

**Table A-20 Farm Budget Analysis - Present Condition**

Projects:	ASH	WEI	AMA	AFI	AVE	KPA	MAN	AKU	TAN	BON	SUB	OKY
No. of Farmers (Household)	120	115	63	533	62	118	89	101	188	525	25	68
Farm Management Size*1 (ha)	0.55	2.81	2.73	2.64	1.10	0.64	0.82	1.14	1.56	1.91	2.25	1.30
Total Irrigated Area (ha)	59.0	323.3	85.2	694.6	-	13.0	26.4	50.2	46.8	461.1	12.6	21.6
Irrigated Area per a Farmer (ha)	0.49	2.81	1.35	1.30	-	0.11	0.30	0.50	0.25	0.88	0.50	0.32
Size of Household (Persons)	7.1	6.8	7.9	8.4	7.5	6.5	6.5	7.8	6.1	7.9	5.9	6.6
<b>1. Gross Income (CD1,000)</b>	<b>2,403</b>	<b>5,667</b>	<b>6,805</b>	<b>3,465</b>	<b>1,694</b>	<b>2,060</b>	<b>1,821</b>	<b>2,394</b>	<b>2,072</b>	<b>2,237</b>	<b>2,858</b>	<b>2,128</b>
(1) Farm Income	784	5,416	6,387	2,296	571	954	1,229	1,605	1,068	1,575	2,315	1,118
a) Crop Income*2	763	5,132	6,335	2,192	419	918	1,213	1,453	1,008	1,458	2,159	1,051
Irrigated												
- Okra	280	852	-	353	-	551	57	-	-	268	-	-
- Tomatoes	-	251	1,454	-	-	-	-	1,000	834	211	-	-
- Egg Plant	-	-	-	-	-	-	357	-	-	94	551	-
- Onion	-	-	3,508	-	-	-	-	-	-	83	-	-
- Water melon	-	-	-	-	-	-	250	-	-	-	-	-
- Hot Pepper	-	311	130	-	-	-	-	-	-	23	273	-
- Tinda*3	-	256	-	-	-	-	-	-	-	-	-	-
- Cluster bean	-	430	-	-	-	-	-	-	-	-	-	-
- Paddy	477	704	-	1,839	-	-	-	-	-	771	-	572
- Maize	-	-	-	-	-	-	-	-	-	8	-	-
- Sweet potatoes	-	212	-	-	-	-	-	-	-	-	-	-
- Others*4	-	2,116	-	-	-	-	-	-	6	-	50	-
Rainfed*5												
- Cassava	-	-	-	-	313	39	49	-	50	-	817	53
- Cowpea	-	-	-	-	-	-	-	29	2	-	159	-
- Groundnuts	-	-	160	-	-	-	-	-	-	-	-	60
- Hot pepper	-	-	570	-	-	-	81	55	-	-	-	-
- Maize	6	-	513	-	106	224	104	135	101	-	306	296
- Millet	-	-	-	-	-	-	-	-	-	-	-	-
- Sugarcane	-	-	-	-	-	-	25	-	-	-	-	-
- Sweet Potatoes	-	-	-	-	-	-	276	-	-	-	-	-
- Tomatoes	-	-	-	-	-	-	14	16	-	-	-	70
- Yam	-	-	-	-	-	104	-	204	-	-	-	-
- Others*6	-	-	-	-	-	-	-	14	15	-	3	-
b) Livestock Income	9	14	33	88	76	10	8	127	34	12	152	49
c) Income from Homestead*7	12	270	19	16	76	26	8	25	26	105	4	18
(2) Non farm Incomes and farm incomes from the outside project areas*8	1,611	247	163	825	1,119	1,105	592	775	1,003	658	543	998
(3) Loan*9	8	4	255	344	4	1	-	14	1	4	-	12
<b>2. Gross Outgoing (CD1,000)</b>	<b>2,403</b>	<b>4,521</b>	<b>5,814</b>	<b>3,465</b>	<b>1,694</b>	<b>2,060</b>	<b>1,821</b>	<b>2,394</b>	<b>2,072</b>	<b>2,237</b>	<b>2,858</b>	<b>2,128</b>
(1) Crop Production Cost*10	329	1,671	2,485	932	85	262	223	522	291	451	907	310
Irrigated*11	323	1,671	1,693	932	-	157	120	386	198	451	467	162
Rainfed	6	-	792	-	85	105	103	136	93	-	440	148
(2) Living Expenses	2,065	2,843	2,818	2,016	1,602	1,796	1,598	1,844	1,780	1,778	1,951	1,794
Foods*12	1,252	1,572	1,680	1,337	1,124	1,125	1,021	1,062	1,035	1,197	1,196	1,111
Other than foods	813	1,271	1,138	679	478	671	577	782	745	581	755	683
(3) Loan Repayment	9	7	511	517	7	2	-	28	1	8	-	24
<b>3. Net Revenue (CD1,000)</b>	<b>-</b>	<b>1,146</b>	<b>992</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

\*1 Including not only the farm lands in the project areas but also the farm land located at the outside project areas.

