansege	220	- do -	N.A.
11	Kahawatta -1	220	- do -	1984
12	Pinoda	135	-	-
13	Liyanagedeniya	260	IRDP	1981/82
14	Nalagama	795	- do -	1981/82
15	Daranda	180	-	-
16	Wile	200	-	-
17	Maha	470	-	-
18	Danketiya	500	-	-
	Total	5,045	3,232Acs. (64%)	

Table 5.3.1-6 Existing Field Water Requirement for Paddy (105 days Variety)

KC:	Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Grouwth Stage and Crop factors	STEP 1	0.90			1.00	1.15	1.20	0.90			1.00	1.15	1.20 0.90
	STEP 2	2.0 0.90			1.00	1.15	1.20	0.90			1.00	1.15	1.20
	STEP 3	1.20	0.90			1.00	1.15	1.20	0.90			1.00	1.15 1.20
	STEP 4	1.5 1.20	0.90			1.00	1.15	1.20	0.90			1.00	1.15
Eto (Evapotranspiration of Reterence Crop in inches)		4.7	5.0	6.2	5.9	6.4	6.9	7.5	7.6	7.5	6.2	4.3	4.5
1. Etc Crop water Requirement ETC=Eto.KC (in inches)	ETc (S_1)	0.53			0.98 0.57	1.23 0.64	1.38 0.52	0.84			1.03 0.59	0.82 0.43	0.90 0.34
	ETc (S_2)	0.24 0.88			0.74	0.27 1.53	0.33 1.73	0.38 1.41			0.78	0.18 1.03	0.22 1.13
	ETc (S_3)	0.94 0.35	0.56			1.07 0.61	1.32 0.69	1.50 0.56	0.86			0.72 0.41	0.86 0.45
	ETc (S_4)	1.18 0.35	0.25 0.94			0.80	0.29 1.65	0.36 1.88	0.38 1.43			0.54	0.19 1.08
	Total ETc	4.35	1.75		2.29	6.15	7.91	6.93	2.67		2.40	4.13	5.17
2. LP (Land Preparation)				2.33	4.66	2.33				2.33	4.66	2.33	
3. Farm Losses		5.25	2.25	0.75	3.75	6.00	6.00	5.25	2.25	0.75	3.75	6.00	6.00
4=1+2+3 FWR (Field Water Requirement)		9.60	4.00	3.08	10.70	14.48	13.91	12.18	4.92	3.08	10.81	12.46	11.17
do (in mm)		244	102	78	272	368	353	309	125	78	275	316	284

Table 5.3.1-7 Existing Field Water Requirement for OFC (Soya Beans 105 days Type)

KC:	Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Grouwth Stage	STEP 1	0.75			0.65 0.85	1.05		0.75			0.65 0.85	1.05	
and Crop factors	STEP 2	0.75			0.65	0.85	1.05	0.75			0.65	0.85	1.05
	STEP 3	1.05	0.75			0.65 0.85	1.05		0.75			0.65 0.85	1.05
Eto (Evapotranspiration of Reterence Crop in inches)		4.7	5.0	6.2	5.9	6.4	6.9	7.5	7.6	7.5	6.2	4.3	4.5
1. Etc	ETc (S_1)	0.59			0.64 0.84	0.30 1.87	2.01 0.29	0.94			0.67 0.88	0.20 1.25	1.31 0.19
Crop water Requirement	ETc (S_2)	0.55 0.78			0.64	1.21 0.75	2.42	0.88 1.25			0.67	0.81 0.50	1.58
ETC=Eto.KC (in inches)	ETc (S_3)	1.37 0.20	0.63			0.69 0.91	0.33 2.01	2.19 0.31	0.95			0.47 0.61	0.21 1.31
	Total ETc	3.49	0.63		2.21	5.73	7.06	5.57	0.95		2.22	3.84	4.60
2. LP (Land Preparation)				0.25	1.25					0.25	1.25		
3=1+2+3 FWR (Field Water Requirement)		3.49	0.63	0.25	3.37	5.73	7.06	5.57	0.95	0.25	1.25	3.84	4.60
do (in mm)		88	16	6	86	146	179	141	24	6	32	98	117

Table 5.3.1-8 Water Issue Records in Present Cropping Pattern and Water Balance Calculation (Case I) for Muruthawela Reservoir Scheme (1984 Sep ~ 1994 Aug)

Table 5.3.1-9 Water Issue Records in Proposed Cropping Pattern and Water Balance Calculation (Case II) for Muruthawela Reservoir Scheme (1984 Sep ~ 1994 Aug)

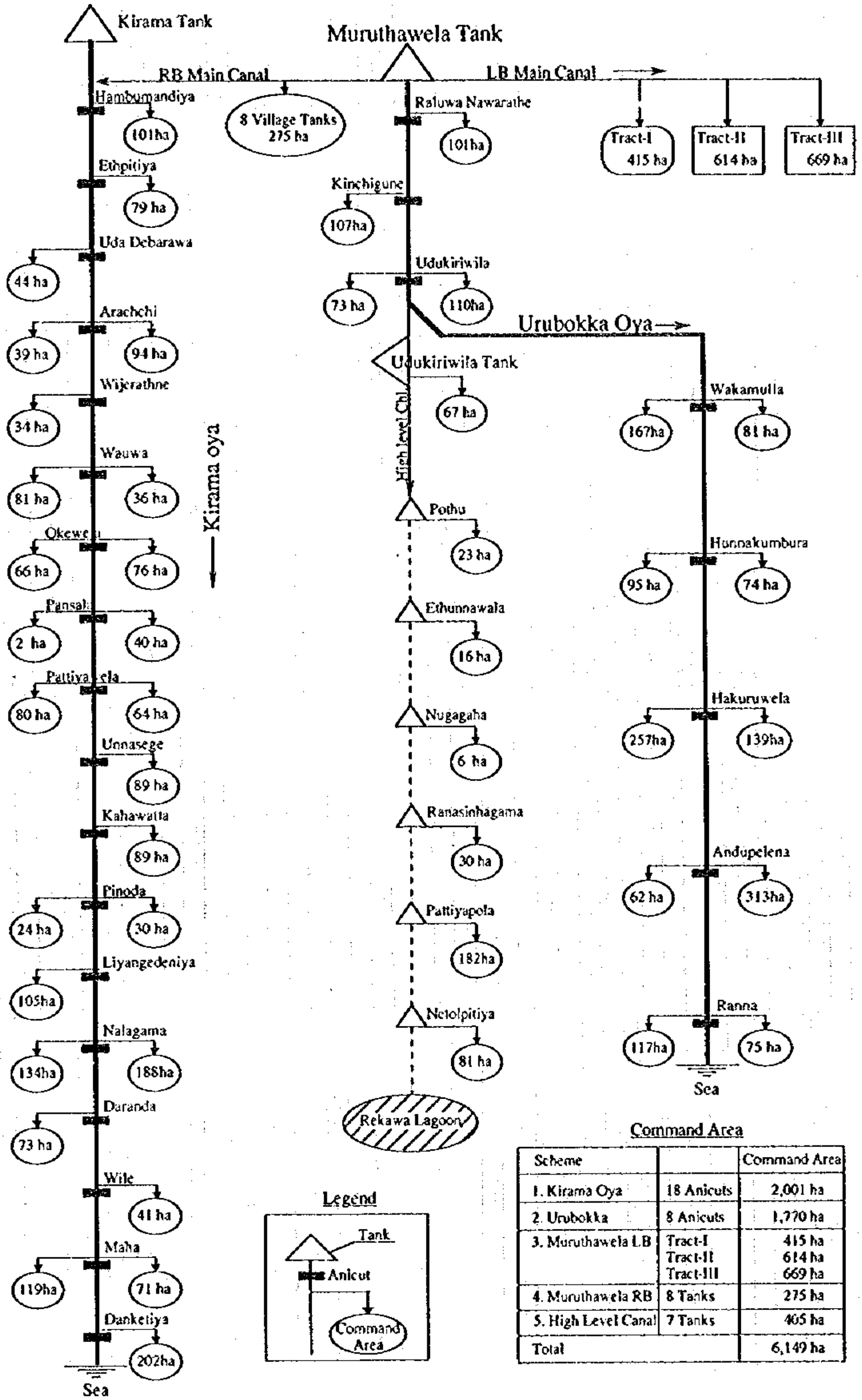
Water Year / Year Maha	Water Issue RB Sluice	Water Issue LB Sluice	Water Issue Total	Rainfall	Effective Rainfall	Field Water Requirement Paddy	Field Water Requirement OFC	Field Irrigation Requirement (FIR) Paddy	Field Irrigation Requirement (FIR) OFC	Tract-I Paddy	Tract-I OFC	Tract-II Paddy	Tract-II OFC	Tract-III Paddy	Tract-III OFC	Total	Irrigation Duty (ID)	Urubokka Oya Urs-A FIR Paddy	Urs-A FIR OFC	Urs-A Return flow	Urs-A Actural FIR	Urs-B FIR Paddy	Urs-B FIR OFC	Urs-B Return flow	Urs-B Actural FIR	Urs-C FIR Paddy	Urs-C FIR OFC	Urs-C Return flow	Urs-C Actural FIR	Total Field Irrigation Requirement
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 5.3.1-10 Water Balance in Proposed Cropping Patern and Water Balance (Case III) for Muruthawela Reservoir Scheme (1984 Sep ~ 1994 Aug)

[illegible]

Table 5.3.1-11 Tank Data Under High Level Canal

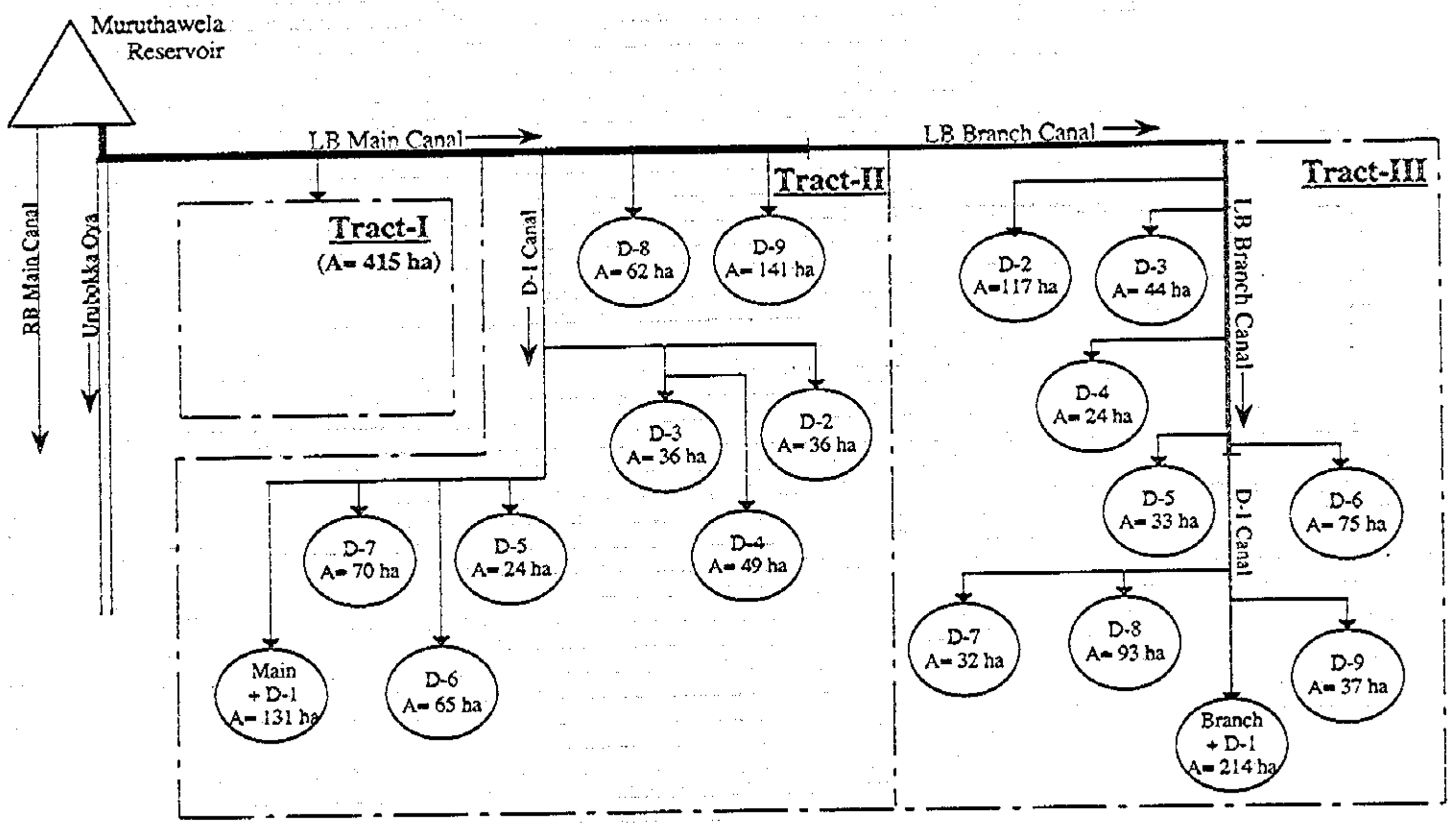
	Udukiriwila	Pothuwewa	Ethunneuwela	Nugagaha	Ranasingha	Pattiyapola	Netolpitiya
Tank							
Catchment Area (km2	25.9		13.8	19.2	32.0	42.2	47.7
Capacity (m3)	3,978,000	74,000	59,000	43,000	54,000	705,000	140,000
Area At F.S.L (m2)	2,631,000	80,000	96,000	60,000	96,000	468,000	288,000
Area cultivated (ha)	67 (RB Canal)	23	16	6	30	182	81
canal longt (km)	1.3 (Low Level Canal)+ 3.8 (High Level Canal)	2.6	1.0	2.4	2.8	4.4	1.0
Bund							
Length (ft)	3,300	750	1,000	1,330	1,400	3,900	2,500
Top width (ft)	15	6	8	8	6	12	8
Top level (ft)	130.50	104.00	108.00	104.75	55.75	113.00	102.00
Side slope	1 on 2	1 on 2	1 on 2	1 on 2	1 on 2	1 on 2	1 on 2
F.S.L. (ft)	125.24	100.00	104.36	100.00	49.00	109.00	98.55
H.F.L. (ft)		102.40	107.24	132.20	53.57	112.50	101.65
Spill 1.							
Type	Masonry clear overfall	Concrete Clear Overfall Type With Two Planded Bays of 4' - 6'x1' - 3" H	Clear Over Fall With Planded Bays	Concrete, Clear Overfall	Skin Type	Spill Cum Causeway	Masonry, Skin type
Length (ft)	68.5	40	120	200	75	250	295
Spill Level (ft)	125.24	100.00(Assumed)	104.36	100.00	49.00	109.00	98.55
Planked Bays							5'-0"x 4'-0"
Waste wire (ft)							33.0
Spill 2.							
Type			Clear Over Fall Type	Concrete, Clear Overfall	Co type spill	Clear over flow with 6 planded Bays	Co type spill
Length (ft)			40	40	125	66	125
Spill Crest (ft)			104.36	100.00	49.00	109.00	49.00
Sluice	No.1 / No.2						
Type		Hume pipe tower sluice	Dressed Rubble Masonry	Rubble Masonry	VT type sluice		
Diameter (inch)	23.5 /	9.0	1.5		9.0		
Size of opening	/ 3'0"x 4'-3"						
Sill Level (ft)	112.84 / 122.84		100.00	94.08	45.25		



Command Area

Scheme		Command Area
1. Kirama Oya	18 Anicuts	2,001 ha
2. Urubokka	8 Anicuts	1,770 ha
3. Muruthawela LB	Tract-I Tract-II Tract-III	415 ha 614 ha 669 ha
4. Muruthawela RB	8 Tanks	275 ha
5. High Level Canal	7 Tanks	405 ha
Total		6,149 ha

Figure 5.3.1-1 Schematic Diagram of Muruthawela Reservoir Scheme



Command Area

Tract-I	415 ha
Tract-II	
D-1	131 ha
D-2	36 ha
D-3	36 ha
D-4	49 ha
D-5	24 ha
D-6	65 ha
D-7	70 ha
D-8	62 ha
D-9	141 ha
Sub-total	614 ha
Tract-III	
D-1	214 ha
D-2	117 ha
D-3	44 ha
D-4	24 ha
D-5	33 ha
D-6	75 ha
D-7	32 ha
D-8	93 ha
D-9	37 ha
Sub-total	669 ha
Total	1,698 ha

