

3.4.6 Constraints and Prospects

(1) Constraints

- a) Low Genetic Potential of the Existing Breeds
- b) Low Utilization of the Existing Animal Resources
- c) Low Productivity of the Feed Production Area
- d) Low Yield on Natural Grassland
- e) Inefficient Utilization of Crop Residues and By-Products.
- f) Low Energy and Protein Intake, Ratio-Imbalance
- g) Performance and Production Losses due to Diseases
- h) Management and Productivity Problems in the State Farms
- i) Increasing Processing and Marketing Problems

(2) Prospects

The livestock industry in the Study area is favoured by several conditions for future livestock development.

- a) The Study area has a range of climates suitable for various livestock activities, including those of exotic or improved breeds.
- b) Livestock products in general are highly marketable on the whole of the Island, because the Study area is located in the central part of the country.
- c) Most people in the Study area are highly familiar with livestock farming either traditionally or through experience since they may have been employed by the large scale farms or state farms.
- d) The Study area has a high yield potential concerning pasture grasses and agricultural products with a variety of grasses and crops compared with another areas.
- e) Most of the farmers are diligent and have an extraordinarily strong drive to study new farming systems and rich labour resources.

3.5 Agricultural Infrastructure

3.5.1 Present Condition of Irrigation Scheme

The irrigation schemes are categorised as minor schemes (village works), medium schemes, and major schemes depending on the command area.

A minor scheme is defined as one with a command area of is less than 200 acres (80 ha) during the season. Traditionally under a minor scheme tank deliveries of water are made from a supply canal to block of several holdings and not individually to each holding.

A medium scheme is defined as one with a command area of more than 200 acres (80 ha) and less than about 1,500 acres (600 ha).

(1) Exiting Major and Medium Schemes

There are 73 major and medium schemes covering 25,632.6 ha in the Study area.

The area under the major and medium schemes in Central, Uva, and Sabaragamuwa provinces is only about 8 % of the total area under the two categories in Sri Lanka, though the gross area of these provinces constitutes about 1/3 of the Island. Table 3.5-1 shows the extent of the major and medium schemes in the three provinces.

The present condition of the major and medium schemes is generally poor. Almost all of the schemes require rehabilitation, especially in regard to their intake facilities, irrigation canals, and related structures.

(2) Existing Minor Schemes

There are 6,935 of minor schemes which cover over 51,772.7 ha in the Study area. These consist of 726 tank schemes of 10,526.8 ha, 6,029 anicut schemes of 41,245.9 ha, and 19 springs of 67.1 ha. The area of the minor schemes in Central, Uva, and Sabaragamuwa covers about 29 % of the total of Sri Lanka. Table 3.5-2 shows the distribution of minor schemes depending on scheme size for the respective divisions.

As for the minor schemes, only 52.8% by area and 36.5 % by number can be categorised in either good or fair condition. On the contrary, the number of schemes categorised in poor is quite large. The percentage of these are 44.2 % in terms of area and 60.5 % in terms of number. There are some abandoned schemes in Matale, Badulla, and Kandy districts. Especially in Matale, there are 121 abandoned schemes covering 1,282 ha.

(3) Irrigation Facilities

The irrigation facilities are, in general, divided into two items. One is the headworks and the other is the canal system. Two kinds of headworks, namely anicut which is a diversion weir and tank which is a reservoir dam can be recognised in the Study area.

(a) Headworks

There are instances where more than two anicuts or two tanks or a combination been found in some schemes in Kandy, Nuwara Eliya, Ratnapura, and Badulla districts. The tank capacity and anicut length vary from 46,101 m³ to 30,380,000 m³ and 7 m to 9 m, respectively, depending on the scheme size. In minor schemes, generally, there is only one intake facility. Of the 6,935 schemes, 726 schemes are irrigated through tanks and 6,935 schemes through anicuts.

(b) Canal System

In the Study area, most canals are earth canals in principle and some canals running on the hill side along the contour line have been provided with stone masonry or a concrete lining. The major and medium schemes have tributary canals, i.e. branch, distributary, and feeder canals. However, there are no tributary canals in the minor schemes, in general.

(4) Cropping Intensity under the Irrigation Schemes

The cropping intensity of the major and medium schemes and minor schemes from the cultivation year of 1986/87 Maha to the cultivation year of 1990 Yala is shown in Table 3.5-3. The cropping intensity of the Study area is higher than or almost the same as the average of Sri Lanka under the minor and major and medium schemes. However, the cropping intensity of the minor schemes is lower than that of the major scheme. The

cropping intensity in the Yala season in both schemes is lower than that in the Maha season. The fluctuation of the cropping intensity is quite large in Yala. It is considered that the large fluctuations are not only caused by the weather pattern itself, but are also due to the problems of the irrigation facilities and water management etc.

(5) Irrigation Rate

The irrigation rate of paddy (total extent of the irrigation scheme/total extent of the paddy field) in the Study area is higher than that at the national level, except in Kegalle district.

As for the irrigation rate of upland crops, there is no reliable data on the extent of the irrigation at the division, district, and national levels. However, there are certain areas of upland crop irrigation in the Study area. In Nuwara Eliya and the hill areas of Kandy and Badulla districts, the irrigation of upland crops is mainly for vegetables. In Moneragala district, the irrigation of upland crops are mainly for sugarcane and pineapple.

(6) Drainage

In the Up-Country area, there are very few drainage canals. Since major parts of schemes, except schemes located in the flat lowlands, are constructed in the valley or beside the hill slope and the irrigation of paddy fields is done by the plot-to-plot method, drainage conditions are quite good and less drainage canals.

In some cases, the natural stream is used as a drainage canal, however, this stream is also used as a water resource of the irrigation schemes located downstream.

(7) Farm Roads

Except for a few major and minor schemes in the lowlands, there are no farm roads with the necessary capacity for farm machinery, transport equipment, or passing vehicles. Since major parts of the canals are constructed beside the hill slope along the contour line, most roads are constructed on the footpath beside the canals with a width of about 50 cm. In some major and minor schemes, the farm roads function as O/M roads. Roads with a width of about 2 to 3 m are provided along the main and branch canals. However, these kinds of roads are not provided along the distributory canals, but they are provided with footpaths in general. These roads are sometimes not in a good proper condition. They are covered with grasses and small trees that block pedestrians. The condition of these roads are closely linked to the condition of the canals. If the maintenance of the canals is competent, the condition of road will be rather good.

(8) Operation and Maintenance

In accordance with the 13th Amendment of the Constitution, the Provincial Councils took over the responsibility for O/M of all minor schemes from DAS since 1990. Therefore, funds for these activities were transferred to the Provincial Councils. However, in 1991 the Government of Sri Lanka's budget for minor schemes was again brought under the DAS. Due to the changing of the administration for minor schemes, relations between the central government and the provincial councils are not stabilized as yet. This affects the O/M activities of the minor schemes.

3.5.2 On-Going Rehabilitation Project

(1) National Irrigation Rehabilitation Project

NIRP was commenced from 1992 to stabilise and increase agricultural production and incomes and to raise the standard of living through the rehabilitation and improved O/M of the existing irrigation schemes.

Under this project, 19 major/medium schemes extending over 4,554 ha and minor schemes extending over 7,700 ha are being will be rehabilitated and improved.

As for the major and medium schemes, the schemes that will be rehabilitated under this project were identified in the NIRP appraisal report 1992. As for the minor schemes, there is no identified list of schemes and the target area of rehabilitation in province level is shown in the appraisal report. Rehabilitation of minor schemes proposed by the agencies concerned will be caught up as a project in accordance with the following selection criteria:

- Command area of the minor schemes to be rehabilitated would not be less than 4 ha.
- The cost of rehabilitation would not exceeded a base cost of Rs. 30,000 (US\$ 750)

(2) Integrated Rural Development Projects

Under IRDP, rehabilitation of the major and medium and minor scheme has /had been carried out. The method of identification of the schemes to be rehabilitated is the same as that of NIRP.

(3) Moneragala Irrigation and Community Development Project

The project was formulated to raise the living standards and quality of life of people in about half of the disadvantaged district of Moneragala through the rehabilitation of 8 medium/major schemes and improvement of rural infrastructures in Moneragala. By the rehabilitation of the 8 schemes shown below, the project will enhance the productive capacity of one fifth of the irrigated paddy land of Moneragala.

3.6 Rural Infrastructure

3.6.1 Rural Roads

The roads in Sri Lanka are classified into classes from A to F. This classification is not based on the traffic volume, road width, or structure, but has been devised conceptually according to the relative importance of the roads. The concept, road width, standard structure, and organization responsible for the maintenance and controls of each class of road are shown in the table below:

Class	A	B	C	D	E	F
Concept/ Function	Trunk roads between major cities (National roads)	Trunk roads linking with Class A roads & urban areas (District roads)	Minor roads linking with Class B roads & local areas (Local roads)	Minor roads linking with Class B roads & local areas (Local roads)	Rural roads; Private roads, in Estates	Lanes, Footpaths, Private roads
Road width	More than 6.2m	3.7~6.2m	3.0~3.7m	3.0~3.7m	less than 3.0m	-
Pavement	Bitumen	Bitumen	Tarred for the greater part	Gravel, partially tarred	Gravel or not paved	not paved
Maintenance & Control of Roads	RDA	RDA	Provincial Councils & Local Authorities	Provincial Councils & Local Authorities	Provincial Councils & Local Authorities, Estates, others	-

The present road conditions in the Study area are summarized as follows.

	Road Length(km)				Density of Roads		
	A	B	C	D	Total	km/km ²	Person/km ²
Kandy	205	466	808	633	2,112	1.12	589
Nuwara Eliya	144	354	381	225	1,104	0.65	631
Matale	112	193	339	237	880	0.44	496
Ratnapura	254	298	495	379	1,425	0.43	668
Kegalla	107	205	377	350	1,038	0.63	728
Badulla	208	354	570	480	1,612	0.57	469
Moneragala	219	161	395	459	1,235	0.22	325
Total	1,247	2,030	3,366	2,763	9,405	0.50	557
(Sri Lanka Total)					(25,953)	(0.40)	(665)

From the results of the inventory survey, it is recognized that the condition of the road network in the Study area is better than that at the national level. However, the inventory survey also revealed that a considerable length of road required rehabilitation as shown below:

Distance of Roads Rehabilitation (km)					
Class of Road	A	B	C	D	E
Kandy District	10	20	549	293	220
Nuwara Eliya District	0	0	194	146	71
Matale District	10	10	177	197	146
Ratnapura District	0	0	233	198	283
Kegalla District	10	0	43	119	269
Badulla District	0	40	292	248	200
Moneragala District	70	30	71	98	219
Study Area Total	100	100	1,559	1,299	1,408
(Ratio to Total Distance)	(7%)	(4%)	(46%)	(47%)	(19%)

The rehabilitation projects of the Class A and B roads have been carried out with financial assistance from the World Bank, ADB and OECF. Accordingly, the ratios of rehabilitation of such roads to the total distance are low, implying well maintained roads. However, of the roads maintained by the Provincial Councils and Local Authorities, nearly 25 % of the Class C and D roads and 20 % of the Class E roads are facing the necessity of rehabilitation due to the insufficiency of budget.

3.6.2 Rural Water Supply

The sources of the domestic water in Sri Lanka are broadly classified into (i) piped water supply system, (ii) tube well with hand pump, (iii) dug well, and (iv) rivers, tanks, and springs.

The diffusion of the water supply and status of its facilities by district are shown below:

	Diffusion rate	Piped Scheme	Hand Pumps	Dug Wells
Kandy	69.3%	17.8%	22.3%	59.9%
Nuwara Eliya	39.0%	24.3%	0%	75.7%
Matale	75.0%	15.3%	34.1%	50.6%
Ratnapura	67.0%	20.3%	6.1%	73.6%
Kegalla	70.3%	11.4%	2.8%	85.8%
Badulla	55.2%	34.9%	10.1%	55.0%
Moneragala	57.7%	9.8%	21.1%	69.1%
Study Area Total	62.8%	19.0%	13.6%	67.4%
(Rural Area in Sri Lanka)	(65%)	(12%)	(88%)	
(Sri Lanka)	(70%)	(28%)	(72%)	

Source: National Water Supply & Drainage Board, & Inventory Survey

In 5 out of 7 districts in the Study area, the district scale water supply development plan has been established with the assistance of various funding agencies. However, the water-supply project in Matale district commenced from 1983 and was completed in 1991. In Nuwara Eliya district, a water supply development plan has not been established as yet.

No definite administering division has been established for O/M of the water supply systems. However, the water intake and distribution of the medium and large water supply facilities are directly maintained by the National Water Supply & Drainage Board (NWS&DB). The distribution facilities of the small water supply schemes, tube wells with hand pump, and dug wells are maintained by the Local Authorities (MC, UC and Pradeshya Sabha) with the support from NWS&DB.

3.6.3 Rural Electrification

The national electrification rate is estimated to have grown to 37% presently. Looking at the ADB reports and other data, the electrification rate in farming areas may reasonably be estimated at 15-20%.

One reason for the low electrification rate in the farming areas is the low density of the low-voltage power distribution network. Another reason is that the costs required for the exterior and interior wiring must be borne by the beneficiaries.

The status of the area studied is summarized below:

No. of Rate	of contracts	Electrification	High-voltage wire density	Low-voltage wire density	Contracts/ (transformer)
Kandy	85,327	34.9%	0.38	1.65	177
Nuwara Eliya	22,176	15.9%	0.34	0.69	65
Matale	18,555	19.2%	0.21	0.66	102
Ratnapura	40,926	21.3%	0.20	0.49	163
Kegalle	31,083	18.1%	0.31	0.86	123
Badulla	44,311	28.4%	0.20	0.78	123
Moneragala	8,252	10.9%	0.08	0.17	84
Study Area Total	250,630	23.3%	0.20	0.68	127
(Whole Country)	(882,373)	(37%)	(0.20)	(0.60)	(118)

Source: Inventory Survey & Ceylon Electricity Board

Following the conclusion of the rural electrification plan under the ADB loan, which was implemented from 1981 through to 1990 (RE-1), the second phase of the plan (RE-2) is being implemented for completion in 1993. Further, based on the ADB's master plan for farm village electrification (March 1992) which is divided into phases RE-3 - 6, the government aims to implement 3,750 rural electrification programmes by the year 2000, thereby raising the national average rate of rural electrification to 70%.

Power production and supply in Sri Lanka are managed by the Ceylon Electricity Board (CEB) under the control of the Ministry of Power and Energy. The Board, through a Provincial Office established in each province, implements the electrification programmes nation-wide. The Area Engineer Offices, subordinate to each Provincial Office, implement the electrification programmes, maintenance and controls, and collection of the electric charges for each district.

3.7 Environmental and Farmland Conservation

(1) Environmental Problems in the Study Area

Although some variations are found among the districts, the following seven (7) issues can be pointed out as the major causes of environmental degradation in the Study area;

(a) Soil Erosion

Soil erosion is identified as a very widespread and serious problem in the Study area. It is a combined effect of other environmental problems such as shifting cultivation, encroachment of reserves, deforestation, removal of surface cover vegetation, and inadequate agricultural practices. Soil conservation activities have been generally given much attention in the larger estates in the area. Thus, the smallholders whose earnings are often inadequate for investment on soil

conservation and the encroachers on state lands who tend to show little interest in soil conservation due to the insecurity of land tenure should put high priority on soil conservation practices in the Study area.

(b) Deforestation

A steady increase of population in the Study area has caused a need for more cultivation lands, and the pressure on lands has further aggravated the virgin forests and physical characteristics of the lands. The principal causes of deforestation in the area are: a) extraction of firewood, b) shifting cultivation, c) encroachment of forest reservations, and d) illicit timber extraction. These are inextricably tied up with poverty and the livelihood of the local people.

(c) Shifting Cultivation

Shifting cultivation which is one of the major factors in deforestation and soil erosion, is quite widespread and more harmful to the environment in the Study area. The traditional form of shifting cultivation has almost disappeared in the area, because the increased pressure on lands does not allow farmers a long fallow period of about 15 years. This has made shifting cultivation no longer a sound system and in turn it becomes a negative factor concerning environmental degradation. At present, it is primarily concentrated in the dry zone segments, and the large extent of lands could be under some forms of the shifting cultivation in the area.

(d) Encroachment of Reserves

In the Study area, different types of reservations have been set up with the objectives of protecting environmentally critical areas such as forests, streams and irrigation canals. These reserves which account for about 18 % of the total Study area have been encroached threatened by the local people due to the increasing demand on cultivation lands though the exact figures are not available. It is evident from the field investigation and inquiry survey that the large number of forest and stream reserves have been encroached upon mainly by shifting cultivation even in highland and hill top areas with steep slopes.

(e) Mono-cropping of Tobacco and Sugarcane

The cultivation of tobacco still goes on in the Up-Country area being met the required a cool climate, in spite of a lot of recommendations regarding the environmental hazards of tobacco cultivation on steep hill sides and river banks. Due to its economic attraction and its capacity to thrive under marginal climate and soil conditions, tobacco has become a popular crop. As for sugarcane cultivation, the plantations so far have been wrecked by open conflict with wildlife particularly elephants and wild pigs because it has brought about forceful exclusion of the local wildlife from the cleared areas.

(f) Gem Mining

Gem mining conducted by licensed and unlicensed operators is a very common economic activity in the Study area. Licensed gem mining operators are required to adhere to certain regulations which have a bearing on environmental conservation. The grater damage is mostly caused by the unlicensed operators who resort to illicit gem-mining with little attention to environmental damage. The most frequent form of gem mining is a stream bed dredging at the upstream reach

of rivers with a temporarily built wooden structure. This is followed by raking up the earth and piling up it in a low ridge. The stream flow removes the lighter materials from the heap leaving gems and more dense materials behind.

(g) Landslides

The Study area has been experiencing a huge number of landslide incidents mainly due to its landslide prone topographic and climate conditions. Of the 7 districts especially, Nuwara Eliya, Badulla, Kegalla, and Matale districts have experienced serious damage by landslides. The damages caused by landslides are normally greater in more intensively used hilly lands and densely populated areas.

(2) State Policy on Environmental and Farmland Conservation

In 1980, the National Environmental Act (NEA) was passed by the Parliament and became in operation. It paved the way for the creation of the Central Environment Authority (CEA) as the policy making and coordinating agency for environmental management. In 1984, the Cabinet Ministers made an important decision related to the environment conservation, namely to introduce a procedure of Environmental Impact Assessment (EIA) to all development projects. Besides, the CEA prepared a draft Environmental Action Plan in 1990 identifying specific projects and institutions that would be responsible for implementation based on the National Conservation Strategy completed in 1988.