\*2 Including crop incomes obtained from the project areas.

\*3 In the Weija area, annual cultivated area of tinda is estimated to be 43.9 ha. Of these, most part has been cultivated by only four (4) farmers, and the farm economy of such large farmers was excluded from this analysis.

\*4 Including following crops:

Weija: Cabbage, round marrow, long marrow, water melon, maize, cucumber, sponge gourd, etc.

Tanoso: Egg plant and water melon. Subinja: Tomatoes and okra.

Gross incomes of these crops were estimated on the basis of the following crops as those representatives; cabbage for Weija, egg plant for Tanoso and tomatoes for Subinja.

\*5 Including crops cultivated at outside project area.

\*6 Other crops in Akumadan and Tanoso include mainly groundnuts. These incomes were estimated based on cowpea because of no detailed data.

\*7 Incomes from crops cultivated at homestead area, and those figures indicate those net incomes excluding production cost.

\*8 Including farm incomes obtained from the outside project areas. With the exception of the Weija project area, the farmers have a lot of farm lands at the outside project area and have obtained a considerable amount of farm incomes from these lands.

\*9 Estimated on the basis of repayment amount of loan (2.(3) of the above table) and following interests obtained from the farm interview survey; 5% for Ashaiman, 50% for Weija, 80% for Bontanga, and 100%/year for other projects.

\*10 Excluding family labour force.

\*11 Including irrigation service charge.

\*12 Including products consumed at home.

Source: Result of farm interview survey (Oct.-Nov. 1995) by the Study Team.

**Table A-21 Present Environmental Issues and Tentative Mitigation Measures**

Environmental Issues	Main Causes	Significance at present	Remedial Measures to be considered	Significance in future	Relating project
1. Silt deposition in the reservoir	Soil erosion from catchment area, due to unproper land use	moderate	Reforestation of the catchment area, Introduction of soil conservation measurement	minor - moderate	all project
2. Water logging and stagnant water in farm land	Poor work of drainage facility	minor - moderate	Improvement of drainage facility	none - minor	As, We, Af, Av, Ma, Bo, Ok
3. Low productivity due to salinity problem	Poor work of drainage facility Inclusion of brackish water (to farmland or grained water)	minor - moderate	Improvement of drainage facility, Leaching of salt	minor minor	As, We, Ok Af
4. Incidence of water-borne diseases	swimming and water taking in reservoir influenced by diseases	minor - moderate	Education of farmers through sanitation program	minor	all project
5. Soil erosion of farm land	no application of soil erosion control unproper land use	minor - major	Introduction of soil conservation measurement, Introduction of orchard or perennial crops	minor	We, Am, Kp, Ak, Ta, Su
6. Decrease in Forest in and around the project areas	Increase demand for fire wood (increase population)	moderate	Recommending sustainable management of limited forest resources, including tree planting, Recommending the use of alternative energy sources such as biogas	minor	all project

**Table A-22 Future Environmental Issues with the Projects**

Environmental Issues	Main Causes	Significance at present	Relating project
1. Health hazard from chemicals	Soil erosion from catchment area, due to improper land use	minor	all project
2. Deterioration of downstream water quality	overuse / misuse of fertilizers and agrochemicals	minor	As, We, Am, Af, Av, Kp, Bo, Ok
3. Ecological changes on lagoon area	overuse / misuse of fertilizers and agrochemicals, Fresh water inclusion because of improvement of drainage	minor	As, We, Af
4. Beneficial impacts on farm economy	Stabilized and equal irrigation supply Introduction of improved farming practices	high	all projects
5. Beneficial impacts on local and regional economy	Increase in employment opportunities and demand for goods as farm economy is improved	high	all projects
6. Land degradation (when the area is expanded)	unproper land use,	minor, moderate	Am, Ma, Ak Kp, Ta, Su
7. Incidence of water-borne diseases (when the area is expanded)	Expansion of paddy fields	moderate	Av
8. Decrease in forest in and around the project areas (when the area is expanded.)	Decrease in fire wood forest area, because of area expansion	minor, moderate	Ak, Su We, Am, Av, Kp, Ma, Ta