Legend

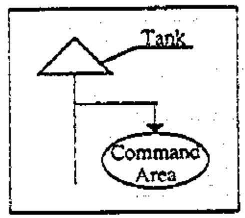


Figure 5.3.1-2 Schematic Diagram of Muruthawela Left Bank Scheme

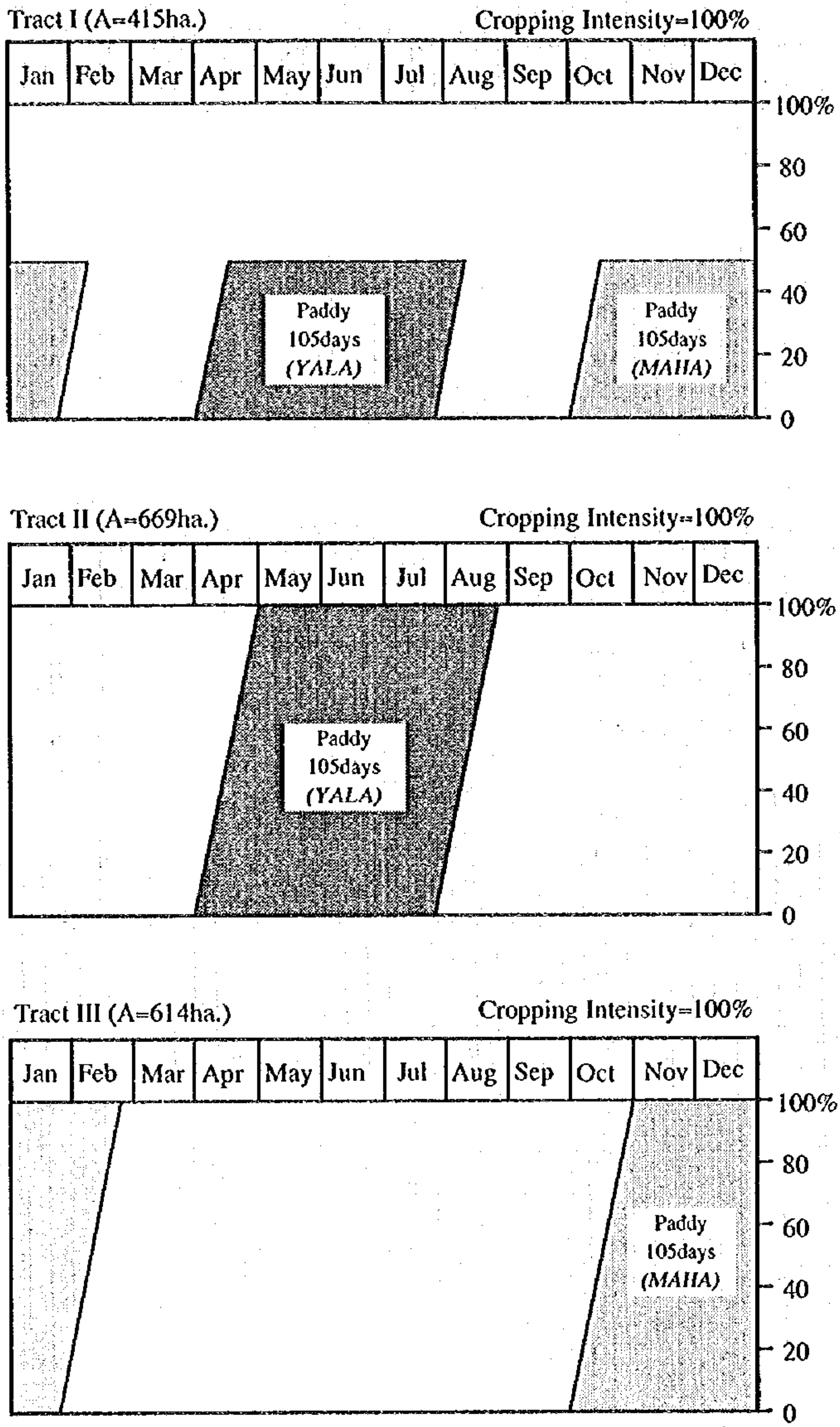
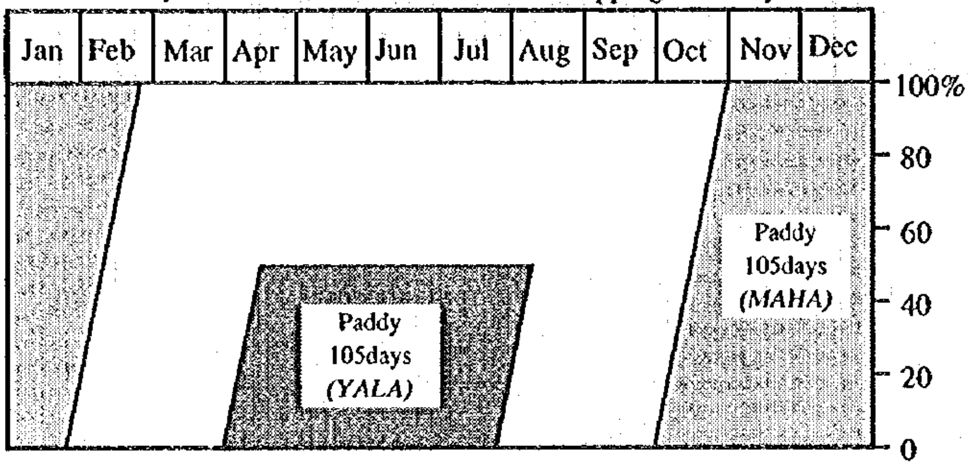


Fig. 5.3.1-3 Present Cropping Pattern for Muruthawela L/B Scheme

Urubokka Oya Scheme (A=2,176 ha.) Cropping Intensity=150%



Kirama Oya Scheme (A=2,276 ha.) Cropping Intensity=140%

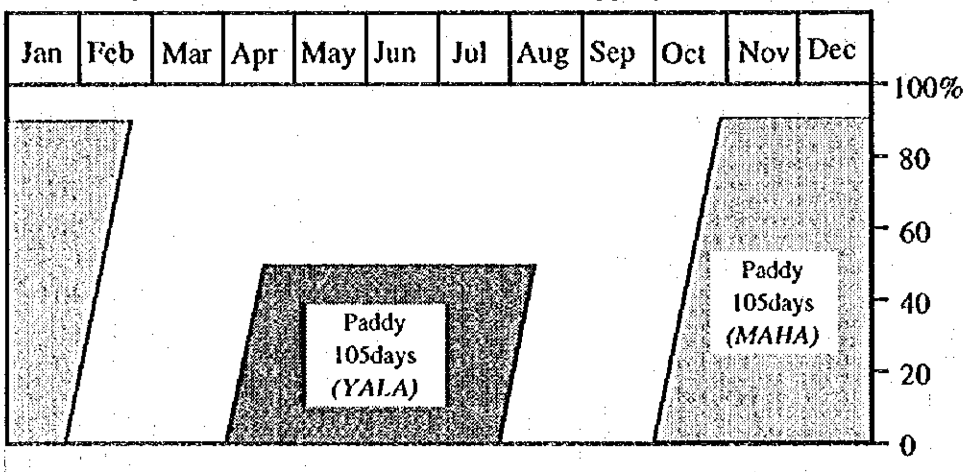


Fig. 5.3.1-4 Present Cropping Pattern for Urubokka Oya and Kirama Oya Scheme

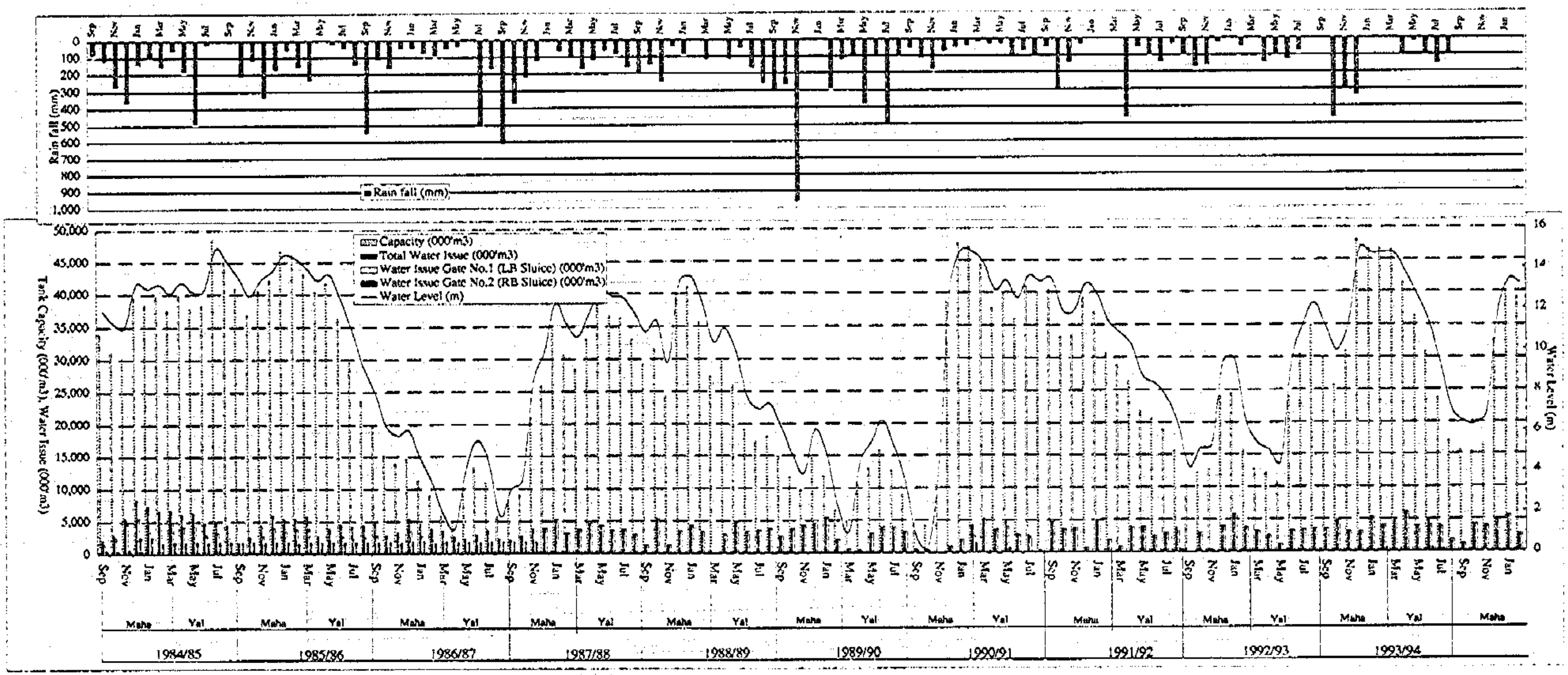


Fig. 5.3.1-5 Water Issue Records of Muruthawela Reservoir (1984 Sep ~ 1995 Feb)

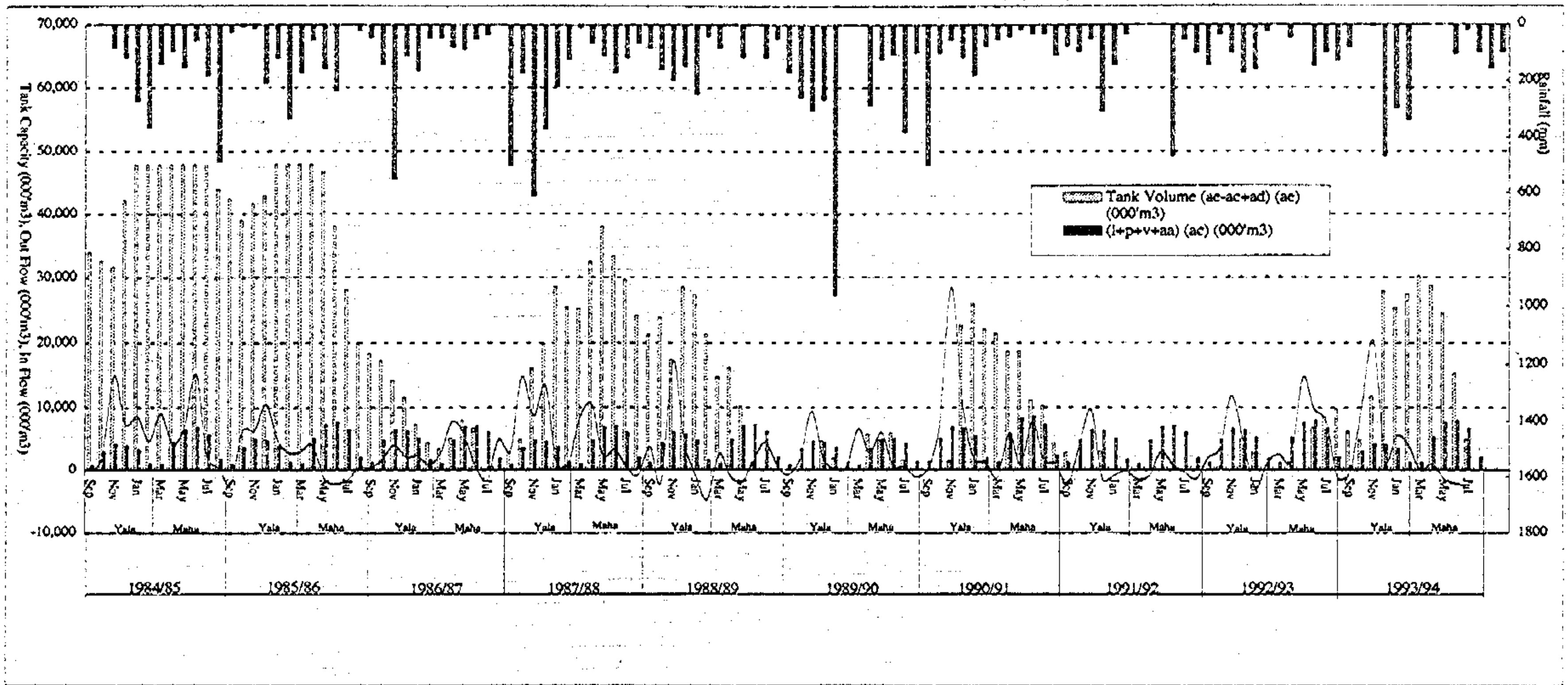


Fig. 5.3.1-6 Proposed Water Issue by Case III for Muruthawela Reservoir

5.3.2 Agriculture

(1) Land Use and Farm Family

Land Use

Muruthawela scheme is composed of three parts; Muruthawela L/B scheme, Urubokka Oya scheme and Kirama Oya scheme.

In the latter two schemes paddies are cultivated in both seasons, however, in Muruthawela L/B scheme the paddy cultivation is allowed only one season throughout a year due to water shortage.

Total paddy land cropped area in 94 Yala and 94/95 Maha is estimated at 8,141 ha in paddy with 132% of cropping intensity for the total irrigable area (6,149 ha). In Kirama Oya scheme, 228ha of irrigable area is not cropped due to insufficient water in tail enders.

Upland areas including homestead are about 1,000 ha in Urubokka and Kirama Oya, and 290 ha in L/B scheme.

Farm Family

Numbers of farm families both of land owners and tenant farmers are estimated at 7,357 with 0.8 ha/ farmer of paddy land on the average.

According to the report by Weeraketiya AGA Division, classes in land holding size are 25% below 0.4ha, 49% between 0.4 and 1.2ha, and 26% over 1.2ha. The holders over 1.2 ha usually lend a part of paddy land to tenant farmers with 14 bushel(300kg) per Ac(0.4ha) of tenancy rate. Tenancy size is mostly 1 Ac (0.4ha).

In Muruthawela L/B scheme, there are no tenants due to comparatively new settlement area.

(2) Crop cultivation and Cropping pattern

Paddy Cultivation

Machinery use is common in land preparation, threshing and transportation of harvested paddy. The machinery cost occupies 47% of production cost in cash outlay. The following cost is fertilizer showing 20% of the cost. Land preparation cost in Muruthawela L/B is a little higher than that in other area because of half-yearly fallow.

Paddy yield is estimated at 3.5 t/ ha on the average.

Cropping Pattern

The present cropping pattern in Muruthawela scheme is identified as follows.

Name of Scheme	Season	Present		
		Crops	CI (%)	Benefitted Area (ha)
Tract I	Yala	Paddy	50	207
(415 ha)	Maha	Paddy	50	208
Tract II	Yala	Paddy	100	669
(669 ha)	Maha	None	0	0
Tract III	Yala	None	0	0
(614 ha)	Maha	Paddy	100	614
	Total		100	1,698

3) Livestock and Tree Crops

Livestock

Hambantota Veterinary Service Center reported 9,000 heads of cattle and 5,000 heads of buffaloes at Weeraketiya AGA division in 1993.

Goats and poultry can be seen in some farm houses, but there were not available.

Tree Crops

According to Coconuts Cultivation Board at Weeraketiya, there are about 4,000 ha of upland area used for small holders' coconuts cultivation with approximately 600,000 trees by about 13,000 farm families. Around 56% of this total is included in Muruthawela scheme.

Besides coconuts trees, there are fruit crops such as banana, papaya, jack-fruits, mango, bread-tree, etc. mainly in the homestead.

(4) Agricultural Support Service

Agricultural extension in this scheme is carried out by one AO and three AI under the provincial Assistant Director under provincial DOA. In L/B scheme, Project manager in Weeraketiya Agrarian Service Center supports farmers with Divisional Officer (DO) of DAS.

5.3.3 Farmer Organizations

For system operations, Muruthawela scheme is administered in three parts: Muruthawela LB, Urubokka Oya and Kirama Oya. FOs too are organized on this basis.