(3) Conditions of On-going Projects and Programs

(a) Environment Conservation on the Mahaweli Development Project

The upper Mahaweli catchment area of about 3,100 km² is actually included in the Study area. Studies have revealed that considerable areas of arable land in this area are affected by non-protective use of natural resources leading to degradation of soil. Further, due to increase of population pressure and lack of new settlement alternatives and non-agricultural employment opportunities, a severe constraint has been placed on marginal and fragile areas exposing ecological systems' irrevocable hazards.

(b) Integrated Rural Development Program

Actually, IRDP has been conducted in all districts of the Study area by introducing bi/multi-lateral foreign assistance. Although to maintain and improve the environmental conditions in the rural area is one of the strategies of IRDP, a very few environment oriented projects, such as a soil conservation project in Ratnapura district and a reforestation project in Kandy district, have been conducted in this program.

(c) Landslide Hazard Mapping Project

The landslide Hazard Mapping Project (LHMP) is jointly funded by the GOSL, the United Nations Development Programme (UNEP) and the United Nations Centre for Human Settlements (Habitat) being started from 1992. The LHMP aims to help resolve the diverse socioeconomic problems faced by the inhabitants under constant threat or affected by landslides through appropriate land use planning coupled with mitigatory measures or planned settlement.

CHAPTER 4 MASTER PLAN ON AGRICULTURAL AND RURAL DEVELOPMENT

4.1 Approach to the Plan Formulation

The objectives of the Study agreed upon between both the Governments of Japan and Sri Lanka are to formulate the Master Plan for the agricultural development in the Study area with due regard to the historical background of the area as well as the basic policy stated above. Furthermore, the main targets of the Master Plan are to improve the small farmers' income and living standard by increasing agricultural productivity and improving their living environment.

There are four main aspects of the Master Plan which are mutually interlinked to achieve the main targets of the Plan shown in Figure 4.1-1. Those are:

- 1) Agricultural production promotion,
- 2) Agricultural infrastructure consolidation,
- 3) Improvement of rural living conditions, and
- 4) Agricultural institutional reinforcement.

The production promotion requires support by infrastructure and institutions. In a similar manner, the living conditions are associated with both infrastructure and institutions. Hence, if the production and living conditions are considered to be the two major priority areas to be targeted, they must be supported by infrastructure and institutional development. Therefore, the Master Plan is conceived to contain four essentials of development in an integrated manner.

Within this structure, the Master Plan will take up a limited number of elements selected on the basis of the Scope of Works. Each large heading contains several project/program components as shown below:

- 1) Agricultural production promotion:
 - Intensification of the agricultural supporting system;
 - Improvement of the agricultural production facilities;
- 2) Agricultural infrastructure consolidation:
 - Improvement of the irrigation facilities and farm road;
 - Strengthening of farmland conservation;
- 3) Improvement of rural living conditions,
 - Improvement of rural roads;
 - Improvement of the water supply;
 - Improvement of electrification;
- 4) Institutional reinforcement:
 - Formulation of the Master Plan;

4.2 Planning Period of the Master Plan

The planning period of the Master Plan is 10 years commencing in 1994 for completion in 2003, and consists of two consecutive 5-year plans.

4.3 Master Plan

4.3.1 Land and Water Resources Development Plan

(1) Land Resources Development Plan

(a) Potential Land for Development

Almost all of the potential development areas are occupied by land classes 4 and 5. The potential development areas for respective districts are summarized below.

(Unit: Km ²)								
Class	Matale	Kandy	Nuwara Eliya	Badulla	Moneragala	Kegalle	Ratnapura	Total
Class 4	353	0	5	280	1271	0	185	2,094
Class 5	35	14	14	17	139	5	86	310
Total	388	14	19	297	1410	5	271	2,404

The above table shows that there are no large potential development areas in Kandy, Nuwara Eliya, and Kegalle districts. Larger areas of potential lands are found in Moneragala, Badulla districts and Matale districts. However, most of these potential lands are located in the dry zone with some technical difficulties for development. The level of priority given to land development in the Master Plan will be rather low.

(b) Land Use Plan

The Master Plan was formulated according to the following basic concepts.

- 1) The potential land for development as mentioned previously is not included in the development plan except for the existing development plans.
- 2) Some abandoned paddy fields should be reclaimed.
- 3) Some low productivity estate plantations should be distributed between the smallholdings.
- 4) Some part of the sloping upland field (over 60% slope) should be converted to a forest plantation. However, the total extent of the forest plantation would depend on the possible alienation plantation areas mentioned above.

The land use plan was estimated as follows:

(Unit: Km ²)			
Land Use	Existing	Plan	Balance
Agricultural Land			
Homesteads	2485.7	2441.7	-44.0 (Forest Plantation)
Plantation	3080.8	3030.8	-50.0 (Alienation)
Paddy Fields	1157.9	1226.1	68.2 (Rehabilitation of abandon paddy fields)
OFC Fields	473.5	467.5	-6.0 (Forest Plantation)
Sparsely Used Cropland	4548.6	4310.4	-238.2 (Development and Rehabilitation)
Forest and Rangeland			
Open Forest and Rangeland	2974.6	2864.6	-110.0 (New development)
Forest Plantation	335.7	385.7	50.0 (From Homesteads and OFC fields)
Development	0	280.0	280.0 (Sparsely Used Cropland and Open Forest and Rangeland)
Alienation	0	50.0	50.0 (From plantation)

(2) Water Resources Development Plan (Irrigation)

In the Study area, there are 15 major river basins with large water resources. Since many water resource developments in most of these basins have already been carried out, the direction of development can be set out on the effective usage of water resources. Four approaches for the development of water resources for irrigation purposes can be recognized:

(a) Effective water usage in the existing irrigation scheme

Many irrigation schemes in the Study area are categorized as in poor condition and are faced with the problems of scarcity of water and/or excessive water usage by the farmers. In order to solve these problems and improve water usage, rehabilitation followed by proper water management and O/M of the schemes are essential.

(b) New irrigation development in the land potential area

The possibility exists for utilization of water resources for new irrigation development in Moneragala and Ratnapura districts, and some parts of the Mahaweli Ganga, Madru Oya, Kala Oya, and Walawe Ganga basins. However, a number of water resources development plans have been set up by the agencies concerned. Accordingly, a feasibility study on water balance shall be carried out in the respective river basins where development plans have been made.

(c) Irrigation development of abandoned schemes

There are some abandoned paddy fields in the Study area. These areas were originally developed as parts of the irrigation schemes, but have been abandoned due to the deterioration of the facilities, scarcity of water, etc. Development of these areas has a greater potential than development of completely new areas.

(d) Irrigation for upland crops

In the Study area where the agroecological region is classified as WM and WU, large-scale production of upland crops is commonly practised. However, the major part of the cultivation is carried out under rainfed conditions. If effective irrigation is applied to these areas, production could be increased substantially and stabilized.

Since the extent under upland crops is smaller than that under paddy cultivation, the affect on the water balance in the basin as a result of irrigating the uplands may be quite small. As for the suitability for provision of irrigation facilities, further detailed examination of the respective schemes is required.

4.3.2 Agricultural Infrastructure Improvement Plan

(1) Basic Concept

The concept of the Master Plan and the target for agricultural infrastructure improvement is can be set up as follows:

- (i) Rehabilitation of major/medium and minor irrigation schemes in the Study area will be carried out in its entirety.
- (ii) Reconstruction of abandoned schemes where study was conducted will be carried out.

(2) Master Plan Formation

(a) Rehabilitation of major/medium and minor irrigation schemes

The Master Plan for the rehabilitation works of the irrigation schemes will be completed by considering the on-going programmes such as NIRP, IRDP, etc. Since these programmes do not cover the total rehabilitation works envisaged, the balance of the work will be completed under the Master Plan. The areas covered and the target completion years for the respective programme are shown in the table below:

Scheme	Project	Rehabilitation Area (ha)	Completion Year	Rate
<u>Major/Medium</u>				
	NIRP	7,104	1996	38 %
	EEC, others	4,272	1995	23 %
	New Project	7,248	1996	39 %
	Subtotal	18,624		100 %
<u>Minor</u>				
	NIRP	7,704	1996	34 %
	IRDP	4,250	2003	19 %
	New Project	10,914	2003	47 %
	Subtotal	22,868		100 %
<u>Total</u>				
	NIRP	14,808		36 %
	EEC, others	4,272		10 %
	IRDP	4,250		10 %
	New Project	18,162		44 %
	Grand Total	41,492		100 %

(b) Reconstruction of abandoned schemes

The Master Plan for development of the abandoned schemes was formulated based on the study for development that has already been completed. Among the abandoned schemes, 11 minor schemes covering 511 ha and 13 major/medium schemes covering 3,389 ha have been studied by the Irrigation Department and other agencies.

4.3.3 Rural Infrastructure Development Plan

(1) Rural Roads

(a) Basic Concept

The concept of the rural roads development plan is to minimize regional differences as far as possible, and it was set up as follows:

- 1) Concerning Class C and D roads, the rehabilitation will be carried out where the ratio of the total length needing rehabilitated to the total length of the roads

within the division exceeds 40%. The goal is to achieve a ratio of less than 40% in all divisions by 2003.

- 2) Concerning Class E road, rehabilitation will be carried out in its entirety by 2003.

(b) Master Plan Formation

The Master Plan quantity for the rehabilitation of the Class C, D and E roads computed in accordance with the basic concept are shown in the following table:

	Total Length(km)			Master Plan Quantity(km)		
	Class C	Class D	Class E	Class C	Class D	Class E
Kandy	808.3	632.6	1,640.0	236	111	202
Nuwara Eliya	380.9	225.2	304.6	69	58	71
Matale	339.0	237.0	1,080.2	63	103	146
Ratnapura	494.8	378.7	1,579.0	81	73	269
Kegalle	377.2	349.6	757.2	1	39	245
Badulla	570.1	480.1	834.0	119	104	182
Moneragala	395.2	459.3	1,115.6	13	39	207
Total	3,365.5	2,762.5	7,350.6	582	527	1,322

(2) Rural Water Supply

(a) Basic Concept

The development programmes aiming for 100% rural water supply in all the districts, except for Nuwara Eliya district, have already been completed. Among these programmes, the programmed quantities by the funding agencies for Ratnapura, Kegalle, Badulla, and Moneragala districts have been applied the Master Plan quantity. On the other hand, the water supply under the Master Plan is newly set up for the remaining districts. Matale district where 100% water supply has not yet been attained even though the programme has been completed; Kandy district where 75% of the supply has been completed in phase II programme but the future implementation programme on the remaining 25% has not yet been completed, and Nuwara Eliya district where no development programme has been completed.

As for Kandy and Matale districts, the target for 100% supply is set for 2003, by NWB&DB. As for Nuwara Eliya district, the supply target was set at 70 %, which is the present national level.

(b) Master Plan Formation

The numbers of beneficiary families and water supply schemes under the Master Plan for the respective supply types are shown in table below:

District	Target year	Piped Scheme		Hand Pump		Dug Well	
		Families	Scheme	Families	Scheme	Families	Scheme
Kandy	2003	18,492	97	23,208	1,414	89,032	5,935
Nuwara Eliya	2003	13,216	131	0	0	54,466	3,631
Matale	2003	5,348	28	11,973	862	26,941	1,796
Ratnapura	2001	22,058	n.a	23,460	n.a	50,920	n.a
Kegalle	2010	9,410	n.a	n.a	357	n.a	19,730
Badulla	2001	15,000	n.a	27,800	n.a	24,838	n.a
Moneragala	2010	17,530	n.a	n.a	965	n.a	11,510

(3) Rural Electrification

(a) Basic Concept

The ADB's master plan, formulates the ratio of the number of contracting households to the number of houses where electrification is possible, and the targeted electrification rate when the national average electrification rate of 70% is attained.

(b) Master Plan Formation

The rate of electrified households and electrification goal, as computed in the ADB master plan, are applied to the Master Plan subject to certain conditions and procedures.

	Total Families(h)	Nos of RESS Schemes up to 2000	Low-Voltage Line (km)
Kandy	273,714	237	1,104
Nuwara Eliya	155,332	307	623
Matale	107,399	114	452
Ratnapura	213,655	228	1,093
Kegalle	190,889	244	1,244
Badulla	173,763	146	584
Moneragala	84,322	118	525
Total	1,199,074	1,394	5,625

4.3.4 Agricultural Promotion and Supporting Plan

The constraints for agricultural development in the Study area can be broadly categorised into two groups: one relating to production and the other relating to institutional support. The Agricultural Promotion and Supporting Plan is designed with the objective of alleviating the major constraints confronting the total production system.

(1) Agricultural production plan

The agricultural development plan will comprise a number of elements. However, the main element on which the others will depend is intensification of production, which can be achieved by the following means:

- Increasing agricultural productivity ,
- Increasing cropping intensity

(Improving yields of existing crops)

Under the Land Use Plan, the crop production plan will be summarised as follows :

Crop	Varieties	Agro-region	Potential Yield	Actual Yield	Possible Yield
Paddy	BG-400, etc.	All zone	6.8	3.3	5.0
Potato	Arka, etc.	WU ,IW, DL	15-20	11.5	15.0
Onion	Pusa Red, etc.	DL	20-30	11.9	18.0
	Jaffna Lo. etc.	DL	15-20	11.5	13.0
Tomato	T-62, etc.	WL, IL, DL	20-30	10.6	16.0
Carrot	Top Weight etc.	WU, IU	35-40	12.3	20.0
Cabbage	Cape Market	WN,IM	15-20	8.0	14.0
	K-Y Cross, etc.	All Zone	40-60	22.0	30.0
Soy bean	PB-1, etc.	DL, IL, WL, IM	3.5-4.5	0.83	2.5-2.8

It is proposed that the following measures to improve the present crop yields will be adopted:

- Provision of irrigation facilities to presently unirrigated and partially irrigated land,
- Adoption of recommended production technologies for efficient crop management
- Selection of crops on their adaptability to the particular agro-ecological region.

(Increasing crop intensity)

The present average cropping intensity in the Study area is at 155.6 % measured in terms of the ratio of extent cultivated in the Yala season. It is planned to improve the cropping intensities by the adoption of the following measures:

- Provision of irrigation infrastructure to new areas and improvement of existing irrigation schemes,
- Revision of cropping patterns, particularly in regard to the Up-Country vegetable and potato growing areas to incorporate a third crop in between the Yala and Maha seasons the Meda season,
- Adoption of viable and sustainable dry farming systems, particularly in the unirrigated dry zone area of the Study area
- Inter-cropping of suitable rubber and coconut lands with appropriate fruit and export agricultural crops.

(2) Agricultural supporting plan

Intensification of agricultural production will be achieved by the effort of farmers and/or farmers' organisations mainly through the increasing use of agricultural inputs, the use of high yielding varieties, adoption of recommended cultivation technologies, etc. However, it is necessary for the government to develop new agricultural production technologies as well as to improve the agricultural institutional supporting system in order to encourage farmers and accelerate their intensive agriculture by the adoption of the following measures.

(a) Improvement of the Agrarian Services Centres

The following measures will be carried out on the 178 ASCs

- Rehabilitation and/or construction of storage;
- Provision of transportation vehicles

(b) Construction of produce storage

Fifty-three produce storage facilities will be constructed in the yards of ASCs in the divisions that are the main producing areas of SFCs and vegetables. Its management will be entrusted to a farmers' organisations under the contract between the Centre and the Organisation.

(c) Development of rural marketing facilities (Pola)

Of the 110 existing Polas, half of them will be improved based on the results of a survey conducted by MUPR.

(d) Improvement of agricultural training facilities

One ISTI will be constructed in Sabaragamuwa Province. Furthermore, 7 existing DATCs will be refurbished.

(e) Strengthening of the Central Artificial Insemination Centre.

(f) Strengthening of the District Level Veterinary Surgeon Stations.

4.3.5 Environmental Preservation and Control Plan

(1) Environmental Preservation and Control Plan

Seven major environmental issues, namely Soil erosion, Deforestation, Shifting cultivation, Encroachment of reserves, Mono-cropping of tobacco and sugarcane, Gem mining, and Landslides are found in the Study area. These environmental issues are firmly linked to each other, and will eventually result in the degradation of Land Resources, Forest Resources and Bio-diversity in the area. Thus, the region oriented strategy against the degradation of land resources, mineral resources, forest resources and bio-diversity should be established in accordance with the national strategy. The Environment Preservation and Control Plan is summarized in Table 4.3-1 including a target for conservation and a legal structure supporting the Plan.

(2) Farmland Conservation Plan

(a) Land to be Treated in the Up-country Area

The land to be treated was defined and the area designated by the following three classes in accordance with the Indicative Land Use Map prepared by the Land Use Policy and Planning Division (LUPPD).

- Class-2 : areas which are now intensively used and where careful soil conservation management is needed with a slope of 30-60 %,
- Class-3 : areas which are now intensively used, but should not normally be used with a slope of more than 60 %, and

- Class-8 : areas where are now under-utilized, but these are unsuitable for smallholder settlements where most parts are suitable for forestry plantations or tree crops under supervised estate conditions with a slope of 30-60 %.

Totally, almost 323,500 ha of the land (about 17 % of the Up-country area) are to be treated with appropriate land conservation measures in the Study area as shown below:

District	Lands to be Treated in the Up-country Area (ha)			Total
	Class-2	Class-3	Class-8	
A. Matale	16,500	3,300	10,200	30,000
B. Kandy	34,500	15,200	16,800	66,500
C. Nuwara Eliya	23,000	5,200	5,100	33,300
D. Badulla	23,300	11,000	22,500	56,800
E. Moneragala	12,300	8,000	9,300	29,600
F. Kegalle	29,400	7,700	7,500	44,600
G. Ratnapura	22,300	29,300	11,100	62,700
Up-country Total	161,300	79,700	82,500	323,500

source: Calculated by JICA Study Team based on the Indicative Land Use Map

(b) The Master Plan of Farmland Conservation

The final goal of farm land conservation is to achieve sustainable development conditions on farm lands in the Up-country area by completion of land conservation treatment in the areas being seriously degraded. Although 110 farmland conservation schemes covering 123,600 ha of land to be treated were identified, it would be too ambitious to set this whole figure as a target of the 10-years Master Plan (1994-2003). Therefore, the Master Plan was formulated for the schemes which are located in the priority divisions (25 divisions) where the areas to be treated cover more than 5,000 ha.