**Table A-23 Proposed Main Crops and Cropping Area in the Projects (1/2)**

Project	Main crops	Cropping area (ha, %)	
		ds	ws
1 Ashaiman (130ha)	Okra	26.00 (20.0)	
	Paddy rice		39.00 (30.0)
	Maize		45.50 (35.0)
	Cowpea, Groundnut		45.50 (35.0)
	Total	26.00 (20.0)	130.00 (100.0)
2 Weija (220ha x 2 = 440ha)		ds & ws	
	Okra	44.00 (10.0)	
	Pepper	22.00 ( 5.0)	
	Tomato	44.00 (10.0)	
	Sweet potato	44.00 (10.0)	
	Tinda	44.00 (10.0)	
	Round marrow	44.00 (10.0)	
	Long marrow	44.00 (10.0)	
	Cluster bean	44.00 (10.0)	
	Paddy rice	44.00 (10.0)	
	Maize	22.00 ( 5.0)	
	Total	440.00 (100.0)	
3 Amate (101ha)		ds	ws
	Tomato	25.25 (25.0)	
	Okra	25.25 (25.0)	
	Onion	50.50 (50.0)	
	Maize		50.50 (50.0)
	Cowpea, Groundnut		50.50 (50.0)
Total	101.00 (100.0)	101.00 (100.0)	
4 Atife (880ha)	Paddy rice	334.40 (38.0)	
	Okra	105.60 (12.0)	
	Paddy rice		440.00 (50.0)
	Total	440.00 (50.0)	440.0 (50.0)
5 Aveyime (150ha)	Paddy rice	75.00 (50.0)	
	Tomato	19.50 (13.0)	
	Okra	18.00 (12.0)	
	Onion	37.50 (25.0)	
	Paddy rice		75.00 (50.0)
	Maize		37.50 (25.0)
	Cowpea, Groundnut		37.50 (25.0)
Total	150.00 (100.0)	150.00 (100.0)	
6 Kpando (200ha)	Okra	34.00 (50.0)	
	Tomato	34.00 (50.0)	
	Onion	100.00 (50.0)	
	Maize		100.00 (50.0)
	Cowpea, Groundnut		100.00 (50.0)
	Total	200.00 (100.0)	200.00 (100.0)

**Table A-23 Proposed Main Crops and Cropping Area in the Projects (2/2)**

Project	Main Crops	Cropping area (ha, %)	
		ds	ws
7 Mankessim (68ha)	Watermelon	34.00 (50.0)	
	Egg plant	17.00 (25.0)	
	Okra	17.00 (25.0)	
	Sweet poteto		34.00 (50.0)
	Maize		17.00 (25.0)
	Cowpea, Groundnut		17.00 (25.0)
	Total		68.00 (100.0)
8 Akumadan (58ha)	Tomato	19.72 (34.0)	
	Okra	19.14 (33.0)	
	Watermelon	19.14 (33.0)	
	Maize		29.00 (50.0)
	Cowpea, Groundnut		29.00 (50.0)
	Total	58.00 (100.0)	58.00 (100.0)
9 Tanoso (64ha)	Tomato	21.76 (34.0)	
	Okra	21.12 (33.0)	
	Watermelon	21.12 (33.0)	
	Maize		32.00 (50.0)
	Cowpea, Groundnut		32.00 (50.0)
	Total	64.00 (100.0)	64.00 (100.0)
10 Bontanga (450ha)	Paddy rice	166.50 (37.0)	
	Okra	81.00 (18.0)	
	Tomato	45.00 (10.0)	
	Egg plant	22.50 ( 5.0)	
	Onion	135.00 (30.0)	
	Paddy rice		247.50 (55.0)
	Maize		103.50 (23.0)
	Cowpea, Groundnut		99.00 (22.0)
	Total	450.00 (100.0)	450.00(100.0)
11 Subinja (60ha)	Egg plant	10.20 (17.0)	
	Pepper	10.20 (17.0)	
	Okra	19.80 (33.0)	
	Watermelon	19.80 (33.0)	
	Maize		30.00 (50.0)
	Cowpea, Groundnut		30.00 (50.0)
	Total	60.00 (100.0)	60.00 (100.0)
12 Okyereko (111ha)	Paddy rice	55.50 (50.0)	
	Tomato	14.43 (13.0)	
	Okra	13.32 (12.0)	
	Onion	27.75 (25.0)	
	Paddy rice		55.50 (50.0)
	Maize		27.75 (25.0)
	Cowpea, Groundnut		27.75 (25.0)
	Total	111.00 (100.0)	111.00 (100.0)

