6.5 Processing and Distribution Plan

6.5.1 Processing

1) Stimulating the development of the rural processing industry

(1) Potential for development of the rural processing industry

The first point to emphasize here is the truly enormous potential for boosting rural incomes through the introduction of a rural industrial sector. The reasons for this are as follows:

i) Most of the items currently enjoying greater production within the Study Area are perennial crops. Although initial expenses are higher, production costs associated with cultivation drop considerably after the first harvest year. It is also easy to acquire cultivation techniques. All these crops require processing and suitable for exports.

ii) The added value that would result from the abundant supply of labour in rural areas would lead to an increase in rural incomes if rural processing facilities were introduced in those areas.

iii) The most important issue for future rural processing is energy sources. The residue from sugarcane could be used as fuel. Within the Study Area sugarcane residue (bagasse) is possibly the value-added fuel most easily obtainable. Similarly, agroforestry including rukina (a type of legume used as cattle feed) should be encouraged together with conservation of forest resources.

(2) Boosting sugar cane production and utilization

The main crops with potential for processing in rural areas are dried fruits such as tomatoes and pineapples, sugar cane and vanilla. According to KARI, fruits are dried within two days by solar energy however, other produce requires additional energy. Processing of vanilla and cacao for instance, requires energy, which could be supplied by sugarcane residue. Sugar cane could already be produced in sufficient quantity to satisfy domestic demand. Production costs are higher when compared with world prices, thus lowering prices on the international market. Ugandan sugarcane is in no position to compete as yet.

However, crude sugar could be produced cheaply in rural areas, and the government should work towards developing international price competitiveness. The price of sugar produced in the company in which the government has a 51% stake are currently above the market price due to the influence of international market prices. Other than supplying raw materials cheaply there is no option for bringing down production costs. The use of wood as fuel for rural processing operations will destroy forests in the region and remove an important means of boosting farm incomes.

Sugar cane residue would provide the cheapest and most stable fuel for vanilla processing. Sugar cane would be produced in the local area primarily for fuel, with crude sugar being a secondary by-product. Sugar cane could be grown on many areas of privately-owned fallow land within the Study Area. Farmers would bring the sugarcane every few days to the processing factories, together with vanilla and/or other produce, in the same way as being currently seen. Crude sugar is extracted and then residue used as fuel.

The same process could be applied to cacao and tea drying, for instance.

It is important to note that the farmer's original income could be provided by produce for processing, such as vanilla, cacao and tea. The sugar company would buy all crude sugar, enabling it to build up competitiveness on the international market.

(3) Plan of Agricultural and Livestock's Processing

Table 6.5.1.1 shows target production volume and number of processing and distribution facilities within the Study Area, and Table 5.2.1 the expected increase in production with the introduction of agricultural processing. Appendix 3.5.1 shows production area, processing volume and labour force for each crop, as well as production levels for each district.

Table 6.5.1.1 Production Plan of Agricultural Processing and Facilities

a) Production

Unit: tons

Item	Total	Luwero	Masaka	Mpigi	Mukono	Remarks
Sugar cane	132,201	71,074	18,845	13,079	29,201	Jaggery 1/7
Tea	947	0	121	237	589	Dry 1/5
Cacao	5,521	0	706	1,384	3,431	Dry 1/1
Vanilla	3,936	1,463	563	566	1,344	Dry 1/6
Bananas	8,051	3,529	1,394	968	2,160	Dry 1/3
Cassava	16,623	4,344	4,228	4,262	3,785	Dry 1/3
Pineapples	13,996	5,123	2,736	1,900	4,239	Dry 1/14
Tomatoes	759	103	208	414	34	Dry 1/15
Milk	53,873	44,981	7,388	1,504	0	
Beef	15,966	7,788	3,906	2,006	2,266	
Goat meat	10,287	2,095	2,759	2,012	3,421	

b) Facility

Unit: Num. of Facilities

Item	Total	Luwero	Masaka	Mpigi	Mukono	Remarks
Total of Facility	380	81	108	94	97	
For Sugar cane/Vanilla	16	3	3	5	5	2,991
For Cacao /Tea	14	3	3	3	5	
Solar Drying House	380	81	108	94	97	*9.3
Collection Centre	25	8	6	5	6	
Collection Sub-centre	200	73	47	41	39	
Tractor Centre	250	100	54	47	49	

Note: *Unit is mn USHS/year

2) Processing Facilities

(1) Crops

Production amounts of the agricultural production plan for the Study Area are shown in section 6.2.2, Agricultural Production Targets. According to this, in addition to increasing the production of rice in order to replace imports, increased production of such export crops as coffee, cotton, tea, sugar cane, cacao beans and vanilla is planned. In order to improve the rate of self-sufficiency in agricultural areas, production of cereals are to be increased, while efforts will be made to increase the production of such export-oriented fruits as pineapples, and passion fruits. Of these agricultural products, processing facilities in the Study Area currently handle the processing of coffee, cotton, tea, sugar cane, and pineapples. The agricultural processing facility improvement plan has set forth the following points for each product considering the possibility of using existing facilities based on these production plans for processing agricultural produce.

a) Coffee

There are 194 coffee factories operating in the Study Area, both private and cooperatively owned. According to estimates by DCOs these factories have a total capacity of 1,762 thousand tons. Since the target coffee production in the area is 204 thousand tons, the existing factories could handle the target volumes (Table 6.5.1.2).

Table 6.5.1.2 Processing Capacity of Coffee

District	Number of Factory	Maximum Processing Capacity	Production	
			Present	Plan
		ton	ton	ton
Luwero	19	57,802	15,557	31,658
Masaka	48	318,720	23,049	46,903
Mpigi	58	556,800	15,332	31,199
Mukono	69	829,457	47,802	97,259
Total	194	1,762,779	101,740	207,019

Source: Maximum Processing Capacity based on site survey from each DCO.

Notes: Factories not working are excluded.

Processing capacity and production volume are shown in kiboko.

b) *Cotton*

There is a ginnery operating in the Study Area at Bamunanika owned by a cooperative, with a capacity of 4,700 tons. According to the Cotton Subsector Development Project (CSDP), a ginnery in Nakasongola, Luwero district, which ceased operation, is scheduled to be rehabilitated. The target production of cotton in the target year is 4,300 tons and this can be processed by these ginneries (Table 6.5.1.3).

Table 6.5.1.3 Processing Capacity of Cotton

District	Number of Factory	Maximum Processing Capacity	Production	
			Present	Plan
		ton	ton	ton
Luwero	1	4,708	818	3,180
Masaka	0	0	13	642
Mpigi	0	0	2	92
Mukono	0	0	112	341
Total	1	4,708	945	4,255

Source: Maximum Processing Capacity based on site survey from each DCO.

Notes: Factories not working are excluded.

Processing capacity and production volume are shown in seed cotton.

c) Tea

There are eight tea factories owned privately or by the government, with a total capacity of 22,000 tons. A factory in Mukono is scheduled to be rehabilitated by British investors, boosting the processing capacity. The target tea production of 15,800 tons can be processed at existing factories (Table 6.5.1.4). However, primary air-drying to reduce green tea moisture content to 30% will be carried out by farmers at the village level.

Table 6.5.1.4 Processing Capacity for Tea

District	Number of Factory	Maximum Processing Capacity	Production	
			Present	Plan
		ton	ton	ton
Luwero	0	0	0	0
Masaka	3	2,846	955	4,105
Mpigi	0	0	315	2,880
Mukono	5	19,615	3,828	17,285
Total	8	22,461	5,098	24,270

Source: Maximum Processing Capacity based on site survey from each DAO.

Note: Factories not working are excluded. Processing capacity and production volume are shown in green leaves.

d) Sugar cane

Sugar cane is grown for sugar and jaggery (crude sugar for traditional alcohol) and for sucking the liquid. A joint private-public sugar factory in the Study Area produced 26,512 tons of sugar in 1992, or 50% of total sugar production in Uganda, using sugarcane grown on its own estate.

The annual target production amounts based on this plan are expected to double current production levels. Thus, facilities necessary to produce bagasse and sugar which is obtained from it are planned in order to utilize bagasse as a needed fuel for agricultural processing in farming areas.

e) Vanilla and cacao

Most fermentation and drying of vanilla produced in the Study Area is carried out by the private sector outside the area, while most cacao is processed by farmers. The production of both vanilla and cacao is to be increased not only for export, but also to develop the rural agro-industry. Processing facilities for these crops are therefore planned.

f) Rice

At present, there are few paddy fields in the Study Area, and no rice mill. The plan calls for production of 26,400 tons of rice on 5,900 ha of reclaimed paddy fields and construction rice mills.

g) Fruits

Fruit processing facilities in the Study Area consist of one factory which is managed by a subsidiary of the cooperative association in the Masaka District which produces a significant amount of pineapple. The factory primarily produces pineapple juice, but also produces some pineapple fruit and mango juice. Further, pineapple and passion fruit hold an important position among fruits as export products after undergoing primary processing (dried fruits, etc.) in addition to being consumed domestically. Product levels by the target year have been set at 2.9 times the current level for pineapples and 2.8 times that of passion fruits. new processing facilities are planned to accommodate these production levels since there are no primary processing facilities in the Study Area.

(2) Livestock produce

a) Milk

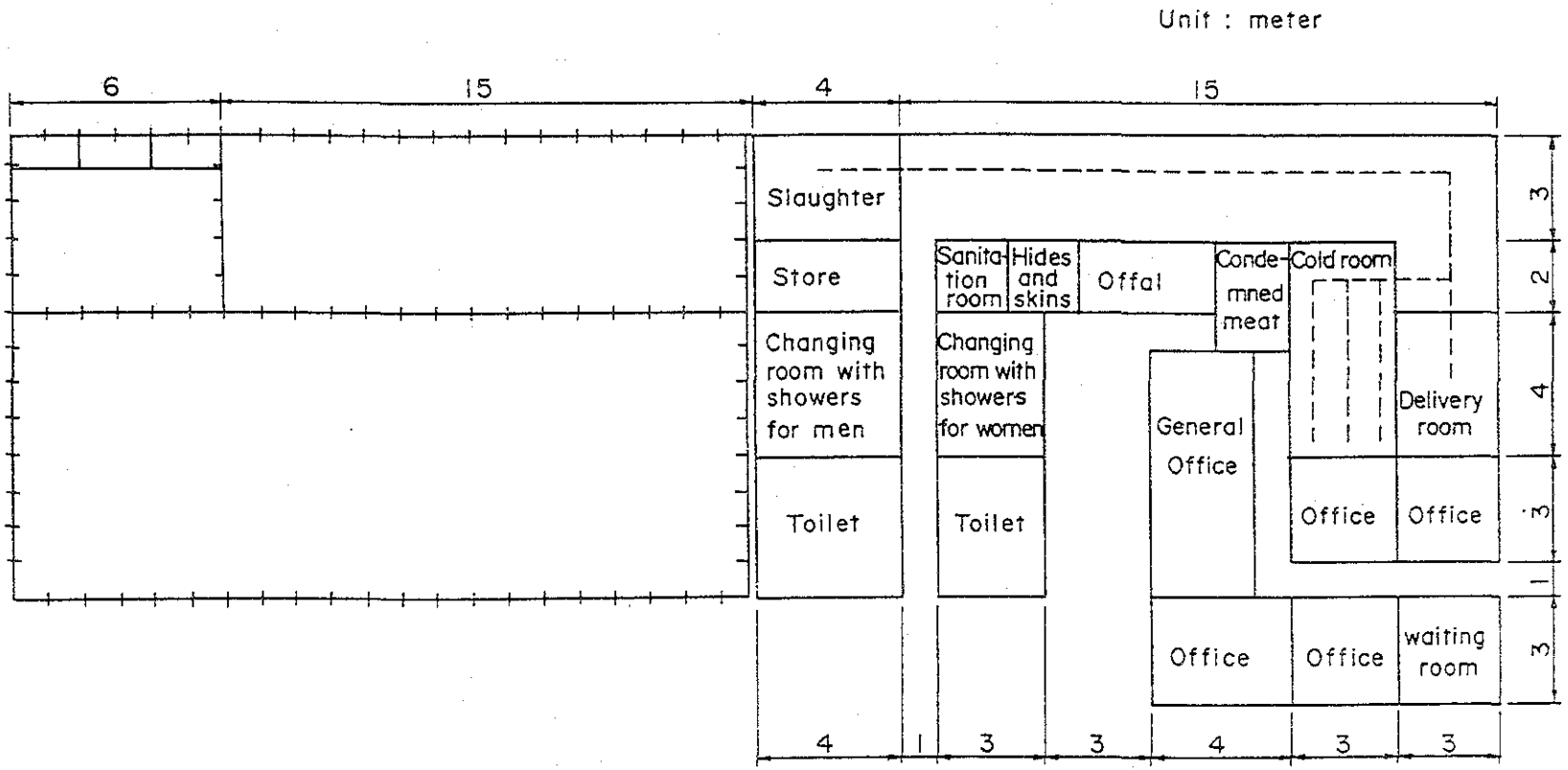
Surplus milk beyond what is consumed within the region (consumption per person is low) will continue to be sold to the milk consuming regions of Kampala and Jinja as in the past. Milk collection centres are planned in order to collect surplus milk and supply it to regional consumers.

b) Beef

There are two types of slaughter facilities: slaughter houses, for which a building structure of some sort has been built, and slaughter slabs which consist simply of a concrete floor. here is one slaughter house and up to eighteen slaughter slabs in each district, except for Luwero. Slaughter slabs suffer from hygiene and meat quality problems due to a lack of roofing and water supplies. Animals are even slaughtered in the rain. Improvements are desired in this area. Since it is expected that demand for beef will expand in keeping with increases in population and incomes, existing facilities will be improved under the plan and new slaughter slabs built in areas where there currently are none.

Refrigerated slaughter facilities are also planned in two districts bordering the consuming regions of Kampala and Jinja in order to meet further expected increases in demand for fresh beef given the increased population of Kampala in the future (see Fig. 6.5.1.1).

Figure 6.5.1.1 Slaughter House Plan



6.5.2 Distribution

1) Distribution facilities

(1) Crops

At present, the most common type of crop trade is between farmers and regional small traders or rural markets. Regional traders and rural markets then sell the produce to traders covering the district or major traders in Kampala.

The collected produce is then transported to the center of the district or to major consumption areas like Kampala if there is sufficient quantity. Most market constraints are at the level of primary distribution of the crops in the rural areas in the districts.

This inefficient collection system of small traders visiting many farmers, with labourious negotiations and long times taken to travel to collect small quantities of crops, drives up distribution costs. A comprehensive project, two key elements is needed: improve rural roads and construct Agricultural Produce Collection Centres (APCC). The concept of this project is described in section 6.5.3.

(2) Livestock produce

The number of cattle is expected to increase as shown in the livestock plan in section 6.4. The new Ranch Plan should greatly increase the number of beef cattle.

At present, cattle trade is between butchers, middlemen and livestock markets with farmers. There are many livestock markets, especially in Luwero and Masaka. Animals are taken from farmers to livestock markets and then on to Kampala. Most livestock markets lack facilities such as offices, fences and weighing scales or bridges, preventing transactions from being conducted properly. It is expected that the number of head of cattle traded on the livestock market will increase with the increased number of cattle raised in the future. New facilities are planned for regions having significant increases in cattle and to improve existing livestock markets in order that it will be possible to evaluate beef cattle with uniform standards.

2) Storage facilities

Coffee, cotton and grains are the main crops produced and stored in the Study Area. However, no data is available on the quantities stored by the private sector. Cotton, coffee and grains are stored in various places during distribution and selling by cooperative societies and unions, middlemen, retailers and processing factories.

Target production increases in the Study Area by the year 2007 are 2.0 for coffee, 4.5 for cotton, and 2.5 for grains (cereals, pulses and oil seeds). The storage capacity for these products will need to be increased.

(1) Coffee

Improvements in transportation and distribution systems as planned in the Agricultural Transportation and Market Activation Project (ATMAP) will reduce the need for storage by enabling faster transactions. The plan calls for the construction of storage facilities to cope with a production in one month.

(2) Cotton

Cotton is stored in ginneries operated by cooperative unions. Stores will be built to accommodate the planned increase (1.5 times) in volume over existing storage capacity.

(3) Grains

Same as for coffee, the required increase in storage capacity will be reduced through faster transactions, and thus a 10% increase of storage capacity of produce for sale will be sufficient.

6.5.3 Distribution System Improvement Plan

1) Background

Since coming to power in 1986, the government has been tackling problems involved in agricultural sector. The two targets of the sector are clearly set up as:

i) To raise living standards of farmers, especially small holders, by encouraging them to participate in market activities.

ii) To diversify crops for exports.

However, due to limitations in transportation, distribution and system of market the targets are still some way off.

(1) Problems with Agricultural Techniques

i) Testing and research

While the development of disease resistant, superior quality breeds of important food and cash crops together with suitable fertilizer and pesticide techniques is desired, the currently weak research and testing systems combined with a lack of facilities act as constraints on the reasonable development of these areas.

ii) Extension

The extension of management techniques to farmers has been quite restricted due to the currently limited number of extension workers, low levels of quality and lack of adequate facilities.

(2) Problems with the Transport of Agricultural Produce

i) The transport of agricultural materials and produce in rural areas is done by manual labour, resulting in low levels of productivity.

ii) Agricultural products are mainly transported to market on bicycles, resulting in low levels of produce being taken to market.

(3) Market and Distribution Related Problems

i) Private traders visit farmers in pick-ups to buy crops. Visits are infrequent and irregular thereby placing constraints on planned production and shipping activities. Further, traders buy crops at prices that are favorable to them.

ii) It is difficult to collect produce due to limited information concerning product collection. This places limits on the distribution of agricultural products in the Study Area.

2) Distribution Activation Measures

Of the problem areas described above, those problems concerned with agricultural techniques are being addressed through projects which aim at enhancing and expanding activities in the testing and research extension field, and consideration is being given to an integrated market activation plan based on the upgrading and development of needed facilities centering on the development of a distribution base.

This plan, as can be seen in figure 6.5.3.1, places Agricultural Product Collection Centres (APCC) in suitable locations throughout rural areas. In addition to seeking to realize a base for the distribution of produce, the plan also aims to provide for the agricultural resources necessary for the expansion of agricultural production, add various functions to the APCCs including offering means of processing and transporting produce, activate agricultural activities through the expansion of production, increasing the amount of produce distributed and the introduction of processing industries, as well as raise incomes in rural areas.

(1) Agricultural Product Collection Centres (APCC)

a) Location

Centres, which will be located in the centre of various regions, will be surrounded by sub-centres. In general, considering what would be reasonable distances between farmers and wholesalers, sub-centres would be located about one in every 10,000 ha (of which agricultural land area is 2,500 ha) and centres would be placed at one in every 90,000 ha (of which agricultural land area is 25,000 ha) (see Fig. 6.5.3.2).

b) Components:

An APCC consists of 6 units as shown in Figure 6.5.3.3.

i) Community Centre Unit (CCU):

Management office, bank branch office, extension staff office (with display of agricultural research and extension materials), multi purpose hall (for training, seminars etc.) and dispensary. Operated by the local administration.

ii) Bidding Unit (BU):

Bidding lot, office, warehouse and packing lot. Management schedules of bidding by crops are announced and records of transactions kept.

iii) Transport Service Unit (TSU):

Office, garage and parking lot. Provides farmers with animal draft carts by lease.

iv) Machine Maintenance Services Unit (MMSU):

Office and workshop. Organised by private mechanics; provides repair services for bicycles, carts, trailers, etc. Includes a garage of farm machinery owned by farmers' groups.

v) Agricultural Inputs Service Unit (AISU):

Shops and warehouses. Mainly private wholesalers and retailers who sell agricultural inputs to farmers.

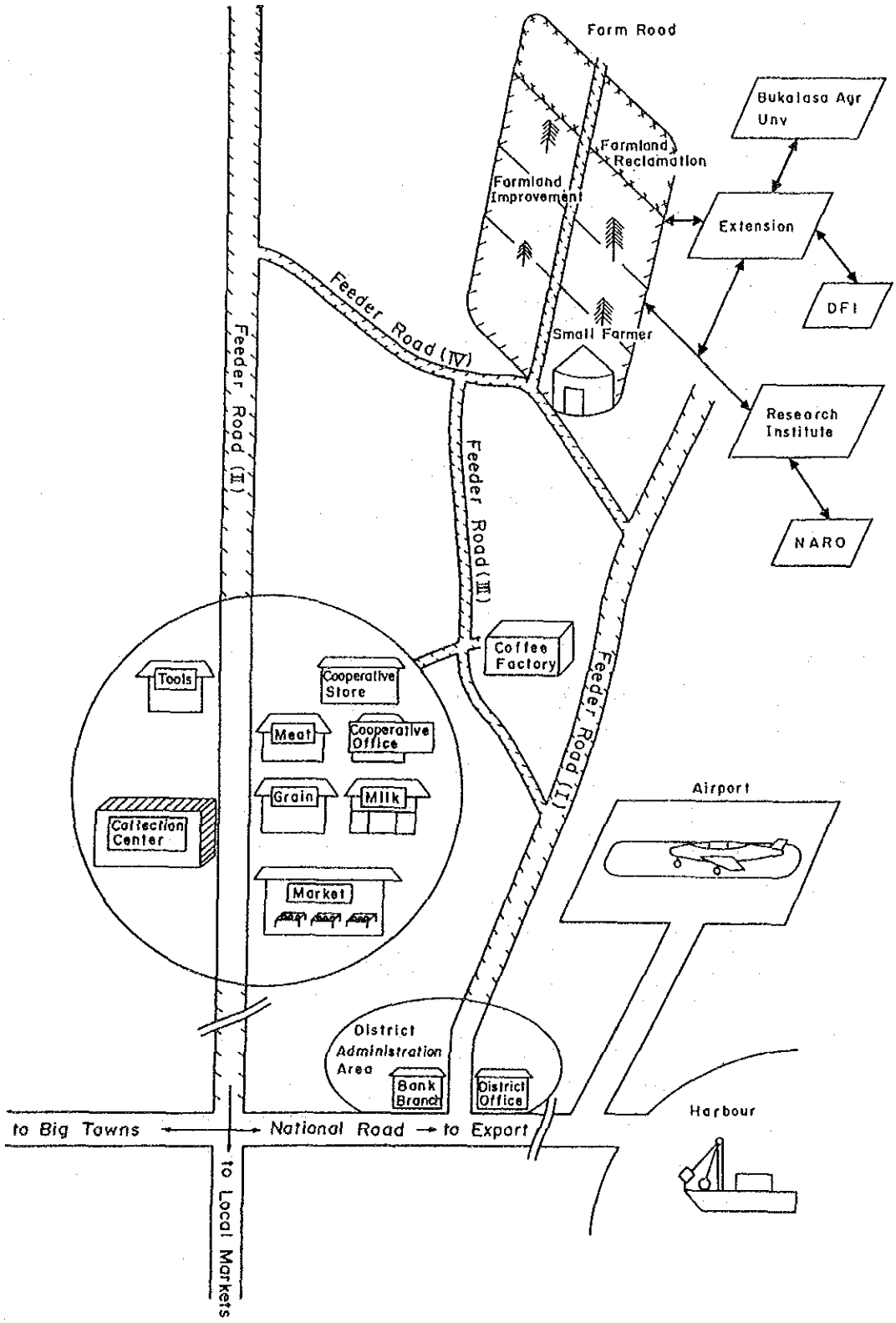
vi) Agro-Industry Unit (AIU):

An office, factories and warehouses. Operated by groups of farmers processing vanilla, sugar cane and fruits such as pineapples and passion fruits.

c) Management of facilities

All facilities are maintained by the IDC. The IDC entrusts the management of these facilities to the UNFA who in turn guides the management associations which are run by the local residents. While mostly public units fall under the direct management of these associations, units of the highly active community MMSU and AISU are each operated by members of the local community.