Muruthawela LB:
There are 9 DCO's in Tract II with a membership of 664 accounting for 87% of the total number of farmers while in Tract III too there are 9 DCG with a membership of 615 farmers representing 74%. The FOs were formed in 1987 under the leadership of an IMD Resident Project Manager (RPM) who is also chairman of the PMC. However due to civil disturbances training programs for farmer members commenced only about 2 years later. Muruthawela LB had been beset with serious water shortages largely due to farmers in Tract I who are not incorporated the system siphoning off water. FOs have been successful in reaching agreement on a system for more equitable sharing of water. At present Tract II and III farmers have agreed to use water for paddy cultivation during one season in a year on a rotational basis. Farmers have participated enthusiastically in the crop diversification program. FOs agree that if water supply is stabilized, Tract I could be incorporated into the system.

The PMC meets once a month to decide on operational matters. FOs have participated actively in water management, crop diversification, and in system maintenance. Although FOs have informally taken over the maintenance of D canals they have declined to take over formally until such time the system is rehabilitated. FOs have undertaken ID contracts and provided tractor hire services to farmers through which they have built up modest reserves.

Urubokka Oya:
There are 16 FOs with 923 members. The FOs are organized under each tank or anicut. In some cases each anicut may have 2 FOs one for the LB and another for the RB. Hence each FO is independent; currently there is no PMC to coordinate the operations of the entire scheme.

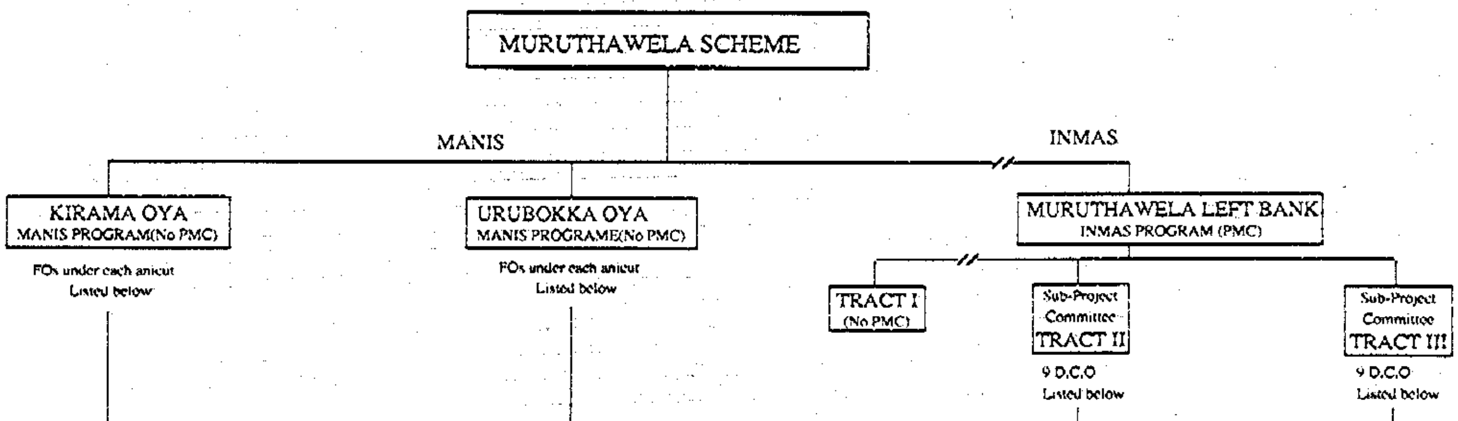
Most operational decisions on the allocation of water to each anicut are taken by the Irrigation Engineer. Kanna meetings for seasonal allocation of water are held under the chairmanship of the Divisional Secretary for a cluster of 2-3 anicuts.

FOs manage the internal distribution of water, maintain the canals mainly through Shramadama and undertake Irrigation Department Contracts for maintenance works. There is no evidence of their participation in input supplies and marketing.

Kirama Oya Scheme:
There are currently 18 FOs with over 700 members. The FOs are organized under each anicut or under each main canal of an anicut. Each FO operates independently as there is no PMC. Operational decisions for the allocation of water to each anicut are made by the IE. Kanna meetings for seasonal allocation of water are chaired by the Divisional Secretary.

FOs manage the internal distribution of water, maintain the canals and undertake ID contracts for maintenance work.

Fig.5.3.3-1 presents the organization for the entire Muruthawela system.



FOs Name	Area (Ac)	Members
1.Hambumandiya Anicut	250	27
2.Ethpitiya Anicut	195	28
3.Uda-debarawa Anicut	110	23
4.Arachchi amun Anicut LB	225	32
5.Arachchi amun Anicut RB	100	150
6.Wijerathna Anicut Pubudu	84	95
7.Wauwa Anicut	290	45
8.Okewela Anicut LB	187	40
9.Okewela Anicut RB	165	40
10.Pansala Anicut	110	18
11.Pattiyawela Anicut	355	82
12.Unnansege Anicut	80	20
13.Kahawatta Anicut	220	51
14.Pinode Anicut	395	28
15.Nalagama Anicut	795	27
16.Daranda Anicut Samagi	80	50
17.Maha Anicut LB	670	38
18.Dankotiya Anicut	530	-

FOs Name	Area (Ac)	Members
1.Raluwa Navarathna Anicut	200	30
2.Kinchigune Anicut	264	35
3.Udukiriwila(Haratis amuna) Anicut	544	100
4.Wakamulla Anicut LB	200	56
5.Wakamulla Anicut RB	415	82
6.Hunnakumbura Anicut	420	55
7.Hakuruwela Anicut LB	342	50
8.Hakuruwela Anicut RB	636	90
9.Andupelana Anicut LB	774	115
10.Andupelana Anicut RB	155	54
11.Ranna Anicut LB 12.Ranna Anicut RB	290	55
13.Udukiriwila Tank(Low)	165	32
14.Udukiriwila Tank(High)	350	52
15.Pattiyapola Mahawewa	650	93
16.Kattakaduwa Tank	225	24

FOs Name	Area (Ac)	Members
1.D-1(up) Kemegala Sama	380	167
2.D-1(down) Perakum	50	21
3.D-2 & 3 Thisara	74	36
4.D-4 Samagi	120	57
5.D-5 Branch canal	60	26
6.D-6 Perakum	160	74
7.D-7 Branch canal	174	81
8.D-8 Eksath	152	66
9.D-9 Branch canal	348	146

FOs Name	Area (Ac)	Members
1.D-1 Branch canal	234	87
2.D-2 Gamunu	314	122
3.D-3 Gajaba	110	49
4.D-4 Wijaya	58	21
5.D-5 Branch canal	84	29
6.D-6 Pragathi	224	84
7.D-7 Pubudu	130	51
8.D-8 Branch canal	178	63
9.D-9 Branch canal	324	129

Fig. 5.3.3-1 Muruthawela FOs Organization Chart & Management

5.3.4 Management of System

Muruthawela Systems : Muruthawela LB, Urubokka Oya and Kirama Oya

Muruthawela LB.: is a settlement scheme of 3,172Acs. irrigated land is managed under the INMAS Program and operates in the same way as described above. 296 FC Groups are represented in the PMC through 18 DCO and 2 Sub-Project Committees for decision making. Farmers receive water for paddy cultivation only during one season in a year. Tract II and III have agreed to share water on a Yala-Maha rotation to give an equitable share to all farmers. In the other season they grow cashcrops which consume less water. Water distribution system has improved considerably since 1987 enabling more farmers to get water in time and to cultivate one season paddy and OFC in the other season. Overuse of water by Tract I farmers has been reduced through direct negotiation. The FOs have agreed to the inclusion of Tract I into the systems on the understanding that Tract I will not expand the irrigated area, nor tap water illicitly as done in the past. Prior to 1987 the scheme had serious problems relating to water sharing and distribution. Farmer participation is reported to have improved the situation to great extent.

Under Urubokka Oya, there are 8 anicuts and 3 tanks which are managed by 16 FOs within the overall calendar for water issues decided by ID (please see diagram III). The downstream anicuts reuse drainage water from those upstream and thus operate in a cascade. They benefit from Uda Walawe drainage water as well. Similarly under Kirama Oya there are 18 anicuts individually managed by FOs under the overall direction of the Irrigation Engineer.

The complexity of the system together with inadequacy of water in some sections due to the deteriorated physical system makes water management extremely difficult. Hence the active co-operation of FOs is necessary to handle the internal distribution water allowing ID to focus on the management of the main system.

In Muruthawela(LB) decisions on water management are made by the PMC while under Kirama Oya and Urubokka Oya decisions for a cluster of 2-3 anicuts are taken at the Kanna meeting where all farmers are represented. Water distribution from the D.Canal or anicut downwards is managed by FOs. The gates in the main system, D.Canal and anicut are operated by ID staff. FOs at the different levels resolve disputes arising from water use and related matters through discussion and where necessary in consultation with government officials.

Operation and Maintenance Costs

O/M costs for the Scheme were allocated by ID as follows:

Muruthawela L.B

Year	Allocation (Rs.)	Area (ha)	Rs./ha
1990	463,469	1,698	272
1991	396,579	"	234
1992	494,319	"	291
1993	493,020	"	290
1994	357,401	"	210

Urubokka Oya

Year	Allocation (Rs.)	Area (ha)	Rs./ha
1990	623,285	2,175	287
1991	610,493	"	281
1992	523,131	"	241
1993	662,997	"	305
1994	491,444	"	226

Kirama Oya

Year	Allocation (Rs.)	Area (ha)	Rs./ha
1990	511,414	2,001	256
1991	544,616	"	272
1992	494,731	"	247
1993	544,052	"	272
1994	401,716	"	261

5.3.5 Environmental Issues

(1) Soil and Water Quality

Soil Sampling

For checking sea water intrusion, 3 soil samples were collected and analyzed. Location of sampling sites and results of analysis are given in Fig.5.2.5-1(4/6) and Table 5.2.5-1.

As a result of the analysis, the influence of sea water intrusion in the soils was not observed in the scheme.

Water Sampling

For checking quality of irrigation water, 3 samples were collected and examined. Location of sampling sites and results of analysis are given in Fig.5.2.5-1 (4/6) and Table 5.2.5-1.

As a result of the analysis, water quality of each site is found to be suitable for cultivation.

(2) Flood Damage

The mouth to Urubokka Oya is perennially closed; accordingly farmers excavate a drainage channel through the sandbars at the mouth before the flood season. As a result, flood damage appears to be limited to lowland along the coast line.

(3) Wildlife

Large areas of mangrove forests and natural vegetation including mangrove are seen at the mouth of Urubokka Oya. The entire area around the river mouth is under the Special Area Management Project (SAM: described later in section 5.8.5, Thangalu Welyaya Scheme). Accordingly, rare sightings of wild elephants are made.

(4) Fishery

a) Tank and Estuary Fishery

120 fishermen (70 families) engange in fishing of Muruthawela, bringing in a total monthly catch of 3,310 kg worth a total income of Rs 43,000, which comes to Rs 360 per fisherman. At Udukiriwala Wewa, 124 fishermen (75 families) are engaged in fishery. They pull in a monthly catch of 9,190 kg, worth Rs 119,000 in total income which is equivalent to Rs 960 per fisherman. At both tanks, farmer-cum-fishermen are regarded as common. Fish caught are fresh water species.

About 50 persons engage in fishing at the mouth of Urubokka Oya according to interview survey. Of these, about 10 fishermen use nets in the river to catch mainly shrimp.

b) Fish Farming

A fresh water fish farm exists at the downstream reaches of Muruthawela Wewa, diverting water directly from the left bank main channel. The farm was established by the Government in 1976, and raises fingerlings under the Inland Fisheries Division to release into fresh water bodies and promote inland fisheries Matara and Hambantota districts. However, with transfer of the farm to the private sector in 1992, it began production of aquarium varieties (color fish) and raising of fingerlings of species fished in area waters has declined. Raising of aquatic varieties comes to 30,000 fish per year with an income value of Rs 300,000. According to the District Fishery Extansion Office, the decline in fingerling release is seen as a major factor in the steady decrease in fish catches in almost all fresh water and brackish water areas in Hambantota District.

(5) Water Use

a) Diversion for Domestic Water Supply

Under the Walasmulla water supply scheme, discharge has been directly diverted from Kirama oya since 1986 for supply to a design population of 3,640 with design discharge of 304 m3/day.

Under the Weeraketiya water supply scheme, water is being diverted from Udkiriwela tank since 1983 for supply to a design population of 1,750 with design discharge of 237.8 m^3/day.

b) Illegal Diversion

Approximately 5,000 farmers are engaged in illegal diversion from the channel in Tract 1 downstream of Muruthawela Reservoir. Benefit area under this diversion is 415ha (1,025 Acs.). Diversion is done by hose siphoning to lower elevation fields. The farmers in Tract 1 have been there before construction of Muruthawela Reservoir, and in light of their ineligibility for water allocation at the time of reservoir construction, the Irrigation Department tends to turn somewhat of a blind eye to this diversion. As a result, some water shortages occur in downstream Tract 2 and 3, hindering cultivation.

5.4 Badagiriya Scheme

5.4.1 Irrigation and Drainage System

(1) Location and Basin Description

The scheme area is located in the lower basin of the Malala River at the boundary of the SEDZ (South East Dry Zone). It comprises a resettlement area spreading at the point of 8.5 km west of Hambantota city along national highway A-2. Originally 770 ha of lands were proposed as command area by discharge from Badagiriya tank (constructed in 1957; storage capacity of 11 million m3) which is the sole major tank in the Malala Oya basin directly under the jurisdiction of the Irrigation Department. Although the storage capacity of the tank has been increased by crest raising works (3 feet), current irrigation service area is barely 617 ha despite a design service area of 703 ha due to water shortage and detrioration of irrigation facilities. Elevation of the Malala Oya basin ranges from 700 feet at the upper reaches to sea level. The basin is narrow, measuring 45 km lengthwise and 10.5 km across. Mean annual rainfall in this basin is only about 1,000~1,400 mm and only 800 mm in the Badagiriya basin. Average annual discharge of the Malala River has reportedly dropped to 1.1 m3/s, although there is no gauging station in the basin to confirm this. There exist 34 small irrigation schemes in the upper basin; however, cropping is done only during the Maha season. The 23 numbers of small farm ponds in the upper basin are one factor in the water shortage occurring at Badagiriya tank.

Shifting cultivation (chena) is the prevailing in the basin. The majority of farmers are poor, and cultivate only minor crops such as banana, papaw, cassava, maize, kurakkan, millets, gingerlly and other vegetables on a very small scale.

(2) Problems Affecting Irrigation

Due to water shortage in the basin, Badagiriya Reservoir is supplemented its water by way of the terminus of the right bank main canal from Lunuganwehera Reservoir (completed in 1986) under the Kirindi Oya Irrigation and Settlement Project (KOISP). The settlers at Badagiriya are entitled to diversion rights as service area of the right bank main canal under the KOISP for irrigation of 70% of paddy field and 30% of upland field during Yala season. After restoration of Lunuganwehera Reservoir, annual supplementary water of 5,000 Acs.ft from the reservoir to this area was assured under an official agreement. However, the scheme is not currently performing as intended as water shortage in the Kirindi Oya basin has constrained water available at Lunuganwehera Reservoir. Therefore, command areas of Badagiriya have not been supplemented with Lunuganwehera Reservoir since the last ten years.

(3) Present Status of Irrigation in the Study Area

a) Command Area

The scheme was inaugurated and farmers settled from 1958. Originally 770 ha of lands were proposed for paddy cultivation. But insufficiency of water caused the abandonment of 80 ha located at the tail end. After restoration of Lunuganwehera Reservoir, annual supplementary water of 5,000Acs.ft. from the reservoir to this area was assured under an official agreement.

Even with this augmentation the abandoned extent of 80 ha has not been cultivated due to system deterioration. The Study Team identified present irrigable area and abandoned area as follows:

	Command Area (ha)	
	Existing Irrigation Area	617 ha
	Abandoned Area	86 ha
Total:		703 ha

b) Schematic Diagram

The Schematic Diagram is shown in Fig.5.4.1-1.

c) Parameters of Irrigation Systems

Parameters in the scheme are shown in Table 5.4.1-1.

(4) Present Condition of Irrigation Systems

a) Features of Badagiriya Tank

Badagiriya Tank constructed in 1957 with earth bund of which the main features are as follows:

Design Features	Design Value
Catchment Area	185.05 sq.mils
F.S.L	78.05 ft. (23.90 m) MSL
Full Supply Depth	14.00 ft. (4.27 m)
Capacity at F.S.L	9.050 Ac.ft. (11MCM)
Sluice Sill Level	64.50 ft. (19.67 m)MSL
Size of Sluice	3.0 ft. diameter (Ø 91.5 mm)

This tank had an inflow from a net catchment area of 116.5 sq.miles prior to the construction of 23 tanks located in the upper reaches of its catchment area in Malala Oya Basin. Now it has been reduced to a net catchment of 35 sq.miles.

When a supply level in the tank goes down to nearly 5 feet, ID starts to supply a water from Lunuganwehera Reservoir through feeder canal from the tail end of its RB main canal. However, it has not been implemented since the last 10 years due to lack of water.

b) Operation of Irrigation Water

4 labours employed by ID, 2 for control gate and the other 2 for maintenance, are operating 7 No.s of GR (Gate of Regulator) which are located in the main canal.