**Table A-24 Anticipated Crop Yield, Crop Production and Proposed Application Rate of Fertilizer**

Project	Main crop	Crop Yield (t/ha)		Crop Production (t/ha)		Application rate of fertilizer				
		ds	ws	ds	ws	N:P:K kg/ha	Compound kg/ha	SA / Urea kg/ha		
1 Ashaiman	Okra	12.00		312		117:45:45	15-15-15 300	SA 300		
	Paddy rice		5.50		215	152:60:60	15-15-15 400	Urea 200		
	Maize		3.00		137	98:45:45	15-15-15 300	SA 250		
	Cowpea, Groundnut		1.50		638	no application	no application			
2 Weija		ds & ws		ds & ws						
	Okra	12.00		528		117:45:45	15-15-15 300	SA 300		
	Pepper	10.00		220		117:45:45	15-15-15 300	SA 300		
	Tomato	15.00		616		123:60:60	15-15-15 400	SA 300		
	Sweet poteto	18.00		792		15:15:15	15-15-15 100			
	Tinda	18.00		792		15:15:15	15-15-15 100			
	Round marrow	20.00		880		30:30:30	15-15-15 200			
	Long marrow	20.00		880		30:30:30	15-15-15 200			
	Cluster bean	8.00		352		no application	no application			
	Paddy rice	5.50		242		152:60:60	15-15-15 400	Urea 200		
	Maize	3.00		66		98:45:45	15-15-15 300	SA 250		
3 Amate		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		152	98:45:45	15-15-15 300	SA 250		
4 Afife		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
5 Aveyime		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		152	98:45:45	15-15-15 300	SA 250		
6 Kpando		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		152	98:45:45	15-15-15 300	SA 250		
	Cowpea, Groundnut		1.50		76	no application	no application			
7 Mankessim		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		152	98:45:45	15-15-15 300	SA 250		
	Paddy rice	5.50		413		152:60:60	15-15-15 400	Urea 200		
	Cowpea, Groundnut		1.50		56	no application	no application			
8 Akumadan		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		152	98:45:45	15-15-15 300	SA 250		
9 Tanoso		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		96	98:45:45	15-15-15 300	SA 250		
	Cowpea, Groundnut		1.50		48	no application	no application			
10 Bontanga		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		1361	152:60:60	15-15-15 400	Urea 200		
	Paddy rice	5.50		916		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		311	98:45:45	15-15-15 300	SA 250		
	Cowpea, Groundnut		1.50		149	no application	no application			
11 Subinja		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		90	98:45:45	15-15-15 300	SA 250		
	Cowpea, Groundnut		1.50		45	no application	no application			
12 Okyereko		ds	ws	ds	ws					
	Tomato	14.00		354		123:60:60	15-15-15 400	SA 300		
	Okra	12.00		303		117:45:45	15-15-15 300	SA 300		
	Onion	18.00		909		98:45:45	15-15-15 300	SA 250		
	Maize		3.00		83	52:60:60	15-15-15 400	Urea 200		
	Paddy rice	5.50		305		98:45:45	15-15-15 300	SA 250		
	Cowpea, Groundnut		1.50		42	no application	no application			

**Table A-25 Proposed Sprit Application of Fertilizer**

Crop	Number of split application	Fertilizer application		
		First application	Second application	Third application
Paddy rice	3	4 weeks after germination	2 weeks after tasseling stage	before heading stage
Maize	2	2 weeks after germination		
Cowpea	0	no fertilization		
Groundnut	0	no fertilization		
Tomato	2	2 weeks after transplanting	first flowering stage	
Egg plant	3	2 weeks after transplanting	first flowering stage	during harvesting
Pepper	3	2 weeks after transplanting	first flowering stage	during harvesting
Okra	3	2 weeks after germination	first flowering stage	during harvesting
Onion	2	2 weeks after transplanting	before bulbing stage	
Sweet poteto	1	2 weeks after vine planting		
Tinda	1	2 weeks after germination		
Cluster bean	0	no fertilization		

**Table A-26 Proposed Application Rate of Fungicide, Insecticide, Herbicide and Rodenticide**

Crop	Fungicide	Insecticide	Herbicide	Rodenticide
Paddy rice	no application	Furadan (nursery) 5 l/ha	Basagram 5 l/ha	Yasodion 5 l/ha
		Karate 2.5E 3 l/ha	Satunil 5 l/ha	
		Dursban 1 l/ha	Arrosolo 3-3E 5 l/ha	
		Diazinon 4 l/ha	Ronstar 5 l/ha	
Maize	no application	Karate 2.5E 3 l/ha	Round up 1.5 l/ha	no application
		Cymbush 2.5 l/ha		
Cowpea	no application	Karate 2.5E 2.5 l/ha	no application	no application
		Cymbush 2.5 l/ha		
Groundnut	no application	Karate 2.5 E 2.5 l/ha	no application	no application
Tomato	Diathine M45 2.5 l/ha	Furadan (nursery) 5 kg/ha	no application	no application
	Fuji One 5 l/ha	Karate 2.5E 2.5 l/ha		
	Topsin 2.5 l/ha	Cymbush 2.5 l/ha		
Egg plant	Kocide 5 kg/ha	Karate 2.5E 2.5 l/ha	no application	no application
	Diathine M45 2.5 kg/ha	Cymbush 2.5 l/ha		
		Actellic 2.5 l/ha		
Pepper	Kocide 1.5 kg/ha	Karate 2.5E 2 l/ha	no application	Yosodion 2 kg/ha (if necessary)
	Topsin 0.5 kg/ha	Actellic 2 l/ha		
	Champion 1.5 kg/ha	Sampi 2.5 l/ha		
Okra	Kocide 3 kg/ha	Karate 2.5E 5 l/ha	no application	Yosodion 1 kg/ha (if necessary)
	Diathine M45 3 kg/ha	Actellic 5 l/ha		
Onion	Diathine M45 2 kg/ha	Elsan 2 l/ha	no application	no application
		Actellic 2.5 l/ha		
Sweet poteto	no application	no application	no application	no application
Watermelon	Diathine M45 2.5 kg/ha	Karate 2.5E 2.5 l/ha	no application	no application
	Topsin 2.5 kg/ha	Cymbush 2.5 l/ha		
	Kocide 5 kg/ha	Dursban 5 l/ha		
Tinda	Kocide 2 kg/ha	Karate 2.5E 3 l/ha	no application	Yosodion 2 kg/ha (if necessary)
	Diathine 1 kg/ha			
	Champion 1 kg/ha			
Cluster bean	Kocide 0.5 kg/ha	Karate 2.5E 1 l/ha (if necessary)	no application	no application

