CHAPTER 11 IMPLEMENTATION PLAN AND COST ESTIMATE

11.1 Implementation Plan

11.1.1 General

The Project consists of the following development programmes: awareness programme, strengthening of FOs, stable crop production and crop diversification, income generation, improvement of marketing and credit, rehabilitation and irrigation facilities, improvement of water management, improvement of farm roads, improvement of support system, research programme for integrated development of cascade system, etc. The implementation plan of these programmes is formulated, taking the following points into account.

a) Implementation of the programme through farmers' initiative
b) Close co-ordination between the executing agencies and farmers
c) Enough time for the implementation of the development programmes
d) Maintaining transparency during the implementation of the programmes
e) Strengthening of grass-root level activities

GSL has a restructuring plan of the Provincial Government, and it is being implemented in the North Central, North Western and Central Provinces. The study on the project executing agencies was, therefore, made on the basis of the organisational structure of the Regional Province as of July 1999.

11.1.2 Project Executing Agencies

The Irrigation Management Division (IMD) of the Ministry of Irrigation and Power (MIP) would be the executing agency of the programmes. In connection with the implementation of the programme, IMD would co-ordinate all activities of the relevant government agencies and regional organisations. Figure 11.1.1 shows the proposed institutional set-up for the implementation and management of the programmes.

The Master Plan consists of various programmes, and many government agencies at central and provincial levels will participate in the implementation of these programmes. The agencies concerned are shown below:

Implementing Agencies of the Development Programmes

Development Programmes		Implementing Agencies										
		PDOA/ IPEU	DOI	PED	IMD	DAS	PDAPH	NAQDA	NYSC	NAITA	DS	KARTI
Awareness Programme												●
Strengthening of FOs and community development	Major scheme				●							
	Medium & Minor schemes					●						
Agricultural development (stable crop production and crop diversification)		●										
Income generation	Home garden development	●										
	Livestock development						●					
	Fishery development							●				
	Vocational Training								●	●		
	Small enterprises and business development										●	
Improvement of marketing						●						
Improvement of credit						●						
Rehabilitation and improvement of irrigation facilities	Major & Medium Schemes		●									
	Minor Schemes			●								
Improvement of water management	Major Schemes				●							
	Medium Schemes		●									
	Minor Schemes					●						
Improvement of farm roads			●									
Strengthening of agricultural support services		●				●	●	●				
Research programme of cascade system and subsurface water						●						
Monitoring and evaluation					●							

PDOAs : Provincial Department of Agriculture
IPEU : Inter Provincial Extension Unit
DOI : Department of Irrigation
PED : Provincial Engineering Department
IMD : Irrigation Management Division
DAS : Department of Agrarian Services
PDAPH : Provincial Department of Animal Production & Health
NAQDA : National Aquaculture Development Authority
NYSC : National Youth Service Council
NAITA : National Apprentice & Industrial Training Authority
DS : Divisional Secretariat
KARTI : Kobbekaduwa Agrarian Research and Training Institute

In order to co-ordinate all these agencies at central and provincial levels, it is proposed to set-up the following co-ordination committees.

Proposed Co-ordination Committees

Co-ordination Committees	Main Activities
1) Central Project Co-ordination Committee (CPCC)	- Co-ordinating of all implementing agencies at central level - Co-ordination with provincial governments - Approval of annual work programme (AWP) - Budget arrangement - Deployment of central level staff - Project monitoring & progress control
2) Provincial Project Co-ordination Committee (PPCC) - NCP	- Inter-provincial co-ordination - Necessary provincial budget arrangement - Deployment of provincial level staff arrangement
3) Provincial Project Co-ordination Committee (PPCC) - CP & NWP	- Inter-provincial co-ordination - Necessary provincial budget arrangement - Deployment of provincial level staff arrangement

Under CPCC, the Project Management Unit (PMU) would be established in the

project site, which has direct responsibility for the implementation of the programmes. The organisational structure of PMU is shown in Figure 11.1.2. In order to manage the implementation of the programmes effectively, PMU has the following seven sub units:

Sub-units of PMU

Proposed Sub Units	Development Programmes covered by Sub Units	Implementing Agencies Concerned
1) Administration		
2) Construction	- Rehabilitation and improvement of irrigation facilities - Improvement of farm roads	DOI PED
3) O&M of irrigation schemes	- Improvement of water management - Research programme of cascade system ans subsurface water	DOI IMD DAS
4) Farmers' supporting / credit	- Strengthening of FOs and community development - Strengthening of rural marketing - Improvement of credit	DAS IMD
5) Agricultural supporting	- Agricultural development (stable crop production and crop diversification)	PODA/IPEU
6) Income generation/social services	- Income generation & social services	PODA/IPEU, PDAPH, NAQDA, NYSC, NAITA, DS
7) Monitoring and evaluation	- Monitoring and evaluation - Workshop with farmers/PCM - Monitoring for environment - Awareness programme	IMD KARTI

The main tasks of PMU are listed below:

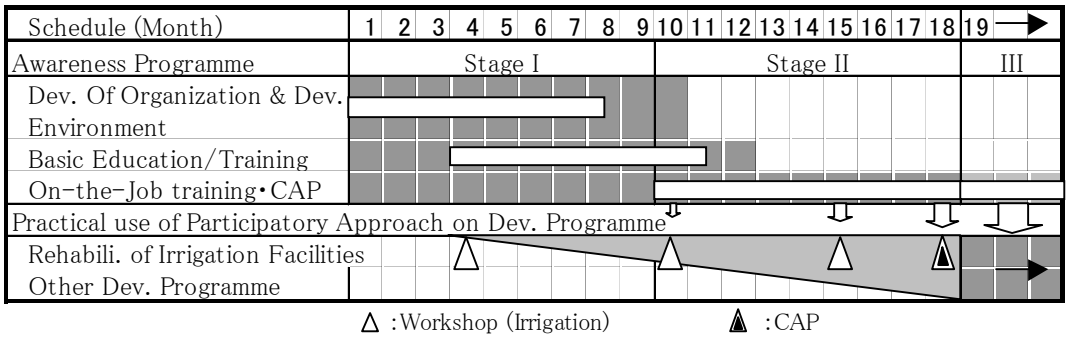
a) Preparation of annual work plan (AWP) including budget,
b) Financial management for the implementation of the programmes,
c) Co-ordination of agencies concerned,
d) Implementation of awareness programme for officers and farmers,
e) Monitoring and supervising of implementation and financial status of the programmes,
f) Workshop with farmers (FOs) or PCM during the implementation of the programmes, and
g) Programme review based on monitoring and workshop/PCM.

During the implementation of the programme, PMU will hold workshop with farmers (FOs) or PCM, and review all programmes, every year. PMU should open all information obtained through the monitoring and evaluation to the public, in order to maintaining transparency of the implementation of the programmes.

11.1.3 Awareness Programme through Process Oriented Community Development

The awareness programme is to be implemented in the major irrigation schemes in about one and a half years, and in the smaller irrigation schemes in about one year. The awareness programme would be implemented in three stages, as shown below.

Process of the Awareness Programme and Relations with Dev. Programme



During the first stage, in order to share the development principles among all those who will be associated with the development project, education and training programmes will be conducted to build ideas and motivate them towards participatory development.

In the second stage, basic administrative, procedural, legal and technical knowledge will be provided through education/training programmes. In addition participatory surveys by the community will enhance and provide knowledge of actual ground situation to the participants. Further, these experiences and the knowledge gained will be utilised during the Community Action Planning (CAP) Workshop.

In the third and final stage, the development components, earlier identified by the Study Team, will be included in the Community Action Plan (CAP) to be implemented with consensus of the community, based on their initiative and sense of self-reliance.

11.1.4 Rehabilitation / Improvement Works for Irrigation Infrastructures

(1) Getting Consensus of Farmers to Formulate the Rehabilitation Plan

As mentioned in Section 4.5, the approaches on how to get consensus of farmers for formulation of the rehabilitation plan have been established in the previous project, such as ADB and IDA funded project. The system would also be applied to the Master Plan, strengthening links between the government officials and the farmers throughout the awareness programme indicated in the preceding section. The meetings held three times during the survey, investigation, and design period are featured by the workshops, in which components of the rehabilitation works with its cost will be discussed and decided. All farmers are entitled to attend the meetings so as to express their intention for the works. The decisions should be documented and presented in the public area to ensure the transparency of the process of the works.

(2) Survey, Investigation, and Design

The survey and investigation, such as the inventory survey of the existing facilities, canal route survey, will be conducted by the government staff in co-operation with the farmers as much as possible. The farmers intention where the facilities are rehabilitated / improved will be collected throughout the survey and the workshops and they will be incorporated in the plan. Once the basic consent by farmers to the plan is obtained, the design with cost estimate will be carried out and discussed in the workshop, where a decision will be made on how the total cost will be shared between the government and farmers.

(3) Tendering and Contracting

In the major and medium irrigation schemes, the rehabilitation / improvement works of D and F-canal systems will be carried out by the farmers, while those of headworks and main canal systems will be carried out by a private contractor. The minor irrigation schemes will be rehabilitated / improved by the farmers. For the rehabilitation works by the farmers, it will be contracted to FO. The farmers should share 10% of total rehabilitation / improvement cost for D and F-canal systems of the major and medium schemes and all canal systems of the medium schemes.

(4) Monitoring Progress of Rehabilitation Works

The progress of the rehabilitation / improvement works will be monitored by ID and PED in each province. The monitored data will be forwarded and compiled to the Sub Unit Construction of PMU to grasp overall status of the programmes, such as:

a) Overall progress of rehabilitation / improvement of scheme facilities,
b) Quality of rehabilitation works done by the farmers' organisations, and
c) Cost invested to the programmes.

(5) Quality Control for Rehabilitation Works

In line with the concept for the participatory approach, the rehabilitation / improvement works for the distributary and field canals will be contracted out to farmers' organisations as much as possible, with some of the costs covered by them providing labour. In such case, it will be required that the government staff take necessary quality control measures to keep the works implemented by farmers up to a normally acceptable level. The following points will be taken into consideration:

a) The design of on-farm facilities necessary for restoration work should be

standardised as much as possible, and no complicated rehabilitation method should be adopted from the standpoint of farmers' works.

b) Before awarding to farmers' organisations, the training programme for rehabilitation works will be implemented to them.

c) The quality of the farmer's rehabilitation works will be monitored with those progress through the monitoring system. Then, based upon the result of monitoring and evaluation, necessary technical guidance will be provided to farmers' organisations during the rehabilitation works.

(6) Joint Inspection and Operation for Irrigation Facilities

In case that the rehabilitation works are carried out by a private contractor, as soon as the works are completed and water issue is commenced, a joint inspection should be carried out by a team consisting of the Engineer's Representative, who is responsible for supervision of the rehabilitation of irrigation facilities, and farmers' representative so as to check irrigation defects and clarify work to be done during the defects liability period. The inspection results should be agreed mutually and records kept in proper manner. This inspection is essential for turnover of O&M to the farmers. At first, for about one year, the irrigation facilities would be operated and maintained jointly by both the government staff and farmers' organisations. Throughout such operation, the O&M skills should be transferred to the farmers.

On the other hand, in the case of the irrigation schemes, in which rehabilitation works are carried out by farmers themselves, the period of joint operation would be not considered but O&M by farmers will commence immediately.

(7) Promotion of Turnover

The turnover is carried out carefully taking progress of outstanding works and capability of the farmers' organisation into account. The documents necessary for the turnover, such as description of the canals with their related structures, water issue trees, will be compiled by the engineers attached to the ID and PED offices.

(8) O&M by Farmers

The O&M of distributary and field canals will be carried out by the farmers' organisation except remedial works due to disasters. Technical instruction and guidance by the engineers will be carried out continuously.

11.1.5 Implementation Schedule

The development programmes consist of five major items: (i) mobilisation of PMU, (ii) awareness programme / training programme, (iii) implementation of development programmes, (iv) monitoring and evaluation, and (v) project evaluation and follow-up programme. The period required for implementation of these works are estimated as follows, based on their work volumes and referring to the relevant ongoing projects.

Implementation Period for Development Components

Major Project Works		Period (Years)
1. Mobilization of PMU (including CPCC & PPCC)		3 (months)
2. Awareness Programme		1.5
3. Implementation of the Development Programmes		1.5
1) Strengthening of FO		5
2) Rehabilitation and improvement of irrigation facilities and farm roads	One major scheme	
	- Survey, design & tendering	2
	- Construction and supervision	2-3
	One medium or minor scheme	
	- Survey, design & tendering	1
	- Construction and supervision	1
3) Strengthening of agricultural support facilities (farmer centre, etc.)		2-3
4) Improvement of water management, stable crop, production and crop diversification, improvement of marketing and credit, income generation		5
5) Research programme of cascade system and subsurface water		5
4. Monitoring and Evaluation (including base line survey, bench mark survey, workshop with farmers, PCM, monitoring of environment)		8
5. Project Evaluation and Follow-up Programme		1 - 1.5

Figure 11.1.3 shows the proposed implementation schedule of overall programmes. Total period of the implementation is supposed to be 8 years, which includes all works mentioned above.

Prior to commencement of the development programmes such as strengthening of FO and rehabilitation works, the awareness programme should be carried out not only to farmers but also to officers and front line staff. During the whole implementation period, monitoring and evaluation will be carried out by PMU, and the result will be fed back immediately to control progress and to review the development programmes. After completion of all development programmes, the programmes should be evaluated, and the follow-up programme will be implemented during one and half years.

11.2 Cost Estimate

(1) Rehabilitation and Improvement Costs of Irrigation Facilities and Farm Roads

The rehabilitation and improvement cost of irrigation facilities including farm roads for respective schemes is estimated on the basis of the following conditions,

mainly for economic evaluation of each scheme.

a) Exchange rates used for the estimate are US$ = 71Rs as of January 2000.
b) Direct cost for civil works are estimated by "Unit Rates for Construction works 1999 MIP" and "Rate Analysis for 1999 ID Kurunegala."
c) Overheads and profit factor is estimated at 26% of direct cost in major and minor schemes, and as 21% of direct cost in minor schemes.
d) The rehabilitation cost includes physical contingency which is estimated at 10% of civil cost as pre-feasibility level estimates.

The rehabilitation and improvement costs for the respective schemes were estimated as follow, and details are shown in Table 11.2.1.

Rehabilitation and Improvement Costs of Irrigation Facilities and Farm Roads
(Excluding Price Contingency and G.S.T.)

	Commanding Area (ha)	Direct Cost (Rs. Million)	Contingency (Rs. Million)	Total (Rs. Million)	Cost per Hectare (Rs./ha)	Cost per Hectare (US$/ha)
Major	14,167	1,194	179	1,373	96,900	1,370
Medium	1,510	104	11	115	76,200	1,070
Minor	2,509	106	5	111	44,200	620
Total	18,186	1,404	195	1,599	87,900	1,240

(US$1.00 = Rs.71)

(2) Capital Costs for Project Management and Support Facilities

The Project provides various buildings, vehicles and equipment for strengthening of agricultural support system including agricultural extension, income generation, etc. Their capital costs were estimated as follows:

Capital Costs for Project Management and Support Facilities
(Excluding Price Contingency and G.S.T.)

(Unit: Rs.1,000)

Items	Amount	Remarks
1. PMU	32,000	Vehicles, equipment
2. O&M Equipment	91,680	
3. Construction of Farmer Centres	238,920	181Nos.
4. Strengthening of Agricultural Support Services		
4.1 Institutional Strengthening Programme for Agricultural extension	11,700	Strengthening of IPEU, PODA
4.2 Strengthening of Farmers / FOs Support Facilities	9,300	ASC
4.3 Support programmes for income generation	28,860	Upgrading of Seed Farm (seedling), IFTC, Nikaweratiya, IFTC, Nikaweratiya, and Acquaculture Extension Centre
4.4 Strengthening RPM Office	1,200	
5. Contingency (5%)	20,620	
Total	433,080	

(3) Costs for Awareness and Training Programmes

The Project implements various training programmes to not only farmers/FOs but

also officers concerned.

