

8. ECONOMIC EVALUATION AND FINANCIAL ANALYSIS

8.1 Economic Evaluation

8.1.1 Basic Conditions and Assumptions

The project evaluation was conducted on the basis of the following basic conditions and assumptions:

- 1) The useful life of the Project is 50 years from project implementation;
- 2) For calculation of the Economic Internal Rate of Return (EIRR), only direct benefits are counted, and no indirect and intangible benefits are taken into account;
- 3) The exchange rate is US\$ 1.00 = Ghanaian Cedi 1,700 (as of December 1996);
- 4) Constant prices at 1996 level are used in the economic evaluation;
- 5) For the financial evaluation, no land acquisition cost is included in the project cost; and
- 6) The financial project cost includes all labour costs required for the construction works, and no consideration is paid to the adoption of the farmers' participatory system which does not pay labour charge.

8.1.2 Economic Project Cost

The Project costs for economic evaluation consist of direct construction cost, cost for O&M equipment, administrative cost, cost for engineering services, and physical contingency. The construction cost for training facilities and O&M equipment used in the whole project area is divided among the five projects according to each project size. The Project costs thus estimated are summarised as follows:

	Total Economic Costs (Cedis Million)	Economic Costs per Ha (US\$/ha)
Ashaiman	810	8,500
Aveyime	2,163	13,400
Kpando-Torkor	4,983	18,900
Mankessim	2,712	18,500
Okyercko	2,057	14,900
Total	12,725	15,800

Note: 1996 Constant Prices US\$ = Cedis 1,700

8.1.3 Economic Project Benefits

The irrigation benefits will accrue primarily from increased crop production owing to stable irrigation water supply. The benefits would start to accrue from the second year after completion of the rehabilitation works, and would gradually increase up to the 5th year. The annual irrigation benefits at the full development stage of each project are summarised as follows:

	Total Benefits (Cedis million)	Benefits per Ha (US\$/ha)
Ashaiman	275	2,890
Aveyime	486	3,010
Kpando-Torkor	1,212	4,600
Mankessim	565	3,860
Okyereko	357	2,590
Total	2,895	3,600

8.1.4 Economic Evaluation

In order to compute EIRR, Benefit-Cost Ratio (B/C) and Benefit minus Cost (B-C), the annual economic costs and benefits flows were firstly prepared, and EIRR of each project was calculated as summarised below. EIRRs of the five projects were estimated to be from 13.0% to 23.2%. The Ashaiman project indicates the highest EIRR, followed by the Kpando-Torkor project. In addition, B/C and B-C at a discount rate of 10% were also estimated and the results are summarised below:

Projects	EIRR (%)	B/C *	B-C * (Cedis million)
Ashaiman	23.2	2.46	1,112
Aveyime	15.7	1.53	1,041
Kpando-Torkor	16.9	1.61	2,849
Mankessim	14.5	1.38	1,065
Okyereko	13.0	1.28	530
Whole Project	16.0	1.55	6,597

* Discount rate: 10%

8.1.5 Sensitivity Analysis

Project sensitivity in terms of EIRR was analysed in respect of changes in project costs and benefits. The result of analysis is summarised below.

Cost	(Unit: %)					
	Increased	Benefit		Benefit 1 Year Delayed	Benefit 1 Year Delayed & Decreased	
		Decreased			-10%	-20%
	0%	-10%	-20%			
Ashaiman						
0%	23.2	21.2	19.2	19.9	18.4	16.7
+10%	21.5	19.7	17.8	18.6	17.1	15.6
+20%	20.1	18.3	16.5	17.4	16.1	14.6
Aveyime						
0%	15.7	14.1	12.5	13.8	12.5	11.2
+10%	14.4	13.0	11.5	12.8	11.6	10.3
+20%	13.4	12.0	10.6	11.9	10.8	9.5
Kpando-Torkor						
0%	16.9	15.2	13.5	14.7	13.3	11.9
+10%	15.5	14.0	12.3	13.6	12.3	10.9
+20%	14.4	12.9	11.4	12.7	11.5	10.1
Mankessim						
0%	14.5	13.0	11.3	12.8	11.5	10.1
+10%	13.3	11.9	10.3	11.8	10.5	9.2
+20%	12.3	10.9	9.5	10.9	9.7	8.5
Okyereko						
0%	13.0	11.6	10.3	11.6	10.5	9.3
+10%	11.9	10.7	9.4	10.7	9.6	8.5
+20%	11.0	9.8	8.6	9.9	8.9	7.8
Whole Project						
0%	16.0	14.4	12.8	14.0	12.7	11.3
+10%	14.7	13.2	11.7	13.0	11.8	10.4
+20%	13.6	12.2	10.8	12.1	10.9	9.7

As seen in the above table, the Ashaiman project is economically viable even if the costs increase 20% and the benefits decrease 20%, while the Okyereko project has no economic viability under the same condition as the Ashaiman project.

8.2 Financial Analysis

In order to assess the capacity to pay of farmers for ISC, an analysis of their farm budget was made under the future "with project" condition. The result of analysis is as follows:

Farm Budget - With Project

(Unit: Cedis 1,000/farmer)

Items	Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko
(Holding Size: ha/farmer)	(0.45)	(1.00)	(0.40)	(0.40)	(0.60)
1) Gross Income	4,761	9,037	5,221	4,243	5,730
- Farm Income	3,398	7,139	4,208	3,596	4,505
- Non farm income*1	1,003	702	694	365	536
- Loans	360	1,196	319	282	689
2) Gross Outgoing	4,478	5,989	4,002	3,487	4,955
- Production Cost*2	695	1,962	703	555	1,219
- Living Expenses*3	3,355	2,604	2,919	2,596	2,916
- Loan Repayment	428	1,423	380	336	820
3) Capacity to Pay	283	3,048	1,219	756	775
Annual Repayment of Irrigation Service Fees					
Annual O&M Cost*4	24	284	170	162	124
Annual Replacement Cost*5	120	620	509	516	287
Total	144	904	679	678	411
% to Capacity to Pay					
Annual O&M Cost	8%	9%	14%	21%	16%
Annual Replacement Cost	42%	20%	42%	68%	37%
Total	51%	30%	56%	90%	53%

*1 50% decrease from present condition.

*2 Excluding family labour force.

*3 30% up from present condition.

*4 Excluding O&M cost of the PM Offices.

*5 Procurement cost / Useful life

Note: 1996 Constant Prices

The analysis was made on the following conditions: i) the non-farm income will decrease 50% from the present condition due to the introduction of labour intensive farming; ii) the living expenses will increase 30% from the present condition; and iii) 1996 constant prices were taken in the analysis.

The result of analysis shows that the capacity to pay or net reserve of farmers would increase remarkably in the future "with project" condition compared to the present condition. As seen in the above table, the annual irrigation service fees occupy 30 - 50% of their capacity to pay, except for the Mankessim project. From this result, it may be concluded that the payment of annual irrigation service fees after implementation of the Project will be possible for the farmers in the 4 projects, excluding Mankessim. In the case of the Mankessim project, the payment of irrigation service fees will hinder further improvement and growth of their living standards, though the amount of service fees is within their capacity to pay. It will be necessary therefore to give some subsidy to the farmers in the Mankessim project.

In addition, the farmers' capacity to pay of the irrigation service fees was studied on the

basis of their intention on the amount to be paid. At a public meeting, the following amounts were accepted by the farmers.

Allowable Amount of Irrigation Service Fees
accepted by the Farmers at Public Meeting

	Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko
Amounts accepted by the farmers at public meeting*					
Cedis/ha/season	100,000	263,500	375,000	250,000	100,000
Cedis/year/farmer	90,000	527,000	300,000	200,000	120,000
Holding size of a farmer (ha)	0.45	1.00	0.40	0.40	0.60

* November 1996

As seen in the above table, all irrigation service fees estimated by the Study Team are over the amounts accepted by the farmers. Although the result of farm budget analysis shows a possibility to pay full amount of irrigation services fees by all farmers, the societies will have a difficulty to collect these fees fully from the farmers. Therefore, it will be necessary to fill the gap by the government subsidy.

In order to estimate reasonable amount of irrigation service fees and the Government's subsidy from the standpoint of the capacity to pay of farmers, farmers' intention and the Government's development budget, the following case studies were made:

- Case-1: All replacement costs are subsidised by the Government, and farmers pay only annual O&M costs.
- Case-2: Farmers pay the allowable amounts accepted at the public meeting
- Case-3: Farmers pay annual O&M costs and 30% of replacement costs
- Case-4: Farmers pay annual O&M costs and 50% of replacement costs

The details of the case studies are presented in Section 3.3 in Annex-J. Based on the result of the studies, it is recommended to adopt the following subsidy for each project, though the amount of subsidy should be decided by the Government.

	Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko
Holding Size (ha/farmer)	0.45	1.00	0.40	0.40	0.60
Capacity to Pay of Farmers (Cedis 1,000/year/farmer)	283	3,048	1,219	756	775
Cases adopted	Case-4	Base	Case-4	Case-3	Case-4
Proportion of subsidy					
Farmers					
O&M Cost	100%	100%	100%	100%	100%
Replacement Cost	50%	100%	50%	30%	50%
Subsidy					
O&M Cost	0%	0%	0%	0%	0%
Replacement Cost	50%	0%	50%	70%	50%
Irrigation Service Fees (Cedis 1,000/year/farmer)					
O&M Cost	24	284	170	162	124
Replacement Cost	60	620	255	155	144
Total	84	904	425	317	268
% to Capacity to Pays	30%	30%	35%	42%	35%
Allowable Amounts of Farmers *1 (Cedis 1,000/year/farmer)	90	527	300	200	120

*1 Amounts accepted by farmers at public meeting.

Note: 1996 Constant Prices

The farmers in the Aveyime project area will have a big payment capacity after implementation of the rehabilitation project, while the Mankessim farmers will have a small capacity. It is recommended that full amount of irrigation service fees including annual O&M costs and replacement costs will be imposed on the farmers in the Aveyime project, and a considerable amount of subsidy will be provided to the farmers in Mankessim. As for the other 3 projects, a half of replacement cost is to be subsidised by the Government in order to secure successful O&M by the societies.

With the exception of the Aveyime project, all estimated irrigation service fees are over the allowable amounts accepted by the farmers at the public meeting, but these amounts are negotiable with farmers. They have judged these allowable amounts mainly based on the crop income obtained from the present irrigation farming in the project areas. However, the projects will provide complete and upgraded irrigation systems with powerful extension services to the farmers, and their crop incomes under the projects will increase over the farmers' estimates made on the basis of the present condition. The project executing agency should explain to them to get their full understanding on the irrigation service fees.

If the above government subsidy is provided to the projects, as is estimated in the following table, its amount would account for 3% - 20% of the Government's development expenditures for agriculture (including forestry and fisheries) or 0.2% - 1.2% of total development expenditures for economic services (see Table-12), and it may be possible for the Government to invest this amount.

Government Subsidy to be Required

(Unit: Cedis million)

Year*1	Government Subsidy (1996 Constant Prices)						Government's Development Expenditure*2 1994 Constant Prices		Proportion of Subsidy (%)
	Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko	Total	Agriculture*3	Whole*4	
	Case-4	Base	Case-4	Case-3	Case-4				
1	-	-	-	-	-	-	5,600	88,800	-
:	:	:	:	:	:	:	:	:	:
13	-	-	-	-	-	-	5,600	88,800	-
14	59	-	-	108	-	166	5,600	88,800	3%
15	-	-	-	-	-	-	5,600	88,800	-
16	-	-	-	-	-	-	5,600	88,800	-
17	-	-	-	-	-	-	5,600	88,800	-
18	-	-	-	-	-	-	5,600	88,800	-
19	-	-	-	520	91	611	5,600	88,800	11%
20	-	-	513	-	-	513	5,600	88,800	9%
21	-	-	-	-	-	-	5,600	88,800	-
22	-	-	-	-	-	-	5,600	88,800	-
23	-	-	-	-	-	-	5,600	88,800	-
24	81	-	-	668	191	939	5,600	88,800	17%
25	-	-	944	-	-	944	5,600	88,800	17%
26	-	-	-	-	-	-	5,600	88,800	-
:	:	:	:	:	:	:	:	:	:
33	-	-	-	-	-	-	5,600	88,800	-
34	66	-	-	828	208	1,102	5,600	88,800	20%
35	-	-	1,106	-	-	1,106	5,600	88,800	20%
36	-	-	-	-	-	-	5,600	88,800	-

*1 Year in order after commencement of the rehabilitation projects.

*2 Annual development expenditure for economic services.

Source: (1) Quarterly Digest, Ministry of Food and Agriculture, March 1995

(2) The State of the Ghanaian Economy in 1994, University of Ghana, July 1995.

*3 Including agriculture, forestry and fisheries, and indicating the average amount from 1992 to 1994.

*4 Total average amount of economic services, and an average amount from 1992 to 1994.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

The Economic Internal Rate of Return (EIRR) of the priority projects ranges from 13% to 23.2%, and even in the case of the whole Project, it is 16%. It can be said that the Project is economically viable from the viewpoint of national economy, and technically feasible. Through the feasibility study, the Project is justified as summarised below:

- (a) The function and productivity of each of the projects will completely be recovered by rehabilitation of all the project facilities, and these reactivated projects will contribute to the achievement of key policies stipulated in the Medium Term Agricultural Development Programme (MTADP) of Ghana.
- (b) The farm economy will remarkably be improved and also stabilised as compared with the “without project” conditions. From the financial point of view, large benefit will accrue for the beneficiary farmers in each of the project areas after implementation of the Project.
- (c) The present irrigation area will be expanded to 473 ha in total under the projects rehabilitation plan, and the number of beneficiary farmers will increase to 950 households in the whole project area.
- (d) The Project would create a demand for farm labour due to the increased farming activities, more intensive land use, and increase in agricultural production. In addition, the construction of the Project would increase employment opportunities in each project area. All these would contribute to activating the regional economy. Further, the employees under the Project will gain more experience, technical know-how and skills in various working fields, and these would be useful for similar developments in the rural area.
- (e) After implementation of the Project, income of farmers in the project areas is expected to increase considerably as a direct result of the increase in crop production. Such increase in income would contribute to improving farmers’ living standards.
- (f) Future marketing activities in the project area will expand as compared with the present condition, because more farm products could be marketed by the farmers, and the proportion of sales to consumption would also increase.

In addition, the following conclusions on the project sustainability were obtained. The farmers’ self-reliance in project implementation will also be one of the essential factors to achieve the project sustainability. At the public meetings held at each project site, the farmers

showed some self-reliance, in particular with regard to the farmers' participation in the rehabilitation works, land acquisition in the project areas, and final levelling of the extension area.

As for O&M by the farmers themselves, all farmers have agreed with this as well as the increase in irrigation services fees after the rehabilitation. They have a positive attitude toward the project implementation, and it may be said that such farmers' attitude will be very helpful to achieve the sustainable O&M of the Project. Moreover, all farmers have accepted the strengthening plan of the farmers' societies necessary for handing-over of O&M, and the farmers' positive participation in its implementation is expected.

9.2 Recommendations

Because the projects rehabilitation will contribute to the national food security improvement, and realistic and practical approach to the achievement of the key policies set forth in MTADP, it is recommended to implement the Project as early as possible.

In addition, GIDA has a programme to transfer the O&M functions of the existing irrigation projects step by step to the farmers' organisations after reactivation of these existing projects. The key measures for successful promotion of this programme are to rehabilitate the deteriorated existing irrigation facilities as the first step and to establish a suitable water management plan and O&M system of the projects together with strengthening of the farmers' organisations through training and support from the government institutes concerned.

In order to meet these purposes and to achieve the sustainable O&M of the Project, the executing agency should undertake the following activities:

Activities up to the end of the rehabilitation works

- 1) Training of staffs involved in all of the project implementation stages including supervision of rehabilitation works, handing-over of O&M, support services for O&M, extension of irrigation farming, strengthening of the farmers' societies, improvement of marketing and credit, etc.
- 2) Training of the farmers and leaders of the societies in the project area
- 3) Strengthening of the organisational structure and staffing of the executing agency
- 4) Strengthening of the farmers' societies
- 5) Strengthening of the extension activities for irrigation farming

Activities after the rehabilitation works

- 1) Continuous support services for O&M, irrigation farming, and activities of the farmers' societies
- 2) Periodical monitoring and evaluation of the farmers' O&M works

- 3) Follow-up training of the farmers and staffs concerned
- 4) Financial support to the farmers for replacement of equipment

These are all prerequisite factors not only for achievement of the Project sustainability but also for implementation of the Project itself. For the activities up to the end of the rehabilitation works from items 1 to 5, the executing agency should start them immediately after the commencement of the rehabilitation works. In addition, it is recommended to prepare manuals for O&M of irrigation facilities as well as for irrigation farming practices for each crop proposed in this plan by the end of the rehabilitation works.

For the projects having pumping irrigation facilities, a considerable amount of replacement cost for their equipment will be required. However, repayment of this cost by the farmers will impede the improvement and growth of their living standards, even if they will have a good income from irrigation farming. It will be necessary that the Government give some subsidies on this replacement cost to the farmers.

TABLES

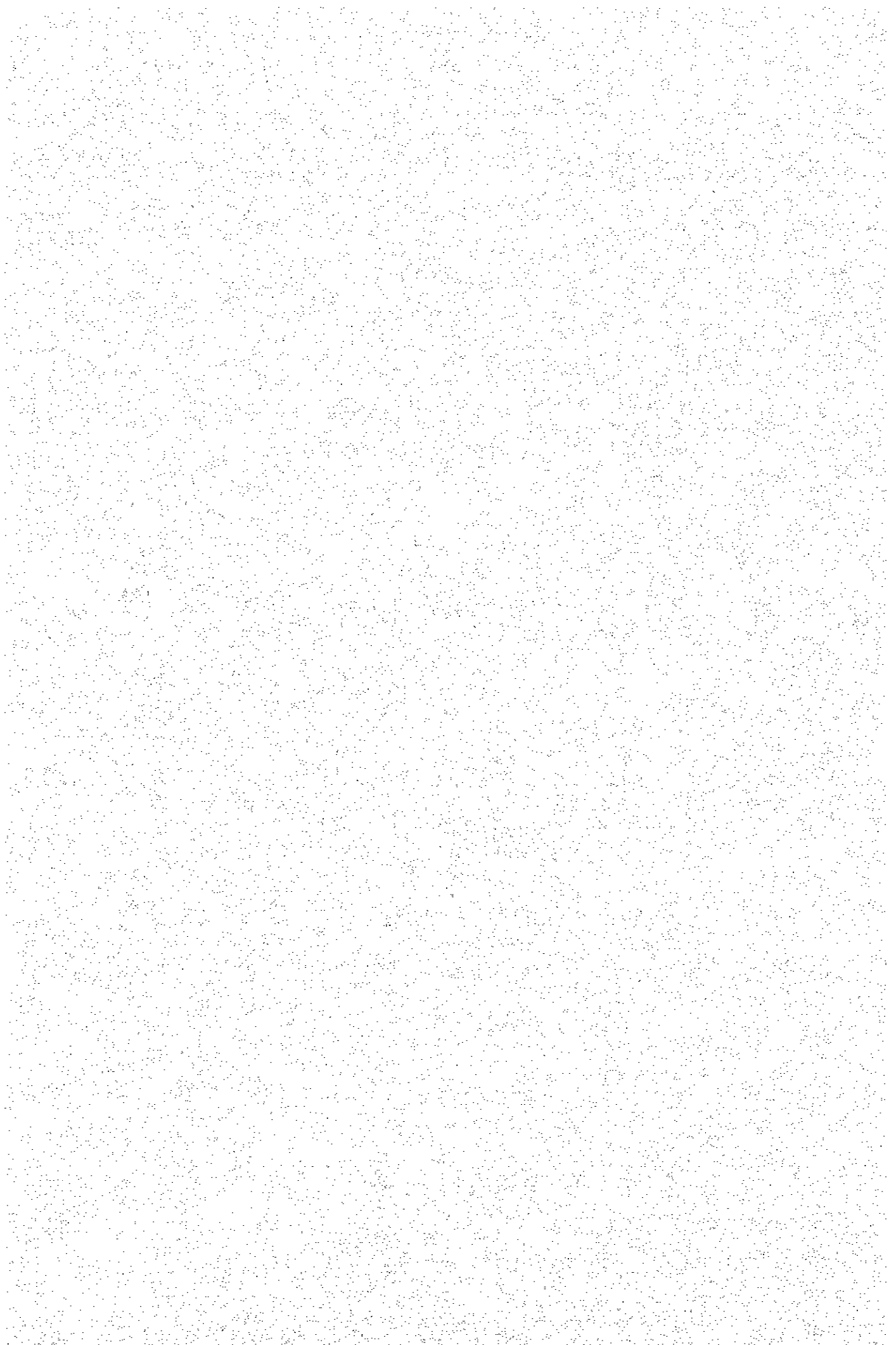


Table-1 Present Conditions of the Projects (1/2)

Description	Ashaiman	Aveyime	Kpando-Torkor
1 Administration			
(1) Region	Greater Accra	Volta	Volta
(2) District	Tema	Tongu	Kpando
2 Planned command area*	148 ha	150 ha	356 ha
3 Actually developed area*	130 ha	63 ha	40 ha
4 Area to be expanded	18 ha	87 ha	316 ha
5 Construction activities			
(1) Commencement	1966	1962	Not available
(2) Completion	1968	1975	1976
6 Water source	Ashaiman reservoir	Volta river	Volta lake
7 Intake method	Butterfly valve	Pumps	Pumps
8 Irrigation and drainage facilities	Dam (5.8 million m ³) Main canal (unlined, L=4.8 km)	Main canal (concrete, L=0.4 km) Lateral canals (concrete, L=3.0 km)	2 movable centrifugal pumps Main pipeline (L=0.6 km)
(Details are given in Table H.3.1)	Laterals (unlined, L=11.0 km) Main drain (unlined, L=3.0 km) Lateral drains (unlined, L=6.0 km) Structures (577 nos.)	Main drain (unlined, L= 1.0 km) Lateral drains (unlined, L= 3.0 km) Structures (43 nos.)	Lateral pipeline (L= 0.2 km) 60 sprinkler system 30 rain guns
9 Project organization	Site officer (1 no.) Extension officer (1 no.) Gate operator (1 no.) Watchman (1 no.)	Project manager (1 no.) Agri. extension worker (1 no.) Agronomist (1 no.) Mechanics (1 no.) Watchman (2 nos.) Cleaner (1 no.)	Project manager (1 no.) Pump attendant (1 no.) Watchman (1 no.)
10 Irrigation period	April to December	April to July	November to January
11 Water distribution method	10.5 hrs. per day and Continuous supply	8 hrs from 7:00 to 15:00 per day and 10 days interval	6 hrs. per day and 2 to 3 days rotation
12 Irrigated crops	Paddy, Okra, Tomato	Paddy	Okra
13 Major problems on irrigation drainage	(a) Deterioration of canals and structures. (b) Water shortage. (c) Much sediment and grasses in drains. (d) Concentration of salinity in parts of the project area. (e) Lack of rice mill, dry yard and storage facilities. (f) Insufficient space of O & M office. (g) No vehicle for O & M.	(a) Deterioration of pumps (b) Leakage of canals (c) No measuring device (d) Much grasses and sediments in drains. (e) No water supply record.	(a) Deterioration of pumps and sprinkler system. (b) No water management manual. (c) No O & M manual. (d) No definite irrigation schedule based on cropping pattern and water requirement. (e) No water supply record. (f) Insufficient number of O & M staff. (g) Poor O & M office. (h) No vehicle/motor cycle for O & M. (i) Deterioration of tractor for carrying movable pumps.