Figure 6.5.3.1 Concept of Agricultural Transportation and Market Activation Project (ATMAP)



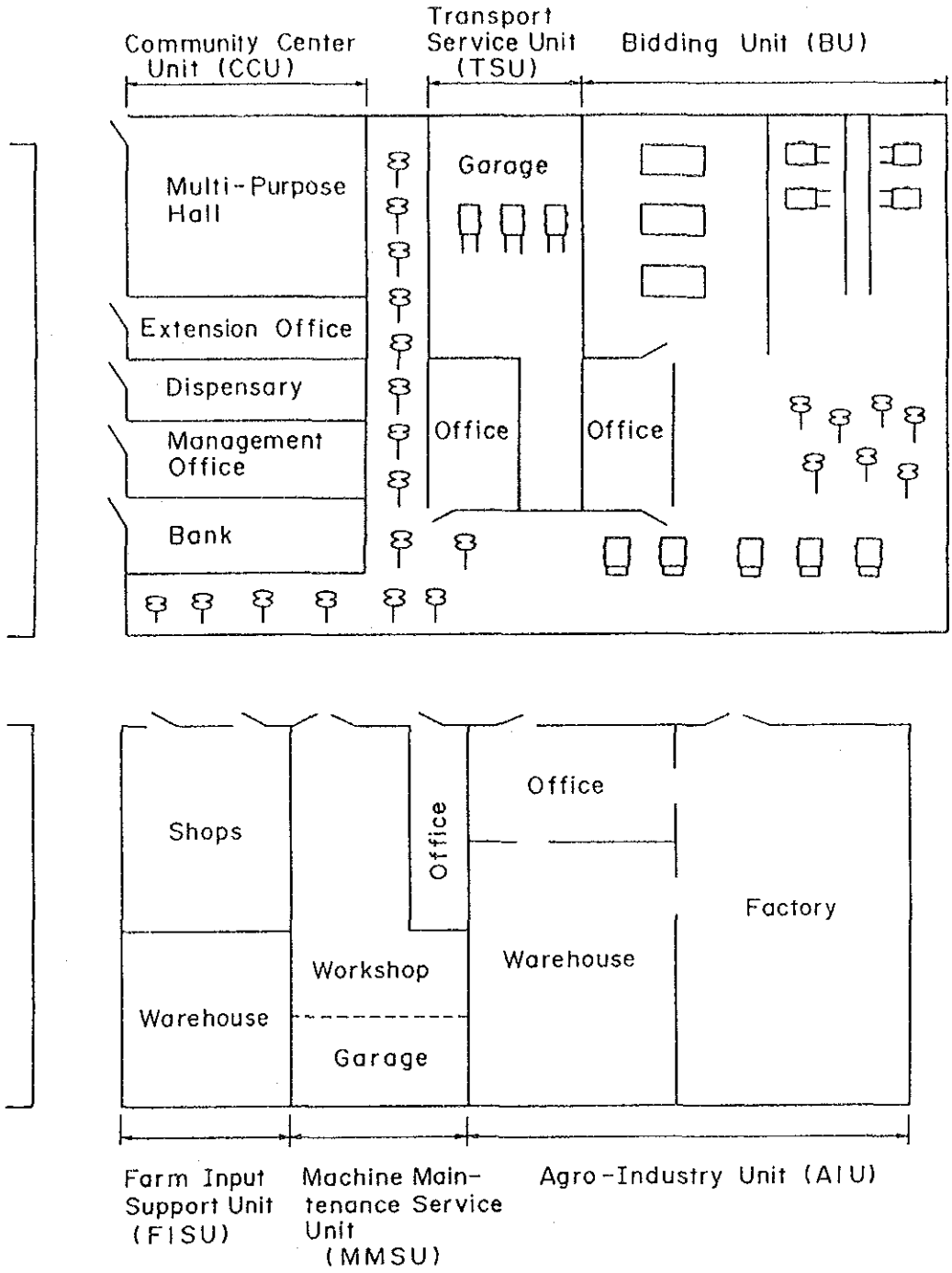
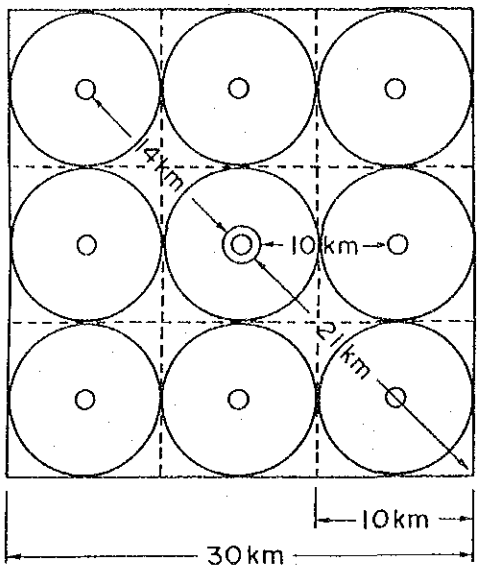


Figure 6.5.3.2. Installation of Agricultural Product Collection Centres (APCC)

Agricultural Product Collection Centres (APCC)
and
Agricultural Product Collection Sub - Centres (APCSC)



◎ : One APCC in every 90,000 ha
Half hour from APCSC to APCC by pick - up

O : One APCSC in every 10,000 ha
One hour from farmer's house to APCSC by animal cart

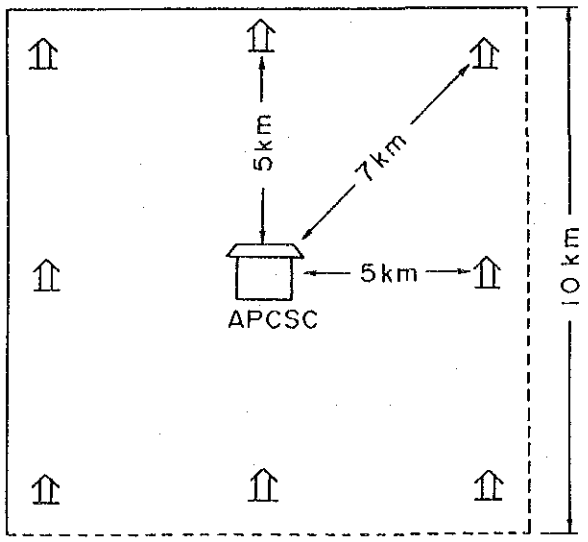


Figure 6.5.3.3 Layout of Agricultural Product Collection Centres (APCC)

6.6 Agricultural Support Plan

6.6.1 Research

1) Background

The main role of government is to lay the necessary foundations for agricultural development and then to maintain and manage them. Along with extensions, research is part of this task, both of which are essential for improving agricultural productivity, and require broad and long-term government support.

Currently the government is working to improve agricultural productivity and to diversify agricultural exports through the development and transfer of agricultural technology. This is being carried out via the "National Agricultural Research Strategy and Plan (NARSP)" and the newly founded "National Agricultural Research Organization (NARO)". The specific tasks of NARSP are to:

i) Draw up detailed research plans to obtain optimal results from the limited resources through allocations and liaisons in related fields, set objectives and targets for each research area
ii) Unify research activities at related ministries
iii) Strengthen motivation, research system and responsibility
iv) Enhance research operations through support systems and fund management
v) Develop liaisons with domestic and overseas research organizations
vi) Explain and support research plans.

It is considered that a more appropriate and effective use of limited resources would be to supplement and aid NARO activities designated by NARSP, rather than establish new research facilities within the Study Area.

2) Objectives

Lack of infrastructure such as electricity, water, and telecommunication facilities, and of research facilities lost during the long-running civil war are considered the major obstacles to research activities. Hence, the plan emphasizes basic infrastructure work and repairs to existing facilities in order to establish an efficient, on going research system. Further, laboratories in high priority areas will be built and existing facilities upgraded.

3) Three aspects to the project:

i) move NARO headquarters office to a more appropriate facility;

ii) upgrade facilities at KARI and NAARI;

iii) move the Forestry Research Institute to Kifu.

4) Details

(1) Moving NARO headquarters

NARO headquarters are currently located in a rented space in MAAIF in Entebbe, but the building is small and the facilities poor.

Furthermore, NARO is supposed to be an independent organization overseeing research into agriculture, livestock, fisheries, and forestry. Such a research management system urgently requires more independent facilities.

(2) Upgrading of KARI and NAARI

The following components are required.

i) Communications equipment

ii) Emergency power generation

iii) Water supply

iv) Housing

v) Irrigation

vi) Agricultural machinery.

(3) Sericulture research laboratory in KARI

Sericulture, which is expected to provide a source for hard currency in the future, has become increasingly attractive to farmers of late. The paucity of sericulture laboratories in KARI will be addressed in the plan.

(4) Plant protection and livestock research laboratory in NAARI

Pests and diseases are one of the major reasons for poor crop production. Research is urgently needed in this important area. Today, plant protection research in Uganda is carried out only at KARI and Makerere University. Requirements for analysis and identification of diseases and pests brought to NAARI by extension officers and farmers have been transferred to KARI and the International Micrological Institute (IMI), IITA and other international institutes. This is because NAARI does not have a plant protection laboratory, despite its research into a large number of commodities. This causes delays in formulating disease and pest strategies.

The difference between plant protection research at each institute can be explained by the difference in their mandates. Research at KARI is focused on plant quarantine and eradication procedures, and at NAARI on basic, everyday research.

The designated crops for each institute also differ as follows.

i) KARI: Perennial cash and food crops such as coffee, banana, cacao and horticulture.

ii) NAARI: Annual industrial and food crops such as yam, sweet potato, beans and maize.

As NAARI does not have a livestock laboratory, despite this being part of its charter, construction of the livestock laboratory is planned.

a) Planned activities

i) Plant protection laboratory

- Control of pests and diseases;
- Advisory services for extension officers and farmers;
- Screening & evaluation of pesticides.

ii) Livestock laboratory

- Identification of diseases, treatment and control of animal diseases;
- Analysis and determination of nutrient requirements for the animals;
- *Preservation of semen for artificial insemination.*

b) Project components

i) Establishment of Plant protection and Livestock laboratories;

ii) Provision of equipment.

c) Laboratory administration and maintenance

NAARI already has qualified scientists to handle these laboratories. Moreover, the World Bank is to provide funding assistance via an "Agricultural Research and Training Project". This plan therefore does not include training for researchers.

(5) Moving the Forestry Research Institute (FORI) to Kifu

According to the NARO charter, FORI, currently locating at Nakawa in Kampala, will be relocated to Kifu, in Mukono, to carry out research in forestry. The importance of forestry research cannot be overemphasized due to its role in the daily lives of most people in cooking, building etc., and in terms of environmental conservation. Enhancement of forestry research is urgently needed in order to stop encroachment on forest lands and to promote balanced development.

a) Activities

Research at Kifu will fall into the following categories:

- Natural forest production and management
- Plantation forest production and management
- Tree seed and propagation technology
- Agro-forestry and forest soil
- Harvesting and utilization
- Forest protection
- Forest social economics
- Forest inventory/data systems

b) Project components

The project provides for the provision of:

- Research laboratories
- Accommodation for researchers
- Research materials and equipment.

5) Implementation

The IDA's 'Agricultural Research and Training Project' is scheduled to begin before this project. Close attention will be paid to the progress of the IDA project in implementing this project.

6.6.2 Extension

1) Background

In 1992 the government released its national "The Agricultural Extension Planning programme". The program was designed to reduce costs and labour by combining separate schemes already underway in crop productivity, livestock productivity, agro-forestry and fish farming. A single person has b en made responsible in a given area for all of the above when working to upgrade agricultural practices. The DFI is expected to be heavily involved in directing farmer training and technology & improvement programs. At the present point in time, the "Agricultural Extension Project (AEP)" at the district level has just been launched with IDA support. Of the 106 sub-county chiefs interviewed through the FIS, 75 wanted more agricultural extension work in their area and were keen to see upgraded extension services (see Figure 6.6.2.1). The Agricultural Productivity Program contained in the Master Plan requires extension services to be provided to at least 240,000 of the estimated 520,000 farm households expected within the Study Area by the year 2007 making the annual target some 20,000 households. At present there are about 200 extension workers, each serving 2,400 farmers. The government hopes to improve this to one worker for every 500 farmers while

simultaneously upgrading the depth and quality of service, a task requiring both training for extension workers and more efficient use of existing facilities and human resources. This plan calls specifically for repairs to Bukalasa Agricultural College where extension staff are trained.

The Agricultural Extension Project (AEP), sponsored by IDA and running over six crop seasons between 1992 and 1994, covers training of both farmers and extension workers. The Master Plan will complement the AEP, for instance, with respect to facilities not covered in the AEP.

2) Objectives

The basic purpose of the Master Plan is to support government efforts to boost production and broaden the range of export products through extension. Specific objectives include upgrading training facilities, boosting the efficiency of extension work itself, motivating workers and clarifying the funding process.

3) General outline

i) Upgrade Bukalasa Agricultural College to provide better training for extension workers.

ii) Upgrade the two existing District Farm Institutes (including attached farms) and construct two more.

iii) Provide extension branch-offices being attached to collection centres (APCC) planned under Section 6.5.3.

iv) Restore an even balance to the distribution of extension workers throughout the Study Area, and boost motivation by upgrading accommodations and reviewing salaries and allowances.

v) Improve disease and insect control through a Plant Protector Unit.

vi) Press for clarification of the budgeting process and worker responsibilities; establish a legislative basis for agricultural extension work to facilitate appropriation of funds.

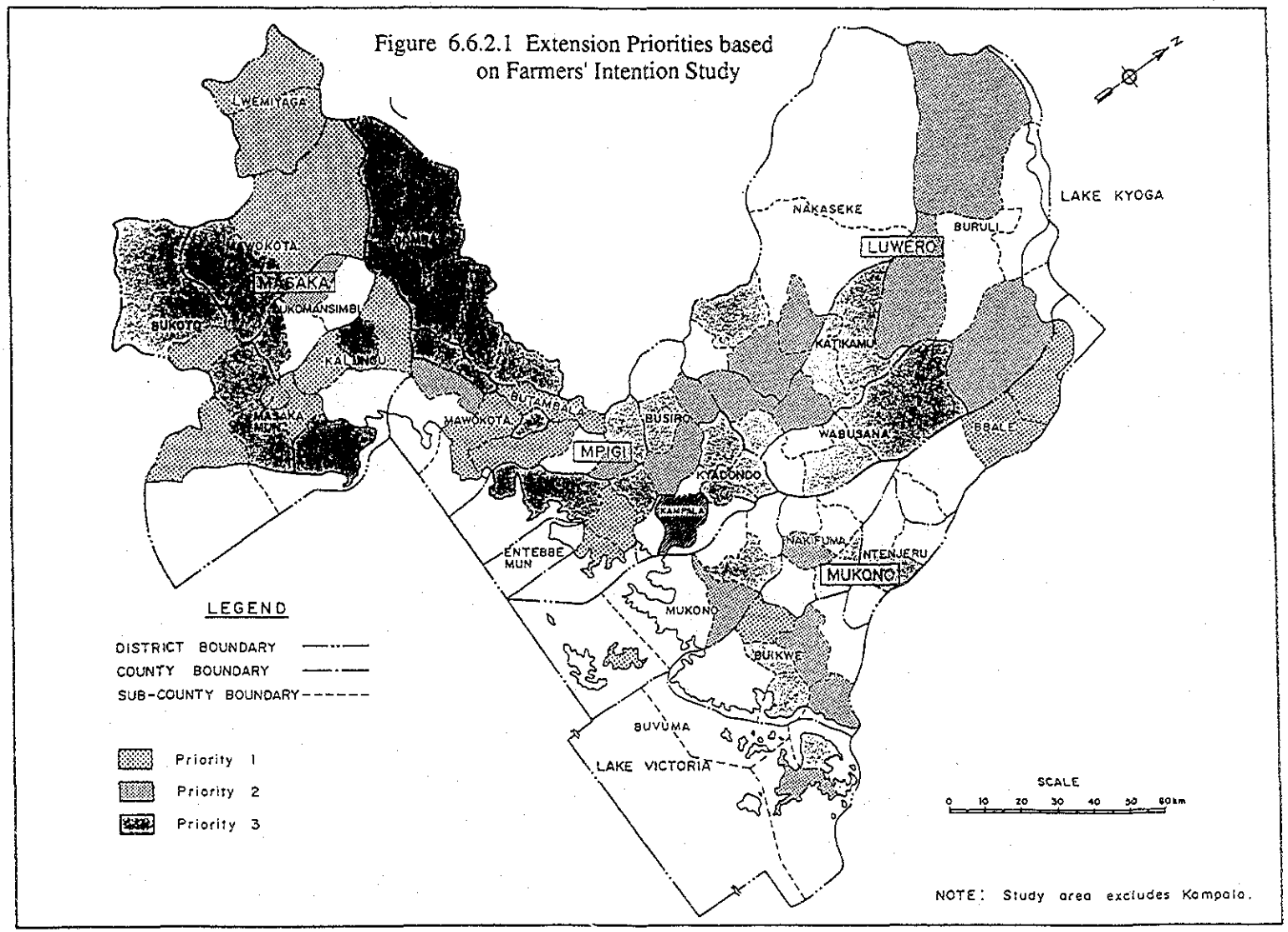


Figure 6.6.2.1 Extension Priorities based on Farmers' Intention Study
N
LWEMIYAGA
MAWOKOTA
MASAKA
KYOMANSIMBI
BUKOTO
KALUNGU
MASAKA MUN
BUTAMBALA
MAWOKOTA
BUSIRO
MPIGI
KYADONDO
KAMPALA
ENTEBBE MUN
NAKASEKE
BURULI
LUWERO
LAKE KYOGA
KATIKAMU
WABUSANA
BBALE
NAKIFUMA
NTENJERU
MUKONO
MUKONO
BUKWE
BUVUMA
LAKE VICTORIA
LEGEND
DISTRICT BOUNDARY
COUNTY BOUNDARY
SUB-COUNTY BOUNDARY
Priority 1
Priority 2
Priority 3
SCALE
0 10 20 30 40 50 60km
NOTE: Study area excludes Kampala.

4) Project details

(1) Rehabilitation of Bukalasa Agricultural College

i) Power and water supplies
ii) Dormitories
iii) Classrooms (including equipment)
iv) Lecture theatres
v) Practical farms
vi) Materials and equipment

(2) Restoration and construction of DFIs

i) Restore Masaka and Mukono DFI
ii) Build Luwero and Mpigi DFI
iii) Upgrade farm lands attached to both existing and new DFIs (temporary storage facilities, fruit dryers, paddy fields, etc.).
iv) Set up system of research and examination system for Subject Matter Specialists jointly with research and testing bodies

(3) Establishment of branch extension offices.

Branch extension offices attached to collection centres will assist in the deployment of in-depth extension services. Extension officers can use the offices as a base for extension service activities on living standards, displays of cropping patterns associated with different forms of farm management, and distribution of pamphlets and information. Community centres attached to collection centres will be used for extension seminars for farmers groups on selected commodities and new transportation facilities. Extension officers will carry out on-site trials together with selected farmers.

i) Extension branch-offices attached to collection centres (225 locations).
ii) Equipment such as audio visual sets, etc.
iii) On-site demonstration trials (400 locations)

(4) Improvement of working conditions of extension staff to mobilize their work ethics

i) Better dormitories for extension staff and their re-allocation
ii) Training for extension staff and increase of their allowance.
iii) Lending bicycles or motorbikes to extension staff

Further, consideration should be given to the establishment of a new selective examination system as an institutional revision, in which the top 5 to 10% of diploma or certificate holders can be promoted based on their performance in the same fashion as more highly personnel.

(5) Support for Plant Protection Unit

The Plant Protection Unit was set up under MAAIF to address chronic crop losses due to insects and disease in the field as well as problems with storage. An estimated 40% of farm produce is wasted due to poor storage and vertebrate migratory pests and weeds on farms.

a) The Plant Protection Unit has been set up specifically to:

- establish and develop an effective and functional Plant Protection Organization for Uganda;
- establish and maintain a Plant Quarantine system;
- provide pest and disease advisory services;
- devise an efficient and integrated mechanism for pesticide regulation, importing, registration, distribution, packaging, labeling, sales, storage, usage and disposal;
- supervise the proper implementation of the FAO International Code of conduct on the distribution and use of pesticides, and the International Plant Protection Convention;
- develop and implement an Integrated Pest Management (IPM) strategy;
- train staff and farmers in plant protection;
- provide a link between research and extension activities in plant protection; and
- prevent the spread of pests affecting plants and plant produce, and control same through legislative, technical and administrative measures.

b) Support via:

- Transport for staff
- Accommodation for District Staff
- Chief Technical Adviser in head office
- Pest and disease identification kits
- Demonstration materials

(6) Agricultural Extension Statute

Basic laws must be established in order to facilitate stable and efficient extension activities under the Plan. The Cooperative Societies Statute was enacted in 1991, and the National Agricultural Research Organization Statute in 1992, but as yet basic laws regarding agricultural extension have not been established. This Plan recommends the enactment of laws governing agricultural extension activities.

National government and local administrations should work together in drafting these laws which should state the purpose, allocation of staff and expenses involved in extension activities, for example, as set out in Table 6.6.2.1. Expenses after the establishment of the law should be allocated by local governments and subsidized by the central government. This would be in line with the current decentralization policy of the Ugandan government.

Table 6.6.2.1. Items to be specified in the Proposed Agricultural Extension Laws

Item	Content
1. Objectives	Stating objectives at the beginning of the law can demonstrate overall principles such as governmental attitudes toward projects, project areas and kinds of activities.
2. Roles of staff 2.1 Roles of staff	(1) Spread and exchange of knowledge and technology to farmers; (2) Teach new agricultural techniques and technologies developed by testing and research organizations.
2.2 Roles of professional technicians	(1) Clearly delineate researchers' tasks and get research results to extension staff as quickly as possible in a form adapted to local conditions; (2) Assist in bringing professional subjects and a professional point of view into the analysis of local problems; (3) Train and upgrade local extension staff; (4) Work on locally important crops, agricultural economy, agricultural machinery, agricultural construction, extension training methods, and life-improving technology; and (5) Activities a. Helping extension staff to provide guidance to farmers upon staff request. b. Training extension staff (preparing and acting on training plans). c. Substantiating technologies that suit sites (adjusting technology developed by testing and research organizations for use by farmers by modifying and testing according to their applicability to various site conditions).
2.3 Roles of administrators and managers	1) Being responsible for overall management planning of projects; 2) Managing operations to facilitate activities of staff and professional technicians; 3) Boosting agricultural production and improving the lives of farmers and measuring the effectiveness of activities; 4) Providing government bodies with information for policy enforcement relating to farmers' production activities; 5) Forming fundamental policies and enforcement plans for training projects of staff in consultation with professional technicians; and 6) Forming and implementing strategies to develop extension workers and professional technicians.
3. Budget measures 3.1 Costs for dispatching staff	Personnel costs for professional technicians, agricultural and life improvement staff
3.2 Operation costs	Traveling costs of professional technicians, study and research costs, and costs of dispatching special mobile technicians
3.3 Operation costs of local agricultural offices	Traveling costs of extension staff training activities, general affairs costs for offices, and costs of extension information activities
3.4 Costs of dispatching mobile guidance facilities	Transportation used by extension staff: bicycles and motorbikes
3.5 Costs of various committees and councils	Local committee and council meetings in the area with farmer representatives or representatives of related organizations
3.6 Costs of agricultural improvement activities	Printing documents and setting up demonstration fields
3.7 Costs of improving standards of farm villages	Operation costs used by life improvement staff
3.8 Costs of fostering youths in farm villages	Technical education and business start-up of farm successors, mainly in the youth club fostering project
3.9 Costs of training staff	Training professional technicians and staff

6.6.3 Farmers' Organizations

1) Cooperatives

Cooperatives have traditionally operated under the supervision of MOTI. Strong government involvement and protection has actually hindered the growth and operation of cooperatives. The 1991 Cooperatives Act reduced government involvement and allowed them more autonomy.