Costs for Awareness and Training Programmes
（Excluding Price Contingency and G.S.T.）

(Unit: Rs.1,000)

Items	Amount	Remarks
1. Awareness Programme and Training Programmes		
1.1 Awareness Programme	108,790	
1.2 Training of FO's Leaders	17,430	
2. Training for construction supervision, water management, and O&M of irrigation facilities	15,070	Training for the government staff and farmers
3. Agricultural Support Programmes for Farmers	55,830	Extension of OFC, Income generation programmes, etc.
4. Strengthening Agricultural Support Programmes for Extension Officers		
4.1 Institutional Strengthening Programme for Agricultural Extension	18,410	Training for staff in IPEU and PDOA
4.2 Strengthening of Farmers / FOs Support Institutions	6,050	Training for DO/ASC, and Animators
5. Follow-up Programme	8,830	10% of 1.2, 2, and 3
6. Contingency (5%)	11,520	
Total	241,930	

(4) Costs for Administration of PMU and Engineering

The cost for management of the programmes during the entire project period of 8 years was estimated to be Rs.71.5 million. The engineering works including survey, planning, detailed design, etc., were estimated at 10% of rehabilitation and improvement, capital for project management and strengthening of support system, and awareness and training programmes.

(5) Total Project Cost

The total project costs including all irrigation schemes were estimated to be Rs.2,668 million (US$ 37.6 million), excluding price escalation. The costs per hectare was estimated at Rs.146,700 (US$ 2,070), and the rehabilitation and improvement costs of irrigation facilities and farm roads account for 60% of total costs. The project costs of each scheme are shown in Table 11.2.1.

Total Project Costs（Excluding Price Contingency and G.S.T.）

(Unit: Rs. Million)

		Commanding Area (ha)	No. of Farm Households (No.)	No. of FOs (No.)	Project Costs					
					Rehabilitation Cost	Capital for Support Facilities	Awareness and Training Programmes	Administration Cost*1	Engineering Cost	Total
Major		14,167	18,100	111	1,373	281	145	128	180	2,107
Medium		1,510	1,800	18	115	38	24	15	18	210
Minor		2,509	5,400	78	111	114	73	23	30	351
All		18,186	25,300	207	1,599	433	242	166	228	2,668
Proportional Extent					60%	16%	9%	6%	9%	100%
Cost per Hectare	(Rs./ha)				87,900	23,800	13,300	9,200	12,500	146,700
	(US$/ha)				1,240	330	190	130	180	2,070

*1 Including capital of revolving loan (Rs.87 million) and physical contingency (Rs.8.5 million).
Note: Exchange rate: US$ 1.0 = Rs.71

CHAPTER 12 PROJECT EVALUATION

12.1 General

The project evaluation is carried out through estimation of the EIRR, the Benefit Cost ratio (B/C), and benefit minus cost (B-C) for each scheme. The project evaluation was based on the following assumptions:

a) As the project costs comprise primarily construction costs for rehabilitation of existing irrigation systems, the project life is assumed to be 25 years.
b) All values are expressed in 1999 constant Sri Lankan Rupees. For internationally traded goods, prices were obtained from the latest World Bank Commodity Forecasts as appear in Global Commodity Markets (February 1999) while those for non-traded goods are based on domestic financial prices. Appropriate adjustments were made for freight, handling, processing, and quality differentials.
c) The exchange rate of US$ 1.00= Rs. 71.00 (January 2000) is used.
d) Given insufficient information to quantify many of the benefits from infrastructure and social amenities as well as environmental benefits, the economic analysis considers agricultural production from the rehabilitated works only. These consist of increased cropping intensity due to increased availability of water, increased yields due to more reliable water supply and the new additional cultivated areas as a result of increased water from the rehabilitated works.
e) In order to evaluate each irrigation scheme, it is assumed that the constructions of all irrigation schemes commence simultaneously.

In addition to this economic evaluation, farm budget analysis under with project condition was also made to evaluate the improvement of farm economy and to clear the farmers' solvency for irrigation service charge.

12.2 Economic Evaluation

After identification and quantification of all costs and benefits, economic prices were applied to estimate the impact on the national economy. Several conversion factors were estimated to convert financial prices to economic values as follows:

(1) Conversion Factors and Prices of Products

In order to evaluate project costs and benefits in terms of world market prices, the

Standard Conversion Factor (SCF) was estimated using trade data (imports and exports values for the five most recent years) and is applied to all non-traded goods and services. The calculated SCF is estimated at 0.95.

Conversion factors were also estimated for agricultural inputs, namely for fertilisers, agro-chemicals, and seeds as 0.84, 0.71, and 0.73, respectively. The shadow wage rate of unskilled labour was estimated at 0.55, based on the recent project which was implemented in the Study area. Economic farm gate price of internationally traded commodities of rice and maize were estimated using international market price forecasts by IBRD in Global Commodity Markets in 1999 current prices. Financial prices were collected during the fieldwork at the farm gate and these prices for locally traded agricultural commodities were converted to economic values using the SCF.

(2) Economic Costs

The economic project costs of all irrigation schemes were estimated, based on the financial project costs. The economic cost of each scheme is shown in Table 12.2.1, and the total cost of the whole schemes is summarised below. Replacement costs were estimated at 1% of capital costs for rehabilitation and improvement of irrigation facilities, and agricultural support facilities and equipment. Annual economic O&M costs of the irrigation facilities were estimated based on the financial O&M costs (Rs.2,000/ha/year for the major irrigation schemes and Rs.1,500/ha/year for the medium and minor irrigation schemes) multiplying by a conversion factor[11] of 0.67. Annual economic O&M costs for agricultural support facilities and equipment were estimated at 1% of those total investment costs.

Total Economic Costs

(Unit: Rs. million)

	Financial Cost	Conversion Factors	Economic Cost
Rehabilitation and Improvement Costs	1,599.2	0.95	1,519.3
Project management and support facilities	433.1	0.95	411.4
Awareness and Training Programmes	241.9	0.95	229.8
Administration Cost	166.5	0.95	158.1
Engineering Cost	227.4	0.95	216.1
Total	2,668.1		2,534.7

(3) Economic Benefits

The net incremental benefit valued in economic terms is the increase in value of agricultural production as a result of the rehabilitation and improvement to the irrigation schemes. Based on the economic crop budgets of each crop under with

[11] Conversion factor for economic O&M costs = material costs 30% x SCF 0.95 + labour cost 70% x SWR 0.55 = 67%

and without project, the annual incremental benefit of each irrigation scheme was estimated as shown in Table 12.2.2, and total benefits of the whole scheme are summarised below.

Total Annual Incremental Benefit

(Unit: Rs. million/year)

	Without Project	With Project	Incremental Benefits
Major Schemes	341.7	768.6	426.9
Medium Schemes	25.6	77.1	51.5
Minor Schemes	35.6	93.7	58.1
Total	402.9	939.4	536.5

(4) Economic Internal Rate of Return

Based on the project economic costs and annual incremental benefits, the EIRR, B/C, and B-C are estimated as follows. The B/C and B-C were based on a discount rate of 10%.

Results of Economic Evaluation

Code No.	Name of Schemes	Economic Cost (US$/ha)	Economic Benefit (US$/ha)	EIRR (%)	B/C	B-C (Rs. Million)
1MA-01	Nachchaduwa Wewa	2,818	743	17.2	2.38	521
1MA-02	Nuwarawewa	1,356	404	20.7	2.48	133
1MA-03	Tissawewa	1,583	325	14.3	1.69	23
2MA-01	Rajangana Wewa	2,375	375	9.5	1.27	197
4MA-01	Palukadawela	1,504	483	21.2	2.65	137
4MA-02	Attaragalla Wewa	645	315	22.5	3.18	44
4MA-03	Abakola Wewa	1,348	337	15.0	1.86	28
5MA-01	Magallewewa	1,256	256	10.5	1.28	55
1ME-01	Thuruweli Wewa	1,117	462	25.2	3.40	37
1ME-02	Eru wewa	3,244	489	10.4	1.26	2
1ME-03	Uttimaduwa Wewa	1,867	515	20.2	2.44	15
1ME-04	Periyakulama	3,433	426	9.2	1.13	2
1ME-05	Maminiya Wewa	2,544	457	13.8	1.63	19
1ME-06	Mahabulankulama	2,742	537	14.7	1.76	11
2ME-01	Angamuwawewa*1					
4ME-01	Mahananeriyawewa	1,976	667	23.9	3.01	36
4ME-02	Mahagalgamuwawewa	2,147	179	4.8	0.74	-6
5ME-01	Hulugalla Wewa	1,034	652	35.6	5.14	32
6ME-01	Meddeketiya Wewa	1,489	575	23.9	3.16	19
6ME-02	Moragoda Anicut	961	496	29.4	4.07	36
I	8 Minor Schemes	1,607	275	12.3	1.45	13
II	8 Minor Schemes	1,602	183	7.5	0.97	-1
III	10 Minor Schemes	1,876	444	16.2	1.99	45
IV	9 Minor Schemes	1,363	337	17.0	2.05	31
V	10 Minor Schemes	2,334	252	5.3	0.69	-8
VI	11 Minor Schemes	1,908	302	11.2	1.34	12
VII	10 Minor Schemes	2,353	362	11.1	1.33	12
VIII	10 Minor Schemes	1,810	313	12.0	1.44	13
IX	4 Minor Schemes	1,634	459	18.4	2.30	18
All Schemes		1,962	415	13.6	1.37	730

*1 Part of Rajangana irrigation scheme

12.3 Farm Budget

(1) Farm Budget Analysis

In order to evaluate the improvement of farm economy and to clear the farmers'

solvency for irrigation service charge, the farm budgets of farmers under with and without project conditions were analysed, as shown in the following table. Present holding size, cultivation extent, and farm budget in the table were obtained from the result of the farm economic survey carried out by the Study Team in 1999, and indicate figures of one year in the 1998 Yala and 1998/99 Maha seasons. Increase in incomes under with project includes only agricultural production consisting of increased cropping intensity due to increased availability of water, increased yields due to more reliable water supply and the new additional cultivated areas as a result of increased water from the rehabilitated works. Other incomes obtained through income generating plan are not included in the analysis, because no reliable data is available for estimating them.

Farm Budget Analysis

Holding size of irrigated paddy field	Present			With Project		
	Average	0.4-0.8 ha	Below 0.4 ha	Average	0.4-0.8 ha	Below 0.4 ha
(No. of samples)*1	1,500	476	321			
(Proportional Extent)	100%	32%	21%	100%	32%	21%
I. Extent of irrigated paddy field (ha/household)	0.75	0.47	0.21	0.75	0.47	0.21
II. Cultivated area (ha/ household)	0.81	0.64	0.38	1.24	0.81	0.41
III. Farm budget (Rs./household/year)						
1) Gross income	96,800	81,200	66,900	146,600	108,900	77,500
- Farm income	33,600	24,000	11,800	76,500	47,600	21,000
- Non farm income *2	60,500	55,200	53,900	60,500	55,200	53,900
- Loan	1,700	1,200	900	8,600	5,300	2,300
- Others	1,000	800	300	1,000	800	300
2) Gross outgoing	77,500	65,400	63,600	99,300	78,000	67,700
- Production cost *3	17,900	12,000	6,200	31,300	19,600	8,400
- Loan repayment *4	700	600	500	9,100	5,600	2,400
- Living expenditure *2	58,700	52,700	56,900	58,700	52,700	56,900
- その他	200	100	-	200	100	-
3) Net income	19,300	15,800	3,300	47,300	30,900	9,800
(Bank deposit)	(1,900)	(1,300)	(1,400)			
IV. Incremental net income (Rs./household/year)				28,000	15,100	6,500
V. Salaris and O&M cost (Rs./household/year)*6						
1) Major schemes				750	470	210
- Salaris *5				380	240	110
- Material cost				110	70	30
- Labour cost				260	160	70
2) Medium & minor schemes				1,130	710	320
- Salaris *5				380	240	110
- Material cost				230	140	60
- Labour cost				520	330	150

*1 Samples of questionnaire survey.
*2 Non-farm income and living expenditure under with project are assumed to be same amount as the present condition.
*3 Excluding family labour.
*4 Assuming that farmers borrow group loan (cultivation loan) from the banks.
*5 Allowance of gate operator.
*6 O&M costs after completion of the project were estimated at Rs.2,000/ha/year for the major schemes (Rs,1,000 for farmers' share) and Rs.1,500/ha/year (all farmers' share). Out of the amount of farmers' share, Rs.500/ha/year is for the Salaris (same amount with the present), 30% for material cost and 70% for labour costs.

(2) Improvement of Farm Economy

Under the with project condition, an average gross income of farmers in all schemes would increase about 50% from the present level, and an annual net incremental income would average Rs.28,000. The gross income of the farmers having irrigated paddy field between 0.4 and 0.8 ha would also increase 34%, and the annual net income would be estimated at Rs.15,000 up from the present. On the other hand, the small farmers having irrigated paddy field less than 0.4 ha and accounting for 20% of total farmers are at a disadvantage for farm economy. The annual gross income of the small farmers would increase only 16%, and the annual net income would also be only Rs.6,500 lower than the above big farmers. The average holding size of irrigated paddy field of such small farmers is estimated at 0.2 ha/household, and it is similar with the landless farmers. To such small farmers, it is necessary to improve non-farm income through income generating plan.

(3) Farmers' Solvency for Irrigation Service Charge

After completion of the rehabilitation works, irrigation facilities of D-canals and F-canals for the major schemes and all facilities for the medium and minor schemes will be maintained by the farmers themselves. (The Government is responsible for the O&M of tanks and main canals of the major scheme.) All costs including material and labour required for O&M of facilities will be borne by the farmers. In addition, the farmers will shoulder all allowance (Salaris) for gate operator.

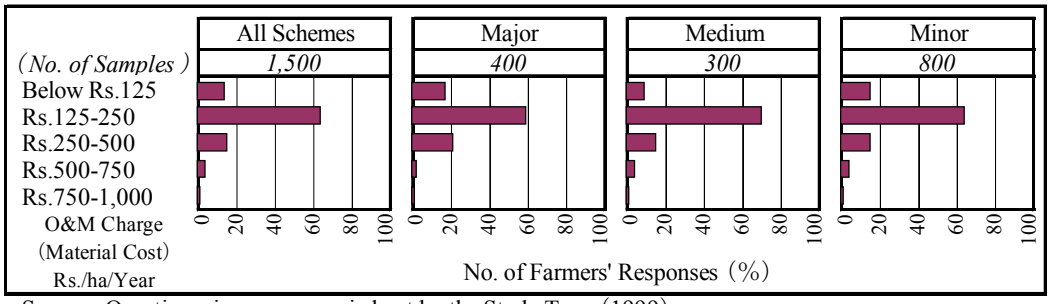
The farmers' solvency for these costs was evaluated. Present collecting method of the irrigation service charge by FOs is that material cost is borne by farmers' cash payment, while labour cost is covered by Sramadana (non cash payment). In addition, FOs is collecting Salaris, separately. In general, the irrigation service charge defined by the farmers is material cost, and Sramadana is not included in the charge. The farmers distinguish Salaris from the irrigation service charge. Therefore, the evaluation was made to the following two cases: i) bearing all of those costs including material, labour and Salaris by cash, and ii) paying only material costs.