**Table A-27 Potential Evapotranspiration (ETp)**

Description	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1 Ashaiman												
(a) Modified Penman (mm/day)	5.0	5.4	5.6	5.5	5.1	4.1	3.9	4.1	4.6	5.2	5.2	4.7
(b) Blaney-Criddle (mm/day)	4.8	4.9	4.9	5.1	5.0	4.5	4.3	4.3	4.3	4.6	4.8	4.8
2 Weija												
(a) Modified Penman (mm/day)	5.1	5.7	5.8	5.8	5.1	4.3	4.3	4.7	5.1	5.3	5.1	4.8
(b) Blaney-Criddle (mm/day)	4.9	5.0	5.1	5.1	4.9	4.4	4.3	4.4	4.6	4.9	4.9	4.8
3 Amate												
(a) Modified Penman (mm/day)	4.1	4.4	4.5	4.5	4.4	3.5	3.1	3.3	3.5	4.0	4.1	3.9
(b) Blaney-Criddle (mm/day)	4.7	4.9	4.9	5.1	5.0	4.5	4.3	4.3	4.4	4.7	4.7	4.7
4 Afife												
(a) Modified Penman (mm/day)	5.0	5.6	5.8	5.6	5.1	4.4	4.3	4.4	5.0	5.5	5.4	4.9
(b) Blaney-Criddle (mm/day)	5.0	5.1	5.2	5.4	5.3	4.6	4.5	4.4	4.5	4.9	5.0	5.0
5 Aveyime												
(a) Modified Penman (mm/day)	4.6	5.3	5.4	5.1	4.7	3.9	3.9	4.1	4.2	4.5	4.5	4.2
(b) Blaney-Criddle (mm/day)	4.9	5.1	5.2	5.3	5.2	4.6	4.5	4.6	4.5	4.7	4.9	4.8
6 Kpando-Torkor												
(a) Modified Penman (mm/day)	4.8	5.1	5.1	5.0	4.7	3.9	3.6	3.6	3.9	4.5	4.8	4.4
(b) Blaney-Criddle (mm/day)	4.9	5.1	5.0	5.2	5.1	4.5	4.4	4.5	4.4	4.5	4.9	4.9
7 Mankessim												
(a) Modified Penman (mm/day)	4.4	4.8	5.0	4.9	4.6	3.8	3.6	3.5	3.9	4.6	4.7	4.2
(b) Blaney-Criddle (mm/day)	4.7	4.9	4.9	5.1	5.0	4.4	4.3	4.4	4.3	4.4	4.8	4.7
8 Akumadan												
(a) Modified Penman (mm/day)	5.3	6.0	5.8	5.3	4.9	4.2	3.8	3.8	3.8	4.1	4.5	4.4
(b) Blaney-Criddle (mm/day)	4.7	5.0	4.9	5.1	5.0	4.4	4.3	4.4	4.3	4.4	4.6	4.5
9 Tanoso												
(a) Modified Penman (mm/day)	5.3	6.0	5.8	5.3	4.9	4.2	3.8	3.8	3.8	4.1	4.5	4.4
(b) Blaney-Criddle (mm/day)	4.7	5.0	4.9	5.1	5.0	4.4	4.3	4.4	4.3	4.4	4.6	4.5
10 Bontanga												
(a) Modified Penman (mm/day)	6.8	7.7	7.5	6.7	6.0	4.9	4.5	4.2	4.3	5.2	4.4	6.0
(b) Blaney-Criddle (mm/day)	6.0	6.4	6.7	5.5	5.3	4.6	4.5	4.6	4.5	4.6	4.9	5.8
11 Subinja												
(a) Modified Penman (mm/day)	5.3	6.0	5.8	5.3	4.9	4.2	3.8	3.8	3.8	4.1	4.5	4.4
(b) Blaney-Criddle (mm/day)	4.7	5.0	4.9	5.1	5.0	4.4	4.3	4.4	4.3	4.4	4.6	4.5
12 Okyereko												
(a) Modified Penman (mm/day)	4.4	4.8	5.0	4.9	4.6	3.8	3.6	3.5	3.9	4.6	4.7	4.2
(b) Blaney-Criddle (mm/day)	4.7	4.9	4.9	5.1	5.0	4.4	4.3	4.4	4.3	4.4	4.8	4.7