The Rehabilitation and Development Plan 1991/92 - 1994/95 and the Way Forward II Medium-Term Sectoral Strategy 1991 - 1995 set out a four-point strategy for revitalizing cooperatives.

i) Improve management and accounting process
ii) Boost production of lucrative export and domestic food crops by upgrading infrastructure and raising quality to secure higher prices in the market
iii) Reform loan system at farm cooperative banks and other financial institutions
iv) Expand influence of farm cooperatives into processing, housing construction and handicrafts.

The Master Plan calls for a wide range of infrastructure development. This will help create a stable economic environment for cooperatives.

2) Ugandan National Farmer Association (UNFA)

The Association will organize and take control of day-to-day administration of collection centres and sub-centres.

3) Farmer Associations established for the implementation of the projects

Three administrative associations will be set up to coordinate materials and facilities in the field to ensure that the project runs smoothly. These associations will be supervised by an independently established Integrated Development Centre (IDC) and Sub-centre (IDSC). The three associations will be responsible for day-to-day operation and maintenance of new equipment and facilities and for obtaining funds for equipment and material updates. Farmers wishing to use equipment and facilities must join a farmer association and take part in their administration.

(1) Agricultural Association (AA)

The follow-up on the FIS found widespread demand for better tractor service. Tractors with disc plows and trucks will be distributed to 225 AAs to reduce the workload on women, who are traditionally responsible for such work. Equipment will be maintained by AAs under the guidance of the IDC. Farmers wishing to use the machinery will be required to join and assist with the running of their local AAs, which will be responsible for construction of farm roads and contour ditches.

(2) Irrigation Association (IA)

Farmers wishing to make use of irrigation facilities built under wetland utilization schemes and small-scale irrigation schemes will be required to join their local IA and assist with water utilization and equipment and machinery maintenance. Technology extension will be provided to each IA.

i) Rice cropping areas will receive 47 sets of processing equipment and transport machinery in addition to the basic irrigation equipment.

ii) Horticultural farming areas will receive 125 sets of cultivation and transport machinery in addition to irrigation equipment.

(3) Livestock Associations (LA)

LAs will be responsible for maintaining facilities (fences, established pasture, boreholes, dipping facilities and machinery received under technology extension schemes). Of the total 87 LAs, 66 will be set up under the New Ranch Plan and 21 in existing farming areas.

6.6.4 Farm Financing

As discussed in 3.6.4, financing systems for farm management, processing and distribution industries have been provided. The systems offer financing to not only small farmers, but also commercially managed farms and other agriculture-related industries. Although funds are inadequate, the systems themselves are in place. This chapter studies policies concerning how to best utilize these financing systems to recover and increase loan source funds.

It is desirable to utilize the existing primary cooperatives network established nationwide for farm financing. For example, farm financing through primary cooperatives is extremely effective in regions where no commercial banks exist. However, in end-user rural areas in particular, even if individual farmers use finance organizations, the transportation system is inconvenient and information is inadequate. Therefore, the problem is how to best improve these conditions.

The survey studied the following potential improvements:

i) Encouraging savings among farmers and traders;

ii) Strengthening the administrative and management abilities of cooperative financial divisions;

iii) Guidance in business and fund management to farmers and traders;

iv) Establishment of a financial system to support production and daily activities, including women's groups.

In the Study Area, commercial farming of fruits and vegetables, as well as coffee and a number of farm products for export, has already begun. Therefore, policies to accumulate the

capital flowing into rural regions and utilize it as capital for investing in the continued growth and improvement of agriculture in the overall region constitute the core of the plan.

As for item i) above, it is necessary to make it mandatory to save a portion of the transactions of both farmers and traders. This will be realized through the construction of APCCs which will enable the control of cargo collections and shipments, assess the flow of capital within rural as well as and to and from urban areas.

Concerning ii), when production of cash crops increases it will be necessary to systematize the various functions of rural areas, especially produce collection systems. Also, there will be an increase in currency circulating between traders and farmers, and this will make it possible to establish financial institutions in rural areas. Although it is possible that private sector financial institutions will also enter this business after the commercial production economy has matured, the Co-operative Bank will establish offices temporarily in APCCs during the initial stage in order to support both farmers and traders on regular days in business and supervise the repayment of loans.

Regarding iii), mutli-purpose halls and extension offices built adjacent to APCCs will serve to offer group guidance to farmers to assist them take advantage of a variety of methods. In addition, it is also possible to consider striving to boost regional income with the aim of encouraging new growth in regional agricultural production by organizing production by crop, collectively implementing land improvement projects through the formation of farmer's associations and developing products with higher commercial value through group utilization of credit.

With regard to iv), there already exist financial systems that support farmer, women and youth groups. However, promotion of rural industries such as folk craft production and sewing should also be considered.

Although creation of light industries and agricultural processing requires considerable initial costs for its investment, the need for such investment is high from the point of view that they can create new job opportunities.

Estimates of the credit to be provided to farmers, their groups and traders in the Study Area is summarized in Table 6.6.4.1 (see Appendix 3.3.2).

Table 6.6.4.1 Required Credit Amount for Each Agricultural Activity

Item	Total Amount Million US$
<Long-Term Credit>	
1) Land Improvement and Reclamation	10,376
2) Construction of Farm Product Processing Plants	27,554
<Medium-Term Credit>	
1) Perennial Crops of Introduction	4,567
2) Farm Machinery Service (Purchase, Repair, Sale)	8,464
3) Farm Tools (Bull-cart Manufacture and Repair)	16,625
<Short-Term Credit>	
1) Farm Input Purchase and Sale	6,151
2) Handicraft Manufacture and Sale	1,820
3) Farm Product Sale	3,640

6.7 Irrigation and Drainage Plan

6.7.1 Irrigation and Drainage

The Irrigation and drainage plan was formulated as the Small-Scale Irrigation Scheme (SSIS) and Wetland Utilization Scheme (WUS) for the cultivation of horticultural crops and rice respectively, both of which require irrigation and which were selected as strategic crops in the farm management plan.

1) Site Selection

(1) Small-Scale Irrigation Scheme (SSIS)

Wetland water sources will be used to irrigate horticultural crops in the Lake Victoria Crescent zone which has good access to city precincts.

Site selection will be based on two principles:

i) suburban location with ready access to cities so that produce can be marketed easily; and

ii) proximity to water source with adequate catchment area to ensure a supply of water for irrigation along with a minimal difference in elevation between farms and water sources.

Requests for SSIS were received from many subcounties in Mpigi and Mukono during the FIS. The following 26 sites covering a total 2,500 ha were chosen using 1:50,000 scale topographical maps and 1:250,000 scale soil maps (see Appendix Table A3.7.1.1).

District	Sites	Area (ha)
Luwero	4	560
Masaka	10	961
Mpigi	6	828
Mukono	6	151
Total	26	2,500

The size of one unit must be suitable with respect to cost efficiency and number of farm households with ready access to the facilities.

An irrigation area of 20 ha and height difference of 30 m would require a 100 mm diameter pump with a drawing water capacity of 11.6 l/s and a total water lifting capacity of 62

m. This is the most readily available type of pump and also be repaired in-country without any major problems.

Between ten and twenty households is considered as an appropriate size for each cooperative administrative body to facilitate collective activities and communications.

Currently such bodies manage areas ranging between 5 and 30 hectares in size.

A collective area of 20 ha of land is taken as a model of the SSIS unit assuming 2 ha per household and 10 households to form an irrigated area. A model of such a unit is shown in Figure 6.11.1.1 (see Appendix Figure A3.11.1 ~ 2).

(2) Wetland Utilization Scheme (WUS)

A rice production scheme which requires a large volume of irrigation water, is to be carried out in wetlands. For economic, social and environmental reasons, the trunks of the wetlands are excluded. The north of Luwero and Mukono Districts are also excluded since:

i) Seasonal wetlands covered mainly with grass are dominant. Due to insufficient available water, they are not suited for rice production. These areas in the districts should be developed for livestock husbandry by establishing water supplies for animals. Site identification was made based on the following principles.

ii) Available areas for paddy cultivation extend downstream from the projected water intake site.

iii) Catchment area is large enough in proportion to projected irrigation area.

The following 47 sites with a total area of 5,900 ha were identified based on an examination of topographical maps (1:50,000), vegetation maps (1:250,000) and field surveys (see Appendix Table A3.7.1.2).

District	Sites	Paddy field (ha)
Luwero	8	600
Masaka	21	1,970
Mpigi	14	2,610
Mukono	4	720
Total	47	5,900

The farm area for each site ranges from 20 to 400 ha.

These sizes are considered appropriate from the points of:

- Past experiences in Africa indicate that large projects are difficult to maintain by farmers and many facilities are dilapidated.

- Design of irrigation facilities for smaller projects can be simplified and consequently lower costs.
- It is easy to copy smaller projects elsewhere, thus fostering paddy production.

The preliminary design assumes a farm area of about 100 ha, the average size of the sites identified.

The WUS model is shown in Figure 6.11.2.1 (see Appendix Figure A3.11.3 ~ 4).

2) Irrigation techniques

(1) Small-Scale Irrigation Scheme (SSIS)

The SSIS is designed primarily for horticultural crops. Plots should be next to wetlands, on low hills with minimum possible height differential from the water source. Water is drawn through a head race into a tank built on the fringe of the wetlands from which it is drawn by pump via pipelines into ponds attached on each farmer's plot.

At the moment, water application on small farms is entirely dependent on human labour, and carried out only on those crops deemed most in need of water.

It is most important that water drawn from wetlands by pump be utilized as efficiently as possible using buckets and hoses. Human labour, although still a central element of irrigation, can be reduced by having a ready supply of water at a high point at all times. Crop yields will also rise as irrigation becomes more efficient.

Advanced methods such as sprinkler and drip irrigation should be introduced in the future in line with technological advances and local needs.

(2) Wetland Utilization Scheme (WUS)

The WUS is designed primarily for paddy cultivation making use of water in wetlands. None of the potential sites identified had the sites suitable for reservoirs, so ditches will be constructed crossing the wetland to collect water. This system takes up less space than reservoirs, but is only capable of ensuring less stable water supplies.

Underground water will not be used, since it causes a number of problems, not least changes in water level. Rice could be grown in areas with inadequate supplies of water through rotation cropping with vegetables to reduce water demand.

WUSs have been designed to enable water management by individual farmers using water provided by gravity through dual-purpose irrigation and drainage earth canals.

Drainage channels will also be provided in the center of wetlands to carry ordinary waste water from plots and flood water in the event of inundation. These will be no more than 50 cm deep in order to prevent any significant lowering of the underground water level. Check gates will be used to regulate the water level in the channels, while buffer zones on both sides of the channels will be used to preserve the original vegetation.

3) Irrigation plan

Design of irrigation facilities is based on analyses of hydrological and meteorological data (effective rainfall, runoff volume and irrigation water) obtained by the Study team.

The various data used are given below.

(1) Basic Year for planning

The data used as daily rainfall statistics for each district is shown as below.

District	Station	Period	(years)
Luwero, Mpigi	Namulonge	1972 - 1992	21
Masaka	Katigondo	1965 - 1992	28
Mukono	Jinja	1961 - 1992	32

Based on the annual rainfall probability for each district derived from the above data, the year for planning corresponding to a 'five year probability of non-exceedence' was found as follows.

District	Station	Year of planning	Annual rainfall of planning (mm)
Luwero, Mpigi	Namulonge	1991	937
Masaka	Katigondo	1969	1,008
Mukono	Jinja	1983	1,137

All meteorological data used below is data corresponding to basic year for planning.

(2) Water requirement

- *Crop basic evapo-transpiration* ET.

  ET_o. was determined using an evaporation metre.

  $ET_o = K_p \cdot E_{pan}$

  E_{pan} (mm /day) = average daily evaporation

  K_p = evaporation meter coefficient (= 0.75)

- Crop coefficient K_c

  Evapo-transpiration volume for each crop relative to the standard was determined from statistics and interviews conducted in each region.

  Rice = 1.4

  Through two five-month cropping periods (February to June and August to December).

Horticultural crops = 1.0

Grown throughout the year; figure of 1.0 taken from banana, which has a high crop coefficient.

The SSIS uses crop coefficients for horticultural crops and the WUS for rice.

(3) Available water

- Runoff coefficient

  Monthly runoff coefficients were calculated from hydrological data (see Table 3.1.2.1).

- Effective rainfall

  Standard design level taken as 70% of monthly rainfall.

(4) Irrigation efficiency

In Uganda irrigation efficiency is generally taken as 65%, which seams somewhat high for paddy fields and somewhat low for dry fields. The Study adopts 60% for both.

(5) Water balance for model

Table 6.7.1.1 shows the water balance for the both schemes taking into account the conditions in each area.

a) Small-Scale Irrigation Scheme (SSIS)

Table 6.7.1.1 shows that in all districts in which SSIS is or will b e applicable, for at least three months of the year rainfall provides sufficient moisture for crops eliminating the need for irrigation. During the months when irrigation is most needed, on the other hand, a catchment area which is between 30 and 45 times larger than the cropping area is required.

If such a large area is unavailable, crops which use less water could be planted, or fields can be left fallow for soil improvement.

The specifications for pumps which apply to all districts are: pipe 100 mm in diameter, 62 m in drawing height, and 11.6 l/s in capacity. (See Appendix Table A3.7.1.5.).

b) Wetland Utilization Scheme (WUS)

As Table 6.7.1.1 shows, the catchment area must be very large, particularly in Masaka where it reaches some 65 times the size of the paddy field area during August. From the point of view of environmental conservation and feasibility of development, most WUS projects are situated in upstream wetland areas where catchment areas become less.

In order to avoid leaving fields fallow due to water shortage, growing periods could be altered or horticultural crops grown in rotation instead.

6.7.2 Water Management

SSIS and WUS constitute planned forms of water management designed to make the most efficient and appropriate use of available water. Usually, participating farmers will carry out water management as an organised group. Water management under SSIS and WUS will be

the responsibility of Irrigation Associations (IA) as set out in Section 8.2. Training in water management techniques will be provided to each IA as a single group.

SSIS will have one IA per pump and WUS one IA per water collection facility.

Each IA is responsible for the fair and efficient distribution of water among farmers using its pumps, valves and gates. IAs are also expected to keep canals, distributor pipes and other shared facilities in good condition at all times by levying fees to cover ordinary operation and maintenance expenses.

Although water management is particularly important during dry years, it should be remembered that even under normal conditions, the entire wetland area needs a given volume of flowing water to preserve its environment. It is not possible to redirect *all* water for irrigation purposes.

Two common methods used in dry years are area-based *rotational irrigation* and time-based *intermittent irrigation*, often used in combination.

Under rotational irrigation, the irrigation area is divided into blocks. Each block receives a designated volume of water at a set time in strict rotation, which amounts to a form of intermittent irrigation for the block. Care must be taken to allocate times fairly within the irrigation cycle. Intermittent irrigation is used when water supplies are extremely limited. Irrigation is carried out only at given times or at fixed intervals of every few days. If neither of the above is sufficient to meet water needs, then the size of the area under irrigation itself must be reduced.

Good communication among IA members is most important in order to ensure fairness and respect for each other.

Table 6.7.1.1 Water Balance of Irrigation Project (Trial on Model)

(1) Applied for Luwero and Mpigi District

Item	Process	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Rainfall(Rf)	a	mm/mon.	12	65	95	193	134	48	14	50	48	161	81	36	937
Rf Volume per Ha	b=a*10	m3/ha	120	650	950	1930	1340	480	140	500	480	1610	810	360	
Runoff Coefficient	x		0.300	0.236	0.217	0.211	0.248	0.322	0.358	0.221	0.205	0.208	0.239	0.269	
Discharge per Ha	c=b*x	m3/ha	36	153	206	407	332	155	50	111	98	335	194	97	2174
Effective Rainfall	d=a*0.7	mm/mon.	8	46	67	135	94	34	10	35	34	113	57	25	658
(Horticulture)															
Water Requirement	g=d*f	mm/mon.	100	76	109	99	81	79	84	86	90	88	92	98	1082
Net Water Requirement	h=g-d	mm/mon.	92	30	42	0	0	45	74	51	56	0	35	73	
Gross Water Requirement	i=h/0.6	mm/mon.	153	50	70	0	0	75	123	85	93	0	58	122	
- do - per Ha	j=i*10	m3/ha	1530	500	700	0	0	750	1230	850	930	0	580	1220	8290
(G.W.R./ha)/(Dis./ha)	k=j/c		42.5	3.3	3.4	0.0	0.0	4.8	24.6	7.7	9.5	0.0	3.0	12.6	3.8
(Rice)															
Water Requirement	m=d*l	mm/mon.		106	153	139	113	111		120	126	123	129	137	1257
Net Water Requirement	n=m-d	mm/mon.		60	86	4	19	77		85	92	10	72	112	
Gross Water Requirement	o=n/0.6	mm/mon.		100	143	7	32	128		142	153	17	120	187	
- do - per Ha	p=o*10	m3/ha		1000	1430	70	320	1280		1420	1530	170	1200	1870	10290
(G.W.R./ha)/(Dis./ha)	q=p/c			6.5	6.9	0.2	1.0	8.3		12.8	15.6	0.5	6.2	19.3	4.7

* Effective Rainfall Rate : 0.7

* Irrigation Efficiency : 0.6

* Reqired Catchment Area Ratio to Irrigation Area : k, q

(2) Applied for Masaka District

Item	Process	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Rainfall(Rf)	a	mm/mon.	100	77	160	106	81	23	52	14	70	141	123	61	1008
Rf Volume per Ha	b=a*10	m3/ha	1000	770	1600	1060	810	230	520	140	700	1410	1230	610	
Runoff Coefficient	x		0.300	0.236	0.217	0.211	0.248	0.322	0.358	0.221	0.205	0.208	0.239	0.269	
Discharge per Ha	c=b*x	m3/ha	300	182	347	224	201	74	186	31	144	293	294	164	2440
Effective Rainfall	d=a*0.7	mm/mon.	70	54	112	74	57	16	36	10	49	99	86	43	706
(Horticulture)															
Water Requirement	g=d*f	mm/mon.	72	95	84	81	58	70	74	93	74	81	79	74	935
Net Water Requirement	h=g-d	mm/mon.	2	41	0	7	1	54	38	83	25	0	0	31	
Gross Water Requirement	i=h/0.6	mm/mon.	3	68	0	12	2	90	63	138	42	0	0	52	
- do - per Ha	j=i*10	m3/ha	30	680	0	120	20	900	630	1380	420	0	0	520	4700
(G.W.R./ha)/(Dis./ha)	k=j/c		0.1	3.7	0.0	0.5	0.1	12.2	3.4	44.5	2.9	0.0	0.0	3.2	1.9
(Rice)															
Water Requirement	m=d*l	mm/mon.		133	118	113	81	98		130	104	113	111	104	1105
Net Water Requirement	n=m-d	mm/mon.		79	6	39	24	82		120	55	14	25	61	
Gross Water Requirement	o=n/0.6	mm/mon.		132	10	65	40	137		200	92	23	42	102	
- do - per Ha	p=o*10	m3/ha		1320	100	650	400	1370		2000	920	230	420	1020	8430
(G.W.R./ha)/(Dis./ha)	q=p/c			7.3	0.3	2.9	2.0	18.5		64.5	6.4	0.8	1.4	6.2	3.5

* Effective Rainfall Rate : 0.7

* Irrigation Efficiency : 0.6

* Reqired Catchment Area Ratio to Irrigation Area : k, q

(3) Applied for Mukono District

Item	Process	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Rainfall(Rf)	a	mm/mon.	33	20	61	208	166	64	58	133	91	171	94	38	1137
Rf Volume per Ha	b=a*10	m3/ha	330	200	610	2080	1660	640	580	1330	910	1710	940	380	
Runoff Coefficient	x		0.300	0.236	0.217	0.211	0.248	0.322	0.358	0.221	0.205	0.208	0.239	0.269	
Discharge per Ha	c=b*x	m3/ha	99	47	132	439	412	206	208	294	187	356	225	102	2707
Effective Rainfall	d=a*0.7	mm/mon.	23	14	43	146	116	45	41	93	64	120	66	27	798
(Horticulture)															
Water Requirement	g=d*f	mm/mon.	88	99	105	74	72	63	65	72	79	88	81	77	963
Net Water Requirement	h=g-d	mm/mon.	65	85	62	0	0	18	24	0	15	0	15	50	
Gross Water Requirement	i=h/0.6	mm/mon.	108	142	103	0	0	30	40	0	25	0	25	83	
- do - per Ha	j=i*10	m3/ha	1080	1420	1030	0	0	300	400	0	250	0	250	830	5560
(G.W.R./ha)/(Dis./ha)	k=j/c		10.9	30.2	7.8	0.0	0.0	1.5	1.9	0.0	1.3	0.0	1.1	8.1	2.1
(Rice)															
Water Requirement	m=d*l	mm/mon.		139	147	104	101	88		101	111	123	113	108	1135
Net Water Requirement	n=m-d	mm/mon.		125	104	0	0	43	0	8	47	3	47	81	
Gross Water Requirement	o=n/0.6	mm/mon.		208	173	0	0	72		13	78	5	78	135	
- do - per Ha	p=o*10	m3/ha		2080	1730	0	0	720		130	780	50	780	1350	7620
(G.W.R./ha)/(Dis./ha)	q=p/c			44.3	13.1	0.0	0.0	3.5		0.4	4.2	0.1	3.5	13.2	2.8

* Effective Rainfall Rate : 0.7

* Irrigation Efficiency : 0.6

* Required Catchment Area Ratio to Irrigation Area : k, q

6.8 Agricultural and Livestock Infrastructure Plan

6.8.1 Agricultural Infrastructure

1) Need for development

(1) Land reclamation and improvement

Raising agricultural production can be achieved in two ways: agricultural development to increase the cultivated land area, and productivity improvements to boost crop yield per unit area. Improvement of crops, better farming methods and upgraded agricultural facilities (through farm improvement programme) are the key to higher productivity levels.

The plan calls for the creation of 5,900 ha of paddy fields and 93,300 ha of farm land within the Study Area in order to promote the development of the agricultural sector in line with anticipated population increases and economic growth. A further 43,200 ha of land need for farm land improvement.

(2) Farm roads

Farm roads are used for transportation of agricultural input and output, cultivation and harvesting, moving machinery, maintaining facilities, obtaining extension services as well as for ordinary daily life in rural areas.

Farm roads are thus essential facilities that affect the entire livelihood of rural communities and the development and expansion of agricultural activities.

(3) Contour ditches

Contour ditches prevent soil loss, provide water for irrigation and help retain water in soil. Ditches are important for environmental conservation, particularly in sloped areas.

(4) Tree lots

Tree lots act as windbreaks, prevent soil loss, maintain fertility and help nurture water sources. In addition, some trees provide shade for crops and livestock, and firewood for domestic use.

2) Development of agricultural infrastructure

(1) Land reclamation

a) Upland fields

Land reclamation is closely interrelated with the provision of infrastructure such as farm roads and forest belts, which should be given due attention at the planning stage. The reclamation process consist of the following major steps: clearing and burning - removal of miscellaneous items (roots, stumps, rocks, etc.) - ploughing - soil improvement - harrowing.

i) Clearing and burning

Shrubs, reeds, grasses and other slow-burning plants which obstruct cultivation are removed manually using long hoes, scythes, hatchets or axes, and taken away to be burnt.

Care must be taken during burning to prevent the fire from spreading to adjacent areas and to avoid excessive smoke inhalation.