In case of i), the farmers' solvency is evaluated to a ratio of the irrigation service charge including all costs (material, labour and Salaris) to the annual net incremental income under with project. As seen in the table of farm budget analysis, the irrigation service charge including all costs is estimated at Rs.210-750/year/household for the major schemes and Rs.320-1,130/year/houshold for

the medium and minor schemes. These amounts account for below 5% of the annual net incremental income, and it seems that almost all farmers can pay such small amounts, in view of the farm economy under with project.

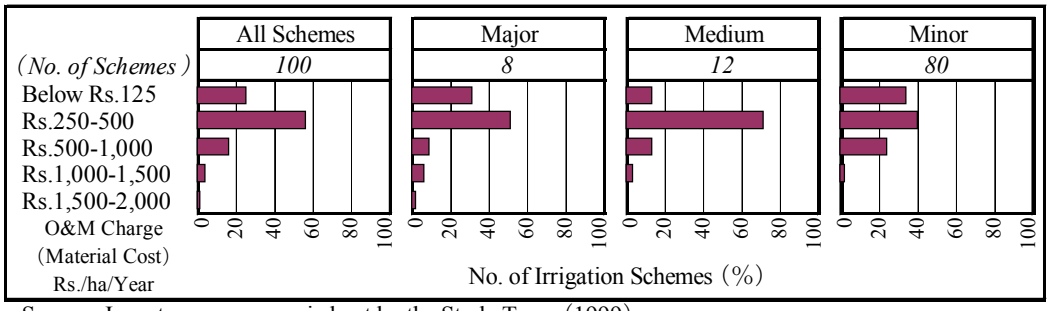
As for the case ii), the evaluation is based on the farmers' willingness to pay the irrigation services charge (material cost), because farmers' share of the charge is largely influenced by their willingness. Based on the results of questionnaire survey and RRA carried out by the Study Team, an appropriate charge considered by the farmers is estimated as follows:

Appropriate Charge considered by Farmers



Source: Questionnaire survey carried out by the Study Team (1999)

Appropriate Charge considered by FOs' Leaders



Source: Inventory survey carried out by the Study Team (1999)

Answers obtained from the farmers and FO's leaders mentioned above include only material costs, and Salaris and labour costs are not included. As seen in the above figure, more than half of the farmers have been estimated at Rs.250/ha/year as the appropriate charge, and the majority of FOs' leaders have been Rs.500/ha/year. To such answers, the required amount of material cost under with project is estimated at Rs.150/ha/year for the major schemes and Rs.300/ha/year for the medium and minor schemes. The required amount of the medium and minor schemes is similar with the appropriate amount pointed out by the farmers, and it will be concluded that the farmers will pay such amount for material cost, if the irrigation facilities are rehabilitated.

12.4 Socioeconomic Impact

After implementation of the Project, various indirect benefits and socioeconomic

impacts are expected as mentioned below.

(1) Improvement of Farmers'/People' Income and Employment Opportunity

As a result of rehabilitation and improvement of irrigation facilities and strengthening of agricultural support services, the farmers' income will improve considerably through increasing of crop yields. In addition, it would be expected to improve employment opportunity and farmers'/people's incomes in consequence of the implementation of income generating programme consisting of home garden activities, livestock raising and inland fisheries, employment information system, job training, loan services for self employment and small enterprises activities.

(2) Activation of Regional Economy

In addition to increase of production, marketing of farm inputs and outputs would expand through establishment of Pola and collecting points, introduction of co-operative shipping system, improvement of agricultural credits, etc. Farmers' purchasing power would increase along with improvement of farmers' income. Moreover, FOs would have profit activities such as co-operative purchasing and agro-processing. All these would contribute to activate the regional economy.

(3) Poverty Alleviation

As the consideration toward the poor who are landless farmers, widow, etc., the income generating programme for them was planned as one of the development component, and its programme will be implemented by FOs. For the target group of this programme, almost all FOs' leaders have agreed at the group discussion carried out by both the Study Team and FOs. In addition, Sri Lankan communities have a good tradition system, so called "Kaiya", which supports them. Therefore, the implementation of this programme for the poor would be possible, and would contribute to alleviate poverty in the community. Moreover, the poor can access not only revolving loan planned in the income generating but also multi-aid credit, therefore, such financial support would also be able to improve the poor.

(4) Creation of Stable Community by FO's Social Support Services

As the autonomous and representative organisation in the community, it was planned that FOs provide social support services such as anti-alcohol campaign and improvement of public health to the farmers/people. For the implementing organisation of such services, it was proposed to establish the subcommittee of

income generating/social services under FO. These activities would contribute to create stable community.

(5) Empowerment of Women

It was proposed to appoint women's leaders in the subcommittee of income generating/social services mentioned above. This is to provide "place" and "organisation" for women's equal activities with men in the community. In addition to such programme, multi-aid credit managed mainly by women's groups was recommended. These would enable certainly to improve social status of women in the community.

(6) Environmental Conservation

Deforestation and soil erosion due to expanding and continuous chena cultivation in the catchment area has become a problem for the environment. This is caused by increasing dependence of villagers to the chena due to low income. The Project would enable to increase people's income through improvement of land productivity and employment opportunity by the rehabilitation of irrigation facilities and the income generating programme. Therefore, the Project would be able to reduce the people's dependence on chena.

(7) Capacity Building-up of Staff Concerned

The development plan includes the following programmes: i) training on participatory planning to officers of the executing agencies concerned, ii) training on agricultural extension to officers related to agriculture, livestock and inland fisheries, and iii) training to officers of the department of agrarian services (staffs for strengthening of FOs). Such capacity building to them would be helpful largely to implement other development projects in the future.

(8) Effect on Strengthening of Extension System to Other Area

The plan for agricultural support services includes upgrading and strengthening of IPEU and PDOA offices, Galgamuwa seed farm (nursery tree), ISTI (Maha Illuppallama), IFTC (Nikaweratiya), Aqua-culture Extension Centre (Anuradhapura). These strengthening and improvement plan would enable activating support services not only in the 100 irrigation schemes but also in those surrounding schemes.

(9) Ripple Effect on Development in the Dry and Intermediate Zones

As the common problem of the irrigation schemes in the intermediate and dry

zones, it is pointed out that the farmers have a general tendency to depend on outside sources for O&M and agricultural supporting services. For the countermeasure, recent projects had and have taken a participatory approach to arouse farmers' self-reliance for sustainable management of facilities. In many cases, however, it shows little effect on farmers' self-reliance for O&M of irrigation facilities.

Meanwhile, a characteristic of this Project differing from others is "implementation of awareness programme" and "strengthening of FOs which play an important role on sustainable development of rural agriculture" through its programme. Prior to commencement of the Project, the awareness programme is implemented to both officials concerned and FOs' leaders for improving their awareness on participatory development and building-up its implementing system. Secondly, the farmers/community people review the development component proposed in this report, then take up them into their own action plan. At the final stage of the awareness programme, the farmers/community people reorganise FO as an autonomous and representative organisation in their community, and the action plan is implemented by this FO. The government agencies concerned will support FOs by the participatory approach (CAP, PCM, LFA, etc.) for raising farmers' self-reliance. As a model project, this development approach would have a considerable ripple effect on development of the irrigation schemes in the dry and intermediate zones.

CHAPTER 13 CONCLUSIONS AND RECOMMENDATIONS FOR THE MASTER PLAN STUDY

13.1 Conclusions

As the objective irrigation schemes for the Master Plan Study, 8 major schemes, 12 medium schemes, and 80 minor schemes were selected. The commanding area of all these schemes reaches a total of 18,200 ha. The numbers of beneficial farm households and population are estimated at 25,300 and 113,000, respectively. The super goals of the integrated agricultural development project to the 100 irrigation schemes were to "improvement of agricultural productivity and farm economy" and "sustainable development of rural agriculture", and project target was established to "improvement of farm income." Under these objectives, the following 12 project components were worked out:

1) Awareness/ Training Programmes
2) Strengthening FOs/Rural Development
3) Stable Crop Production/Crop Diversification
4) Income Generation Programme
5) Rehabilitation of Irrigation Facilities
6) Farm Road Improvement
7) Improvement of Water Management
8) Improvement of Marketing
9) Improvement of Rural Credit
10) Strengthening Agricultural Extension Services
11) Research Programme of Cascade System and Subsurface Water
12) Monitoring and Evaluation

Of these, the components from 1) to 10) were based on the result of workshop with FO's leaders held in the RRA survey. The component 11) aims at further development of the minor irrigation schemes, and the main objective of component 12) is to effectively and efficiently implement the Project. These two components were proposed by the Study Team. With exception of price escalation and GST, all project cost including the these 12 components amounts to Rs.2,670 million (US$ 36.7 million). As a result of economic evaluation, EIRR of the project is estimated at 13.7%. It is concluded that the Project is economically feasible and technically viable.

Under the with project condition, an average gross income of farmers in all schemes would increase about 50% from the present level, and annual net incremental income would average Rs.28,000. On the other hand, the small farmers having irrigated paddy field less than 0.4 ha and accounting for 20% of total farmers are at a disadvantage for farm economy. The annual gross income of the small farmers would increase only 16%, and the annual net income would also be only Rs.6,500 lower than the above farmers. The average holding size of irrigated paddy field of such small farmers is estimated at 0.2 ha/household, and it is similar with the landless farmers. To such small farmers, it is proposed to

implement the income generating programme.

After implementation of the Project, various indirect benefits and socio-economic impacts are expected as mentioned below.

1) Improvement of non-farm income and employment opportunity of the farmers / people.
2) Activation of regional economy through increasing of production and improvement of marketing and rural credits.
3) Poverty alleviation through the implementation of income generating programme.
4) Creation of stable community by FO's social support services.
5) Empowerment of women through establishment of the FO's sub-committee of income generating/social services managed by women's leaders and extension of multi-aid credit managed mainly by women's groups.
6) Environmental conservation in the catchment area by decreasing people's dependence to the chena cultivation through improvement of land productivity and farmer's/people's income.
7) Capacity building-up of staff concerned by implementing awareness and training programmes.
8) Effect on strengthening of extension system to other area.
9) Ripple effect as the participatory development in the dry and intermediate zones.

13.2 Recommendations

(1) Early Implementation of the Project

During the recent past, the agricultural sector in Sri Lanka has faced the following problems: (i) a stagnant production of rice and OFC, (ii) decreasing productivity and profitability of agricultural products, and (iii) declining farm economy. To overcome these problems, the Sri Lankan Government has worked out several development policies, such as, a changeover to commercial agriculture having a high productivity, and the encouragement of export oriented crops. Emphasis has been laid on the agricultural development in the dry and intermediate zones, which produce about 70% of total crops in the whole country. The Government has envisaged encouraging irrigated agriculture in these zones, with the goal of achieving more profitable agriculture and higher standards of living for rural farm households.

Meanwhile, the development component of the Project was planned based on the

needs of farmers identified through the workshop with them in the RRA survey, and reflected farmers' suggestions/opinions obtained at the group discussion with FOs' leaders. The Project aims at comprehensive approach including not only the effective utilisation of water resources through rehabilitation and improvement of irrigation facilities but also raising farmers' independence through implementation of awareness programme, activation of FOs by reforming to multi-functional organisation, improvement of employment opportunity through implementation of income generating programme for the poor, and so on. The implementation of such project would solve or relieve the problems mentioned above and contribute to sustainable development of rural agriculture. In addition, the beneficial farmers have desired to implement the Project.

Under such circumstance, it is recommended to materialise this Project as soon as possible.

(2) Additional Survey

This Study of the 100 irrigation schemes was made at the master plan level. Therefore, it is recommended to carry out the following additional survey for early implementation.

1) The rehabilitation and improvement costs of the irrigation facilities estimated in this report improved those precision based on the result of feasibility study carried out at the second stage in this Study. However, it will be necessary to carry out additional survey in order to estimate the costs on a level with a standard feasibility study.

2) In general, the projects under the foreign aid loan should avoid overlapping those objective areas among them. At the selection of irrigation schemes of this Project, the irrigation schemes that overlapped with other projects funded by ADB, the World Bank, IFAD, etc., were also rejected. But some irrigation schemes had overlapped with others, after the selection works. In this case, the proceedings passed off uneventfully, because both projects had quite different fields. However, the executing agency should investigate all 100 irrigation schemes for ongoing projects to avoid overlapping with others, before commencement of the Project.

(3) Officers' Positive Participation to Awareness Programme

A characteristic of the Project that differed with others is putting emphasis on the awareness programme. This programme consists of "raising awareness of parti-

cipatory development through training and practice" and "establishment of implementing system for participatory development." Namely, for the participatory development, the awareness of both officials and farmers is firstly improved through training programme. Secondly, as the practice, the farmers and people in the community review the development component proposed in this report and take up it as own action plans by themselves. In addition, the present FO is reorganised by all farmers/people as the representative and autonomous body of the community. The officials trained at the first stage provide necessary support to them as the need arises. At the final stage, the new FO implements the action plans (the development), and the officials concerned provide support services to the FO by means (CAP, PCM, LFA, etc.) to raise their independence. As a finally result obtained from the implementation of all these processes (training and practices), a system on participatory development is established on both sides (government and farmers).

The key to success of the Project is the awareness programme; therefore, it is recommended that all officers concerned including not only the MIP as main executing agency but also the central, provincial, and district government participate positively in this awareness programme.

(4) Establishment of Project Co-ordination Committee

The Project consists of various programmes, and many government agencies at central and provincial levels will participate in the implementation of these programmes. In order to co-ordinate all these agencies at central and provincial levels, it was planned to establish the Central Project Co-ordination Committees (CPCC) in the central government and the Provincial Project Co-ordination Committee (PPCC) in the provincial government. Although the Project Management Unit (PMU) established under the Ministry of Irrigation and Power has direct responsibility for the implementation of the programmes, the role of CPCC and PPCC is very important in order to smoothly and effectively implement the Project. Therefore, it is recommended to establish these co-ordination committees before commencement of the Project.

(5) Enactment of Laws for O&M of Irrigation Facilities and Water Management

The laws on O&M of irrigation facilities and water management, "Irrigation Ordinance" and "Agrarian Services Act" have been enacted. However, unclear articles are seen in these laws for the O&M of irrigation facilities and water management by FOs. Moreover, collection of irrigation service charge by FOs is not included in these laws. Therefore, it is recommended to enact clear laws on these matters.

PART - III FEASIBILITY STUDY FOR THE PRIORITY IRRIGATION SCHEMES

CHAPTER 14 EVALUATION AND SELECTION OF PRIORITY IRRIGATION SCHEMES

14.1 Evaluation Method

The feasibility study is made on the priority irrigation schemes selected in the Master Plan. The selection of the priority irrigation schemes to be proposed for the feasibility study in the next stage is made on the basis of all the findings obtained from the site investigations and the Master Plan study.

The priority schemes are selected based on the following concepts:

1) The number of priority schemes to be selected two major, two medium schemes and one cascade system including five to six minor schemes, on the basis of meeting with MIP.
2) For the selection of schemes, hydrological linkage of major, medium, and minor schemes within the cluster should be considered.
3) Because the proposed development plan could be used as a model for further development in the dry and intermediate zones in future, the selection of priority irrigation schemes is made, taking into consideration the effects as a model.

The following eleven parameters are proposed for the evaluation of each scheme. The evaluation of each of these parameters is made by a combination of scoring method in each parameter and weighted method among the parameters.