The controlled area and canals under these GR are as follows:

No.of GR	Controlled Area	Acs. (ha)	Name of Canal
GR - 01	205	(82)	K1, K2, FC1, F C4
GR - 02	101	(41)	FC6, FC8
GR - 03	53	(21)	FC9A
GR - 04	605	(245)	FC9B, FC10, DC1
GR - 05	392	(159)	FC25, FC29, DC3
GR - 06	118	(48)	FC39, FC40A, FC40B, FC41
GR - 07	34	(14)	FC42
Total	1,508	(610)	

c) Present Extent Area in Yala Season

At present, the proposed cultivation area for this Yala is limited to 33 % of the total irrigable area in the upper reaches of the area. In this season, about 500 Acs. for maize and 30 Acs. for seed paddy are planned to cultivate. In normal year, cultivation in Maha and Yala are ; Mid Oct. - Feb. (100% paddy) and April - July (90% paddy, 10% ground nut).

d) Canal Design Features in the Badagiriya Scheme

The canal system in the scheme comprises Main, Distributory and Field canals and their breakdown are as follows:

Type of Canal	Length
Main Canal	5.4 km
Distributory Canal	3.1 km (DC1 + DC3 + DC4)
Field Canal	34 km

The canal sections designed in 1956 are as follows;

Main Canal Section (an example)

Canal Section	1 Mile -	2M3250' -3M3200'	3M3280' -3M3500'	3M3500' -3M4200'	3M4200' -4M3000(END)
Discharges (cusec)	47.63 (assumed)	35.72	19.77	12.77	11.61
Bed Width (ft)	15'	11'	8'	6'	6'
F.S.D (ft)	N.A	2.15'	1.90'	1.75'	1.65'
Gradient			0.0002		
Side Slope			2 ON 1		
Velocity (ft/sec)	N.A	1.30	1.16	1.06	1.03
Duty			40 Acs/cusec		
Can Irrigate (Acs.)	1,905 (assumed)	1,348	790	510	484
Must Irrigate (Acs.)	N.A	1,244	726	456	395

Distributory Canal No.1 (an example)

Section	I	II	III	IV
Distance	0 ML - 200 Ft	200 Ft - 3100Ft	3100 Ft - 3950 Ft	3950 Ft - 4700 Ft
Discharges (cusec)	14.87	13.30	10.02	1.34
Bed Width (ft)	4'	3' - 6"	3' - 0"	1' - 6"
F.S.D (ft)	1.85'	1.85'	1.70'	0.75'
Gradient	0.00035			
Side Slope	1 ON 1			
Velocity (ft/sec)	1.37	1.34	1.25	0.79
Duty	35 Acs/cusec			
Can Irrigate (Acs.)	520	465	351	40
Must Irrigate (Acs.)	510	447	351	36

Feeder Canal No.1 - No.3 (an example)

Section	$FC\text{-}1_{-1}$	$FC\text{-}1_{-2}$	FC-2	FC-3
Discharges (cusec)	3.80	3.44	0.95	0.68
Bed Width (ft)	2' - 5"	2' - 0"	1' - 6"	1' - 6"
F.S.D (ft)	1.05'	1.10'	0.6'	0.5'
Gradient	0.0004	0.00	0.00045	0.00045
Side Slope	1 ON 1			
Velocity (ft/sec)	1.02	1.01	0.753	0.68
Duty	30 Acs/cusec			
Can Irrigate (Acs.)	114	103	28	20
Must Irrigate (Acs.)	114	99	21	9

According to these, the design discharges are as follows:

Main canal	-	40 Acs./cusec (1.75 l/s/ha)
Distributory canal	-	35 Acs./cusec (2.00 l/s/ha)
Feeder canal	-	30 Acs./cusec (2.33 l/s/ha)

e) Present Conditions of Irrigation Facilities

i. Main Canal

A number of portions of the main canal are eroded because of growing of water weed, cattle crossing, using for bathing spots and surface run off from the home lots. Portions required for rehabilitation in the main canal were identified by the Study Teams follows;

Station	Description of Damage	
0.82 km	Top concrete surface causeway	(l = 40m)
2.67	do	(l = 30m)
3.96	do	(l = 30m)
5.44	do	(l = 20m)
5.59	Grown water weed in the canal	(l = 275m)
6.00	Canal bund erosion	
6.44	Top concrete surface of causeway	(l = 25m)
D/S of 7 GR	Scoured and sides collapsing of canal	(7 No.s)

ii. Distributory Canal

There are 3 distributory canals in the scheme, namely D-1, D-3 and D-4. In D-1 and D-4 sections are lined with concrete, damages identified by the Study Team are as follows;

Station	Description of Damage	
0.00 km	Retaining walls collapsed at the turn-out	(l = 14m)
0.02	do	(l = 23m)
0.04	do	(l = 21m)
0.07	Drop structure completely collapsed	
0.19	do	
0.45	do	
0.60	Retaining walls completely; collapsed	(l = 7m)
0.78	do	(l = 3m)
0.90	do	(l = 5m)
0.90	Weir regulator collapsed	
0.96	Ret. wall collapsed	(l = 5m)
1.10	Drop str. collapsed	
1.14	Ret. wall collapsed	(l = 9m)
1.26	Drop str. collapsed	

iii. Field Canal

There are 51 field canals, totaling to a length of 20 miles approximately. Field canal No.1 and No.2 are most urgent for repairing damages such as collapsed retaining walls, eroded canal bed and cracked bund, etc.

iv. Abandoned Area of 80 Hectares

This area was provided with the canal system with 2 miles length of F.C. more than 20 years ago. At present, this area is covered with thick jungle.

In case of rehabilitating the system in this area, the following works would be necessary; Jungle clearing, land levelling, reconstruction of irrigation and drainage systems for the farm lands.

(5) Water Balance Analysis

a) Condition of Analysis

i. Field Water Requirements

Main crops are paddy 105 days type and OFC (Soya Beans 105 days type) for both seasons (refer to Fig.5.4.1-2). Paramentors on field water requirements for main crops are based on the design standard of ID.

ii. Inflow Data

Water Issue Records of Badagiriya Tank (1983 Jan. to 1994 Oct.) are adopted as inflow data (refer to Fig.5.4.1-3).

iii. Analysis Period

20 cases, from 1984/85 Maha to 1994 Yala, are set for calculation period.

iv. Case Studies

Through a study in 3 cases, water balance is estimated under the present and proposed cropping patterns. 3 cases are based on the following conditions.

	Cropping Pattern and Intensity	Water Issue	Command Area
Case I	present pattern	Badagiriya Tank Water Issue Record	617 ha
Case II	Proposed pattern; paddy (70%) and OFC (30%) for total command area on both seasons.	Same as above.	703 ha (included 86 ha of tail end)
Case III	Same as above	Same as above and supplement water from Lunuganwhera Reservoir (5,000 Ac · ft /year)	703 ha

b) Results of Analysis

The results indicate that Case III is recommendable as proposed water utilization in Badagiriya Scheme.

Results of water balance analysis are estimated as follows (refer to Table 5.4.1-2 and 5.4.1-3):

Water Year	Season	Case I Parcentage of Irrigable Area (%)	Case I Non-irrigable Area (ha)	Case II Parcentage of Irrigable Area (%)	Case II Non-irrigable Area (ha)	Case III Parcentage of Irrigable Area (%)	Case III Non-irrigable Area (ha)	Supplemented water volume form Lunuganwhera Tank in Case III ($\times 10^3$)	(%)
1984/85	Maha	129	OK	175	OK	175	OK	0	
85	Yala	158	OK	78	▲155	100	OK	1,920	(31%)
1985/86	Maha	107	OK	137	OK	137	OK	0	
86	Yala	139	OK	69	▲218	100	OK	2,719	(44%)
1986/87	Maha	12	▲543	16	▲590	100	OK	6,136	(99%)
87	Yala	8	▲568	4	▲675	4	▲675	0	
1987/88	Maha	118	OK	150	OK	150	OK	0	
88	Yala	44	▲346	22	▲548	97	OK	6,170	(100%)
1988/89	Maha	4	▲592	5	▲668	94	OK	5,700	(92%)
89	Yala	176	OK	87	▲91	92	OK	470	
1989/90	Maha	2	▲604	3	▲682	92	OK	6,170	(100%)
90	Yala	201	OK	99	OK	99	OK	0	
1990/91	Maha	219	OK	281	OK	281	OK	0	
91	Yala	232	OK	116	OK	116	OK	0	
1991/92	Maha	76	▲148	99	OK	99	OK	0	
92	Yala	0	▲617	0	▲703	67	▲232	6,170	(100%)
1992/93	Maha	154	OK	194	OK	194	OK		
93	Yala	49	▲315	24	▲534	92	OK	6,170	(100%)
1993/94	Maha	125	OK	158	OK	158	OK		
94	Yala	205	OK	101	OK	101	OK		

Note: 1) Command area of water balance are set as follows:
Case I : Maha = 617 ha (Paddy), Yala = 617 ha (Paddy)
Case II : Maha = 703 ha (Paddy; 70%,OFC; 30%), Yala = 703 ha (Paddy; 70%,OFC; 30%)
Case III : Same as Case II

2) Over 90% of irrigable area is shown "OK" and below of 90% is shown "▲".

3) Supplementary water under official agreement is 5,000 Acs.ft (6.17 MCM).

Table 5.4.1-1 Parameters of Irrigation System of Badagiriya Scheme

Name of Canals	Unit Figure					Accumulated Figure						FC Density
	Length of Canals			Command Area		Length of Canals			Command Area		Nos. of FC	
	(chs)	(Mile)	(km)	(Acres)	(ha)	(chs)	(Mile)	(km)	(Acres)	(ha)		(m/ha)
Badagiriya Scheme						**1,367.0**	**26.6**	**42.5**	**1,738**	**703.4**	**49**	**60.4**
Exis. Irrigable Area						**1,225.6**	**23.9**	**38.2**	**1,525**	**617.2**	**43**	**61.9**
Main Canal.	246.1	4.7	7.5			1,292.1	25.2	40.3	1,525	617.2	43	65.3
K1	9.3	0.2	0.3	33	13.4	9.3	0.2	0.3	33	13.4	1	22.5
K2	19.3	0.4	0.6	15	6.1	19.3	0.4	0.6	15	6.1	1	98.8
FC1	58.0	1.1	1.8	84	34.0	114.9	2.2	3.5	124	50.2	4	69.7
T1	12.3	0.2	0.4	10	4.0	12.3	0.2	0.3	10	4.0	1	74.1
FC2	36.6	0.7	1.1	21	8.5	36.6	0.7	1.1	21	8.5	1	129.4
FC3	8.0	0.2	0.2	9	3.6	8.0	0.2	0.3	9	3.6	1	82.4
FC4	19.0	0.4	0.6	15	6.1	24.0	0.5	0.8	42	17.0	2	47.1
FC5	5.0	0.1	0.2	27	10.9	5.0	0.1	0.2	27	10.9	1	18.3
FC6	12.0	0.2	0.4	24	9.7	14.0	0.2	0.5	27	10.9	2	45.8
FC7	2.0	0.0	0.1	3	1.2	2.0	0.0	0.1	3	1.2	1	82.4
FC8	36.8	0.7	1.1	36	14.6	36.8	0.7	1.1	36	14.6	1	75.5
FC9A	19.4	0.4	0.6	30	12.1	19.4	0.4	0.6	30	12.1	1	49.4
FC9B	24.6	0.5	0.7	36	14.6	24.6	0.5	0.7	36	14.6	1	48.0
FC10	17.6	0.3	0.5	24	9.7	17.6	0.3	0.5	24	9.7	1	51.5
DC1	49.5	0.9	1.5			349.7	6.7	10.6	528	213.7	13	49.6
FC11	24.6	0.5	0.7	33	13.4	29.1	0.6	0.8	45	18.2	2	43.9
FC12	4.5	0.1	0.1	12	4.9	4.5	0.1	0.1	12	4.9	1	20.6
FC13	14.2	0.3	0.4	18	7.3	14.2	0.3	0.4	18	7.3	1	54.9
FC14	7.0	0.1	0.2	15	6.1	7.0	0.1	0.2	15	6.1	1	32.9
FC15	30.0	0.6	0.9	24	9.7	48.8	0.9	1.5	84	34.0	3	44.1
FC16	7.0	0.1	0.2	33	13.4	7.0	0.1	0.2	33	13.4	1	15.0
FC17	11.8	0.2	0.4	27	10.9	11.8	0.2	0.4	27	10.9	1	36.6
FC18	29.5	0.6	0.9	33	13.4	29.5	0.6	0.9	33	13.4	1	67.4
FC23	18.9	0.4	0.6	33	13.4	30.9	0.6	1.0	48	19.4	1	51.5
FC24	12.0	0.2	0.4	15	6.1	12.0	0.2	0.4	15	6.1	1	65.9
FC19	50.3	1.0	1.5	102	41.3	81.5	1.6	2.5	165	66.8	3	37.4
FC21	9.0	0.2	0.3	18	7.3	9.0	0.2	0.3	18	7.3	1	41.2
FC22	22.2	0.4	0.7	45	18.2	22.2	0.4	0.7	45	18.2	1	38.4
FC20	59.3	1.1	1.8	120	48.6	59.3	1.1	1.8	120	48.6	1	37.1
FC25	17.0	0.3	0.5	30	12.1	70.2	1.3	2.1	84	34.0	4	61.8
FC26	6.0	0.1	0.2	6	2.4	6.0	0.1	0.2	6	2.4	1	82.4
FC27	7.2	0.1	0.2	21	8.5	7.2	0.1	0.2	21	8.5	1	23.5
FC28	40.0	0.8	1.2	27	10.9	40.0	0.8	1.2	27	10.9	1	109.8
FC29	17.0	0.3	0.5	24	9.7	40.7	0.8	1.2	57	23.1	3	52.0
FC30	19.5	0.4	0.6	24	9.7	19.5	0.4	0.6	24	9.7	1	61.8
FC31	4.2	0.1	0.1	9	3.6	4.2	0.1	0.1	9	3.6	1	27.5
DC3	22.5	0.4	0.7		0.0	139.6	2.5	4.3	261	105.6	3	40.7
FC35	33.0	0.6	1.0	96	38.9	33.0	0.6	1.0	96	38.9	1	25.7
FC36	60.1	1.1	1.8	114	46.1	72.1	1.3	2.2	147	59.5	2	37.0
FC38	12.0	0.2	0.4	42	17.0	12.0	0.2	0.4	42	17.0	1	23.5
FC37	12.0	0.2	0.4	9	3.6	12.0	0.2	0.4	9	3.6	1	109.8
FC39	37.8	0.7	1.2	54	21.9	37.8	0.7	1.2	54	21.9	1	54.9
DC4		0.6	0.9		0.0	128.1	3.1	4.8	174	70.4	5	68.2
FC40	26.0	0.5	0.8	42	17.0	26.0	0.5	0.8	42	17.0	1	47.1
FC40A	16.6	0.3	0.5	18	7.3	16.6	0.3	0.5	18	7.3	1	68.6
FC41	25.5	0.5	0.8	48	19.4	25.5	0.5	0.8	48	19.4	1	41.2
FC42	45.9	0.9	1.4	45	18.2	60.0	1.2	1.8	66	26.7	2	67.4
FC43	14.1	0.3	0.4	21	8.5	14.1	0.3	0.4	21	8.5	1	47.1
Exis. Irrigable Area Total	**1,292.1**	**25.2**	**40.3**	**1,525**	**617.2**							
Proposed Area						**141.4**	**2.7**	**4.3**	**213**	**86.2**	**6**	**49.9**
DC4	23.0	0.4	0.7			141.4	2.7	4.3	213	86.2	6	49.9
FC44	25.8	0.5	0.8	42	17.0	25.8	0.5	0.8	42	17.0	1	47.1
FC45	12.6	0.2	0.4	33	13.4	27.3	0.5	0.8	63	25.5	2	31.4
FC46	14.7	0.3	0.4	30	12.1	14.7	0.3	0.5	30	12.1	1	41.2
FC47	20.5	0.4	0.6	30	12.1	20.5	0.4	0.6	30	12.1	1	49.4
FC48	18.8	0.4	0.6	21	8.5	18.8	0.4	0.6	21	8.5	1	70.6
FC49	26.0	0.5	0.8	57	23.1	26.0	0.5	0.8	57	23.1	1	34.7
Proposed Area Total	**141.4**	**2.7**	**4.3**	**213**	**86.2**							
Badagiriya Scheme Total	**1,433.5**	**27.9**	**44.6**	**1,738.0**	**703.4**							

Table 5.4.1-2 Water Issue Records in Present Cropping Pattern and Water Balance Calculation for Badagiriya Scheme (1984 Sep ~ 1994 Dec)