Table-1 Present Conditions of the Projects (2/2)

Description	Mankessim	Okyereko
1 Administration		
(1) Region	Central	Central
(2) District	Mfantsiman	Gomoa
2 Planned command area*	256 ha	111 ha
3 Actually developed area*	17 ha	40 ha
4 Area to be expanded	239 ha	71 ha
5 Construction activities		
(1) Commencement	1974	1976
(2) Completion	1981	1988
6 Water source	Apropong reservoir	Okyereko reservoir
7 Intake method	Intake valve and pumps	Intake valve
8 Irrigation and drainage facilities (Details are given in Table H.3.1)	Dam (5.7 million m ³) Intake gate/valve 2 pumps Main pipeline (L = 0.9 km) Lateral pipeline (L = 0.4 km) 45 sprinkler system	Dam (2.71 million m ³) Main canal (lined, L=1.3 km) Laterals and sub-laterals (L=2.8 km) Main drain (unlined, L=2.0 km) Lateral drain (unlined, L=2.0 km) Structures (74 nos.)
9 Project organization	Project manager (1 no.) Topo-surveyor (1 no.) Driver/Mechanic (1 no.) Pump Attendant (1 no.) Watchman (1 no.)	Project manager (1 no.) Gate operator (1no.)
10 Irrigation period	December to April	September to January
11 Water distribution method	6 hrs. per day for 3.4 ha and 5 days rotation	12 hrs. for 2 laterals 10 days rotation
12 Irrigated crops	Okra, watermelon, garden egg	Paddy
13 Major problems on irrigation drainage	(a) Deterioration of pumps and sprinkler system. (b) Severe inundation by flood every year. (c) No water management manual. (d) No O & M manual. (e) No definite irrigation schedule based on cropping pattern and water requirement. (f) No water supply record. (g) Deterioration of O & M office. (h) Damage of bridge for spillway. (i) Much grasses in spillway drain.	(a) Deterioration of canals and structures. (b) Water shortage. (c) Much sediment and grasses in drains. (d) Concentration of salinity in parts of the project area. (e) No water management manual. (f) No O & M manual. (g) No definite irrigation schedule based on cropping pattern and water requirement. (h) Insufficient number of O & M staff. (i) Deterioration of O & M office. (j) No vehicle for O & M.

Table-2 Rehabilitation Plan for Respective Projects

Facilities	Ashaiman	Aveyime	K.-Torkor	Mankessim	Okyereko
1 Pump station					
(1) Pump	- no(s)	5 no(s)	6 no(s)	5 no(s)	2 no(s)
(2) House	- no(s)	2 no(s)	2 no(s)	2 no(s)	1 no(s)
2 Irrigation system					
(1) Canal					
(a) Head race	- km	0.4 km	- km	- km	- km
(b) Main	1.8 km	3.4 km	- km	- km	2.5 km
(c) Secondary	- km	0.3 km	- km	- km	0.3 km
(d) Lateral	4.6 km	7.8 km	- km	- km	6.7 km
(2) Pipeline system					
(a) Main	- km	1.3 km	2.9 km	1.7 km	- km
(b) Secondary	- km	- km	2.5 km	1.5 km	- km
(c) Lateral	- km	- km	10.8 km	6.3 km	- km
(e) Sprinkler	- sets	7 sets	66 sets	36 sets	- sets
3 Drainage system					
(1) Main	3.5 km	1.3 km	- km	- km	1.8 km
(2) Secondary	- km	1.8 km	- km	- km	1.7 km
(3) Lateral	7.2 km	12.3 km	- km	- km	7.6 km
(4) Collector	- km	- km	4.7 km	4.9 km	- km
4 Related structure					
(1) Outlet	- no(s)	1 no(s)	no(s)	no(s)	- no(s)
(2) Distribution box	- no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(3) Inlet	- no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(4) Division structure	1 no(s)	1 no(s)	- no(s)	- no(s)	- no(s)
(5) Turnout	11 no(s)	36 no(s)	- no(s)	- no(s)	19 no(s)
(6) Check	11 no(s)	25 no(s)	- no(s)	- no(s)	19 no(s)
(7) Measuring device	13 no(s)	38 no(s)	- no(s)	- no(s)	19 no(s)
(8) Syphon	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(9) Drop	130 no(s)	3.0 no(s)	- no(s)	- no(s)	73 no(s)
(10) Energy dissipator	1 no(s)	- no(s)	- no(s)	- no(s)	- no(s)
(11) Culvert	8 no(s)	15 no(s)	- no(s)	- no(s)	6 no(s)
(12) Field outlet	140 no(s)	238 no(s)	- no(s)	- no(s)	203 no(s)
(13) Cross drain	11 no(s)	14 no(s)	20 no(s)	28 no(s)	6 no(s)
(14) Causeway	2 no(s)	- no(s)	5 no(s)	- no(s)	2 no(s)
(15) Drop for drain	1 no(s)	- no(s)	- no(s)	- no(s)	- no(s)
(16) Protection for spillway	700 m ²	- m	- m ²	- m ²	1,200 m ²
5 Farm road					
(1) Main	1.6 km	2.9 km	3.3 km	0.9 km	2.2 km
(2) Lateral	4.0 km	6.0 km	10.1 km	8.9 km	7.6 km
(3) Access road	- km	- km	4.3 km	- km	- km
6 Project building					
(1) Office	- no(s)	1 no(s)	1 no(s)	1 no(s)	1 no(s)
(2) Store	- no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(3) Garage	- no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(4) Dry yard	- no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(5) Sorter house	1 no(s)	1 no(s)	2 no(s)	1 no(s)	1 no(s)
(6) Dormitory for officer	2 no(s)	- no(s)	- no(s)	no(s)	- no(s)
(7) Lecture hall	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(8) Dormitory for farmers	1 no(s)	- no(s)	- no(s)	- no(s)	- no(s)
(9) Fence for office	500 m	- no(s)	- no(s)	- m	- m
7 Electric line	- km	2.6 km	8.0 km	3.5 km	8.0 km
8 Green belt	- km	- km	9.6 km	2.5 km	- km
9 Supplymentary water supply facilities					
(1) Weir	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(2) Head race	- km	- km	- km	- km	0.2 km
(3) Pipe line	- km	- km	- km	- km	0.8 km
(4) Outlet	- no(s)	- no(s)	- no(s)	- no(s)	1 no(s)
(5) Chute	- km	- km	- km	- km	0.3 km

Table-4 Training Courses and Contents for O & M and Strengthening of Farmers' Society

Training Course	Period of Course (day)	Persons/ Course (Person)	Times/ Year (Time)	Trainees	Contents of Training
Course-A	2	4 - 5	1	Senior officers of GIDA and other agencies involved in O&M (Director, Deputy Director, department heads, etc.)	<ul style="list-style-type: none"> - Outline of O&M and strengthening of the societies, - Outline of agricultural support services, - Farmers' participant management system, - Role of women in development
Course-B	6	20	2	Officers involved in O&M (Regional managers, officers of head office, PM, production officers, technical officers, etc.)	<ul style="list-style-type: none"> - Estimation of water requirement - Preparation of irrigation schedule, - O&M of facilities and handing over process, - Strengthening of the farmers' societies, - Duties of GIDA and the farmers' societies for O&M - Monitoring system, measuring and surveying methods, - Administrative services to the farmers, - Promoting women in development, etc.
Course-C	12	20 - 30	3	Farmer's level including leaders of the farmers' societies, gate keepers, pump attendants, mechanics, key farmers and informal rural leaders.	<ul style="list-style-type: none"> - O&M of facilities, water requirement, water delivery, etc. - Irrigation schedule and cropping calendar, - Management of the farmers' societies such as accounting, book keeping and auditing, - Articles and by-laws for O&M - Duties of GIDA and the farmers' society for O&M - Monitoring system, measuring and surveying methods, - Group loan, cooperative purchasing of farm inputs, etc.
Course-D	2	20	2	Officials involved in irrigation management in other agencies (extension officers of MOFA, officers of the Department of Cooperative at district level, Banks, etc.)	<ul style="list-style-type: none"> - Objectives and outline of O&M by the farmers' society, - Activities of farmers' society, - Required agricultural supporting services, - Promoting women in development, etc.
Course-E	2	20 - 30	1	Village chiefs, elder people in the village, etc.	<ul style="list-style-type: none"> - Outline of O&M by the farmers' society, - Organization and activities of the society, - Duties of GIDA and the farmers' societies, etc.

Note: The following-up training for specific items is conducted occasionally after handing over of O&M.

Table-5 Assessment of Probable / Potential Impacts (1/5)

(1) Ashaiman Project

Probable / Potential Impacts	Stage				Comments / Recommended Mitigation Measures
	Construction		Operation		
	without	with *1	without	with *1	
1 Soil erosion in and around the construction sites	3N	-	-	-	<ul style="list-style-type: none"> No fresh cut and embankment which can introduce the effect are not in the project works.
2 Alteration or destruction of the habit of flora and fauna	-	-	-	-	<ul style="list-style-type: none"> Unlikely
3 Damage to historic, cultural or religious area	-	-	-	-	<ul style="list-style-type: none"> No such site exists
4 Effects on farm land, existing facilities, houses, due to project works	3N	-	-	-	<ul style="list-style-type: none"> Quality and quantity of water flowing into the fish pond near dam wall might be effected. This effect will be eliminated by undertaking the proper management of waste water.
5 Deterioration of water quality in downstream	2N a-c-e	3N	2N a-c-e	3N	<ul style="list-style-type: none"> Liquid waste from concrete preparation works might be effused. Proper disposal of the liquid waste the shall be enforced thoroughly. IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. Proper water management taking agro-chemical input into consideration will be undertaking.
6 Health hazard from agro-chemical	-	-	2N a-c-e	3N	<ul style="list-style-type: none"> IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. The hazard will be minimized by proper handling way of chemical under proposed extension works.
7 Reduction of downstream flows that affect users of water	-	-	-	-	<ul style="list-style-type: none"> Present flow from project site into drain is quite low.
8 Increase of downstream flows affecting downstream ecology and/or community	-	-	2P a-d	2P a-d	<ul style="list-style-type: none"> Water quality of downstream will be improved by diffusion effect of the polluted water.
9 Land degradation in the project area due to erosion hazard	-	-	-	-	<ul style="list-style-type: none"> No such site exists
10 Land degradation in the project area due to salt-accumulation	-	-	2N a-d-e	2P a-d	<ul style="list-style-type: none"> Present salt-effected area will be reclaimed by irrigation farming because of establishment of proper drainage system.
11 Increased incidence of water borne diseases	-	-	3N	-	<ul style="list-style-type: none"> The infection from paddy field is hardly observed at present. Cropping intensity of paddy will not be increased with project. O&M works such as weeding canal and bund, and pesticide application which make snail's habitat decrease will be undertaken by farmers.
12 Increase of constructed-related employment opportunity	2P a-c	2P a-c	-	-	<ul style="list-style-type: none"> The construction works will provide temporary job opportunity to the villagers nearby.
13 Increase of crop production	-	-	1P a-d	1P a-d	<ul style="list-style-type: none"> The biggest positive effect of the project. This will be lead to higher living standard of the population.
14 Increase of agricultural-related employment opportunity	-	-	1P b-d	1P b-d	<ul style="list-style-type: none"> Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.

Remarks : *1 "with" indicates future condition with conservation measurements.

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- a : Direct
- b : Indirect
- c : Short term
- d : Long term
- e : Reversible
- f : Irreversible

The feature of impacts is indicated as follows:

1N Negative impact would be significant, a-c-e direct, short term, and reversible.

1P Positive impact would be significant, direct, a-c-e short term, and reversible.

The characteristics of insignificant impacts are not identified.

Table-5 Assessment of Probable / Potential Impacts (2/5)

(2) Aveyime Project

Probable / Potential Impacts	Stage				Comments / Recommended Mitigation Measures
	Construction		Operation		
	without	with *1	without	with *1	
1 Soil erosion in and around the construction sites	3N	-	-	-	<ul style="list-style-type: none"> No fresh cut and embankment which can introduce the effect are not in the project works.
2 Alteration or destruction of the habit of flora and fauna	-	-	-	-	<ul style="list-style-type: none"> Unlikely
3 Damage to historic, cultural or religions area	-	-	-	-	<ul style="list-style-type: none"> No such site exists
4 Deterioration of water quality in downstream	2N a-c-c	3N	2N a-c-c	3N	<ul style="list-style-type: none"> Liquid waste from concrete preparation works might be effused. Proper disposal of the liquid waste the shall be enforced thoroughly. IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. Proper water management taking agro-chemical input into consideration will be undertaking.
5 Decrease of crop production on construction phase	-	-	-	-	<ul style="list-style-type: none"> Irrigation facility completely does not work at present.
6 Health hazard from agro-chemicals	-	-	2N a-c-e	3N	<ul style="list-style-type: none"> IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. The hazard will be minimized by proper handling way of chemical under proposed extension works.
7 Increase of downstream flows affecting downstream ecology and/or community	-	-	-	-	<ul style="list-style-type: none"> Unlikely
8 Land degradation in the project area due to erosion hazard	-	-	-	-	<ul style="list-style-type: none"> No such site exists
9 Land degradation in the project area due to salt-accumulation	-	-	2N a-d-e	-	<ul style="list-style-type: none"> Salt-effected area is not found in the project area at present. But it has a potential to progress the salt accumulation under un-proper drainage system.
10 Increased incidence of water borne diseases	-	-	2N a-d-e	2 - 3N a-d-e	<ul style="list-style-type: none"> The infection from paddy field is hardly observed at present. However, since cropping intensity of paddy will be increased with project, the incident of diseases might be increased. Health education of local people shall be undertaken. O&M works such as weeding canal and bund, and pesticide application which make snail's habitat decrease will be undertaken by farmers.
11 Increase of constructed-related employment opportunity	2P a-c	2P a-c	-	-	<ul style="list-style-type: none"> The construction works will provide temporary job opportunity to the villagers nearby.
12 Increase of crop production	-	-	1P a-d	1P a-d	<ul style="list-style-type: none"> The biggest positive effect of the project. This will be lead to higher living standard of the population.
13 Increase of agricultural-related employment opportunity	-	-	1P b-d	1P b-d	<ul style="list-style-type: none"> Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.

Remarks : *1 "with" indicates future condition with conservation measurements.

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- a : Direct
- b : Indirect
- c : Short term
- d : Long term
- e : Reversible
- f : Irreversible

The feature of impacts is indicated as follows:

- 1N Negative impact would be significant.
- a-c-e direct, short term, and reversible.
- 1P Positive impact would be significant, direct,
- a-c-e short term, and reversible.

The characteristics of insignificant impacts are not identified.

Table-5 Assessment of Probable / Potential Impacts (3/5)

(3) Kpando-Torkor Project

Probable / Potential Impacts	Stage				Comments / Recommended Mitigation Measures
	Construction		Operation		
	without	with *1	without	with *1	
1 Soil erosion in and around the construction sites	3N	-	-	-	<ul style="list-style-type: none"> No fresh cut and embankment which can introduce the effect are not in the project works.
2 Alteration or destruction of the habit of flora and fauna	3N	-	2-3N b-d-e	3N	<ul style="list-style-type: none"> The extension area of about 110 ha presently used for shifting cultivation and woods collection by villagers, even the area is not primary forest. Dependence on remaining bush will be increased and it might result in land degradation. Extension works for reforestation and reduction of shifting cultivation shall be carried out. Through the works, the farmers could aware the importance of forest for their life and they could manage the area by themselves.
3 Damage to historic, cultural or religions area	-	-	-	-	<ul style="list-style-type: none"> No such site exists
4 Deterioration of water quality in downstream	1 - 2N a-c-f	2 - 3N a-c-f	2N a-c-e	3N	<ul style="list-style-type: none"> Efficient use (recycle) or leveling of disposal materials from excavation works shall be undertaken completely. Liquid waste from concrete preparation works might be effused. Proper disposal of the liquid waste shall be enforced thoroughly. IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. Fertilizer incorporating and mulching works could minimize the effect.
5 Health hazard from agro-chemicals	-	-	2N a-c-e	3N	<ul style="list-style-type: none"> IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. The hazard will be minimized by proper handling way of chemical under proposed extension works.
6 Land degradation in the project area due to erosion hazard at operation stage	-	-	1 - 2N a-d-f	2 - 3N a-d-f	<ul style="list-style-type: none"> Soil conservation measures such as contour bund with strip cropping and waterways will be included in the project components. Mulching and contour plowing undertaken by farmers could minimize the effect.
7 Land degradation in the project area due to salt-accumulation	-	-	-	-	<ul style="list-style-type: none"> No such site exists.
8 Increased incidence of water borne diseases	-	-	3N	-	<ul style="list-style-type: none"> No additional effect can be expected.
9 Increase of constructed-related employment opportunity	2P a-c	2P a-c	-	-	<ul style="list-style-type: none"> The construction works will provide temporary job opportunity to the villagers nearby.
10 Increase of crop production	-	-	1P a-d	1P a-d	<ul style="list-style-type: none"> The biggest positive effect of the project. This will be lead to higher living standard of the population.
11 Increase of agricultural-related employment opportunity	-	-	1P b-d	1P b-d	<ul style="list-style-type: none"> Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.

Remarks : *1 "with" indicates future condition with conservation measurements.

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- a : Direct
- b : Indirect
- c : Short term
- d : Long term
- e : Reversible
- f : Irreversible

The feature of impacts is indicated as follows:

- 1N Negative impact would be significant, direct, short term, and reversible.
- 1P Positive impact would be significant, direct, short term, and reversible.

The characteristics of insignificant impacts are not identified.

Table-5 Assessment of Probable / Potential Impacts (4/5)

(4) Mankessim Project

Probable / Potential Impacts	Stage				Comments / Recommended Mitigation Measures
	Construction		Operation		
	without	with *1	without	with *1	
1 Soil erosion in and around the construction sites	3N	-	-	-	<ul style="list-style-type: none"> No fresh cut and embankment which can introduce the effect are not in the project works.
2 Alteration or destruction of the habit of flora and fauna	3N	-	3N	-	<ul style="list-style-type: none"> Almost rehabilitation area has been developed and existing forest is scarcely found in the area.
3 Damage to historic, cultural or religions area	2N a-c-f	3N	2N a-c-f	3N	<ul style="list-style-type: none"> There is a sacred grove of 0.4 ha in rehabilitation area. However, the area is excluded from rehabilitation plan. Careful attention for un-disturbing the area should be taken on both stages.
4 Deterioration of water quality in downstream	2N a-c-e	3N	2N a-c-e	3N	<ul style="list-style-type: none"> Liquid waste from concrete preparation works might be effused. Proper disposal of the liquid waste shall be enforced thoroughly. IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. Fertilizer incorporating and mulching works could minimize the effect.
5 Decrease of crop production on construction phase	3N	3N	-	-	<ul style="list-style-type: none"> No irrigation water supply in construction phase, but just 1 year. This effect is already accepted by farmers. In the year, farmer can get a work as construction labour.
6 Health hazard from agro-chemicals	-	-	2N a-c-e	3N	<ul style="list-style-type: none"> IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. The hazard will be minimized by proper handling way of chemical under proposed extension works.
7 Land degradation in the project area due to salt-accumulation	-	-	-	-	<ul style="list-style-type: none"> No such site exists.
8 Increased incidence of water borne diseases	-	-	3N	-	<ul style="list-style-type: none"> No additional effect can be expected.
9 Increase of constructed-related employment opportunity	2P a-c	2P a-c	-	-	<ul style="list-style-type: none"> The construction works will provide temporary job opportunity to the villagers nearby.
10 Increase of crop production	-	-	1P a-d	1P a-d	<ul style="list-style-type: none"> The biggest positive effect of the project. This will be lead to higher living standard of the population.
11 Increase of agricultural-related employment opportunity	-	-	1P b-d	1P b-d	<ul style="list-style-type: none"> Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.

Remarks : *1 "with" indicates future condition with conservation measurements.

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- a : Direct
- b : Indirect
- c : Short term
- d : Long term
- e : Reversible
- f : Irreversible

The feature of impacts is indicated as follows:

1N Negative impact would be significant, direct, short term, and reversible.

1P Positive impact would be significant, direct, short term, and reversible.

The characteristics of insignificant impacts are not identified.

Table-5 Assessment of Probable / Potential Impacts (5/5)

(5) Okyereko Project

Probable / Potential Impacts	Stage				Comments / Recommended Mitigation Measures
	Construction		Operation		
	without	with *1	without	with *1	
1 Soil erosion in and around the construction sites	3N	-	-	-	<ul style="list-style-type: none"> No fresh cut and embankment which can introduce the effect are not in the project works.
2 Alternation or destruction of the habit of flora and fauna	-	-	-	-	<ul style="list-style-type: none"> Unlikely
3 Damage to historic, cultural or religions area	2N a-c-f	3N	3N	-	<ul style="list-style-type: none"> There is a sacred grove of 0.4 ha in rehabilitation area. However, the area is excluded from rehabilitation plan. The excavation works for drainage improvement is not included in project activities.
4 Effects on farm land, existing facilities, houses, due to project works	-	-	2N a-d-e	3N	<ul style="list-style-type: none"> After construction of pumping station and intake facilities, seasonal flood damage will expand to roads and/or farm land. Design and plan shall pay the attention carefully, and flood dike to protect to farm lands will be established.
5 Deterioration of water quality in downstream	2N a-c-e	3N	2N a-c-e	3N	<ul style="list-style-type: none"> Liquid waste from concrete preparation works might be effused. Proper disposal of the liquid waste shall be enforced thoroughly. IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. Proper water management taking agro-chemical input into consideration will be undertaking.
6 Health hazard from agro-chemicals	-	-	2N a-c-e	3N	<ul style="list-style-type: none"> IPM or proper use of fertilizer and pesticide will be included in the improved farming practices. The hazard will be minimized by proper handling way of chemical under proposed extension works.
7 Reduction of downstream flows that affect users of water	-	-	-	-	<ul style="list-style-type: none"> Present flow from project site into drain is quite low.
8 Increase of downstream flows affecting downstream ecology and/or community	-	-	-	-	<ul style="list-style-type: none"> Unlikely
9 Land degradation in the project area due to salt-accumulation	-	-	2N a-d-e	2P a-d	<ul style="list-style-type: none"> Present salt-affected area will be reclaimed by irrigation farming because of establishment of proper drainage system.
10 Increased incidence of water borne diseases	-	-	2N a-d-e	3N	<ul style="list-style-type: none"> The infection from paddy field is hardly observed at present. However, since cropping intensity of paddy will be increased with project, the incident of diseases might be increased. Health education of local people shall be undertaken. O&M works such as weeding canal and bund, and pesticide application which make snail's habitat decrease will be undertaken by farmers.
1 Increase of constructed-related employment opportunity	2P a-c	2P a-c	-	-	<ul style="list-style-type: none"> The construction works will provide temporary job opportunity to the villagers nearby.
2 Increase of crop production	-	-	1P a-d	1P a-d	<ul style="list-style-type: none"> The biggest positive effect of the project. This will be lead to higher living standard of the population.
3 Increase of agricultural-related employment opportunity	-	-	1P b-d	1P b-d	<ul style="list-style-type: none"> Employment opportunity in marketing of inputs and outputs, processing, etc. will be increased substantially.

Remarks : *1 "with" indicates future condition with conservation measurements.