Parameters for Evaluation of Each Scheme

(1) Location of the Scheme Site			
Scoring Method in Location and Access to Site	Score Given	Proportion	● Favourable location for marketing of products ● This will not be a major parameter in evaluation because most of the existing schemes are served by relatively good road network. The evaluation in this parameter could, however, be made in terms of marketing services of private sectors (traders of OFC, livestock companies, etc.). ● The scoring weight given to this parameter is 5 points out of 100 points.
Very good	5	1.0	
Good	4	0.8	
Moderate	3	0.6	
Poor	2	0.4	
Very poor	1	0.2	

(continued)

(2) Land Status

Scoring Method in Soil Conditions	Score	Proportion
Good / suitable	3	1.0
Moderate	2	0.7
Poor / not suitable	1	0.3

- Soils condition and topography
- Soil conditions have much effect on crop productivity, especially for OFC cultivation and are evaluated. The data and information used in this evaluation were mainly from the soil maps (1:250,000) prepared by the Survey Department and the result of field investigation.
- The scoring weight given to this parameter is 5 points out of 100 points.

(3) Water Resources Potential

Increase in Cropping Intensity	Score	Proportion
Over 100%	5	1.0
75 - 99 %	4	0.8
50 - 74 %	3	0.6
25 - 49 %	2	0.4
0 - 24 %	1	0.2

- Increasing ratio of cropping intensity between with and without project.
- Details of the water resources potential are given in Section 9.7.3.
- The scoring weight given to this parameter is 15 points out of 100 points.

(4) Deterioration and Problems of Irrigation Facilities

Rehabilitation and Improvement Cost (Rs./ha)	Score	Proportion
Over 100,000	5	1.0
75,000 - 100,000	4	0.8
50,000 - 75,000	3	0.6
25,000 - 50,000	2	0.4
0 - 25,000	1	0.2

- Necessity for rehabilitation and improvement of irrigation facilities
- The evaluation is made based on these rehabilitation and improvement costs per hector.
- The scoring weight given to this parameter is 15 points out of 100 points.

(5) Present Farmers' Participation in O&M of Facilities

Participation in their O&M Work	Score	Proportion
No participation or very limited	3	1.0
Partly participation	2	0.7
Full participation	1	0.3

- Necessity for improving and strengthening O&M in view of institutional and technical aspects. The evaluation of this parameter is made mainly on the basis of findings obtained from site investigations and questionnaire survey.
- The scoring weight given to this parameter is 10 points out of 100 points.

(6) Present Situation of Water Management

Water Management Situation	Score	Proportion
Inactive / nearly no management	3	1.0
Moderate / within permissible range	2	0.7
Active	1	0.3

- Necessity for improving water management in view of institutional and technical aspects.
- The evaluation points are to i) participation of Kanna meeting, ii) collecting irrigation services fee (ISF), iii) O&M of main and branch canals, iv) O&M of D- and F-canals, and v) carrying out irrigation rotation.
- The scoring weight given to this parameter is 5 points out of 100 points.

(7) Present Activity and its Performance of Farmers' Organization

Activity and Performance	Score	Proportion
In activity	3	1.0
Moderate	2	0.7
Active	1	0.3

- This parameter is used for evaluation of the present activities and their performance of FO in each schemes, and at the same time, needs for strengthening of FO is evaluated.
- Main evaluation points are as follows : i) existence of FO, ii) farmers' participation ratio, iii) registration of 56B, iv) co-operative purchasing, and v) co-operative shipping.
- The scoring weight given to this parameter is 15 points out of 100 points.

(continued)

(8) Present Farmers' Economy

Net Farm Income per Household	Score	Proportion
Less than Rs. 10,000	4	1.00
Rs. 10,000-20,000	3	0.75
Rs. 20,000-30,000	2	0.50
Over Rs. 30,000	1	0.25

- Necessity to improve farm income.
- The scoring weight given to this parameter is 5 points out of 100 points.

(9) Environmental Effects

Environmental Effect	Score	Proportion
None or negligible	5	1.0
Very small	4	0.8
Moderate	3	0.6
Large	2	0.4
Very large	1	0.2

- No adverse effect to environment
- The environmental effects for the implementation of the project will be, i) decrease of wild land, ii) effects on water quality and ecology due to agricultural intensification, iii) spread of water-borne diseases due to expansion of irrigated land, iv) decrease of fire-wood forest, and v) decrease of grazing areas.
- The scoring weight given to this parameter is 5 points out of 100 points.

(10) Equity Development

Average Ratio of the poor per Village	Score	Proportion
Over 40%	5	1.0
30 - 40%	4	0.8
20 - 30%	3	0.6
10 - 20%	2	0.4
Less than 10%	1	0.2

- Ratio of the poor
- Taking into account the equity development, the schemes having higher ratio of the poor will be selected as far as possible. Ratio of the poor is recognised by FO leader through RRA workshop in 1999.
- The scoring weight given to this parameter is 10 points out of 100 points.

(11) Economic Viability

EIRR			B-C		
%	Score	Proportion	(Rs. Million)	Score	Proportion
25 <	5	1.0	200 <	5	1.0
20-25	4	0.8	150-200	4	0.8
15-20	3	0.6	100-150	3	0.6
10-15	2	0.4	50-100	2	0.4
15 >	1	0.2	50 >	1	0.2

- High economic return in terms of IRR and B-C
- The scoring weight given to this parameter is 10 points out of 100 points. Further allocation of 10 points of weight to EIRR and B-C on the schemes is 5 points, respectively.

14.2 Result of Evaluation

The evaluation of each scheme is made quantitatively, using these 11 parameters, and the evaluation procedure is as follows:

(a) At first, judgement of the category in each parameter is made on the basis of the findings and all study results. Then, appropriate score is given to the category selected through the judgement in accordance with the scoring method applied for each parameter.

(b) Second, weighted score is calculated, multiplying the weight given to each parameter or sub-parameter of the parameter by proportion of the category selected.

(c) Third, weighted score of each parameter is summed up in the table for each scheme in order to calculate Total Point given to each scheme.

The evaluation of each scheme and group expressed in points is thus made as presented in Tables 14.2.1 and 14.2.2, and summarised as follows.

Evaluation for Selecting Priority Schemes

	Cluster	Code No.	Name of Scheme	Score
Major Schemes				
1	Nachchaduwa	1MA-01	Nachchaduwa	70.8
2	Nachchaduwa	1MA-02	Nuwarawewa	58.5
3	Mi Oya	4MA-01	Palukadawela	55.5
5	Kala Oya 1	2MA-01	Rajangana	54.5
4	Mi Oya	4MA-02	Attaragallewa	52.5
6	Mi Oya	4MA-03	Ambakolawewa	51.8
7	Nachchaduwa	1MA-03	Tissawewa	49.3
8	Deduru Oya 1	5MA-01	Magalle Wewa	46.5
Medium Schemes				
1	Deduru Oya 2	6ME-01	Meddeketiya	74.5
4	Nachchaduwa	1ME-03	Uttimaduwa	72.0
5	Mi Oya	4ME-01	Mahananneriya	71.8
2	Nachchaduwa	1ME-04	Periyakulama	71.3
3	Nachchaduwa	1ME-06	Maha bunankulama	70.5
6	Nachchaduwa	1ME-05	Maminiyawa	64.0
7	Deduru Oya 1	5ME-01	Hulugallawewa	63.0
8	Nachchaduwa	1ME-02	Eru Wewa	62.8
9	Mi Oya	4ME-02	Maha galgamuwa	61.5
10	Nachchaduwa	1ME-01	Thuruwila	58.3
11	Deduru Oya 2	6ME-02	Moragada Anicut	55.5
12	Kala Oya 1	2ME-01	Angamuwa	7.5
Minor Schemes				
1	Mi Oya	VII	10 Schemes	74.5
2	Nachchaduwa	III	10 Schemes	65.8
3	Deduru Oya 1	VIII	10 Schemes	63.8
4	Kala Oya 1	IV	9 Schemes	64.8
5	Nachchaduwa	II	8 Schemes	63.3
6	Mi Oya	VI	11 Schemes	59.8
7	Deduru Oya 2	IX	4 Schemes	58.5
8	Kala Oya 2	V	10 Schemes	54.8
9	Nachchaduwa	I	8 Schemes	53.8

Note: Code I – IX: See location map

14.3 Selection of Priority Irrigation Schemes

As seen in this summary table, the Nachchaduwa and Mi Oya clusters have many irrigation schemes having high scores, in comparison with the other four clusters. The priority schemes would, therefore, be selected from these two clusters, taking into account the hydrological linkage within the respective cluster. In the Nachchaduwa cluster, the irrigation scheme having a high score with the hydrological linkage is the Nachchaduwa major scheme. As for the medium schemes, Periyakulama, Maha bunankulama, and Uttimaduwa have the high score. Of these, Periyakulama scheme is selected, which is easy to access. For the Mi Oya cluster, it is proposed to select Palukadawela (major), Mahananneriya (medium), and one cascade system consisting of 6 minor schemes in VII. These schemes are outlined below:

Proposed Priority Schemes

	Nachchaduwa Cluster		Mi Oya Cluster		
	Nachcha-duwa Major Scheme	Periya-kulama Medium Scheme	Palukada-wela	Mahanan-neriya Medium Scheme	VII*1
Location	A'pura	A'pura	K'gala	K'gala	K'gala
Commanding area (ha)	2,540	91	956	158	260

*1 Hydrological group of minor schemes consisting of 10 schemes. One cascade system consisting of 5 to 6 minor schemes will be selected from these 10 schemes.

*2 Land owner

CHAPTER 15 PRESENT CONDITIONS OF THE PRIORITY IRRIGATION SCHEMES

15.1 Location and Population of the Priority Irrigation Schemes

The Project for the Feasibility Study covers five irrigation schemes: i) Nachchaduwa major irrigation scheme, ii) Palukadawela major irrigation scheme, iii) Periyakulama medium irrigation scheme, iv) Mahananneriya medium irrigation scheme, and v) Mahananneriya minor irrigation schemes (cascade) consisting of 6 minor schemes. These schemes fall within the two districts of Kurunegala and Anuradhapura, and consist of the following three Divisional Secretariats (DS) and 35 Grama Niladharis (GN).

The Nachchaduwa major scheme is located in the southern part of Anuradhapura (see Location Map). The Periyakulama medium scheme lies halfway between Anuradhapura and Dambulla. The three schemes of Palukadawela major, Mahananneriya medium and Mahananneriya minor schemes are situated in the southern and western parts of the Galgamuwa town, which lies midway between Anuradhapura and Kurunegala. The National Roads, A10, A28, A9 and A6, are running near the schemes and connecting these major towns.

Population and household are summarised in the table below. Details are shown in Table 15.1.1.

Population and Household

	Nach-chaduwa Major Irrigation Scheme	Palu-kadawela Major Irrigation Scheme	Periyaku-lama Medium Irrigation Scheme	Mahanan-neriya Medium Scheme	Mahanan-neriya Minor Irrigation Schemes (Cascade)	Total
Population	21,900	7,200	1,000	2,200	2,800	35,100
Household	6,860	2,170	210	510	730	10,480
Farm Household	3,240	1,100	210	510	450	5,510

Source: Information obtained from Farmers' Organisation.

15.2 Natural Condition

(1) Topography and Geology

Nachchaduwa basin is an undulating peneplain with eroded remnants by weathering. Mi Oya basin is featured by scattered hillocks over peneplain and stretches towards the west coast.

The geological structure of Sri Lanka is subdivided into three types: i) the Highland Series, ii) the South-western group, and iii) the Vijayan Complex. Nachchaduwa Tank and Periyakulama Tank is situated entirely in the Highland Series, which is composed of charnokite, charnokitic geniuses and metamorphosed sedi-

ments. The geology of the Palukadawela Tank site is featured by undifferentiated metasediments of Vijayan Complex overlaid with alluvial deposit of Quaternary Deposit while Granitic Gneiss of Vijayan Complex overlaid by Quaternary Deposit is observed in the Maha Nanneriya as well as the Maha Nanneriya minor schemes.

(2) Meteorology and Hydrology

Monthly and annual rainfall data for meteorological stations around the schemes are summarised below.

Average Rainfall

(Unit: mm)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Nachchaduwa	75	47	59	151	80	10	30	37	53	214	225	186	1,167
Anuradhapura	94	52	67	163	90	13	33	36	68	244	242	207	1,308
Maha Illuppallama	85	61	74	179	94	17	35	33	83	256	264	222	1,398
Galgamuwa	74	48	84	195	91	31	34	27	66	273	245	189	1,356

The Nachchaduwa tank impounds the waters of Malwatu Oya and Maminiya Oya both of which originate mainly from the Ritigala mountain range and confluence about 5 km east of the tank. The water source of the Periyakulama Tank, with a catchment area of 13.0 km^2 is a tributary of the Malwatu Oya, which originate from Maradankadawela. The river runs northwards along the A9 National Road, collecting rainfall and drainage water from paddy field, until it flows into the Periyakulama Tank. The river flows into the Nachchaduwa Tank directly through several minor tanks.

The Palukadawela Tank with a catchment area of 19.4 km^2 collects rainfall and drainage water from paddy field located in upstream minor irrigation schemes. The supply to Palukadawela is augmented by inflow from a feeder canal from the Ambakolawela traversing the Mi Oya through the Attaragala Tank. Of the tributary rivers within the basin, the Nanneri Oya sub-basin, in which the Maha Nanneriya scheme and the Maha Nanneriya minor schemes are located, deserves mention in being the largest.

The hydrological features of each tank are summarised below:

Hydrological Features of Tanks

Description	Unit	Major Schemes		Medium Schemes	
		Nachchaduwa	Palukadawela	Periyakulama	Maha Nanneriya
River Basin		Malwatu Oya	Mi Oya	Malwatu Oya	Mi Oya
Catchment area	km^2	611.3	19.4	13.0	36.0
Estimated annual runoff	$1000m^3$	107,756	3,283	2.530	5,874

Description	Unit	Minor Schemes					
		Kallanchiya	Attikulama	Mailewa	Ihalagama	Thambare	Ihala Nanneriya
River Basin		Mi Oya	Mi Oya	Mi Oya	Mi Oya	Mi Oya	Mi Oya
Catchment area	km^2	1.4	2.2	2.9	4.4	5.7	9.3
Estimated annual runoff	$1000m^3$	281	378	462	684	852	1,154

15.3 Agriculture

15.3.1 Land Holding and Land Tenure

The survey results of Grama Niladhari (GN) show that land holding per farm household was slightly larger for the major scheme followed by the medium and minor, and the percentage of land per household that is leased is high in Nachchaduwa and low in the other Priority Irrigation Schemes.

Land Holding and Land Tenure of Priority Irrigation Schemes

	Irrigation Scheme	Land Holding per Household					Land Tenure per Household			
		Paddy Field		High-land	Others	Total	Own land	Leased	Tenure "Ande"	En-croach
		Irrigated (ha)	Rainfed (ha)	(ha)	(ha)	(ha)	(%)	(%)	(%)	(%)
Major	Nachchaduwa	1.66	-	0.19	0.47	2.32	74	18	4	4
	Palukadawewa	1.18	0.05	0.35	0.54	2.12	89	1	9	0.5
Medium	Periyakulama	0.94	0.06	0.20	0.48	1.68	85	7	2	6
	Mahananneriya	0.61	-	0.24	0.54	1.39	62	4	13	21
Minor	Cascade	0.57	0.02	0.21	0.57	1.37	84	4	7	5

Source: Questionnaire Survey carried out by the Study Team in 1999.

15.3.2 Crop Production

(1) Paddy Cultivation

1) Cultivation Extents and Yields

Nachchaduwa, and Palukadawela and Periyakulama are harvesting every cropping season and major schemes are achieving considerably stable cultivation and higher yield comparing with minor scheme. Mahananneriya and cascade of Mahananneriya minor schemes were not able to cultivate in Yala cultivation in the last five years. Table below shows an average crop cultivation and yield for 5 years from 1994/95 Maha to 1999 Yala.