Useful species should be replanted or cut down and stored in a safe place.

ii) Removal of miscellaneous items

Slow or non-burning roots, stumps and other obstructions are removed manually.

iii) Ploughing

The topsoil layer (approx. 15 cm) is prepared for cultivation manually using long hoes which break up root systems and mix the surface and lower layers together.

iv) Soil improvement

Lime and phosphorous are added to correct acidity and improve the chemical composition of the soil. Application rates are determined according to crop type and soil conditions. Application is performed by manual labour.

v) Harrowing

Lumps of soil are broken up and the above additives are thoroughly mixed in by manual labour to a depth of about 15 cm. New crops form roots in the freshly turned soil layer.

b) Paddy fields

Care must be taken not to harm the wetland environment. The center of the wetland is left as a drainage channel and buffer zone with paddy fields on the both sides. Paddy field reclamation is closely interrelated to infrastructures such as farm roads and water channels, which should be given due attention during the planning stage. The reclamation process is as follows: clearing and burning - removal of miscellaneous items (roots, stumps, rocks etc.) - leveling - levee construction.

i) Clearing and burning

The same as for upland fields described above, except that the vegetation is mainly papyrus.

ii) Leveling

Uneven land causes irregularities in water depth and prevents proper growth of rice plants. Leveling of large lots requires the removal of correspondingly large volumes of earth and should be avoided where possible.

iii) Removal of miscellaneous plant matter

Same as for upland fields described above.

iv) Levee construction

Levees are built around each plot to keep the water in. Clayey soils are ideal for levees. Care should be taken to prevent water from escaping horizontally over the levee.

(2) Farm roads

a) Layout: Use of existing road network; where roads are sparse, new road networks to be built in a grid pattern at intervals of 200 m.

b) Standard:

i) Width of farm roads for small-scale agricultural machines is to be 2.5 m (effective width 2.0 m).

ii) Gutters are to be provided on the both sides of roads. Earth removed is to be reused for building the roads.

iii) Graveling or paving of farm roads is not considered at present.

(3) Contour Ditches

a) Layout:

i) Ditches are provided in each parcel located in sloped areas. They run parallel with contour lines and are joined to road gutters.

ii) Intervals are to be determined according to the slope gradient and soil. Guidelines are approximately 20 m for the slope of less than 9% and 10 m for more than 9%.

b) Standard:

i) Ditches are to be 0.7 m wide and 0.3 m deep.

ii) Earth and sand removed from excavation is to be used for banking on lower sides of ditches.

iii) Grass seeds are to be sown in and around ditches to prevent erosion.

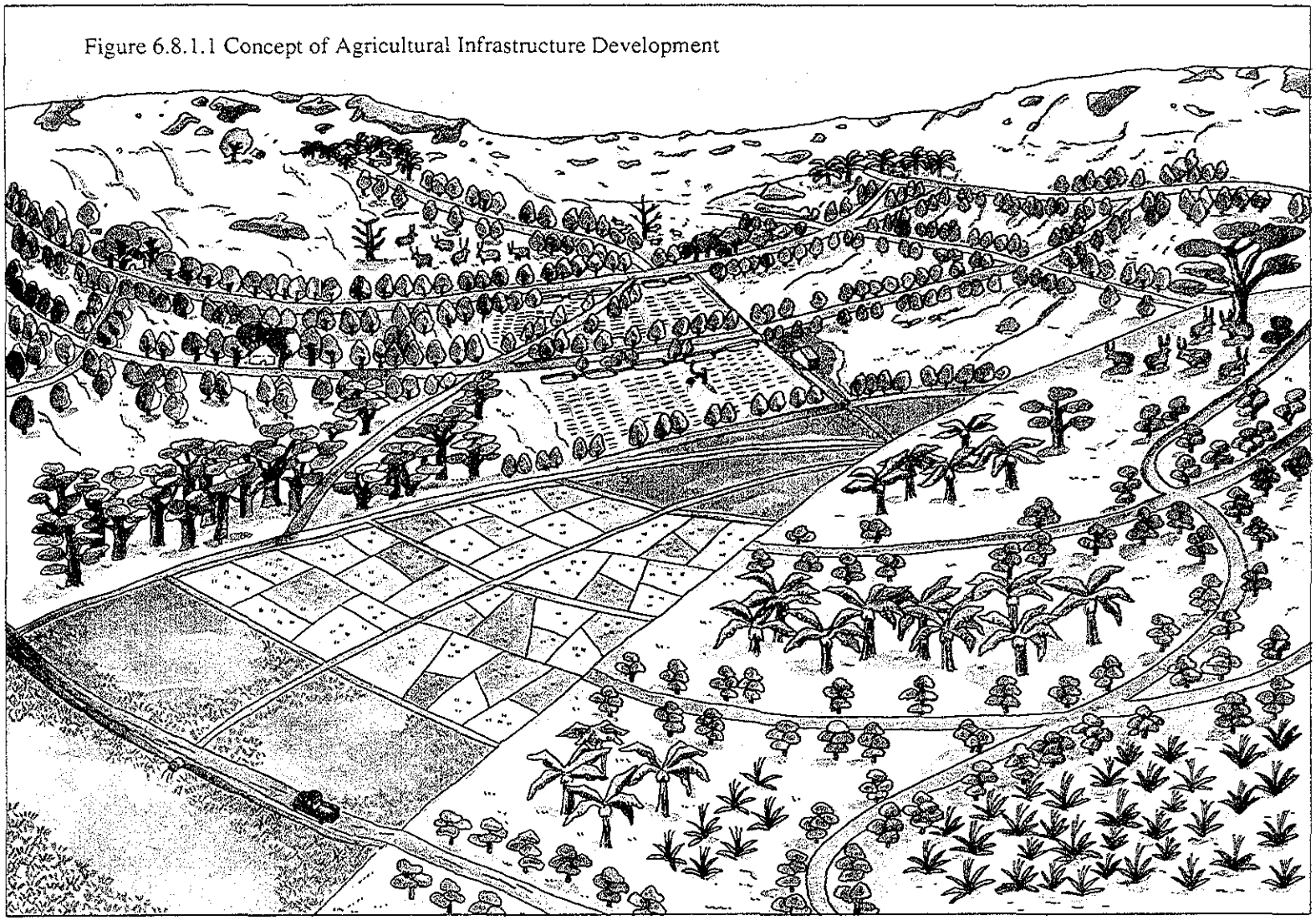
(4) Tree lots

a) Layout:

i) Existing tree lots are to be utilized wherever possible.

ii) Tree lots are to be placed along roads and boundaries and around water sources for environmental and water conservation and to provide sources of fuelwood.

Figure 6.8.1.1 Concept of Agricultural Infrastructure Development



6.8.2 Livestock Infrastructure

1) Grassland improvement and development

At present some 715,000 ha of grasslands are used for grazing. Most of these areas are in a natural state and thus have very low productivity.

The Livestock Plan in Section 6.4 calls for herd sizes to be increased 1.6 times that of 1991 levels for cattle and 3.7 times for sheep and goats by the year 2007. The plan also calls for feeding techniques to alleviate the drop in nutrient content during the dry season. This requires expansion of existing grassland areas and conversion of grasslands for production of cut grass.

The New Ranch Plan calls for grassland development by 29,440 ha while 47,100 ha of existing grasslands are required to be converted for hay production.

Figure 6.8.2.1 illustrates the concept of the Livestock Infrastructure Plan.

2) Grasslands improvement methods

Improvement of natural grasslands is done through the: removal of bushes occupying large sections of grassland to create usable land introduction of useful fodder trees and additional sowing of useful species. Standard methods for accomplishing these tasks are shown below.

(1) Fodder trees

Fodder trees provide wind shields as well as fodder during the dry season. Ideal varieties include legume shrubs such as acacia and Leucaena Spp., which has a high fodder value. Planting density should be 1 tree per 1,000 m^2.

(2) Removal of unwanted bushes and weeds

To expand grassland areas, unwanted bushes and weeds will be removed by manpower or machine and burned.

(3) Introduction of improved grass species by additional sowing to increase crude protein content.

Improved grass seeds will be introduced in natural pastures so as to keep crude protein content on a proper level (especially during the dry seasons). These include Pennisetum clandestinum, Chloris Spp., Setalia Spp., (granineous grasses) and Glycine wightii, Stylosanthes graciiis, Desmodium intortum, Centrosema pubescens, Macroptilium atropurpureum (legumes).

One of each of the above grasses and legumes will be selected for mixed sowing in quantities of about one-third that at initial development in established pastures (equivalent to 2–3 kg/ha for grass and 1.5 kg/ha for legumes). Sowing will begin early in the rainy season.

(4) Soil Improvement

Soil improvement will be carried out on the basis of soil diagnoses. Soil acidity will be corrected where necessary before sowing, and phosphate will also be added to increase fertility.

Table 6.8.2.1 gives the pH level and exchangeable calcium and available phosphate content of soils in northern Luwero and Mukono and northwestern Masaka. The figures suggest that pH should be corrected to approximately 6 by adding 2 t/ha of calcium carbonate. Phosphate levels will be enriched to 500 kg/ha of SSP (single super phosphate) before sowing.

Table 6.8.2.1 Soil Analysis

Area	Soil	pH (H_2O)	Ex-Ca m.e/100g	Truog-P_2O_5 ppm
North of Luwero and Mukono	Buruli Catena	4.7	0.7	10
Northwest of Masaka	Mawogola Catena	5.3	2.1	10

Source: The soils and land use of Buganda, S.A., Radwanski, 1960.

3) Grassland development method

The following method is recommended to achieve the proposed target yield for established grassland (50 t/ha of green grass).

(1) Removal of unwanted bushes and weeds (See paragraph (2) in 2) Grassland improvement methods).

(2) Preparation of land for sowing seeds

Prior to developing established grassland, cleaner crops such as sweet potatoes and maize will be sown. After harvesting, the soil will again be cultivated and plowed to a depth of 15 cm for grass seeds, which will be sowed at the beginning of the rainy season.

(3) Soil improvement

Lime and phosphate will be added to correct acidity where indicated by soil diagnosis. Application of lime and phosphate is necessary for the healthy growth of legumes. Lime will be added at volume 2 t/ha for soil of pH 5, and 1.5 t/ha for soil of pH 5.5 in order to bring pH up to about 6. As for phosphate, Single Super Phosphate (SSP) will be applied at a volume of 500 kg/ha in cases where the rate of P_2O_5 in soil shows 10 ppm.

(4) Selection of grasses and legumes, and sowing quantity

Grass species suitable for established grassland include Kikuyu grass (Pennisetum clandestinum), Chloris spp. and Setaria (granineous grass) as well as Glycine (Glycine Wightii), Stylo (Stylosanthes gracilis), Greenleaf desmodium (Desmodium intortum), and Sirato (Macroptilium atropurpureum) (legume).

Grass seeds and legumes will be mixed with two species each. Quantities will vary according to land conditions. The sowing rate will be 5–10 kg/ha for grass and 2–4 kg/ha for legumes. Grazing will not start until the grass grows to at least 30 cm in height.

Grass species on grassland for hay production are either Elephant grass (Pennisetum purpuretum) or Guinia grass (Panicum maximum) (granineous grass) or Lablab pursureus (legume).

Standards of fertilization for mixed grassland were drawn up in order to keep constant high yields with reference being made to the Japanese Pasture Management Index.

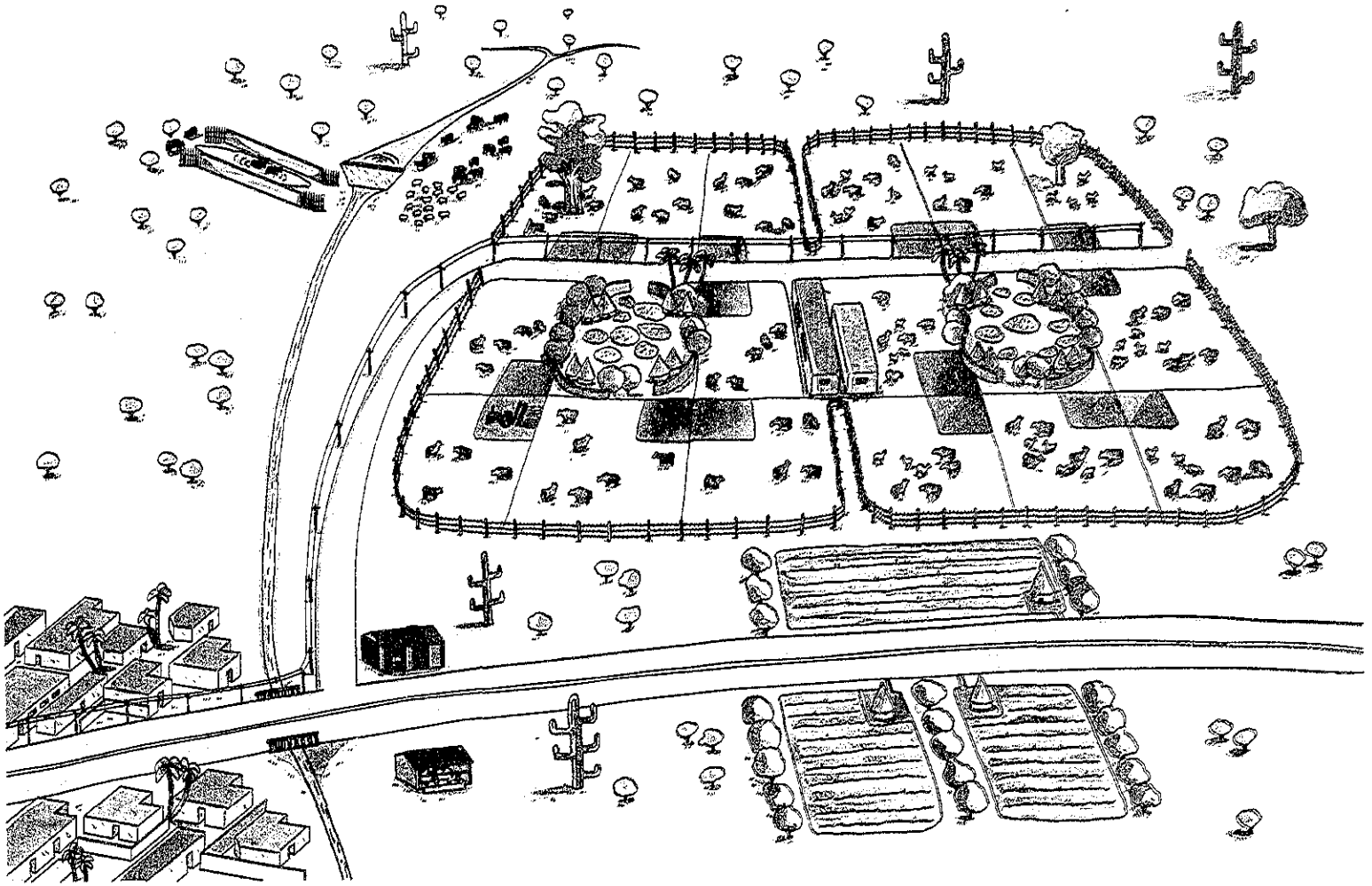
Fertilization is done three times annually in order to realize constant yield throughout the year by doing 40% each in March and September (the beginning of wet season) and 20% in June (dry season).

Compound fertilizer available in Uganda will be used.

Table 6.8.2.2. Standard of Fertilization (kg/ha)

Target production	N	P_2O_5	K_2O
50 t/ha in green grass	100	80	100

Figure 6.8.2.1 Concept of Livestock Infrastructure Development



6.9 Rural Social Infrastructure Plan

The lag in development of rural social infrastructure such as water supplies, roads, education, health care and electrification is one factor hindering the motivation of farmers to cultivate crops and boost agricultural productivity.

The Rural social Infrastructure Plan focuses on the development of the rural social infrastructure in order to make rural areas comfortable bases for living as well as for agriculture and other activities. Bearing in mind the current situation described in section 3.8, the plan was formulated along the following lines with the aim of resolving the imbalance in current levels of development between the four districts as well as of developing infrastructure to appropriate levels.

i) Construction and rehabilitation of drinking water facilities
ii) Construction and rehabilitation of principal roads to establish rural transportation systems
iii) Construction of schools in settlement areas to cultivate human resources
iv) Construction of community centres in rural areas and health centres in settlement areas to establish a health care and hygiene system
v) Development/expansion of a telecommunications system to transfer agriculture-related information

6.9.1 Water Supplies

1) Standards

Individual development plans for each district have been formulated by RUWASA, SWIP and ODA in Mukono, Masaka and Luwero, respectively, following NRWP in 1991. Standards for per capita consumption and supply volume per site differ between these plans (see Appendix 3.9.1). The plan has set the standards described below.

(1) Water consumption per capita

Most water supply projects in Africa have set a target of 15 litres against a present standard daily consumption of 10 litres per person (with 100 metres to water source) to be achieved through hygiene education and other extension services. The Master Plan uses a target of 25 litres per person per day, based on standards in other projects in Uganda (from 20 to 30 litres) and household livestock needs, and taking into account water losses.

(2) Population per facility

The maximum number of people per facility is determined by individual daily consumption levels, water supply capacity and supply time per day. A RUWASA study of boreholes in current use found 60% having a well capacity of more than 0.5 m^3/h, with a

weighted total average of 0.7 m^3/h. (one spring water facility restored under SWIP in Masaka was found to have an average capacity of only 0.4 m^3.)

Water is generally drawn in the morning and evening so as to avoid the heat of the day. With a drawing time of 8 hours per day, boreholes can serve 200 people and spring water sources 120, as follows:

Boreholes:

0.7 m^3/h x 8h/day = 5.6 m^3/ day > 200 people x 25 l/d = 5.0 m^3/day

Spring water:

0.4 m^3/h x 8h/day = 3.2 m^3/ day > 120 people x 25 l/d = 3.0 m^3/day

(3) Distance to water facility

The average distance to water sources depends on the number of people per facility and the population density of the area. Since rural people live in FFGM and SFGM areas, the mean population density within the 16,927 km^2 area is expected to reach 257 per km^2 in target the year.

Assuming one borehole is used to support 200 people at the above capacities, every 0.8 km^2 needs one borehole or the radius is 500 m per borehole. The maximum distance to water would thus be 500 metres, a highly acceptable figure in terms of regional averages.

2) Type of facilities

Potential types of facilities include springs in valleys, auger and dug wells where the ground water level is close to the surface and boreholes for ground water further down.

(1) Springs

Springs are cheap to protect and maintain. The water is simply drawn into screen pipes installed behind a concrete wall. However, supply is subject to seasonal fluctuations, and water quality at some springs is poor.

(2) Auger and dug wells

Auger wells consist of an eight to ten-inch diameter hole, a 5-inch casing pipe and a hand pump. Auger wells are limited to sandy or clayey soft ground which can be dug by hand. Maximum depth is only 20 metres.

Dug wells consist of concrete blocks 1.3 metres in diameter and 0.6 metres thick dug into the ground. Underground water is obtained from the surfaces of a permeable block laid beneath the water layer and from a sand layer at the bottom.

At least five concrete blocks are required under the ground water level in order to guarantee steady water supplies.

(3) Boreholes

Boring machinery is used to dig a 10-inch hole. Ground water from the aquifier is then drawn up through slits in a screen pipe inserted in the hole. Casing pipes are sometimes required to protect the sides of the hole where the ground is vulnerable to collapse. Sometimes

the hole needs to be bored deep depending on the water level, and sometimes boreholes do not reach water at all.

Although they also require hand pumps, as well as packing to surround the casing, boreholes are still the best way to obtain water in the absence of springs. Despite the initial costs involved, they provide a steady, reliable supply of good quality water.

The choice of facility is usually restricted by geological conditions. An overall evaluation by RUWASA, based on the relative weight of the five elements listed below, proposes rehabilitation of existing boreholes and preservation of springs as the most viable alternative, followed by construction of new boreholes. Auger and dug wells were found to be basically the same, to be continued as before.

i) Construction and maintenance costs
ii) Level of participation by rural community
iii) Restrictions on site location
iv) Water quality
v) Use of existing facilities or resources

3) Planning

Estimates of construction costs have been made for two case of 50% and 75% in the target year 2007. These ratios reflect the population served by facilities to total rural population (Table 6.9.1.1).

The rural social infrastructure includes facilities associated with roads, electricity and communication, health and education, as well as drinking water supplies.

The Master Plan adopts a ratio of 50%, in view of the need to attain balanced development in rural society, and to satisfy the very minimum demand levels for drinking water.

Table 6.9.1.1 Water Supply plan

	Unit price ($)	Luwero			Masaka			Mpigi			Mukono			Total	
		Rate (%)	Number	Cost ($1000)	Rate (%)	Number	Cost ($1000)	Rate (%)	Number	Cost ($1000)	Rate (%)	Number	Cost ($1000)	Number	Cost ($1000)
Case 1															
Spring Protection	1,700	10	304	517	14	1,043	1,773	33	2,442	4,151	24	1,658	2,819	5,447	9,260
Dug Well	4,400	24	730	3,212	26	1,937	8,523	12	888	3,907	24	1,658	7,295	5,213	22,937
Augered Well	3,200	24	730	2,336	48	3,576	11,443	12	888	2,842	12	829	2,653	6,023	19,274
Borehole (new)	6,800	42	767	5,216	12	536	3,645	41	1,820	12,376	40	1,658	11,274	4,781	32,511
Borehole (Rehabili)	2,900	-	-	-	-	-	-	2	89	258	-	-	-	89	258
Total		100		11,281	100		25,384	100		23,534	100		24,041		84,240
Case 2															
Spring Protection	1,700	10	154	262	14	686	1,166	33	1,576	2,679	24	864	1,469	3,280	5,576
Dug Well	4,400	24	370	1,628	26	1,274	5,606	12	573	2,521	24	864	3,802	3,081	13,557
Augered Well	3,200	24	370	1,184	48	2,352	7,526	12	573	1,834	12	432	1,382	3,727	11,926
Borehole (new)	6,800	42	(1,000) 389	(6,800) 2,645	12	(18) 353	(122) 2,400	41	(18) 1,175	(122) 7,990	40	(164) 864	(1,115) 5,875	(1,200) 2,781	(8,159) 18,910
Borehole (Rehabili)	2,900	-	-	-	-	-	-	2	57	167	-	-	-	57	167
Total		100		(6,800) 5,719	100		(122) 16,698	100		(122) 15,191	100		(1,115) 12,528		(8,159) 50,136

Note : 1. Case 1 and 2 correspand to 75 % and 50 % of rural people to be supplied with safe water.
2. Unit costs are of NRWP (except Borehole (new) of the study)
3. Rate of facilities in Luwero,Mpigi of NRWP,in Masaka, SWIP, in Mukono of RUWASA.
4. Capacities for a borehole and others are 200 and 120 people respectively.
5. People to be supplied with safe water (number of facility × capacity of facility) corresponds to Table 6.9.1.2.
6. Figures in parenthesis are requirements of new Ranch plan in addition to the existing rural area.

6.9.2 Feeder Roads

The plan calls for rehabilitation and construction of new feeder roads. New roads total to 2,358 km in settlement areas. Four sets of heavy machinery are to be provided for rehabilitation work of existing feeder roads. This will enhance transportation of both agricultural input and output and raise rural living standards (see Table 6.9.2.1 and Figure 6.9.2.1).