Table A-28 Crop Coefficient

No	Crop	Crop Coefficient by Growing Stage (10 days basis)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Paddy (120 days)	1.10	1.10	1.10	1.15	1.18	1.22	1.25	1.25	1.25	1.25	1.23	1.18	1.08		
2	Maize	0.45	0.50	0.60	0.80	0.95	1.05	1.05	1.05	1.05	1.05	0.80				
3	Tomato	0.48	0.52	0.65	0.90	1.02	1.05	1.02	0.95	0.75						
4	Onion	0.48	0.62	0.85	0.92	0.95	0.95	0.87	0.77	0.62						
5	Okru/eggplant	0.48	0.52	0.60	0.70	0.85	0.95	0.95	0.90	0.65						
6	Groundnuts	0.50	0.53	0.60	0.72	0.88	0.92	0.95	0.88	0.70						
7	Cowpeas	0.50	0.58	0.75	0.92	1.05	1.05	1.00	0.95							
8	Watermelon	0.50	0.52	0.60	0.70	0.85	0.90	0.90	0.80							
9	Pepper	0.50	0.50	0.60	0.78	0.90	0.95	0.95	0.88	0.60						
10	Sweetpotato	0.50	0.65	0.65	0.82	1.00	1.05	1.05	0.95	0.80						



**Table A-29 10-Day 80% Probable Water Requirements for Respective Projects**

(Unit:lit/s/ha)												
Project	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
<b>1 Ashaiman</b>												
1 -10	0.63	0.49	0.57	0.64	0.44	0.31	0.00	0.00	0.00	0.56	0.74	1.03
11 -20	0.25	0.66	0.57	0.59	0.50	0.17	0.00	0.00	0.00	0.77	0.91	1.17
21 - end	0.18	0.69	0.58	0.58	0.47	0.03	0.00	0.00	0.23	0.85	1.07	0.93
<b>2 Weija</b>												
1 -10	0.73	0.33	0.05	0.41	0.38	0.59	0.62	0.29	0.05	0.39	0.56	0.82
11 -20	0.55	0.21	0.02	0.57	0.60	0.69	0.51	0.18	0.02	0.54	0.72	0.91
21 - end	0.43	0.10	0.15	0.61	0.73	0.65	0.38	0.08	0.16	0.55	0.76	0.82
<b>3 Amate</b>												
1 -10	0.44	0.11	0.00	0.18	0.31	0.38	0.36	0.17	0.00	0.26	0.39	0.59
11 -20	0.30	0.04	0.00	0.22	0.42	0.46	0.30	0.08	0.00	0.29	0.57	0.65
21 - end	0.16	0.00	0.08	0.24	0.43	0.36	0.31	0.00	0.12	0.27	0.62	0.55
<b>4 Afife</b>												
1 -10	0.15	0.00	1.60	1.77	1.45	1.29	1.10	1.19	1.45	1.47	1.67	1.24
11 -20	0.06	0.00	2.25	1.75	1.78	1.49	0.71	1.61	1.23	1.51	1.77	0.90
21 - end	0.00	0.82	2.20	1.74	1.59	1.60	0.55	1.43	1.42	1.77	1.70	0.32
<b>5 Aveyime</b>												
1 -10	1.23	0.94	0.00	0.92	0.89	1.02	1.07	0.79	0.00	0.88	1.08	1.24
11 -20	1.15	0.47	0.00	1.24	1.22	1.21	1.05	0.39	0.00	1.07	1.27	1.31
21 - end	1.09	0.05	0.35	1.13	1.07	1.16	1.06	0.05	0.38	1.10	1.32	1.33
<b>6 Kpando-Torkor</b>												
1 -10	0.51	0.34	0.12	0.19	0.38	0.45	0.45	0.17	0.00	0.17	0.42	0.54
11 -20	0.45	0.27	0.05	0.23	0.46	0.47	0.26	0.08	0.00	0.22	0.51	0.60
21 - end	0.37	0.20	0.08	0.34	0.56	0.41	0.21	0.00	0.08	0.29	0.61	0.60
<b>7 Mankessim</b>												
1 -10	0.42	0.60	0.63	0.20	0.00	0.09	0.38	0.49	0.60	0.30	0.00	0.20
11 -20	0.58	0.64	0.46	0.08	0.00	0.11	0.54	0.53	0.64	0.14	0.00	0.27
21 - end	0.56	0.69	0.34	0.00	0.04	0.21	0.55	0.62	0.54	0.00	0.08	0.32
<b>8 Akumadan</b>												
1 -10	0.65	0.84	0.33	0.00	0.18	0.32	0.38	0.66	0.12	0.00	0.13	0.42
11 -20	0.73	0.71	0.15	0.00	0.23	0.34	0.60	0.43	0.06	0.00	0.18	0.59
21 - end	0.78	0.62	0.00	0.08	0.23	0.43	0.63	0.32	0.00	0.05	0.29	0.57
<b>9 Tanoso</b>												
1 -10	0.58	0.73	0.49	0.12	0.00	0.36	0.28	0.68	0.30	0.00	0.13	0.28
11 -20	0.66	0.66	0.37	0.06	0.00	0.38	0.51	0.55	0.16	0.00	0.18	0.39
21 - end	0.68	0.65	0.30	0.00	0.15	0.36	0.60	0.53	0.04	0.05	0.23	0.44
<b>10 Bontanga</b>												
1 -10	1.37	1.25	0.91	0.25	0.33	1.09	1.17	0.80	0.42	0.78	0.92	1.22
11 -20	1.30	1.19	0.65	0.26	0.36	1.34	0.77	0.73	0.47	0.66	1.18	1.24
21 - end	1.20	1.35	0.34	0.27	0.76	1.58	1.00	0.55	0.75	0.63	1.16	1.34
<b>11 Suybinja</b>												
1 -10	0.57	0.71	0.31	0.19	0.34	0.44	0.45	0.21	0.00	0.06	0.15	0.46
11 -20	0.58	0.64	0.14	0.26	0.51	0.41	0.50	0.08	0.00	0.07	0.20	0.61
21 - end	0.61	0.59	0.08	0.29	0.44	0.54	0.39	0.00	0.03	0.09	0.32	0.57
<b>12 Okyreko</b>												
1 -10	0.93	0.22	0.09	0.92	0.90	0.64	1.18	0.68	0.76	0.88	1.19	1.26
11 -20	0.67	0.17	0.03	1.25	1.07	1.15	1.26	0.36	1.05	0.98	1.21	1.25
21 - end	0.30	0.13	0.35	1.11	0.98	1.03	1.11	0.35	1.12	1.13	1.32	1.16