Crop Cultivation and Yield in the Priority Irrigation Schemes

Irrigation Scheme	Cultivation Area (ha)				Yield (MT/ha)				
	Paddy		OFC		Paddy		OFC*1		
	Maha	Yala	Maha	Yala	Maha	Yala	Beans *2	Chilli	B'onion
Nachchaduwa	2,540	1,473	1	201	4.43	3.81	-	0.67	-
Palukadawewa	956	433	-	192	3.55	2.66	0.57	0.38	1.00
Periyakulama	91	19	-	4	4.15	3.56	-	0.39	-
Mahananneriya	158	-	-	3	2.71	-	0.49	1.71	-
Minor Cascade	68	5	19	2	3.16	4.40	2.20	1.28	0.22

Source：1998 cropping, Interview survey of the Study team、1999

*1: Cultivation report of ASC, *2: Green gram

2) Cultivation Practices

Paddy varieties utilised in the Study area are mainly 3 month and $3^1/_2$ month varieties. Popular varieties are LD355, BG357 and AT353 for $3^1/_2$ months, and BG300 and BG304 for 3 months. Present fertiliser application in the schemes is largely varied on amount and an excess application was observed

in the Questionnaire Survey. High yielding programme mainly by fertiliser application is carried out and its target yield of the programme is set to 120 bushels/acre (6,000kg/ha) and 140 bushels/acre (7,000kg/ha). Commonly observed problem on paddy cultivation is weed and insect. Farmers are using weedicide and insecticide; however, the method and amount of use is largely varied. Fungicide is not frequently used on paddy.

3) Cropping Damage

Problem and damage of crop production differs by scheme. Generally, they are water supply, pest and diseases, and damage by wild animal, especially by elephant. Elephant attack seemed not only to reduce farmer's production but a more serious problem is to discourage farmers' intention for cultivating agricultural commodities.

4) Cropping Calendar

Present cropping model from average across schemes in 1999 cropping is described in Figure 15.3.1. A considerable portion of paddy land has not been used as the crop intensity exhibited. OFC cultivation is recommended in paddy land under irrigated condition for less water consumption in the Lowland Dry zone. As water is insufficient and land is limited, it is important for improving farming that establishing a incorporated system of paddy and OFCs in irrigated paddy land for sustainable farming.

(2) OFC Production

1) Crops and Yields

Present OFC cultivation is mainly carried out in the highland. Some chilli and pulses are cultivated in paddy land. Mixed cropping is popular cultivation pattern, though sesame, chillies and soybean are mostly cultivated as single crop. DOA recommended inter-row cropping such as pulses in between maize, vegetables or pulses in between chilli and pumpkin in between maize for the Lowland Dry and Intermediate Zones.

Yield of typical OFCs in respective study schemes is shown in the table below. The level of yield varied by crops and cultivation areas. As okra and Brinjal exhibit very high yield, these are harvesting for long period when water is available. Overall, potential to increase yield of respective crops is recognised through the field observation of farmers' poor cropping practices.

Crop protection on pest control is practised on some high value crop as chilli and vegetable. Main agro-chemical application is insecticide and some fungicide. Weedicide application is not popular as paddy and hand weeding with earthing is practised.

Unit Yield of OFCs in the Priority Irrigation Schemes

(Unit: ton/ha)

Crops	Nachchaduwa		Periyakulama		Palukadawela		Mahanan-neriya		Minor Schemes	
	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala
Chilli	1.88	1.48	1.03	0.43	1.61	1.36	1.21	1.51	1.67	1.73
Red Onion	7.12	9.09	-	-	-	-	4.45	4.12	-	-
Cowpea	2.90	1.48	0.56	-	1.11	0.98	1.24	1.16	1.12	1.25
Greengram	1.45	1.12	-	-	0.76	0.66	1.14	1.22	0.98	0.82
Maize	3.95	3.56	1.21	-	0.83	0.81	2.03	0.41	2.36	0.85
Sesame	-	-	-	-	0.82	0.66	0.57	0.62	0.96	0.82
Okra	16.40	10.00	-	-	13.10	10.20	15.80	13.20	15.10	12.40
Brinjal	16.00	7.30	0.80	-	16.00	10.50	19.30	-	19.40	15.40

Sources: Questionnaire survey carried out by the Study Team (1999)

2) Farmers' Intention on OFC Cultivation

Farmers' experience and their intention on OFC cultivation were inquired during the PCM workshops (refer to Table 15.3.2). Their degree of interest is varied and by season. Generally, OFC cultivation in Yala is preferable than Maha. They have expressed that they do not have enough experiences on crops for the market demand. Among crops, chillies and onions were commonly favoured and vegetable varied by groups. Women in many group were interested to vegetable cultivation, though there was some exceptions. Farmers' experience on OFC cultivation in paddy is few and especially cultivation in Maha season is very exceptional. OFC in paddy land in Yala season has experienced by 10 to 30 % of participants.

15.3.3 Livestock

Livestock per household in Nachchaduwa is more than average but less on Buffalo. Nachchaduwa is located adjacent to Anuradhapura town and chicken is kept at more than double the average. The other schemes are not active except goats in minor cascade. As a source of income generation, milk production is considered in the Master Plan study. The Priority Irrigation Schemes are not so active in milk production though milk-collecting points are available within or near the scheme.

Livestock in the Priority Irrigation Schemes

		Major		Medium		Minor	Total
		Nachcha-duwa	Palukada-wela	Periya-kulama	Mahanan-neriya	Mahanan-neriya	
Buffalo	(Head)	708	424	13	28	461	1,634
Buffalo-Milk	(Head)	112	264	35	53	44	508
Cattle	(Head)	2,132	1,251	56	86	815	4,340
Cattle-Milk	(Head)	2,205	700	366	411	337	4,019
Goats	(Head)	791	705	40	157	121	1,814
Chicken (broiler)	(Head)	4,180	511	0	75	35	4,801
Chicken (layer)	(Head)	2,749	2,567	0	167	105	5,588

Sources: Questionnaire survey carried out by the Study Team (1999), Grama Niradhali(GN)

Veterinary Surgeon's Centre is promoting milk production in every VS region with Artificial insemination (AI) for improvement of quality of cows. AI is charged Rs.22 for three times (three months) and its success percentage is 50% to 90% depending on the centre. Semen of Sindy, Sahiwal, Jersey, Friesian, and Milking Zebu varieties are available for improving cows for milking. Problems of the present livestock raising are no proper feeding, no cattle shed, no proper medical care as vaccination, and no pasture improvement.

15.3.4 Inland Fishery

The fishing population in the Study schemes recognised by the participants of PCM workshop is 188 men in Nachchaduwa, 5 to 6 men in Periyakulama, 15 men in Mahananneriya, and about 9 men in the minor cascade. Muslim community around the Nachchaduwa reservoir has the Nachchaduwa Fresh Water Organisation with around 150 members, and other Farmers' Organisation are given 25 fishing boats for 34 fishing people from SANASA. Fishing is not practised in Palukadawela. Normally fish is sold at Rs.30 to Rs.40 per kilogram as wholesale price and retail price is Rs.40 to Rs.50 per kg. Main kind of fish variety is Tilapia.

Monthly report of the Statistics office in the Ministry of Fishery briefly reported a fish catch of 3.6 tons and 110 fishing population with 48 fishing crafts in June 1999 in Nachchaduwa reservoir. The other data from Fishery Extension Centre in Anuradhapura reported 6.0 ton in the same month. Potential fish production by tank are estimated to be 200 to 300 kg/ha/year in Minor tank and 35 kg/ha/day in Major and Medium tank according to the Fishery Extension Co-ordinator. In case of small-scale fishpond cultivation, 1,380 kg of fish is estimated from 1,500 fingerings in 0.5 acre pond after 8 month cultivation.

15.4 Irrigation and Drainage

(1) General

General information on each scheme, such as history of scheme, and commanding area is given below.

General Information of Irrigation Schemes

Description	unit	Major Schemes		Medium Schemes	
		Nachchaduwa	Palukadawela	Periyakulama	Maha Nanneriya
Project history		- Built in 9th century - Restored in 1906 - Rehabilitated in 1958 - Rehabilitated in 1989 by MIRP	- Built in 1958 - Rehabilitated by ADB assisted WRDP in 1997	- Tank rehabilitated in 1973	- Built in 1885 - Tank rehabilitated in 1939 - Rehabilitated by ADB assisted WRDP in 1995
CA	ha	2,540	956	91	158

Description	unit	Minor Schemes					
		Kallanchiya	Arthiku-lama	Meilewa	Ihalagama	Thambare	Ihala Nan-neriya
Project his-tory		- Improved by Janasaviya fund in 1993	- Improved by DAS in 1982	- Improved by ADB assisted WRDP in 1998	- Improved by ID in 1989	- Improved by ID in 1956	- None
CA	ha	8	12	22	29	20	26

This table shows that most schemes have been rehabilitated or improved by the Government with either external or internal resources.

(2) Water Source

The salient features of each tank are presented below.

Features of Tanks

Description	unit	Major Schemes		Medium Schemes	
		Nachchaduwa	Palukadawela	Periyakulama	Maha Nanneriya
Catchment area	km^2	611.3	19.4	13.0	36.0
Extent of tank reservation area :	ha	1,783.8	261.0	119.4	135.2
Effective storage capacity	$1000m^3$	55,688	7,709	1,674	2,504
Length of bund	m	1,649	1,178	1,220	1,097
Bund elevation*	m	104.70 msl	93.27 msl	104.88*	106.40*
Nos. of sluice		3	2	3	1
Nos. of spillway		1	1	3	1

Description	unit	Minor schemes					
		Kallan-chiya	Arthi-kulama	Meilewa	Ihalagama	Tham-bare	Ihala Nanneriya
Catchment area	km^2	1.4	2.2	2.9	4.4	5.7	9.3
Extent of tank reservation area :	ha	6.1	12.1	13.3	20.6	17.6	13.3
Effective storage capacity	$1000\ m^3$	59	118	150	217	165	130
Length of bund	m	548	350	496	1,300	200	1,200
Bund elevation*	m	103.35*	103.34*	102.95*	103.95*	103.2*	103.65*
Nos. of sluice		1	2	3	1	1	1
Nos. of spillway		1	1	1	1	1	1

* : Bund top elevation is expressed, assuming that the elevation of low level sluice is 100 m.

(3) Present Irrigation and Drainage System

1) General Features of Distribution System

The following table summarises the general feature of the distribution system for each scheme.

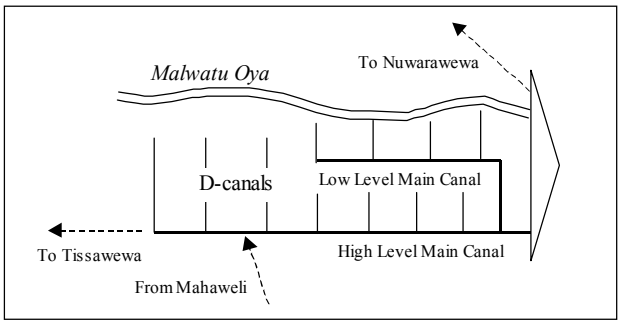
General Features of Irrigation Facilities

Description	unit	Major Schemes		Medium Schemes	
		Nachchaduwa	Palukadawela	Periyakulama	Maha Nanneriya
Main Canals	m	40,070	19,700	3,480	3,280
D-canals	m	20,800	18,200	-	-
F-canals	m	113,600	28,400	-	

Description	unit	Minor schemes					
		Kallan-chiya	Arthi-kulama	Meilewa	Ihala-gama	Tham-bare	Ihala Nan-neriya
Main Canals	m	630	720	1,330	1,150	1,090	1,540
D-canals	m	-	-	-	-	-	-
F-canals	m	-	-	-	-	-	-

2) Nachchaduwa Major Irrigation Scheme

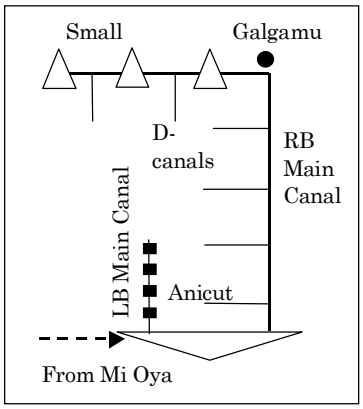
Nachchaduwa Tank releases water to downstream users through three sluices. The canal extending from the main sluice situated at the end of the left bank, bifurcates to the high level main canal and the low level main canal. The extents fed by the high level and low level main canals are 1,460 ha and 1,080 ha, respectively. Drainage water from paddy field fed by the high level canal is collected by the small tanks and re-used for irrigation. While the main canals are unlined, retaining walls with brick masonry are provided in some portions of the D-canals and F-canals.



Nachchaduwa Scheme

3) Palukadawela Major Scheme

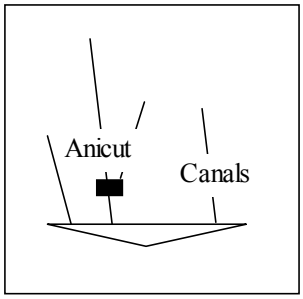
Water is delivered to the commanding area through two sluices in Palukadawela Tank. A RB canal feeds the commanding area for new settlers while a LB canal provide water for commanding area in a traditional village (namely Purana Gama in Sinhala language). The 16km long RB canal runs northwards along the contour line until it reaches Galgamuwa town, traversing paddy fields fed by the Maha Galgamuwa Tank. The RB main canal fed areas are divided into six tracts. About 20 D-canals branch off from the main canal. Several temporary earthen dams (namely, Amuna in Sinhala language) have been constructed by the farmers across the canal to divert the flow into their fields.



Palukadawela Scheme

4) Periyakulama Medium Scheme

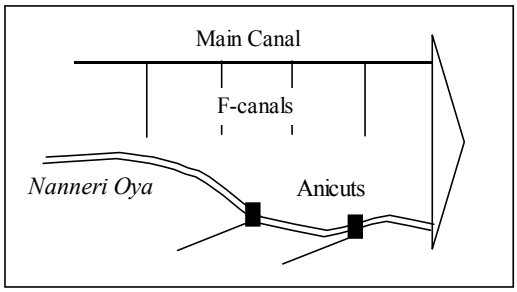
Three intakes are diverting water to the commanding area of the Periyakulama scheme. All the canals are earth type without any turnout structures. The farmers take water by blocking or breaching the canals. Immediately downstream of the intake on the centre main canal, a concrete pick-up anicut is provided to divert water to the commanding area.



Periyakulama Scheme

5) Maha Nanneriya Medium Scheme

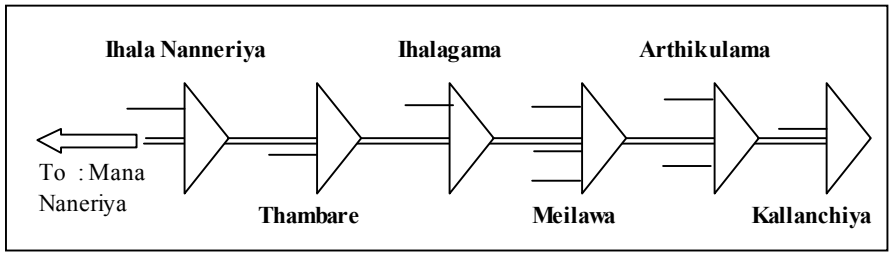
The distribution system of the Maha Nanneriya medium scheme consists of a RB Main canal 4.5 km long with 16 Field canals directly feeding 37 ha of total commanding area of 158 ha. Turnout structures are provided to divert water to the Field canals. The balance of 113 ha are fed thorough the spill tail canal, which collects the return flow and the drainage water. Temporary earthen dams and an anicut made of concrete have been constructed by the farmers across the spill tail canal.