Water Year	Yala/ Maha		Tank Volume (000m3)	Water Issue (000m3)	Total Water Issue (a) (000m3)	Rainfall (mm)	Effective Rainfall (ER) (b) (mm)	Field Water Requirement (FWR) Paddy (g) (mm)	FWR OFC (h) (mm)	Present Cropping Pattern (Case I): Field Irrigation Requirement (FIR) Paddy (g)-(b) (i) (mm)	FIR Paddy Total (j) (mm)	FIR OFC (h)-(b) (k) (mm)	FIR OFC Total (l) (mm)	Paddy Maha (86%) Yala (34%) (m) (mm)	OFC (2%) (4%) (n) (mm)	Total (m+n) (o) (mm)	Irrigation Duty (ID) (o)x1.43 (p) (mm)	Irrigated Area (a)/(p) (q) (ha)	Specified Area =617 ha (%)
1984/85	Maha	Sep	8,021.0			27.0	0.0	78	6	78		6							
		Oct	4,538.7	1,665.9		173.0	98.9	275	32	176		0							
		Nov	3,202.2	1,036.5		147.0	81.5	316	98	235		17							
		Dec	11,167.7	2,912.2		148.0	82.1	284	117	202		35							
		Jan	10,828.4	2,665.4		161.0	90.9	244	88	153		0							
		Feb	9,872.0	0.0	8,280.1	251.0	151.2	102	16	0	844	0	57	726	1	727	1,039	797	(129%)
	Yala	Mar	9,964.6	0.0		125.0	66.7	78	6	11		0							
		Apr	11,167.7	1,638.7		110.0	56.7	272	86	215		29							
		May	8,730.6	1,777.0		12.0	0.0	368	146	368		146							
		Jun	6,853.6	573.8		13.0	0.0	353	179	353		179							
		Jul	5,553.0	1,752.3		0.0	0.0	309	141	309		141							
		Aug	2,221.2	900.8	6,842.5	0.0	0.0	125	24	125	1,382	24	519	470	21	491	701	976	(158%)
1985/86	Maha	Sep	123.4	0.0		39.0	0.0	78	6	78		6							
		Oct	715.7	0.0		156.0	87.5	275	32	187		0							
		Nov	3,146.7	820.6		237.0	141.8	316	98	174		0							
		Dec	7,650.8	1,456.1		31.0	0.0	284	117	284		117							
		Jan	10,587.7	3,925.4		38.0	0.0	244	88	244		88							
		Feb	10,180.5	2,326.1	8,428.2	82.0	37.9	102	16	64	1,032	0	211	887	4	892	1,275	661	(107%)
	Yala	Mar	7,650.8	1,314.2		139.0	76.1	78	6	2		0							
		Apr	6,682.1	0.0		68.0	28.5	272	86	243		57							
		May	7,274.4	1,357.4		32.0	0.0	368	146	368		146							
		Jun	6,435.3	1,425.3		77.0	34.6	353	179	318		144							
		Jul	3,270.1	505.9		9.0	0.0	309	141	309		141							
		Aug	740.4	1,338.9	5,941.7	4.0	0.0	125	24	125	1,366	24	513	464	21	485	693	857	(139%)
1986/87	Maha	Sep	1,633.1	1,079.8		85.0	36.8	78	6	41		0							
		Oct	444.2	0.0		61.2	0.0	275	32	275		32							
		Nov	3,529.2	0.0		59.9	0.0	316	98	316		98							
		Dec	5,059.4	0.0		70.7	30.4	284	117	254		87							
		Jan	6,601.9	61.7		20.9	0.0	244	88	244		88							
		Feb	6,268.7	0.0	1,141.5	70.8	30.4	102	16	72	1,202	0	305	1,033	6	1040	1,487	77	(12%)
	Yala	Mar	3,633.2	24.7		83.9	42.5	78	6	35		0							
		Apr	5,293.9	37.0		45.1	0.0	272	86	272		86							
		May	5,522.2	98.7		0.0	0.0	368	146	368		146							
		Jun	4,966.9	0.0		0.0	0.0	353	179	353		179							
		Jul	4,405.4	74.0		9.0	0.0	309	141	309		141							
		Aug	3,455.2	135.7	370.2	32.1	0.0	125	24	125	1,462	24	576	497	23	520	744	50	(8%)
1987/88	Maha	Sep	2,955.4	35.5		289.1	176.7	78	6	0		0							
		Oct	2,455.7	0.0		0.0	0.0	275	32	275		32							
		Nov	9,131.6	771.3		0.0	0.0	315	98	316		98							
		Dec	11,223.2	5,065.6		0.0	0.0	284	117	284		117							
		Jan	8,130.6	2,899.9		161.0	90.9	244	88	153		0							
		Feb	5,322.2	1,406.8	10,199.0	32.2	0.0	102	16	102	1,130	16	263	972	5	977	1,397	730	(118%)
	Yala	Mar	3,455.2	1,616.5		41.9	0.0	78	6	78		6							
		Apr	2,659.3	197.4		103.0	52.0	272	86	220		34							
		May	2,406.3	0.0		158.0	88.8	368	146	279		57							
		Jun	2,221.2	0.0		16.1	0.0	353	179	353		179							
		Jul	1,962.1	0.0		27.0	0.0	309	141	309		141							
		Aug	1,431.4	0.0	1,814.0	72.0	34.6	125	24	90	1,330	0	417	452	17	469	670	271	(44%)
1988/89	Maha	Sep	999.3	123.4		116.2	60.8	78	6	17		0							
		Oct	691.0	0.0		200.9	117.6	275	32	157		0							
		Nov	1,110.8	0.0		111.6	57.8	316	98	258		40							
		Dec	11,167.7	0.0		0.0	0.0	284	117	284		117							
		Jan	11,167.7	49.4		0.0		244	88	244		88							
		Feb	11,167.7	148.1	320.8	37.5	0.0	102	16	102	1,063	16	261	914	5	919	1,315	24	(4%)
	Yala	Mar	10,180.3	3,788.4		41.2	0.0	78	6	78		6							
		Apr	7,630.8	1,715.3		37.0	0.0	272	86	272		86							
		May	5,553.0	1,283.4		11.0	0.0	368	146	368		146							
		Jun	3,393.5	604.7		95.4	46.9	353	179	306		132							
		Jul	2,221.2	388.7		0.7	0.0	309	141	309		141							
		Aug	3,635.4	246.8	8,027.2	0.0	0.0	125	24	125	1,458	24	535	496	21	517	740	1,065	(176%)
1989/90	Maha	Sep	2,165.7	98.7		69.3	29.3	78	6	48		0							
		Oct	1,853.3	0.0		184.3	106.5	275	32	169		0							
		Nov	2,560.6	0.0		0.0	0.0	316	98	316		98							
		Dec	4,319.0	74.0		71.6	31.0	284	117	253		86							
		Jan	4,041.4	0.0		0.0	0.0	244	88	244		88							
		Feb	3,979.7	0.0	172.8	39.1	0.0	102	16	102	1,132	16	288	974	6	979	1,400	12	(2%)
	Yala	Mar	3,671.2	0.0		101.7	51.1	78	6	27		0							
		Apr	3,393.5	0.0		66.5	27.5	272	86	244		58							
		May				10.5	0.0	368	146	368		146							
		Jun	2,659.3	2,666.5		0.0	0.0	353	179	353		179							
		Jul	2,955.4	2,521.0		0.0	0.0	309	141	309		141							
		Aug	2,838.2	3,628.6	8,818.2	65.2	26.7	125	24	98	1,400	0	524	476	21	497	711	1,241	(201%)
1990/91	Maha	Sep	1,912.7	2,043.3		95.8	47.2	78	6	31		0							
		Oct	1,863.3	100.1		233.7	139.6	275	32	135		0							
		Nov	7,558.3	2,323.4		288.1	176.0	316	98	140		0							
		Dec	11,167.7	3,041.3		69.3	29.4	284	117	255		88							
		Jan	11,167.7	4,564.0		0.0	0.0	244	88	244		88							
		Feb	10,513.7	3,085.1	15,177.3	0.0	0.0	102	16	102	907	16	192	780	4	784	1,121	1,354	(219%)
	Yala	Mar	9,131.6	2,313.3		61.3	0.0	78	6	78		6							
		Apr	7,928.5	302.2		87.2	41.4	272	86	231		45							
		May	8,280.1	2,021.0		116.2	60.8	368	146	307		85							
		Jun	5,713.4	2,011.7		25.6	0.0	353	179	353		179							
		Jul	4,319.0	2,026.0		52.1	0.0	309	141	309		141							
		Aug	3,202.2	1,501.0	10,175.4	0.0	0.0	125	24	125	1,403	24	480	477	19	496	709	1,434	(232%)
1991/92	Maha	Sep	2,838.2	0.0		104.7	53.1	78	6	25		0							
		Oct	2,838.2	1,025.3		104.7	53.1	275	32	222		0							
		Nov	2,560.6	1,443.9		102.1	51.4	316	98	265		47							
		Dec	2,221.2	1,398.6		149.7	83.3	284	117	201		34							
		Jan	1,727.6	1,650.6		7.9	0.0	244	88	244		88							
		Feb	1,172.3	603.9	6,122.4	0.0	0.0	102	16	102	1,058	16	184	910	4	914	1,306	469	(76%)
	Yala	Mar	1,246.3	0.0		0.0	0.0	78	6	78		6							
		Apr	1,382.1	0.0		10.0	0.0	272	86	272		86							
		May	1,110.6	0.0		84.4	39.5	368	146	328		106							
		Jun	1,203.2	0.0		0.0	0.0	353	179	353		179							
		Jul	999.5	0.0		0.0	0.0	309	141	309		141							
		Aug	666.4	0.0	0.0	0.0	0.0	125	24	125	1,465	24	542	498	22	520	744	0	(0%)
1992/93	Maha	Sep	357.9	0.0		0.0	0.0	78	6	78		6							
		Oct	0.0	0.0		244.2	146.6	275	32	128		0							
		Nov	0.0	1,234.1		88.6	42.3	316	98	274		56							
		Dec	3,270.1	4,344.2		17.0	0.0	284	117	284		117							
		Jan	4,405.4	3,908.2		0.0	0.0	244	88	244		88							
		Feb	2,955.4	3,552.9	13,039.4	32.7	0.0	102	16	102	1,110	16	283	955	6	960	1,373	950	(154%)
	Yala	Mar	2,406.3	2,222.5		62.6	0.0	78	6	78		6							
		Apr	2,067.0	0.0		120.8	63.9	272	86	208		22							
		May	2,221.2	0.0		28.9	0.0	368	146	368		146							
		Jun	2,287.9	0.0		44.9	0.0	353	179	353		179							
		Jul	1,912.7	0.0		0.0	0.0	309	141	309		141							
		Aug	1,530.2	0.0	2,222.5	18.2	0.0	125	24	125	1,441	24	518	490	21	511	730	304	(49%)
1993/94	Maha	Sep	999.5	34.8		109.6	56.4	78	6	22		0							
		Oct	468.9	0.0		277.9	169.2	275	32	106		0							
		Nov	1,635.1	2,217.0		292.7	179.1	316	98	137		0							
		Dec	9,471.0	922.2		50.3	0.0	284	117	284		117							
		Jan	11,167.7	2,895.5		0.0	0.0	244	88	244		88							
		Feb	10,686.4	2,446.2	8,515.3	58.0	0.0	102	16	102	894	16	221	769	4	774	1,106	770	(125%)
	Yala	Mar	9,265.9	1,423.2		15.0	0.0	78	6	78		6							
		Apr	8,730.6	1,037.9		12.0	0.0	272	86	272		86							
		May	8,280.1	3,165.0		0.0	0.0	368	146	368		146							
		Jun	4,896.8	2,305.6		43.1	0.0	353	179	353		179							
		Jul	2,067.0	898.1		28.8	0.0	309	141	309		141							
		Aug	1,820.2	339.8	9,165.5	145.0	80.1	125	24	45	1,425	0	558	484	22	507	725	1,265	(205%)

Table 5.4.1-3 Water Issue Records in Proposed Cropping Pattern and Water Balance Calculation for Badagiriya Scheme (1984 Sep ~ 1994 Dec)