Significance of impact

- 1 : Significant
- 2 : Moderate
- 3 : Minor

Feature of impact

- P : Positive
- N : Negative

Characteristics of impact

- a : Direct
- b : Indirect
- c : Short term
- d : Long term
- e : Reversible
- f : Irreversible

The feature of impacts is indicated as follows:

- 1N Negative impact would be significant, direct, short term, and reversible.
- 1P Positive impact would be significant, direct, short term, and reversible.

The characteristics of insignificant impacts are not identified.

Table-6 List of Recommendable Soil Erosion Control Measures

Descriptions	Merits	Demerits
<u>Vegetative Measures</u>		
<p>1. Contour hedgerow (Strip cropping)</p> <p>Vegetative rows or strips established along the contour. Trees serve as live barrier to surface runoff and soil erosion. If the nitrogen fixing crops or trees such as leguminous crops are used, it can improve soil condition.</p>	<ol style="list-style-type: none"> 1. Economical 2. Adaptable to various conditions 3. Easier to establish and repair 4. Durable if maintained properly 5. Improve the soil condition, if nitrogen fixing crops are used 	<ol style="list-style-type: none"> 1. It takes some time to attain benefits 2. Less effective when slope is too steep 3. Hedgerows may pose competition with crops
<p>2. Mulching</p> <p>The mulching is the covering of the soil with crop residues such as straw, maize stalks, palm fronds or standing stubbles. The effect of mulching is the reducing of raindrop impact and of the velocity of runoff.</p>	<ol style="list-style-type: none"> 1. Economical 2. Adaptable to various conditions 3. Easier to establish and repair 4. Keeping of soil moisture and temperature 5. Improve the soil condition 	<ol style="list-style-type: none"> 1. Application of mulch may be required on each cropping season in tropical area 2. It requires a large amount of grasses (materials) for mulching
<p>3. Agroforestry</p> <p>It is a system to incorporate trees within a farming system by planting them on land.</p>	<ol style="list-style-type: none"> 1. Economically 2. Trees can provide fuels, fodder, fruits, etc. to the farmers. 	<ol style="list-style-type: none"> 1. It takes some time to attain benefits 2. Trees may pose competition with crops 3. Less effective when slope is too steep
<u>Physical Measures</u>		
<p>4. Contour bunds</p> <p>They are earth bunds, 1.5 to 2 m wide, thrown across the slope to act as a barrier to runoff, to form a water storage area on their upslope side and to break up a slope into segments shorter in length than is required to generate overland flow. They are frequently used with strip-cropping system.</p>	<ol style="list-style-type: none"> 1. Relatively easier to construct and repair 2. They are suitable for slopes of 1 to 7 degree. 	<ol style="list-style-type: none"> 1. The effectiveness is limited when heavy rains continue long. 2. The effectiveness is limited when used in very steep slope.
<p>5. Waterways (Contour Ditches and Drainage Canals)</p> <p>They are digging structures established in the hillsides to check the erosive power of surface runoff by tapping soil particles. Drainage canal (grass waterways) are used as the outlet for contour ditches. It runs downslope and empty into river system or other outlets.</p>	<ol style="list-style-type: none"> 1. Relatively easier to construct and repair 2. Ditches and canals can be good water impoundment structures that can hold water for plants. 	<ol style="list-style-type: none"> 1. The effectiveness is limited when heavy rains continue long. 2. The effectiveness is limited when used in very steep slope.
<u>Cultural Measures</u>		
<p>6. Contour Plowing</p> <p>It is a plowing method to create furrows following the contour of the land.</p>	<ol style="list-style-type: none"> 1. It increases water absorption capacity of the soil. 2. It also reduces both the quantity and velocity of surface runoff. 	<ol style="list-style-type: none"> 1. A bit difficult to plow properly.
<p>7. Contour Planting</p> <p>It is a planting method following the contour of the land. The crops planted act as barriers to the force of surface runoff.</p>	<ol style="list-style-type: none"> 1. Easy to adopt 	<ol style="list-style-type: none"> 1. The effect is not high, if only it is adopted .

Table-7 Implementation Schedule

Activities	FY1996*			FY1997*			FY1998*			FY1999*			FY2000*																	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M			
1 Feasibility Study																														
(1) Report preparation																														
(2) Submittal of Final Report																														
2 Implementation of the Projects																														
(1) Project appraisal and financial arrangement:																														
(2) Selection of consultant																														
(3) Survey and Design																														
(4) Tender, evaluation and approval																														
(5) Selection of consultant																														
(6) Construction																														
(a) Ashaiman project																														
- Irrigation system																														
- Drainage system																														
- Road network																														
- Building																														
(b) Aveime project																														
- Pump and pump station																														
- Irrigation system																														
- Drainage system																														
- Road network																														
- Building																														
(c) Kpando-Torkor project																														
- Pump and pump station																														
- Pipeline system																														
- Drainage system																														
- Road network																														
- Building																														
(d) Mankessim project																														
- Pump and pump station																														
- Pipeline system																														
- Drainage system																														
- Road network																														
- Building																														
(d) Okyerokoproject																														
- Pump and pump station																														
- Intake weir and head race																														
- Irrigation System																														
- Drainage system																														
- Road network																														
- Building																														

* Japanese fiscal year

Note: Construction of five projects will be carried out by dividing them into two groups: 1st group=Ashiman project, Mankessim project and Okyeroko project and 2nd group=Kpando-Torkor project and Aveime project. This grouping is made considering the need of early implementation of Ashaiman project due to execution of farmers' training and easy and effective control of construction of Mankessim and Okyeroko projects due to close location.

Table-8 Project Cost

(Unit :10^6 Cedi)

Item	Ashaiman	Aveyime	Kpando-Torkor	Mankessim	Okyereko	Total
	56 ha	95 ha	155 ha	86 ha	81 ha	473 ha
1 Development Area	0	558	1,953	747	272	3530
2 Direct Construction Cost						
(1) Pump station	0	558	1,953	747	272	3530
(2) Irrigation system						
(a) Canal	388	729	0	0	595	1712
(b) Pipeline	0	106	1,360	787	0	2253
(3) Drainage system	33	28	285	394	38	778
(4) Farm road	44	97	178	92	87	498
(5) Related structures	116	95	67	31	155	464
(6) Building*	306	167	221	167	188	1049
(7) Supplemental water supply facility	0	0	0	0	219	219
(8) Green belt	0	0	118	31	0	149
(9) Electric line	0	72	218	97	207	594
(10) Minor repairing of dam crest	0	0	0	4	0	4
Total of Item 2	887	1,852	4,400	2,350	1,761	11,250
3 O & M Equipment**	319	113	176	150	148	906
4 Engineering Services***	133	278	660	353	264	1688
5 Administration Cost****	44	93	220	118	88	563
Total of Item 2 to 5	1,383	2,336	5,456	2,971	2,261	14,407
6 Physical Contingency*****	89	185	440	235	176	1,125
Total of Item 2 to 6	1,472	2,521	5,896	3,206	2,437	15,532
(Cost per ha in 10^3 Cedi)	26,286	26,537	38,039	37,279	30,086	32,837
(Cost per ha in US\$)	15,462	15,610	22,376	21,929	17,698	19,316
7 Price Contingency*****	490	1,055	1,896	671	759	4871
Total of Item 2 to 7	1,962	3,576	7,792	3,877	3,196	20,403
Total in 10^3 US\$	1,154	2,104	4,584	2,281	1,880	12,002
Cost per ha in 10^3 Cedi	35,036	37,642	50,271	45,081	39,457	43,135
Cost per ha in US\$	20,609	22,142	29,571	26,518	23,210	25,374

* : Cost of training facility such as lecture hall, dormitories and dining hall is included in Ashaiman project, and cost of lecture hall is also included in Okyereko project.

** : Purchasing cost of backhoe and bus which will be used for all projects, is included in Ashaiman project.

*** : 15% of direct construction cost.

**** : 5% of direct construction cost.

***** : 10% of direct construction cost.

***** : annual escalation rate of 2.5% for Foreign currency and 25.0% for local currency (see Table I-14).

Table-9 Annual Disbursement Schedule

(unit: 10⁶ Cedi)

Item	Total			FY1997			FY1998			FY1999			FY2000		
	L/C	F/C	Amount	L/C	F/C	Amount	L/C	F/C	Amount	L/C	F/C	Amount	L/C	F/C	Amount
1 Ashaiman Project															
(1) Direct construction cost*	505	382	887	0	0	0	253	191	444	252	191	443	0	0	0
(2) O & M equipment**	0	319	319	0	0	0	0	319	319	0	0	0	0	0	0
(3) Engineering services (15% of F/C of (1))	0	133	133	0	40	40	0	67	67	0	26	26	0	0	0
(4) Administration cost (5% of (1))	25	19	44	0	12	12	12	10	22	0	10	22	0	0	0
Sub-total	530	853	1,383	0	40	40	265	587	852	264	227	491	0	0	0
(5) Physical contingency (10% of (1))	51	38	89	0	0	0	26	19	45	25	19	44	0	0	0
Sub-total	581	891	1,472	0	40	40	291	606	897	289	246	535	0	0	0
(6) Price contingency	439	51	490	0	1	1	164	31	195	275	19	294	0	0	0
Total	1,020	942	1,962	0	41	41	455	637	1,092	564	263	829	0	0	0
2 Awavime Project															
(1) Direct construction cost	728	1,124	1,852	0	0	0	0	0	0	510	787	1,297	218	337	555
(2) O & M equipment	0	113	113	0	0	0	0	0	0	0	113	113	0	0	0
(3) Engineering services (15% of F/C of (1))	0	278	278	0	83	83	0	56	56	0	83	83	0	56	56
(4) Administration cost (5% of (1))	36	57	93	0	0	0	0	0	0	26	39	65	10	18	28
Sub-total	764	1,572	2,336	0	83	83	0	56	56	26	102	1,558	228	411	639
(5) Physical contingency (10% of (1))	73	112	185	0	0	0	0	0	0	51	79	130	22	33	55
Sub-total	837	1,684	2,521	0	83	83	0	56	56	77	110	1,688	250	444	694
(6) Price contingency	919	136	1,055	0	2	2	0	3	3	559	85	644	360	46	406
Total	1,756	1,820	3,576	0	85	85	0	59	59	1,146	1,186	2,332	610	490	1,100
3 Kpando-Torkor Project															
(1) Direct construction cost	1,146	3,254	4,400	0	0	0	0	0	0	688	1,952	2,640	458	1,302	1,760
(2) O & M equipment	0	176	176	0	0	0	0	0	0	0	176	176	0	0	0
(3) Engineering services (15% of F/C of (1))	0	660	660	0	198	198	0	132	132	0	198	198	0	132	132
(4) Administration cost (5% of (1))	57	163	220	0	0	0	0	0	0	34	98	132	23	65	88
Sub-total	1,203	4,253	5,456	0	198	198	0	132	132	72	2,424	3,146	481	1,499	1,980
(5) Physical contingency (10% of (1))	115	325	440	0	0	0	0	0	0	69	195	264	46	130	176
Sub-total	1,318	4,578	5,896	0	198	198	0	132	132	141	2,619	3,410	527	1,629	2,156
(6) Price contingency	1,513	383	1,896	0	5	5	0	7	7	754	202	956	759	169	928
Total	2,831	4,961	7,792	0	203	203	0	139	139	1,545	2,821	4,366	1,286	1,798	3,084
4 Mankessim Project															
(1) Direct construction cost	635	1,715	2,350	0	0	0	381	1,029	1,410	254	686	940	0	0	0
(2) O & M equipment	0	150	150	0	0	0	0	150	150	0	0	0	0	0	0
(3) Engineering services (15% of F/C of (1))	0	353	353	0	106	106	0	177	177	0	70	70	0	0	0
(4) Administration cost (5% of (1))	32	80	118	0	0	0	19	52	71	13	34	47	0	0	0
Sub-total	667	2,304	2,971	0	106	106	400	1,408	1,808	267	790	1,057	0	0	0
(5) Physical contingency (10% of (1))	63	172	235	0	0	0	38	103	141	25	69	94	0	0	0
Sub-total	730	2,476	3,206	0	106	106	438	1,511	1,949	292	859	1,151	0	0	0
(6) Price contingency	525	146	671	0	3	3	247	77	324	278	66	344	0	0	0
Total	1,255	2,622	3,877	0	109	109	685	1,588	2,273	570	925	1,495	0	0	0
5 Okerekeko Project															
(1) Direct construction cost***	764	997	1,761	0	0	0	382	499	881	382	498	880	0	0	0
(2) O & M equipment	0	148	148	0	0	0	0	148	148	0	0	0	0	0	0
(3) Engineering services (15% of F/C of (1))	0	264	264	0	79	79	0	132	132	0	53	53	0	0	0
(4) Administration cost (5% of (1))	38	50	88	0	0	0	19	25	44	19	25	44	0	0	0
Sub-total	802	1,459	2,261	0	79	79	401	804	1,205	401	576	977	0	0	0
(5) Physical contingency (10% of (1))	76	100	176	0	0	0	38	50	88	38	50	88	0	0	0
Sub-total	878	1,559	2,437	0	79	79	439	854	1,293	439	626	1,065	0	0	0
(6) Price contingency	665	94	759	0	2	2	247	44	291	418	48	466	0	0	0
Total	1,543	1,653	3,196	0	81	81	686	898	1,584	857	674	1,531	0	0	0
6 Grand Total	8,405	11,998	20,403	0	513	513	1,826	3,321	5,147	4,682	5,871	10,553	1,896	2,288	4,184

* : including common training facility such as dormitories, lecture hall and dining hall (160,701,000 Cedi under L/C and 106,801,000 Cedi under F/C).

** : including common O & M equipment such as Backhoe and bus (209,000,000 Cedi under F/C).

*** : including common training facility of lecture hall (12,403,000 Cedi under L/C and 8,269,000 Cedi under F/C).

Table-10 Replacement Cost

(Unit: 1000 Cedi)

Item	Useful Life	Ashiaman (56 ha)		Aveyime (95 ha)		Kpandor-Torkor (155 ha)		Total
		L/C	F/C	L/C	F/C	L/C	F/C	
1 Pump and accessories	15	-	-	50,074	450,653	125,181	1,126,635	1,251,816
2 Steel pipe	20	-	-	4,335	39,015	58,908	530,175	589,083
3 Sprinkler system	15	-	-	6,340	57,060	59,777	537,992	597,769
4 Steel gate	20	898	8,078	3,169	28,520	680	6,120	6,800
5 Intake valve	20	560	5,040	-	-	-	-	-
6 O & M equipment	10	0	137,000	0	153,800	0	243,700	243,700

(Unit: 1000 Cedi)

Item	Useful Life	Mankessim (86 ha)		Okyeroko (81 ha)		Total
		L/C	F/C	L/C	F/C	
1 Pump and accessories	15	68,726	618,538	25,546	229,918	255,464
2 Steel pipe	20	35,852	322,665	12,500	112,500	125,000
3 Sprinkler system	10	32,606	293,450	-	-	-
4 Steel gate	20	-	-	1,550	13,949	15,499
5 Intake valve	20	-	-	-	-	-
6 O & M equipment	10	0	149,900	0	147,800	147,800

Table-11 Operation and Maintenance Cost

(Unit : 1000 Cedi)

Description	Ashaiman	Aveyime	Kpndo-Torkor	Mankessim	Okyereko
1 Development Area	56 ha	95 ha	155 ha	86 ha	81 ha
2 Administration Cost					
(1) Salary of project staff	3,700	3,700	3,700	3,700	3,700
(2) Operation cost of office	500	500	500	500	500
Sub-total	4,200	4,200	4,200	4,200	4,200
3 O & M of Pump and Pump Station					
(1) Operation cost (Cedi 49/kWH)	-	8,300	20,400	12,100	7,800
(2) Maintenance cost*	-	15,500	41,700	20,700	6,400
Sub-total	-	23,800	62,100	32,800	14,200
4 O & M of Command Area					
(1) O & M equipment	1,003	1,142	1,464	1,148	1,176
(2) Labour cost**	678	1,086	551	516	783
(3) Material cost***	778	839	1,024	438	693
(4) Contract for repair****	1,170	1,259	1,536	657	657
Sub-total	3,629	4,326	4,575	2,759	3,309
Total	7,829	32,326	70,875	39,759	21,709
Cost per ha in Cedi	139,804	340,274	457,258	462,314	268,012
Cost per ha in US\$	82	200	269	272	158

* : 5 % of pump and accessories costs per year.

** : 10 man-day per km for irrigation canal, drainage canal, green-belt and road (Cedi 3000/man-day).

*** : 0.08 % of direct construction cost excluding pump and pump station.

**** : 0.12 % of direct construction cost excluding pump and pump station.

Table-12 Central Government Accounts - Recurrent and Development Expenditures
(Functional Classification)

	(Unit: Cedis Million)														
	Total Expenditures					Recurrent Expenditures					Development Expenditures				
	1990	1991	1992	1993	1994*	1990	1991	1992	1993	1994*	1990	1991	1992	1993	1994*
General Services	33,376	41,732	60,710	78,116	168,188	27,787	34,113	46,861	71,488	134,878	5,589	7,619	13,849	6,628	33,310
General Public Services	9,006	15,230	18,201	26,600	36,147	8,334	14,750	16,783	24,712	31,883	672	480	1,418	1,888	4,264
Defence	13,470	17,155	25,717	35,718	50,448	12,905	15,622	23,802	32,224	44,442	565	1,533	1,915	3,494	6,006
Public Order and Safety	55,852	74,117	104,628	140,434	254,783	49,026	64,485	87,446	128,424	211,203	6,826	9,632	17,182	12,010	43,580
Total	64,835	78,801	119,383	158,119	213,901	58,139	74,452	113,814	151,345	208,864	6,696	4,349	5,569	6,774	5,037
Community and Social Services	25,706	28,654	38,893	59,674	55,802	20,584	25,501	34,738	52,873	49,907	5,122	3,153	4,155	6,801	5,895
Education	18,389	23,884	34,674	68,424	82,587	18,041	22,624	33,054	67,932	81,495	348	1,260	1,620	492	1,092
Health	6,607	7,481	9,242	11,136	33,326	1,516	1,894	2,189	3,351	3,133	5,091	5,587	7,053	7,785	30,193
Social Security and Welfare Services	6,872	7,810	9,648	16,151	17,343	4,054	5,159	6,867	12,426	12,721	2,818	2,651	2,781	3,725	4,622
Housing and Community Amenities	122,409	146,630	211,840	313,504	402,959	102,334	129,630	190,662	287,927	356,120	20,075	17,000	21,178	25,577	46,839
Recreational, Cultural & Religious Services	1,048	1,102	1,380	1,450	1,525	20	16	23	32	41	1,028	1,086	1,357	1,418	1,484
Total	10,438	12,378	15,667	21,150	18,950	7,188	9,045	10,681	14,927	13,213	3,250	3,333	4,986	6,223	5,737
Economic Services	2,625	3,186	4,950	8,123	29,761	1,952	2,008	3,264	4,317	2,889	673	1,178	1,686	3,806	26,872
Fuel and Energy	16,089	28,168	51,150	69,481	81,331	3,799	5,074	5,499	10,306	8,991	12,290	23,094	45,651	59,175	72,340
Agriculture, Forestry and Fishing	3,248	4,325	4,074	6,049	6,321	1,657	1,705	1,421	2,811	3,085	1,591	2,620	2,653	3,238	3,236
Mining, Manufacturing and Construction	4,834	5,613	7,541	15,674	19,778	2,266	2,770	3,787	5,772	6,812	2,568	2,843	3,754	9,902	12,966
Roads and Waterways	38,282	54,772	84,762	121,927	157,666	16,882	20,618	24,675	38,163	35,031	21,400	34,154	60,087	83,762	122,635
Other Transport and Communication	27,318	42,828	61,004	135,904	230,146	27,318	42,828	61,004	135,904	230,146	0	0	0	0	0
Other Economic Services	2,633	6,151	9,475	6,138	44,759	2,633	6,151	9,475	6,138	6,460	0	0	0	0	38,299
Total	0	6,443	0	0	0	0	0	0	0	0	0	6,443	0	0	0
Other Purposes	7,980	9,320	27,106	43,004	50,998	0	0	0	0	0	7,980	9,320	27,106	43,004	50,998
Interest on Public Debt	37,931	64,742	97,583	185,046	325,903	29,951	48,979	70,472	142,042	236,606	7,980	15,763	27,106	43,004	89,297
Transfers to Other Levels of Government	254,474	340,261	498,815	760,911	1,141,311	198,193	263,712	373,262	596,558	838,960	56,281	76,549	125,553	164,353	302,351
NAM Capital Expenditure															
Other - Special Efficiency Fund															
Total															
Grand Total															

* Provisional

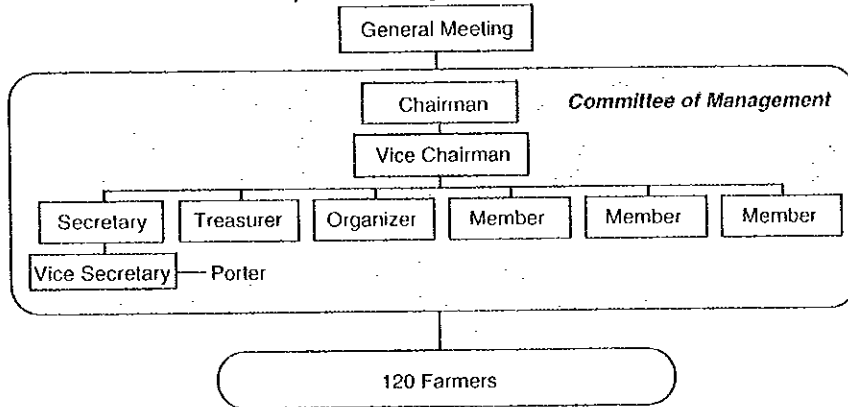
Source: (1) Quarterly Digest, Ministry of Food and Agriculture, March 1995.

(2) The State of the Ghanaian Economy in 1994, University of Ghana, July 1995.

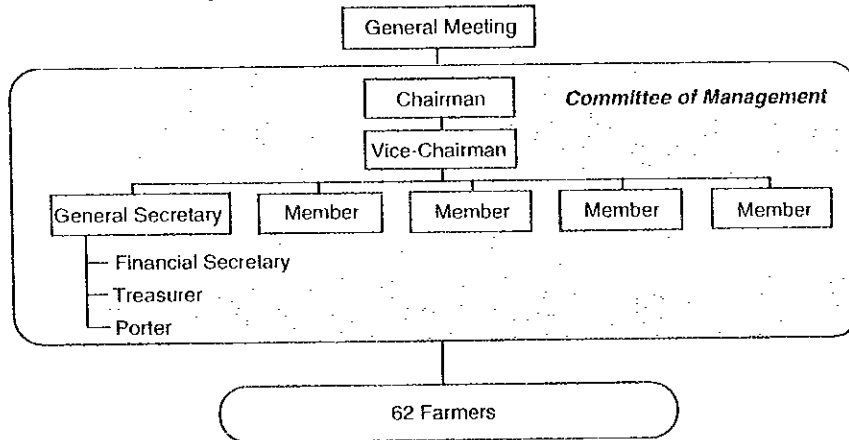
Note: Includes current expenditure elements.