Maha Nanneriya Scheme

6) Maha Nanneriya Minor Schemes

The selected Maha Nanneriya minor schemes consisting of six minor tanks, Kallanchiya, Attikulama, Meilawa, Ihalagama, Thambare, and Ihala Nanneriya form a linear cascade with direct succession, one below the other. The irrigation water that originates from a tank sluice runs usually along the side of paddy field. In some schemes, small anicuts tap water from drainage channels and re-used for irrigation. No structure on the canal is provided except the Mailawa scheme in which was rehabilitated recently under the financial assistance of ADB.



Maha Nanneriya Minor Schemes

(4) Drainage and Flood Condition

In all schemes, natural streams have been utilised for drainage channel. Through interviews with farmers, serious drainage and flooding problems were not identified in any schemes.

(5) O&M Roads

Except the Periyakulama and the minor schemes, roads are provided along main and distributary canals for operation and maintenance of irrigation facilities. The roads are also used to transport agricultural inputs and products.

(6) Present Conditions of the Existing Irrigation Facilities

Present condition of the existing irrigation facilities revealed through field investigation by the Study Team is shown in the following table.

Present condition of irrigation facilities

Scheme	Tank	Irrigation
Nachchaduwa	- No serious problem is observed	- In some portion of canals, slopes inside the canal is scoured, embankment of the canals are broken. - In some portion of D-canals, retaining wall are deteriorated - Most measuring devices installed at the head of the D-canal are broken
Palukadawela	- No serious problem is observed	- Same as the Nachchaduwa scheme
Periyakulama	- Sluice gates are not functioned well	- No structures is provided in the canals
Maha Nanneriya	- No serious problem is observed	- Some structure on the main canal are damaged
Maha Nanneriya minor schemes	- Some of sluice gates are broken	- No structure is provided except the Mailawa scheme

(7) Water Management and Maintenance

1) O&M Responsibilities

The following table indicates the responsibility of O&M per each scheme category:

Responsibilities of O&M

	Operation			Maintenance		
Name of Scheme(s)	Tank Sluices	Turnouts on main canal	Turnouts on D-canal	Tank	Main canal	D & F – canals
Nachchaduwa	ID	ID	Farmers	ID	ID	Farmers
Palukadawela	ID	ID	Farmers	ID	ID	Farmers
Periyakulama	Farmers	-	-	ID	-	-
Maha Nanneriya	Farmers	Farmers	-	ID & farmers	Farmers	-
Maha Nanneriya Minor Schemes	Farmers	Farmers	-	Farmers	Farmers	-

Turnover can take place either formally or informally. Under formal turn-

over an agreement is signed between the agency and the relevant FO specifying the responsibilities to be fulfilled by the parties concerned. Informal turnover is a verbal agreement between the two parties. The FOs in the Palukadawela scheme operate and maintain irrigation facilities below D-canal in an informal status. Both medium schemes are also fully operated by FOs without official handed over.

2) Staff and Organisation

Administration of the irrigation schemes are carried out by the Anuradhapura Irrigation Engineer's Office (IE's office) under of the Anuradhapura Deputy Director's Range Offices (DD's Office) and the Galgamuwa IF's office under the Kurunegala DD's office. Technical staff of the IE's Office, headed by an Irrigation Engineer, consist of a Technical Assistant (TA), a Work Supervisor (WS), and a Maintenance Labour (ML). The number of technical staff engaged in the scheme is summarised below.

Staff in Irrigation Department

DD's office	IE's office	Name of scheme	IE	TA	WS	ML
Anuradhapura	Anuradhapura	Nachchaduwa	1	2	2	6
		Periyakulama		1	1	1
Kurunegala	Galgamuwa	Palukadawela	1	1	1	-
		Maha Nanneriya		1	1	-

At present, there are two types of O&M by farmers. One is that members of a Farmers Organisation are appointed at farmers' meeting so as to carry out O&M. This type includes the major irrigation schemes, such as the Nachchaduwa scheme, and the Palukadawela scheme, and the Maha Nanneriya medium scheme. Another is a traditional management system, which has been taken over from ancient time. Minor irrigation schemes as well as some medium irrigation schemes, like the Periyakulama scheme, with rather small extents, are categorised in the system. In such schemes, water distributors are selected at a "Kanna Meeting", which is held before every cultivation season. A gate operator, named by a "Vel Vidane" is responsible for the O&M of the schemes. The Vel Vidane, appointed regardless of entry the FO, is hereditary in some schemes.

3) Planning and Scheduling

The "Kanna meeting" (a seasonal cultivation meeting) is held before every seasonal cultivation, twice a year, to decide the cultivation schedule. With respect to major and medium irrigation schemes, a pre-Kanna meeting are held before Kanna meeting. The attendance of the meetings varies depending on the category of schemes as shown below.

Attendance of Kanna Meeting

	Major Schemes	Medium Schemes	Minor Schemes
FO Meeting Chairman	FO Leader	FO Leader	N.A.
Participants	FO members	FO members	
PMC Chairman	RPM of IMD	Chaired by TA of ID	N.A.
Participants	IE and TA of ID AI, DO, FO leaders	FO leaders, Farmer representatives	
Kanna Meeting Chairman	Divisional Secretary or District Secretary	Divisional Secretary	Divisional Officer of ASC
Participants	Grama Niladali, Bank, Insurance, IMD, ID, DOA, DAS, Land, Commissioner FR, Farmers	Grama Niladali ID, DOA, DAS, FR, Farmers	Grama Niladali Farmers

4) Water Distribution

The following tables show the person in charge of water distribution.

Gate Operators

Nachchaduwa	WS in ID	WS in ID	FO leader, FO secretary, FO Jalapalaka, or FC leader
Palukadawela	WS in ID	WS in ID	FO leader, FO secretary, or Yaya representative in traditional village
Periyakulama	Farmer named by Vel Vidane selected in the Kanna meeting	-	-
Maha Nanneriya	FO secretary	Yaya representative	-
Maha Nanneriya Minor Schemes	Farmer named by Vel Vidane selected in the Kanna meeting, or FO meeting	-	-

As for major irrigation schemes, the tank sluices and turnouts gates on main canal system are operated by the irrigation department, while some distributary canals and almost all field canals are operated by members of FOs. Sluice gates are controlled by ID staff according to the operation schedule decided at the Kanna meeting. The rotation rules among the D-canals are also decided at the meeting according to the extent of land fed by the canals and informed to the FO leaders in writing. The heads of distributary canals are operated in accordance with the rotational rules. The FO sets the rotation rules within a D-canal, discussing it at a FO general meeting, but it depends on the scarcity of water. Usually, priority is given to areas located downstream of the canal for fair water distribution.

In medium irrigation schemes, the tank sluice gates control is carried out by the farmers under technical guidance of the irrigation department officials in spite of the official hand-over to the farmers has not been made. The water distribution method within the command area is decided by the farmers.

The water distribution in minor irrigation systems is carried out by farmers themselves. In general, there is a flexible water distribution method in the minor schemes according to farmer's need. The farmers take water of the F-canals through a farm turnout or by cutting the canal bund. Plot-to-plot

irrigation is basically adopted within a farmer's field.

5) Maintenance

At present, maintenance activities for each scheme is carried out as follows:

Maintenance Activities

Name of scheme(s)	Tank	Main Canals	D-canals	F-canals
Nachchaduwa	ID	ID	farmers by sramadana or contract	Farmers by panggu
Palukadawela	ID	ID	Farmers by sramadana or contract	Farmers by panggu
Periyakulama	ID	Farmers by panggu	-	-
Maha Nanneriya	ID & Farmers	Farmers by sramadana	-	Farmers by panggu
Maha Nanneriya Small Schemes	Farmers by sramadana	Farmers by panggu	-	

ID conducts the maintenance works for tanks and main canal in major and medium schemes, among which some works is entrusted to FOs on contract basis. For instance, in the Maha Nanneriya scheme, the maintenance of the tank sluice and spillway is carried out by the farmers on contract basis.

There are two major maintenance activities carried by FOs: clearing and desilting. FOs are also expected to clear the weeds (jungle) from their own field canals by themselves. Before the Government carried out weeding in the major and medium schemes, but it is done by FOs at present. Farmers are also de-silting their field canals by themselves. Besides these major activities, FOs are also attend to small repairs, including minor earthworks of the tanks and adjustment of canal gates.

There are two kinds of maintenance works, namely, Sramadana and Panggu. Sramadana, a volunteer labour service, is a communal works which all farmers are expected to attend. In principal, Sramadana is carried out without compensation for the attendance, refreshment or allowance for them are sometimes covered by the FO's account or a contract. In some cases, the contracted maintenance work is carried out by Sramadana basis to deposit all money to the FOs account. Panggu is a maintenance system, that work is allocating a length of canal to be maintained according to the extents farmers cultivates. The maintenance works of the F-canal is conducted by the Panggu method. Usually, farmers attend the maintenance in the canals that are adjacent to their farmlands.

6) O&M Costs

Annual O&M budget for each scheme is summarised as follows:

Operation and Maintenance Costs of Irrigation Facilities

Name of Scheme(s)	Government O&M cost (Rs.)	Cost allocated to FOs (Rs. /FO/year)	Salaris (per acre/season)
Nachchaduwa	960,000	- 5,000 – 10,000	- 0.5 bushel
Palukadawela	300,000	- 5,000 – 10,000	- 0.5 bushel
Periyakulama	42,000	- 17,000	- Not collected
Maha Nanneriya	57,000	- Not received	- Rs. 50 or 0.5 bushel
Maha Nanneriya Minor Schemes	- No government O&M cost	- Not received	- Rs. 50 or 0.5 – 1.0 bushel

The O&M cost of ID includes the operation cost for the DD's office and the IE's office, and operation and maintenance cost for irrigation facilities. The operation cost includes office administration and allowance for the staff and excludes the staff salaries. Some 30% of total maintenance costs are allocated to the FOs for the maintenance of D-canals even though the responsibility of O&M have been handed over. The FOs spend the money on refreshment or allowances for their sramadana participants or make a deposit for future repair or maintenance works.

An allowance named by a "Salaris" is collected from farmers. They are spent for allowance of the gate operator and reserved for the maintenance activities. It is found that the collecting rate of the salaris is less than 50%, at present.

Some of the FOs, such as in Ihalagama, Thamare, and Ihala Nanneriya schemes, receive a Samurdhi fund. The funds are being used for maintenance work without collecting any O&M fee from the farmers.

7) O&M Equipment

No major O&M equipment other than tractors is operated by the office of the irrigation department.

15.5 Marketing and Rural Infrastructure

15.5.1 Marketing and Processing Facilities

The present situation of marketing and processing facilities in the priority schemes is shown below. The processing machines of small-scale rice mills and mills are used for local consumption in the area.

Marketing and Processing Facilities in the Schemes

	Nachcha-duwa Major Scheme	Palukada-wela Major Scheme	Periya-kulama Medium Scheme	Maha-nanneriya Medium Scheme	Maha-nanneriya Minor Schemes	Total
Rice mill - Large	17	-	-	1	-	18
- Small	43	19	3	9	6	80
Chilli mill	22	3	2	1	2	30
Coconut oil mill	1	1	-	-	-	2
Storage house - Fertiliser	6	1	-	1	1	9
- Rice	2	3	-	-	1	6
Pola	1	-	-	-	-	1
Milk collecting point	2	1	-	-	-	3

Sources: Interview survey for FOs and animators

15.5.2 Rural Infrastructure

The present conditions of rural infrastructure in the schemes are summarised as follows:

Rural Infrastructure in the Schemes

Subsector	Nachcha-duwa	Periyakulawa	Palukadawela	Mahanan-neriya	Mahananneriya Minor Schemes (Cascade)				
					Kallan-chiya	Aarthi-kulama	Ihalagama/ Pal Mailawa	Tambare-wewa	Iharanan-neriya
(1) Domestic Water Supply & Sanitation									
- Adequate potable water	75%	66%	38.7%	29.0%	20%	24.8%	24%	8.5%	27.9%
- Protected wells	45%	40%	27.4%	28.2%	5.3%	5%	24%	8.5%	27.9%
- Tube wells	59nos	3 nos	55nos	3nos	nil	1nos	nil	nil	nil
(2) Electrification	59.1%	95%	15.1%	5.5%	0%	14.5%	60%	0%	34.5%
(3) Roads									
- D class roads	48km	3 km	131.4km	9.9km	nil	4km	3.2km	10km	28km
- Rural roads	90km	2 km	51.6km	9km	10 km	2km	1.6km	5km	16km
(4) Health Care									
- Hospital	2	nil	nil	1	nil	nil	nil	nil	nil
- Clinics &,or Dispensary	nil	1	1	nil	nil	nil	nil	nil	nil
(5) Education									
- Primary Schools	1	1	7	1	1	nil	nil	nil	nil
- Secondary Schools	8		2	nil	nil	nil	nil	nil	nil
(6) Community Hall	22		17	7	1	1	3	1	1
(7) Farmer Centre	nil	1	nil	nil	nil	nil	nil	nil	nil

Source: Divisional Secretariats, Grama Niladali, Irrigation offices.

15.6 Marketing Agricultural Products and Farm Inputs

15.6.1 Marketing of Agricultural Products

The marketable surplus paddy to the outside market is very small. Normally surplus paddy in the Project area is sold either to assemblers or directly to millers, then assemblers to collectors. Storable field crops in the Project area are bought by collectors and resident traders while some produce is sold in roadside stalls or taken to the polas. The farmer in the Project area has the choice of selling his produce to the village or local shopkeeper, at the rural pola to traders, sell at collection points along the road or at few local assembly markets. A part of the products is for repayment of loan and stored for next crop.

Farmers in the Project area are well served with a network of roads. The farmers in Nachchaduwa, Palukadawela, and Periyakulama have collectors operating in the area. Farmers in Nachchaduwa have easy access to the Athuruwela pola while farmers in Palukadawela and Mahananneriya have easy access to the Galgamuwa pola that is 8 to 12 km distance and operating twice weekly. In addition, there are many collectors and mills that also collect produce in the Project area. It is also a practice among some farmers to send their produce (especially vegetables) by lorry to Dambulla. In the case of Palukadawela, farmers who cultivate year round irrigated vegetables have arrangements with traders to

take their products on a regular basis to Galgamuwa for disposal. Generally marketing is not problem if their products are transported to the main roads; however, farmers face the problem of unstable price due to the free market system and their no quality management.

15.6.2 Marketing of Farm Inputs

The private sector plays an important role supplying inputs to the farmers, but the public sector still plays a relatively important role on paddy seed. Paddy seeds required for the next cropping are mainly retained by farmers. Some farmers buy paddy seed from the Agrarian Service Centre and Co-operatives. Other seeds are obtained from the village or town store or from agents of seed companies.