Water Year	Yala/ Maha	Month	Tank Volume ('000m3)	Water Issue ('000m3)	Total Water Issue (a) ('000m3)	Rainfall (mm)	Effective Rainfall (ER) (b) (mm)	Field Water Requirement (FWR) Paddy (g) (mm)	FWR OFC (h) (mm)	Proposed Cropping Pattern (Case II): Field Irrigation Requirement (FIR) Paddy (g)-(b) (i) (mm)	FIR Paddy Total (j) (mm)	FIR OFC (h)-(b) (k) (mm)	FIR OFC Total (l) (mm)	Paddy Maha (70%) Yala (70%) (m) (mm)	OFC (30%) (n) (mm)	Total (m+n) (o) (mm)	Irrigation Duty (ID) (o)x1.11 (p) (mm)	Irrigated Area (a)/(p) (q) (ha)	Specified Area =703 ha (%)	(Case III) Supplemental Water Volume (5,000 Ac ft = 6,170 x 1000 m3) ('000m3)	(%)	Irrigable Area (ha)	(%)	
1984/85	Maha	Sep	8,021.0			27.0	0.0	78	6	78		6												
		Oct	4,538.7	1,665.9		113.0	98.9	275	32	176		0												
		Nov	3,302.2	1,036.6		147.0	81.5	316	98	235		17												
		Dec	11,167.7	2,912.2		149.0	82.1	254	117	172		35												
		Jan	10,628.4	2,665.4		161.0	90.9	244	88	153		0												
		Feb	9,872.0	0.0	8,280.1	251.0	151.2	102	16	0	844	0	57	591	17	608	675	1,227	(175%)					OK
	Yala	Mar	9,964.6	0.0		125.0	66.7	78	6	11		0												
		Apr	11,167.7	1,838.7		100.0	56.7	272	86	215		29												
		May	8,100.6	1,277.0		12.0	0.0	368	146	368		146												
		Jun	6,553.6	573.8		13.0	0.0	353	179	353		179												
		Jul	5,553.0	1,752.3		0.0	0.0	309	141	309		141												
		Aug	2,221.2	903.3	6,842.5	0.0	0.0	125	24	125	1,382	24	519	967	156	1,123	1,246	549	(78%)	1,919.8	(31%)	703	(100%)	OK
1985/86	Maha	Sep	123.4	0.0		39.0	0.0	78	6	78		6												
		Oct	713.7	0.0		156.0	87.5	275	32	187		0												
		Nov	3,146.7	629.6		237.0	141.8	316	98	174		0												
		Dec	7,650.8	1,456.1		31.0	0.0	254	117	254		117												
		Jan	10,587.7	3,525.4		36.0	0.0	244	88	244		88												
		Feb	10,180.5	2,326.1	8,429.2	42.0	37.9	102	16	64	1,032	0	211	722	63	785	872	967	(137%)					OK
	Yala	Mar	7,650.8	1,314.2		136.0	76.1	78	6	2		0												
		Apr	6,682.1	0.0		69.0	28.5	272	86	243		57												
		May	7,274.4	1,357.4		32.0	0.0	368	146	368		146												
		Jun	6,435.3	1,423.3		77.0	34.6	353	179	318		144												
		Jul	3,230.1	505.9		9.0	0.0	309	141	309		141												
		Aug	240.4	1,358.9	5,941.7	4.0	0.0	125	24	125	1,366	24	513	956	154	1,110	1,232	482	(69%)	2,719.2	(44%)	703	(100%)	OK
1986/87	Maha	Sep	1,635.1	1,079.8		80.0	36.6	78	6	41		0												
		Oct	441.2	0.0		61.2	0.0	275	32	275		32												
		Nov	3,529.2	0.0		59.9	0.0	316	98	316		98												
		Dec	5,050.4	0.0		70.7	30.6	254	117	254		87												
		Jan	6,501.9	61.7		20.9	0.0	244	88	244		88												
		Feb	6,268.7	9.0	1,141.5	70.8	30.4	102	16	72	1,202	0	305	841	91	933	1,035	110	(16%)	6,135.5	(99%)	703	(100%)	OK
	Yala	Mar	5,633.2	24.7		88.9	42.5	78	6	35		0												
		Apr	5,293.9	37.0		45.1	0.0	272	86	272		86												
		May	5,522.2	96.7		0.0	0.0	368	146	368		146												
		Jun	4,966.9	0.0		0.0	0.0	353	179	353		179												
		Jul	4,405.4	74.0		9.0	0.0	309	141	309		141												
		Aug	3,455.2	135.7	370.2	32.1	0.0	125	24	125	1,462	24	576	1,024	173	1,197	1,328	28	(4%)	34.5	(1%)	30	(4%)	
1987/88	Maha	Sep	1,955.4	55.5		269.1	176.7	78	6	0		0												
		Oct	1,455.9	0.0		0.0	0.0	275	32	275		32												
		Nov	9,130.6	271.3		0.0	0.0	316	98	316		98												
		Dec	11,223.2	5,065.6		0.0	0.0	254	117	254		117												
		Jan	8,730.6	2,899.9		161.0	90.9	244	88	153		0												
		Feb	5,522.1	1,406.8	10,199.0	32.2	0.0	102	16	102	1,130	16	263	791	79	870	966	1,056	(150%)					OK
	Yala	Mar	3,455.2	1,616.5		41.9	0.0	78	6	78		6												
		Apr	2,659.3	197.4		103.0	52.0	272	86	220		34												
		May	2,406.3	0.0		158.0	85.8	368	146	279		57												
		Jun	2,221.2	0.0		16.1	0.0	353	179	353		179												
		Jul	1,962.1	0.0		27.0	0.0	309	141	309		141												
		Aug	1,431.4	0.0	1,814.0	77.0	34.6	125	24	90	1,330	0	417	931	125	1,056	1,172	155	(22%)	6,170.0	(100%)	681	(97%)	OK
1988/89	Maha	Sep	999.5	921.4		136.2	60.8	78	6	17		0												
		Oct	691.0	0.0		246.9	117.6	275	32	157		0												
		Nov	1,110.6	0.0		111.6	57.8	316	98	258		40												
		Dec	11,167.7	0.0		0.0	0.0	254	117	254		117												
		Jan	11,167.7	49.4		0.0		244	88	244		88												
		Feb	11,167.7	148.1	320.8	57.5	0.0	102	16	102	1,063	16	261	744	78	822	913	35	(5%)	5,700.0	(92%)	660	(94%)	OK
	Yala	Mar	10,180.5	3,768.4		41.2	0.0	78	6	78		6												
		Apr	7,650.0	1,755.3		37.0	0.0	272	86	272		86												
		May	5,553.0	1,263.4		11.0	0.0	368	146	368		146												
		Jun	3,763.5	604.7		95.4	46.9	353	179	306		132												
		Jul	2,121.2	368.7		0.7	0.0	309	141	309		141												
		Aug	3,635.4	246.8	8,027.2	0.0	0.0	125	24	125	1,458	24	535	1,021	162	1,181	1,311	612	(87%)	470.0	(8%)	648	(92%)	OK
1989/90	Maha	Sep	2,165.7	98.7		69.5	29.5	78	6	49		0												
		Oct	1,863.3	0.0		184.3	108.5	275	32	169		0												
		Nov	2,560.6	0.0		0.0	0.0	316	98	316		98												
		Dec	6,319.0	74.0		71.6	31.0	254	117	251		86												
		Jan	4,641.4	0.0		0.0	0.0	244	88	244		88												
		Feb	3,979.7	0.0	172.8	39.1	0.0	102	16	102	1,132	16	288	792	86	879	976	18	(3%)	6,170.0	(100%)	650	(92%)	OK
	Yala	Mar	3,671.2	0.0		161.7	51.1	78	6	27		0												
		Apr	3,363.5	0.0		66.5	27.5	272	86	244		58												
		May				10.5	0.0	368	146	368		146												
		Jun	2,659.3	2,666.5		0.0	0.0	353	179	353		179												
		Jul	2,955.4	1,523.0		0.0	0.0	309	141	309		141												
		Aug	2,839.2	3,628.6	1,818.2	65.2	26.7	125	24	98	1,400	0	524	960	157	1,137	1,262	699	(99%)					OK
1990/91	Maha	Sep	1,912.7	2,043.3		95.8	47.2	78	6	31		0												
		Oct	1,863.3	100.1		133.7	139.6	275	32	135		0												
		Nov	2,558.3	2,123.4		281.1	176.0	316	98	140		0												
		Dec	11,167.7	3,043.3		69.3	29.4	254	117	255		88												
		Jan	11,167.7	4,546.0		0.0	0.0	244	88	244		88												
		Feb	10,543.7	3,065.1	15,177.3	6.0	0.0	102	16	102	907	16	192	635	57	692	768	1,975	(281%)					OK
	Yala	Mar	9,131.6	2,313.3		61.3	0.0	78	6	78		6												
		Apr	7,928.5	302.2		47.2	41.4	272	86	231		45												
		May	8,260.1	2,721.0		116.2	60.8	368	146	307		85												
		Jun	5,713.4	2,011.7		26.8	0.0	353	179	353		179												
		Jul	4,359.0	2,076.0		52.1	0.0	309	141	309		141												
		Aug	3,202.1	1,501.0	10,135.4	0.0	0.0	125	24	125	1,403	24	480	982	144	1,126	1,250	814	(116%)					OK
1991/92	Maha	Sep	2,838.2	0.0		104.7	53.1	78	6	25		0												
		Oct	2,838.2	1,025.3		104.7	53.1	275	32	222		0												
		Nov	2,565.6	1,443.0		102.1	51.4	316	98	265		47												
		Dec	2,212.2	1,298.6		149.7	83.3	254	117	171		34												
		Jan	1,727.6	1,650.6		7.9	0.0	244	88	244		88												
		Feb	4,172.3	634.1	6,122.4	0.0	0.0	102	16	102	1,058	16	184	741	55	796	884	693	(99%)	88.6	(1%)	703	(100%)	OK
	Yala	Mar	4,246.3	0.0		0.0	0.0	78	6	78		6												
		Apr	1,302.1	0.0		30.0	0.0	272	86	272		86												
		May	1,110.8	0.0		84.4	[illegible]	368	146	325		106												
		Jun	1,293.2	0.0		0.0	0.0	353	179	353		179												
		Jul	999.5	0.0		0.0	0.0	309	141	309		141												
		Aug	866.4	0.0	0.0	0.0	0.0	125	24	125	1,465	24	542	1,026	163	1,189	1,319	0	(0%)	6,170.0	(100%)	468	(67%)	
1992/93	Maha	Sep	357.8	0.0		0.0	0.0	78	6	78		6												
		Oct	0.0	0.0		244.2	146.6	275	32	128		0												
		Nov	0.0	1,234.1		88.6	42.3	316	98	274		56												
		Dec	5,370.1	4,344.1		17.0	0.0	254	117	254		117												
		Jan	4,845.4	3,968.2		0.0	0.0	244	88	244		88												
		Feb	3,955.4	3,352.9	13,039.4	32.7	0.0	102	16	102	1,110	16	283	777	85	862	957	1,363	(194%)					OK
	Yala	Mar	2,446.3	2,221.5		61.6	0.0	78	6	78		6												
		Apr	2,067.0	0.0		128.8	63.5	272	86	208		22												
		May	2,221.2	0.0		28.9	0.0	368	146	368		146												
		Jun	2,252.9	0.0		44.8	0.0	353	179	353		179												
		Jul	1,912.7	0.0		0.0	0.0	309	141	309		141												
		Aug	1,530.2	0.0	2,222.5	18.2	0.0	125	24	125	1,441	24	518	1,009	155	1,164	1,292	172	(24%)	6,170.0	(100%)	649	(92%)	OK
1993/94	Maha	Sep	999.5	34.6		186.8	56.4	78	6	22		0												
		Oct	468.9	0.0		277.8	169.2	275	32	106		0												
		Nov	1,635.1	2,217.0		292.7	179.1	316	98	137		0												
		Dec	9,471.0	922.2		51.3	0.0	254	117	254		117												
		Jan	11,167.7	2,865.5		0.0	0.0	244	88	244		88												
		Feb	10,556.4	2,445.1	8,515.3	59.0	0.0	102	16	102	894	16	221	626	66	692	768	1,108	(158%)					OK
	Yala	Mar	9,265.9	1,423.2		15.0	0.0	78	6	78		6												
		Apr	8,330.6	1,037.8		12.0	0.0	272	86	272		86												
		May	8,280.1	3,165.0		0.0	0.0	368	146	368		145												
		Jun	4,556.6	2,365.6		43.1	0.0	353	179	353		179												
		Jul	2,067.0	868.1		28.8	0.0	309	141	309		141												
		Aug	1,629.2	335.8	9,165.5	145.0	80.1	125	24	45	1,425	0	558	997	167	1,165	1,293	709	(101%)					OK

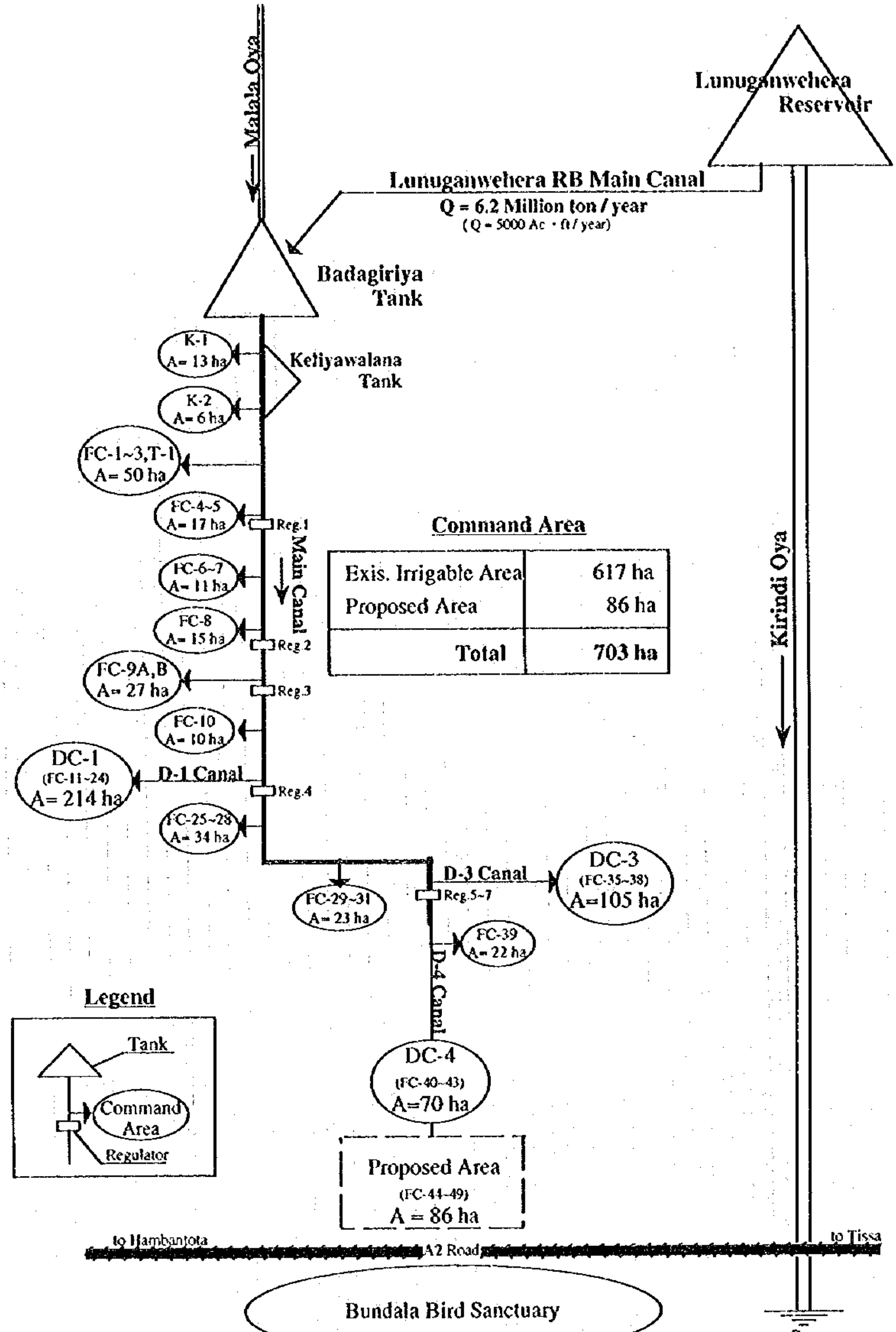


Figure 5.4.1-1 Schematic Diagram of Badagiriya Scheme

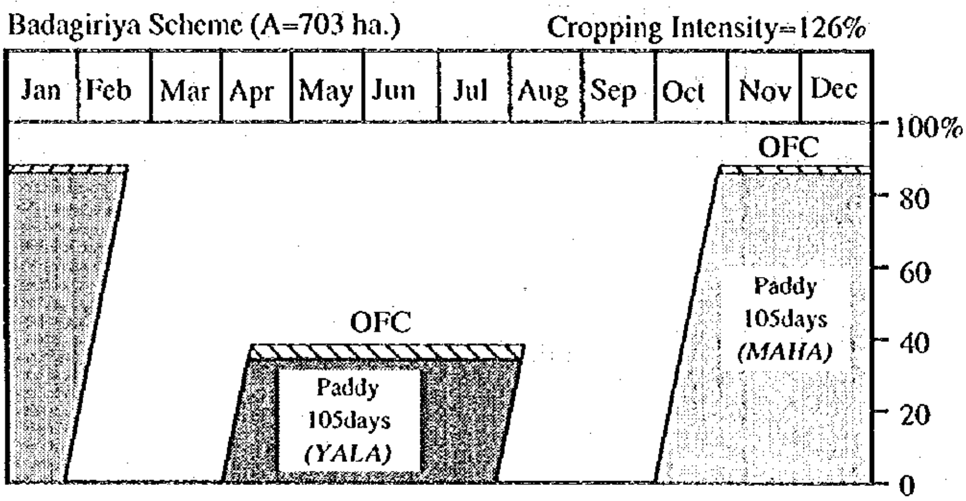


Fig. 5.4.1-2 Present Cropping Pattern for Badagiriya Scheme

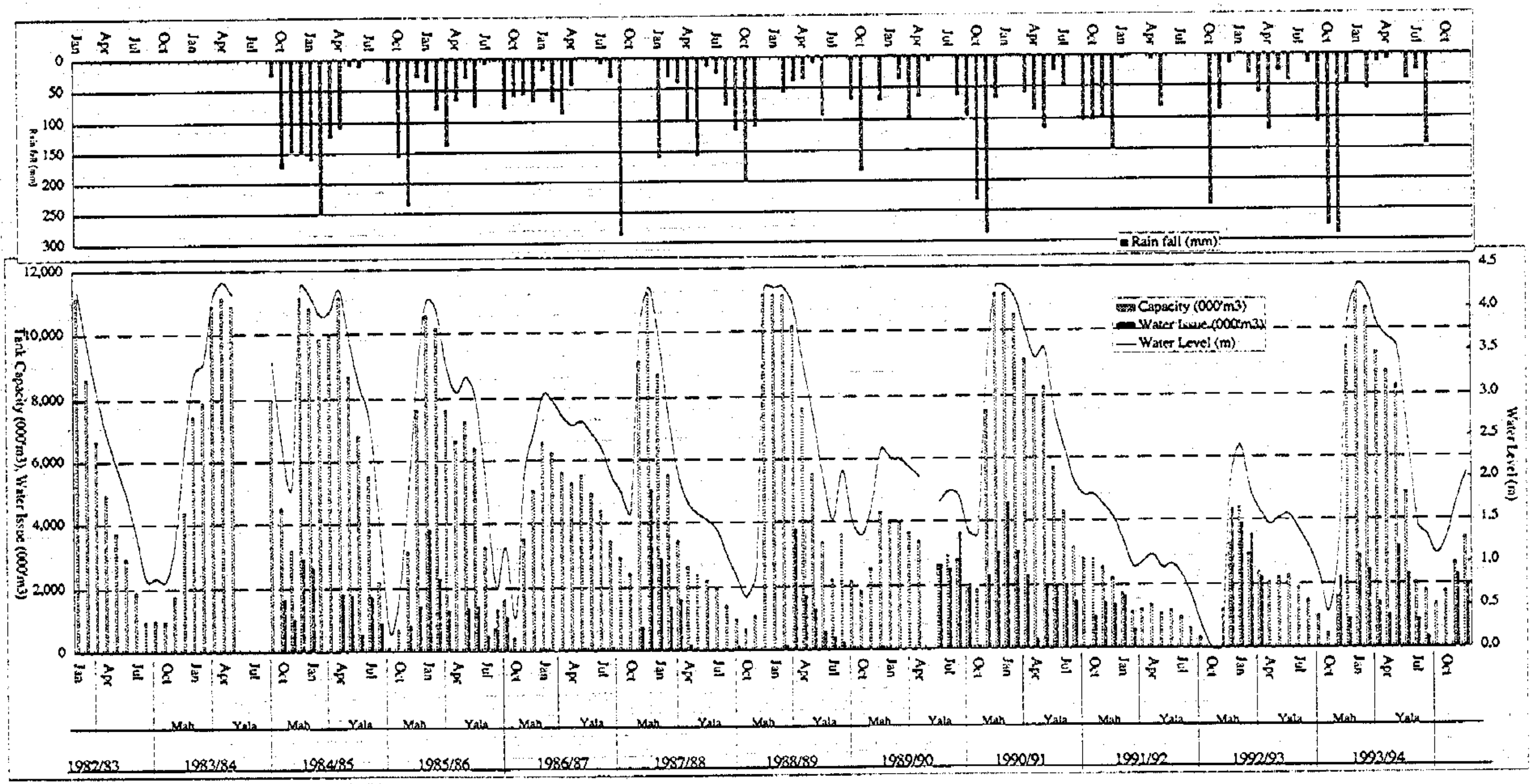


Fig. 5.4.1-3 Water Issue Records for Badagiriya Tank (1984 Sep ~ 1994 Aug)

5.4.2 Agriculture

(1) Land Use and Farm Family

Land Use

This scheme belongs to typical dry zone, and the farm productivity in homestead as well as in paddy land is constrained by few rainfall and water shortage particularly in dry season.

Total paddy cropped areas in Yala are estimated at 239 ha in paddy and 28 ha in OFC and in Maha 605ha in paddy and 14 ha in OFC with 126 cropping intensity.

Upland is only homestead area counted 120 ha in total, which is used for tree crops such as coco-nuts or fruits and OFC of chili, onion, vegetable, etc.