FIGURES

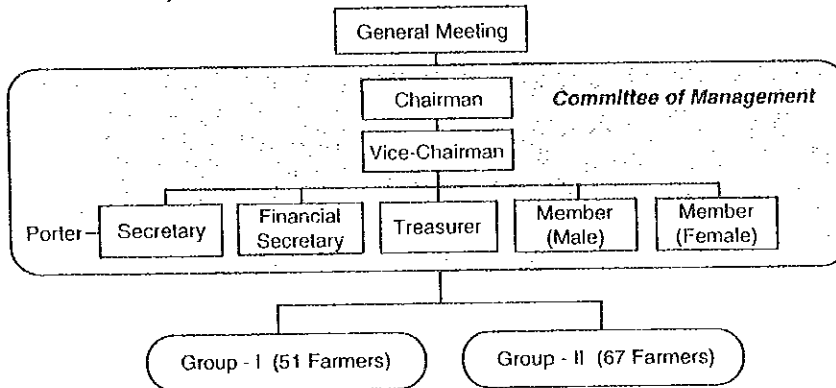
The Ashaiman Co-operative Irrigation Rice Farmers Society Ltd.



Aveyime Irrigation Farmers Association (AIRFAS)



Kpando-Torkor Co-operative Farmers Society Ltd.



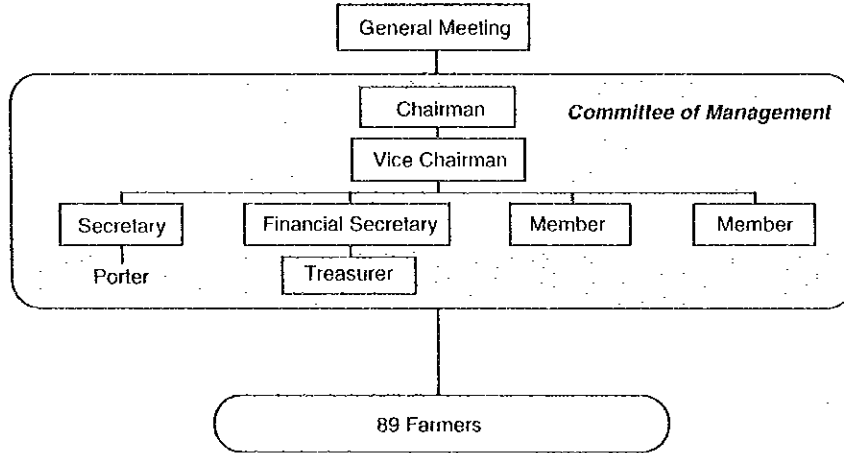
Note: As of December 1995

Figure-1
Organisational Structure of Existing Farmer's Societies (1/2)

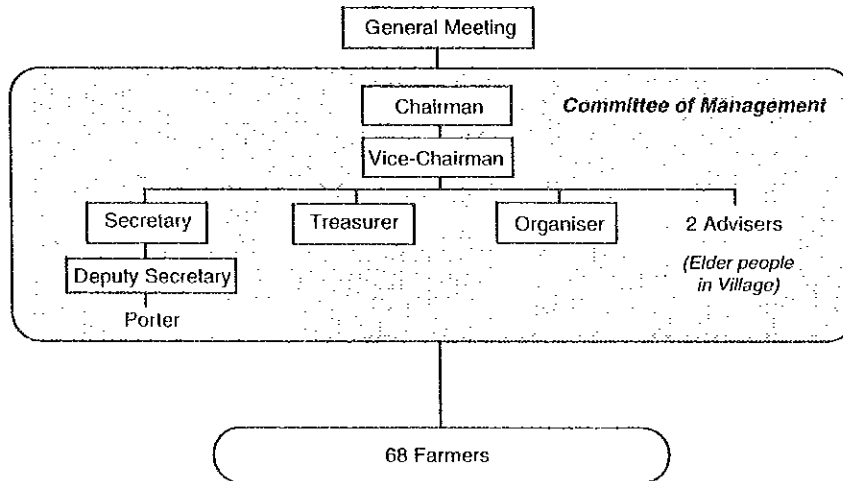
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Japan International Cooperation Agency

**Beefikrom Co-operative Irrigation Vegetable
Growers and Marketing Society Ltd.
(Mankessim Irrigation Project)**



Okyereko Irrigation Rice Farmers Co-operative

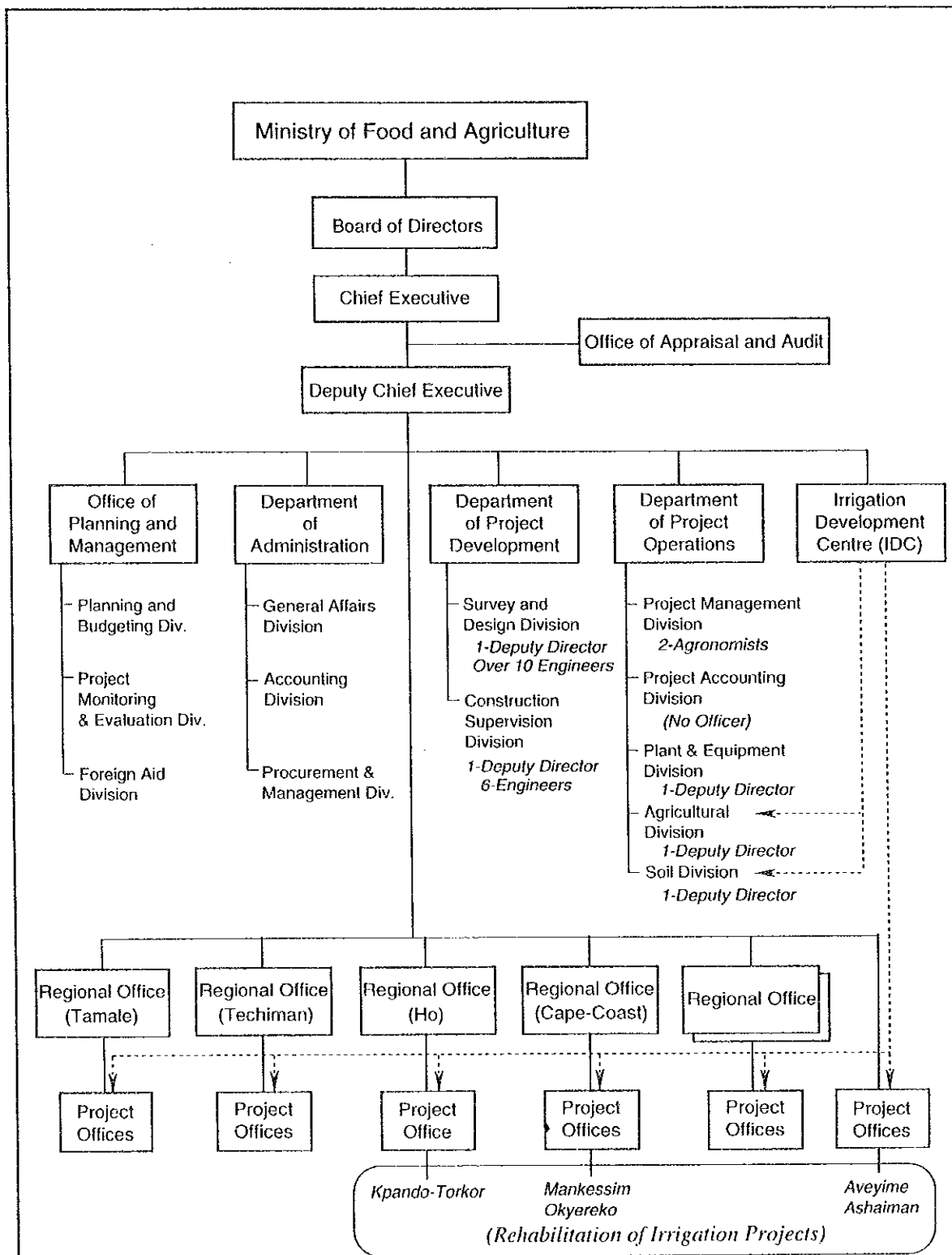


Note: As of December 1995

Figure-1
Organisational Structure of
Existing Farmer's Societies (2/2)

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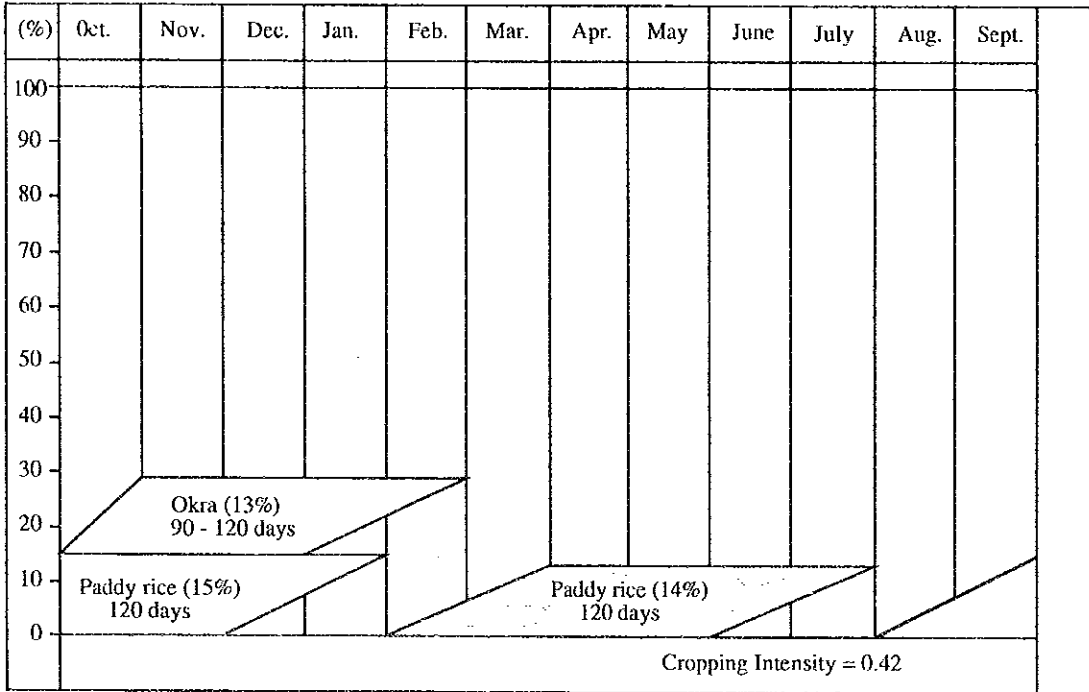


Note: As of December 1995 Source: GIDA Head Office

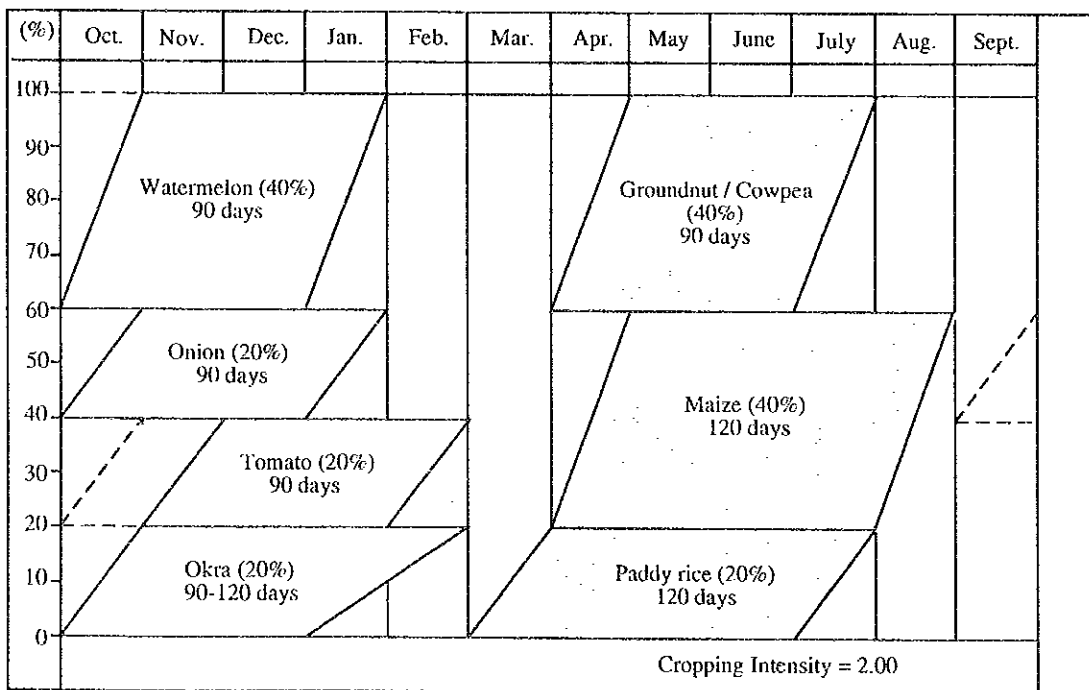
Figure-2
Present Organisational Structure
of Ghana Irrigation Development
Authority (GIDA)

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Present Cropping Pattern

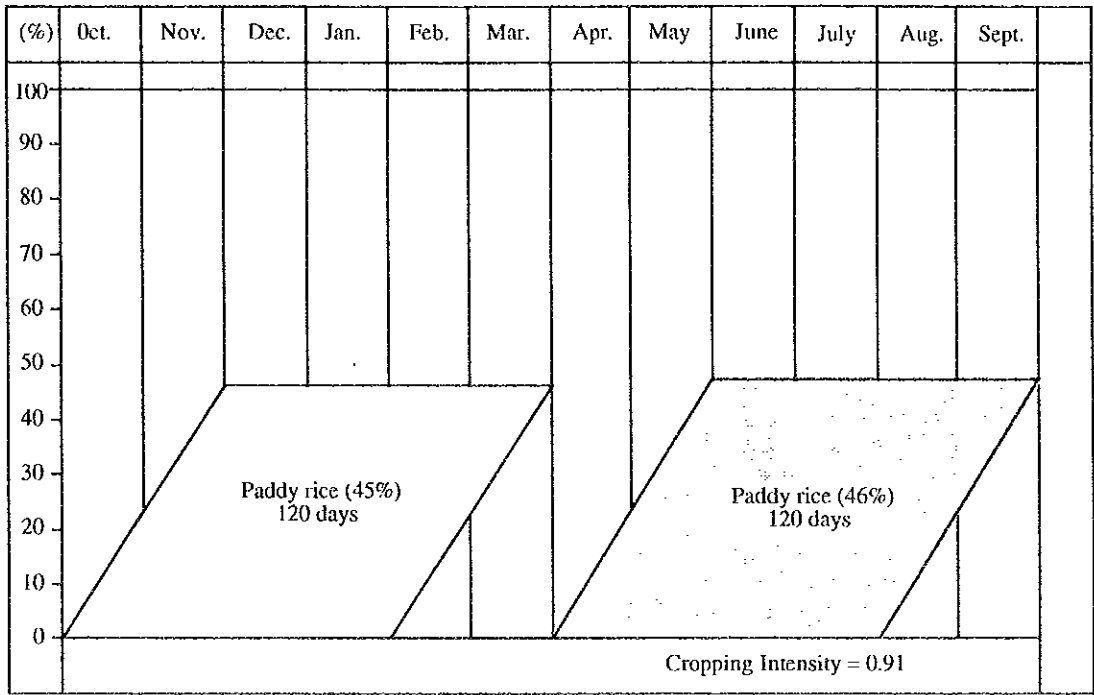


Proposed Cropping Pattern

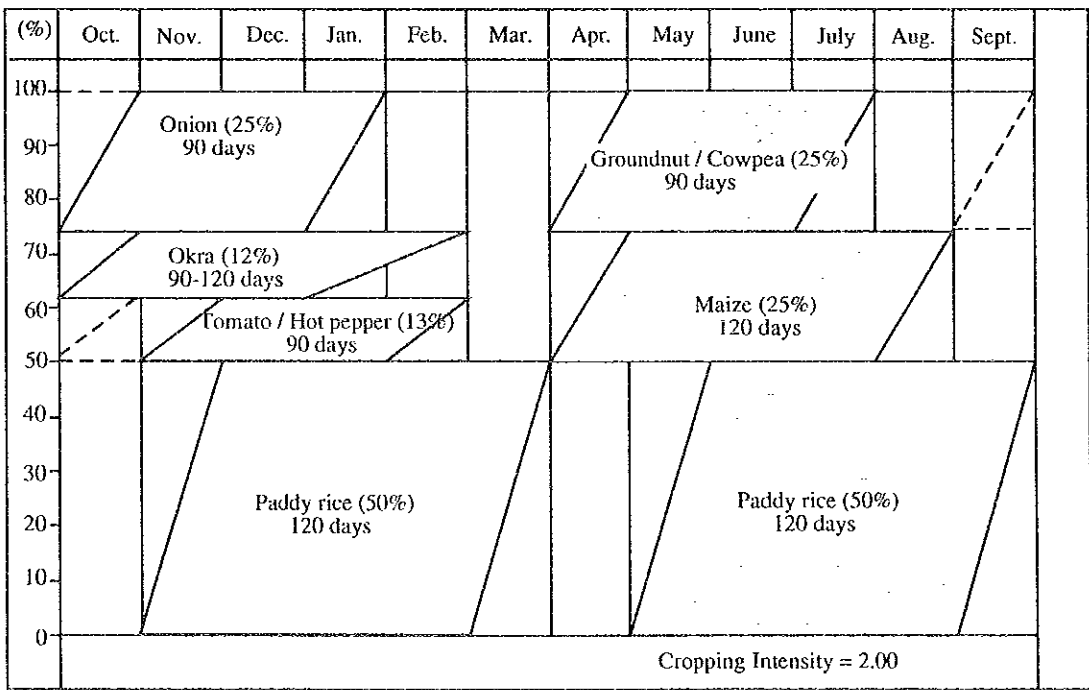
Figure -3
Present and Proposed Cropping
Pattern at Ashaiman Project

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Present Cropping Pattern

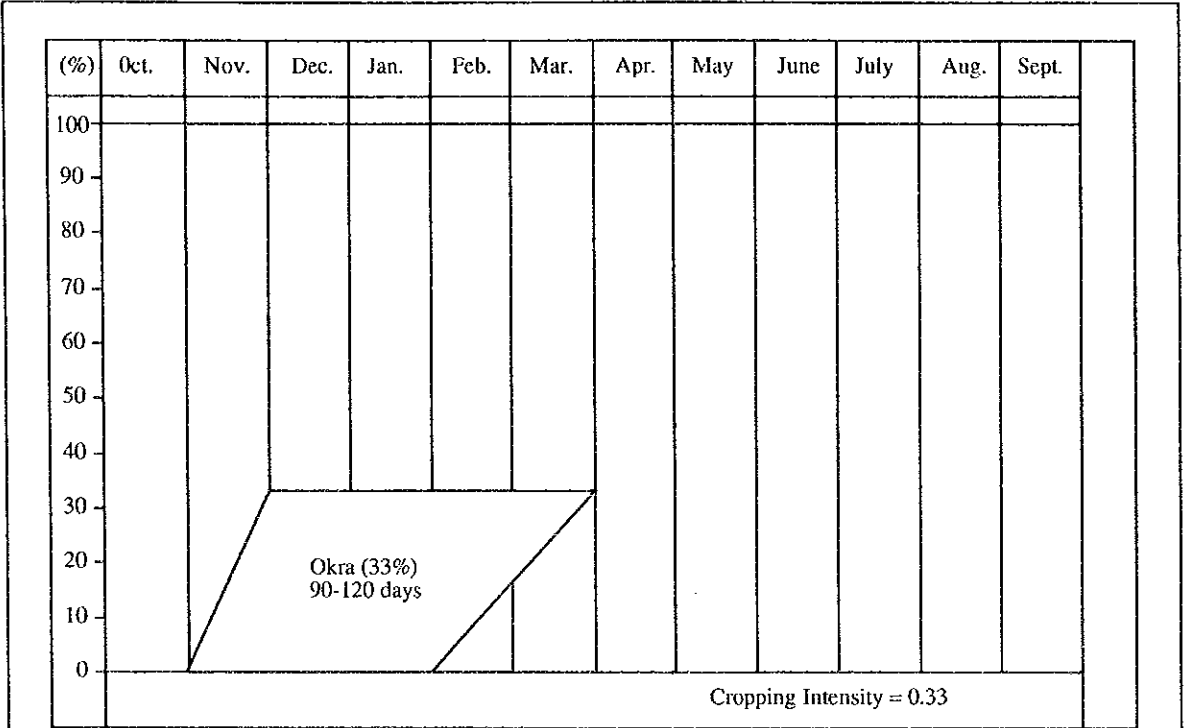


Proposed Cropping Pattern

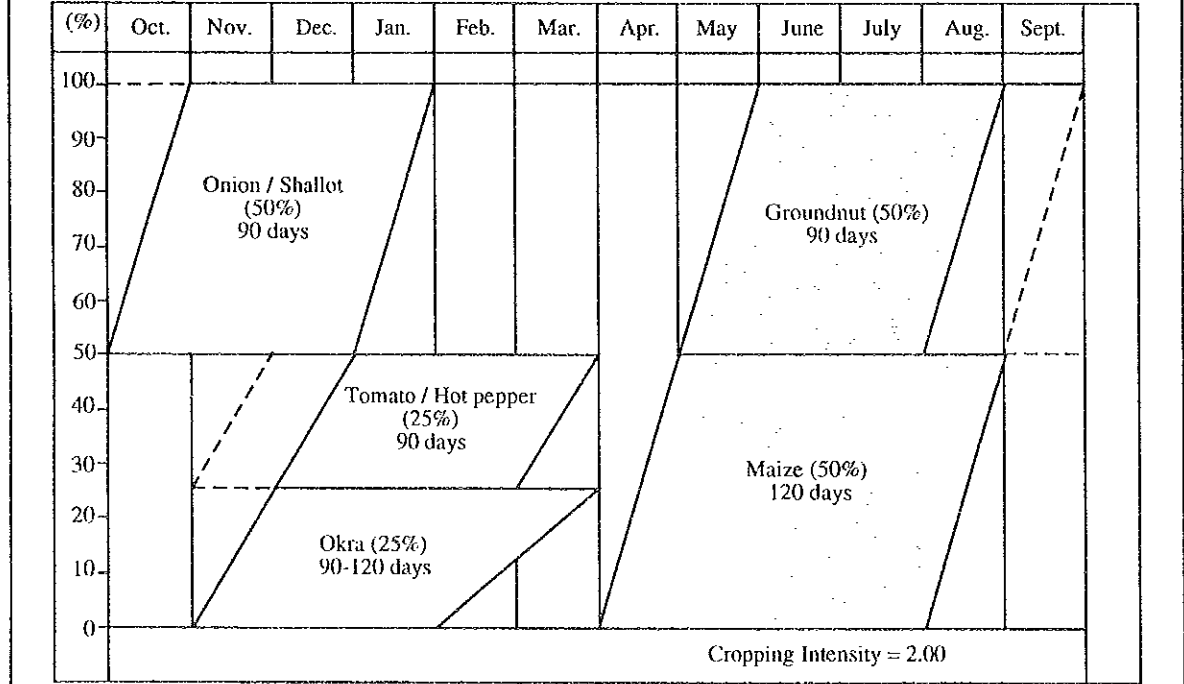
Figure -4
Present and Proposed Cropping Pattern at Aveyime Project