Table 6.9.2.1 Construction and Rehabilitation of Feeder Roads

District	Present (1991)			Plan (2007)		
				Construction	Rehabilitation	
	Area km2	Ratio km/km2	Length km	Length km	Length km	Sets of machines
	(1)	(2)=(3)/(1)	(3)	(4)	(5)=(3)	(6)=(5)/1,190*1
Luwero	8,539		I -	I -	-	
			II 913.1	II -	913.1	
			III 49.6	III -	49.6	0.81
			IV -	IV 1,774.0	-	
		0.113	To 962.7	To 1,774.0	962.7	
Masaka	5,531		I 302.5	I -	302.5	
			II 149.0	II -	149.0	
			III 402.0	III -	402.0	0.72
			IV -	IV = 32.0		
		0.154	To 853.5	To 32.0	853.5	
Mpigi	4,514		I -*1	I -	-	
			II -	II -	-	
			III -	III -	-	1.46
			IV -	IV = 32.0	-	
		0.384	To 1,735.1	To 32.0	1,735.1	
Mukono	4,594		I -*2	I -		
			II -	II -		
			III -	III -		0.54
			IV -	IV = 288.0		
		0.139	To 639.7	To 288.0	639.7	
Total	23,178		I 302.5	I -	302.5	
			II 1,062.1	II -	1,062.1	
			III 451.6	III -	451.6	3.53
			IV -	IV = 2,096	-	=4.0
		0.181	To 4,191.0	To 2,096	To 4,191.0	

Notes: *1 A full operation of one set of machines is assumed to cover 170 km per year. The machines are usable for 7 years. 170 km/year x 7 years = 1,190 km

*2 Roads in Mpigi and Mukono are not classified.

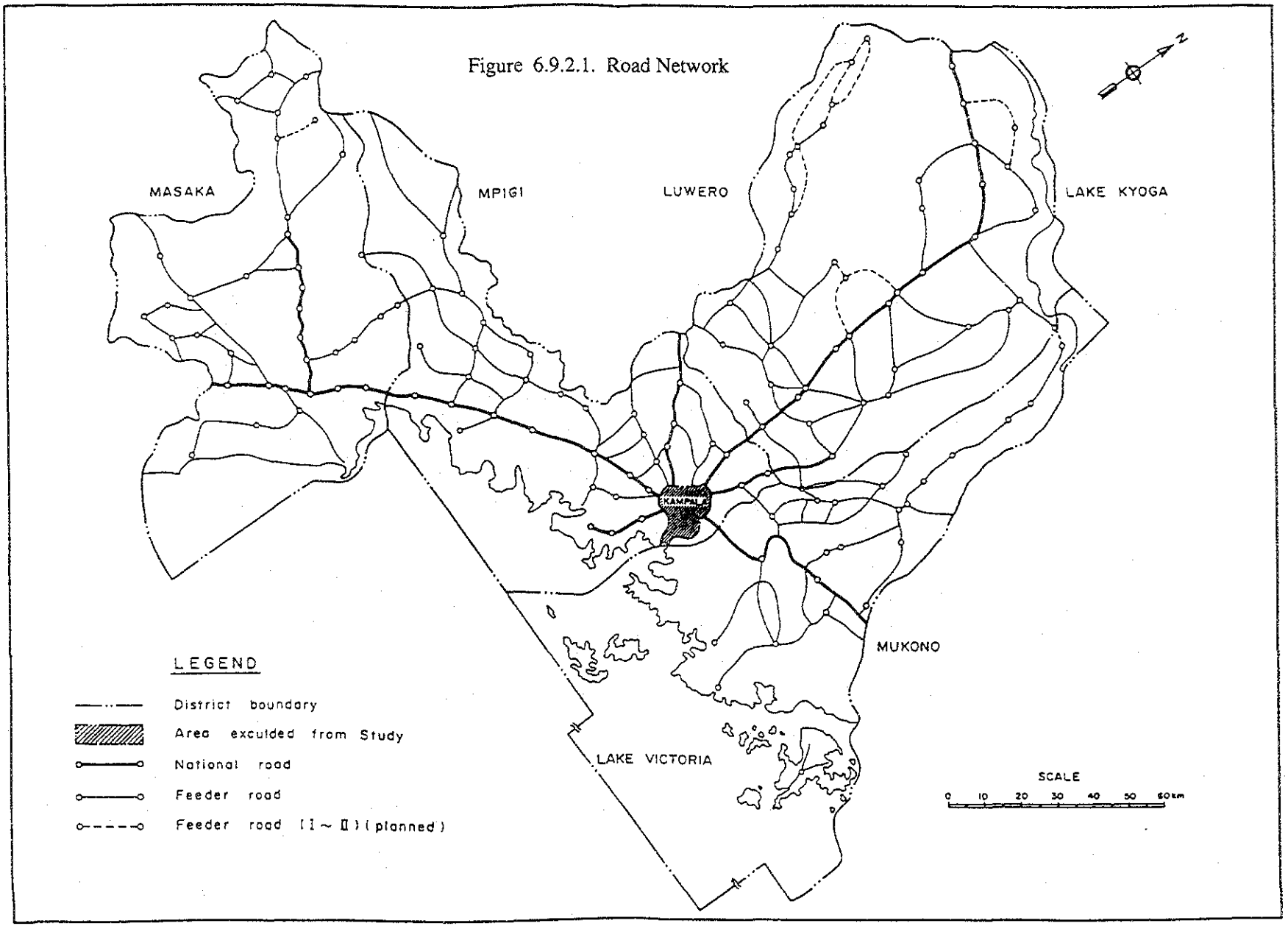


Figure 6.9.2.1. Road Network

6.9.3 Education, Health Care and Hygiene

1) Education

Sixty primary schools and 19 secondary schools are to be built in settlement areas and provided with teaching materials. Community Centres attached to APCCs will be used for training and provision of information to rural people (see Table 6.9.3.1).

Table 6.9.3.1 Construction of Schools in New Ranch Plan

District	Primary Schools				Secondary Schools				Remarks
	No. of House-holds	Ratio	Require-ment	Plan	No. of House-holds	Ratio	Require-ment	Plan	
	(1)	(2)	(3)= (1)/(2)	(4)= (3)*0.9	(5)	(6)	(7)= (5)/(6)	(8)= (7)*0.47	
Luwero	8,720	160	55	50	8,720	320	27	13	
Masaka	160	160	1	1	160	320	1	1	
Mpigi	160	160	1	1	160	320	1	1	
Mukono	1,440	160	9	8	1,140	320	4	2	
Total	10,480		66	60	10,180		35	17	

Notes: A primary school is required for every 160 households (20 groups x 8 households)
A primary school has a capacity for 280 pupils (40 pupils x 7 grades)
A secondary school is required for every 320 households (40 groups x 8 households).
A secondary school has a capacity for 160 pupils (40 pupils x 4 grades).

2) Health care and hygiene

The Plan does not include the new establishment or improvement of hospitals. Instead, health centres will be attached to collection centres in order to meet minimum health requirements and supplied with medicines for epidemic control as well as pesticides.

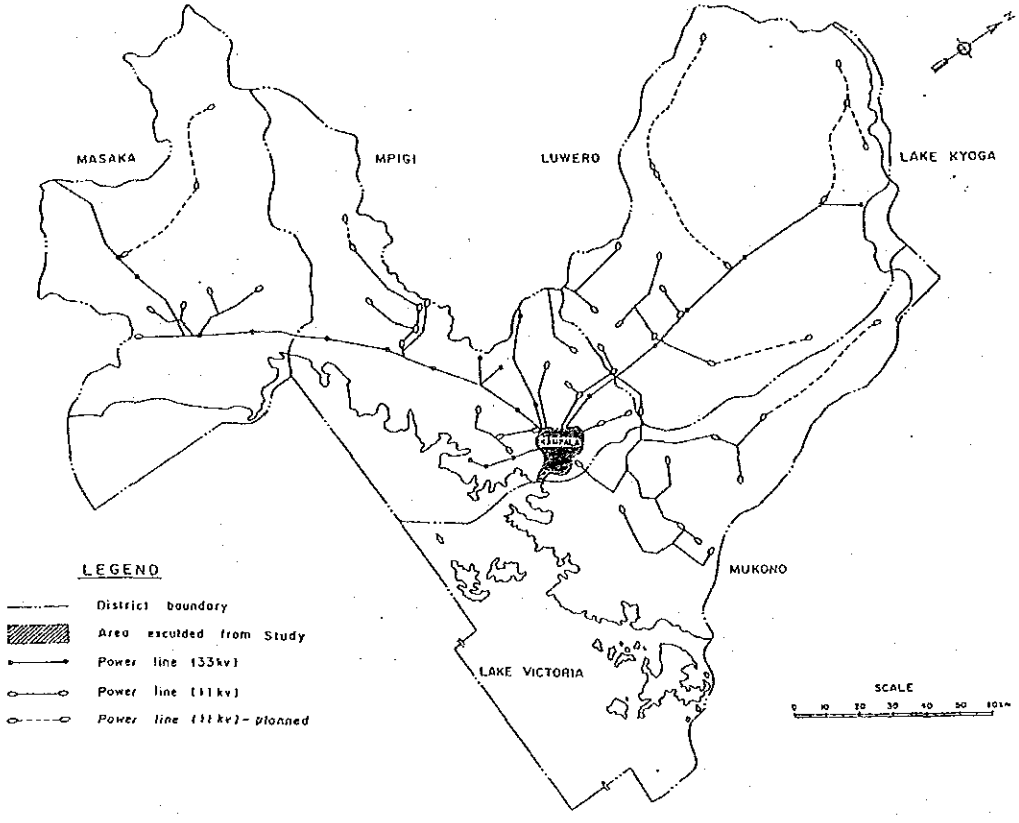
The numbers of health centres in each district are 81 in Luwero, 53 in Masaka, 46 in Mpigi and 45 in Mukono, respectively.

6.9.4 Electrification

Electrification in the Study Area remains low ranging from 2 to 27%. The FIS revealed a considerable imbalance between counties and subcounties. 11 kv electricity lines are to be installed in settlement areas (see Figure 6.9.4.1).

The telecommunication system lies at lower service levels compared to electrification under the control of UPTC. The plan is left to the national programme.

Figure 6.9.4.1. Electrification



6.10 Environmental Conservation

6.10.1 Environmental Conservation

1) Forests

(1) Outline

The forests which account for 16% of the land area of the Study Area are important in conserving the soil and water environment, and also are a source of wood along with the tree lots found mixed with farm-grasslands. Forestry resources, however, have substantially decreased due to their conversion to farmland and lumbering. This must be prevented in the future through active measures taken to foster forests. Current efforts to conserve forests consist of:

i) regulating the conversion of forests to farmland and restoring converted forest reserves;
ii) systematic fostering and use of forests;
iii) the promoting of agroforestry.

(2) Forest conservation measures

This Master Plan will leave the present forests (forest reserves and private forests) as they are. Conservation will be assisted by forestry projects under the Forestry Department mentioned in section 3.9.2 as well as work done by district forestry offices and NGOs.

In Mukomo District, and through guidance by the forestry offices, schools and churches have already begun to actively foster seedlings by developing seedbeds in the parishes. In Masaka District, a forestry project by the Swedish NGO Vi was started in 1991 with the goal of filling up the shores of Lake Victoria with vegetation. It has been promoting forestry development by annually distributing free seedlings developed through this project to local residents.

As regards agroforestry, it will be necessary to select appropriate trees (fuel wood, forage, fruit trees, etc.) and planted area in accordance with local needs. The demand and supply balance by area of fuel wood will be assessed during 1994 through the National Biomass Study. The basic design will be based on these findings. The Master Plan recommends planting trees on the following kinds of land through farmland and grassland improvement projects under Agricultural and Livestock Infrastructure Plan.

i) Land boundaries
   Land along roads, boundaries associated with land use (such as housing lots and farmland), ownership boundaries
ii) Farmland and grassland
iii) Housing lots

iv) Land such as steep slopes susceptible to soil erosion

2) Wetland conservation

(1) Outline

Tropical Africa, south of the Sahara, has many inland wetlands of the kind found in the Study Area, estimated to cover an area of some 85 million hectares (Andriesse W., 1986). in order to cope with rapidly increasing populations, many countries have been attempting to convert wetlands into paddy fields for the sustainable cultivation of low-cost African rice appropriate to the area.

Uganda is no exception. Already, the wetland paddy field area has reached 20,000 hectares, mainly in the Iganga and Tororo Districts to the east of the Study Area (FAO Production Yearbook).

In recent years however, there has been a growing tendency to conserve wetlands in view of such water functions as water shed conservation and flood control, and the preservation of wildlife. The National Wetland Conservation and Management Programme, one of the projects implemented by NEAP, has made conservation a top priority in the development of laws.

The Study Area still does not have paddy fields due to a shortage of technology and funds. However, conversion of wetland into grassland and farmland has begun. Such conversion, however, is mainly done by individuals and is undertaken without sufficient surveying and design. It is hence flawed in terms of sustainability.

It has been said that "given the present conditions, Africa's wetlands will sooner or later be replaced by farmlands and grasslands and disappear" (S. J. P. Gore, Ecosystems of the World). The wetlands in the Study Area can also be said to be standing at a crossroads between these two scenarios (continuation or disappearance) as shown in Figure 6.10.1.1.

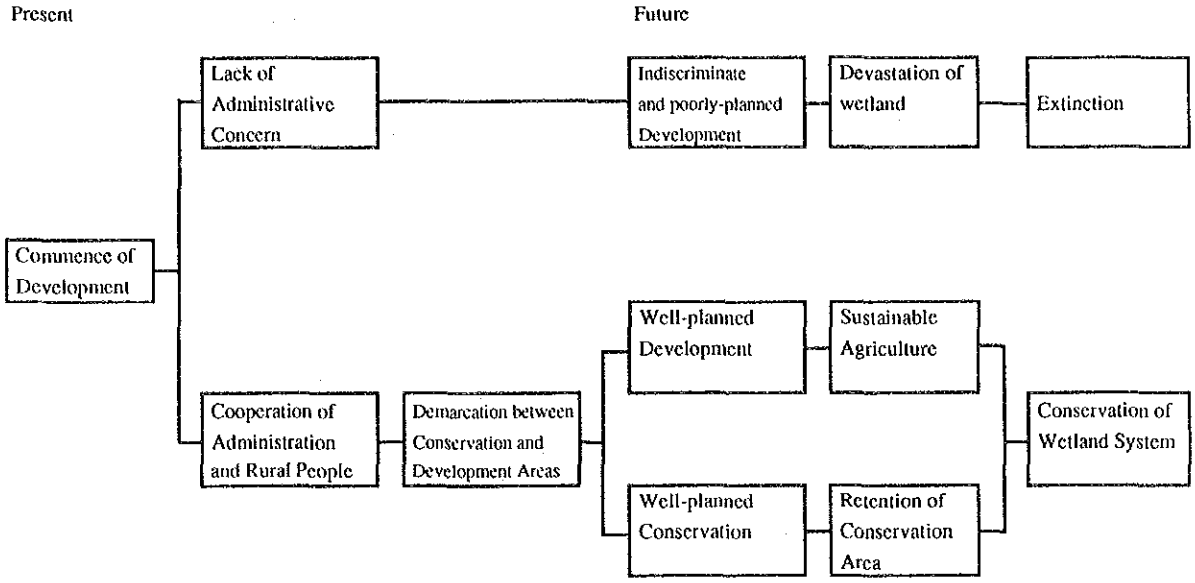


Figure 6.10.1.1 Two Scenarios Concerning Wetlands

Indiscriminate development based on the interests of a few people will destroy the wild life of the wetlands. There are also fears that agriculture to be will become adversely affected sooner or later due to soil deterioration. Hence, it is necessary to develop wetlands systematically and to involve local administrations and residents in conservation.

(2) Wetland conservation and development

The urgent issue to be tackled in conserving wetlands is to prepare a register of individual wetlands in each wetland system.

Such a register should give the size, vegetation and state of land use of the wetland based on the most up-to-date topographical maps of the scale of 1/50,000. It must also clarify the seasonal changes in the water conditions and the range of wildlife. The need for conservation and the possibilities for development based on such registers is required, so as to distinguish between areas to be conserved and those to be developed, and to prepare suitable guidelines.

In developing wetlands, the following three basic matters must be satisfied.

i) Development of sustainable agriculture.

ii) Conservation of water and flood control for the entire wetland.

iii) Sustainable use of wetland resources such as papyrus and fish.

This in turn gives rise to the following socio-economic, agricultural and technical requirements:

a) Socio-economic countermeasures

The conservation and use of wetlands must benefit not just some people but all local residents. Conservation and use must involve extensive participation by local residents.

For this reason, projects should be led by irrigation associations organized by local farmers, and existing women's and youth groups under the guidance of the District Development Committee.

It is most important in developing sustainable agriculture to keep the cost of developing irrigation and drainage facilities and paddy fields to a level which can be borne by farmers, and to ensure that farmers are able to maintain and control the facilities.

b) Countermeasures by crop cultivation

Farmlands in wetlands can be supplied with irrigation water, but this requires initial costs to develop facilities and fields. Hence, crops should be economically advantageous in terms of demand. Rice can only be cultivated on wetlands, and is economically advantageous. Rice is also the most appropriate crop in terms of soil and water quality conservation.

c) Technical countermeasures

Wetland used as farmland should not extend into areas of peat soil which could sink or cause problems in the future. Development scales should be in keeping with water resources. Further, buffer zones to retain wild vegetation should be used widely. The structure of the irrigation and drainage facilities should be made simple. In particular, check gates should be installed where necessary to control the water level in drains so as not to cause excessive decline of the ground water level. Since it is necessary to minimize the movement of soil, small plots should be allowed. Water management will require tertiary irrigation and drainage canals.

3) Farmland and grasslands conservation

(1) Farmlands

For sustainable agriculture, soil deterioration must be prevented. The loss of soil from farmland must be controlled. Annual permissible soil loss is generally considered 15 tons per hectare, equivalent to 1 millimeter of top soil in depth. Based on the Universal Soil Loss Equation (USLC), the soil in the survey area was divided into four categories according to organic matter content. Annual soil loss was estimated for land gradients of 6% and 9% (Table 6.10.1.1).

Table 6.10.1.1 Soil Loss Estimates per Year

Item	Soil Group	SG1		SG2		SG3		SG4		Remarks
	Slope (%)	6	9	6	9	6	9	6	9	
	R (Rain)	351	351	351	351	351	351	351	351	Appendix
Case I	K (Soil)	0.23	0.23	0.31	0.31	0.47	0.47	0.65	0.65	Appendix
Slope	LS (Length • Slope)	0.55	0.95	0.55	0.95	0.55	0.95	0.55	0.95	
Length:	C (Crop)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
(20 m)	P (Practice)	0.50	0.60	0.50	0.60	0.50	0.60	0.50	0.60	
	RKLSCP	OK	20.7	OK	27.9	18.1	42.3	28.2	58.5	ton/ha/year
	(Soil Loss)	10.0		13.5						
Case II	LS (Length	0.39	0.68	0.39	0.68	0.39	0.68	0.39	0.68	
Slope	• Slope)									
Length:	RKLSCP	OK	OK	OK	20.0	OK	30.2	20.0	41.9	ton/ha/year
(10 m)	(Soil Loss)	7.1	14.8	9.5		12.9				

Notes:

1. Crop Factor (C): Assuming maize and beans
2. Practice Factor (P): Assuming 6% and 9% gradient
3. The difference between Case I and II lies only in the slope length.
4. 'OK' for soil loss under 15 ton/ha/year.
5. Soils classified into soil groups (SG) as follows.

SG1: Mabira, Nakabango, Kifu, Kafu, Sesse

SG2: Buganda, Buyaga, Kabira, Koki, Bukora

SG3: Mirambi, Mawogola, Lukaya, Mulembo, Makolo, Buganda/Mirambi

SG4: Buruli, Lwampanga, Sango, Tolero

Farmland in the Study Area has been given four classifications depending on the extent of measures required to manage the farmland in terms of controlling soil erosion.

Class A: Farmland where ordinary farm management suffices.

Class B: Farmland requiring either contour ditches with an interval of around 10 meters or soil coverage (mulching)

Class C: Farmland requiring of both intensive contour ditches and mulching

Class D: Farmland which needs to be converted into grassland or forests in order to prevent excessive soil loss.

Table 6.10.1.2 shows the combinations of soil and gradient corresponding to these classes.

The area for each of the four farmland soil erodibility classes has been calculated by district from land use and soil surveys (Table 6.10.1.3).

Table 6.10.1.2 Classification of Soil Conservation Methods by Soil Type

Slope Class	SG1		SG2		SG3		SG4	
	6%	9%	6%	9%	6%	9%	6%	9%
A	○ (10.0)		○ (13.5)					
B		○ (14.8)			○ (12.9)			
C				○ (20.0)			○ (20.0)	
D						○ (30.2)		○ (41.9)

Notes: 1. SG denotes Soil Groups in Table 6.10.1.1.

2. Figures in parentheses denote soil loss estimate (t/ha/year) in Table 6.10.1.1.

Table 6.10.1.3 Area of Soil Conservation Methods by District

District	Class A		Class B		Class C		Class D		Total	
	1,000 ha	%	1,000 ha	%	1,000 ha	%	1,000 ha	%	1,000 ha	%
Luwero	148.0	20	209.9	28	362.4	48	27.5	4	747.8	100
Masaka	68.7	17	183.8	45	43.3	10	115.3	28	411.1	100
Mpigi	57.6	22	86.2	34	48.2	19	65.1	25	257.1	100
Mukono	162.6	58	25.4	9	77.0	27	16.2	6	281.2	100
Total	436.9	26	505.3	30	530.9	31	224.1	13	1,697.2	100

Notes 1. For details refer to Appendix 3.10.1.

2. Areas correspond to forest/farmland-grassland mosaic and savanna/farmland-grassland mosaic areas with farmlands.

Over the entire Study Area, Classes B and C was found to account for 61% and Class D 13% of all farmland. This suggests that over half the farmland requires intensive soil conservation measures and some needs to be converted to grassland or forests.

(2) Grassland

If the surfaces of the natural grassland which makes up most of the grassland in the Study Area are covered properly and managed well, soil will not be lost regardless of soil type or gradient. However, inappropriate livestock grazing, will strip grassland and cause considerable soil loss.

At present, much of this natural grassland is used to graze livestock without being improved at all. Moreover, in many cases, grazing is not properly managed. Therefore, it will be necessary to take the following measures in conserving grassland.

i) The land use rate should be increased by removing bushes such as shrubs and vines which occupy a large portion of the natural grasslands, and expanding the area of edible grassland.

ii) Facilities such as fences, water and roads should be suitably distributed so that the livestock can graze large grassland areas uniformly to enhance the effective use of grassland.

iii) The number of the livestock grazed should be in keeping with the available grass resources. Further, grazing intervals needed for grasslands to recover should be maintained.

iv) Soil loss due to rills and gullies on grassland must be quickly restored to prevent expansion. Areas with a very high risk of soil loss (such as steep slopes) should be converted from grazing areas to forests.

4) Water quality

(1) Water pollution and its causes

A wide-area survey found that water in the wetlands was not markedly polluted in terms of electric conductivity. The major reasons for this are that the use of chemical fertilizers and agricultural chemicals on farmlands in the basin is limited, and also becouse the water is purified by papyrus and other wild vegetation.

In contrast, water quality surveyed along the shores of Lake Victoria found that the lake is polluted in general. In recent years eutrophication has advanced due to increases in nitrogen and phosphorus levels in the lake. Social and economic effects represented by the massive generation of water hyacinths and substantial decreases of indigenous fish species have become prevalent.

Lake Victoria is the world's third largest lake with an area of 68,800 km^2. It extends over the three countries of Uganda, Kenya and Tanzania (which have 43%, 6% and 51%, respectively, of the lake within their territories). The causes of the pollution in recent years are not restricted to Uganda. One of the major factors is said to be an inflow of waste water from areas in Kenya in particular where the population is concentrated. Others are a decline of water purification as wetland zones around the lake shores shrink, changes in weather patterns, and the inflow of nitrogen and phosphorus from the basin's farmlands.