**Table A-30 Proposed Irrigation Plan (1/2)**

Description	Project					
	1. Ashaiman	2. Weija	3. Amate	4. Afife	5. Aveyme	6. Kpando-Torkor
Water source	Ashaiman reservoir	Weija reservoir	Volta lake	Kplikpa reservoir	Volta river	Volta lake
Potential area (ha)	148	220	203	880	150	356
Prevailing soils	Loamy sand	Course sand	Sandy loam	Clay loam	Clay loam	Sandy loam
Intake method	Intake valve	Pumps	Pumps	Intake gates	Pumps	Pumps
Distribution method	Open canal system	Pipelines and sprinklers	Pipelines and sprinklers	Open canal system	Open canal system	Pipelines and sprinklers
Major crops	Paddy	Okra, tomato, tinda	Tomato, onion, maize	Paddy	Paddy	Maize, tomato, okra
Net irrigation requirement (lit/s/ha)	0.7	0.6	0.5	1.4	0.7	0.4
Irrigation efficiency (%)	60	70	70	60	60	70
Irrigation requirement (lit/s/ha)	1.2	0.9	0.7	2.3	1.2	0.6
Average basic intake rate (mm/hr)	14.3	7.1	N.A	N.A	N.A	19.3
Water supply method	Continuous	Rotation	Rotation	Rotation	Continuous	Rotation
Irrigation time at one time	24 hours	5.0 hours	3.5 hours	24 hours	24 hours	3.5 hours
Sprinkling intensity (mm/hr)	-	6	11	-	-	11
Space of sprinkler and sub-lateral	-	12m x 12m	18m x 18m	-	-	18m x 18m
Supply amount (mm/day)	-	30	40	-	-	40
Irrigation interval (days)	-	5	6	-	-	6

Table A-30 Proposed Irrigation Plan (2/2)