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Present Cropping Pattern

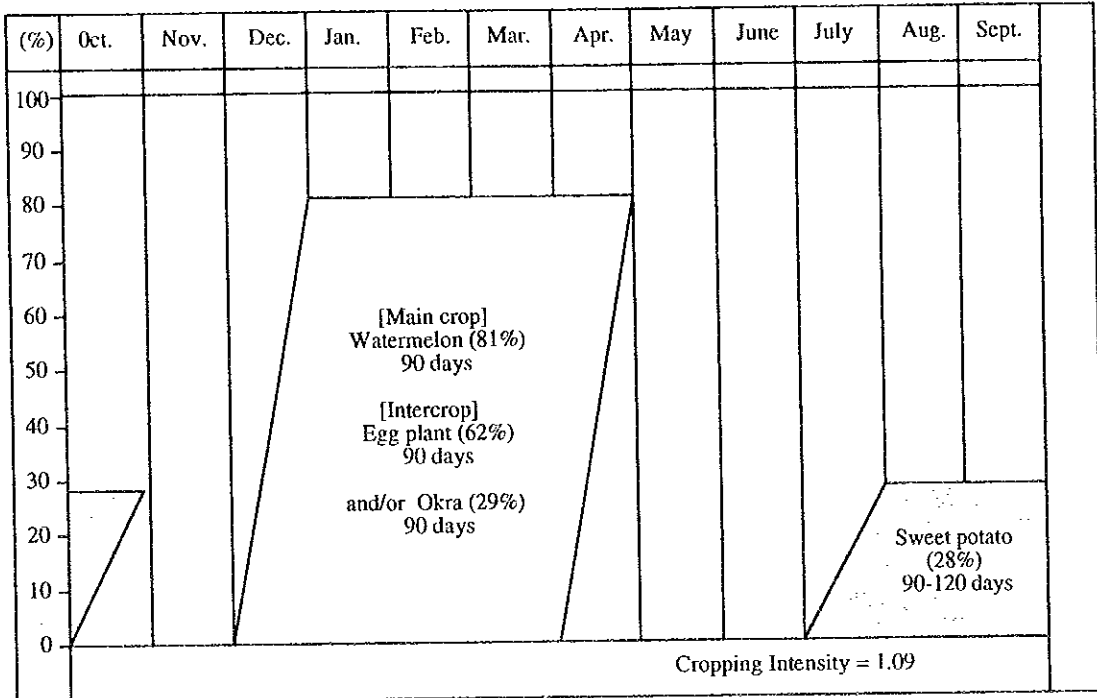


Proposed Cropping Pattern

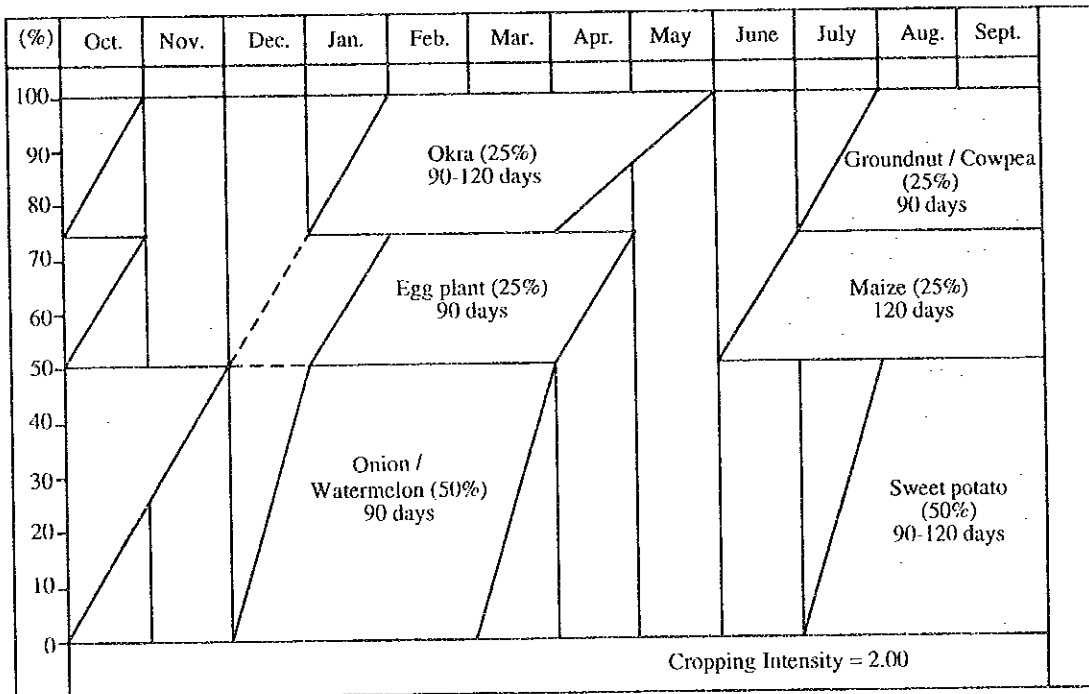
Figure -5
Present and Proposed Cropping
Pattern at Kpando-Torkor Project

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Present Cropping Pattern

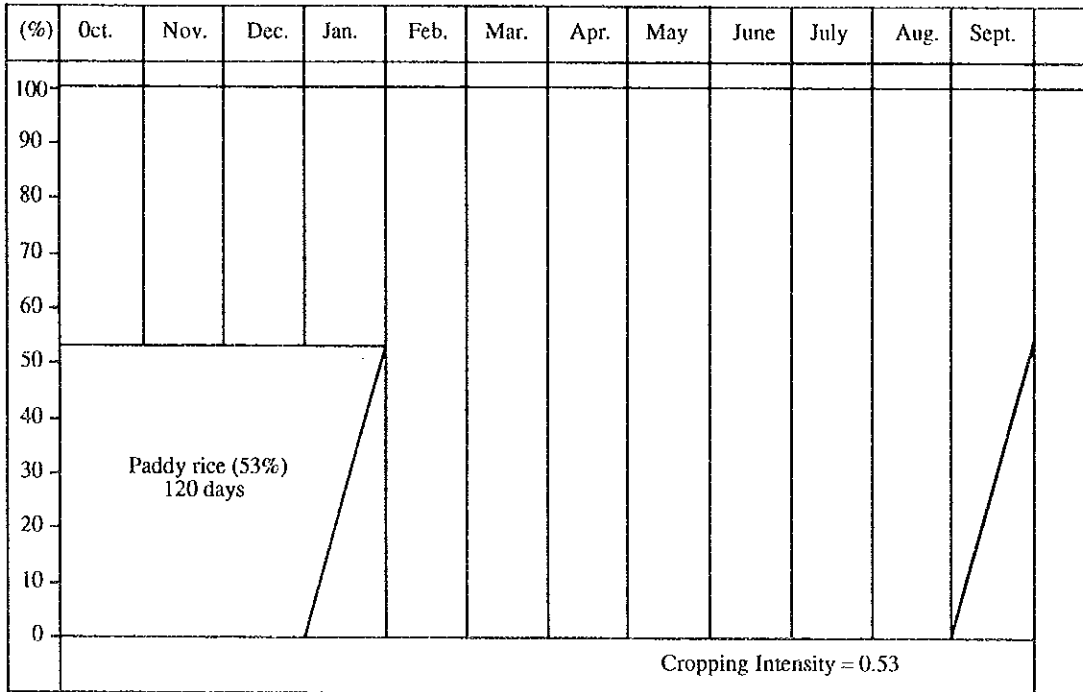


Proposed Cropping Pattern

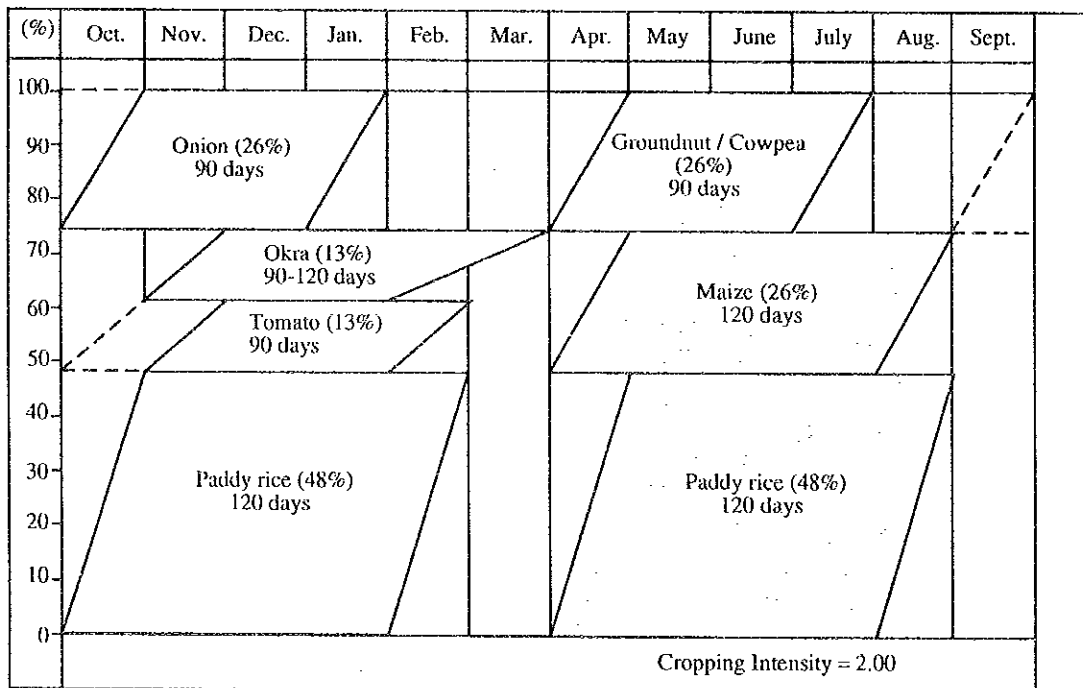
Figure -6
Present and Proposed Cropping Pattern at Mankessim Project

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Present Cropping Pattern



Proposed Cropping Pattern

Figure -7
Present and Proposed Cropping
Pattern at Okyereko Project

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IN THE REPUBLIC OF GHANA

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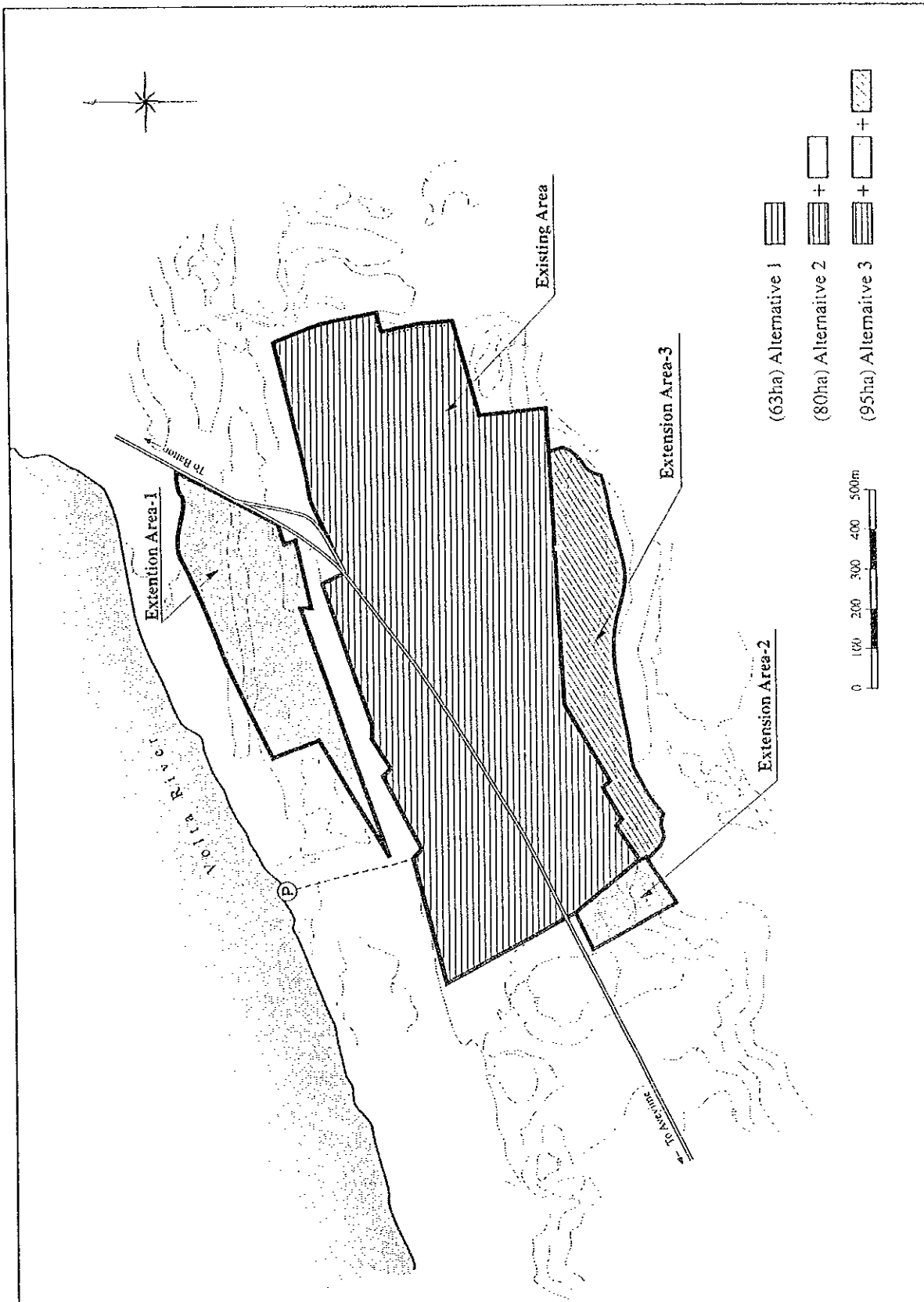


Figure-8
Alternative Plans for Aveyime Project

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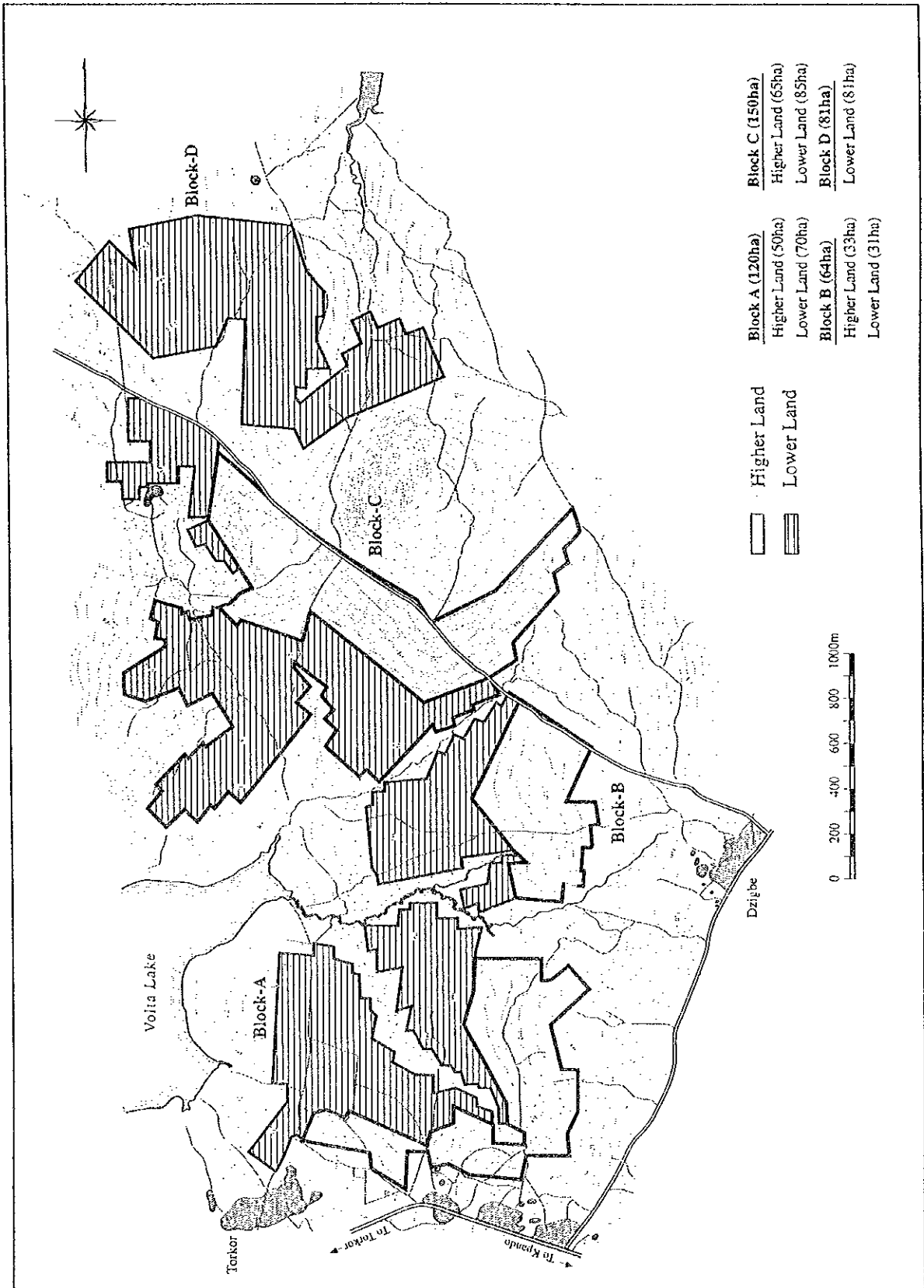


Figure-9
Alternative Plans for Kpando -Torkor Project

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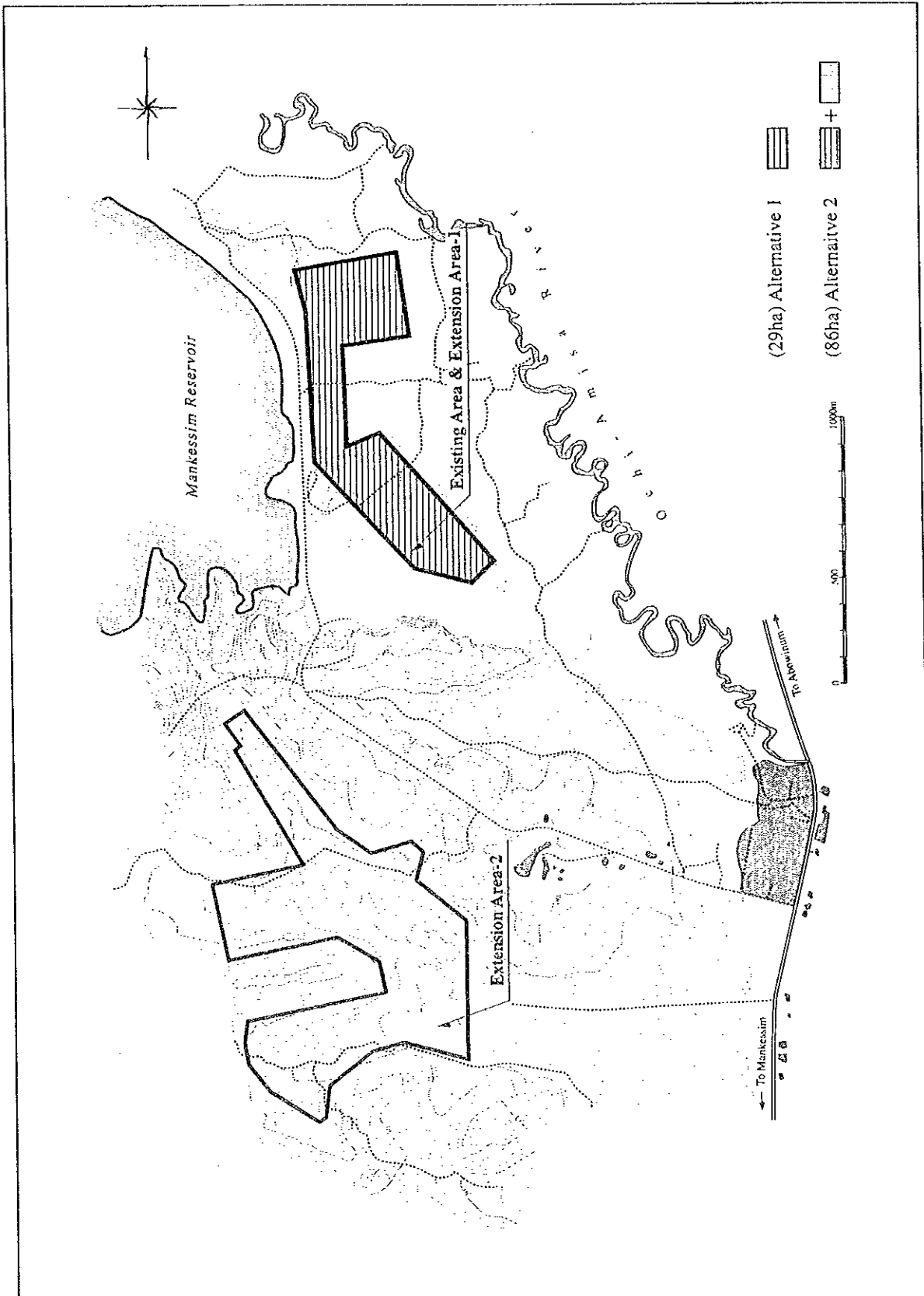