District	Name of Division	Covered Area(ha)
A. Matale	4	8,300
B. Kandy	13	24,200
C. Nuwara Eliya	12	10,300
D. Badulla	9	10,900
E. Moneragala	4	5,100
F. Kegalle	3	2,200
G. Ratnapura	7	8,000
Up-country Total	52	69,000

source: JICA Study Team

CHAPTER 5 IMPLEMENTATION PROGRAMME AND COST

5.1 Project Components and Project Quantity

The components, quantities and implementation agencies of the Master Plan are listed below:

Component	Description	Quantity	Implementation Agency	Project Name	Funding Agency
1. Irrigation	1. R.Major Irr. Scheme	4,250ha	ID	NIRP	WB/EEC
	2. - ditto -	1,660ha	ID	MICDP	EEC
	3. - ditto -	7,250ha	ID	-	to be decided
	4. Recon.Major Irr.Scheme	3,390ha	ID	-	to be decided
	Sub-total	16,550ha			
	5. R.Minor Irr. Scheme	4,500ha	ID/DAS	NIRP	WB/EEC
	6. - ditto -	3,750ha	MPPI	IRDP	German,Dutch, Norwegian, IFAD
	7. - ditto -	10,920ha	ID/DAS	-	to be decided
	8. Recon.Minor Irr.Scheme	510ha	ID	-	to be decided
	Sub-total	19,680ha			
	Total	36,230ha			
2. Rural Road	1. R.Class C Road	250km	PC	-	the Government
	2. - ditto -	375km	PC	-	to be decided
	Sub-total	582km			
	3. R.Class D Road	250km	PC	-	the Government
	4. - ditto -	277km	PC	-	to be decided
	Sub-total	527km			
	5. R.Class E Road	860km	MPPI/PC	IRDP	German,Dutch, Norwegian, IFAD
	6. - ditto -	462km	PC	-	to be decided
	Sub-total	1,322km			
	Total	2,431km			
3. Rural Water Supply	1. Kandy WS	-	NWSDB	NWSDB	FINNIDA
	2. Badulla WS	-	NWSDB	NWSDB	UNDP
	3. Moneragala WS	-	NWSDB	NWSDB	ADB
	4. Ratnapura WS	-	NWSDB	NWSDB	UNDP
	5. Kegalle WS	-	NWSDB	NWSDB	ADB
	6. Matale :Piped WS	28 Scheme s	NWSDB/PC	-	the Government
	:TW 8,625 Scheme s		PC	-	- ditto -
	:DW 1,796 Scheme s		PC	-	- ditto -
	7. N. Eliya:Pipe WS	131 Scheme s	NWSDB/PC	-	- ditto -
	:DW 3,631 Schemes		PC	-	- ditto -
4. Rural Electrification	1. MV/LV wire	1,394 Schemes	CEB	Project	ADB
5. Agricultural Promotion and Support	1. R. Seed&Fertilizer	178ASC	DAS	-	to be decided
	2. Production Storehouse	53 Sites	DAS	-	to be decided
	3. R.Pola	55 Nos.	DAS	-	to be decided
	4. C. Sabaragamuwa	1 Site	DA	2nd AEP	WB/IDA
	5. R. DATC & ISTI	7 DATC, 3 ISTI	DA	2nd AEP	WB/IDA
	6. Imp. CAIC	1 Centre	DAPH	-	to be decided
	7. Imp. DVSS	7 Sites	DAPH	-	to be decided
6. Farmland Conservation	1. Farmland Conservation	13,500ha	to be decided	-	to be decided
	2. Watershed Management	58,200ha	to be decided	-	to be decided
	Subtotal	71,700ha			

<Note> R.: Rehabilitation, Recon.: Reconstruction, C.: Construction, Imp.: Implementation

5.2 Organization of the Project Implementation

The implementation agency for the Master Plan is the MUPR. Since MUPR is the coordinating agency, the implementation of the projects will be carried out by

cooperating with the ministries and agencies concerned. Accordingly, "Steering Committee" as a national level and "Coordination Committee" as a provincial level. Accordingly, the establishment of a "Steering Committee" at the national level, and a "Coordination Committee" at the provincial level is desired.

The project system flow is shown in Fig.5.2-1.

5.3 Implementation Programme

The infrastructure rehabilitation goals of the Master Plan are summarized in Table 5.3-1. To achieve the targeted level, the programme is established as follows.

The Master Plan includes the on-going projects or those scheduled for implementation in the near future. These projects shall be implemented according to their own schedules.

5.4 Implementation Schedule & Period

The Master Plan period is 10 years from 1994 to 2003. The period of 10 years is divided into Phase I from 1994 to 1998 and Phase II from 1999 to 2003.

The implementation programme of the Master Plan is shown in Figure 5.4-1, taking account of on-going and scheduled projects.

5.5 Implementation Cost

(1) Estimate Conditions

The project cost was estimated from the following conditions;

- 1) The cost is based on the results of the field survey from February to May 1993.
- 2) The following exchange rate was used:
US \$ 1.00 = Rs. 46.73 = J. Yen 115.0
Rs. 1.00 = J. Yen 2.46
- 3) The project cost does not include contingencies, land acquisition, and crop compensation costs, engineering and administration costs, and O/M cost.

(2) Implementation Cost

The total implementation cost was estimated at Rs. 15,386.6 Million, with Rs. 7,283.8 Million in Phase I and Rs. 8,102.8 Million in Phase II. The cost of the respective components are shown in Table 5.5-1.

Since the implementation cost of the on-going and scheduled projects is Rs. 6,784.4 Million, the remaining implementation cost amounting to Rs. 8,602 Million requires further financial arrangements.

PART 2

PART 2 CASE STUDY

CHAPTER 1 OBJECTIVE OF CASE STUDY AND SELECTION OF CASE STUDY AREA

1.1 Objective of the Case Study

The implementation of the Case Study has been stipulated by the Scope of Work agreed by MLIMD and JICA. The objectives of the Case Study are summarized as follows:

- 1) To formulate an agricultural and rural development plan for the Case Study areas on the basis of the Master Plan formulated through the Study.
The Master Plan as been set up for implementation over a period of ten years, commencing from 1994. Projects identified through the Master Plan would require comprehensive study for their implementation. Thus, in the Case Study, projects identified in the Master Plan would be prioritized based on their necessity and urgency, and in-depth studies would be carried out for the implementation.
- 2) To verify the effectiveness of the Guidelines through the study of the planning and designing of the priority projects, such as for irrigation, rural road, rural water supply, farmland conservation, and agricultural promotion and support and thereby, to finalize the Guidelines.

1.2 Selection of the Case Study Area

The selection criteria for the Case Study areas were decided upon following deliberations between MUPR and the Study Team. The selection criteria was set out as follows:

- 1) In principle, one Study area shall be selected within each province.
- 2) The boundary of each Study area shall be delineated using the administrative boundaries.
- 3) The Study area shall be for the agricultural development of the peasantry. Therefore, areas where the estate sector is dominant shall not be selected in principle.
- 4) The Study area shall be a main production area of paddy and/or cash crops (especially vegetables).
- 5) The Case Study area shall be in the up-country area instead of in lowland in the dry zone in accordance with the purpose of the up-country peasantry rehabilitation.
- 6) Since the Guidelines prepared by the Study Team will be applied to the Case Study, the area shall be representative as much as possible.
- 7) The opinion of MUPR shall be considered for the selection of the Study area.

The following two areas are selected according to the selection criteria described above:

1) Case Study Area-I (Total area; 172,380 ha)

Kandy District	:	Kundasale, Meda Dumbara, Uda Dumbara
Nuwara Eliya District	:	Hanguranketa, Walapane
Badulla District	:	Welimada, Uva paranagama, Haliela, Kandeketiya

2) Case Study Area-II (Total area; 144,695 ha)

Kegalle District	:	Dehiowita, Deraniyagala, Yatiyantota, Aranayake
Ratnapura District	:	Eheliyagoda, Kuruwita, Ayagama, Elapatha

CHAPTER 2 CASE STUDY AREA-I

2.1. Present Condition of Case Study Area-I

2.1.1 Natural Condition

Case Study Area-I covers 9 administrative divisions in Kandy, Nuwara Eliya, and Badulla districts of Central and Uva Provinces. It forms a contiguous area of 1,725 km² in extent, and consists of Kundasale, Uda Dumbara, and Meda Dumbara divisions of Kandy district, Hanguranketha (Uda Hewaheta) and Walapane divisions of Nuwara-eliya district, and Welimada, Uva Paranagama, Haliela, and Kandeketiya divisions of Badulla district. Area-I is shown in Figure 2.1-1.

Being located largely in the high peneplain at an altitude of over 500m, Case Study Area-I is characterized by rugged landforms with high mountain ranges, peaks and plateaux.

The western strip of the Case Study Area-I cutting across Uda Hewaheta, Uva Paranagama, and Welimada divisions along the western slopes of the central mountain range is in the wet zone and receives annual rainfall of 2,000-3,000 mm. The rest of the area is located within the intermediate zone and receives annual rainfall of 1,000-2,000 mm.

Variations in the temperature in Area-I are associated with the altitude. The mean daily maximum temperatures recorded at Nuwara-Eliya and Badulla meteorological stations, located around Area-I, are 20.1 and 28.1°C, respectively. The respective mean daily minimum temperatures are 10.7 and 18.3°C.

Case Study Area-I is located in the Mahaweli river basin, the longest river in Sri Lanka, where 13 major tributaries of the Mahaweli Ganga traverse the Case Study Area.

Red Yellow Podzolic soils is the most dominant Great Soil Group found in Case Study Area-I. The Group is often associated with Mountain Regosols and occurs in mountainous terrain as well as steeply dissected, hilly, and rolling terrain. In the flat valley bottoms of the Study area are found Alluvial soils and Low Humic Gley soils.

The natural vegetation of Case Study Area-I, though much has been removed and the area is devoid of forest cover, consists of a number of major natural plant communities.

2.1.2 Socioeconomic Situation

Based on data collected from 1986-1989 at GN division level the population in 1991 was estimated at 644,000 showing an average annual growth rate of 1.25%. The estimated economically active population was 258,000. The total number employed in Area-I was estimated at 194,000, giving an unemployment rate of 25% which is higher than below the national rate of 14.1% (first quarter of 1991). The largest proportion of the population, accounting for about 71%, were engaged in agricultural activities, with 47% in crop and/or livestock farming and a further 24% in the estate sector. The division wise labour force and employment are shown in Table 2.1-1.

The average holding size for the area was 0.50 ha. In Area-I, 11.7% of the agricultural operators out of a total of 83,890 did not own any land, while 30.6% owned only a home garden.

Though the wide variations in the topographic features put some restrictions on agricultural production, Area-I is blessed with favourable agro-climatic conditions for successful cultivation of a range of high value crops, such as exotic up-country vegetables and potato, and tree crops, such as tea, spices, and fruits. Agriculture is basically dual structured with a majority of the population cultivating very small mixed holdings on the one hand, and large-scale, highly commercialized tea plantations on the other. Area-I is a major producing area of up-country vegetables and potato. However, very little development has taken place regarding the value-added processing of agricultural products, except for tea.

Non-agricultural sectors of the economy are largely concerned with the provision of rural consumer goods, farm sector inputs, small intermediate goods, and public services. Manufacturing is chiefly limited to local market demands, such as rice milling, fruit processing for jams and cordials, etc.

At least 35 % of the families in Area-I have a monthly income of less than Rs 700 which is the maximum level of qualification for Food Stamp recipients. On the other hand, the average annual income per household in the farming community is estimated at Rs 38,278 (Rs 3,190 per month).

The important Public Institutions serving the needs of the population in Area-I are listed in Table 2.1-2. The proportionate distribution of these Institutions as well as the shortcomings in terms of the provision of staff, equipment and buildings in some, are similar and conform to the present national level resource allocation pattern.

2.1.3 Agriculture

(1) Present Land Use

Details of the present land use conditions in the Case Study Area-I are summarized as follows:

Land Use Category	Extent (ha)	Percent
Urban Land	190	0.11
Agricultural Land		
Homestead	23,750	13.77
Paddy	15,910	9.22
Plantations	28,330	16.43
Mixed Trees	2,960	1.72
Sparsely Used	28,370	16.45
Others	13,300	7.71
Forest Land	36,060	20.90
Range Land	21,080	12.22
Water Bodies	2,020	1.17
Barren Land	500	0.30
Total	172,470	100.00

(2) Cropping Patterns

The cropping patterns adopted in Area-I can be generalized based on the mode of irrigation and soils. During the Maha season, nearly all of the irrigated lands are cultivated with paddy while in the Yala season, potato and vegetables are the dominant crops.

The rainfed uplands in Area-I are cultivated only during the Maha season due to insufficient rainfall in the Yala season. In the northern parts of Area-I, chena like

cultivation is practised in the highlands where the main crops are maize, grain legumes (blackgram, greengram and cowpea), Kurakkan (finger millet), and tobacco.

Large-scale cultivation of potato is practised in the southern parts of the area. Vegetables, particularly carrot, beet, and radish, are grown in pockets which are subject to strong winds.

(3) Crop Production and Yields

The major economic crops in the area include potato, vegetables, tobacco, and tea. A division wise summary of the annually cultivated areas of potato and vegetables is shown in the table below:

Division	Annual Extent Cultivated (ha)				S.Total (ha)	Percent (%)
	Total	Potato	UC Veg	LC Veg		
Kundasale	1,832	-	302	294	596	32.5
Meda Dumbara	2,231	4	87	85	176	7.8
Uda Dumbara	5,306	6	802	250	1,058	19.9
Hanguranketha	9,519	380	2,780	596	3,756	39.4
Walapane	9,972	444	2,425	789	3,658	36.7
Uva Paranagama	6,676	1,953	2,436	291	4,680	70.1
Welimada	11,045	3,924	4,908	257	9,089	82.3
Haliela	3,848	475	498	136	1,109	28.8
Kandeketiya	4,480	-	109	134	243	5.4
Total	54,909	7,186	14,347	2,832	24,365	44.4

The average yields of some selected crops are shown below and the division and ASC area wise annual production figures computed based on the estimated yields and cultivation areas are shown in Tables 2.1-3.

(Unit: ton/ha)			
Crop	Average Yield	Crop	Average Yield
Potatoes	11.2	Tomato	8.7
Bush Bean	3.0	Brinjal	11.3
Pole Bean	3.9	Cucumber	11.6
Beet	12.5	Okra	4.6
Cabbage	17.2	Gourds	10.5
Carrot	12.3	Radish	8.2

Of the plantation crops, tea is the most important, occupying 25% of the total agricultural lands in Area-I. Approximately 21.6 % of the tea area is owned by the private sector and the balance by the state. The following table shows the division wise production data of the smallholdings sector based on the census of 1983 census.

Division	Total Land Area (ha)	Mature Land Area (ha)	Average Yld (kg/ha)	Production (kg)
Kundasale	412	255	223.6	57,020
Meda Dumbara	1,032	924	144.7	132,764
Uda Dumbara	207	164	232.8	38,185
Hanguranketha	660	567	345.4	195,842
Walapane	402	313	581.5	182,021
Uva Paranagama	1,014	963	435.0	418,962
Weimada	1,229	1,087	936.9	1,018,502
Haliela	1,033	949	761.3	722,536
Kandeketiya	56	53	439.4	23,289

Note: Made tea conversion factor- 1=4.5

Paddy is the single annual crop that dominates all areas except Welimada and Uva Paranagama divisions. A total land area of 22,500 ha is cultivated in the two seasons. The average yields of paddy is estimated at 2.7 ton/ha.

(4) Farming Practices

Potato, vegetables and subsidiary food crops and tobacco are cultivated extensively in the highland areas in the Maha season, under rainfed conditions. For the planting of these crops, the land is ploughed and clean weeded before the commencement of the heavy rains. However, the adoption rate of soil conservation measures is very low. In areas where tobacco and high value food crops are cultivated on a regular basis year after year, a feeble attempt has been made to conserve soil which is inadequate. In chena (slash and burn) type cultivation prevalent in the Uda Dumbara, Meda Dumbara, northern parts of Hanguranketha and Walapane and Kandeketiya divisions, where the land is cultivated once every 4-6 years, soil conservation measures, for the most part, are totally lacking.

(5) Marketing

(a) Marketing

The initial step in the marketing process is the transaction that takes place between the farmer and the buyer who provides the direct market outlet. There are a number of different types of market outlets operating in the Case Study Area.

(i) Periodic Market Centres (Pola)

There are 12 periodic market centres or Polas operating in Case Study Area-I. Meda Dumbara, Uva Paranagama, Welimada and Haliela divisions have one each and the other divisions have two each. In general, the pola functions one or two days a week, and within a region, the days are scheduled on a rotational sequence to enable outside traders to attend them conveniently. The size of the Polas in terms of area, daily turnover, and numbers attending varies widely from place to place. All the Polas are owned by respective Pradesiya Sabhas, but are operated by private individuals to whom the management is awarded through an annual tender.

Farmers arrive in the Pola at daybreak, using the all modes of available transportation, with their produce and the transactions commence early in the morning. Trading that takes place in the Pola can be differentiated into the following categories: (i) wholesale buyers purchasing farm produce from farmers; (ii) traders/collectors purchasing farm produce from farmers; (iii) consumers purchasing farm produce and miscellaneous items from farmers and

traders. The traders in the Pola offer a wide range of merchandize that includes groceries, fish and meat, vegetables, fancy goods, textiles and garments, household items, etc.

(ii) Commission Agents

Commission Agents are the main operators in the terminal market, Manning Market located in Pettah, Colombo, and other central markets, such as Kandy and Ratanapura. Their operation is characterized by large-scale trading involving high turn-over which necessitates the securing of assured supply lines as well as sales contracts. In order to ensure the steady supply of commodities, the Agents often provide farmers with production credit, thus binding the farmer to sell their produce to the Agent.

(iii) Traders

Traders who engage in a buy and sell marketing operation, though small in relative terms, provide an important market outlet for the produce of Area-I. They are independent dealers collecting farm produce directly from farmers for resale to market retailers. They sometimes own retail shops/boutiques in the local bazaar which selling fertiliser, agro-chemicals, and daily provisions. Farmers often purchase these items on credit for settlement in kind after harvest throughout Case Study Area-I.

(b) Prices

There are no government supported price protection mechanisms for vegetables and fruits. The seasonal nature in the production is reflected in the variation in retail and wholesale prices as shown in Table 2.1-4. Producer prices of vegetables are subject to influences other than that determined by the local supply level. These arise from the complex exchange relationships between producer and trader as well as the supply situation in the central wholesale markets.

(6) Farmers' Organizations

The establishment of formal farmers' organizations at the village level in accordance with the Agrarian Services (Amendment) Act No. 4 of 1991 has progressed in Area-I, with 535 organizations out of 711 formed registered with the Agrarian Services Department by the end of October 1993.

The success of a few of the more progressive farmers' organizations in the area stems from their association with some economic activity.