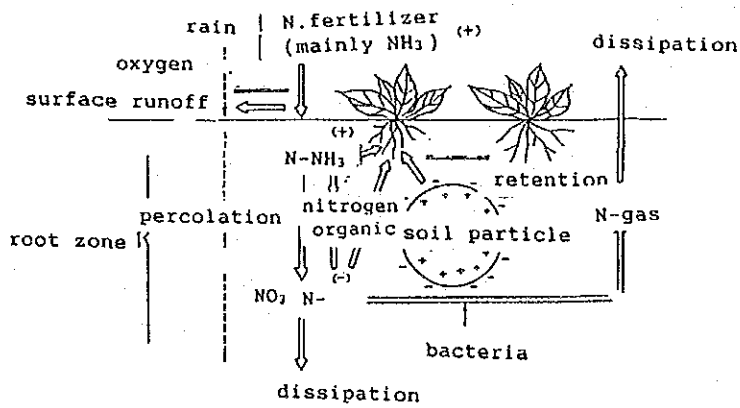
Lake Kyoga in the north of the Study Area receives water at 800 m^3/sec from Lake Victoria through the Victoria Nile. Thus, its water quality is closely related with the contamination of Lake Victoria.

(2) Outflow of nitrogen and phosphorus from farmlands

Nitrogen and phosphorus are discharged from factories and miscellaneous drainage. Some chemical fertilizers and livestock excretions are also dissolved in water from farmlands, and flow out along with surface and ground water. To control this outflow volume, it is important to assess this outflow process accurately.

Figure 6.10.1.2 shows the inflow/outflow balance of nitrogen. The sources of inflow are fertilizers and rain water while sources of outflow include absorption by crops, surface outflow, ground permeation in the form of N-NO_3 and diffusion into the atmosphere in the form of nitrogen gas. The same applies to phosphorus except that there is no diffusion into the atmosphere. However, phosphorus in many cases becomes fixed in the soil by combining with aluminum and iron. The outflow volume of phosphorus from farmland is much lower than that for nitrogen.

Figure 6.10.1.2 Schematic Flow of N-Fertilizer



The percentage of fertilizers dissolving in water in the region depends on such factors as the quantity of fertilizer, crop and soil type, precipitation and topography. There are many variations in test findings. The results of testing in Japan have shown that nitrogen outflows at a rate of 5-200 kg/ha and phosphorus 0-1.5kg/ha.

In general, fertilizer residue outflow is highest from vegetable farmlands due to the quantities of fertilizers used. This is followed by other crops and then grassland. There have been reports of outflow rates (outflow quantity/quantity of applied fertilizers) of 20-30% for farmland and of around 10% for grassland.

Since the quantity of chemical fertilizers used is expected to increase in the future, control of the outflow of nitrogen and phosphorus is a major issue in conserving water quality. The following measures will be required:

i) Boost capacity of the soil to retain fertilizers and water through use of organic matter and mulching.

ii) Enhance the rate of manure absorption by crops via efficient manure control using distributed application techniques.

iii) Since the manure absorption rate (quantity absorbed by crop / quantity of manure) is higher for root crops and beans than for vegetables., excess nutriment in the soil should be absorbed by these crops using rotation systems.

Agricultural chemicals and livestock disinfectants include heavy metals and poisonous substances whose outflow directly leads to water pollution affecting human health. Hence, it will be necessary to implement the following measures.

i) Avoid the use prohibited chemicals (BHC, DDT and agricultural chemicals containing organic mercury)

ii) Practice efficient and economic manuring (period and frequency)

iii) Control insects and pests by exploiting biological methods

6.10.2 Social Environment

1) Related social environmental factors

As shown in Table 3.9.2.2, the following three social environmental issues are to be addressed especially in implementing, the irrigation and agricultural-livestock infrastructure related projects formulated in the Master Plan.

i) Human relations

Friction between those who do and do not participate in the projects, widening of income differentials and changes in social structure due to organization of participants

ii) Health and sanitation

Outbreaks of endemic diseases

iii) Institutions and customs

Water rights and land ownership

2) Considerations

(1) Human relations

In developing sustainable agriculture, the various projects under this Master Plan are all designed to be implemented chiefly by local farmers. The projects are small taking into consideration the most appropriate size for farmer's association, construction costs, management and maintenance. Farmers are expected to bear an appropriate financial burden in accordance with the project cost.

For this reason farmers can relatively easily implement the project by organizing an agricultural association, livestock association or irrigation association or by reorganizing existing farmer organizations. In contrast, the projects will take some time to recover invested capital. Since fairness in terms of participation can be ensured among local farmers, and since income differentials will not emerge rapidly, the projects should not be major problems in terms of human relations.

(2) Health and sanitation

Changes in the biological environment with the conversion of wetlands into paddy fields could cause outbreaks of malaria and other vector borne diseases. However, such outbreaks have not been reported in Iganga and Tororo Districts, east to the Study Area where there have been many cases of conversion into paddy fields.

In West Africa, the risk of endemic disease is higher during the dry season, due to use of standing water as drinking water for unavoidable reasons during water shortages, than in the rice cultivation season, when there is sufficient water. If it becomes possible to control water as in paddy fields, it should also be easier to prevent endemic diseases.

It will be necessary to develop a system of emergency measures by regularly monitoring endemic diseases as part of the Wetland Utilization Scheme. However, it is believed that such problems should not greatly affect the project.

(3) Institutions and customs

a) Land system

Uganda's land system is based on a traditional system formulated before 1900, and has gone through changes during British colonial times and through the Land Reform Decree of 1975. The principle of the 1975 Decree is that all the lands belong to the Ugandan government, and the lands are to be leased. This was unacceptable to the original landholders, and the Decree was observed in a very limited fashion. The current situation of land ownership is complicated by a form of ownership passed on by those who acknowledge traditional customs. In general, there are four basic systems:

i) Freehold

Traditional freehold titles were given to subjects from lords for large areas measured by square mile, called 'mailo'. These mailo have been restricted in terms of transaction and inheritance. A modern freehold system was introduced after 1900 in response to agricultural modernization. In order to enable owners to buy and sell land, proprietary right are recognized with the conservative obligations to Kibanya mentioned below.

ii) Customary

This is a traditional land ownership system. It limits rights to some extent. Use of land is permitted under supervision of owners' family members, relatives or the local community. This applies even to public lands.

iii) Kibanya

This is a customary system of cultivation and use of lands introduced before the modern freehold system.

It is a guaranteed title and landholders can not deprive kibanyas of their titles.

iv) Lease

Under the 1975 Land Reform Decree, freeholds were obliged to change to lease.

According to the Census (1991, MAAIF), about 60% of private land is owned in the form of Kibanya in the Study Area, as well as Uganda as a whole. In the Study Area the freehold system is second at 23% followed by the lease system 10%, customary ownership 6%, and illegal occupancy combined with others a mere 1% in area.

In Uganda, there have been moves to establish a new land system centering around the freehold system. However, since the present administration is cautious about reviewing the land system in which the people's interests are so intimately intertwined, the present situation is likely to continue for some time.

In implementing the projects, it will be necessary to clarify the participants' rights and obligations based on the form of land rights.

b) *Water rights*

At present, Ugandan water resources are governed by a number of laws and regulations gradually enacted after the 1920s, many of which are contradictory or do not suit the present administrative organization. Moreover, punitive standards are very low in terms of current price levels, and the laws and regulations are virtually ignored.

Uganda is now promoting comprehensive legislation for water systems, and in the near future is likely to establish specific systems for developing and using surface and ground water (Water Legislation Study, 1993, MWEMEP).

As far as the Wetland Utilization Scheme and Irrigation Plan are concerned, effective and appropriate development and use of the limited water resources will be based on new water systems.

6.11 Preliminary Design of Major Structures

The Major structures involved in the two schemes in the irrigation and drainage sector have been designed.

In the Small Scale Irrigation Scheme (SSIS), water collected in wetlands is taken by pump to farmland via a farm pond built nearby. The Wetland Utilization Scheme (WUS) consists of water collection facilities upstream of the wetlands, canal systems for irrigation and drainage and paddy fields in down stream areas of the same wetland. The concepts for each design are similar to those employed in Japan.

6.11.1 Structures involved in SSIS

A unit of the scheme consists of a head race (an intake channel), a suction pond, a pump station, pipe lines and farm ponds.

1) Head race

To collect water in the wetland, a head race have been designed to run from the wetland to the suction pond. It is made of earth and is 50 cm in bottom width and 50 cm deep.

2) Suction pond

A suction pond will be installed next to the pump station to supply water to the pump. It will be made of reinforced concrete provided with a silting basin at the joint part of the head race. The capacity of the pond is to be 8 m^3.

3) Pump station

A pump station houses the pump, a mortar or an engine, and valves.

(1) Pump

A small multi-stage turbine pump will be provided to satisfy the engineering specifications involved in the irrigation plan. Required capacities to the pump are: water lift: 70-80 m, water volume: 0.8 m^3/min, diameter: 100 mm.

(2) Motor or engine

It is preferable to install a motor with a capacity of 20-30 kw, provided electricity is available. Where electricity is not available, an engine with a capacity of 30-40 hp can be used.

(3) Valves

Valves to control water flow are provided within the main pipe line system.

(4) Pipe line system

100 mm steel pipes supply water from the pump to the farm ponds.

5) Farm ponds

Earth farm ponds reserve water so as to adjust the differences in time between water application on the farm and water supply from the pipe line system. The capacity is to be decided from the planned maximum daily water requirement and water application frequency involved in the irrigation plan (about 110 m^3). The pipelines having stop valves at their end will be connected to farm ponds. Water will be supplied directly from hydrants attached to the farm pond. The number of farm ponds will be one per household (2 ha).

6.11.2 Structures involved in WUS

In the plan, WUS units consist of a water collecting wall, an intake, main canals, secondary canals, paddy fields, farm roads and main drainage canal. The area between an intake and paddy fields as well as between paddy fields and the drainage canal will be kept in natural condition for the buffer zone. The structures of WUS are as follows.

1) Water collecting wall

A plastic wall is to be provided crossing the wetland into the ground (about 2 m deep from the ground surface) to help the intake collect water by raising the ground water level.

2) Intake

An intake is to be installed above the water collecting wall. This is to be made of concrete and provided with a gate for releasing flood water.

3) Main canals

Two main canals connect the intake to the secondary canal through the buffer zone. Taking subsidence of the ground into consideration, the canal is to be made of light materials such as steel semicircular corrugated flume supported by a wooden foundation (upper width of the flume will be about 0.5 m).

4) Paddy fields, secondary canals and farm roads

Paddy fields are divided into farm blocks by farm roads provided every 150 metres in the plan. A farm block is divided into 16 square plots (37.5 x 37.5 m per one plot) by levee. Levelling will be made in the plots. Secondary canals are provided along the farm roads running from the upper to the lower part of the wetland. Tertiary canals start from the secondary canal uprights up to the main drainage canal. They are all made of earth. The levee measures is 30 cm in upper width and 30 cm in height.

5) Drainage canals

Drainage canals will be excavated in the center of wetlands for the purpose of draining the water from paddy fields and the spilled water at the inundation. The depth of excavation is designed to be dozens of centimetres in order to prevent the excessive dryness of the wetlands.

Figure 6.11.1.1

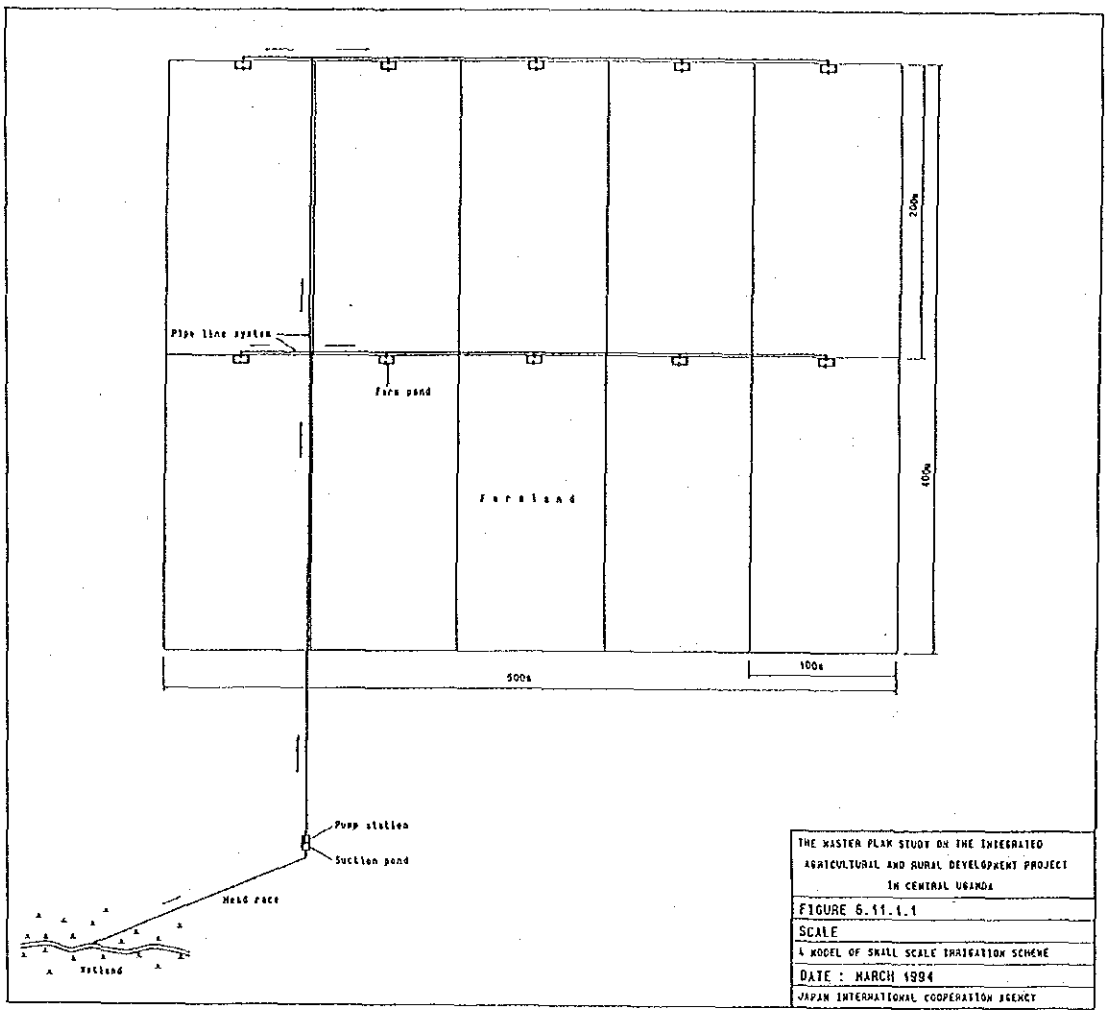
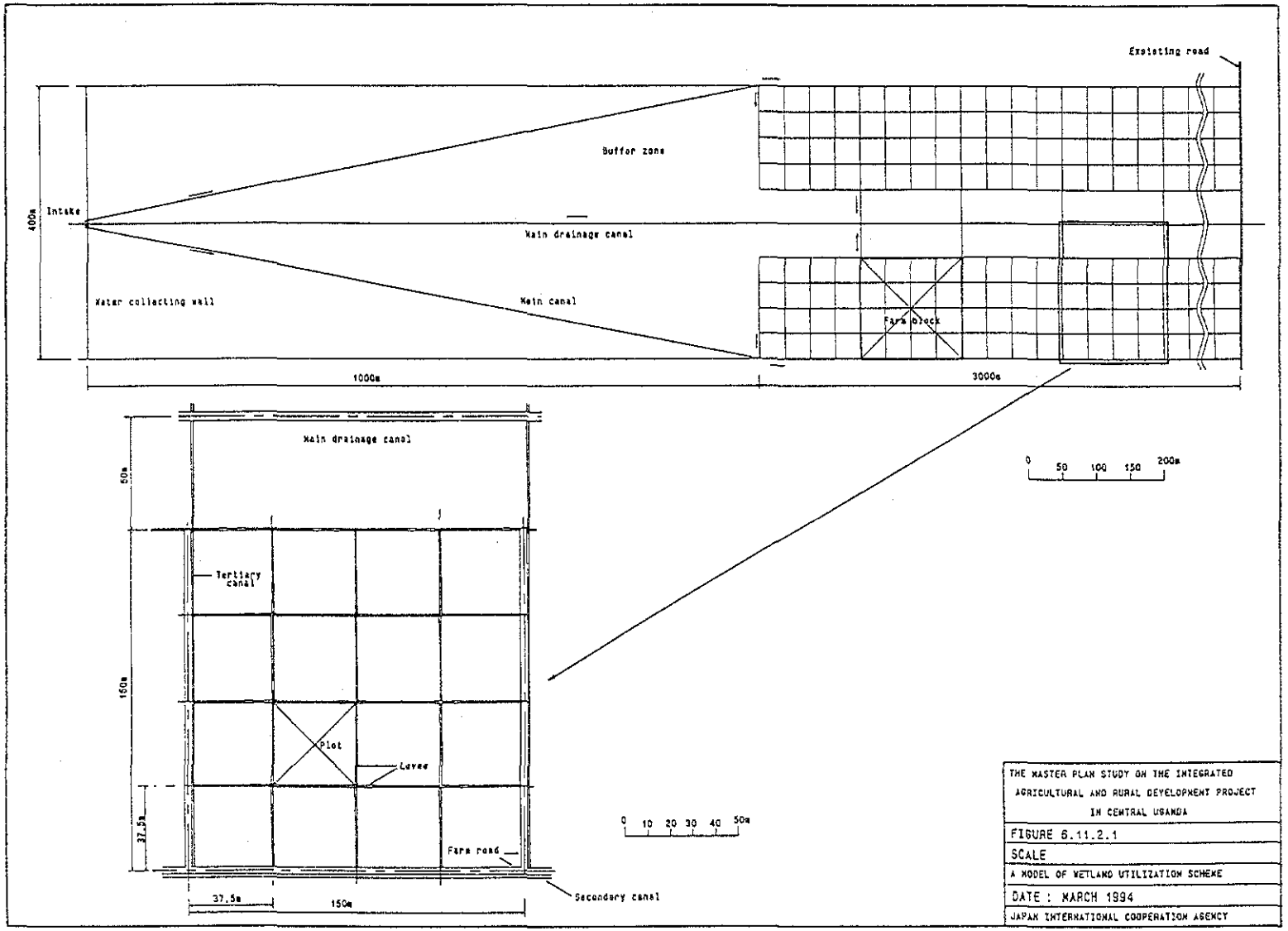


Figure 6.11.2.1



7. Priority Projects

7.1 Criteria Used in Determining Priority Projects

Projects that should be given priority in being implemented among all fields relating to agriculture, livestock and rural social infrastructure are to be in accordance with one of the following three criteria.

i) Projects which make it possible to expect long-term extensive effectiveness regarding agricultural development (increased productivity, diversification of crops, increased employment, etc.)

Projects which make it possible to expect significant development of agricultural production activity

ii) Projects which strengthen the public community

Projects which have a strong public nature and which require the leadership of an administrative organization to implement

iii) *Projects which promote the integrated development of the region as a whole*

Projects in which administrative leadership and model forms of implementation are desired in order to encourage well balanced development of the region as a whole

7.2 Priority Projects

The following six priority projects (Article 7.2) were selected based on the above-mentioned three criteria as well as for their need and importance.

7.2.1 Agricultural Extension Institute Improvement Project

Sector:	Agriculture
Sub-sector:	Extension
Project Type:	Facilities Rehabilitation & Construction
Responsible Ministry:	MAAIF

1) Current situation in the sector

Most agricultural produce comes from small farmers, the key to the Ugandan economy. Accordingly, national policies centered on higher agricultural production address small-scale farmers to boost their living standards, national food security and exports of agricultural produce. However, slow progress in farm management and livestock husbandry improvement has prevented any significant change in production levels. This can be attributed to inactivity of research institute ties with extension work, as well as the paucity of extension facilities and

skilled extension workers. The research works are assured to be improved under NARO programme, whereas extension works carried out by a small number of staff of DAO and DVO have a lot of things such as the necessity of staff increase and facility improvement.

2) Necessity and importance of the project

Within the Study Area only 200 extension workers are available for some 480,000 farmers, an extremely low ratio of workers to farmers. The lack of skilled workers and failure to utilize modern techniques further compounds the problem. The Master Plan to increase agricultural production is predicated on the provision of extension services to at least half the present farmers in the Study Area (some 240,000 farm households) by the target-year 2007, a cumulative increase of 20,000 every year. The government target is 500 farmers per worker, which would ensure an unprecedented level of thorough service. This can only be achieved through training of new personnel in addition to more effective use of existing workers and facilities.

Direct training for extension workers and farmers is being conducted over the entire country under the IDA Agricultural Extension Project (AEP). The Master Plan will complement this by focusing instead on facilities not already covered under the AEP.

3) Project concepts

i) Rehabilitation of Bukalasa Agricultural College and associated farm lands including necessary equipment and vehicles.

ii) Establishment of new DFIs and model farms in Luwero and Mpigi, including necessary equipment and vehicles.

iii) Rehabilitation of DFIs and farms in Masaka and Mukono, including necessary equipment and vehicles.

iv) Rehabilitation and establishment of access roads for all institutes.

7.2.2 Agricultural Transportation and Market Activation Project

Sector:	Agriculture
Sub-sector:	*Transportation and Distribution*
Project Type:	Facilities Construction
Responsible Ministry:	MAAIF

1) Current situation of the sector

The latest statistics show an upward trend in agricultural production but many crops, especially traditional cash crops, are still far below the peaks achieved before the civil war.

The pace of recovery and development is too slow to achieve the targets which have been set in the national policies. To the large extent this is due to the poor transportation and distribution system in rural areas which are restricting distribution of agricultural inputs and outputs and suppressing both farmer and trader activity.

2) Necessity and importance of the project

The project aims at the conversion of current transportation system and the stimulation of market and distribution systems. Manual transportation of agricultural input/output on farms and by bicycle to and from local markets should change to more efficient means such as wheel barrows and carts. The present poor capacity of transportation greatly limits the scope of cultivation and distribution.

In the current distribution system, traders collect produce from farmers in small lots, in most cases at prices favoring the traders. The inactivity of local markets, attributed mainly to the quantities of produce supplied by farmers, is commensurate with the limited local demand. There is however potential for demand to be developed by traders. Agricultural development will not be achieved as planned unless transportation and distribution system is significantly improved.

3) Project concepts

The project will establish coordinated transportation and distribution systems centering on the following two components:

i) Transportation System

Improvement of rural road network through construction of farm roads in farm lands, improvement of feeder roads so as to enable farmers to transport their products and inputs between to market by cart.

This will be supported by transport service units and agricultural machines maintenance service units at Agricultural Product Collection Centres (APCCs).

ii) Agricultural Product Collection Centres (APCCs)

Provide farmers and traders with facilities for bidding, accounting and storage to encourage market and distribution activities. Also including community centres (offices for management, bank and extension services, multi-purpose hall) and agro-industry units.

One centre every 900 km^2 is supported by 8 Sub-centres (APCSC) every 100 km^2, a total of 25 APCCs and 200 APCSCs in the Study Area, to be put under the control of IDC.

7.2.3 Livestock Service Strengthening project

Sector:	Livestock
Sub-sector:	Animal Industry
Project Type:	Facilities Construction, Equipment supply
Responsible Ministry:	MAAIF

1) Current situation in the sector

Cattle are the main domestic animal in Uganda. Of 4,500,000 nationwide, 660,000 are in the Study Area. The cattle population fell drastically during the war and has not fully recovered, mainly due to the constant threat from diseases such as East Coast Fever (ECF), Contagious Bovine Pleuropneumonia (CBPP) and Trypanosomiasis, which are rampant in Central Africa. Rural Veterinary Centres (VCs) which used to control diseases have all but ceased to function due to the destruction of facilities.

Although not as bad as disease control, cattle breeding services have also been affected by the war. Artificial Breeding Centres (ABC) established in the 1960's used to distribute semen of good-breed cattle to Artificial Insemination Sub-Centres (AISCs). The service is gradually being restored (7,281 inseminations in 1992 vs 12,586 in 1970) but further improvement on facilities and equipment in ABC and AISCs is required.