Figure-10
Alternative Plans for Mankessim Project

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 IN THE REPUBLIC OF GHANA**

Japan International Cooperation Agency

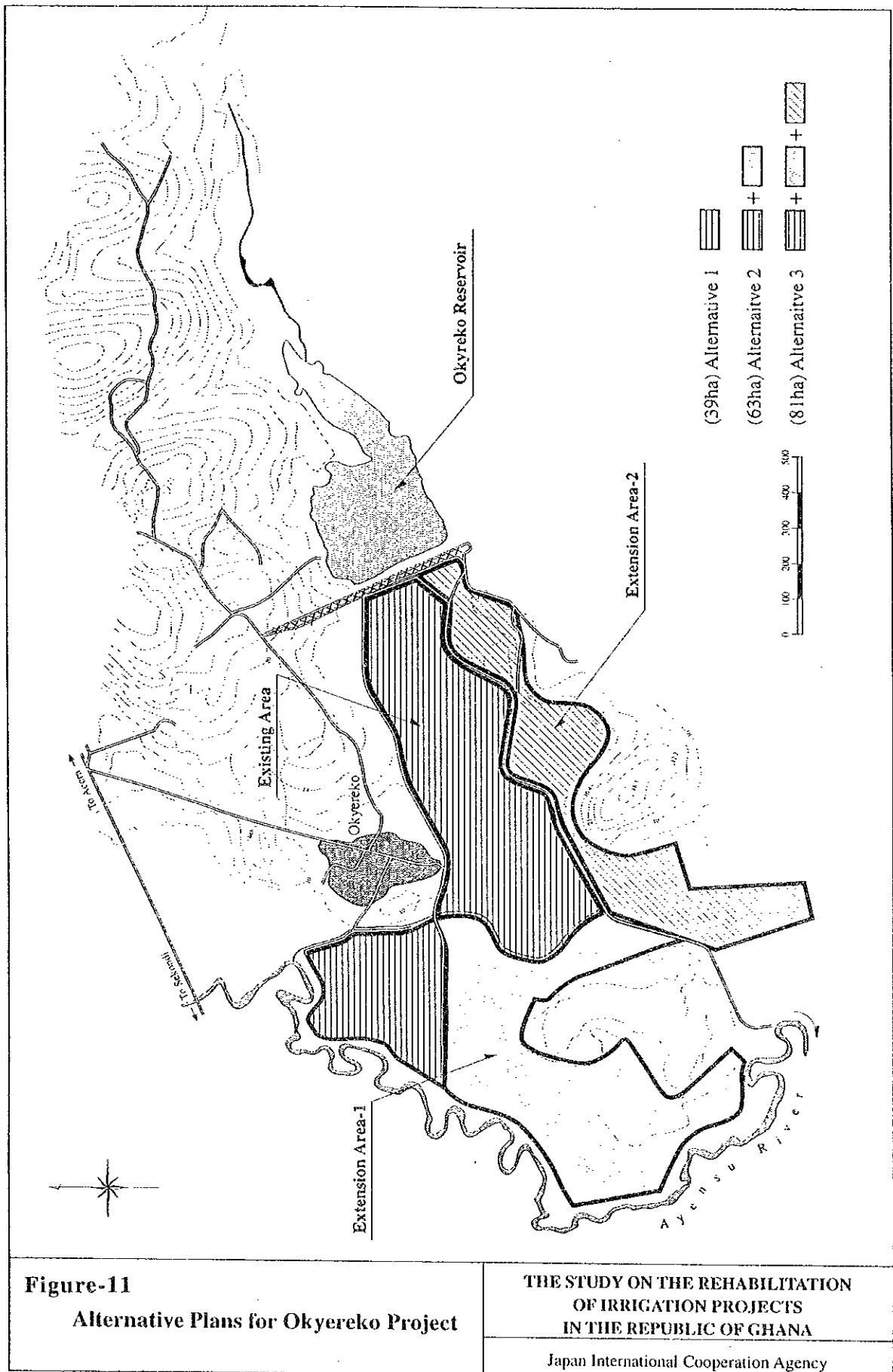
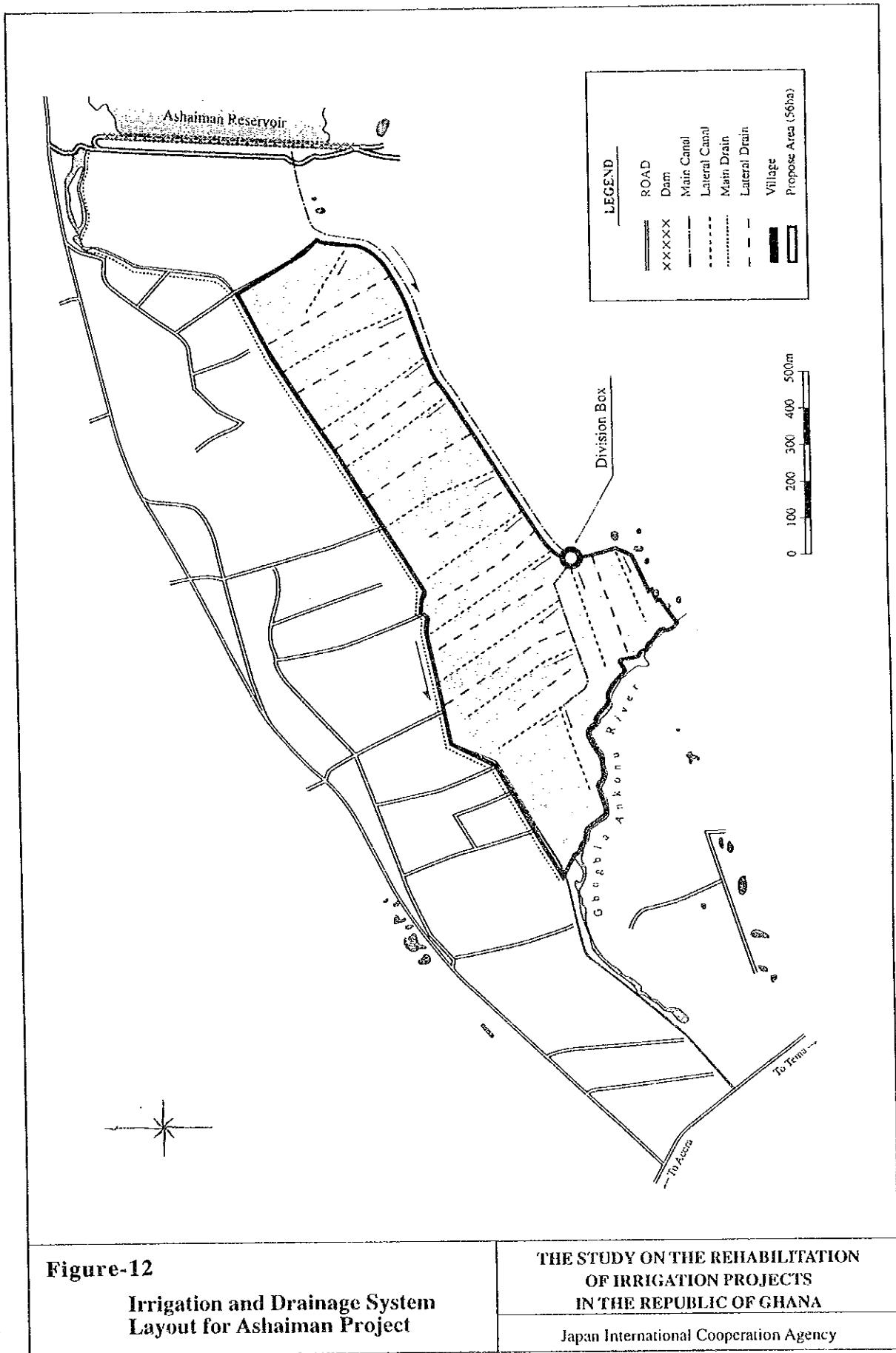


Figure-11
Alternative Plans for Okyereko Project

**THE STUDY ON THE REHABILITATION
 OF IRRIGATION PROJECTS
 IN THE REPUBLIC OF GHANA**

Japan International Cooperation Agency



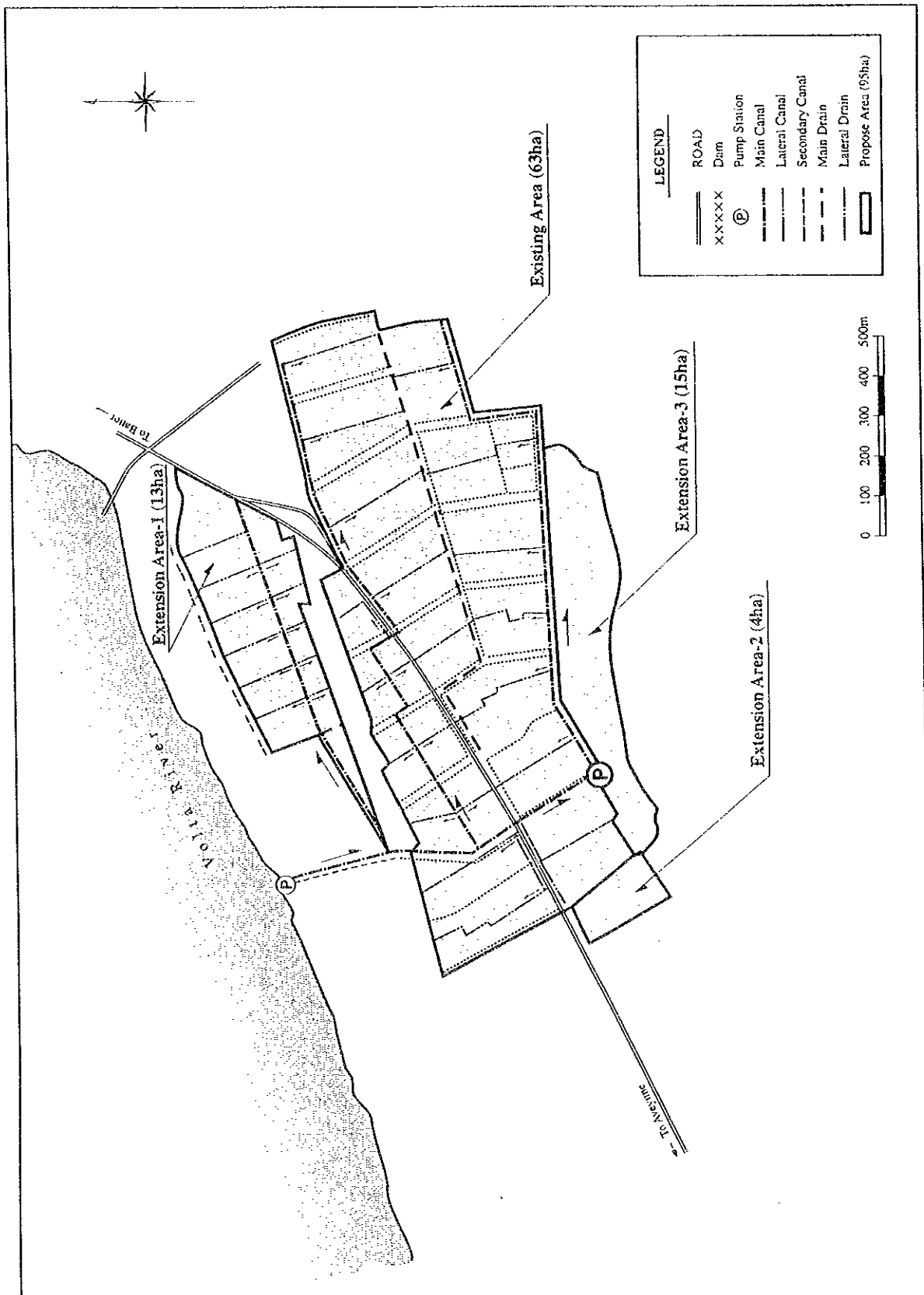


Figure-13
Irrigation and Drainage System
Layout for Aveyime Project

THE STUDY ON THE REHABILITATION
OF IRRIGATION PROJECTS
IN THE REPUBLIC OF GHANA

Japan International Cooperation Agency

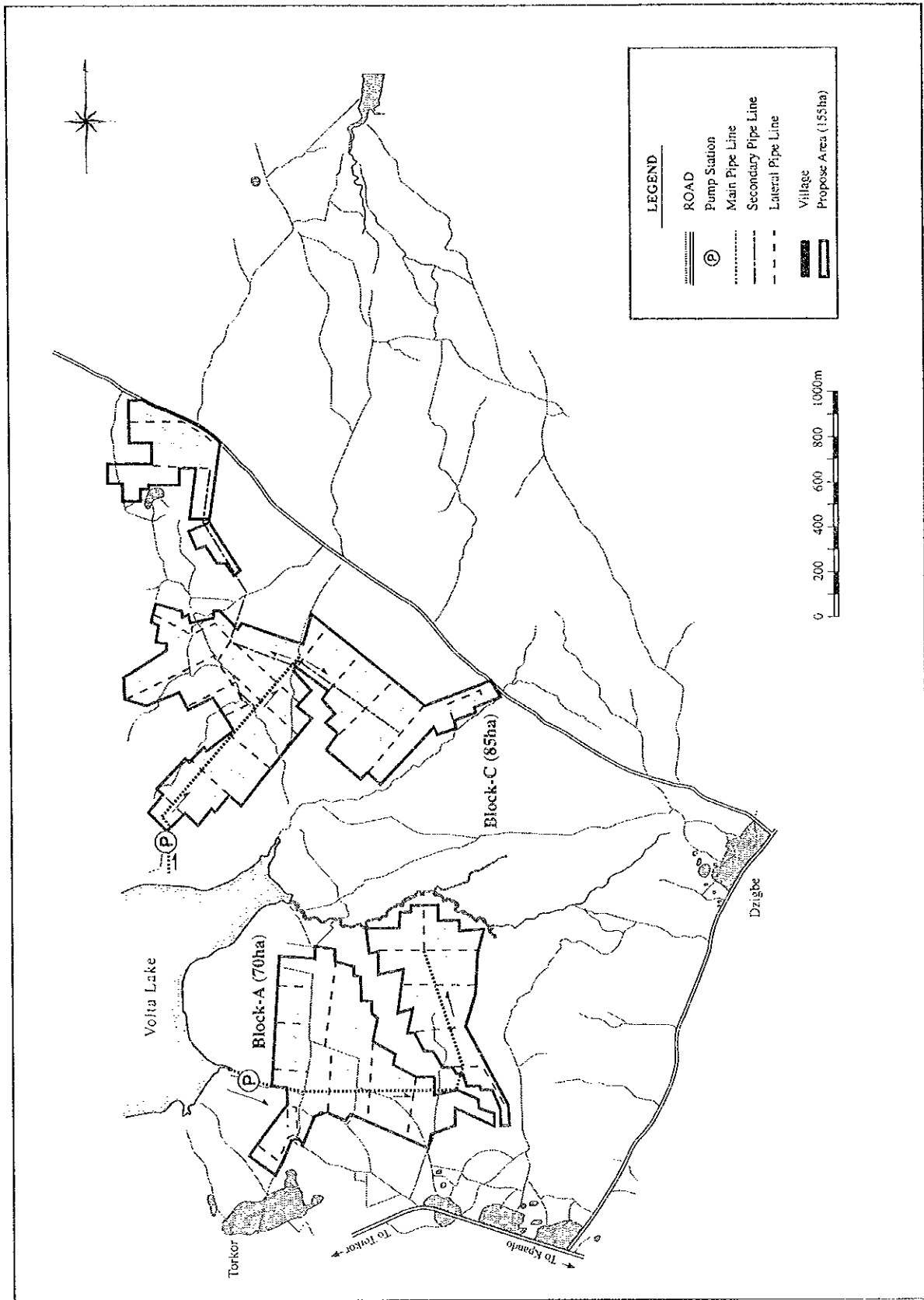


Figure-14
Irrigation and Drainage System
Layont for Kpando-Torkor Project

THE STUDY ON THE REHABILITATION
OF IRRIGATION PROJECTS
IN THE REPUBLIC OF GHANA

Japan International Cooperation Agency

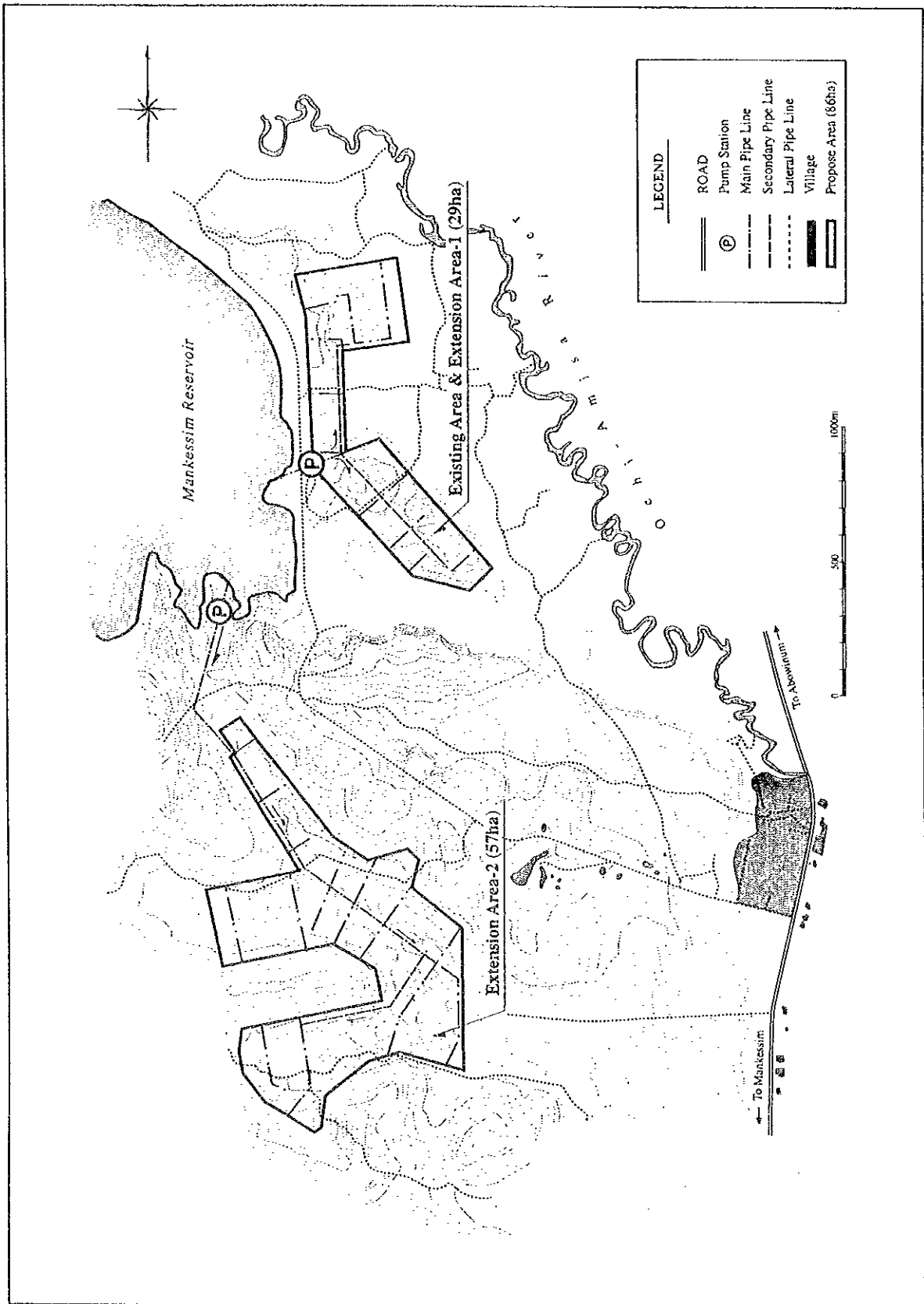
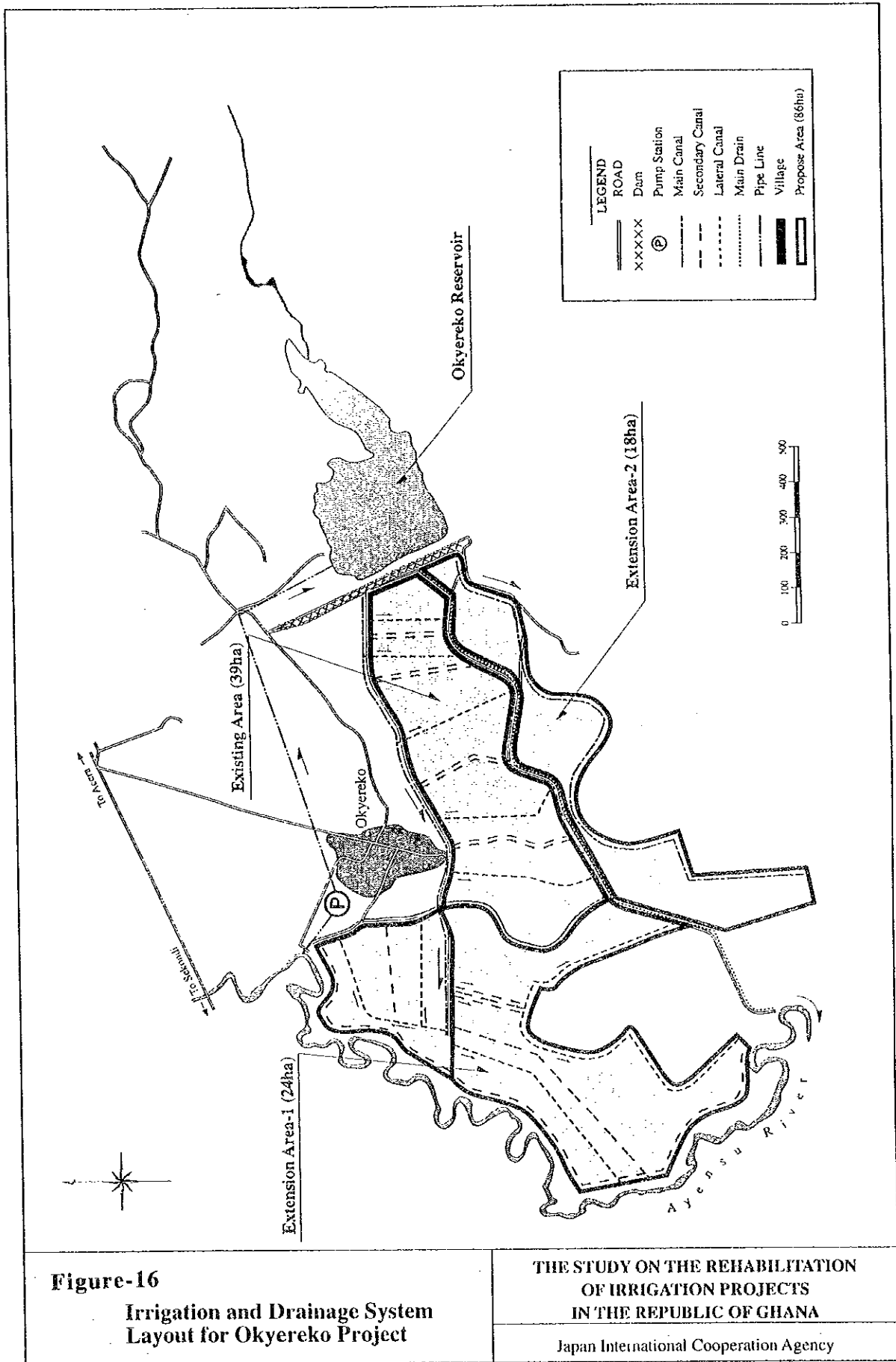
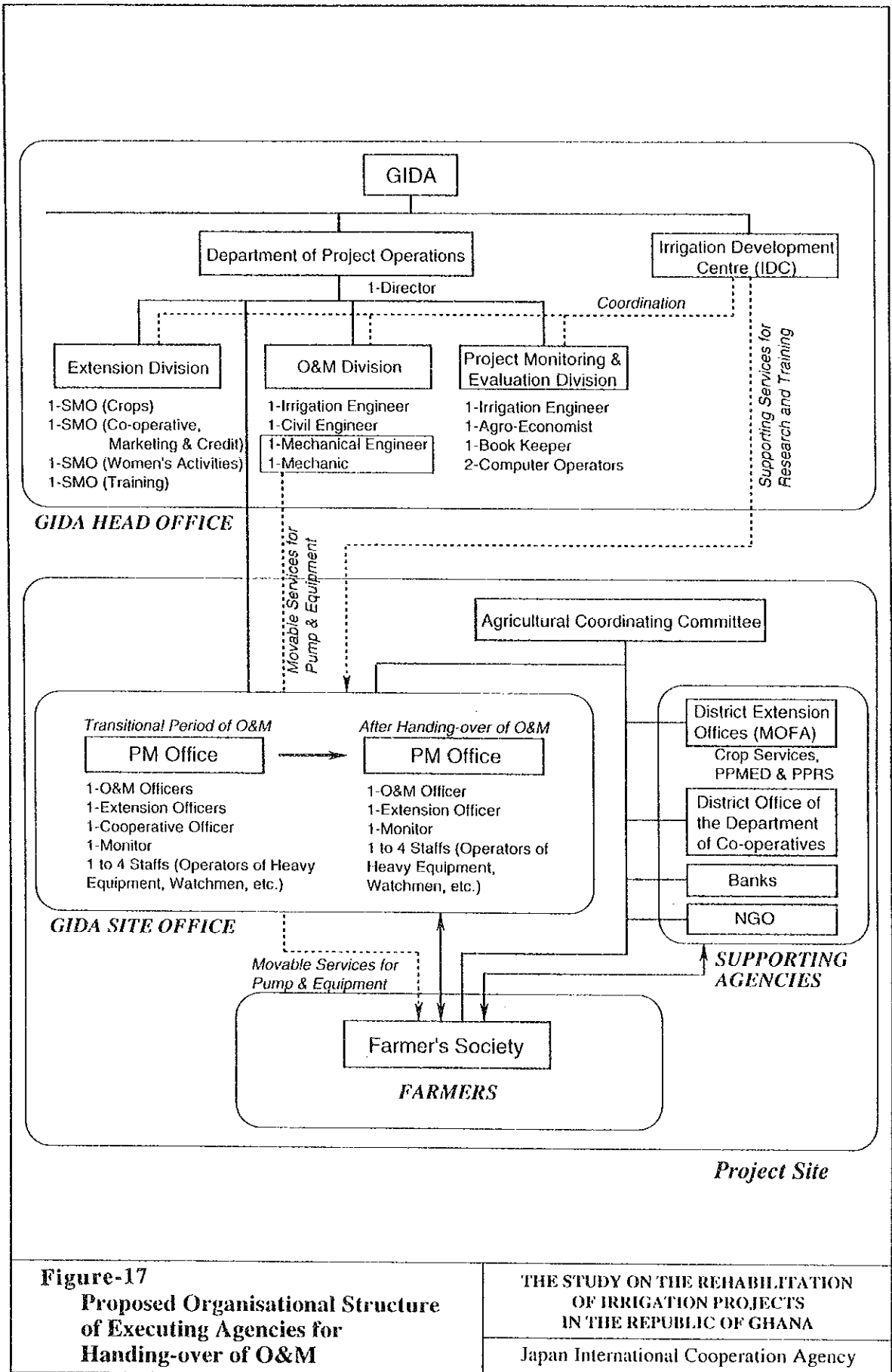