(7) Agricultural Research and Extension

(a) Food and Horticultural Crops

Agricultural research needs for the development the food and horticultural crops sector in Case Study Area-I, as in the rest of the country, comes under the purview of DOA of the Ministry of Agricultural Development and Research. The development of research is assisted by the World Bank funded Agricultural Research Project (ARP) in progress at present.

The extension arm of DOA, the Agricultural Extension Division (presently the Technology Transfer Division), as the responsible organization, has been playing the key role in providing extension services for food and horticultural crops. The established T&V extension system under the Agricultural Extension

and Adaptive Research Project (AEARP) assisted by the World Bank was severely disrupted as a result of the project conclusion in 1986, and the devolution of the extension function of the Provincial Governments in 1990. The main issues arising from the policy changes and elements of the World Bank funded Second Agricultural Extension Project (SAEP) are presented in the Interim Report of the current Study.

(b) Tea

The extension services for the tea small holder sector are provided by the Tea Small Holdings Development Authority (TSHDA). The TSHDA offices located in Kandy, Nuwara-Eliya and Bandarawela serve the smallholders in Case Study Area-I. A Tea Inspector is stationed in each division and is sometimes assisted by Field and Nursery Assistants. The extension system is basically linked to subsidy administration and the coverage of the smallholder sector is somewhat limited.

2.1.4 Animal Husbandry

According to the information available, it was estimated that there were 56,000 head of cattle, 18,000 head of buffaloes, 17,000 heads of goats and 180,000 units of poultry with a negligible number of pigs and ducks in 1993. The estimated livestock population in Area-I is as follows:

Division	Cattle	Buffalo	Goats	Pigs	Poultry
Kundasale	8,045	1,109	1,265	57	53,250
Meda Dumbara	4,965	3,535	4,084	79	17,364
Uda Dumbara	3,791	3,358	719	35	6,725
Hangranketa	9,029	2,873	2,981	6	26,514
Walapane	10,066	3,439	3,137	83	19,389
Kandaketiya	2,938	1,790	788	37	6,264
Haliela	7,177	1,064	907	-	25,715
Uva Paranagame	6,584	1,258	2,155	-	20,215
Walimada	3,561	421	855	-	6,737
Total	56,156	18,847	16,891	297	182,173

Source: Department of Animal Production and Health, (DAPHI) 1993

Dairy forming is the most popular use for livestock and ruminant animals and poultry are spread over all the divisions of Area-I, with concentration of certain farming systems in particular areas because of sociocultural, religious, market, and agro-climatic reasons.

2.1.5 Agricultural Infrastructure

(1) Extent of Irrigation Schemes

There are 17 major/medium irrigation schemes commanding 5,205 ha and 1,931 minor schemes commanding 13,774 ha in Case Study Area-I. The number of schemes and extents commanded in the respective divisions are as follows:

Division	Major/Medium		Minor		Total	
	nos.	ha	nos.	ha	nos.	ha
Uda Dumbara	0	0	265	1,579	265	1,579
Meda Dumbara	0	0	241	2,502	241	2,502
Kudasale	0	0	55	301	55	301
Hanguranketa	4	1,014	531	3,733	535	4,747
Walapane	4	506	307	2,942	311	3,448
Kandaketiya	3	1,231	70	125	73	1,356
Uva Paranagama	1	813	157	609	158	1,422
Hali Ela	1	285	109	555	110	840
Welimada	4	1,356	196	1,428	200	2,784
Total	17	5,205	1,931	13,774	1,948	18,979

(2) Irrigation Network and Irrigation Method

Irrigation water is generally diverted from a river by an anicut (diversion weir) in the Area. The main canal lies along the contour line with a gradient of 4/1,000 to 3/1,000. The main canal is usually longer than that in the flatland, since the irrigation blocks are quite small and narrow, and are scattered reflecting the topographic characteristic of the Case Study Area.

Plot-to-plot irrigation for paddy and border irrigation for the upland crops are generally practised in the Case Study Area. The drainage canals and irrigation canals are not independent. Drained water is often used as irrigation water in the downstream areas.

(3) Condition of the Schemes

The condition of the schemes is generally poor, due to inadequate maintenance caused by a shortage of funds and low participation of the beneficiary farmers. Leakage from structures and canal bunds caused by deterioration and poor construction has been confirmed in many schemes.

In northern part of Case Study Area-I, chena-like cultivation is practised while in the southern part, upland rainfed cropping in the upper hill slopes is practised on a regular basis. Such practices in the uphill portion of canals cause much damage, sometimes resulting in silting or sedimentation in canals due to inadequate erosion control. In some schemes, the thickness of silt measured more than 70 cm.

All the major/medium schemes in Area-I are require rehabilitation. 75.4 % in terms of numbers and 56.0 % in term of area of minor schemes need rehabilitation.

(4) On-going Project in the Case Study Area

The national Irrigation Rehabilitation Project (NIRP) commenced from 1992. During the 5 year implementation period, about 1,000 minor schemes and 60 major/medium schemes covering of about 37,500 ha will be rehabilitated in the whole country. All the major/medium schemes to be implemented in the Study Area have been identified, while the minor schemes are yet to be identified. As a rule of selection of minor schemes, rehabilitation schemes will be selected on a year-to-year basis, as implementation proceeds, after evaluation of the feasibility reports of the proposed schemes.

(5) Operation and Maintenance

The irrigation Department (ID) carries out the maintenance works for the head works and main and branch canals while maintenance of the downstream works below

the field canals in the major/medium schemes and all of the minor schemes is carried out by the Department of Agrarian Services (DAS).

(6) Water Management

Intake gate operation is carried out by ID for the major/medium works and by DAS or the farmers for the minor schemes. Most of the schemes are not provided with measuring devices and canal discharge and intake gate operation are carried out practically. Water issue is decided by the Kanna Meeting.

(7) Farmers Needs for Rehabilitation

Through the inquiry survey of farmers, it was recognized that they strongly desire a reliable water supply. The constraint of water shortage is caused by the: (a) poor condition of the irrigation facilities, (b) poor performance of the maintenance activities, and (c) improper water management. In order to solve this constraint, rehabilitation of the schemes is essential.

2.1.6 Rural Infrastructure

(1) Rural Roads (Agricultural Feeder Road)

(a) Condition of the Agricultural Feeder Roads

On the basis of the results of the inventory survey carried out during the Phase-I Study period, the relationship of the length of the existing A, B, C, and D class roads and their road density in the area by division are shown in Table 2.1-5.

The road density in the Area-I (1.12 km/km^2) is higher than that in the Study Area (0.8 km/km^2) as well as the national average (0.48 km/km^2) due mainly to the development of the plantation industry. The major A and B class trunk roads linking the capital city of Colombo and the capital towns of districts, are adequate for the level of service demanded. However, minor roads (class C, D, and E) which are unevenly distributed over the area are in terms of quality, particularly concerning the pavement condition. The condition of Class E roads, which play an important role in villagers' marketing their farm produce and provide access to their daily necessities, remains very backward quantitatively as well as qualitatively.

The width of Class C and D roads is 3m to 3.7m of motorable width. These road surface are provided with either tarred or gravel pavement. However, it was observed in many sections of the existing agricultural feeder roads that the subbase was excluded and no proper compaction was carried out though the paved structure of roads is made up of a subgrade, subbase, and base course with rolled compaction. As a result of this weakness, any small damages to the road surface develops into major damage works out large washout too costly to repair, especially at steep gradients on hilly terrain where water routes of rain deteriorate the condition even more.

The width of Class E road is less than 3m. Almost all of Class E roads are used as footpaths, have no pavement, and are unmotorable.

(b) On-going Project in the Case Study Area

Since of late, attempts to improve unmotorable roads are being made by constructing culverts and macadamizing road surfaces with funds provided by DUPR, IRDP, Decentralized Budget (DCB), 15,000 Rural Projects programme and etc. But in most cases, the works are left incomplete due to the lack of

funds, or due to technical problems where some sections are constructed with steep gradients unsuitable for vehicular traffic.

(c) Farmers' Need for Improvement

Under the circumstances mentioned above, farmers strongly desire road's improvement. Particular attention should be focused on the following points:

(i) Area-I presents a series of landforms, namely narrow and deep valleys, high mountain ranges, peaks, high plateaux, and broad planes. These geographical formations cause severe hardship to farmers living in the narrow and deep valleys in regard to transporting their produce to the closest market centre. Some areas are so isolated that the transportation of products, is being carried out by people using the head-loads method and on animals backs through hilly terrain to the nearest collecting centre. This system is highly inefficient in terms of cost, time, energy, and wastage of perishable produce.

(ii) The Uma Oya that flows from south to north in the eastern part of the Area, cuts off the transportation system of two agricultural areas, namely Walapane and Uva Paranagama divisions on the left bank of the Oya, and Kandaketiya and Haliela divisions on the right bank. Farmers living on either side of the Uma Oya, have to make long journeys to contact supporting organizations for agricultural inputs and polas for marketing their products, as a result of the obstructions in the transport network.

(iii) The new Mahaweli Road, constructed recently, runs through Area-I, connecting Kandy with Mahiyangana. Farmers in Area-I, especially in Walapane division, look forward to the convenience of the connection of this road as a means of easy access to the Kandy commercial centre.

(2) Rural Water Supply

(a) Present Condition

The present condition of the rural water supply in Area-I is shown in Table 2.1-6. The coverage rate(46.8%) of the water supply scheme in Area-I is lower than that of the Study Area(62.8%), although the majority of people living in urban centres have access to pipe borne water. The balance of 53.2% obtain water from unprotected sources, such as streams, springs and unprotected open wells.

The number of beneficiaries of hand pump facilities is rather low, except in Kundasale division. Since the area is blessed with natural water resources, such as precipitation, streams and springs, the demand for the construction/improvement of water supply facilities has not been strong. However, in order to improve the health and sanitation standards of the rural inhabitants, raising the coverage rate of sanitary water through providing rural water supply facilities, is envisaged.

(b) On-going Project in the Case Study Area

Water supply schemes under the assistance of FINNIDA have now been implemented in Kandy district, and the coverage rate of the rural water supply in Kundasale division has reached the national level (70%). For Badulla district, the Rural Water Supply District Development Plan covering 1993 ~ 2001, was established in 1991 with the assistance of UNDP, and was to be implemented from 1993. However, Nuwara Eliya district has not benefited, with no donors not only for the implementing of the Project but also for the planning of the Project.

(3) Rural Electrification

The present condition of rural electrification in Area-I is shown in Table 2.1-7. The electrification rate of Kundasale division is remarkably high (50.6%), and the rates for respective divisions in Badulla district are slightly higher than that of the Study Area (23.3%). Other divisions have not yet developed in terms of electrification.

Rural electrification is one of the most important national development policies in view of economic growth, saving on fuel imports, reducing the collection of firewood and charcoal, and promoting employment. According to the ADB's Master Plan for rural electrification (March 1992), the government aims to raise the national average rate of rural electrification to 70% by 2000 with the assistance of ADB.

2.1.7 Farmland Conservation

Most divisions have been seriously affected by soil erosion mainly due to the cultivation of lands with steep slopes without proper soil conservation measures. According to the Indicative Land Use Map, the total area to be conserved amounts to almost 59,300 ha and it covers about 34% of the total Case Study Area-I as shown below. Only except for Kundasale and Uva paranagama divisions, other seven divisions are ranked to the top priority for farm land conservation in the Master Plan.

Division	Total Area	Area to be Conserved			(unit: ha)	
		Class-2	Class-3	Class-8	Sub Total Area	%
Uda dumba	29,000	6,000	3,100	5,100	14,200	49
Meda dumba	18,000	5,900	1,400	2,500	9,800	55
Kundasale	8,300	700	200	100	1,000	12
Hanguranketa	23,000	4,200	1,100	1,700	7,000	31
Walapane	30,600	2,200	2,300	2,300	6,800	22
Kandaketiya	15,700	600	500	4,700	5,800	37
Uva paranagama	13,300	1,900	800	600	3,300	25
Haliela	16,600	4,700	600	600	5,900	35
Welimada	18,000	3,300	800	800	4,900	27
Grand Total	172,500	29,500	10,800	19,000	59,300	34

note: Class-2: Areas which are now intensively used and where careful soil management is needed. The slope is 30-60%.

Class-3: Areas which are now intensively used, but these should not normally be used. The slope is more than 60%.

Class-8: Areas which now under-utilized, but are unsuitable for smallholder settlement and forestry plantations or tree crops under supervised estate conditions. The slope is 30-60%.

source: Indicative Land Use Map, 1992, Land Use Policy Planning Division

Mainly due to the high development potential of annual crops such as vegetables, potato, and tobacco, the highland area in Case Study Area-I, especially Welimada, Uva paranagama and Haliela divisions, has been cultivated intensively up to the top of the hills and mountains with fairly steep slopes. Although, some farmland conservation practices can be found in the area, they are very limited and are sometimes inadequate in protecting the soil from erosion. Terrace cutting is normally carried out without any retaining walls and stable intercepting drains along the contour lines. Some terraces are collapsing because of scouring and gully erosion because of lack of proper drainage network systems in the farmlands.

While shifting cultivation prevail especially in the northern part of Area-I causing serious soil erosion during the rainy season. Despite the dissemination efforts

by the regional offices in charge, poor management of the farmlands is still very common and few facilities for soil erosion control can be found in this area. Therefore, the immediate action for farm land conservation should be taken in the Case Study Area-I to attain the sustainable conditions for agricultural production and for future development.

2.2 Basic Development Plan

2.2.1 General

The master Plan Study on the Agricultural and Rural Development of the UPR programme conceptualizes the development strategy based on the following mutually interlinked components to achieve the set targets:

- (a) Agricultural production promotion
- (b) Agricultural infrastructure consolidation
- (c) Improvement of rural living conditions
- (d) Agricultural institution reinforcement

The selection of sectoral development projects/plans in Case Study Area-I will be made within the framework of the Master Plan.

MUPR, as the implementation agency of the Study has the strong intention of implementing the development plan under Japanese assistance and of implementing it within a shorter period as far as possible. Accordingly, the implementation period of the development plan is two years in principle. The project formulation in the Case Studies would take into account the period for implementation of the development plan as well as the capacity and/or ability of the implementing agency, etc.,

2.2.2 Selection of Priority Projects

(1) Basic policy for Selection of Priority Projects

The construction and/or execution of all the projects in the Master Plan within a few years would be a difficult task for the following reasons:

- (a) Budgetary constraints of the Government of Sri Lanka,
- (b) Limitation of the execution capacity,
- (c) Differences in the execution capacity,
- (d) Differences in the relative importance and urgency within a sector, and
- (e) Difficulty in conducting detailed studies on all projects.

Under these circumstances, the basic policy on the selection of priority projects would be as follows:

- (a) The total volume of construction work in the Case Study Area should be determined by giving due consideration to the execution capability at the most within two fiscal years.
- (b) The sector-wise priority should be based on the direct contribution made towards agricultural production, e.g., irrigation, agricultural feeder roads, agricultural facilities, etc.
- (c) Priority projects within a sector should be selected considering their urgency and efficiency.
- (d) On the provision of social infrastructure, a Case Study on rural electrification will not be made since an electricity supply plan is scheduled for implementation under ADB finance. Rural water supply projects would be excluded for the same reason. However, in the context of the objectives of the Case Study, one scheme will be incorporated.
- (e) As for farmland conservation, projects would be planned and designed for verification of the "Guideline". Further, a model project would be

established to demonstrate the conservation measures for subsequent adoption in the vast area that requires protection.

(2) Selection of Priority Projects by Sector

(a) Agricultural Promotion and Supporting Plan

The targets for crop production through increased crop yields and cropping intensities have been set up in the Master Plan. Matters relating to improvements in the institutional services sector are discussed in the "Guideline for Agricultural Promotion and Support". As a major vegetable and potato production and supply area, the present development plan will give priority to the following projects that provide facilities for improvement of the marketing conditions.

(i) Rural Marketing Facilities (Pola)

The Pola plays a vital role in the rural economy as the centre for the promotion of commodity inflow-outflow. Among the 12 existing Pola centres distributed in Case Study Area-I, the following 3 Pola centres were selected taking into account the: (i) number of persons served, (ii) volume of agricultural produce transacted (iii) potential for further expansion, and (iv) views of the Pradeshiya Sabha, etc.

District	Division	Name of Pola
Kandy	Uda Dumbara	Uda Dumbara (Madugoda)
Badulla	Uva Paranagama	Napolabokka (Nikagolla)
	Welimada	Welimada

(ii) Produce Storage

Vegetables are divided into two categories, vegetables with a longer shelf life like potato and onions and perishable vegetables. The facilities will basically consist of storage for keepable vegetables like potato and a secure open area with a roof for the transit storage of perishable vegetables. The storage facility will make the long-term preservation of potato possible, and people will be able to take advantage of higher mid-season prices.

In the selection of sites for the establishment of proposed produce storage facilities, the following considerations were taken into account:

- Productivity of the area in terms of quantity and continuity of potato and vegetables
- Condition of connection with transportation
- Availability of suitable state land in close proximity to the ASC
- Consideration of ASC level farmers' organization activity
- Opinion of the officers and farmers of the particular ASC

Finally, judging from the location of the sites and availability of suitable state land in close proximity to ASC, the following proposed project sites selected:

District	Division	Name of ASCs
Nuwara Eliya	Hanguranketa Walapane	Hanguranketa Walapane
Badulla	Uva Paranagama	Uva Paranagama Ambagasdowa
	Welimada	Bogahakumbura Boralanda

(b) Agricultural Infrastructure (Irrigation Schemes) Development Plan

As described earlier, 17 major/medium schemes and 1,414 minor schemes require rehabilitation in Case Study Area-I. Rehabilitation of minor irrigation schemes has been implemented and programmed under NIRP and IRDP. Thus, it is hardly possible to note a proposed scheme of the Case Study.

As for the 17 major/medium schemes that require rehabilitation in the Case Study Area, 9 schemes are (will be) being executed under the on-going projects of NIRP. Other than these, the following 8 schemes require rehabilitation works by the new Project as formulated in the Master Plan and the selection of the proposed schemes will be made from these schemes.

Name of Scheme	District	Division	Command Area
Lamusooriyagama Anicut	Nuwara Eliya	Hanguranketa	138.0 ha
Bodhi Ela Anicut	Nuwara Eliya	Hanguranketa	147.6 ha
Mulhaela Anicut	Nuwara Eliya	Walapane	173.2 ha
Keenawela Anicut	Nuwara Eliya	Walapane	106.5 ha
Paragaha Arawa Anicut	Nuwara Eliya	Walapane	81.3 ha
Badulu Oya Anicut	Badulla	Kandaketiya	685.0 ha
Bathmedilla Anicut	Badulla	Kandaketiya	465.0 ha
Uma Ela	Badulla	Uva Paranagama	813.0 ha

Taking into consideration the necessity of urgent rehabilitation in to the selection of the proposed Case Study schemes, it was judged that urgent rehabilitation of the Uma Ela Scheme is keenly required since more than half of the schemes do not function as irrigation schemes. Accordingly, a case study on the Uma Ela Scheme will be carried out as a proposed irrigation scheme.