Fertilisers are marketed in the Project area through distributors as well as the Agrarian Service Centres. Four farmer organisations in the Nachchaduwa Scheme undertake group purchase of fertiliser requirements of its members. However, most farmers obtain their fertiliser needs from private traders, dealers and agents of fertiliser importers in the town or villages in the Project area. Cattle manure is also available and traded in the Project area. Along with fertiliser, distributors and local agents also market agro-chemicals. Traders in the town or village in the Project area usually stock seeds, fertiliser, and agro-chemicals in their store and act as agents for several suppliers

15.7 Community and Farmers' Organisation

15.7.1 Village Community

(1) Present Situation of the Priority Irrigation Schemes

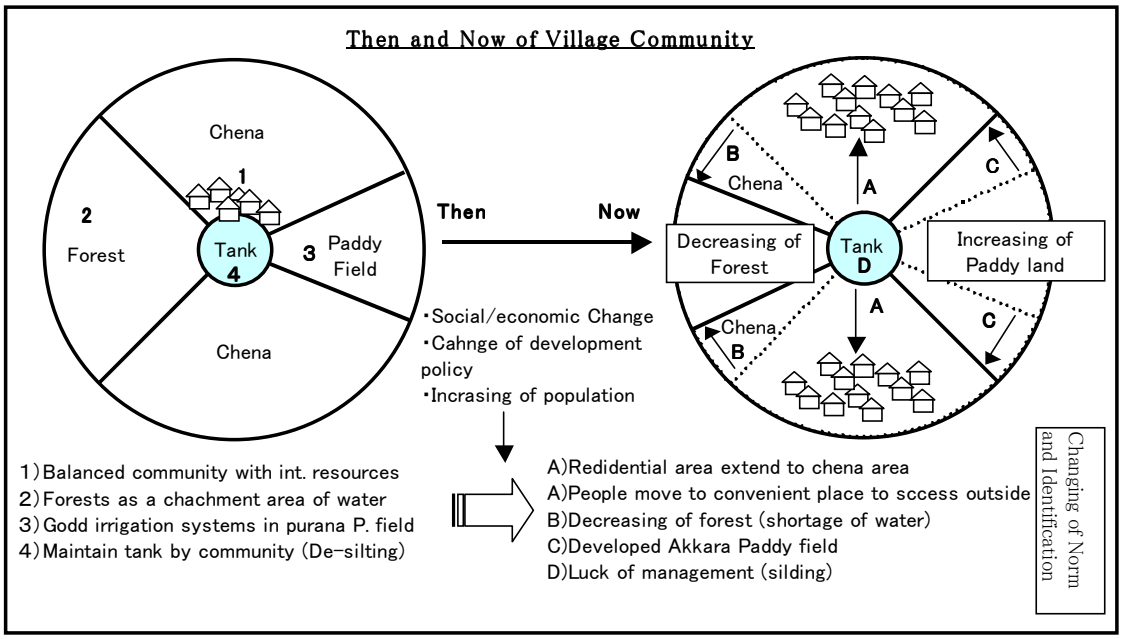
Hydrological communities in the dry and intermediate zones are based on village tanks in small irrigation schemes and the major irrigation schemes are based on the irrigation system. Generally, Farmers' Organisations and other Community Organisations are also established on these hydrological communities. Almost all traditional villages, not settlement, consist of single caste and ethnic group, which is distinct, particular of the irrigated agricultural area in the north, and the ties in the community are strong. In addition, some of communities have their own unique festivals, ceremonies and traditions according to RRA survey. Generally, a community consists of 2 to 3 'Gamas' or villages. In the case of the medium and minor irrigation schemes, a community could be consisted from a single 'Gama'. Grama Niladari (GN) is a village level administrative officer and the GN division is the smallest administrative unit in Sri Lanka. A GN division is formed from several village communities. However, a GN division does not coincide with a hydrological community or a water cascade boundary. Numbers of GN administrative boundaries are set within a community or a FO jurisdiction area due to the re-demarcation of boundaries after settlement in major irrigation schemes. Consequently, it is difficult to collect fundamental data based on the

rural communities or FO jurisdiction areas. Thus, all necessary data has to be gathered through interviews or collected from FOs or the Farmer Animators of ASC directly.

(2) Traditional Norms and Historical Changes of Communities

The farmers generally feel that they have lost the traditional norms (moral values, mutual help, unity). It seems that such norms had been created in the past through the communal activities as maintenance of community resources, irrigation systems, etc. However, the recent social and economic changes has affected the Government policies, the administration and development system in the rural areas. The population increase also influenced these changes. The village norms and traditions that regulated important community work related to the use of resources and preservation of the environment has also declined by such internal and external factors influenced the rural communities both directly and indirectly. The present Study clearly understood that there are not much differences between farmers' ideas and the government policies on the community initiated rural development. It is required to prepare the basic situations, such as the regular information release, fair distribution of the system use and the dispatch and the receive methods of the peoples needs, in order for the communities and the farmers' organisations to be able to actively use the systems effectively and continuously.

Highly sustainable implementation of the rural development by active participation of the communities requires that external agencies should understand the reality of village communities and villagers. The stakeholders on the development required the method considered the formation process of the new norms by sharing the mutually agreed ideas and adapting to each community through the activities for supporting to formulate an autonomous and an active communities.



15.7.2 Community Based Organisations in the Community

The present situation of community based organisations in Grama Niladhali divisions including the priority irrigation schemes is as follows.

Distribution of Community Based Organisations by Grama Niladari Divisions

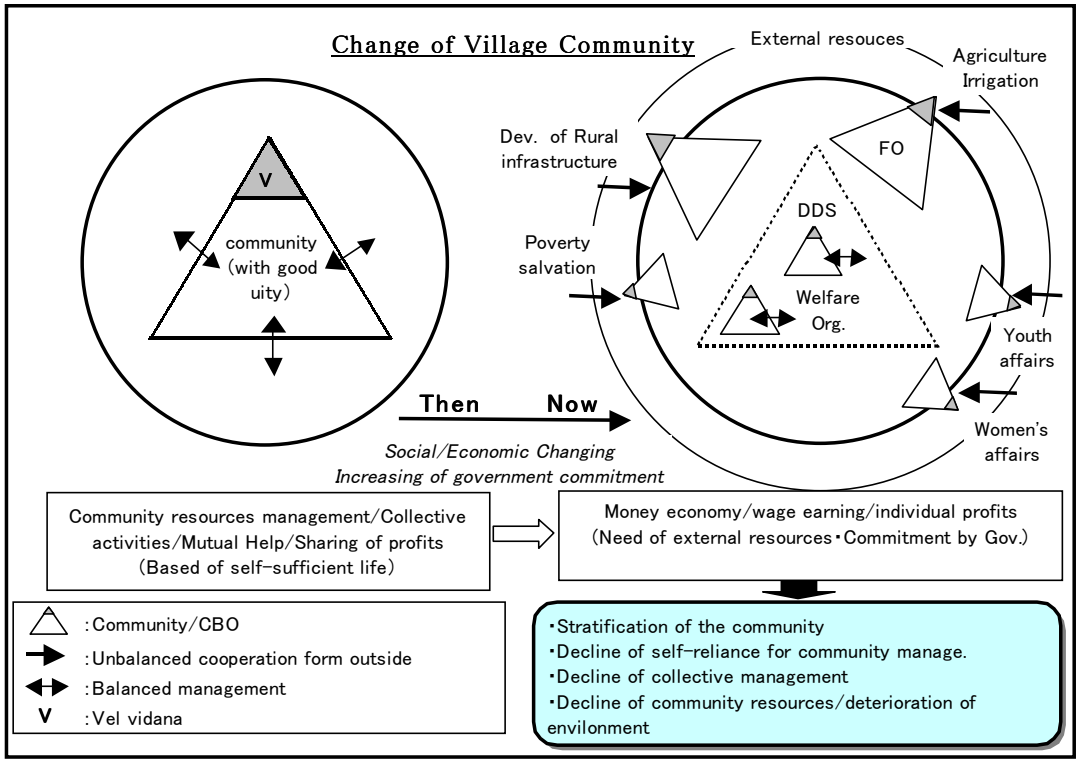
Irrigation Scheme	Major			Medium			Minor			
CBOs in the study area (GN division based)	Nachcaduwa	Palkadawela	Sub Total	Periyakulama	Maha-nanneriya	Sub Total	Maha-nanneriya	Sub Total	Ratio	Relative Institution
1. Group Society	148	15	163	17	-	17	13	193	40%	NGO, Community, Development Programme
2. Dead donation Society	32	22	54	3	2	5	6	65	13%	Community
3. Farmers' Organisation	31	13	44	3	2	5	4	53	11%	DOI, DAS
4. Samurdhi	20	14	34	1	4	5	4	43	9%	Ministry of Samurdhi
5. Women's Society	18	13	31	1	1	2	4	37	8%	NGO, Department of Women affairs
6. Youth Club	17	6	23	1	-	1	2	26	5%	NYSC
7. Village Development Council	15	6	21	1	-	1	1	23	5%	Local government (the system was abolished)
8. Farmers' Co-op. Society	9	2	11	1	-	1	-	12	2%	Department of Co-operative
9. Village Council	9	2	11	-	-	-	1	12	2%	Local government (the system was abolished)
10. SANASA	8	2	10	-	-	-	-	10	2%	SANASA Bank
11. Library committee	4	1	5	-	1	1	-	6	1%	NGO, Government Institutions
12. Village Community Council	2	2	4	-	-	-	1	5	1%	Local government (the system was abolished)
Total	313	98	411	28	10	38	36	485	100%	
No of GN	18	13	31	1	2	3	4	*37		
No. of Village	38	19	57	3	5	8	7	72		(GAMA)

Note: A GN division is involved in Mahananneriya minor scheme and Palkadawela Major irrigation scheme. Therefore total No. of GN comes to 37.

Generally these CBOs are set up within a village community and act in their areas. The Government organisations for the administrations and the development projects are also established based on communities. As in the above table, most formal organisations are set up by external agencies. On the other hand, there are informal organisations/groups such as the "Seettu" group, other saving organisation as women's bank group, welfare society/group and contact groups on development projects and small-scale activities.

Among the external organisations, the Government concerned organisations are active with external sources of finance and resources during the project period. However these are affected largely by the project termination or the political changes, and most of CBOs had collapsed with termination of budget allocation from the external organisation. There are other instances that some sponsor organisations for the CBOs had not been functioning, but the CBOs are still continuing by only the committee/board members without any notice. The Village Councils and Rural Development Societies in the table above are in this case.

Many community organisations were established for promoting activities and for development by the government institutions in the past and these reflect the objectives and the activities of the respective institutions. Therefore, careful consideration should be given to the situation that several Government-led-CBOs are established in the same community and these formed special groups and accelerated the stratification in the community such as big landlord, rich farmer and target group of poverty alleviation, and they are connecting strongly with specific external agencies. It resulted that information and activity sharing among groups are not realised and created a factor of limiting villagers on positive movements by the one-sided assistance to CBOs by external agencies.



15.7.3 Farmers' Organisations

The Agrarian Services Act (Amendment in 1992) and Irrigation Ordinance (Amendment in 1994) have been enacted for sustainable development of agriculture in the rural community by the democratic and vital movement process of managing by the representatives of owner farmers, tenant farmers, and farm labours. Nevertheless, the most active and popular organisation in the community is the Death Donation Society (DDS). However, DDS in Puranagama, an ancient village, in Palukadawela major irrigation scheme, has formed five organisations and divided the community due to its strong unity.

Under these situations, the basic situation that makes participatory development possible legally and systematically is prepared. FOs established in the Agrarian Services Act are the most suitable community based organisations to implement

rural development of the community. There are 28 FOs in the priority scheme area and the membership of FOs by sex is shown below:

Membership by Sex Ratio

Irri-gation Schemes	Major Irrigation Scheme				Medium Irrigation Scheme				Minor		Total	Ratio
	Nachchcaduwa		Palkadawela		Periyakulama		Mahananneriya		Mahananneriya			
	Mem-ber	Ratio	Mem-ber	Ratio	Mem-ber	Ratio	Mem-ber	Ratio	Mem-ber	Ratio		
Male	2107	82%	770	83%	49	94%	171	92%	237	79%	3334	83%
Female	451	18%	157	17%	3	6%	15	8%	64	21%	690	17%
Total	2558	100%	927	100%	52	100%	186	100%	301	100%	4024	100%

Source: Interview to FOs carried out by the Team.

Some FOs in Palukadawela of the major scheme are established in the 1970s in Palukadawela. The Agrarian Services Act was amended in 1992 and this clearly legalised the status of FOs and all FOs in the major and medium irrigation schemes have completed registration in 1992.

The FOs in the minor schemes started the process of registration after 1996 and Kallanchiya FO in the Mahananneriya Minor Irrigation Scheme is still in the process of registration at the Study time in 1999. The way of charging the entrance fee and membership fee is described in the model of the articles of an association of DAS. However, charged fees in FOs vary largely as shown in the table below. The ratio of participation to FO is high in the major schemes.

General Characteristics of Farmers' Organisation

Irrigation Scheme	Major		Medium		Minor	Average
Name of Scheme	Nachcha-duwa	Palukada-wala	Periya-kulama	Maha-nanneriya	Maha-nanneriya	
Joining ratio	70%	72%	25%	10%	56%	43%
Year of establishment of FO	1982-1990	1970-1990	1984	1982	1988-1996	1994
Year of registration of FO	1992-1992	1991-1992	1992	1993	1996-1999	1997
Registration No.56A	87%	57%	100%	0	80%	65%
Registration No.56B	13%	43%	0%	100%	0%	11%
Not registered	0%	0%	0%	0%	20%	4%
Entrance fees (Rs.)	5 - 100	0 - 5	25	25	0 - 100	36
Members fees (Rs./month)	5 - 120	5 - 100	5	5	5 - 100	15
No. of Share (No.)	0 - 80	0	150	170	15 - 63	49
Price of a Share (Rs.)	100	0	100	100	100	100
Amount of share (Rs.)	4,391	0	15,000	17,000	4,267	4,932

Source: Interview to FOs carried out by the Study Team.

Structure and operation of FOs is shown in the table below.

Structure and Operation of Farmers' Organisation

	Irrigation Scheme	(Unit)	Major		Medium		Minor	Total of 28 Fos	Average
			Nachcha-duwa	Palkada-wela	Periya-kulama	Maha-nanneriya	Maha-nanneriya		
1	No. of FO	(No.)	14	7	1	1	5	28	
2	No. of Office bearers in each FO	(No./FO)	5	4.4	5	5	5	135	4.8
3	Existing of Internal Auditor	(%)	11	0	1	1	6	19	68%
4	No. of committee member	(person)	4.6	3.4	6	8	6.2	132	4.7

(continued)

5	Total of committee	(No./FO)	9.6	7.9	11	13	11.2	268	9.6
6	Existing of Sub-committee	(No.)	2	0	1	0	0	3	0.1
7	No. of female committee member	(person)	1	0	0	0	5	6	0.2
8	Method of Election								
	Proposing and seconding method at general meeting	(No. of FO)	14	7	1	1	5	28	100%
	Voting is practiced occasionally	(No. of FO)	2	2	0	0	0	4	14%
	Selecting from yaya representatives	(No. of FO)	14	7	1	0	0	22	79%
	Selecting from all farmer members	(No. of FO)	0	0	0	1	5	6	21%
9	Having by-lows	(No. of FO)	14	7	1	1	5	28	100%
10	No. of general meeting	(Time/Year)	2.5	3.3	1	4	5.2	88.5	3.2
11	Percentage of attendance	(%)	52%	56%	50%	50%	51%		52%
12	No. of Committee meeting /year	(Time/Year)	10.6	10.7	4	18	6.2	277	9.9

Source: Interview to FOs carried out by the Study Team.

In the major irrigation schemes, committee members are selected from the Yaya Representatives (Field canal representatives), but in the medium and minor irrigation schemes the elections are open to all farmers. There are 5 females committee members in the minor irrigation schemes but in the major irrigation scheme of Nachchaduwa, there is only 1 female in all 14 FOs. However, very few members and no leaders are in the medium irrigation schemes. Although the by-laws of each FO stipulate 5 office-bearers, there are 3 FOs without posts of vice-chairman and assistant secretary in Nachchaduwa and Palukadawela.

15.7.4 Gender

The rate of female's participation to FO in the minor schemes is higher than of the major schemes according to the survey. Most females became FO's members automatically when their spouse died. Principally the head of household is the member and female and youth members are very few.

Gender issues in the Study area observed a traditional life style in the community, which is relatively rich in larger schemes. This is understood through the discussion of participants especially youths and women in the participatory surveys and the workshops.

The women and youths in the family raised the following three issues.

a) Lack of opportunity to speak in public in the community as neutral position.
b) Lack of co-operation of men for the activities of youths and women.
c) Domestic trouble on dependence of men to alcohol.