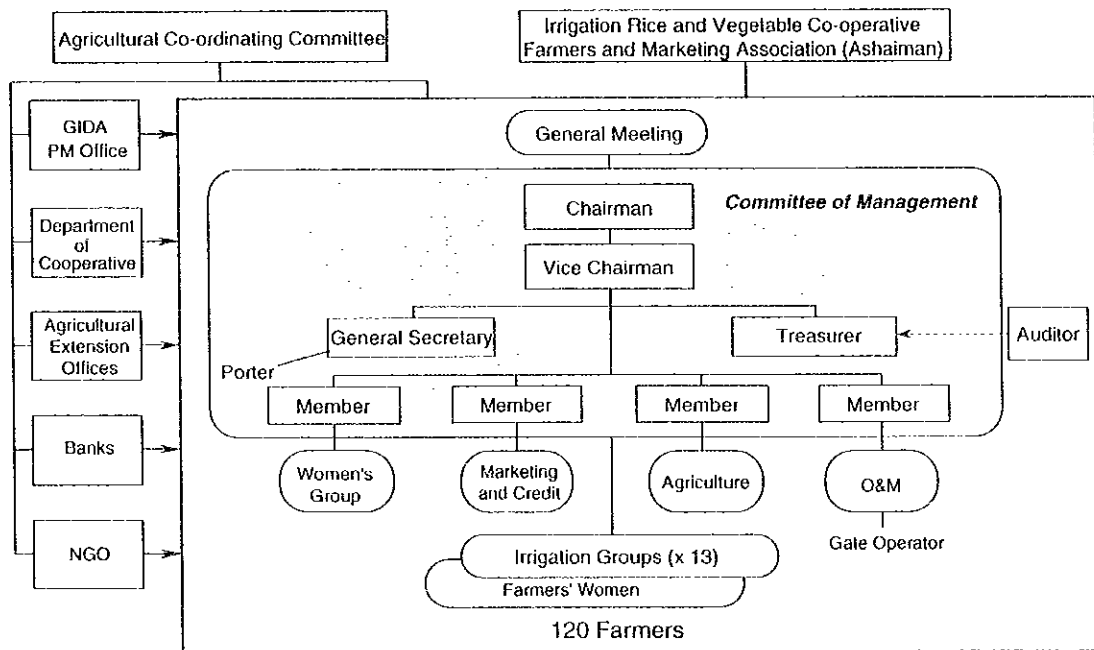
Figure-15
Irrigation and Drainage System
Layout for Mankessim Project

THE STUDY ON THE REHABILITATION
OF IRRIGATION PROJECTS
IN THE REPUBLIC OF GHANA

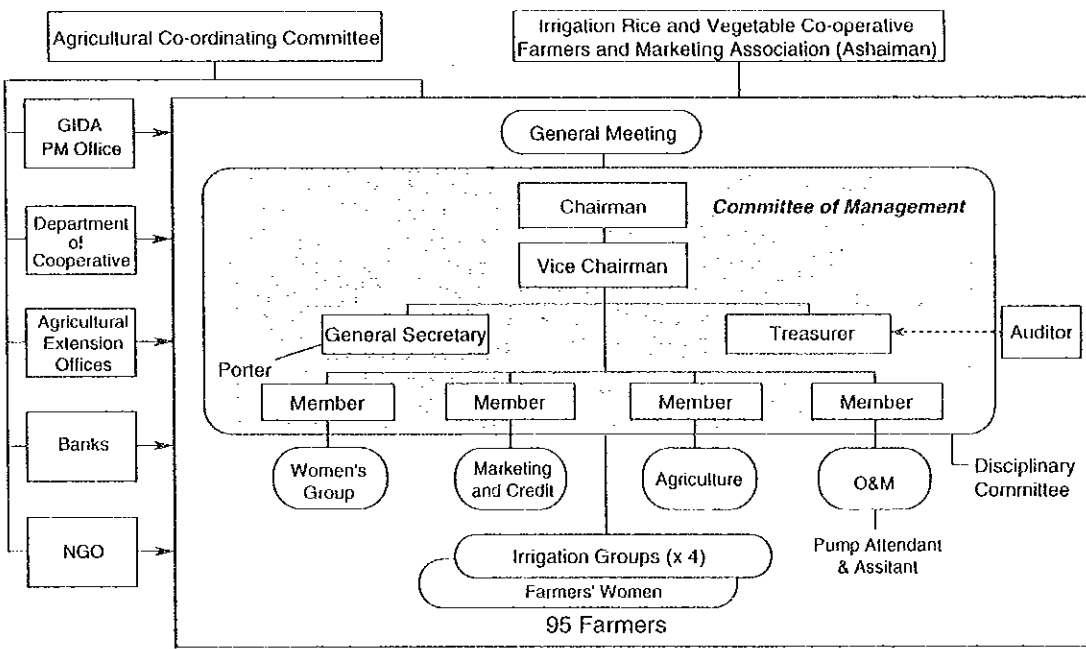
Japan International Cooperation Agency







Ashaiman Project
(54 ha)



Aveyime Project
(95 ha)

Figure-18(1/4)
Proposed Organisational
Structure of Farmers' Societies

THE STUDY ON THE REHABILITATION
OF IRRIGATION PROJECTS
IN THE REPUBLIC OF GHANA

Japan International Cooperation Agency

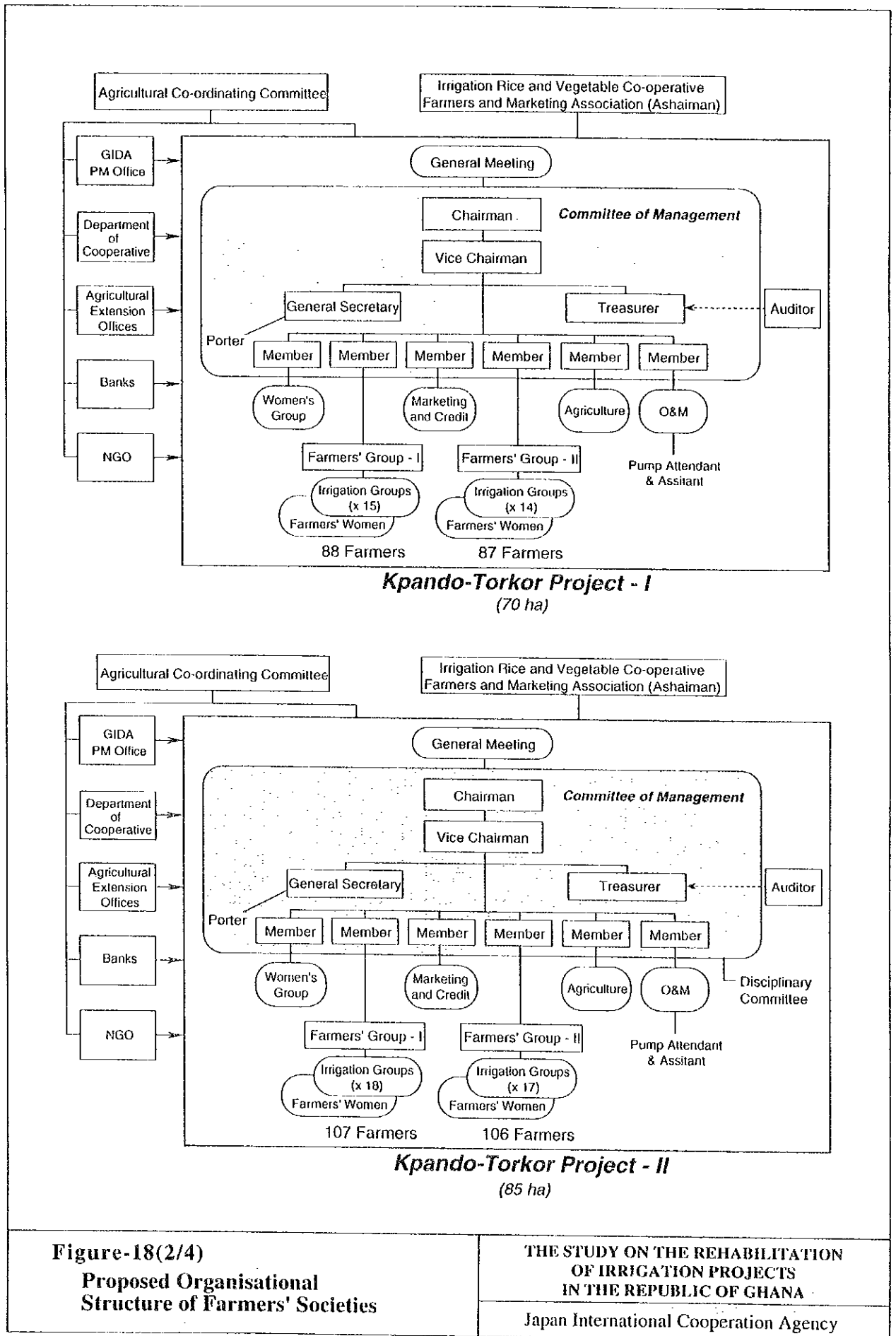
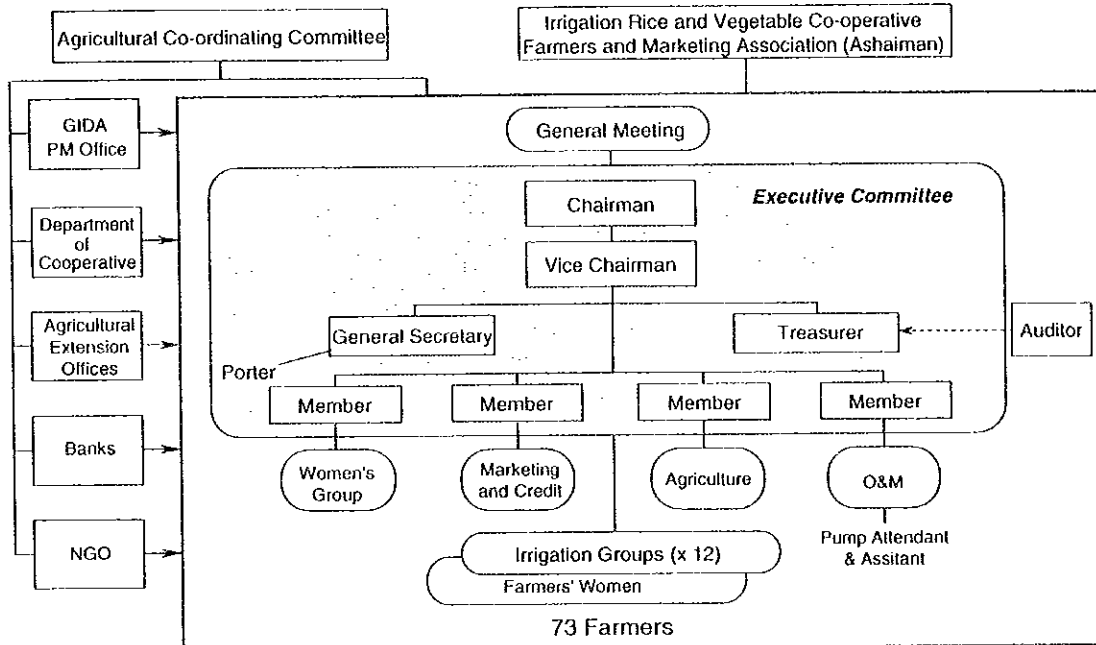


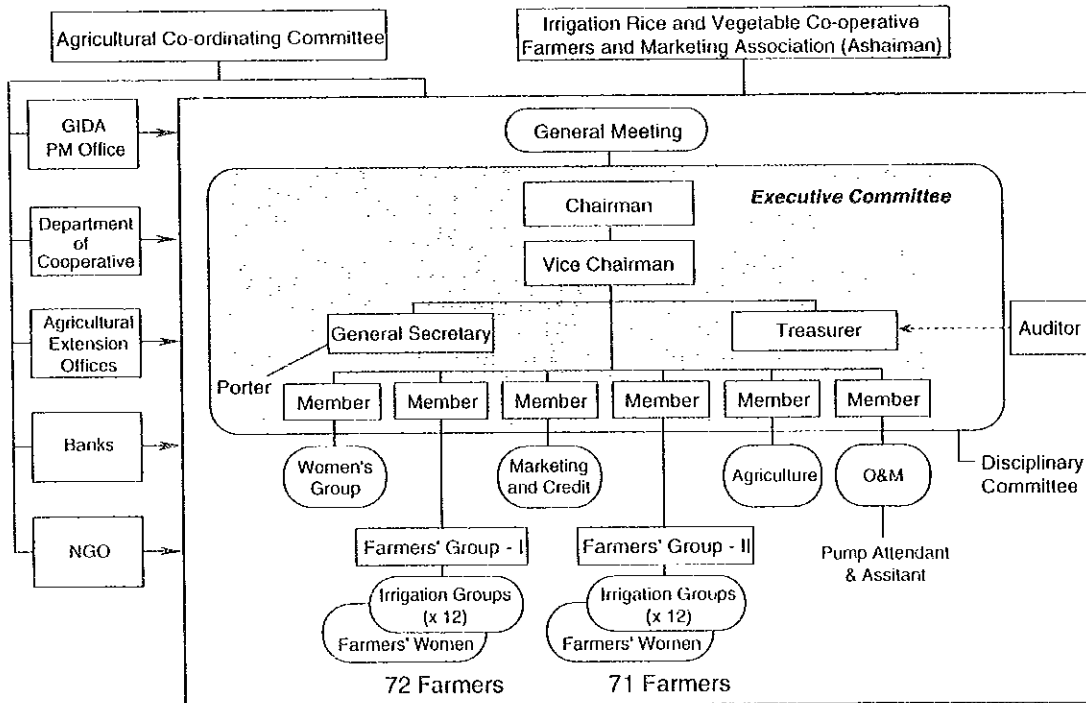
Figure-18(2/4)
Proposed Organisational
Structure of Farmers' Societies

THE STUDY ON THE REHABILITATION
OF IRRIGATION PROJECTS
IN THE REPUBLIC OF GHANA

Japan International Cooperation Agency



Mankessim Project - I
(29 ha)



Mankessim Project - II
(57 ha)

Figure-18(3/4)
Proposed Organisational Structure of Farmers' Societies

THE STUDY ON THE REHABILITATION OF IRRIGATION PROJECTS IN THE REPUBLIC OF GHANA

Japan International Cooperation Agency

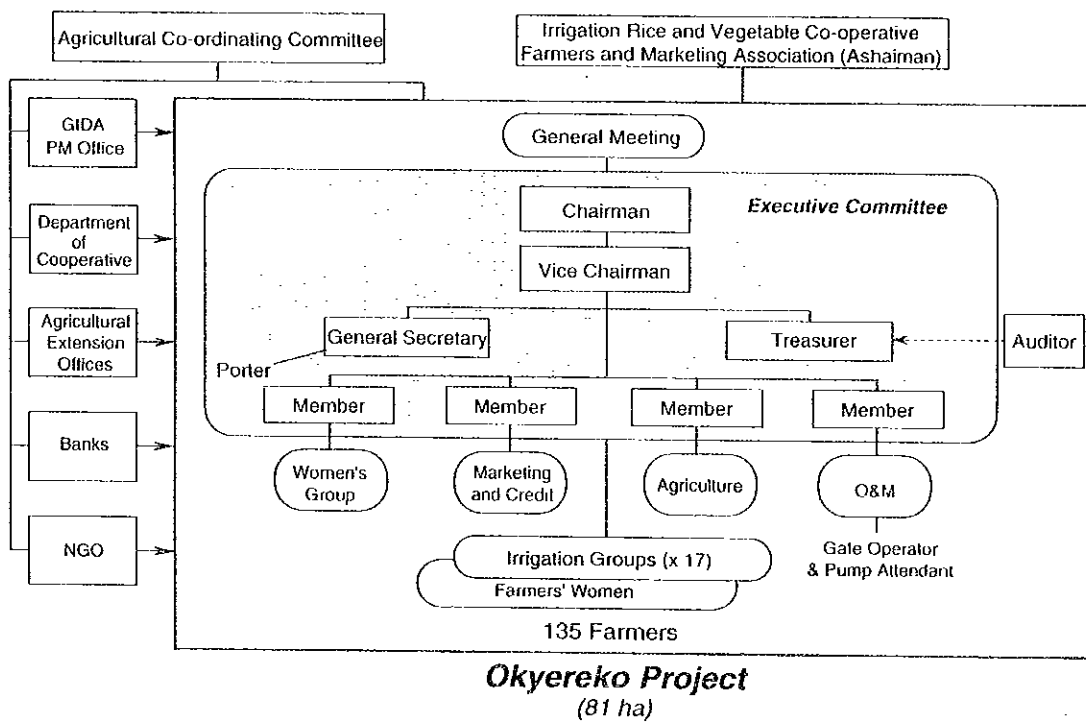
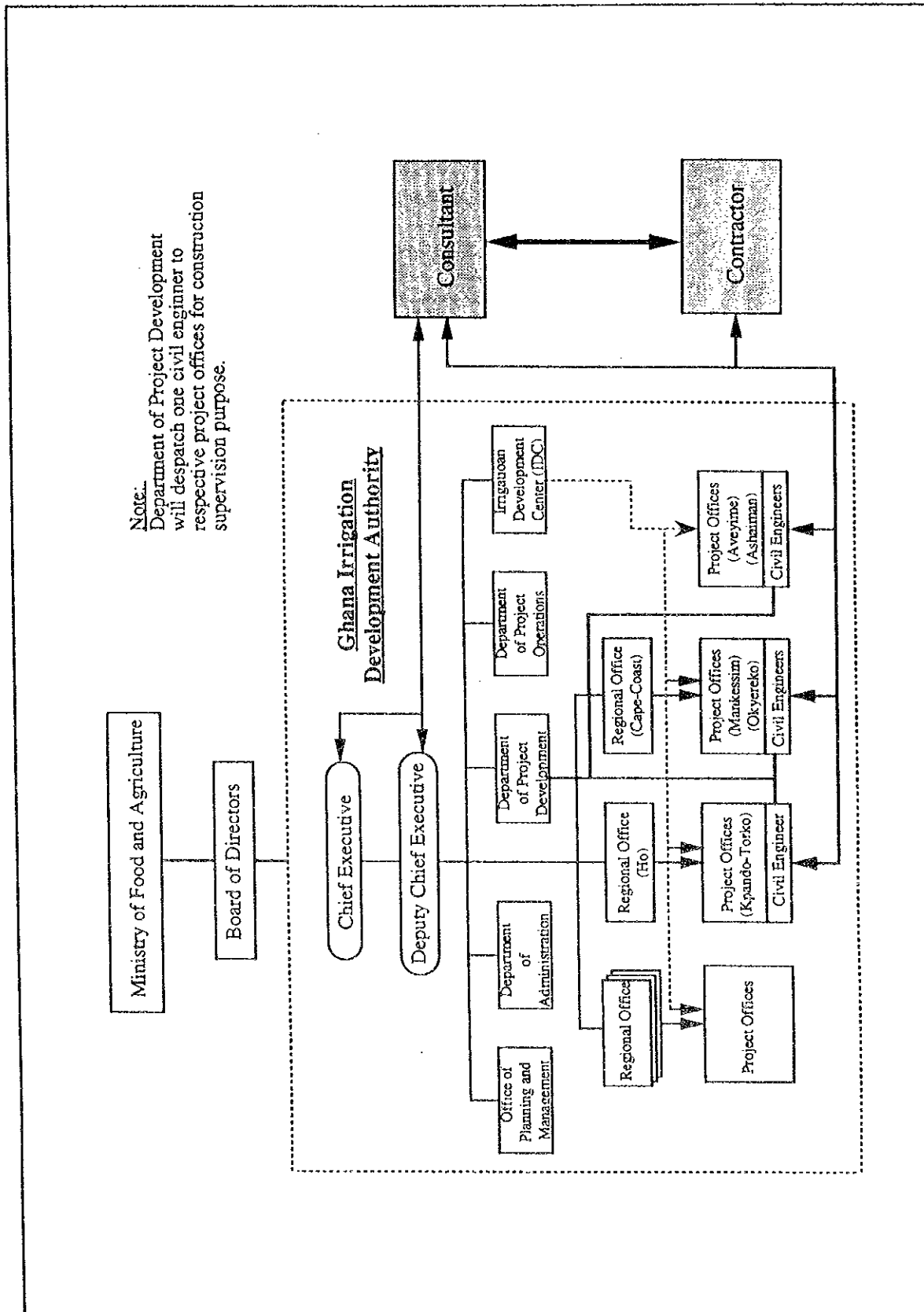


Figure-18(4/4)
**Proposed Organisational
 Structure of Farmers' Societies**

**THE STUDY ON THE REHABILITATION
 OF IRRIGATION PROJECTS
 IN THE REPUBLIC OF GHANA**

Japan International Cooperation Agency



Note...
 Department of Project Development
 will despatch one civil engineer to
 respective project offices for construction
 supervision purpose.

Figure-19
Organization Chart of GIDA
at Construction Time

THE STUDY ON THE REHABILITATION
OF IRRIGATION PROJECTS
IN THE REPUBLIC OF GHANA

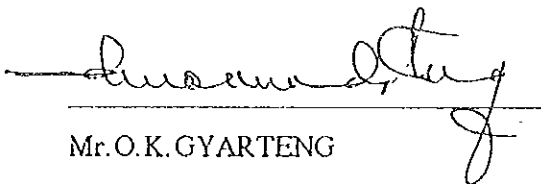
Japan International Cooperation Agency

ATTACHMENT

MINUTES OF MEETING
ON
SCOPE OF WORK
FOR
THE STUDY
ON
THE REHABILITATION OF IRRIGATION PROJECTS
IN
THE REPUBLIC OF GHANA

AGREED UPON
BETWEEN
GHANA IRRIGATION DEVELOPMENT AUTHORITY
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

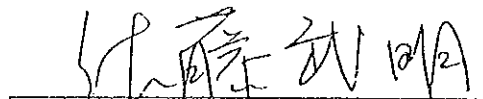
ACCRA, 19 APRIL, 1995



Mr. O.K. GYARTENG

Chief Executive,

Ghana Irrigation Development Authority



Mr. TAKEAKI SATO

Leader,

Preparatory Study Team,

Japan International Cooperation Agency

The preparatory study team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), and headed by Mr. Takeaki SATO, visited the Republic of Ghana April 9 to April 21, 1995 for the purpose of discussing and confirming the Scope of Work for the the Study on the Rehabilitation of Irrigation Project in the Republic of Ghana (hereinafter referred to as "the Study").