(c) Agricultural Feeder Roads Development Plan

Based on the Master Plan, a preliminary inventory survey for the selection of priority feeder roads was undertaken by DUPR under close consultation with the divisional secretaries. The result of the survey was put together as a "List of Candidate Agricultural Feeder Roads" as shown in Table 2.2-1.

In order to select priority projects from the candidate schemes, the following selection criteria were set up.

- (i) Proposed projects are distributed equitably by division;

- (ii) Priority should be given to remote/inaccessible villages;
- (iii) Selected roads should serve a maximum number of agricultural families, enabling the farmers to transport their produce to the nearest marketing centres, ASCs, and other agricultural supporting organizations;
- (iv) Project requiring substantial acquisition of private property should not be included;
- (v) Construction or rehabilitation of roads should not involve major bridges. Minor bridges, culverts, or causeways should be provided where necessary;
- (vi) Selected roads should evolve from existing footpaths or cart tracks; and
- (vii) Priority should be given to the roads which trucks and lorries cannot enter due to sharp bends or steep gradients.

Based on the above criteria, the Study Team carried out field investigations on all the agricultural feeder roads listed in the Candidate Feeder Road's List. Thus, a total length of 128.8 km of road scattered throughout the area was selected for the priority road schemes in Area-I. The list is shown in Table 2.2-2, and is summarised as follows:

Division	No. of Roads	Class	Length(km)
Kundasale	1	E	7.5
Meda Dumbara	1	E	7.0
Uda Dumbara	2	D,E	27.1
Hanguranketa	2	E	15.0
Walapane	2	E	12.7
Uva Paranagama	2	E	29.3
Haliela	2	E	12.2
Welimada	2	E	14.0
Kandeketiya	1	E	4.0
Total	15	-	128.8

(D) Rural Water Supply Development Plan

Nuwara Eliya is the only district which has not seen the execution of a programme /project for water supply in Area-I. Thus, a priority project should be selected from Nuwara Eliya district.

The following schemes were identified in Nuwara Eliya district through the Master Plan Study:

Name of WSS	Position of WSS (Newly/Existing)	Type of WSS (Pumping /Gravity)	Nos.of proposed Beneficiaries (Families)	Location of Water Source	Tank Capacity "Existing" (Gallon)	Total Pipe Length (m)
Watumulla	Existing	Gravity	440	Kurudu oya	25,000	3,900
Nildandahinna	Existing	Gravity	570	Kokitiya spring	10,000	3,500
Liyanwela	Newly	Pumping	250	2 Wells	-	700
Ukuthule	Newly	Gravity	190	Gallenamulla spring	-	1,800

Based on the following criteria, the Watumulla Scheme was selected as a priority project:

- (i) Water source has a sufficient water volume
- (ii) Water source is from surface water
- (iii) Data on the existing facilities are available
- (iv) High demand from villagers

(E) Farmland Conservation Plan

Twenty three farmland conservation schemes to be implemented during the Master Plan period (1994-2003) are located in the Case Study Area-I. For selection of the model scheme area in Case Study Area-I, priority farm land conservation schemes are identified by the following consideration;

- Command area of model scheme should be focused on intensively used farm land, and
- Model schemes should represent typical type of farm land conservation.

Taking the selection criteria into account, the Madugoda Farm Land Conservation Scheme and the Hakgala Farm Land Conservation Scheme are selected.

Taking the location of the schemes and selection criteria into account, the Madugoda Farmland Conservation Scheme (Northern part) and the Hakgala Farmland Conservation Scheme (Southern part) were selected.

2.3 Project Proposal

2.3.1 Agricultural Promotion and Supporting Facilities

(1) Rural Marketing Facilities (Pola)

(a) Purpose

Pola plays a vital role in the rural economy as the centre for promotion of commodity inflow-outflow. The main purpose of improvement of rural marketing centres is to upgrade the service facilities in the rural markets (pola) in order to attract more trade as a means of activating the rural economy and to provide better marketing environment to the users.

(b) Development Plan

Uda Dumbala (Madugoda) Pola in Kandy District, Nappolabokka Pola and Welimada Pola in Badulla District should be improved on the basis of the following conditions.

- (i) Permanent buildings to conduct wholesale and retail sales should be constructed.
- (ii) In order to use the lands effectively, two-storey buildings for accommodating shops should be constructed with steel structure according to the availability of the land area.
- (iii) Facilities of drainage, water supply, toilets, and park should be improved.

According to the above basic plan, the improvement plan for the Pola is proposed as follows:

i) Trading Area

A standard room size for trading is determined to be 4.0 m² (2m x 2m). The floor area for trading of each Pola is summarized as follows.

Uda Dumbara (Madugoda):	96 m ² (24 rooms)
Napporabokka:	604 m ² (151 rooms)
Welimada:	816 m ² (204 rooms)

ii) Improvement of Facilities

Uda Dumbara (Madugoda):	Toilet, garbage pit, stand post of water supply, retaining walls,
Napporabokka:	Toilet, garbage pit, parking area, inner drain, and approach road
Welimada:	Toilet, garbage pit, stand post of water supply, retaining walls, approach road, Lighting facility, kiosk and office building

iii) Operation and Maintenance

The land, buildings, and services such as electricity and water supply where available, are provided to the centre (pola) by respective Pradeshiya Sabha.

Pradeshiya Sabha is also expected to look after the security and maintenance of the premises.

The management system of the pola has been well established over many years of practice. Thus, no change on the management system is envisaged under the "with project" conditions. It is, however, stressed that the present level of maintenance of the pola should be improved. In this regard, the Pradeshiya Sabha needs to ensure that sufficient funds are allocated in its budget for this purpose. It is expected that the annual tender rate will increase adequately on account of the improved facilities provided under the Project.

(2) Agricultural Produce Storage

(a) Purpose

The main purposes of construction of Agricultural Produce Storage's are to improve the marketing conditions of the farming community through provision of infrastructure to:

- (i) store potato and onion harvested during peak production periods, enabling farmers to take advantage of high mid-season prices;
- (ii) streamline marketing activity at the village level in order to minimize time less to the farmers
- (iii) give farmers the opportunity to deal directly with the buyers as a group or an organization rather than individuals, thereby improving their bargaining power.

(b) Development Plan

The following basic plans should be provided at Hanguranketa and Walapane in Nuwara Eliya Districts and Uva Paranagama and Welimada in Badulla Districts.

- (i) construction of agricultural produce storages for crops with longer shelf life like potato, and open areas (with roof) for the transit storage of perishable vegetables;
- (ii) preparation of equipment for agricultural produce storages and construction of office buildings with equipment for operation and maintenance;
- (iii) improvement of the transportation system.

According to the above basic plan, the capacity of facilities and required equipment were determined.

(i) Capacity of the Agricultural Produce Storage Facilities

Capacity (ton)	Storage Space (m ²)	Name of ASCs
600	200	Hangranketa and Walapane
2,000	670	Uva Paranagama and Ambagasdowa
2,400	800	Bogahakumbura and Borarenda

Crops will be stored in bulk which is the prevailing method for potato storage. The warehouse will be ventilated by louvers and ventilators.

(ii) Related Equipment

Belt conveyor, cart, packing equipment, preparation equipment, weighing meter, 2 - 3 ton capacity truck, etc.

(c) Operation and Management

The buildings, vehicles and other equipment which are allocated to the selected ASCs will be the property of the Department of Agrarian Services. The ASC level farmer organization, which is composed of elected members from the village level farmer organizations, will take over the management of the facilities under the guidance of the official working committee of ASC. The farmer organization will pay the relevant ASC a nominal rent for the use of the facilities and equipment/vehicles to cover part of their maintenance costs.

2.3.2 Agricultural Infrastructure Development Plan

(1) General

The scheme having a 766 ha (1,900 acres) in command area and 813 ha in gross area, is located in Uva Paranagama Division, Badulla District. A location map of the scheme is shown in Figure 2.3-1. The area lies in the agro-ecological region IU-3, characterized by an elevation of over 900 m, rainfall of over 1,150 mm (75% expectancy value) and soils of the red yellow podsolic group. It consists of 17 villages and support of about 20,000 inhabitants belonging to 4,400 farm families.

The water sources of the scheme are the Uma Ela Anicut and the Bomurela Reservoir on the Dolgolle Oya (which is called the Bomurella Oya at its upper reaches), a tributary of the Uma Oya.

(2) Present Agricultural Condition

The agro-ecological conditions of the area are very favourable for production of potato and other high value crops such as up-country vegetables. The scheme has been designed to command an area of 766 ha, of which 366 ha are identified for paddy cultivation and the balance 400 ha for upland crops production. The demarcation is based on the soils and drainage conditions in order to maximize the command area and to promote diversification. Of the planned command area, only 259 ha consisting of 170 ha of paddy lands and 89 ha of uplands are irrigated at present due to the poor condition of the irrigation facilities. The present cropping pattern applied in the area is as follows:

Crops	(Unit: ha)			
	Maha	Meda	Yala	Total
Irrigated paddy	170			170
Irrigated vegetables	89		259	348
Irrigated potato		259		259
Rainfed paddy	173			173
Rainfed vegetables	334		100	434
Total	766	259	359	1,384

In the irrigated area of the scheme, a 3-crop rotation -paddy or high value vegetables in Maha season, potato in Meda season and vegetables mainly pole beans in Yala season- is generally practised. In the non-irrigable area of the scheme, paddy is cultivated in 173 ha and vegetables in 334 ha during the Maha season as rain-fed crops. High value crops are generally not cultivated during the Yala season due to the risks involved. A limited extent of about 100 ha is cultivated mainly with short aged, low risk crops such as knol khol and radish.

(3) Present Irrigation Condition

Irrigation water is diverted from the Uma Ela Anicut and supplied to the field directly through 115 field outlets from the main canal. Plot-to-plot irrigation for the paddy field and border irrigation for upland crops are made under the scheme. The paddy field is developed downstream of the upland crops area due to the topographic and soil condition of the site. Field channels, constructed and maintained by the farmers, are provided downstream of field outlets or paddy/upland crop fields. Irrigation and drainage canals are not independent and drainage water from the upstream area is used as irrigation water in the downstream area.

A main canal is provided on the hill slope along the contour line. Upland rainfed cropping in the upper hill slopes has been practised on a regular basis in the first section about 8 km of the canal since around 1974. This practice in the uphill portion is causing silting and sedimentation in the canal due to inadequate erosion control. Water flow completely stops at about 8 km from the beginning of the canal and no irrigation water is supplied to the downstream area.

There are 254 related structures on the main canal. The condition of these structures is generally poor. There are hydraulic problems especially for the field outlets because these structures are reused. No measuring devices are provided at intakes and all field outlets, causing difficulty in water management. The condition of the inspection road used for regular operation and maintenance as well as agricultural activities is quite poor.

(4) Development Plan

As described in (2) above, the present overall cropping intensity is 181%. However, the cropping intensity under irrigation condition is 300%. This figure means that a 3-crop rotation cultivation (300% cropping intensity) is possible under the scheme if irrigation water supply is reliable. Accordingly, the cropping intensity of 300% under the most suitable cropping pattern shown in Annex 2 is targeted through effective water usage in the agricultural development plan.

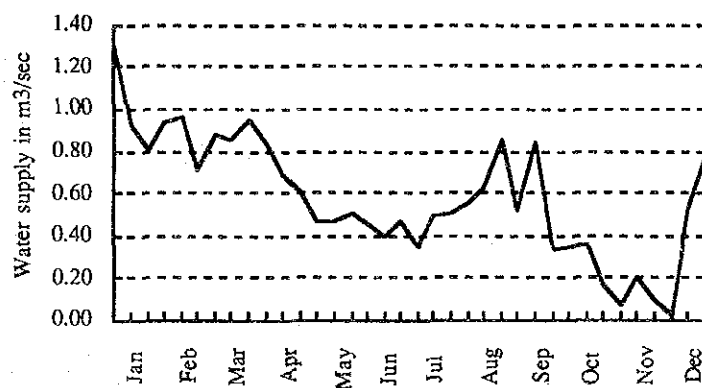
In order to perform reliable water issue and to solve the present constraint, the irrigation development plan will be set up (1) effective water use for irrigation development under proposed scheduled water issue, (2) protection of eroded soil from uphill portion, and (3) improvement of inspection road for O&M and agricultural activity.

In the Case Study, no studies carried out for the Uma Ela project to exert influences upon the down stream area of the Uma Oya. The Uma Ela Project will not have any harmful influence upon the down stream due mainly to the project is not so big in scale and just rehabilitation in nature, however, it is desirable to carry out an environmental study before the implementation of the project.

(5) Water Balance and Scheduled Water Supply

The water balance study is made to achieve the full development of 766 ha with 300 % cropping intensity based on hydrological analysis results and scheduled water issue. The results of water balance study shows that full development could be made providing concrete flume canal with 80 % reliability as described in the Annex 2. The result of the study is shown in Fig. 2.3-2

The details of hydralogical analysis is shown in the Annex 2, and scheduled water issue based on 80 % probable effective rainfall and the proposed cropping pattern, is shown in below. Preliminary design for the facilities as well as water management is made based on scheduled water issue.



(6) Rehabilitation Plan

The rehabilitation plan for the scheme based on the development plan described the above is summarized below;

(a) Main canal:

provision of a concrete flume for a 16 km section and concrete slabs in the first 8 km of the canal.

(b) Related structures:

Description	Numbers
Parshall flume 4 ft type	1
Field outlet	51
Drop structure	5
Regulator cum drop	10
Regulator cum wasteway	10
Regulator cum spillway	24
Foot bridge	53
Syphon	1
Washing step	32
Culvert	1
Overcrossing	15

(c) Inspection road :

improvement of the road by widening to 2.4m in minimum and metaling.

(d) Provision of communication system at the Anicut site, Badulla Office, Nuwara Eliya Office and Bandarawela Office to strengthen water management, and a gate keeper office at the Anicut site.

(7) Operation and Maintenance

Operation and maintenance of the structures on the main canal will be undertaken by the ID Badulla Office, and the structures below the field outlets by the 8 farmers' organizations under the Scheme. It is proposed to establish a project committee for the smooth and effective operation of the scheme. The committee is composed of the Irrigation Department, 8 farmers' organizations, Department of Agrarian Service, Department of Agriculture and banks. A project manager, representative of the committee, is responsible for the operation of the Scheme.

2.3.3 Rural Infrastructures

(1) Agricultural Feeder Roads

(a) Objective

The present conditions of the proposed agricultural feeder roads selected for the Case Study Area-I are shown in Table 2.3-1. These conditions prevent smooth transport of agricultural products by farmers. The objective of the road projects is to improve the present poor condition and increase efficiency of transport.

(b) Design Policy

For the 128.8 km (of 12 routes in 15 divisions) of the priority project roads, rerouting will not be feasible. The design policy was established as follows:

- (i) Condition of subgrade :
Design CBR 6 is adopted as the feasible subgrade.
- (ii) Road cross section :

The standard cross-section of the roads comprises a traffic lane (pavement width 3.5m), 2 shoulders (1.2m for each side), and a side drain on the mountain side. Passing places shall be provided at intervals of about 300m..

- (iii) Vertical gradient :
The gradient is kept within 20% in accordance with the Guidelines. Sections of the roads with a gradient exceeding 20% will be rerouted.
- (iv) Pavement :
Following types are classified depending on present conditions.
 - Type A : Rehabilitation of all layers of pavement by concrete pavement
 - Type B : Rehabilitation of all layers of pavement by tarred pavement
 - Type C : Rehabilitation of the base course and surface course by tarred pavement
 - Type D : Rehabilitation of the surface only
- (v) Side drains :
The side drains of road sections with a gradient of over 8% will be lined with concrete (type-I), and those of sections with a gradient below 8% will be constructed by simple excavation (type-II).
- (vi) Retaining walls :
Retaining walls will be provided at the valley side on steep slopes and at sections requiring widening the classified Type-A (wall height = 5 m) and Type-B (wall height =3m) will be applied.
- (vii) Improvement of sharp bends :
Sharp bends of the roads will be widened to avoid sharp turning.
- (viii) Crossing structures over rivers/streams :
Two proposed road crossings over the Uma Oya (width approx. 50m), and one road crossing over the Ma Oya. Causeways are proposed for these crossing points. Regarding existing bridges, only the surface layer will be rehabilitated. However, a new bridge is required at one point on a proposed road. Regarding the existing crossing structures on small rivers or streams (culverts, small causeways, etc.), these are to be reconstructed at the same level as the sections requiring rehabilitation.

(c) Volume of Construction

The volume of construction by proposed road computed according to the above conditions is shown in Table 2.3-2 and summarized below:

Total	Pavement(km)				Side drain(km)		Culvert	Bridge	Causeway	Retaining		Widening
length(km)	type-A	type-B	type-C	type-D	type-I	type-II	(nos)	(nos)	(nos)	type-a	type-b	(nos)
128.8	12.4	101.2	11.8	3.3	52.2	76.3	592	1	37	11.8	3.9	84

(d) Operation and Maintenance

After implementation of the projects, operation and maintenance of roads will be carried out by Pradeshiya Sabha as before.

(2) Rural Water Supply

(a) Outline of the Present Water Supply Scheme

Watumulla, selected for the Case Study, is the capital city of Walapane Division in Nuwara Eliya District. Presently, water is supplied to a part of GN (Grama Niladari) in Watumulla, Kandegawa, Walapane, Watarakgoda, Manilwala, and Katakandura. An present beneficiaries are 720 persons of 170 households. The outline of the existing water supply facilities is given below:

- (i) Water source : Kurudu Oya
- (ii) Intake facility : Small weirs with filtered intake
- (iii) Transmission pipeline : ϕ 6" GI pipe: 235 m, ϕ 4" GI pipe: 680 m, Total: 915 m
- (iv) Storage tank : 114m³ capa. RC structure x 1 unit
- (v) Distribution pipes : Total length : 3,195m (PVC ϕ 1" ~ ϕ 6")

(b) Design Policy

(i) Target year of the rehabilitation plan :

The target year is 2013.

(ii) Service area and beneficiary population :

The service area shall cover a total of 6 GN. The population of the area covered by the present plan is 1,780. The future population in 2013 is estimated at 3,917 assuming a population increase of 2.5% per annum.