2) Necessity and importance of the project

Uganda national policies have an increase in animal produce, especially milk and beef, to raise nutrition levels and increase population. For the animal produce expansion more animals, improved breeds and better feeding systems are required.

The veterinary sub-sector, responsible for increasing animal number by means of disease control needs to be further developed.

3) Project components

The project consists of four components:

i) Rehabilitation and Construction of Veterinary Centres (VCs) (See Figure 6.4.3.1).
   Rehabilitation of existing VCs (8)
   Construction of new VCs (10)

ii) Construction of Vaccine Production Labouratory
   Equipment for vaccine production (Brucellosis, Contageous Bovine Pleuropneumonia)

iii) Rehabilitation and Construction of Artificial Insemination Sub-Centres (AISCs)
   Rehabilitation of existing AISCs (10)
   Construction of new AISCs (11)

iv) Rehabilitation of Artificial Breeding Centres (ABC)
Infrastructure
Equipment and bulls

7.2.4 Paddy Field Development Pilot Project (PFDPP)

Sector:	Agriculture
Sub-sector:	Irrigation
Project Type:	Facilities Construction and Development of Adaptive Technology
Responsible Ministry:	MAAIF

1) Current situation in the sector

Rice is becoming popular in Uganda as food consumption patterns diversify. The majority of paddy fields are in Iganga, Tororo and Pallisa with few seen in the Study Area. Rice production which is estimated more on less 30 thousand tons per year does not yet meet domestic demand, and large quantities of rice are being imported. To avoid using foreign currency on rice imports, due attention should be given to rice growing in the Study Area.

2) Necessity and importance of the project

Rice is the most suitable crop for wetlands, which occupy 13% of the Study Area. Bio-diversity in wetlands is in abundance in terms of flora and fauna. However, current trends are not geared toward conservation. Even though agricultural encroachment is, only in the initial stage, and usually on a small scale, this trend will accelerate with increasing population pressure and demand for commercial agriculture, threatening wetland ecosystems. Conservation simultaneously with increased food production is predicated on the appropriate demarcation of wetlands into conservation and development areas.

Appropriate models of wetland conservation and development are needed to be built for utilizing 5,900 ha of wetland identified for paddy field in the Study Area.

3) Project concepts

The project includes five pilot farms (30~100ha per one pilot) of paddy field in wetlands provided with rice mills and other necessities. Wetlands which are ensured with cooperation of rural people together with favorable soils and water will be designated for pilot farms.

It should be noted that the project should be subject to EIA (Environment Impact Assessment) and feasibility studies (including social effects) to ensure the compatibility of environmental conservation and sustainable agriculture. The project is accompanied with

experiments for establishing wetland conservation and development models which cover rice cultivation, water and soil control and environmental conservation.

7.2.5 Rural Water Supply Project (RWSP)

Sector:	Rural Social Infrastructure
Sub-Sector:	Water supplies
Project Type:	Facilities Construction
Responsible Ministry:	Ministry of Natural Resources

1) Current situation in the sector

Uganda has a population of 16.7 million and about 90% live in rural areas. Only 20% of these have access to safe drinking water. Water-borne diseases are prevalent and the infant mortality rate is over one in ten. People have to go to rivers and springs located in many cases far from their homes. And the water usually is not safe to drink. It is normally the work of women and children to collect water, which is considerable burden.

2) Necessity and importance of the project

Water supply projects are either underway or about to start in all districts covered by the Study Area except Mpigi. Masaka is covered by SWIP (South West Integration Project) and Mukono by RUWASA (Rural Water and Sanitation Project). Luwero has already received a feasibility study and is expected to be funded.

In Mpigi 773,000 people live in rural areas. Of those only 60,000 have access to safe water from 87 boreholes and 226 protected springs, leaving the majority (92%) in a critical state.

3) Project concepts

The project aims to raise the number of people in rural area with access to safe water from 8% in 1991 to 50% by 2007 taking the population increase into consideration.

The following facilities are required to attain the target.

i)	spring protection	x	1,576
ii)	dug wells (new)	x	573
iii)	augered well (new)	x	573
iv)	boreholes (new)	x	1,175
v)	boreholes (rehabilitation)	x	57

7.2.6 Integrated Agricultural and Rural Development Project

Sector:	Agriculture
Project Type:	Feasibility Study (F/S)
Conducted by:	MAAIF

1) Current situation of the sector

Agriculture is the mainstay of the Ugandan economy, constituting more than half of GDP, providing the majority of exports and a significant proportion of tax revenues. It provides a living for about 80% of the population, and more than 90% of households own some land. Economic recovery is heavily dependent on the growth and diversification of this sector. Most of Uganda's farming is carried out by about 2.0mn smallholders using simple traditional methods on average plots of 2.5ha. The natural environment provides good grazing for cattle, goats and sheep, most of which are almost indigenous breeds. About 95% of the cattle are owned by smallholders, though several hundred modern commercial ranches were established during the mid 1960s and early 1970s in tsetse-cleared areas. Nutrition levels, mainly of animal matter, is very low.

2) Necessity and importance of the project

The project aims at self-sufficiency in food, improvement of nutrition, settling of farmers for livestock production in savanna, and the improvement of rural social infrastructure. The implementation of this project, in consideration of WID and environmental issues, will be one of the models for the Integrated Agricultural and Rural Development in the Master Plan Study Area and the similar regions near the Study Area.

3) Selection of area for F/S

i) Within the scope of the development plans for each sector described above, certain areas will be designated for priority development. To facilitate the selection process and formulation of terms and conditions, a set of fair standards will be developed at the smallest administrative unit of sub-county.

ii) The Master Plan Study covers four districts containing 22 counties and 106 sub-counties. Designation of priority development areas was carried out in each district according to the five criteria given below, based on detailed interviews with sub-county chiefs. In order to prevent developmental imbalances between regions, one priority development area was selected from each of the four districts.

iii) The following 5 criteria were used to identify priority development areas:

C1: Facing trunk roads (e.g. national roads) to maximize flow-on effect development;

C2: Proximity of DAO and DUO, to facilitate of study, implementation and farm management;

C3: High motivation level of farmers and sub-county chief;

C4: Existance of sufficient area of public land;

C5: Achievement of at least four of the seven points set out in the development targets; either a complete range of facilities (from production through distribution) located nearby, or construction plans underway at the national level.

iv) Each of above criteria was rated on the following 4-point scale:

(a) 4 = very good, (b) 3 = good, (c) 2 = ordinary, (d) 1 = bad.

Sub-counties in each districts were then ranked according to their total marks. The highest scoring sub-county was give priority (see Appendix 1.7).

v) Highest priority area

Butuntumula Sub-county in Luwero District ranked highest, as shown in Table 7.2.6.1. This Sub-county should be the first area to receive a F/S. The next sub-counties, in priority order, are Kayunga, Malongo and Budde.

4) Project concepts

Table 7.2.6.1 gives information about the main planning scheme in the Study Area. The main contents have been summarized below.

i)	Land reclamation	800 ha
ii)	Farm land improvement	300 ha
iii)	Grassland development	2,240 ha
iv)	New ranches	100
	Beef cattle only	60
	Beef cattle + goats	40
v)	Valley dams, including dip facility for Nomads	1
vi)	Machinery	
	Agricultural Association (AA)	1
	Livestock Association (LA)	5
vii)	Boreholes for water supply	
	Construction	110
	Rehabilitation	10
viii)	Feeder roads	
	Construction	200 km
	Rehabilitation	40 km
ix)	Electrification (construction)	10 km
x)	Community centres, including health centres	3
xi)	Collection centres	3

5) Location of project area

Figure 7.2.6.1 shows the location of Priority Areas.

Table 7.2.6.1 Contents of Priority Areas

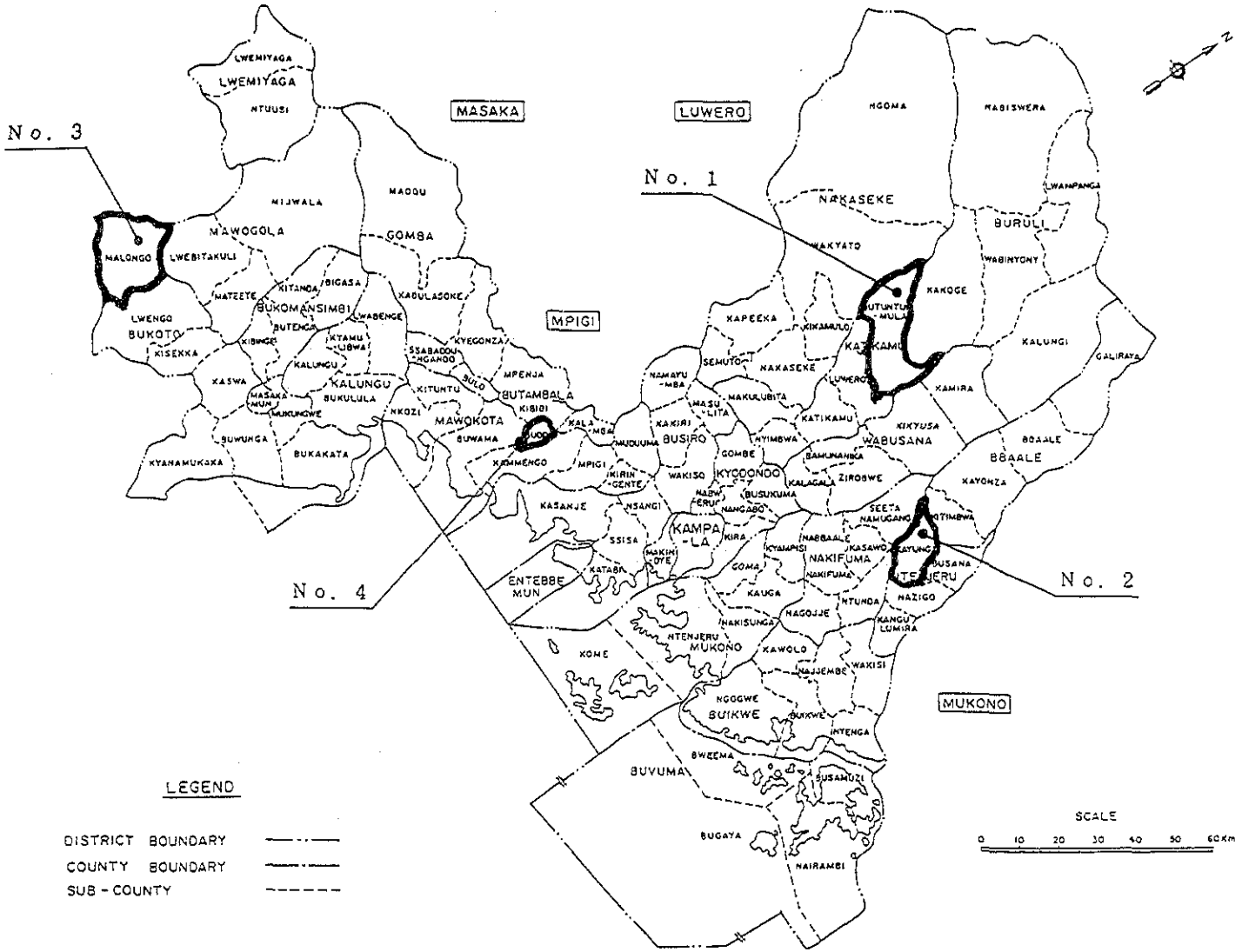
(1/2)

Item	No.1	No.2	No.3	No.4
1. Marks	4.0	3.8	3.6	3.4
2. Name of District	Luwero	Mukono	Masaka	Mpigi
3. Name of County	Katikamu	Ntenjeru	Bukoto	Butambala
4. Name of Sub-county	Butun-tumula	Kayunga	Malongo	Budde
5. Land Area (ha)	32,650	17,590	36,820	5,950
6. Public Lanf (ha)	22,550	5,590	5,550	1,330
Dry Land	22,300	1,930	5,550	0
Wet Land	250	3,660	0	1,330
7. Attainable Targets(max.7)	(6)	(5)	(5)	(6)
1) Self-sufficiency in Food	○	○	○	○
2) Improvement of Nutrition	○	○	○	○
3) Promotion of Productivity	○	○	○	○
4) Promotion of Exports and Decrease of Imports	○	○	○	○
5) Settling of Farmers	○	×	×	×
6) Suburban Agriculture	×	×	×	○
7) Social Infrastructure	○	○	○	○

(2/2)-- continued

Item	No.1	No.2	No.3	No.4
8. Main Planning Scheme (ha)				
1) Land Reclamation	800	100	300	150
2) Farm Land Improvement	300	250	300	300
3) Grassland Development	2,240	100	200	150
4) Grassland Improvement	-	-	-	-
5) Development of Irrigation	-	30	-	40
Paddy Field	-	10	-	20
Horticulture	-	20	-	20
6) New Ranch Plan (grs)	100	-	-	-
Beef Cattle Only	60	-	-	-
Beef cattle + Goats	40	-	-	-
7) Valley Dam and Dip (pl)	1	-	-	-
8) Zero Grazing (st)	-	-	-	1
9) Association (sts)	6	3	1	3
AA(sts)	1	1	1	1
IA(sts)	0	1	0	1
LA(sts)	5	1	0	1
10) Borehole (pls)	120	10	15	10
Construction	110	5	10	5
Rehabilitation	10	5	5	5
11) Feeder Roads (km)	240	70	60	30
Construction	200	20	20	10
Rehabilitation	40	50	40	20
12) Electrification (km)				
Construction	10	-	-	-
13) Community Centre and Health Centre (pls)	3	2	4	1
14) Collection Centre (pls)	3	2	4	1

Figure 7.2.6.1 Location Map of Priority Areas



6) Time schedule for Feasibility Study

i)	Review of previous study and collection of data	3 mos
ii)	Agricultural infrastructures	5 mos
iii)	Rural social infrastructures	5 mos
iv)	Detail design and cost estimates	4 mos
v)	Preparation of reports (IC/R, P/R(1), IT/R, P/R(2), FR)	6 mos
vi)	Total study period	18 mos

8. Implementation and Management Plan

The Integrated Agricultural and Rural Development Project is based on Constraints on Agricultural Development (Chapter 4), Basic Plan for Development (Chapter 5), Development Plan for Each Sector (Chapter 6), and Priority Projects (Chapter 7).

8.1 Implementation Plan

8.1.1 Fundamental Values

1) Growth rate of population;

The IBRD estimates a population growth rate for Uganda of 3.14% in 1996-2000 and 3.27% in 2000-2005 (with AIDS control), while the medium prevalence of Ugandan population factors in National Rehabilitation and Development is expected to be 3.5%. Based on these figures, the Master Plan for these projects assumes annual population growth rate of 3.1%.

2) Number of farm household

Table 8.1.1.1 and Figure 8.1.1.1 show the farm households in 1991 and 2007 in the Study Area. By the year 2007 there will be 520,000 farm households and 360,000 non-farming households. The breakdown of farm households is give in Table 8.1.1.2. The ratio of farmers is 2.0% at NRP. Those farmers will be grouping for the management association under the IDC by Table 8.1.1.3. The three associations (AA,LA and IA) will play an important role in WID and environmental conservation by common usage of agricultural machinery.

3) Land Use Plan

Table 8.1.1.4 shows the land use plan in the Study Area. Forest reserves and water areas are excluded from development projects. The total area available for development is 221,000 ha or 6.1% of the Study Area.

Table 8.1.1.1 Farm Households in the Study Area

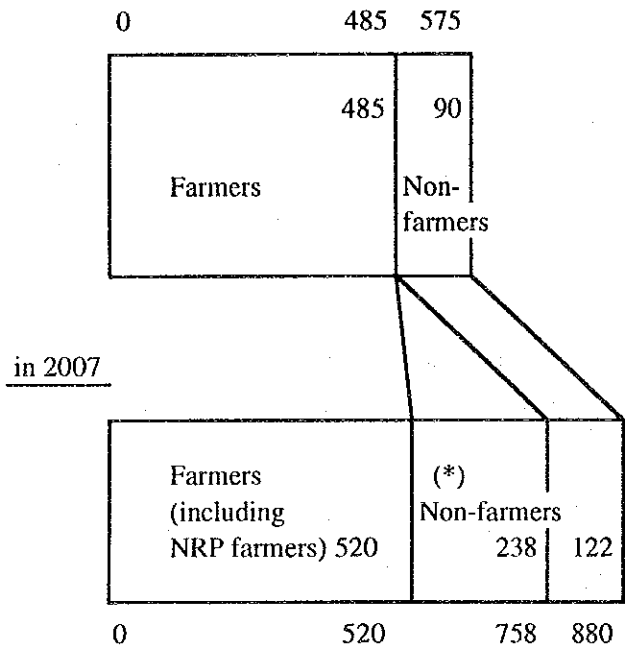
(Unit='000 families)

Item	Luwero	Masaka	Mpigi	Mukono	Total
Households in 1991 (a)	72	163	148	102	485
In 2007:					
Farmer population	668	1,248	1,373	1,258	4,547
Average size of household	6.0	6.0	6.0	6.0	
Household (b)	111	208	229	210	758
Difference (c)=(b)-(a)	39	45	81	108	273

Source: Farmers' Intention Study

Figure 8.1.1.1 Employment by Industry Type in 1991 and in 2007

(Unit : '000 households)



(*) By processing, marketing manufacturing and other sector

Table 8.1.1.2 Number of Farm Households

(Unit:family)

Item	Luwero	Masaka	Mpigi	Mukono	Total	Ratio
Existing area	69,155	174,858	159,594	105,913	509,520	98.0
As of 1991	74,934	168,694	153,529	103,414	500,571	
Change(2007)	-5,779	6,164	6,065	2,499	8,949	
NRP	8720	160	160	1440	10480	2.0
Beef cattle only	5,600	80	80	720	6,480	
Beef cattle + goats	3,120	80	80	720	4,000	
Total	77,875	175,018	159,754	107,353	520,000	100.0
Ratio (%)	15	33.7	30.7	20.6	100	

Source: Tables 5.1.4, 8.1.1.1 and the others

Table 8.1.1.3 Plan of Farmers Associations

Item	No. of Farmer	No. of Association	No. of Farmer per Association
1 Existing farmers	509,520	418	1,219
AA(Agricultural Association)	473,220	225	2,103
LA(Livestock Association)	15,520	21	740
IA(Irrigation Association)	20,780	172	121
2 New Ranch Plan (NRP)			
LA(Livestock Association)	10,480	66	160
3 Total	520,000	484	1,074

Source: Tables 8.1.1.1, 8.1.1.2 and the others

Table 8.1.1.4 Land Use Plan

(Unit:sq.km)

Item	Luwero	Masaka	Mpigi	Mukono	Total	Ratio
	(35.9)	(23.4)	(20.6)	(20.1)	(100)	
1 Land area	9,017.3	5,865.2	5,167.5	5,041.2	25,091.2	68.4
Reclamation	946.0	24.4	154.4	109.6	1,234.4	3.4
Farm field	700.0	20.0	150.0	70.0	*1 940.0	
Grassland	246.0	4.4	4.4	39.6	294.4	
For NRP	2,130.6	37.8	37.8	340.4	2,546.6	6.9
Improvement	259.0	311.0	142.0	207.5	919.5	2.5
Farm field	84.6	125.1	87.7	152.6	*2 450.0	
Grassland	174.4	185.9	54.3	56.4	471.0	
Swamps(rice)	6.0	19.7	26.1	7.2	59.0	0.2
Existing use	3,362.0	3,784.4	2,196.1	2,520.0	11,862.5	32.3
Farm field	641.4	1,288.9	984.3	1,650.4	4,565.0	
Grassland	2,720.6	2,495.5	1,211.8	869.4	7,297.3	
Plantation	23.7	-	205.3	440.5	669.5	1.8
Forest	860.4	361.7	1,430.7	1,386.6	4,039.4	11.0
Reserve	689.3	361.7	659.4	721.8	2,432.2	
Individual	171.1	-	771.3	664.8	1,607.2	
Other land*3	1,429.9	1,326.2	975.1	29.8	3,760.3	10.2
2 Water area	180.5	1,120.9	1,110.5	9,199.9	11,611.8	31.6
3 Total	9,197.8	6,986.1	6,278.0	14,241.1	36,703.0	100.0
4 Ratio (%)	25.1	19.0	17.1	38.8	100.0	

Sources: Table 1.3.1 and the others

Notes: (1) ( )=% of land area

(2) Forest reserves and water areas excluded from the development projects

(3) - ; Negligible or unknown

(4) *1, *2; Including small-scale irrigation scheme of 7.0 km^2 and 18.0 km^2, respectively.

(5) *; Including in urban area, swamps (except project areas for rice), road, waterways, etc.

Table 8.1.1.5 Agricultural Production Plan

(Unit: 1,000 tons)

Item	1991*	2007	Balance	Ratio
1 Food crops				
Bananas	1,017.0	1,693.0	676.0	1.66
Cereals	69.2	273.6	204.4	3.95
Root crops	710.4	1,036.4	326.0	1.46
Pulses	81.8	150.6	68.8	1.84
Oil seed	31.9	61.5	29.6	1.93
Vegetables	115.0	286.1	171.1	2.49
Fruits	150.5	495.1	344.6	3.29
2 Cash crops				
Coffee(robusta)	170.5	203.6	33.1	1.19
Sugar cane	2,939.6	4,083.8	1,144.2	1.39
Tea	1.7	5.1	3.4	3.00
Cacao	3.5	10.4	6.9	2.97
Cotton	0.9	4.3	3.4	4.78
Vanilla	0.1	29.7	29.6	297.00
3 Livestock				
Meat	28.8	61.9	33.1	2.15
Milk	76.5	157.3	80.8	2.06
Eggs	1.4	5.0	3.6	3.57
4 Economy (mn US$)				
Gross income	261.6	639.5	377.9	2.44
Production cost	62.1	235.7	173.6	3.80
Net income	199.5	403.8	204.3	2.02

Sources: Table 6.2.2.1, 6.4.1.1 and the others

Note: * = 3-year averages for 1990 and 1992 on food crops and cash crops in 1991

4) Agricultural production plan

Table 8.1.1.5 shows that estimated agricultural production varies in ratio from 1.19 to 4.78 times, except in vanilla. The livestock component will double between 1991 and 2007. The economy will reach a gross income of US$ 640 mn, net income US$ 403.8 mn. Some of 35% of gross income will contribute to improvement of the balance of international trade.

8.1.2 Implementation Schedule

1)	Preparation	1 year	1994/95

This period is for arranging finance and the detailed designs for the implementation of the priority projects (Stage 1).

2)	Implementation	12 years	1995/96 - 2006/07

The 12-year period is divided into three stages of four years each. The terms correspond to the National Plan in Uganda. Those contents will be nominated at the Plan for the authorization.

(1)	Stage 1: Short-term projects	4 years	1995/96-1998/99
(2)	Stage 2: Medium-term projects	4 years	1999/00-2002/03
(3)	Stage 3: Long-term projects	4 years	2003/04-2006/07

3)	Year of maturity	2006/07

The Plan will mature at the end of Stage 3. By the year 2007, all projects will be finished achieving all targets in the Master Plan.

8.1.3 Cost Estimates

1) Basic assumptions

The construction costs have been estimated based on the preliminary design and following conditions:

i) Administrative costs are 3% of the Investment Cost Total (ICT) and are cumulatively carried over to each next year;

ii) Engineering service fees are 15% of ICT for each year;

iii) Physical contingency reserves are 10% of ICT for each year;

iv) Price contingency reserves will be considered at an annual escalation rate 3% for foreign currency and 10% for domestic currency for each year;

v) Exchange rate: 1,185 USHS = US$ 1.

Construction cost of Project over 12 years and disbursement plan will be estimated based on the Programme for Each Stage (see Table 8.1.4.1). The Programme consists of five fields, e.g. Agricultural Infrastructure, Agricultural Support, Processing and Distribution, Rural Social Infrastructure, and the Integrated Development Centre.