Men's drinking is pointed out in the RRA survey and by increasing domestic violence to women. According to the continuing RRA survey and the workshops, More woman are speaking out on issues that concern them. They have spoken out the matters what was not able to speak among the community member, then the participants are adequately correspondences to them, where observed in the workshop. It is likely that they have no opportunity of speaking in the better irrigation supplied Puranagama, an ancient village, where strong traditional cus-

toms remain.

15.8 Agricultural and Social Support Services

15.8.1 Agriculture and Rural Development Institutions

The introduction of the decentralisations policy in Sri Lanka in 1997 promoted the involvement of the Provincial Councils in development. The agricultural and rural developments have currently been implemented both by the central governmental line agencies and the institutions under the Provincial Councils (PCs). Major institutions related to the Study are as follows.

Major Institutions on the Study

Major Functions	Institutions
Irrigation Development & Management	Department of Irrigation Development
Irrigation Management	Irrigation Management Division
Crop sub-sector Development & Extension	DOA, IPEU, PDO NCP & NWP
Livestock sub-sector Development & Extension	PDAP&H, NCP & NWP
Inland Fisheries sub-sector Development & Extension	NAQDA
Farmer Supporting & Management of Minor Scheme	DAS, Anuradhapura & Kurunegala
Agricultural Research & Development	Research institutions of DOA, KARTI & others
Seed Production & Distribution	DOA, PDOA & private sector
Rural Credit Services	State & private banks, co-operatives etc.
Income Generation Support	NYSC, NAITA, SEDD, DS

15.8.2 Agricultural Extension

A number of institutions under different jurisdictions engage in agricultural support activities in the Project areas as shown in Figure 3.9.2. Among such institutions, the IPEU, PDOAs, DAS, and NAQDA have the most important role in extension activities and provide a range of extension services in the areas as shown in Table 3.9.2. The extension services of the crop sub-sector in the Project areas are provided by the IPEU, Anuradhapura, the PDOA of NCP and NWP, and the DAS, Anuradhapura and Kurunegala. The field extension staffs of these agencies are AI of the IPEU and PDOAs and FA/ADPA of the DAS. The deployment of AIs and FA/ADPAs in and around the Project areas are as shown below.

No. of Extension Staffs Deployed in and around the Project Areas

Staff	Nachchaduwa	Palukadawela	Periyakulama	Mahananneriya	Minor Schemes
AI (No.)	4	3	1	1	3
Service Area/AI	1,480	2,670	3,490	3,270	-
FA/ADPA	13	7	1	1	3

Note: Service Area/AI – Farmland area in AS division/No. of AIs at the AS Centre

It is obvious from the table that the posting of AIs appears to be limited compared with the service areas of them. Meanwhile, one FA/ADPA is posted to every GN division in principle and the intensity of their deployment is enough to meet farmers requirement. However, their technical and extension skills are rather poor since their technical background are mostly obtained through the induction

training of three months at the PDOA or ASC and the recipients of technical training are limited.

The extension services of the livestock sub-sector in the areas are covered by the PDAPH, NCP and NWP. The deployment of livestock field staffs, VS and LDI, is at the VSD basis and the number of staffs posted in the project-related divisions is limited compared with their service areas as shown below.

No. of Livestock Field Staffs Deployed in and around the Project Areas

VS Division	Project Schemes in Service Area	Staff Deployment
Nuwaragam Palata East	Nachchaduwa	VS 1; LDI 1
Tirappane	Periyakulama	VS 1; LDI 1
Galgamuwa	Palukadawela, Mahananneriya, Cascade VII	VS 1; LDI 1

The inland fisheries development activities and extension services of the NAQDA at district/divisional level are provided by the Aqua-culture Extension Centres (AEC) and the Nachchaduwa and Periyakulama Schemes are located within the service areas of the AEC Anuradhapura and the Palukadawela and Mahananneriya Schemes and Cascade VII are in the service areas of the Nikaweratiya AEC. The AEC at Anuradhapura was established in 1997 and are staffed with seven technical staffs. However, the AEC in Nikaweratiya is yet to be established and currently only one field officer, Fisheries Inspector (FI), is posted at the Nikaweratiya DS office. The present extension system employed by the IPEU and PDOAs have continued to apply similar approach to the system introduced under the SAEP.

Present Extension System in the Project Areas

Field Extension Staffs	- AIs stationed at AS Centres supervised.
Target Groups	- Small farmer groups of 10 to 25 farmers (basically), FOs & individual farmers.
Field Extension Method	- Training/guidance through implementation of field programmes, - Periodical visits to programme sites & groups (once/ 1-2 weeks), - Assistance provided by Farmer Animator, and - Visits to non-beneficiary areas are limited.
Farmer Training (Class)	- Representatives of small farmer groups & FOs organised at division, district & province level, and - Guidance/training through training components accommodated in field programmes.
Extension Coverage	- Targeted to be about 20 % of the whole farmer groups within the service area and 2 FGs/day; (However hard to accomplish) - Capacity in coverage of field programmes/AI: about 6 programmes
Supervision/ Monitoring	- By senior officers at segment or divisional offices, and - Supervision/monitoring by district/province staff is limited.
Guidance/Training: (Staff)	- Periodical meeting at divisional office & district offices (once per 1 to 2 weeks & monthly, respectively), - Pre-seasonal in-service training, and - Ad-hoc training on special subjects on needs basis.

The agricultural extension programmes in the Project areas are implemented under the central and provincial budgets or the support of the donor funded projects in the rural development and irrigation development sectors. The extension programs in the cropping seasons of 1999 (1999 Yala and 1999/2000 Maha implemented or scheduled in the project schemes), as large-scale (yaya) paddy demonstration programme, seed production programme and IPEU programme, are pre-

sented in Table 15.8.1. As shown in the table, the programme implemented in the PDOA is rather limited comparing with the programmes conducted under IPEU. The extension programmes other than animal health services of vaccination and treatment and breeding services of AI implemented in the Project schemes are shown in Table 15.8.2. Although the coverage of the current extension programmes is rather limited, the programmes include animal distribution, cattle shed construction support, farmer training and poultry supply.

The project related main agricultural supporting include the Agrarian Service Centre (AS centre), In-service Training Institute (ISTI) Maha Illuppallama, PDOA, NCP, Provincial Seed Farms, PDOA, NWP and the Integrated Farmer Training Centre (IFTC), PDAP&H, NWP as shown in Table 3.9.1.

15.8.3 Agrarian Service Centre and Agrarian Service Committee

The farmer supporting services of the DAS including farm inputs supply, establishing & strengthening FOs, establishing & supporting Agrarian Service Committee (AS Committee), cultivation loans through Farmer Bank and other services are provided through the Agrarian Service Centre (AS Centre) established at the divisional level. The AS Centre is to be established as a nucleus place for providing support services to FOs and individual farmers. The Project areas are located within the service areas of the Nachchaduwa, Tirana, Galugamuwa, and Mahananneriya AS Centres.

The Divisional Officer (DO) of the DAS is the head and also serves as the Secretary to the AS Committee. The AS Centre is established with offices for the DO, AS Committee, AI and for other field officers of various institutions involved in agricultural development and support. It is to be administered by the AS Committee, which composed of the representatives of 10 FOs and 5 agricultural officers and the DO is practically responsible. The AS Centre has a dual function, firstly as retail outlets of farm inputs and as local headquarters for all divisional level staff engaged in agricultural development and support works. The common operational problems of the centres are poorly established office facilities, lack of communication means, and transportation means for the integrated activities of the related field officers.

The AS Committee is the committee established as the organisation executing support services provided through the AS Centre and it is to prepare estimates of required inputs in advance to cultivation seasons and procure them for timely distribution to FOs and farmers in the service area of the centre. However, the business activities of the project related AS Committees are rather limited and the current financial status of them are marginal suffering from the substantial cumulative losses.

15.8.4 Agricultural Research

The research institutions which are expected to be the technical resources for the present Project are the Rice Research and Development Institute (RRDI) of Battalagoda, Field Crops Research and Development Institute (FCRDI) of Maha Illuppalluma, Horticultural Crop Research and Development Institute (HORDI)of Gannnoruwa and Regional Agricultural Research and Development Centre (RARDC) Makandura under the DOA. Liaison between the regional research organisations and the extension agencies is effected through the Provincial Technical Working Group (PTWG) organised on provincial basis as shown in Figure 3.9.3.

15.8.5 Seed Production and Distribution

The production of seeds in Sri Lanka has been privatised and is performed by both the public and private sectors. The paddy and OFC seed production by the public sectors is carried out by the seed farms of the Central Government and the Provincial Councils, and by the contract seed growers with the government farms. In the Project related areas, there are two Government Seed Farms, one in Maha Illupallama, Anuradhapura district and the other is in Nikaweratiya, Kurunegala district, and one provincial seed farm of the PDOA, NWP is operated at Galgamuwa. Paddy seed production is also encouraged through extension programs of the IPEU/PDOA. Such programmes implemented in 1999 in the Project schemes include paddy seed production program and self-seed production programs as shown in Table 15.8.1. The areas covered by such programmes in the schemes are summarised below.

Paddy Seed Production Programmes Implemented by Extension Agencies in 1999

Schemes	Programmes & Areas Covered		Institute
Nachchaduwa	Seed Production Programme / Self-Seed Prod. Programme	17.4 ha	IPEU
Palukadawela	Seed Production Programme	10.3 ha	PDOA/NWP
Periyakulama	Seed Production Programme / Self-Seed Prod. Programme	4.2 ha	PDOA,/NCP
Mahananneriya	Self-Seed Prod. Programme	0.2 ha	PDOA/NWP
Cascade VII	New Variety Introduction programme	0.1 ha	PDOA/NWP

The main private seed producer in and around the Project areas is the CIC Seeds (Private) Ltd, which is a large-scale private producer operated in the two-privatised government seed farms under lease agreement. The current capacity of its paddy seed production is around 4,000 t/year.

15.8.6 Rural Credit and Agricultural Insurance

The rural credit facilities in and around the Project areas are operated by the three categories of institutions, the formal, semi-formal and informal institutions as explained in the Section 3.9.4. The bank branches rendering services in and around

the areas are presented by scheme in Table 15.8.3. The GOSL's rural credit sector policy of establishing a widespread rural banking network at the grass root level has been pursued by the Central Bank of Sri Lanka (CBSL) and a substantial number of credit facilities are presently operated in the rural areas. Major institutional credit facilities being operated in and around the Project areas include NCRCS, other forms of cultivation loans, medium term credits for procurement of machinery and animal and for purchasing farm products as shown in Table 15.8.4.

The agricultural insurance is issued by the Agriculture and Agrarian Insurance Board (AIB) of the MOAL. The AIB has its district offices in Maho, Kurunegala District and Anuradhapur. The Nachchaduwa and Periyakulama Schemes are covered by of the Anuradhapura Office and Palukadawela, Mahananneriya Schemes and Cascade VII are in the service area of the Maho Office. The AIB operates two types of agricultural insurance, crop insurance and animal insurance. Target crops of the crop insurance are paddy and OFC and the animal insurance covers cattle and goat.

15.8.7 Support Services of Agencies Related to Income Generation

The current support services rendered by the project related agricultural agencies, which are the important institutions for the income generation activities, are discussed in the preceding section and their major support are shown in Table 15.8.1 and Table 15.8.2. The major support activities of other project agencies related to income generation are rather focused on vocational and technical training and credit supply for the establishment micro enterprises or self-employment needs. Generally speaking, similar support activities are introduced by different agencies and the target groups of the activities are the rural poor and the rural unemployed youth.

15.9 Environment

The Project areas are predominantly agricultural. Natural resource use is therefore, largely focussed on the use of land and water for the production of the basic food needs of the people. The usual natural vegetation in the DL1 agro-ecological region, where all the proposed schemes are located, is the typical dry mixed evergreen type. There are, however, varying extents of forest plantations of teak, eucalyptus, and acacia in and around of the schemes.

With the gradual elimination of the forest and grassland for agriculture and settlement, while the elephant has chosen to remain and pocketed among cultivation and settlements, and it causes regular depredations. Other animal families have been pushed into small forests and the population are decreasing drastically. Reportedly threatened species are the elephant, leopard, and mouse deer.

Environmental situations in and around the priority irrigation schemes are discussed below.

1) Man-elephant Conflict

The human-elephant conflict has at the present time, reached serious proportions to warrant immediate attention. Wild elephants damage paddy and upland crops, houses and cause death and injury to man. Damage control measures so far adopted have not brought about the desired results. Several countermeasures are available, but it takes effort and time to get them into the farmer's hand. On the other hand, wild elephants too have had their share of injury and death, caused by angry farmers resorting to extreme measures in order to safeguard themselves, their crops, and property. Animals take refuge during the day in patches of forest and at night, move into cultivated lands, also damaging houses in search of stored paddy and salt. Men and women, in the course of their normal work in the fields, have met with their death and have also been injured.

Wild elephants are scattered over all Project areas. Their numbers vary from place to place and from time to time, for they move over large areas in search of food and water, the availability of which is determined by the alternating Yala and Maha seasons. Herds, made up of adult females, young and sub-adult males, have established their own habitual feeding and watering grounds referred to as home ranges. In the Maha when water and food are plentiful, the animals disperse in groups of varying number, always led by a female, and also in singles, twos, and threes. The latter grouping is essentially male. In the Yala, when water and food are both limited, the tendency is for the animals to move closer to watering places. Receding water lines permit the growth of luscious grasses on the tank beds, as is a feature in the Kalawewa-Balaluwewa which attracts the elephant. According to the Department of Wildlife Conservation, Northwest Range office based at Anuradhapura, elephant numbers in and around the areas of Study are estimated. These may vary from 360-465. Present day numbers are too many to be supported by the food and water in the areas they are now forced to inhabit. Their home ranges have been drastically reduced by man's incursions. There is only one declared sanctuary in these areas, i.e. Kahalla-Pallekelle, at the southeastern boundary of Anuradhapura district and spilling into the Kurunegala district. Although relatively large, it is reported to be in poor condition, with many settlers.

2) Pesticides and Fertiliser Use and Water Quality

Farmers, in general, use excessive amounts of pesticides, much more than

the department's recommendation. It has added to the cost of production. More rational use will bring about better incomes and improved environmental quality.

The sources of water in all tanks under study, except Nachchaduwa, is rainfall runoff from the respective catchments. Agricultural runoff rich in nitrogen and phosphate will lead to algal growth and eutrophication. COWI consulting work carried out in 1993, in connection with the Anuradhapura district water supply and sanitation study, concluded that surface and groundwater showed the presence of nitrate, ammonia, and phosphate, derived very likely from high fertiliser use in crop husbandry. No pesticide residues were detected.

The construction of agro-wells is a recent phenomenon. There have been problems of well location, recharge, water quality, water management.

3) Runoff of Surface Soil

Much of the vegetation of tank catchments has been cleared for upland rainfed cultivation. Soil erosion is quite common on the rainfed uplands and in the home gardens and reduce productivity. The erosive processes culminate in the silting of waterways and tanks, particularly seen in the small tanks. It has been reported that salinity problems have occurred in a number of fields due to poor drainage. Desilting and protection of drainage canal are required.

4) Water Borne Diseases

Of the public health issues, that of malaria is common. The periodicity of the disease is associated with weather conditions. Serious outbreak is occurs when necessary protection is neglected. The incidence of malaria, however, appears to be on the decline. Other vector-borne diseases present are dengue and Japanese encephalitis, but these are of low significance.

5) Cultural Heritages and Ruins

An abundance of historical and cultural heritages and ruins are around the priority irrigation schemes. Some of them are protected by the law and the others are not. There are not situating such properties within the schemes.

Hence, it is suggested that the issue of the human-elephant conflict be resolved in a more lasting manner. In the case of all other issues listed above, initial corrective measures and subsequent good management can bring about a more sustainable means of agricultural production.