(iii) Future water demand :

Proposed average water demand 528.5 m³/day
Proposed max. daily water demand 660.6 m³/day

(iv) Design of facilities

i) Intake facility :

The existing intake facilities on the Kurudu Oya will be provided with a small weir (proposed intake volume : 8.41 l/sec)

ii) Transmission pipeline

The flow volume of the transmission pipeline will be identical to the intake volume. The diameter and length of pipeline will be 100 mm and 915 meter respectively.

iii) Slow sand filtration

A new slow sand filter with a filtration speed of 4.0 m/day is proposed (165m²).

iv) Distribution facilities

A gravity system with pressure reduction equipment will be employed. The existing 114m³ storage tank will be rehabilitated for use and new 216m³ tank is proposed. The pipeline diameters are 25 mm ~ 150 mm and the total length is 3,695 m.

(c) Operation and Maintenance

The intake and transmission pipe facilities are maintained by the National Water Supply and Drainage Board (NWS & DB) and distribution pipe facilities by Pradeshiya Sabha with support of NWS & DB.

2.3.4 Farm Land Conservation Plan

(1) Description of the Model Schemes

Madugoda Farm Land Conservation Model Scheme

The Madugoda Farm Land Conservation Model Scheme is located in Udadumbara Division, Kandy District and its command area is about 50 ha including eight (8) Grama Niladari divisions, namely Halyala, Mediriya, Udadumbara, Mediawaka, Godakumbura, Gangoda, Talagune and Gederambura (See 2.3-3). The area is mostly populated and developed in the District, which has a high population density of about 164 persons per km². The area is used for cultivation but suffered from severe soil erosion and the land degradation has hampered sustainable agricultural production. Moreover, sifting cultivation is widely conducted in and around the project area. Most people are engaged in agricultural production and eager to prevent soil erosion in their farm lands. A combination of physical and agronomic conservation measures is suitable for the command area, considering the existing land use and slope. Improvement of the drainage network should be a key component of the scheme.

A topo-survey area of about 3.4 ha which has typical site conditions of the command area is selected for detailed study for design and cost estimation of conservation measures. The area with a slope of 30-60% is now intensively used for cultivation of tobacco and other annual crops. The upper edge of the area is a shoulder of the trunk road No. A26, and some parts have collapsed by scouring. The upper part of the area has a rather steep slope of about 45-60% which is unlikely to be applicable for physical conservation measures, so plantation of trees or perennial crops would be recommended in this part. The middle part is widely cultivated by the farmers, and it has the slope about 30-40% on which physical conservation measures are applicable. The lower part including residence areas of farmers is rather gentle slope of less than 30%, and some areas are used for paddy. Though several insufficient terracing practices are conducted by the farmers can be found in the area, no systematic erosion control measures and drainage networks were established yet. Thus, the integrated approach combined with physical, vegetative, and agronomic measures would be suitable for the effective implementation of farmland conservation in this area based on the proper land use plan.

Hakgala Farm Land Conservation Model Scheme

The Hakgala Farm Land Conservation Model Scheme is located in Welimada Division, Badulla District and its command area is about 50 ha including three (3) Grama Niladari divisions, namely Boragas, Silmiyapura, and Hulankapolla (See Fig 2.3-4). The area is intensively used for cultivation of vegetables even in the area with a slope of more than 60 %. Although some erosion protective measures have been applied by farmers, They are not sufficient mainly due to the lack of proper drainage networks and poor maintenance of structures. Thus, improvement of existing physical structures is indispensable for controlling farmland degradation and attaining sustainable agricultural production. The population density of the model scheme area is

estimated at more than 300 persons per km². Most people are engaged in agricultural production, especially potatoes and vegetables. Installation of drains and drainage networks is essential for improvement of the existing preventive measures of soil erosion. A combination of vegetative and agronomic conservation measures is suitable for the area with a steep slope of more than 60 %, and change of land use pattern and reforestation should be conducted in the long term.

A topo-survey area of about 2.4 ha which has typical site conditions of the command area is selected for detailed study for design and cost estimation of conservation measures. The area with a slope of about 35-75% is now intensively used for cultivation of up-country vegetables, potatoes, and other annual crops. Due to the rather steep slope, physical conservation works are limited in small areas. Thus, improvement of the drainage network is considered very important for control of soil erosion. It is recommendable to change crops from annual crops to trees or perennial crops in the area with a slope of more than 60%.

(2) Project Components

Considering the topographic and land use conditions in the model scheme area, an adequate combination of physical and vegetative conservation measures should be applied in this area. Thus, the following project components are required for farmland conservation:

- Bench terracing for reducing the slope;
- Vegetative measures using the Sloping Agricultural Land Technology (SALT),
- Intercepting drains along contour lines;
- Collecting drains to receive water from the command area and upper catchment area;
- River protection works, and
- Road shoulder protection works.

(3) Design and Work Quantities

The typical layout and design of structures in the topo-surveyed areas were determined and the unit work quantities per ha were estimated based on a topo-survey map prepared by the JICA Study Team. The calculated work quantities are shown in Tables 2.3-3 and 2.3-4, and the features of Madugoda and Hakgala Farm Land Conservation Schemes are summarized below.

Work Items	Madugoda	Hakgala
i) Retaining wall for bench terracing	172 m/ha	258 m/ha
ii) SALT length	625 m/ha	781 m/ha
iii) Intercepting drains	780 m/ha	1,039 m/ha
iv) Collecting drains	129 m/ha	175 m/ha
v) River protection works	11 m ³ /ha	-
vi) Road shoulder protection works	35 m/ha	-

(4) Operation and Maintenance

It is proposed that operation and maintenance of the Model Scheme be undertaken by NADSA under the jurisdiction of M/AD&R in cooperation with the Department of Provincial Land Commissioner in MOL. Necessary technical and administrative staff should be provided by NADSA and other agencies concerned. After completion of the Model Scheme, NADSA should monitor the conditions of maintenance, provide appropriate assistance to the local people, establish an appropriate policy and approach to the farm land conservation sector, and promote the implementation of the Master Plan.

CHAPTER 3 CASE STUDY AREA-II

3.1 Present Condition of Case Study Area-II

3.1.1 Natural Condition

Eight administrative divisions in Kegalle and Ratnapura districts of Sabaragamuwa Province comprise Case Study Area-II. It forms a contiguous area of 1,330 km² in extent, and consists of Aranayake, Yatiyantota, Dehiowita, and Deraniyagala divisions of Kegalle district and Eheliyagoda, Kuruwita, Ayagama, and Elapatha divisions of Ratnapura district. Area-II is shown in Figure 3.1-1

Area-II, for the large part, falls in the second or middle peneplain and is at an altitude ranging between 125 and 750m.

Case Study Area-II is located in the wet zone and receives a mean annual rainfall in excess of 4,000 mm. The rainfall follows the typical bimodal pattern with distinct peaks in the months of September to December, the Maha season and April to July, the Yala season. The mean annual maximum and minimum temperatures recorded at Ratnapura meteorological station are 31.5°C and 22.8°C, respectively.

There are three river basins in the Case Study Area-II, namely the Maha Oya river basin, Kelani river basin, and Kalu river basin..

The soils of Case Study Area-II are predominantly Red Yellow Podsollic soils. This Great Soil Group is characterized by well drained reddish to yellowish moderately fine textured strongly acid soils occurring in steeply dissected, hilly and rolling terrain.

Area-II consists largely of non-forested areas with scattered patches of tropical wet evergreen forests confined mostly to Ayagama, Dehiowita, Yatiyantota Kuruwita and Deraniyagala divisions.

3.1.2 Socioeconomic Situation

The population in Area-II, estimated based on data collected through the inventory survey (1993) is around 512,858 with an average annual growth rate of 1.6%. The economically active population was estimated at 237,314. The total number employed II was estimated at 146,858 giving an average unemployment rate of 38.12 %, which is higher than the national rate of 14.1% (first quarter of 1991). The largest proportion of the employed population is engaged in agricultural activities, with 24 % in crop and/or livestock farming and a further 29 % in the estate sector. The division wise labour force and employment are shown in Table 3.1-1.

The average landholding size for the Area was 0.56 ha, with the lowest of 0.49 ha for Kuruwita division and the highest of 0.79 ha for Deraniyagala divisions. According to the Agricultural Census 1982, the latest available data source, about 5,800 or 10 % of the agricultural operators out of a total of 57,250, did not own any land.

Agriculture in Area-II follows the dual structured production pattern typical of most parts of the Up-country Peasantry Rehabilitation Project area, with the majority of the population cultivating small mixed holdings amidst large scale commercialized tea and rubber plantations. The available land area for cultivation by the small farmers is restricted, which for the most part has been asweddumized for paddy cultivation. The principal crop is paddy with very little diversification. The highlands of the small farmers, where the homestead is generally located, are farmed as mixed gardens of perennial crops. Export agricultural crops, fruit crops jak, breadfruit, and coconut are

the dominant crops in the highlands. Sometimes, yams, such as turmeric, ginger and sweet potato are also grown in the home gardens.

The nonagricultural sector of the economy is largely concerned with the provision of rural consumer goods, farm sector inputs, small intermediate goods and public services. Large-scale manufacturing is largely limited to the plantation industries, while rice milling, fruit processing etc., are carried out to cater for the local market demand.

At least 66,700 or 60 % of the total families in Case Study Area-II have a monthly income of less than Rs. 700 which is a maximum levee for qualifying for Food Stamps. The Socioeconomic Survey (1993), covering 2 divisions of Case Study Area II, namely, Deraniyagala and Kuruwita divisions, revealed that the annual income per household in the farming community was Rs. 31,362 (Rs. 2613 per month)

The important public institutions serving the needs of the population in Area-II are listed in Table 3.1-2. The proportionate distribution of these institutions as well as the shortcomings in terms of the provision of staff, equipment, and buildings in some, are similar and conform to the present national resource allocation pattern.

3.1.3 Agriculture

(1) Present Land Use

Details of the present land use conditions in the Case Study Area-II are shown in the following table:

Land Use Category	Extent (ha)	Percent
Urban Land	140	0.09
Agricultural Land		
Homestead	30,920	21.37
Paddy	8,340	5.76
Plantations	53,090	36.69
Mixed Trees	7,600	5.26
Sparsely Used	10,600	7.33
Others	14,510	10.03
Forest Land	15,770	10.90
Range Land	2,470	1.70
Water Bodies	810	0.57
Barren Land	440	0.30
Total	144,690	100.00

The agricultural lands, which comprise 86.4% of the total land area, can be broadly classified as lowlands and highlands based on the relief, hydrographic, and soil characteristics.

The lowlands are the low lying areas in the landscape, such as the valley floors and bottom lands, and include the terraced lower slopes of hills. These lands are usually asweddumized for paddy cultivation and are categorized as paddy lands in the land use classification.

The highlands are the well drained areas in the upper slopes of the landscape where the homesteads, tree crops forests and shrub lands are located. A major extent, amounting to 37% of the total lands and 42% of the agricultural lands of Area-II, is occupied by the plantation crops, particularly, rubber. Other tree crops include export

agricultural crops, fruit crops, and coconuts, and are generally cultivated in the homesteads. The sparsely used lands are highlands that have generally been used for chena (slash-and-burn) cultivation.

(2) Cropping Patterns

The distinction of agricultural lands into highlands and lowlands is somewhat well defined in Area-II. The highlands are unirrigated and are mainly occupied by perennial crop. Rubber and tea plantations under the estate and smallholder sectors account for over 40% of the total agricultural lands in the area. The lowlands in the Area are asweddumized for paddy cultivation under irrigated or rainfed conditions during both the Maha and Yala seasons. Because of the lower variation in agro-ecological conditions, the cropping patterns adopted in Area-II show a higher degree of uniformity.

(3) Crop production and Yield

The entire Case Study Area-II is located in the wet zone of Sri Lanka with the majority of the area falling within the low country region of elevation less than 300 m. The adequate rainfall that the area receives during both the Maha and Yala seasons makes double cropping possible. However, the land area available for annual cropping is limited since much of it is occupied by the plantation crops, tea and rubber.

(a) Paddy

The total gross land area prepared for paddy cultivation (asweddumized) in the area and the average extent cultivated annually (Yala and Maha) are given in the Table below:

Division	Asweddumized Ext. (ha)			Ann.Cultivated Ext. (ha)			Intensity (%)
	Minor	Rainfed	Total	Minor	Rainfed	Total	
Aranayake	532	922	1,454	1,064	1,834	2,898	199
Yatiantota	223	396	619	441	786	1,227	198
Dehiowita	130	292	422	260	526	786	186
Deraniyagala	30	135	165	46	235	281	170
Eheliyagoda	660	314	974	1,320	628	1,948	200
Kuruwita	1,183	1,431	2,614	2,340	2,684	5,024	192
Ayagama	112	248	360	212	483	695	193
Elapatha	541	297	838	1,054	567	1,621	193
Total	3,411	4,035	7,446	6,737	7,743	14,480	194

As shown above, the land area under paddy in Area-II is limited to 7,446 ha, and is cultivated at a cropping intensity of 194% with hardly any diversification. The average paddy yield per net ha in Area-II is estimated at 3.3 mt per ha. The division wise yield and production estimates for the two seasons are shown in Table 3.1.-3.

(b) Tea

Tea occupies over 11,500 ha of land area in Case Study Area-II. Of this, 74 % (excluding Elapatha division) is held by the estate sector and the balance by the small holder sector. The smallholder sector is composed of holdings of less than 20 ha in extent that are privately owned. The following table shows the division level production data of the small holder sector based on the 1983 census:

Division	Total Land Area (ha)	Mature Land Area (ha)	Average Yield.(kg/ha)	Production (kg)
Aranayake	846	702	315.2	221,246
Yatiantota	913	644	399.2	257,110
Dehiowita	74	59	966.1	57,004
Deraniyagla	298	203	907.5	184,232
Eheliyagoda	59	49	142.7	8,423
Kuruwita	423	277	863.5	239,192
Ayagama	459	408	719.7	293,654
Elapatha	n.a	n.a	n.a	

Note: Made tea conversion factor- 1=4.5

(c) Rubber

The total land area under rubber in Case Study Area-II is 42,435 ha. Of this, 35 % is owned by the State and the balance by the private sector. The privately owned rubber areas of less than 20 ha constitute the smallholding sector. In general the area under rubber has tended to decline during the last 10 years due to price stagnation and declines. Some smallholders have replaced the rubber with tea and other export agricultural crops. The last census of the rubber smallholdings was conducted in 1994, by the Rubber Control Department. The census is not as comprehensive as that for the tea smallholding sector by TSHDA. The division wise areas under rubber smallholdings according to the census are summarised as follows:

Division	Total Land Area (ha)	Tapped Land Area (ha)
Aranayake	2,579	1,500
Yatiantota	3,761	2,651
Dehiowita	5,295	3,534
Deraniyagla	2,856	2,022
Eheliyagoda	5,213	3,692
Kuruwita	6,959	4,497
Ayagama	4,002	2,336
Elapatha	1,458	1,061
Total	32,123	21,293

Reliable yield records in respect of the smallholders rubber plantations are not available. The Rubber Advisory Department estimates the yield to be about 700 kg per ha for seedling PB 86 and about 800 kg per ha for improved clones under smallholder management systems.

(4) Farming Practices

In Case Study Area-II, economically important crops are limited to a few, namely, tea, rubber and paddy, and to a less degree, the export agricultural crops. Cultivation of annual crops such as vegetables, pulses etc., are virtually restricted to home gardens largely for self and/or local consumption.

(a) Paddy

Transplanting is the favoured method of crop establishment in the irrigated areas of Aranayake, Yatiyantota, and Dehiowita divisions (80%), while in the rest of Area-II, direct seeding by the broadcast method is more common (70%).

In the northern part of Case Study Area-II, 80% of the land area is prepared using tractors or draft animals, shared equally, except for the final levelling operation which is done manual using levelling boards. In the southern areas, the traditional manual land preparation using a special mamoty is more common accounting for about 70% of the area. A large majority of the farmers use new improved paddy varieties.

One hundred and thirty kg of seed paddy per ha is used when the crop is established by the broadcast method and half this quantity is used when it is transplanted. The non availability of quality seed material is a major problem that has continued to affect paddy production in the area.

Fertilizers are applied as basal and top dressings. The DOA recommendations for Case Study Area II, based on the soils, are as follows: Basal: 15-20 kg N, 30 kg of P_2O_5 , and 30-50 kg of K_2O ; and Top dressing: 20-30 kg of N per ha.

The manually harvested crop is heaped in the field for threshing. Over 95% of which is done using threshers and the balance is done using buffaloes.

(b) Tea

Tea is the second most important plantation crop in Case Study Area-II. As with rubber, the selected land for the replanting or new planting of tea is cleared of vegetation by uprooting. Lateral contour drains are cut to join leader drains sited along natural drainage lines. Terracing is carried out in the steep lands using stone hedges. High and medium shade is established with *Grevillea robusta* or *Albizia moluccana* and *Gliricidia maculata*.

Popular tea clones in the Case Study Area are TRI 2023, TRI 2026 and TRI 2025.

After 9-12 months of free growth, bush formation to bring the plants into bearing by the cut across or centring method is carried out. The filling of vacancies and control of weeds and termites are the main aftercare operations in the area.

The harvesting of tea is carried out by selective hand picking of the tender shoots at 4-10 day intervals throughout the year. The unit harvested consists of the terminal bud, internodes (staks), and 1-3 leaves immediately below the bud.

(5) Marketing

Agricultural surpluses of subsidiary food crops in Case Study Area-II, for the most part, cater to the local consumption demand. The flow of subsidiary food crops as well as products of the smallholder plantation crops, namely, green leaf and latex/RSSs from the farm to the consumer/end user is provided by different market outlets operating in Case Study Area-II.

(a) Periodic Market Centres (Pola)

There are 10 periodic market centres or Polas operating in Case Study Area-II distributed as follows: Dehiowita, Deraniyagala, Eheliyagoda, and Kuruwita divisions-one each; Aranayake and Ayagama divisions- two each; Yatiyantota division-three, while Elapatha division has none. The Pola provides the only direct outlet for the farmers to sell their farm produce. Polas are operated on one or two days of the week on a rotational sequence to enable traders to cover as many, within the region, conveniently. All Polas are owned by the relevant Pradeshiya Sabha, but are operated by a private individual to whom the management is awarded through an annual public tender. The operator in turn collects a fee from the traders, vehicle owners, and farmers for its use.

The sellers of goods at the Pola are the local producers, who offer farm produce and the products of cottage industries, and the traders who offer a range of items: textiles, garments, groceries, fish and meats, fancy goods, vegetables and the like. Buyers, on the other hand, consist of the wholesalers purchasing farm produce for sale outside the area, local traders purchasing miscellaneous items for retailing until the next Pola day, and the consumers purchasing for their own consumption.