2) Cost estimates

The general descriptions of the projects to be undertaken are shown in Table 8.1.3.1 (see Appendix 4.1). The principles are as follows:

(1) Agricultural Infrastructure:

a)	Land reclamation and farm land improvement	136,500 ha
b)	Grassland development and improvement	76,540 ha
c)	Irrigation for rice and horticulture	8,400 ha
d)	Improvement of Livestock facilities	
	New Ranch Plan	10,480 sites
	Valley dams and dipping facilities	36
	Bee keeping (5,000 bee hives, etc.)	1

(2)	Agricultural Support	
a)	Research	
	NARO Headquarters	1
	Kawanda Agricultural Research Institute	1
	Namulonge Agricultural & Animal Production Research Institute	1
	Kifu Forestry Research Institute	1
b)	Extension	
	Bukalasa Agricultural College	1
	Establishment of DFI	2
	Rehabilitation of DFI	2
	Branch Extension Offices	225
	Improvement of Working Condition	1
	Improvement of Plant Protection	1
	Tannery & Foot Wear Training School	1
c)	Animal Improvement	
	Breed Importation (beef cattle, milk cattle, goats, sheep, pig)	11,000 head
	(excluding poultry 230,000 heads)	
	Artificial Breeding Centre	1
	Artificial Insemination including 11 sub-centres	21
	Veterinary Centres	18
	Vaccine Production Labouratory	1
d)	Machinery Service (common use)	
	Agricultural Association for tillage	225
	Irrigation Association for cultivation	172
	Livestock Association for stock feed	87
(3)	Processing and Distribution (for increasing added value, exports)	
a)	Slaughter house for meat:	
	Slaughter slabs	35
	Slaughter houses	2
b)	Milk collection centres	6
c)	Livestock markets	10
d)	Cereal warehouses (Coffee, Grain and Cotton)	7,415 tons
e)	Rice processing facilities	47
f)	Agricultural Product collection centres	225
g)	Rehabilitation of Masaka fruits factory	1

(4) Rural and social infrastructure for the improvement of living conditions:

a)	Water supply for drinking:	
	Boreholes (establishment and improvement)	4,038
	Spring (establishment and improvement)	10,088
b)	Feeder roads:	
	Establishment (for New Ranch Plan (NRP))	2,096 km
	Improvement by motor graders, bulldozers, etc.	4
c)	Education:	
	Primary schools (establishment for NRP)	60
	Secondary schools (establishment for NRP)	19
	Community centres for training	225
d)	Electrification:	
	Establishment (11kv, 433v, 240v for NRP)	3,156 km

(5) Integrated Development Centre (IDC):

a)	IDC for implementation of projects and their maintenance	1
b)	IDSC (Sub-centre for IDC at District level)	4
c)	DAO (improvement)	4
d)	DVO (improvement)	4
e)	DCO (improvement)	4

(6) Cost estimates:

a)	Investment Cost Total (ICT)	US$ 414,307,000		(45.4%)	
	i) Agricultural Infrastructure		US$ 183,541,000		(20.1%)
	ii) Agricultural Support		US$ 73,510,000		(8.1%)
	iii) Processing and Distribution		US$ 32,321,000		(3.5%)
	iv) Rural Social Infrastructure		US$ 124,222,000		(13.6%)
	v) Integrated Development Centre		US$ 713,000		(0.1%)
b)	Administration Cost	US$ 105,400,000		(11.6%)	
c)	Physical Contingency	US$ 41,431,000		(4.5%)	
d)	Engineering Service Fee	US$ 62,146,000		(6.8%)	
e)	Price Contingency	US$ 288,814,000		(31.7%)	
f)	Total Costs	US$ 912,098,000		(100.0%)	
	Foreign Currency		US$ 555,884,000		(60.9%)
	Local Currency		US$ 356,214,000		(39.1%)

Table 8.1.3.1 List of Cost Estimates

Item	Quantity	Amount (US$)
1. Agricultural Infrastructure		183,541,000
1) Land Reclamation	93,300ha	86,118,000
2) Farm Land Improvement	43,200ha	35,825,000
3) Grassland Development	29,440ha	6,925,000
4) Grassland Improvement	47,100ha	9,901,000
5) Irrigation, Drainage	8,400ha	26,291,000
Small Scale Irrigation	2,500ha	7,798,000
Paddy Field Development	5,900ha	18,493,000
6) Livestock Facilities		18,481,000
New Ranch Plan	10,480pls	17,046,000
Valley Dams	36pls	1,135,000
Bee Keeping	1se	300,000
2. Agricultural Support		73,510,000
1) Research		11,478,000
NARO Headquarters	1pl	3,135,000
Kawanda A.R.I.	1pl	3,944,000
Namulonge A.A.P.R.I.	1pl	2,740,000
Kifu Forestry Research Institute	1pl	1,659,000
2) Extension		18,909,000
Bukalasa Agriculture College	1pl	3,235,000
Establishment of DFI	2pls	3,510,000
Rehabilitation of DFI	2pls	2,445,000
Branch Extension Office	225pls	4,113,000
Improvement of Working Conditions	1se	4,756,000
Improvements for Plant Protection	1se	99,000
Tannery & Foot Wear Training	1se	751,000
3) Animal Improvement		7,772,000
Breed Importation	11,000hed	6,267,000
Artificial Breeding Centre	1pl	202,000
Artificial Insemination Sub-centres	21pls	568,000
Veterinary Centres	18pls	485,000
Vaccine Production Laboratory	1se	250,000
4) Machinery Service		35,351,000
Agricultural Associations	225ses	9,150,000
Irrigation Associations	172ses	11,381,000
Livestock Associations	87ses	14,820,000
3. Processing & Distribution		32,321,000
1) Slaughter Slabs	35pls	557,000
2) Slaughter Houses	2pls	127,000
3) Milk Collection Centres	6pls	415,000
4) Livestock Markets	10pls	802,000
5) Cereal Warehouses	7,415ton	2,258,000
6) Rice Porcessing Facilities	47pls	662,000
7) Collection Centres	225pls	24,000,000
8) Rehabili. Masaka Fruit Factory	1pl	3,500,000
4. Rural Social Infrastructure		124,222,000
1) Water Supply	14,126pls	58,295,000
Boreholes	4,038pls	27,236,000
Springs	10,088pls	31,059,000
2) Feeder Roads		17,341,000
Establishment (IV)	2,096km	12,576,000
Improvement (I ～IV)	4ses	4,765,000
3) Education		7,846,000
Primary Schools	60pls	1,720,000
Secondary Schools	19pls	709,000
Community Centres (Health Centres)	225pls	5,417,000
4) Electrification	3,156km	40,740,000
5. Integrated Development Centre		713,000
1) IDC	1pl	104,000
2) IDSC	4pls	170,000
3) DAO, DVO, DCO	12pls	439,000
Sub-total		414,307,000
Administration Cost		105,400,000
Physical Contingency		41,431,000
Engineering Service		62,146,000
Price Contingency		288,814,000
Total		912,098,000
Foreign Currency		555,884,000
Local Currency		356,214,000

8.1.4 Implementation Priority

The order of the priority stages is described in 8.1.2. The implementation schedules are as follows:

i) Stage 1 (short-term projects) is for the urgent and important projects, including the priority projects described in Chapter 7;

ii) Completion ratios are about 50% at Stage 1 (short-term), 30% at Stage 2 (medium-term) and 20% at Stage 3 (long-term), respectively. These will produce satisfactory results in the early stages. The distribution of project costs is roughly equivalent to the above ratios.

iii) In consideration of funds and office staff, larger and long-term projects will on an average be implemented between Stages 1 and 3.

iv) WID and environmental issues have been given due attention in this Project.

v) Table 8.1.4.1. shows the completion ratio for each stage. This Project will create commercial farmers in the Study Area.

8.1.5. Structure of Project Implementation

An overall organization should be necessary to successfully implement the above-mentioned projects. As Figure 8.1.5.1 shows, implementation is the responsibility of the Integrated Development Centre (IDC) and Integrated Development Sub-centres (IDSCs).

The Principal Agricultural Officer (PAO) will coordinate with the Steering Committee (SC) over inter-ministerial affairs.

The IDC consists of seven sections. General Affairs Section oversees the other sections for their smooth job execution, besides accounting. Account Section is responsible for management of farmers associations. Planning Section deals with planning, monitoring and evaluation of projects. Other four sections (AIS, TSS, PFS, RSIS, See Figure 8.1.5.1) have responsibilities to carry out respective projects such as agricultural infrastructure, agricultural support, agricultural processing and distribution and rural social infrastructure.

It should be noted that both IDC in MAAIF and IDSCs in district administrative offices are to be formed by reorganizing existing institution so as to avoid duplicated administrative structures.

Table 8.1.4.1 Project Implementation Schedule

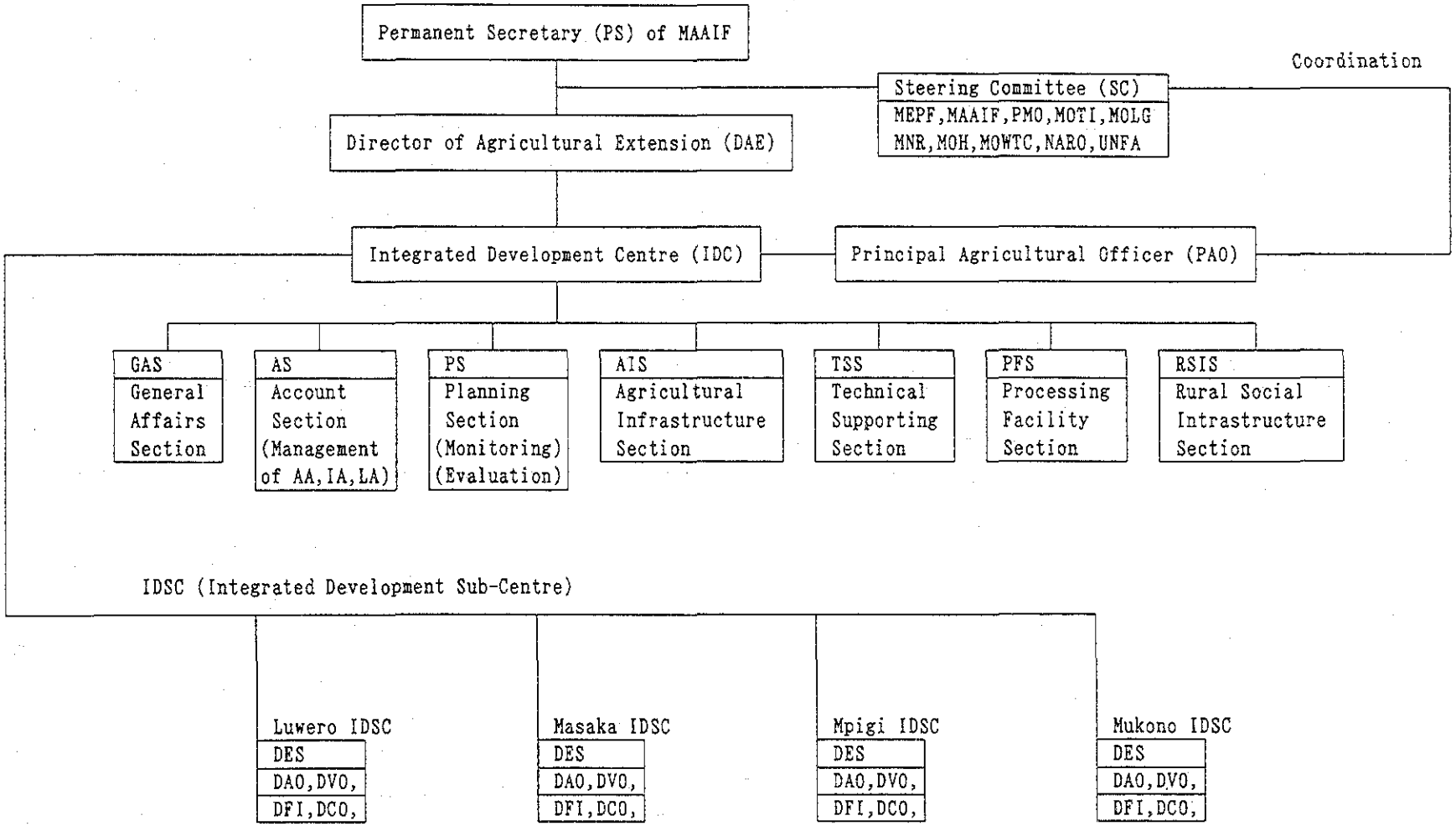
(Unit:%)

Contents of projects	(Short-Term) Stage 1				(Medium-Term) Stage 2				(Long-Term) Stage 3			
	1	2	3	4	5	6	7	8	9	10	11	12
1. Agricultural Infrastructure												
1) Land reclamation	10	10	10	10	10	10	10	10	10	10		
2) Farm land improvement	10	10	10	10	10	10	10	10	10	10		
3) Grassland development	10	10	10	10	10	10	10	10	10	10		
4) Grassland improvement	10	10	10	10	10	10	10	10	10	10		
5) Irrigation & drainage												
Paddy field development	10	15	15	15	15	15	15					
Small-scale irrigation	10	15	15	15	15	15	15					
6) Livestock facility												
New Ranch Plan		10	10	10	10	10	10	10	10	10	10	
Valley dam	10	20	20	20	20	10						
Bee keeping	20	20	20	20	20							
2. Agricultural Support												
1) Research												
NARO Headquarters					50	50						
Kawanda A.R.I.	100											
Namulonge A.A.P.R.I.		100										
Kifu Forestry Research Inst.		100										
2) Extension												
Bukalasa Agri. College	100											
Establishment of DFI	50	50										
Rehabilitation of DFI			50	50								
Branch Extension Office	10	10	10	10	10	10	10	10	10	10		
Improvement of Working Condition	25	25	25	25								
Improvement of for Plant Protec.	25	25	25	25								
Tannery & Foot Wear Training S.	50	50										
3) Animal improvement												
Breed importation	20	20	20	20	20							
Artificial Breeding Centre	50	50										
Artificial Insemination	50	50										
Veterinary Centre	50	50										
Vaccine Production Labouratory	50	50										

Cont.

Contents of Projects	(Short-Term) Stage 1				(Medium-Term) Stage 2				(Long-Term) Stage 3			
	1	2	3	4	5	6	7	8	9	10	11	12
4) Machinery services												
Agricultural Association	10	10	10	10	10	10	10	10	10	10		
Irrigation Association	10	15	15	15	15	15	15					
Livestock Association	10	10	10	10	10	10	10	10	10	10		
3. Processing & Distribution												
1) Slaughter slab	10	20	20	20	20	10						
2) Slaughter house	50	50										
3) Milk Collection Centre	25	25	25	25								
4) Livestock market	10	20	20	20	20	10						
5) Cereal warehouse	10	20	20	20	20	10						
6) Rice processing Facility		10	10	10	10	10	10	10	10	10	10	
7) Collection centre	10	20	20	20	20	10						
8) Rehabili. of Masaka F.F	50	50										
4. Rural Social Infrastructure												
1) Water supply												
Borehole	10	20	20	10	10	10	10	10				
Spring	20	30	30	20								
2) Feeder roads												
Establishment (IV)	10	20	20	10	10	10	10	10				
Improvement (I-IV)	20	20	20	20	20							
3) Education												
Primary school	10	10	10	10	10	10	10	10	10	10		
Secondary school	10	10	10	10	10	10	10	10	10	10		
Community centre(Health C.)	10	20	20	20	20	10						
4) Electrification												
Establishment(11kv-240v)	10	10	10	10	10	10	10	10	10	10		
5. Integrated Development Centre												
1) IDC (establishment)	50	50										
2) IDSC (establishment)	50	50										
3) DAO (improvement)	50	50										
4) DVO (improvement)	50	50										
5) DCO (improvement)	50	50										

Figure 8.1.5.1 Responsibility for Implementation of Projects



8.2 Management and Maintenance

Proper systems of management and maintenance are required to ensure that facilities are used effectively and maintained in good condition at all times. The plan has been formulated for the facilities categorized into agricultural infrastructure, agricultural support, processing and distribution, rural social infrastructure and executive bodies.

1) Agricultural infrastructure facilities

Development of agricultural infrastructure includes farmland (grassland) development/ improvement, small-scale irrigation, paddy field development in wetlands, and livestock husbandry facilities. Maintenance procedures will be tailored to the size, use and public benefit of specific facilities. Facilities with a highly public nature (major irrigation works and livestock facilities) will be operated by IAs and LAs set up for the purpose. On smaller farms and grasslands, individual farmers will be responsible for maintenance as part of their normal farming routine. Rural organizations such as AAs will involve train farmers in maintenance of farm -level facilities such as farm roads and contour ditches.

Public facilities such as small-scale irrigation facilities, wetland utilization facilities and livestock facilities with a large number of users require correspondingly more work for maintenance. As maintenance standards are directly linked to life span and repair costs, it is crucial that agricultural organizations train and hold their own maintenance experts among their members to direct operations carried out by all members. Selected representatives from each organization will be responsible for maintenance. Administration, machinery purchase and repair costs will be met through membership fees.

2) Agricultural support

Agricultural support covers such fields as research, extension, animal breeding and hygiene and farm machinery services. Research and extension activities will, as far as possible, use existing facilities, maintenance of which will be the responsibility of existing organizations. Livestock will be upgraded by introducing new breeds, rehabilitating artificial breeding centres (ABC), rehabilitating and constructing artificial insemination sub-centres (AISCs) and veterinary centres (VCs). LAs will lend out superior heifers to individual farmers for breeding improvement and collect the resultant heifer calves along the way.

New and renovated livestock related facilities are to be operated by IDS in MAAIF, due to the high standard of performance and maintenance required. IDC will cover these costs by levying charges on users. AAs, IAs and LAs will be provided with machines required for farm work and transportation, to be used and maintained by members of their associations. Rental charges will be levied to cover administration, repair and upkeep expenses.

3) Processing and distribution facilities

New agricultural product collection centres (APCCs) provided with multiple functions will be established to redress the current constraints involved in distribution. New livestock produce processing and distribution facilities will be built to deal with the incremental production. Due to the public nature of APCCs they should be administrated by farmers association such as UNFA entrusted by IDSCs. Livestock related facilities, on the other hand, are to be handled by cooperatives.

4) Rural social infrastructure

Owing to the technical level and costs involved, water supplies work on feeder roads, education, health and electrification will be administered by the relevant public bodies in each District in accordance with existing practices. A portion of cost will be charged to the users.

5) Executive bodies

IDC and IDSCs will be responsible for executing the Master Plan, supervising the revamped DAOs, DVOs and DCOs.

Table 8.2.1 shows maintenance required at major facilities and the organizations responsible.

Table 8.2.1 Management and Maintenance Plan for Main Facilities

Field and Facilities	Institutions for maintenance	Major facilities of maintenance
1. Agricultural Infrastructure		
1) Farm land (reclaimed & improved)	Agricultural Association(AA)	Major farm roads and Contour ditches
2) Grassland (developed & improved)	Livestock Association(LA)	Farm roads, Water, Fences and Grasslands
3) Small-scale irrigation scheme	Irrigation Association(IA)	Major irrigation facilities
4) Wetland utilization scheme	ditto	Major irrigation/Drainage facilities
5) Livestock facility	LA	Water,Dips and Fences
2. Agricultural Support		
1) Research		
(1) National Agricultural Research Organization (NARO) Headquarter	NARO	Buildings and Equipment
(2)Kawanda A.R.I.	KARI	ditto
(3)Namulonge A.A.R.I.	NAARI	Buildings,Equipment and Roads
2) Extention		
(1)Bukasala agri. college	Bukalasa agri.college	Buildings, Equipment and roads
(2)DFI (Established & rehabilitated)	DFI	ditto
(3)Branch extension offices	Extension office	Buildings and Equipment
3) Animal improvement		
(1)Breed importation	LA	Cattle
(2)Artificial Breeding Centre(ABC)	ABC	Buildings,Equipment and Bulls
(3)Artificial Insemination Sub-Centre	ditto	Buildings and Equipment
(4)Veterinary Centre	DVO	ditto
4) Machinery service		
(1)Agricultural machinery centre	AA	Agricultural machines (Tracters,Ploughs,etc.)
(2)Paddy machinery centre	IA	Paddy cultivation related machines (Tractors,Trucks & Rice mills)
(3)Livestock machinery centre	LA	Livestock industry machines (Tractors,Ploughs,mowers,etc.)

Cont.

3. Processing & distribution		
1) Slaughter slab	Cooperative entrusted by IDC	Facilities
2) Slaughter house	Cooperative	ditto
3) Livestock market	ditto	ditto
4) Cereal warehouse	ditto	ditto
5) Agricultural product collection centre (APCC)	ditto	ditto
4. Rural & social infrastructure		
1) Borehole	Local Community	Hand pumps
2) Spring	ditto	Springs
3) Primary School	MES	Facilities
4) Secondary school	ditto	ditto
5) Feeder road	MLG	Feeder roads and Machines
6) Community centre	MWTC	Facilities
7) Electrification	MWTC	ditto
5. Integrated development centre(IDC)		
1) IDC	IDC	Facilities
2) IDSC	ditto	ditto
3) DAO,DVO,DCO	DAO,DVO,DCO - IDC	ditto

9. Project Evaluation

9.1 Environmental Impact Assessment (EIA)

9.1.1 Criteria of EIA

The EIA was implemented based on the following criteria which dominate the success of environmental conservation within Study Area.

i) sustainable agriculture

ii) conservation of natural resources

iii) social cohesion

The projects which require the EIA among the all projects formation in the Master Plan are two types.

The one is land expansion type such as farmland and grassland reclamation and paddy field development. The other is land improvement type such as farmland and grassland improvement, and irrigation.

Each projects was planned in accordance with the criteria in order to meet the EIA requirement that is prerequisite for the implementation of projects. At the same time, the establishment of agricultural support institutes (such as research, extension and agricultural credit) and processing and distribution system can assure the achievement of the EIA.

9.1.2 Sustainable Agriculture

Two factors — soil conservation and economics (profitability) — determine sustainability, which may be achieved through biological and/or engineering methods.

The plan calls for the continuation of traditional farm management methods (mixed cropping, inter-cropping, crop rotation), together with the regulated use of organic matter and agro-chemicals suited to soil, topography and crop types. Further, bush clearing provides more grazing area within grasslands. Fences and water supplies are required for controlling grazing density and frequency, thereby reducing the burden on grasslands.

All these policies would ensure soil conservation supported by suitable engineering structures such as contour ditches.

Minimal earth movement, leveling within small plots only and high ground water levels all combine to maintain soil fertility in wetlands.

As far as wetland utilization and small-scale irrigation schemes are concerned farm income should be increased through the introduction of rice and horticulture crops which have high market values, and project costs should also be decreased through the simplification of facilities and participation of farmers in implementation of the projects.

9.1.3 Conservation of Natural Resources

Forests, wetland wildlife and water resources should be conserved as natural resources. Existing forests (including forests reserves and private forests) are excluded from the land use plan. Tree planting on farms, grasslands, homesteads and marginal lands is encouraged for soil conservation and to meet demand for fuelwood.

In terms of preserving wetland plant and wildlife, paddy development is planned as a suitable development model for wetlands in order to control current random or haphazard development, keeping the extent of such paddy development low at 1.4% of the total wetland land area. Areas that are to be so developed and areas to be left as wetlands are clearly distinguished with thorough consideration given to both aspects of development and conservation through the participation of local population.

9.1.4 Social and Environmental Issues

Disparities in income distribution and the control of epidemics in wetland reclamation and development are social environment issues that are also addressed in the Master Plan. Steps to remedy the former will be realized through the appropriate participation of the IDC and such farmers' associations as AAs, IAs and LAs in implementation. The latter will be dealt with through careful supervision and prompt counter measures.