Farm Family

All the farm families in this scheme, being land owners, count 594, with holding 1.2 ha of irrigable area (1.1 ha of actual crop area) on the average. They had been originally given 1ha of paddy land and 0.2ha of homestead for settler

(2) Crop cultivation and Cropping pattern

Paddy Cultivation

This scheme is a part of Kirindi Oya project, and the supporting services for machinery and farm inputs are arranged by Kirindi Oya project office.

According to the questionnaire survey, the machinery cost occupies 45% of production cost in cash outlay. The following cost is fertilizer occupying 18% of the cost. They use fertilizer to good effect with 260kg/ ha for 3.6 t/ ha of the yield. Agro-chemicals seem to be effective in suitable dosage.

Yields are estimated at 3.6 t/ ha on the average.

OFC Cultivation

OFC cultivation in paddy land is recommended by AO and the Project office due to water shortage. OFC can be seen also in homestead. The OFC ratio in paddy land shows 2% in Maha and 4% in Yala.

Cropping Pattern

The present cropping pattern in Badagiriya scheme is identified as follows.

Season	Present		
	Crops	CI (%)	Benefitted Area (ha)
Yala	Paddy	34	239
	OFC	4	28
Maha	Paddy	86	605
	OFC	2	14
Total		126	886

3) Livestock and Tree Crops

Livestock

Hambantota Veterinary Service Center reported 17,465 heads of cattle and 19,898 heads of buffaloes at Hambantota AGA division in 1993.

Goats and poultry can be seen in some farm houses. One of farmers leaders keeps 300 hens in homestead with a brick hen house. He earns Rs 3,000/ month in net, selling 200 eggs every day.

Tree Crops

Every farm house holds 10 to 15 coconuts trees and 10 to 20 other fruit trees such as papaya, banana, mango, jack-fruits, etc,.

(4) Agricultural Support Service

Agricultural extension is carried out by one AO and one AI under an inter-provincial Assistant Director under the control of central DOA, in cooperation with Kirindi Oya project office. More than 50% of paddy seeds are supplied with Governmental ones, and 50% of paddy poroduction is sold to Paddy Marketing Board.

5.4.3 Farmer Organizations

FOs in the Badagiriya scheme were formed as part of the institutional development program in the Kirindi Oya scheme. All 586 farmers in the scheme are members of 43 FCG which have representation in 4 DCOs. They are represented in the Sub-Project Committee for Badagiriya and in the PMC for Kirindi Oya. The Resident Project Manager chairs the PMC meetings while the Badagiriya sub-project committee is chaired by a farmer.

These committees have been functioning for over 5 years. FOs have women members but not committee members. The sub-project committee meets at least once a month and other committees meet as often as is necessary.

Main functions of the FOs are water management organization of Shramadana handling ID contracts, input supplies and marketing. They plan to embark on post harvest processing, value added products and marketing. The FOs and the sub-project committee have played an active role in project management, in determining water allocation and sharing, cropping patterns, maintenance programs and so forth. FOs have taken over the O/M of D canals downwards on an informal basis.

Fig.5.4.3-1 presents the current organization of the PMC.

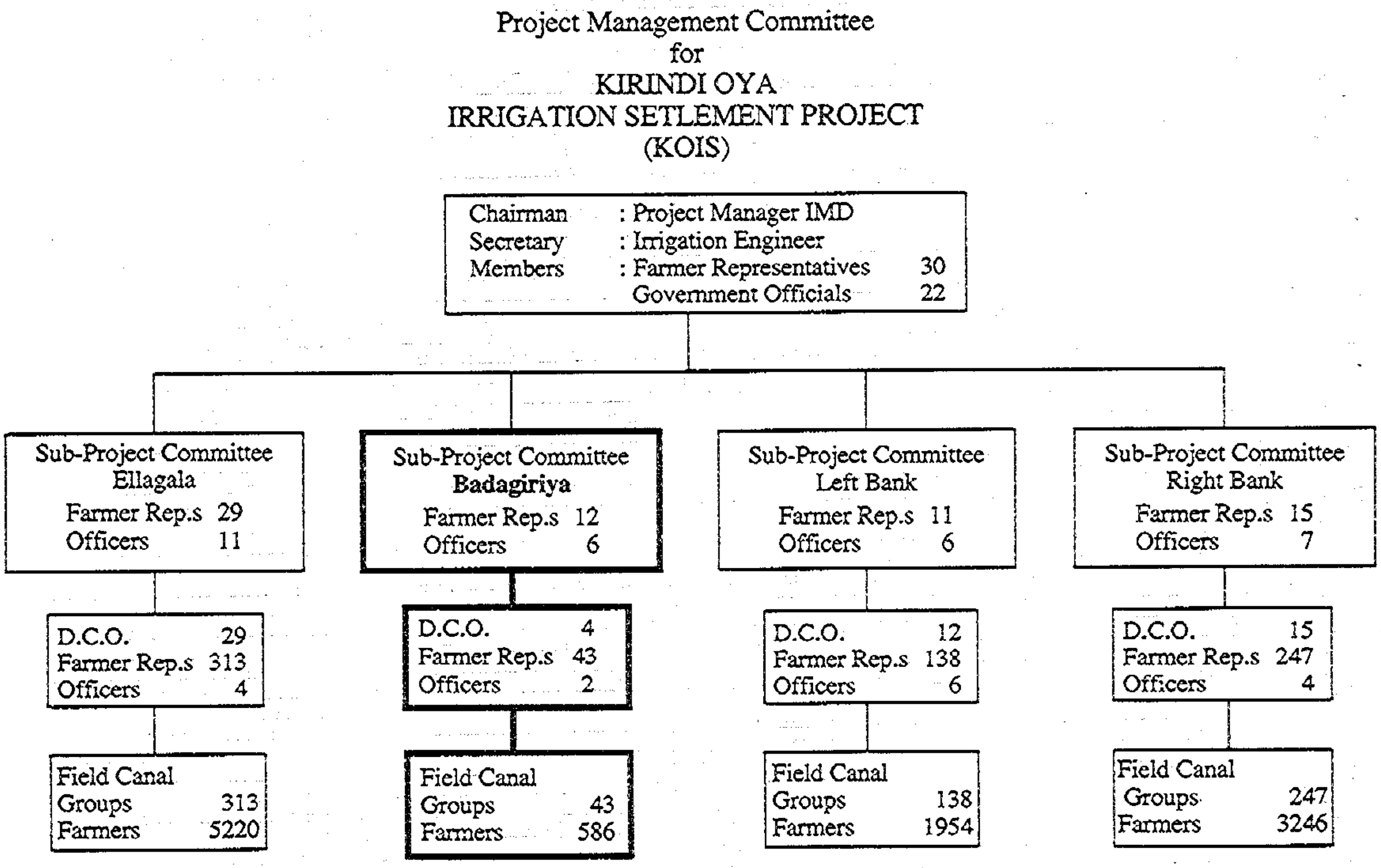


Fig. 5.4.3-1 Badagiriya FOs Organization Chart

5.4.4 Management of System

Water management is planned and monitored by the Kirindi Oya Project Management Committee of which Badagiriya is a sub-project. The sub-project has 4 DCO. and 43 FCC. Groups. FO. officials are represented at each level including in the Project Management Committee. The Committees meet at least once a month to plan and monitor the cultivation program. They meet more often if the need are to arise. Hence farmers are involved in all the decision making with regard to the dates of water issues, quantity of water to be issued, rotational issues and water use efficiency. Also they make decisions on cropping patterns, maintenance plans, contributions (to labor or cash) towards maintenance. Especially in water scarce situations the participation of farmers helps to achieve consensus in sharing limited water available and in adjusting cropping patterns and cropping calendars to suit the availability of water. The FOs also take responsibility for the maintenance of Distributary and Field Canals. In Badagiriya FOs have taken over O&M of the canals from D. Canal downwards on an informal basis. They are willing to take over formally after rehabilitation.

Representation in the Project Management Committee helps the Badagiriya farmers to have a voice in the allocation of water from the main Lunugamvehera reservoir which is crucial to their planning and monitoring. Water use efficiency has increased to 5Acs.ft in 1994.

Operation and Maintenance Costs

Badagiriya System improvement works were executed under allocation by ID from 1992 to 1994. O/M costs are included in part of the works:

Year	Allocation (Rs.)	Area (ha)	Rs./ha
1992	404,258	617*	655
1993	1,130,755	"	1,833
1994	3,100,792	"	5,026

* The proposed area (86 ha) is not involved.

5.4.5 Environmental Issues

(1) Soil and Water Quality

Soil Sampling

For confirming the existence of saline soil, 4 soil samples were collected and analyzed. Location of sampling sites and results of analysis are given in Fig.5.2.5-1 (6/6) and Table 5.2.5-1.

The existence of saline soil has been pointed out in the preliminary information. However, as a result of the analysis, it was not found through this survey.

Water Sampling

For checking quality of irrigation water, a water sample was collected in the Badagiriya reservoir and examined. Location of sampling site and results of analysis are given in Fig.5.2.5-1 (6/6) and Table 5.2.5-2.

As a result of the analysis, the sample has shown a few saline contents. However, according to the standard of IIMI (Table 5.2.5-4), the amount is within the permissible range for cultivation.

(2) Flood Damage

Despite the fact that the area around highway A2 is inundated with about several 10 cm of water during flooding in October and November, flooding is both infrequent and of small scale. Farmers excavate sandbars blocking the river mouth to establish a drainage channel from the Malala Lewaya to the sea.

(3) Wildlife

The entire Bundala National Park area has been registered as a Ramsar site as of 1990, and in 1992 the area's status was upgraded from sanctuary to national park with overall management under the Department of Wildlife Conservation.

Vegetation is dry/arid evergreen scrub, greatly influenced by human and livestock presence. 48 species of flowering plants have been identified around Bundala. Endemic, threatened or endangered species of plant are not observed.

A wide variety of animal species are found in the park, particulary with regards to bird species of which 149 are identified (9 rare migrant, and 1 endemic species). Around 15,000 birds are perennially present in the park. 48 species of mammal are observed (including eight rare species comprising 1 globally endangered, 1 globally threatened, 3 nationally threatened and 3 endemic species). The coastal area is a spawning ground for sea turtles.

In terms of biodiversity, scientific value, uniqueness, and wildlife habitat, Bundala National Park is assessed as an extremely valuable asset. According to the Wetland Site Report of CEA, water is supplied to the park via KOISP and rainfed tank system. At present, impact on the park from agriculture in the surrounding areas is considered small; however, there is concern that this may change with modernization of farming and increase in drainage discharge containing agro-chemicals, etc.

Around 3,000 head of cattle and buffalo are present in the surrounding area, having a very negative impact on the environment through overgrazing and damaging of natural wildlife habitats. Restricting this livestock population to a manageable size would ease pressure on the natural ecosystem.

The following items are considered important with regards to the proposed scheme to ensure appropriate conservation and management of the area.

- It is recommended that at 2 km wide buffer zone be established around the periphery of the park, within which settlement would not be permitted, various ordinances enacted to ensure the welfare of the area population, and appropriate planting and reforestation undertaken to provide livestock grazing areas and sources of firewood. This would reduce adverse pressures from the surrounding area on the ecosystem of the park

- A study is necessary of chemical contamination in the area in light of the paucity of data on the quality of farm drainage water. Contamination by insecticides, herbicides, chemical fertilizers, etc. has the potential to impact negatively on the ecosystem of the park.

- It is necessary to precisely identify currently cultivated areas, and on this basis to assess cultivability of areas and the possibility for relocation of farmland.

- It is recommended that grazing areas be designated to reduce overgrazing, and further that numbers of grazing days and livestock be controlled. Owners of livestock would have access to such grazing areas under a punch ticket type system under the supervision of WLAC.

- At present, in addition to around 25~30 elephants living permanently in the park, other elephant herds migrate through the Uda Walawe - Bundala - Lununganwehera - Yala areas. In the case of Uda Walawe and Kirindi Oya, various project implementation has cut-off elephant trails resulting in their forced intrusion into agricultural areas where they rest during the day in scrub forest and emerge at night into cultivated fields in search of food. The methods to prevent this would be to relocate herds, erect electrical fences, etc.

(4) Fishery

There are 121 fishermen (48 families) engaged in fishing at Badagiriya Tank. Total monthly catch is 3,120 kg equivalent to total income of Rs 47,000 which computes to Rs 390 per fisherman per month.

In addition, some 280 fishermen (140 families) fish the waters of Lunugamwehera Reservoir, from which discharge is diverted for irrigation. Total monthly catch is 21,800 kg, equivalent to a total income of Rs 284,000 which comes to Rs 1,010 per fisherman monthly. Fish species are fresh water, and as with the case at other lakes in Hambantota District, catches have been declining over the past 10 years.

86 fishermen (31 families) earn there livelihood at Embilikala kalapuwa, catching 1,730 kg per month with a per person income of Rs 730. Around 56% of total income is accounted for by shrimp, which are fished perennially.

At Malala Lewaya, 126 fishermen (76 families) work the waters catching 9,500 kg per month with a per person income of Rs 3,500. Around 68% of total income is accounted for by shrimp.

At Koholankala Lewaya, 20 fishermen (10 families) are engaged in fishing, catching 67 kg per month with a per person income of Rs 100.

All total for Embilikala kalapuwa, Malala lewaya, and Koholankala Lewaya, there are 232 fishermen (117 families) working the waters downstream of the subject scheme with total monthly catch of 11,300 kg and total income of Rs 507,000. In all of the lagoons catches have declined over the past 10 years.

(5) Water Use

Water is diverted for domestic purposes at Lunuganwehera Reservoir.

5.5 Kachigala Ara Scheme

5.5.1 Irrigation and Drainage System

(1) Location and Basin Description

The scheme area is located at the north of Hungama in Hambotota district. Hungama is about 25 km west of Hambotota city, the district headquarters. The Kachigala River has a total catchment area of 176 km2, and comprises an area of paddy field extending toward the coast. Prior to the inauguration of the Uda Walawe Scheme, the river, unlike today, was not perennial and was identified as a "dry river". Even during the Yala harvest time (February~March) and the Maha harvest time (August~September) rainfall is small and river flow scarce. However, during the paddy cultivation season, excess water from the Uda Walawe R/B areas flows mounting up to 1.7 m3/s at Kalamitiya located on the river mouth.

Three anicuts, Mahabemma, Hatagala and Galamuna, have been constructed in the scheme. 222ha is irrigated from the Mahabemma anicut, 162 ha from Hatagala anicut and 132 ha from the Galamuna anicut for a total of 516 ha. A portion of the upstream Uda Walawe scheme (5,520 acs.; approx. 2,234 ha) is currently being rehabilitated under the Mahaweli Development Authority with funding from the ADB.

a) Flood Damages in the Basin

After the commissioning of Udawalawe scheme in 1967, about 13,710 Acs. paddy lands drain into Kalametiya Lagoon through Kachigala Ara. In addition 2,100 Acs. of lands under Liyangastota WRB scheme drains into Kachigara. It is said, about 28 cumec drains into Kalametiya Kalapuwa from the above schemes and about 37.1cumec of flood water flows into the Lagoon during the rainy season, in a 10 years flood.

Before construction of the above scheme Kachigala Ara was not perennial; so about 1,500 Acs are reported to have been irrigated under village tanks.

By 1969 flood, almost all the tanks and existing irrigation systems were washed away. The drainage system for the tail end of Kachigala Oya basin comprises 3 drainage channels (Kachigala River, Lunama River and Miniethiliya River) which flow into two lagoons along the coast (Kalametiya Kalapuwa and Lunama Kalapuwa). The inflow of this fresh water into the foregoing lagoons has disturbed their natural ecologies, severely affecting fishing particularly shrimp harvesting. This in turn has impacted adversely on the population who gain their livelihood from the lagoon. Excessive drainage discharge from upstream has further rendered low land paddy of 1,000 acs. in the vicinity unproductive. Relationship between the Walawe Scheme and the Kachigala one is shown in Fig. 5.5.1-1.

b) Prevention Works for Floods

i. Anicuts

Mahaweli Authority constructed the Maha Jandura anicut at Majandura across Kachigala Ara. Irrigation Department also constructed Maha Bemma anicut and Buweliara (Galamuna) anicut is now under construction. These anicuts were planned to prevent and reduce the floods (refer to Fig.5.5.1-2).

ii. Works in Kachigala Ara Tail End

The catchment area of Kachigala Ara Basin drains into two lagoons namely Kalametiya and Lunama Kalapuwa situated close to the sea via Kachigala Ara, Lunama Ela and Mini - Ethiliya Drainage Canal.

Irrigation Department constructed a 40 ft wide sea outfall canal, named Kalametiya outfall, to keep the sea mouth open. In 1976 under the World Food Program, a Lunama outfall canal 3,168 feet (950 m) long was launched but was abandoned in 1977 due to unsuitable site condition. At the moment, Mini-Ethiliya and Lunama drainage canal are silted and overgrown with water weeds.

c) The Complex Mechanism of Lagoon Water Level

It is said, when water level of Kalametiya Lagoon is reduced to + 2.0 feet MSL the sea outfall canal ceases to function; then the sand bar starts to form and close the canal.

When the water level attains + 3.0 feet MSL, about 1,000 Acs. of paddy fields get inundated. If the water level rises to + 4.0 feet MSL the affected people particularly the farmers cut the sand bar; as a result prawns and fishes escape into the sea.