(b) Tea

Tea leaves produced by the small holders are sold to the private factories that depend on bought leaf or those factories supplementing their own leaf production. Collecting sheds have been constructed in some areas within Case Study Area-II, particularly, in the northern sector in Kegalle district. However, the private collectors, registered with the Tea Control Department, remain the main operators in the area.

The leaf prices vary with the quality of the pick, and the international market prices. The current price is around Rs 11 per kg.

(6) Farmers' Organizations

The institution of formal farmers' organizations at the village level in accordance with the Agrarian Services (Amendment) Act No. 4 of 1991 has progressed in Case Study Area-II, with 212 of the organizations out of 222 formed already registered with the Department of Agrarian Services by the end of October 1993. The success of a few of the more progressive farmers' organizations in the area stems from their association with some economic activity, which in most cases is the contractual work on minor irrigation schemes.

(7) Agricultural Research and Extension

(a) Food and Horticultural Crops

Agricultural research needs for the development of the food and horticultural crops sector in Case Study Area-II, as in the rest of the country, comes under the purview of DOA of the Ministry of Agricultural Development and Research. The development of research is assisted by the World Bank funded ARP in progress at present.

The extension arm of the DOA, the Agricultural Extension Division (presently the Technology Transfer Division), as the responsible organization, has been playing the key role in providing extension services for food and horticultural crops. The established T&V extension system under AEARP assisted by the World Bank was severely disrupted as a result of the project conclusion in 1986,

and the devolution of the extension function of the Provincial Governments in 1990. All 8 divisions in Case Study Area-II are under the administrative authority of the Provincial Government of Sabaragamuwa Province. A range AI was placed at each of the 12 ASCs in the 8 divisions of Area-II. Due to the weakened staff strength at the field level as well as the changes to the administrative set-up, hardly any organized field level extension activity takes place at present in Case Study Area-II.

(b) Tea

The central Tea Research Institute (TRI) is the organization responsible for carrying out research work on tea. It is located at Thalawakelle in Nuwara-Eliya district and serves the needs of high grown teas.

The extension services for the tea smallholder sector are provided by TSHDA. The regional offices of TSHDA located at Kegalle and Ratnapura serve the smallholders in Case Study Area-II. A Tea Inspector is stationed in each division and is sometimes assisted by Field and Nursery Assistants. The extension system is basically linked to subsidy administration and the coverage of the smallholder sector is somewhat limited.

3.1.4 Animal Husbandry

The livestock sector activity in Case Study Area-II is rather limited compared to Case Study Area-I, but traction and cultivation power by cattle and buffalo are significant. Livestock industry in the Case Study Area-II may not be important in terms of the overall agriculture sector. This mainly depends on the climate, method of cultivation, and manner of feeding.

There are about 18,000 cattle, 10,000 buffaloes and 12,000 goats. The poultry population was estimated to be around 115,000 in 1993. The division wise number of livestock and poultry are shown in the following table:

Division	Cattle	Buffalo	Goat	Pigs	Poultry
Aranayake	2,504	2,674	4,044	143	26,931
Yatiyantota	2,987	1,152	2,904	51	31,417
Dehiowita	3,677	904	2,477	311	20,310
Deraniyagala	1,189	297	929	38	8,507
Eheliyagoda	2,631	1,592	563	40	9,340
Kuruwita	3,186	2,863	658	55	11,704
Ayagama	675	232	411	7	3,910
Elapatha	1,446	855	215	-	6,046
Total	18,295	10,569	12,201	645	118,165

Source: Department of Animal Production and Health (DAPH), 1993

3.1.5 Agricultural Infrastructure

(1) Extent of Irrigation Schemes

There is one medium irrigation scheme commanding 178 ha and 510 minor schemes commanding 3,680 ha in the Case Study Area-II. The number of schemes and the extent of the command areas in the respective divisions are as follows:

Division	Major/Medium		Minor		Total	
	nos.	ha	nos.	ha	nos.	ha
Aranayake	0	0	155	1,021	155	1,021
Yatiyantota	0	0	68	265	68	265
Deraniyagala	0	0	7	46	7	46
Dehiowita	0	0	20	52	20	52
Eheliyagoda	0	0	33	332	33	332
Kuruwita	0	0	150	1,498	150	1,498
Elapatha	1	178	45	323	46	501
Ayagama	0	0	32	143	32	143
Total	1	178	510	3,680	511	3,858

(2) Irrigation Network and Irrigation Method

Irrigation water is generally diverted from a river by an anicut (diversion weir) in the Area. The main canal lies along the contour line with a gradient of 4/1,000 to 3/1,000. The main canal is usually longer than that in the flatland, since the irrigation blocks are quite small and narrow, and are scattered reflecting the topographic characteristic of the Case Study Area. Since a main canal lies along the hillside, several small streams intercept the canal. A characteristic of the irrigation schemes in the Case Study Area, is that streams are allowed to flow into the canal for use as irrigation water.

Plot-to-plot irrigation for paddy and border irrigation for the upland crops are generally practised in the Case Study Area. The drainage canals and irrigation canals are not independent. Drained water is often used as irrigation water in the downstream areas. Downstream of the drainage canal, weir-like diversion structures (called pickup anicuts) have been constructed to irrigate the downstream fields in several schemes. The water reuse system is called a cascade system.

(3) Condition of the Schemes

The condition of the schemes is generally poor, due to inadequate maintenance caused by a shortage of funds and low participation of the beneficiary farmers. Leakage from structures and canal bunds caused by deterioration and poor construction has been confirmed in many schemes.

In the northern part of the Case Study Area, chena-like cultivation and upland rainfed cropping in the upper hill slopes is practised on a regular basis. Such practices in the uphill portion of the canals cause much damage, sometimes resulting in silting or sedimentation in canals due to inadequate erosion control. However, the affect of shifting cultivation on the irrigation schemes in Case Study Area-II is less than that in Case Study Area-I.

There is only one medium scheme in the Case Study Area and it requires rehabilitation. Among the 510 minor schemes in the Case Study Area, 41.7 % in terms of numbers and 38.4 % in terms of area need rehabilitation.

(4) On-going Project in the Case Study Area

NIRP commenced from 1992. During the 5 year implementation period, about 1,000 minor schemes and 60 major/medium schemes covering about 37,500 ha will be rehabilitated in the whole country.

All the major/medium schemes to be implemented in the Study Area have been identified, while the minor schemes are yet to be identified. As a rule of selection of

minor schemes, rehabilitation schemes will be selected on a year-to-year basis, as implementation proceeds, after evaluation of the feasibility reports of the proposed schemes.

(5) Operation and Maintenance

ID carries out the maintenance works for the headworks and main and branch canals while maintenance of the downstream works below the field canals in the major/medium schemes and all of the minor schemes are carried out by DAS.

(6) Water Management

Intake gate operation is carried out by ID for the medium scheme and by DAS or the farmers for the minor schemes. Most of the schemes are not provided with measuring devices and canal discharge and intake gate operation is carried out practically.

The main objects of the NIPR in now progress are to rehabilitate existing irrigation schemes and to strengthen their operation and maintenance works. In addition to the above, therefore, it is desirable to harmonise with general rules on operation and maintenance works which might be formulated through the implementation of the NIRP.

(7) Farmers' Need for Rehabilitation

Through the inquiry survey of farmers, it was recognized that they strongly desire a reliable water supply. The constraint of water shortage is caused by the: (a) poor condition of the irrigation facilities, (b) poor performance of the maintenance activities, and (c) improper water management.

3.1.6 Rural Infrastructure

(1) Rural Roads (Agricultural Feeder Road)

(a) Condition of the Agricultural Feeder Roads

On the basis of the results of the inventory survey carried out during the Phase-I Study period, the relationship of the length of the existing A, B, C, and D class roads and their road density in the area by division are shown in Table 3.1-4.

This table shows that the road density in the Area-II (0.68 km/km^2) is higher than the national average (0.48 km/km^2), and slightly lower than in the Study Area (0.8 km/km^2), though it varies depending on the division. The major A and B class trunk roads, linking the capital city of Colombo and the capital towns of districts, are adequate for the level of service demanded. The road condition of major roads (class A and B) are fairly good, and have been improving through the rehabilitation projects financed by the ADB and other agencies. However, minor roads (class C, D, and E) which are unevenly distributed over the area are inadequate in terms of quality, particularly concerning the pavement conditions. The condition of Class E roads, which play an important role in villagers' marketing their farm produce and provide access to their daily necessities, remains very backward quantitatively as well as qualitatively.

The width of Class C and D roads is 3m to 3.7m of motorable width. These road surface are provided with either tarred or gravel pavement. However, it was observed in many sections of existing agricultural feeder roads that the subbase was excluded and no proper compaction was carried out though the paved structure of roads is made up of a subgrade, subbase and base course with

rolled compaction. As a result of this weakness, any minor damage to the road surface which develops into major damage works out too costly to repair, especially at steep gradients on hilly terrain where water routes of rain deteriorate the condition even more.

The width of Class E roads is less than 3m. Almost all Class E roads are used as footpaths, have no pavement, and are unmotorable.

(b) On-going Project in the Case Study Area

Since of late, attempts to improve unmotorable roads are being made by constructing culverts and macadamizing road surfaces with funds provided by DUPR, IRDP, DCB, 15,000 Rural Projects programme and etc. But in most cases, the works are left incomplete due to the lack of funds, or due to technical problems where some sections are constructed with steep gradients unsuitable for vehicular traffic.

(c) Farmers' Need for Improvement

Under the circumstances mentioned above, farmers strongly desire road improvement. Particular attention should be focused on the following two points:

(i) Steep terrain, which occurs in tea or rubber smallholders and vegetable cultivators areas and makes the for transportation of agricultural produce difficult. This can could be observed mainly in Aranayake, Yatiyantota, Deraniyagala, and part of Kuruwita divisions.

(ii) Overflow of streams during the rainy season which inundates the roads in the paddy areas, in the Kuda Oya and Kalu Oya basins in Elapatha, Dehiowita, and part of Kuruwita divisions. Under these conditions farmers transporting inputs and harvests have to make long detours due to the lack of roads on higher contours. Proposals have been make to avoid areas frequently affected by floods, when opening new roads.

(2) Rural Water Supply

(a) Present Condition

The present condition of the rural water supply in Area-II is shown in Table 3.1-5. The coverage rate (59.8%) in Area-II is similar to that of the Study Area (62.8%). The balance households(40.2%) would obtain their domestic water from unprotected sources such as streams, springs and unprotected open wells.

In the case of hand pump facilities, the extension' rate is much lower in all divisions than that in Area-I, because Area-II has not yet experienced any big rural water supply projects.

(b) On-going Project in the Case Study Area

For Kegalle district, a district development plan involving rural water supply was drawn up in 1922 supported by the ADB fund. This plan aims to achieve 100% water supply in rural area by 2010. For Badulla district, the Rural Water Supply District Development Plan covering 1993~2001 was established in 1991 with the assistance of UNDP, and was to be implemented from 1993.

(3) Rural Electrification

The present condition of rural electrification in Area-II is shown in Table 3.1-6. The electrification rates for the respective divisions of Area-II are lower than that of the Study Area(23.3%), except for Eheliyagoda division.

Rural electrification is one of the most important national policies in view of economic growth, saving on fuel imports, reducing the collection of firewood and charcoal, and promoting employment. According to the ADB's Master Plan for rural electrification (March 1992), the Government of Sri Lanka aims to raise the national average rate of rural electrification to 70% by 2000 with the assistance of ADB.

3.1.7 Farmland Conservation

The divisions which have been seriously affected by soil erosion are Deraniyagala, Yatiyantota and Dehiowita, and these divisions are ranked to the top priority for farm land conservation in the Master Plan. According to the Indicative Land Use Map, the total area to be conserved can be counted almost 41,200 ha, and it covers about 28% of the total Case Study Area-II as shown below.

Division	Total Area	Area to be Conserved			Subtotal	
		Class-2	Class-3	Class-8	Area	%
Aranayake	11,700	800	400	400	1,600	13
Yatiyantota	24,600	4,100	2,200	2,300	8,600	35
Deraniyagala	21,800	6,100	1,300	2,500	9,900	45
Dehiowita	23,300	5,900	900	1,100	7,900	34
Eheliyagoda	12,800	1,500	1,100	0	2,600	21
Kuruwita	25,900	1,700	1,900	1,100	4,700	18
Elapatha	9,500	900	1,100	0	2,000	21
Ayagama	15,000	1,100	2,000	800	3,900	26
Grand Total	144,600	22,100	9,900	8,200	41,200	28

note: Class-2: Areas where are now intensively used and careful soil management is needed with slope of 30-60%.

Class-3: Areas where are now intensively used, but these should not normally used with slope of more than 60%.

Class-8: Areas where now under-utilized, but these are unsuitable for smallholder settlement and most parts suitable for forestry plantations or tree crops under supervised estate conditions with slope of 30-60%.

source: Indicative Land Use Map, 1992, Land Use Policy Planning Division

The lands to be treated in Case Study Area-II are widely covered by the plantation crops, such as rubber and tea. Since the target area of the Project is limited to the homestead areas surrounded by gardens which are sporadically scattered in the plantation areas, the conditions of soil erosion and land degradation in Case Study Area-II are less serious than those in the Case Study Area-I. The practices of farmland conservation are almost similar in condition of Case Study Area-I. Terrace cuttings and stone bunds without proper drainage systems are common, and these are mostly poorly maintained.

Besides, it should be noted that Case Study Area-II includes several high potential areas for agricultural development. More profitable crops such as potatoes and Up-Country vegetables can be cultivated successfully, especially in the eastern part of Aranayaka, Yatiyantota, and Deraniyagala divisions. Although the farmlands having rather steep slopes in these areas are currently cultivated on a small-scale mainly due to lack of adequate market system, these would be developed and intensively used for cultivation by the farmers in future. Thus, there is an urgent need to prepare a proper land use and farmland conservation plan and its implementation in these high potential areas of agriculture development.

3.2 Basic Development Plan

3.2.1 General

The master Plan Study on the Agricultural and Rural Development of the UPR programme conceptualizes the development strategy based on the following mutually interlinked components to achieve the set targets:

- (a) Agricultural production promotion
- (b) Agricultural infrastructure consolidation
- (c) Improvement of rural living conditions
- (d) Agricultural institution reinforcement

The selection of sectoral development projects/plans in Case Study Area-II will be made within the framework of the Master Plan.

MUPR as the implementation agency of the Study has the strong intention of implementing the development plan under the Japanese assistance and of implementing it within a shorter period as far as possible. Accordingly, the implementation period of the development plan is two years in principle. The project formulation in the Case Studies would take into account the period for the implementing of the development plan as well as the capacity and/or ability of the implementing agency, etc.

3.2.2 Selection of Priority Project

(1) Basic policy for Selection of Priority Projects

The construction and/or execution of all the projects in the Master Plan within a few years would be a difficult task for the following reasons:

- (a) Budgetary constraints of the Government of Sri Lanka,
- (b) Limitation of the execution capacity,
- (c) Differences in the execution capacity,
- (d) Differences in the relative importance and urgency within a sector, and
- (e) Difficulty in conducting detailed studies on all projects.

Under these circumstances, the basic policy on the selection of priority projects would be as follows:

- (a) The total volume of the construction work in the Case Study Area should be determined by giving due consideration to the execution capability, at the most within two fiscal years.
- (b) The sector-wise priority should be based on the direct contribution made towards agricultural production, e.g., irrigation, agricultural feeder roads, agricultural facilities, etc.
- (c) Priority projects within a sector should be selected considering their urgency and efficiency.
- (d) On the provision of social infrastructure, a Case Study on rural electrification will not be made since an electricity supply plan is scheduled for implementation under ADB finance.
Rural water supply projects would be excluded for the same reason. However, in the context of the objectives of the Case Study, one scheme will be incorporated.

- (e) As for farmland conservation, projects would be planned and designed for verification of the "Guideline". Further, a model project would be established to demonstrate the conservation measures for subsequent adoption in the vast area that requires protection.

(2) Selection of Priority Projects by Sector

(a) Agricultural Promotion and Supporting Plan

The targets for crop production through increased crop yields and cropping intensities have been set up in the Master Plan. Matters relating to improvements in the institutional services sector are discussed in the "Guideline for Agricultural Promotion and Support".

As the aim of a paddy production area is primarily to meet local consumption demands, stabilization of production through assured input supplies will be a priority consideration in the sectoral plan for agriculture. The training of paddy and export agricultural crop farmers as well as the smallholder sector farmers (tea, rubber and coconut) on improved technologies for field adaptation will no doubt contribute towards increased production.

Since the farm production is basically for local consumption, marketing does not have the same relevance as in Case Study Area-I. However, considered from a rural socio-economic viewpoint, its role as a vital component in the social fabric becomes highly significant. The agricultural promotion and supporting plan will give priority to the following projects.

(i) Rural Marketing Facilities (Pola)

The Pola plays a vital role in the rural economy as the centre for the promotion of commodity inflow-outflow. Among the 11 existing Pola centres distributed in Case Study Area-II, the following 3 Pola centres were selected taking into account the: (i) number of persons served, (ii) volume of agricultural produce transacted, (iii) potential for further expansion, and (iv) views of the Pradeshiya Sabha, etc.

District	Division	Name of Pola
Kegalle	Yatiantota Dehiowita	Yatiantota Taldewa
Ratnapura	Kuruwita	Kuruwita

(ii) Improvement of ASCs

The number of ASCs in this area is limited to one for each division except for Aranayake, Eheliyagoda, and Kuruwita. As regards the supply of inputs, the services provided by these centres are restricted. Under the influence of the shortage of transportation at the district level, the situation gets worse. Inconveniences are caused by the location itself and the insufficient number of ASCs.