The Team had a series of discussions with the officials concerned at Ghana Irrigation Development Authority (hereinafter referred to as "GIDA") and other organizations on the Scope of Work for the Study. The list of participants in the meetings is attached in the ANNEX I.

As a result of the discussions, The Team and GIDA agreed on the Scope of Work for the Study.

The following are the main issues discussed and agreed upon by both sides in relation to the Scope of Work for the Study.

1. GIDA requested that countermeasure(s) against soil erosion in the catchment area(s) be prepared in the Study.
The Team replied that general countermeasure(s), without cost estimate, in the catchment area(s) will be proposed in the Study.
GIDA agreed with the Team.
2. Thirty copies of the Draft Final Report will be submitted.
3. GIDA requested that "private properties or restricted areas" in the sentence of VII, 1., (6) be replaced with "project area and its vicinity".
4. Counterpart personnel will be assigned from GIDA staff members.
5. Offices for the Japanese study team equipped with telephone(s) or communication facilities, electricity, water supply and necessary number of desks and chairs will be provided in Accra, Techiman and Tamale.
6. GIDA requested that the equipment necessary for the Study (attached as ANNEX II) be provided by JICA and the Team promised to convey its request to the Government of Japan.
7. GIDA shall provide necessary number of drivers for vehicles at its own expense.
8. GIDA requested a counterpart training in Japan. The Team promised to convey its request to the Government of Japan.
9. GIDA requested that Subinaja project and Okyereko project be included in the Study.
The Team agreed with GIDA.



LIST OF PARTICIPANTS

Ghanaian Side

Ministry of Food and Agriculture

Hon. Mr. Atsu-Ahedor	Deputy Minister of Food and Agriculture (Crops)
----------------------	---

Ghana Irrigation Development Authority

Mr. O. K. Gyarteng	Chief Executive
Mr. Kwabena Wiafe	Deputy Chief Executive (Engineering)
Mr. A. K. Affram	Deputy Chief Executive (Agronomy)
Mr. Opoku-Mensah	Director of Planning
Mr. H. A. Torghor	Director of Project Development
Mr. D. M. Ohemeng	Director of Project Operation / Director of IDC

Japanese Side

Preparatory Study Team

Mr. Takeaki SATO	Leader
Mr. Izumi OBA	Member
Mr. Hideki NISHIJIMA	Member
Mr. Masahiro IIDA	Member
Mr. Sumio SHINDO	Member
Mr. Kenichi MATSUMOTO	Member

JICA Ghana Office

Mr. Toshiharu KAI	Deputy Resident Representative
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Irrigation Development Center (IDC)

Mr. Akira OGAWA	Colombo Plan Expert
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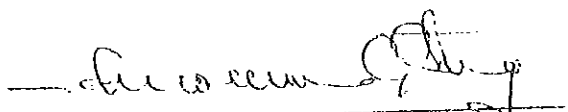

LIST OF EQUIPMENT

- copying machine
- communication equipment
- vehicles
- computing equipment and accessories (IBM compatible)
- air conditioner

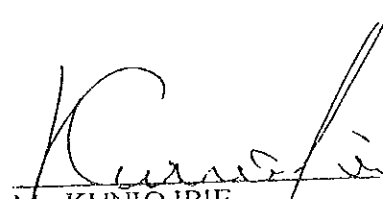
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MINUTES OF MEETING
FOR
INCEPTION REPORT
ON
THE STUDY
ON
THE REHABILITATION OF IRRIGATION PROJECTS
IN
THE REPUBLIC OF GHANA

ACCRA, 23 OCTOBER, 1995



Mr. O.K. GYARTENG
Chief Executive
Ghana Irrigation Development Authority



Mr. KUNIO IRIE
Leader
JICA Study Team

Witnessed by



Mr. TAKEAKI SATO
Leader
Advisory Team
Japan International Cooperation Agency

1. **Date** : 20 October, 1995 (9 : 30 am - 12 : 00 pm)

2. **Place** : Conference Room at GIDA

3. **Attendants** : See attached list

4. **Summary of Discussion** :

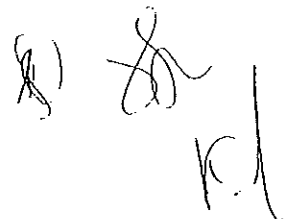
The JICA Study Team (the Study Team) submitted twenty (20) copies of the Inception Report (the Report) to Ghana Irrigation Development Authority (GIDA) on 20 October, 1995 in accordance with the Scope of Work for the Study on the Rehabilitation of Irrigation Projects agreed upon between GIDA and Japan International Cooperation Agency (JICA) on 19 April, 1995.

The meeting was held at GIDA's conference room. Prior to the meeting, the Minutes of Meeting agreed between GIDA and the Preparatory Study Team on 19 April, 1995 were confirmed.

In the meeting, Mr. K. Irie, Leader of JICA Study Team, presented the highlights of the Inception Report. Discussions followed after the presentation with the following as conclusions:

- (1) In principle, the contents of the Inception Report were accepted by GIDA.
- (2) GIDA requested the Study Team that the agricultural development plan to be proposed should be worked out, putting careful attention to the sufficient maintenance period for operation and maintenance of the project facilities. The Study Team agreed to this request.
- (3) GIDA requested the Study Team to study the possibility of expansion of irrigated land in the areas adjacent to the existing project sites. The Study Team agreed to make such a study within the extent economically justifiable.
- (4) GIDA requested that the Steering Committee Meeting be held once a month. The Study Team agreed to this request.
- (5) EIA study shall be executed for the selected priority projects in line with the latest government regulation.

- (6) The proposed cropping pattern should include plan for crop diversification, taking into account the natural, social and economic conditions of the respective study projects.
- (7) The weighted selection criteria which will be used for selection of priority projects should be prepared and discussed with GIDA in advance.
- (8) The possibility of recovering capital cost of the Projects from the farmers should be studied.
- (9) The contractor(s) for execution of any work on the agreement should be selected by bidding, except soil laboratory test.

Handwritten signatures and initials in the bottom right corner of the page. There are three distinct marks: a stylized signature on the left, a signature in the middle, and the initials 'K.L.' on the right.

LIST OF ATTENDANTS

Ghanaian Side

1. Ministry of Food and Agriculture

Hon. Mr. V.K. Atsu-Ahedor Deputy Minister of MOFA (Crops)

2. Ministry of Finance

Mr. E.K. Nkansah Representative of Ministry of Finance

3. Ghana Irrigation Development Authority

Mr. O.K. Gyarteng	Chief Executive
Mr. Kwabena Wiafe	Deputy Chief Executive (Engineering)
Mr. M.A.K. Affram	Deputy Chief Executive (Agronomy)
Mr. H.A. Torgbor	Director of Development
Mr. Yaw Yeboah	Deputy Director of Planning
Mr. S. Oduro-Konadu	Principal Agronomist
Mr. Sammy Akagbor	Principal Agronomist (Soils)
Mr. E.T. Obuobi	Chief Personnel Officer
Mr. P. Osew-Owusu	Solicitor

Japanese Side

1. Advisory Team :

Mr. Takeaki Sato	Leader
Mr. Makoto Takahashi	Coordinator

JICA Ghana Office :

Mr. Toshiharu Kai	Deputy Resident Representative
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Irrigation Development Centre (IDC) :

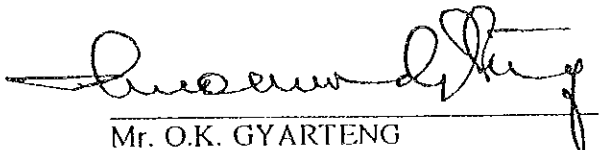
Mr. Akira Ogawa	Colombo Plan Expert
-----------------	---------------------

2. JICA Study Team :

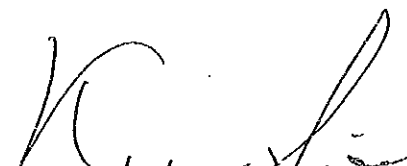
Mr. Kunio Irie	Leader
Mr. Hitoshi Shimazaki	Irrigation and Drainage System
Mr. Tadaharu Muroto	Social and Farmer' Organisation
Mr. Noboru Mochizuki	Management and Agricultural Aspects
Mr. Kisaku Yamada	Agro-economic Study & Project
	Evaluation
Mr. Mototaka Nishi	Hydrological & Meteorological Study
Mr. Yasushi Osato	Structure Design & Cost Estimate
Mr. Yoji Mizuguchi	Pedology & Environment
Mr. Shigeya Otsuka	Coordinator

MINUTES OF MEETING
FOR
PROGRESS REPORT - I
ON
THE STUDY
ON
THE REHABILITATION OF IRRIGATION PROJECTS
IN
THE REPUBLIC OF GHANA

ACCRA, 22 DECEMBER, 1995



Mr. O.K. GYARTENG
Chief Executive
Ghana Irrigation Development Authority



Mr. KUNTORRIE
Leader
JICA Study Team

1. Date : 22nd October, 1995 (10:00 - 13:30)
2. Place : Conference Room at GIDA
3. Attendants : See attached list
4. Summary of Discussion :

The JICA Study Team (the Study Team) submitted twenty (20) copies of the Progress Report-I (the Report) to Ghana Irrigation Development Authority (GIDA) on 19th December, 1995 in accordance with the Scope of Work for the Study on the Rehabilitation of Irrigation Projects agreed upon between GIDA and Japan International Cooperation Agency (JICA) on 19 April, 1995.

At the meeting, Mr. K. Irie, Leader of JICA Study Team, presented the highlights of the Report, and other experts made additional explanation of their technical sections. Discussions followed after the presentation with the following as conclusions:

- (1) In principle, the contents of the Report were accepted by GIDA.
- (2) GIDA requested the Study Team to :
 - (a) Spell out the title of all tables shown in the paragraphs,
 - (b) Make further study on the water requirements,
 - (c) Make further study on possibility of increasing the reservoir capacity of Ashaiman project,
 - (d) Make a study on improvement of intake valve at Ashaiman reservoir,
 - (e) Study the maintenance method of drainage system,
 - (f) Make further study on fertilizer and other agro-chemicals application effects on environment,
 - (g) Study needs of rehabilitation and new construction of staff quarters in connection with the projects rehabilitation, and
 - (h) Make further study on credit facilities to farmers.



LIST OF ATTENDANTS

Ghanaian Side

1. Ghana Irrigation Development Authority :

Mr. O.K. Gyarteng	Chief Executive
Mr. Kwabena Wiafe	Deputy Chief Executive (Engineering)
Mr. M.A.K. Affram	Deputy Chief Executive (Agronomy)
Mr. H.A.Torgbor	Director of Development
Mr. D.N. Ohemeng	Acting Director of Operations
Mr. Yaw Yeboah	Deputy Director of Planning
Mr. Nana Kofi Koduah	Deputy Director of Plant
Mr. Sammy Akagbor	Deputy Director of Agriculture
Mr. Chris Bence	Agronomist

Japanese Side

1. JICA Study Team :

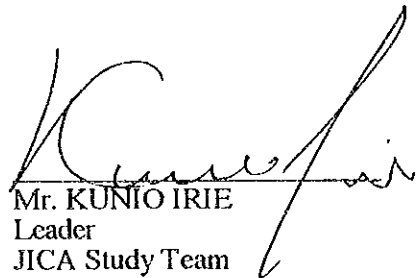
Mr. Kunio Irie	Leader
Mr. Hitoshi Shimazaki	Irrigation and Drainage System
Mr. Tadaharu Murono	Social and Farmer' Organisation
Dr. Noboru Mochizuki	Management and Agricultural Aspects
Mr. Kisaku Yamada	Agro-economic Study & Project Evaluation
Mr. Yasushi Osato	Structure Design & Cost Estimate
Mr. Yoji Mizuguchi	Pedology & Environment
Mr. Shigeya Otsuka	Coordinator

MINUTES OF MEETING
FOR
INTERIM REPORT
ON
THE STUDY
ON
THE REHABILITATION OF IRRIGATION PROJECTS
IN
THE REPUBLIC OF GHANA

ACCRA, 14th MARCH, 1996



Mr. O.K. GYARTENG
Chief Executive
Ghana Irrigation Development Authority



Mr. KUNIO IRIE
Leader
JICA Study Team

1. **Date** : 12th March, 1996 (10:00 - 13:30)
2. **Place** : Conference Room at GIDA
3. **Attendants** : See attached list
4. **Summary of Discussion** :

The JICA Study Team (the Study Team) submitted twenty (20) copies of the Interim Report (the Report) to the Ghana Irrigation Development Authority (GIDA) on 11th March, 1996 in accordance with the Scope of Work for the Study on the Rehabilitation of Irrigation Projects agreed upon between GIDA and Japan International Co-operation Agency (JICA) on 19 April, 1995.

At the meeting, Mr. K. Irie, Leader of the Study Team, presented the highlights of the Report. Discussions followed after the presentation with the following as conclusions:

- (1) In principle, the contents of the Report were accepted by GIDA.
- (2) GIDA agreed to the five selected priority projects, but requested that three more projects namely, Amate, Subinja and Akumadan be added to the priority projects in an attempt at obtaining a reasonable regional balance. Reasons for requesting for the specific three projects are as follows:
 - (a) Amate project:

Amate is one of the lakeshore projects which the Government of Ghana is trying to promote due to vastness of the Volta Lake. Kpando-Torkor serves as a pilot for the eastern side of the Volta whilst Amate serves as a pilot for the western side. The EIRR is higher than Aveyime. The reason for non-selection is access. Fortunately, the latest information is that the road is just about to be rehabilitated, and access would have considerably improved by the time of project implementation.
 - (b) Subinja project:

Subinja has high total point but low EIRR. Only two projects were studied in the region, Tanoso and Subinja. Both were initiated by FAO as pilot to act as a catalyst for private tomato and other vegetable growing initiative. Apart from



the regional balance expected from such rehabilitation work, Subinja is needed as a model farm for vegetable growers in the district and in the region.

(c) Akumadan project:

Akumadan serves as a pilot scheme for tomatoes. It was established by FAO to propagate the growing of vegetables. Its main objective in vegetables production has now caught on very well with the population. There is now need to provide better facilities to upgrade the present husbandry. The total of points is high and the EIRR is quite low. The reason is the calculated low dependable water. It is suggested that the study be carried to feasibility level whilst checking calculations and assumptions.

In any case as far as the Study Team is concerned, the go ahead has been given to it to prepare the feasibility study on the five projects as proposed in the Report.

- (3) It was confirmed that the feasibility study on Ashaiman project shall be executed for the existing facilities covering 44 ha of the irrigable area only.
- (4) GIDA requested the Study Team to make further study on capital and O&M cost recovery at the feasibility study time:
- (5) The costs for rehabilitation of the projects should be shown separately as construction costs per ha, costs for institutional improvement per ha, and those for agricultural extension services, etc. per ha.
- (6) GIDA suggested the Study Team check the availability of existing aerial photography prepared by the Government of Ghana recently which may be used for preparation of topographic maps of the five priority projects.



LIST OF ATTENDANTS

Ghanaian Side

1. Ministry of Food and Agriculture :

Mr. J.A. Poku Deputy Director, Department of Crop Services

2. Ghana Irrigation Development Authority :

Mr. O.K. Gyarteng Chief Executive
Mr. Kuwabena Wiafe Deputy Chief Executive (Engineering)
Mr. M.A.K. Affram Deputy Chief Executive (Agronomy)
Mr. H.A.Torgbor Director, Department of Project Development
Mr. D.M. Ohemeng Acting Director, Department of Project
Operations
Mr. A. Opoku-Mensah Director, Department of Planning

Japanese Side

1. Irrigation Development Centre :

Mr. Akira Ogawa JICA Expert

2. JICA Study Team :

Mr. Kunio Irie Leader
Mr. Hitoshi Shimazaki Irrigation and Drainage System
Mr. Tadaharu Murono Social and Farmer' Organisation




MINUTES OF MEETING
FOR
PROGRESS REPORT-II
ON
THE STUDY
ON
THE REHABILITATION OF IRRIGATION PROJECTS
IN
THE REPUBLIC OF GHANA

ACCRA, 18th DECEMBER, 1996



Mr. O.K. GYARTENG
Chief Executive
Ghana Irrigation Development Authority



Mr. KUNIO IRIE
Leader
JICA Study Team

1. **Date** : 18th December, 1996 (10:00 - 12:00)
2. **Place** : Conference Room at GIDA
3. **Attendants** : See attached list
4. **Summary of Discussion** :

The JICA Study Team (the Study Team) submitted twenty (20) copies of the Progress Report -II (the Report) to the Ghana Irrigation Development Authority (GIDA) on 16th December, 1996 in accordance with the Scope of Work for the Study on the Rehabilitation of Irrigation Projects agreed upon between GIDA and Japan International Co-operation Agency (JICA) on 19th April, 1995.

At the meeting, Mr. K. Irie, Leader of the Study Team, presented the highlights of the Report. Discussions followed after the presentation with the following as conclusions:

- (1) In principle, the contents of the Report were accepted to GIDA.
- (2) As for the rehabilitation plan on the projects, the following are confirmed to be included in the study:
 - (a) Downstream portion of the existing spillways of Ashaiman and Okyereko projects shall be rehabilitated because of severe damages.
 - (b) Green belt with intercepting drain and collector drain shall be provided in Kpando-Torkor and Mankessim projects, in order to avoid soil erosion.
 - (c) Staff quarters will be needed for the visiting researchers at Ashaiman project. In addition, a fence will also be needed for security purpose.
- (3) GIDA has no specific design standard. Feasibility level design for the project facilities such as canals, road, related structures and pump station may be made using the generally authorized Japanese, USA and British standards.
- (4) **Institutional Improvement Plan**
The institutional improvement plan was basically accepted by GIDA. Further study on credit facility will be made taking into consideration revolving fund.
- (5) **Privatization of GIDA**
GIDA is requesting the Cabinet cancellation of its privatization. It is confirmed that even if GIDA were to be privatized in the future, the Ministry of Food and Agriculture shall take care of the Project as the government executing agency.

LIST OF ATTENDANTS

Ghanaian Side

1. Ghana Irrigation Development Authority :

Mr. O.K. Gyarteng	Chief Executive
Mr. Kwabena Wiafe	Deputy Chief Executive (Engineering)
Mr. D.M. Ohemeng	Acting Director, Department of Project Operations
Mr. A. Opoku-Mensah	Director, Department of Planning

Japanese Side

1. Japan International Cooperation Agency :

Mr. Osamu Kosegawa	Deputy Resident Representative of JICA Ghana Office
--------------------	--

2. Irrigation Development Centre :

Mr. Akira Ogawa	JICA Expert
-----------------	-------------

3. JICA Study Team :

Mr. Kunio Irie	Leader
Mr. Hitoshi Shimazaki	Irrigation and Drainage System
Mr. Tadaharu Murono	Social and Farmers' Organisation
Mr. Noboru Mochizuki	Management and Agricultural Aspects
Mr. Kisaku Yamada	Agro-economic Study and Project Evaluation
Mr. Yasushi Osato	Structure Design and Cost Estimate
Mr. Shigeya Otsuka	Coordinator

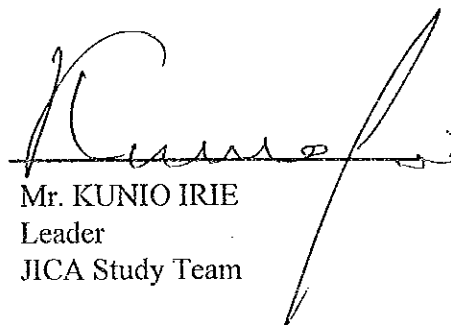


MINUTES OF MEETING
FOR
DRAFT FINAL REPORT
ON
THE STUDY
ON
THE REHABILITATION OF IRRIGATION PROJECTS
IN
THE REPUBLIC OF GHANA

ACCRA, 14 MARCH, 1997

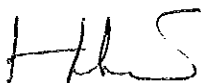


Mr. O.K. GYARTENG
Chief Executive
Ghana Irrigation Development Authority



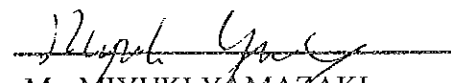
Mr. KUNIO IRIE
Leader
JICA Study Team

Witnessed by



Mrs. AGNES M. BATSA
Head, Bilateral Unit
International Economic Relations Division
Ministry of Finance

Witnessed by



Ms. MIYUKI YAMAZAKI
Coordinator
Advisory Team
Japan International Cooperation Agency

1. Date : 11th March, 1997 (9 : 00 am - 11 : 00 am)

2. Place : Conference Room at GIDA

3. Attendants : See attached list

4. Summary of Discussion :

The JICA Study Team (the Study Team) submitted twenty (20) copies of the Draft Final Report (the Report) to Ghana Irrigation Development Authority (GIDA) prior to this explanation meeting, in accordance with the Scope of Work for the Study on the Rehabilitation of Irrigation Projects agreed upon between GIDA and Japan International Cooperation Agency (JICA) on 19 April, 1995.

At the meeting, Mr. K. Irie, Leader of JICA Study Team, presented a brief explanation on the contents of the Report. Discussions followed after the presentation with the following as conclusions:

- (1) In principle, the contents of the Report were accepted to GIDA.
- (2) GIDA asked the Study Team to ensure that Table-7 "Implementation Schedule" is given a footnote mentioning that the fiscal year in the table means the Japanese fiscal year. The Study Team agreed to this request.
- (3) GIDA asked that the Study Team to change the expression of "no or low interest" on the 6th line from top on page S-14 to "prevailing interest." The Study Team agreed to this request.
- (4) GIDA requested the Study Team to mention reforestation/green belt which will be provided around the Okyereko reservoir by beneficiaries as a recommendation, in order to protect the reservoir from further siltation. The Study Team agreed to this request.
- (5) GIDA asked the Study Team whether the budgets for training of staff and capital for the revolving loan recommended in the Report are included in the project cost or not. The Study Team answered that these budgets are not included in the project cost. Hence, GIDA asked for the possibility to the JICA Advisory Team of finding out whether something could be done about it. The JICA Advisory Team agreed to convey the message to JICA Headquarters.

- (6) Further comments on the Report by GIDA, if any, will be sent to the JICA Study Team by 15 April, 1997.
- (7) It was confirmed that the official letter stating that GIDA will not be privatized, will be issued to JICA by the Ministry of Food and Agriculture. (The JICA Study Team later informed GIDA that the Deputy Minister for Food and Agriculture in charge of crops (Mr.V.A.Atsu Ahedor) also confirmed the above when the JICA Study Team paid a courtesy call on him on 11th March, 1997)
- (8) GIDA agreed to circulate the Final Report under the condition of "for official use only".

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LIST OF ATTENDANTS

Ghanaian Side

1. Ghana Irrigation Development Authority

Mr. O.K. Gyarteng	Chief Executive
Mr. Kwabena Wiafe	Deputy Chief Executive (Engineering)
Mr. A.Opoku-Mensah	Director of Department of Planning
Mr. H.A. Torgbor	Director of Development
Mr. D.M. Ohemeng	Acting Director, Department of Project Operation

Japanese Side

1. JICA Advisory Team :

Ms. Miyuki Yamazaki	Coordinator
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2. JICA Study Team :

Mr. Kunio Irie	Leader
Mr. Hitoshi Shimazaki	Irrigation and Drainage System
Mr. Tadaharu Murono	Social and Farmer' Organization

JICA