(2) Present Condition of Irrigation System in the Schemes

a) Command Area

During site survey the command area identified by the Study Team in consultation with ID Hambantota and MECA Embilipitiya as irrigation rehabilitation project, is as follows:

Irrigation Sub-Area	Command Area (ha)
Buweliara Anicut (Galamuna)	132
Mahabenmma Anicut	222
Hatagala Anicut	162
Total	516

Present Cropping pattern is shown in Fig.5.5.1-3

b) Present Condition of Anicut Irrigation System

Before floods in 1969, under Mahabenmma Anicut and Galamuna Anicut, 300 ha and 60 ha of paddy were cultivated respectively. These Anicuts were reconstructed under IRDP program and at present O&M is under ID. Hatagala Anicut area is located between Kachigala Ara and Mini-Ethiliya drainage canals which extend up to Kalametiya Lagoon. When Udawalawe project came into operation, the systems began to face inundation problems and damage. A masonry dam constructed in 1958 was washed out in 1981 due to heavy floods. In 1984, Hatagala Anicut was reconstructed a little below the original site, yet the canal system has not been developed due to floods.

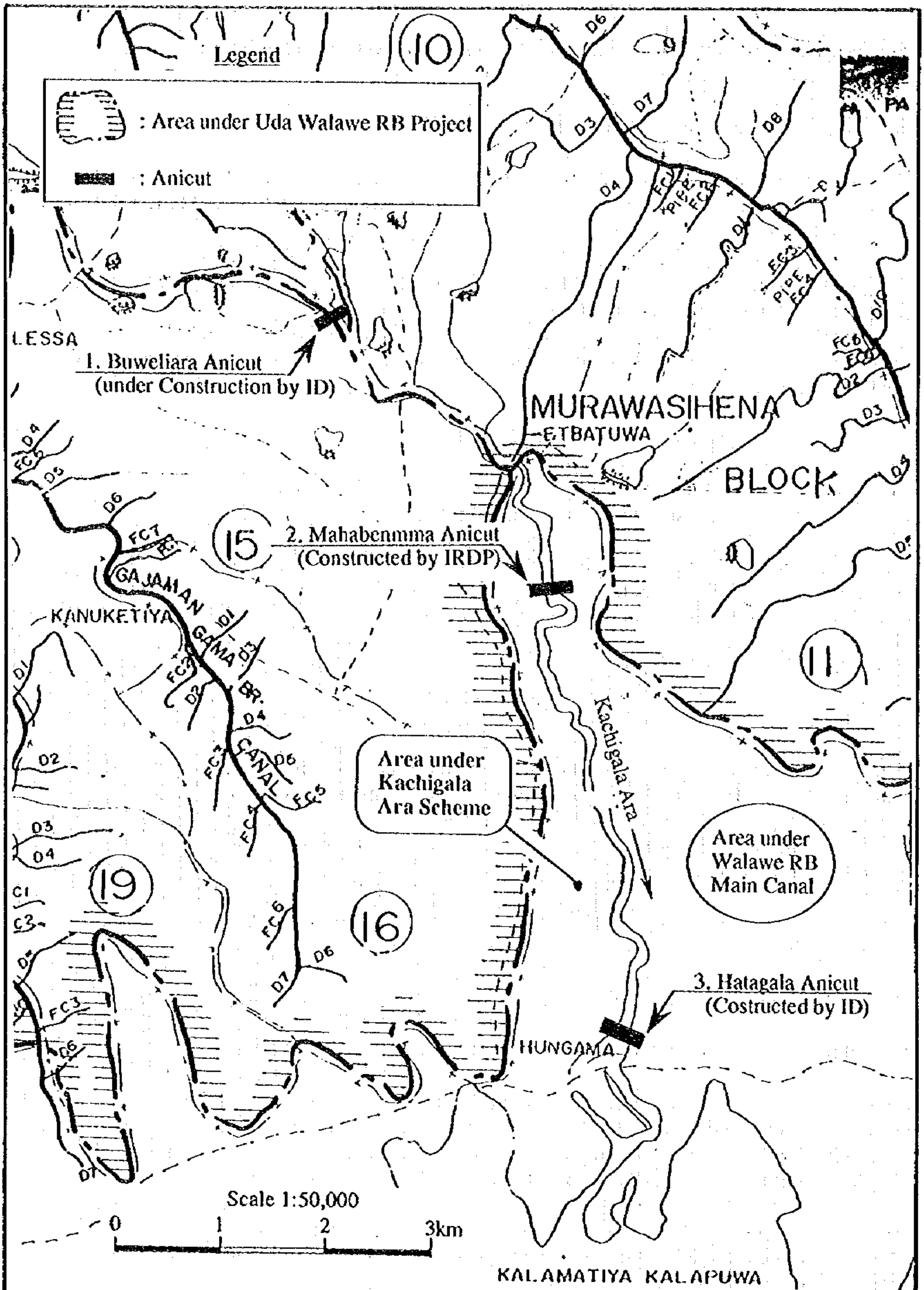
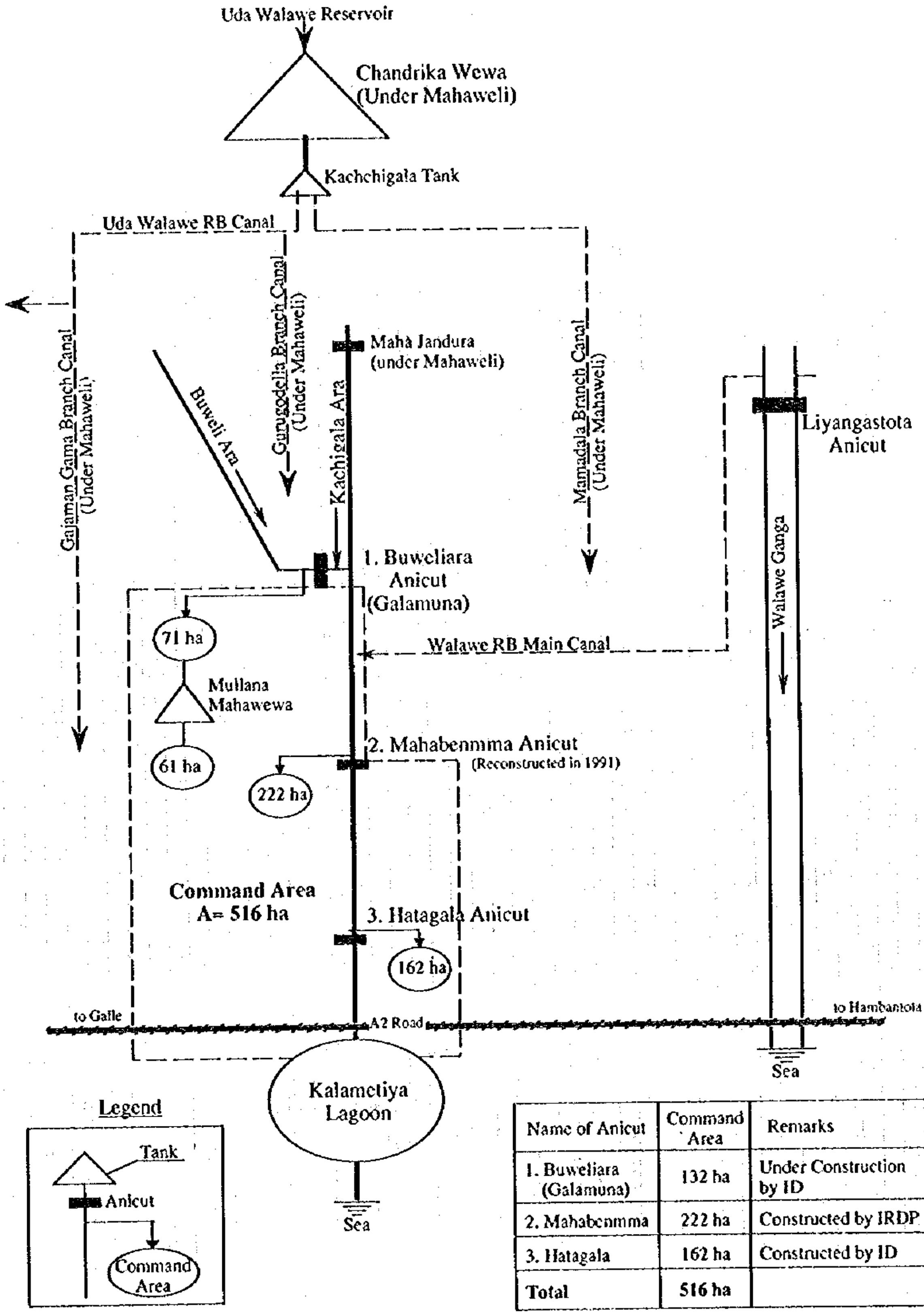


Fig. 5.5.1-1 Kachigala Ara Area under Uda Walae RB Project



Name of Anicut	Command Area	Remarks
1. Buweliara (Galamuna)	132 ha	Under Construction by ID
2. Mahabenmma	222 ha	Constructed by IRDP
3. Hatagala	162 ha	Constructed by ID
Total	516 ha	

Figure 5.5.1-2 Schematic Diagram of Kachigala Ara Scheme

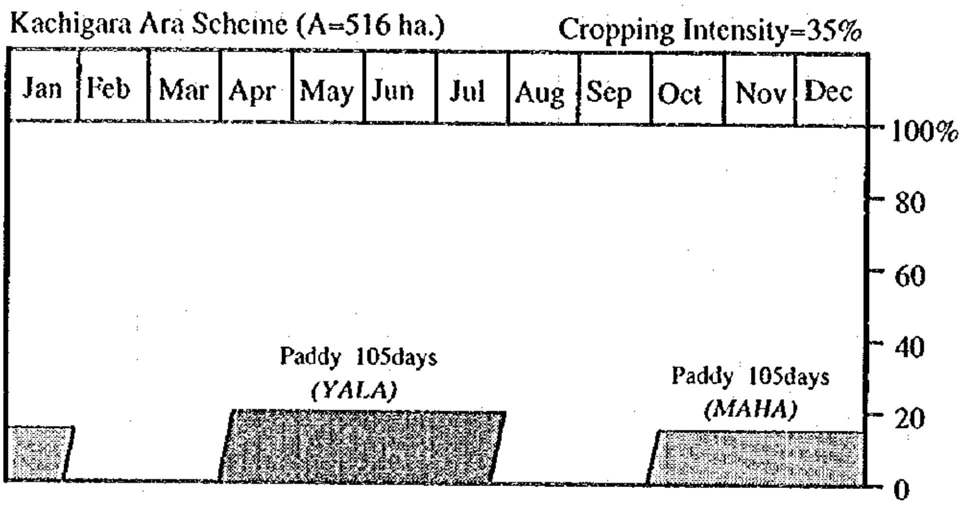


Fig.5.5.1-3 Present Cropping Pattern for Kachigara Ara Scheme

5.5.2 Agriculture

(1) Land Use and Farm Family

Land Use

This scheme area had held 516 ha of irrigable paddy land by the Kachigala Wewa and Chandrika Wewa situated in upper reaches of the scheme.

In rainy season the lower valley of Kachigala Ara scheme area flooded and most of all the paddy land has become no cultivable.

At present paddy cropping area is only 103 ha in Yala and 77 ha in Maha.

Farm Family

Numbers of farm families are roughly estimated at 645 with calculating from 0.8 ha of average land holdings in 516 ha of total irrigable area.

(2) Crop cultivation and Cropping pattern

Paddy Cultivation

Farming practices are almost as same as other drainage schemes with the yield standard of 3.0-3.2 t/ ha.

Cropping Pattern

Present cropping pattern and cropping intensity in Kachigala Ara scheme is as follows.

Name of Season	Present		
	Crops	CI (%)	Benefitted Area (ha)
Yala	Paddy	20	103
Maha	Paddy	15	77
Total		35	180

5.5.3 Farmer Organizations

FOs have been organized recently by the Agrarian Services Department. There are said to be about 300 members. In the absence of a working irrigation system, it was not possible to obtain accurate information. Further, in the absence of an organized cultivation program there is no regular role for FOs to play. Currently they are organized as an interest group to improve the drainage and irrigation facilities of the scheme.

5.5.4 Management of System

In the scheme, there exist two Anicuts; Mahabenmma and Hatagala. They were reconstructed by IRDP and ID, respectively, while their irrigation systems were not developed due to the prevailing inundated condition in the benefitted areas.

These Anicuts are managed by ID. The catchment area of Kachigala Ara Basin drains into two lagoons namely Kalametiya and Lunama Kalapuwa through Kachigala Ara, Lunama Ela and Mini-Ethiliya Drainage Canal.

Both of these Drainage Canals do not well function because of poor maintenance which develops silting and water weed growing in them.

5.5.5 Environmental Issues

(1) Soil and Water Quality

Soil Sampling

For checking sea water intrusion, 3 soil samples were collected and analyzed. Location of sampling sites and results of analysis are given in Fig.5.2.5-1 (5/6) and Table 5.2.5-1.

As a result of theanalysis, the influence of sea water intrusion in the soils was observed in the downstream part of the scheme, near the Kalametiya lagoon. At present, most of the area under the influence of sea water intrusion has been abandoned due to being flooded (sample No. K-2 and 3).

Water Sampling

For checking quality of irrigation water, some sample was collected and examined. Location of sampling site and results of analysis are given in Fig.5.2.5-1 (5/6) and Table 5.2.5-2.

As a result of the analysis, water quality is suitable for cultivation.

(2) Poor Drainage and Flood Damage

During flooding, water flows over highway A2 to inundate the northern side. In the area of highway A2, inundation depth is 50 cm and reaches 1 m depth near Kalametiya kalapuwa.

Kalametiya kalapuwa is connected to the sea by and unblocked, 10 m wide channel. However, drainage capacity is insufficient during floods, and farmers accordingly excavate the sand banks along the channel prior to the onset of the monsoon.

In 1968, Udawalawe dam was constructed in the Walawe basin, with drainage from the 2,200 ha benefit area of the Udawalawe right bank scheme being discharged into Kachigala ara. This substantially increased the "real" catchment of the said basin which was originally around 220 km^2. Although a number of tanks were destroyed by flooding in 1969, these were not reconstructed as irrigation to the Udawalawe right bank scheme remained sufficient. Tanks at various locations were also modified, with the result being that ponding capacity in the basin dropped. Now, even moderate rain can cause flooding that renders farm land downstream untillable.

With increased drainage discharge from the Udawalawe right bank scheme project, the salt concentration in Kalametiya kalapuwa has decreased impacting on catches of shrimp and other species.

(3) Wildlife

Kalametiya and Lunama Kalapuwa are designated sanctuaries since 1938 at the mouth of Kachgala Ara. In 1984 they were re-registered at a reduced area of 700 ha (1,760 ac) corresponding to full supply level of the lagoons. While Lunama kalapuwa is cut-off from the sea, Kalametiya is connected to the ocean by a narrow, 2 km long channel. Historically, rainfall in the Kachigala Ara basin ran off, via the irrigation schemes in the basin, into the Kalametiya kalapuwa and salt water entered the same via intrusion through the lagoon mouth and seepage through the sandbars. Nevertheless, construction of the Udawalawe dam in 1967 greatly altered the upstream hydrology, causing an increase in drainage from farmland.

Although Kalametiya kaoapuwa is connected to the sea via a channel constructed in the late 1960's, the channel has insufficient capacity for effective flood drainage. As a result, area farmers excavate a supplementary channel though the sand bank on the side of the said channel.

Fifty two indigenous species of common higher plants have been identified in the area. There also exists a broad mangrove forest on the eastern side of Kalametiya lagoon. Forty seven species of fish have been identified, of which 2 are globally threatened species, 2 are nationally threatened species and 6 are endemic species. Of the 47 confirmed species of reptile in the area, roughly 70 percent are either globally threatened, nationally threatened or endemic species. In the case of officially confirmed bird species, 4 are nationally threatened. For mammals, 20 species have been identified and 9 are classified as nationally threatened or endemic. It can thus be seen that the area constitutes an important wetland ecosystem with a wealth of rare and endangered species of both flora and fauna. According to local residents, wild elephants were seen on the west side of the lagoon as recently as the early 1970's; however, these have since disappeared from the area with encroachment of human settlement.

(4) Fishery

In Kalametiya Kalapuwa, 40 fishermen (25 families) are engaged in fishing, with total monthly catch of 1,470 kg with an income value of Rs 131,000, equivalent to a per person monthly income of Rs 3,300. Shrimp accounts for 73% of total catch weight and about 89% of total income from fishing in the lagoon.

In the case of Lunama Kalapuwa, 30 fishermen work the waters catching a monthly 610 kg of fish worth a total monthly income of Rs 29,000, equivalent to a monthly per person income of Rs 970. Shrimp accounts for 19% of total catch weight and about 44% of total income from fishing in the lagoon, a considerably lower rate than for Kalametiya Kalapuwa highlighting the fact that the environmental status of the two (salt concentration, etc.) is quite different.

Fishing is carried out perennially in both lagoons, and in both cases catches have decreased over the past 10 years.

Fishing is also done along the coast of the area.

(5) Water Use

Under the Hugama Water Supply Scheme, design discharge of 364 m^3/day is being diverted for a design supply population of 5,700 since 1981.