The expansion of input storage facilities and improvement of transportation by the provision of a truck are simple ways to solve this kind of problem. The construction sites for the input storage facilities were selected in regard to urgency, demand from ASCs and farmers response in the area. The selected sites are listed below:

District	Division	Name of ASCs Area
Kegalle	Yatiantota	Palempitiya
Ratnapura	Eheliyagoda	Eheliyagoda
	Kuruwita	Kuruwita Dodampe
	Ayagama	Gawaragiriya

(iii) Establishment of Facilities for Paddy Seed Storages

At present, the supply of registered seed paddy is largely hampered by the non-availability of required quantities at the DOA farms. In order to stabilize certified paddy seed supply at the required quantity, quality, and time, improvement of ASC and support for the Provincial Seed Paddy Multiplication Programme are priorities. It is proposed that seed paddy storage be constructed at each of the following ASCs:

District	Division	Name of ASCs Area
Ratnapura	Eheliyagoda	Eheliyagoda
	Ayagama	Ayagama Ketepola Dumbara/Manana

(iv) Establishment of the Seed Testing Centre

In order to give other provinces a lead as the first model case, establishment of a provincial level medium-scale seed testing laboratory to test the seed paddy in the first instance and to extend to other seeds later is seen as a useful contribution in easing the current problem in the long run. Such a project will not contradict the government policy since the seed producers will be the farmers. The provincial administration is authorized to issue a certificate under the direct supervision of the SCU of DOA. The proposed plan for a seed testing centre is as follows:

District	Division	Name of DTC
Ratnapura	Kuruwita	Karapincha DTC

(v) Improvement of Agricultural Training Facilities

In the Master Plan, an implementation plan for 7 DATCs was proposed. The District Training Centre located in Karapincha, which is only a DATC located in both of the Case Study Areas, plays an important role in the agricultural training programme in the province. Hereafter, the importance of agricultural training will greatly increase and the needs of trainees will diversify with the promotion of crop diversification. The hostel block and office/lecture room block equipped with a training centre was built in 1958, and lacks facilities.

It is proposed that the capacity of the hostel block and lecture/multipurpose room be expanded to the scale corresponding to the future demand. The project will provide equipment for training, particularly visual and multimedia training equipment.

(b) Agricultural Infrastructure (Irrigation Schemes) Development Plan

Agricultural land use in Case Study Area-II is characterized by large-scale tea/rubber plantations in the majority of the upland areas and paddy in the limited lowland areas. Paddy is the major irrigated crop, but development of new irrigation schemes will be difficult due to the non availability of suitable lands. The agricultural infrastructure development plan will, therefore, focus on the recovery of abandoned areas and effectiveness of water usage through rehabilitation of the existing irrigation schemes.

As described earlier, one medium scheme and 213 minor schemes are require rehabilitation in the Case Study Area. The rehabilitation of minor irrigation schemes have been implemented and programmed under NIRP and IRDP. It is hardly possible to note as a proposed scheme of the Case Study. However, as a verification of the "Planning and Design Guidelines" of the minor schemes, Issodanawela Scheme in Aranayake division was selected as a Case Study suggested by ID.

As for the major/medium schemes, Damme Ela Scheme in Elapatha division is the only scheme in Case Study Area-II and that needs rehabilitation. Accordingly, a case study on the Damme Ela Scheme will be carried out as a proposed irrigation scheme in Case Study Area-II.

(c) Agricultural Feeder Roads Development Plan

Based on the Master Plan, a preliminary inventory survey for the selection of priority feeder roads was undertaken by DUPR under close consultation with the divisional secretaries. The result of the survey was put together as a "List of Candidate Agricultural Feeder Roads" as shown in Table 3.2-1.

In order to select priority projects from the candidate schemes, the following selection criteria were set up.

- (i) Proposed projects are distributed equitably by division;
- (ii) Priority should be given to remote/inaccessible villages;
- (iii) Selected roads should serve a maximum number of agricultural families, enabling the farmers to transport their produce to the nearest marketing centres, ASCs, and other agricultural supporting organizations;
- (iv) Projects requiring substantial acquisition of private property should not be included;

- (v) Construction or rehabilitation of roads should not involve major bridges. Minor bridges, culverts, or causeways should be provided where necessary;
- (vi) Selected roads should evolve from existing footpaths or cart tracks; and
- (vii) Priority should be given to the roads which truck and lorries cannot enter due to sharp bends or steep gradients.

Based on the above criteria, the Study Team carried out field investigations on all the agricultural feeder roads listed in the Candidate Schemes List. Thus, a total length of 67 km of roads scattered throughout the area was selected for the priority road schemes in Area-II. The list is shown in Table 3.2-2, and is summarised as follows:

Division	No. of Roads	Class	Length(km)
Aranayake	2	E	14.0
Dehiowita	1	E	7.0
Deraniyagala	1	E	6.0
Eheliyagoda	1	E	12.0
Kuruwita	1	C	15.0
Ayagama	1	E	5.0
Elapatha	1	C,E	8.0
Total	8	C,E	67.0

(d) Rural Water Supply Development Plan

In both Kegalle and Ratnapura districts, a district water supply development plan has already been established under the assistance of ADB and UNDP, respectively. Therefore, it is not necessary for this plan to manage priority water supply schemes of the Case Study. However, as verification of the "Planning and Design Guidelines" for the water supply schemes, expansion of the existing Kuruwita Water Supply Scheme located in Kuruwita division was selected as a Case Study.

(e) Farmland Conservation Plan

Selection of Model Scheme Area

For selection of the demonstration area in Case Study Area-II, one priority farmland scheme was identified by the following considerations:

- Command area of model scheme should be focused on intensively used farmland, and
- Model schemes should represent typical type of farmland conservation.

The Pelanpitiya Farmland Conservation Model Scheme is considered adequate through the viewpoint of the agricultural practices.

3.3 Project Proposal

3.3.1 Agricultural Promotion and Supporting Facilities

(1) Rural Marketing Facilities (Pola)

(a) Purpose

Pola plays a vital role in the rural economy as the centre for the promotion of commodity inflow-outflow. The main purpose of improvement of rural marketing centre is to upgrade the service facilities in the rural markets (pola) in order to attract more trade as a means of activating the rural economy and to provide better marketing environment to the users.

(b) Development Plan

Yatiantota Pola and Talduwa Pola in Kandy District and Kuruwita Pola in Ratnapura District should be improved on the basis of the following conditions.

- (i) Permanent buildings to conduct wholesale and retail sales should be constructed.
- (ii) In order to use the lands effectively, the one or two-storey buildings for accommodating shops should be constructed with steel structure according to the availability of the area.
- (iii) Facilities of drainage, water supply, toilets, and park should be improved.

According to the above basic plan, the improvement plan for the Pola is proposed as follows:

i) Trading Area

The standard room size for trading is determined to be 4.0 m² (2m x 2m). The floor area for trading of each Pola is summarized as follows:

Yatiantota:	1,000m ²	(250 rooms)
Talduwa:	492m ²	(123 rooms)
Kuruwita:	640m ²	(160 rooms)

ii) Improvement of Facilities

Yatiantota:	Toilet, garbage pit, stand post of water supply, inner drain, culvert for outside drain, river protection works
Talduwa:	Toilet, garbage pit, stand post of water supply
Kuruwita:	Butcher shop, fish shop, toilet, garbage pit, stand post of water supply

(c) Operation and Maintenance

The land, buildings and services such as electricity and water supply where available, are provided to the centre (pola) by respective Pradeshiya Sabha. Pradeshiya Sabha is also expected to look after the security and maintenance of the premises.

The management system of the pola has well established over many years of practice. Thus, no change on the management system is envisaged under the "with project" conditions. It is, however, stressed that the present level of maintenance of the pola should be improved. In this regard, the Pradeshiya Sabha need to ensure that sufficient funds are allocated in its budget for this purpose. It is expected that the annual tender rate will increase adequately on account of the improved facilities provided under the Project.

(2) Improvement of ASCs

(a) Purpose

The main purpose of improvement of the farm input storage facilities is to ensure easy access to agricultural inputs, particularly, fertilizers and agro-chemicals, for small-scale farmers in remote areas that are poorly served by other supply sources. Furthermore, seed paddy storage facilities should be provided in order to ensure easy access to seed paddy for small-scale farmers and to support the Provincial Seed Distribution Programme.

(b) Development Plan

The agricultural inputs storage facilities should be provided and attached to the branch office of ASC. The outline of the storage facilities is as follows.

- i) Construction of simple buildings for agricultural inputs
- ii) Procurement of operation and maintenance equipment
- iii) Improvement of the transportation system

According to the above outline, the capacity of the required facilities and equipment was planned as follows:

(i) Capacity and structure of the agricultural input storage

The storage should be constructed with steel structure and concrete brick walls.

- Capacity of the storage : 20 ton or 45 m²
- Office space attached the storage : 20 m²

(ii) Related facilities and equipment

Four-wheel-drive tractors (35 to 45 hp) with trailer will be provided for transportation of fertilizers and agro-chemicals.

Eheliyagoda, Ayagama, Ketepora, and Dunbara are selected as the construction sites for paddy seed storage. The paddy seed storage should be provided on the basis of the following conditions:

- i) Construction of simple buildings for storing paddy seeds
- ii) Improvement of the transportation system

According to the above outline, the capacity of the required facilities and equipment was planned as follows:

(i) Capacity and structure of the paddy seed storage

The storage should be constructed with steel structure and concrete brick walls.

- Capacity of the storage: 20 ton or 45 m²
- Office space attached to the storage: 20 m²

(ii) Related facilities and equipment

Four-wheels-drive tractors (35 to 45 hp) with trailers will be provided for transportation of fertilizer and agro-chemicals. The proposed paddy seed storage will be provided with manual carts for loading and unloading, weighting meters, and moisture test equipment for quality control.

(c) Operation and Management Plan

Under the improvement plan of the Agrarian Services Centres, input (fertilizers and agro-chemical) and paddy seed storage will be provided to the identified ASCs. These facilities will come under the direct purview of the ASC concerned, and the present operational system of delivery of inputs will continue without change. Farmers will make prior reservations for the inputs needed for the season, and ASC will make arrangements with the respective supply sources to obtain and store the inputs in adequate quantities for distribution. Maintenance of the facilities, as being presently practised, will continue to be the responsibility of the Department of Agrarian Services.

(3) Paddy Seed Testing Laboratory

(a) Purpose

The main aim of this project is to augment the provincial paddy seed production under contracts with farmers by carrying out seed testing under a seed certification programme at the provincial level.

(b) Development Plan

The Provincial Paddy Seed Testing Laboratory should be constructed in the District Training Centre, Karapincha, Kuruwita on the basis of following conditions:

- i) Construction of a laboratory building with sufficient office space
- ii) Procurement of equipment for seed inspection and certification

According to the above outline, the capacity of required facilities and equipment was planned as follows:

(i) Laboratory building

The laboratory building should be constructed with steel structure and concrete brick walls.

- Laboratory building with attached office area and air conditioned room for seed storage: 168m²

(ii) Equipment for seed inspection and certification

- Field inspection kit
- Moisture test equipment
- Purity test equipment
- Germination test equipment
- Seed pathology test equipment
- Microcomputer and related equipment

(c) Operation and Management Plan

The laboratory will be constructed at DATC in Karapincha of Kuruwita Division and will be placed under direct administration of the Provincial Ministry of Agriculture, Uva Province, which will provide the required staff. Two laboratory assistants and office clerks, trained on seed testing at the Central Seed Certification Unit of DOA, will run the laboratory under PDA. Provincial DOA will make arrangements with regard to the distribution of the certified seeds to ASCs according to the agricultural implementation plan. PDOA will be responsible for the operation, management, and maintenance of the laboratory.

(4) Improvement of DATC Facilities

(a) Purpose

The main objective of the improvement of DATC facilities is to promote an integrated approach to the agricultural training and extension services in the small holder sector of the province, which comprises paddy, subsidiary food crops, tea, rubber, export agricultural crops and coconut farmers, and to provide practical training for school leavers who intend to pursue a career in agriculture.

(b) Development Plan

The development plan includes the following works:

- i) Improvement of the hostel block
- ii) Improvement of the lecture room and welfare facilities
- iii) Improvement of audio-visual training equipment and office equipment
- iv) Improvement of the transportation system

According to the above plan, the capacity of the required facilities and equipment was planned.

(i) Hostel block and lecture/recreation room

The building should be constructed with steel structure and concrete brick walls.

- Hostel block to accommodate 30 trainees at a time with kitchen and toilet facilities : 567m²
- Lecture/recreation room to accommodate 100 persons : 320m²

(ii) Audio-visual training equipment and related equipment

- Audio-visual training equipment
- Microphones and related equipment
- Projectors

(iii) Improvement of efficiency of training and administrative work

- A micro computer with related equipment
- A photocopy machine
- A facsimile machine
- A microbus (30 persons)

(c) Operation and Management Plan

The proposed agricultural training facility is an improved facility of the existing DATC at Karapincha under the administration of PDOA of the Provincial Ministry of Agriculture. No change in the present management and maintenance is envisaged. To streamline the training activity, it is proposed to form a special training committee comprising senior staff representatives from Central, Provincial, District and other institutions (e.g. the Department of Export Agriculture, Tea and Rubber Research Institutes, TSHDA, Rubber Advisory Services Department along with PDOA) to formulate integrated training programmes for the officers, farmers and other prospective groups. Funds for conducting the training programmes may come from the budget allocations of the respective extension organizations.

3.3.2 Agricultural Infrastructure Development Plan

(1) General

The Case Study for the Damme Ela Scheme and Issodanawela Scheme is conducted as a proposed scheme in the Case Study Area-II.

For the Issodanawela Scheme located in Aranayake Division, the study is conducted to verify the "Planning and Design Guidelines" for the minor schemes. The development plan is made to restore the scheme to the original designed condition considering the present constraint. The development plan of the Issodanawela Scheme is described in Annex 2, and that of the Damme Ela Scheme is described in this section.

The Damme Ela Scheme having a 178 ha of designed command area is located in Elapatha division, Ratnapura district, consists of 8 villages and 150 farm families. The area lies in the agro-ecological region WL-1 characterised by elevation of about 20 m, rainfall of over 2,362 mm (75% expectancy value). The water resources of the scheme is the Damme Ela Anicut on the Niriella Ganga, a tributary of the Kalu Ganga. A location map of the scheme is shown in Fig. 3.3-1.

(2) Present Agricultural Condition

The Scheme has been designed to command an area of 178 ha. Of this area, 92 ha are irrigated and cultivated, 61 ha are not cultivated continuously and 25 ha are abandoned at present. The present cropping pattern applied in the 92 ha irrigated area is paddy in both Maha and Yala seasons as shown below.

(Unit: ha)			
Crops	Maha	Yala	Total
Irrigated paddy	92	92	184
Total	92	92	184

(3) Present Irrigation Condition

Irrigation water is diverted from the Damme Ela Anicut and supplied to the field through the main canal, LB branch canal, LB D-channel, and RB branch canals 1 and 2. Plot-to-plot irrigation is made through 62 field outlets provided on these canals. Field channels are developed downstream of field outlets or paddy fields. Irrigation and drainage canals are not independent and drainage water from the upstream area is used as irrigation water in the downstream area.

The flow in canals is not uniform and the hydraulic condition is disadvantageous. Excessive seepage (leakage) from the canal bund is confirmed along the canal due to poor construction and decrepitude. 113 related structures provided on the canals are also in poor condition. No measuring devices are provided at intakes and major parts of field outlets. The condition of the inspection roads on the main and LB branch canals used for regular operation and maintenance as well as agricultural activities are quite poor.

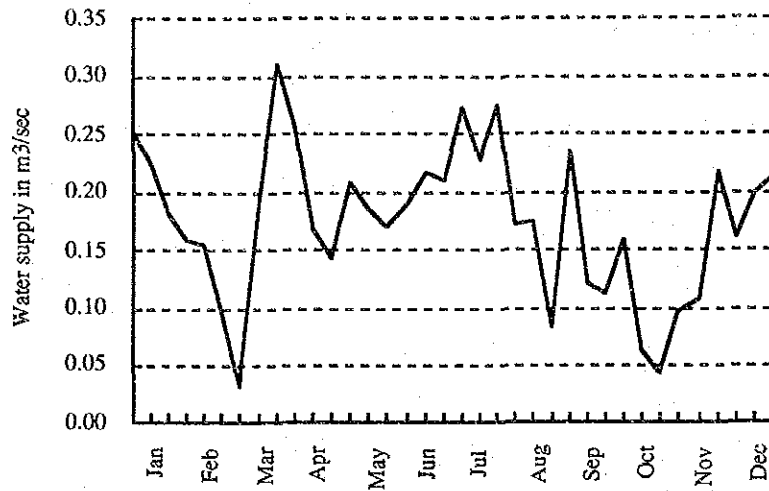
(4) Development Plan

As described in (2) above, the present irrigated area is 92 ha out of the design command area of 178 ha. 61 ha of paddy field are not cultivated continuously and 25 ha are abandoned due to poor condition of the scheme and inundation.

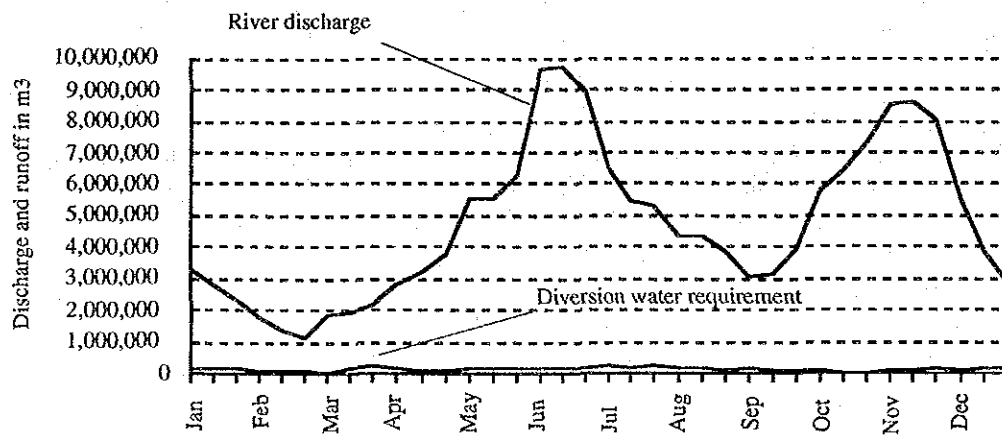
Considering the soil and topographic condition, it is possible to supply irrigation water to 15 ha out of 25 ha of abandoned land. Therefore, the development of 167.90 ha, consisting the existing area of 152.9 ha an extension area of 15 ha, with a 200% cropping intensity will be made through (1) effective water use applying the proposed modified cropping pattern, and (2) improvement of inspection roads for O&M and agricultural activities.

(5) Water Balance and Water Supply Schedule

To develop 167.90 ha with a 200% cropping intensity a water balance study is conducted based on the hydrological analysis results and water supply schedule. The details of the hydrological analysis are shown in Annex 2, and the water supply schedule based on 80% probable effective rainfall and the proposed cropping pattern is shown in the figure below. Preliminary design of the facilities as well as water management is made based this water supply schedule.



According to the results of water balance study shown below, the river discharge is quite enough for the development of 167.90 ha.



(6) Rehabilitation Plan

The rehabilitation plan for the scheme based on the development plan described above is summarized as follows:

(a) Main canal:

provision of a concrete flume for a section of 6.23 km of the main canal and rehabilitation of the remaining section of the earth canal.