Description	Project					
	7. Mankessim	8. Akumadan	9. Tanoso	10. Bontanga	11. Subinja	12. Okyereko
Water source	Apropong reservoir	Atwetwe river	Tano river	Bontanga reservoir	Subin river	Okyereko reservoir
Potential area (ha)	256	65	115	450	121	111
Prevailing soils	Sandy loam	Clay loam with gravel	Sandy loam	Clay loam	Sandy soil	Clay loam
Intake method	Intake valve	Pumps	Pumps	Intake gates	Pumps	Pumps
Distribution method	Pipelines and sprinklers	Pipelines and sprinklers	Pipelines and sprinklers	Open canal system	Pipelines and sprinklers	Open canal system
Major crops	Watermelon, eggplant	Maize, tomato, okra	Maize, tomato, okra	Paddy	Maize, cowpea, okra	Paddy
Net irrigation requirement (lit/s/ha)	0.5	0.6	0.5	1	0.5	0.8
Irrigation efficiency (%)	70	70	70	60	70	60
Irrigation requirement (lit/s/ha)	0.7	0.8	0.7	1.6	0.7	1.3
Average basic intake rate (mm/hr)	58.4	278.4	35.3	11.1	13.8	N.A
Water supply method	Rotation	Rotation	Rotation	Continuous	Rotation	Continuous
Irrigation time at one time	3.5 hours	3.5 hours	3.5 hours	24 hours	3.5 hours	24 hours
Sprinkling intensity (mm/hr)	11	11	11	-	11	-
Space of sprinkler and sub-lateral	18m x 18m	18m x 18m	18m x 18m	-	18m x 18m	-
Supply amount (mm/day)	40	40	40	-	40	-
Irrigation interval (days)	6	6	6	-	6	-

**Table A-31 Rehabilitation Plan for the Projects (1/4)**

Project Facilities	Ashaiman		Weija		Amate	
	Quantity	Works required	Quantity	Works required	Quantity	Works required
1 Dam						
(1) Embankment	1 no	As it is.	1 no	As it is.	- nos	
(2) Spillway	1 no	As it is.	1 no	As it is.	- nos	
2 Weir	- nos		- nos		- nos	
3 Intake						
(1) Gate	- nos		- nos		- nos	
(2) Valve	2 nos	Renew	- nos		- nos	
(3) Pump	- nos		6 nos	Renew	4 nos	Renew
4 Irrigation system						
(1) Canal						
(a) Main	5 km	Rehabilitation	5.7 km	Partial repair	- km	
(b) Lateral	11 km	Rehabilitation	- km		- km	
(b) Sub lateral	- km		- km		- km	
(2) Pipeline system						
(a) Main	- km		12 km	Renew	6 km	Renew
(b) Sprinkler	- ha		220 ha	Renew	203 ha	Renew
5 Drainage system						
(1) Drainage canal						
(a) Main	3 km	Rehabilitation	5 km	Rehabilitation	2 km	New construction
(b) Lateral	6 km	Rehabilitation	5 km	Rehabilitation	10 km	New construction
(c) Sub lateral	- km		- km		- km	
(d) Intercept	- km		- km		13 km	New construction
(e) Spillway canal	- km		- km		- km	
6 Related structure						
(1) Farm pond	- nos		1 no	As it is.	- nos	
(2) Turnout	286 nos	Rehabilitation	1 no	As it is.	- nos	
(3) Check	26 nos	Rehabilitation	1 no	As it is.	- nos	
(4) Syphon	1 no	Rehabilitation	- nos		- nos	
(5) Aqueduct	- nos		- nos		- nos	
(6) Drop	260 nos	Rehabilitation	- nos		- nos	
(7) Spillway	2 nos	New construction	2 nos	As it is.	- nos	
(8) Wasteway	2 nos	New construction	1 no	As it is.	- nos	
(9) Impact box	- nos		- nos		13 nos	New construction
(10) Measuring device	2 nos	New construction	- nos		- nos	
(11) Bridge	- no	New construction	3 nos	As it is.	- nos	
(12) Irrigation crossing	10 nos	New construction	1 no	As it is.	- nos	
(13) Drainage culvert	7 nos	New construction	16 nos	As it is.	28 nos	New construction
(14) Drainage gate	- nos		2 nos	New construction	- nos	
7 Farm road	16 km	Rehabilitation	14 km	Rehabilitation	20 km	New const. 15 km
8 Project building						
(1) Pump house	- nos		2 nos	As it is.	2 nos	New construction
(2) Office	- nos	As it is.	2 nos	As it is.	1 no	Rehabilitation
(3) Store	- no	As it is.	2 nos	New const. 1 no.	2 nos	New construction
(4) Garage	- no	As it is.	1 no	As it is.	1 no	Rehabilitation
(5) Dry yard	- no	As it is.	1 no	New construction	- nos	
(6) Sorter house	1 no	New construction	2 nos	New construction	2 nos	New construction
9 Others						
(1) Dyke	- km		2 km	New construction	- km	

Note : Quantities are preliminarily estimated.

**Table A-31 Rehabilitation Plan for the Projects (2/4)**

Project Facilities	Affe		Avcyme		Kpando-Torkor	
	Quantity	Works required	Quantity	Works required	Quantity	Works required
1 Dam						
(1) Embankment	1	no As it is.	-	nos	-	nos
(2) Spillway	1	no As it is.	-	nos	-	nos
2 Weir	-	nos	-	nos	-	nos
3 Intake						
(1) Gate	1	no Partial repair	-	nos	-	nos
(2) Valve	-	nos	-	nos	-	nos
(3) Pump	-	nos	3	nos Renew	8	nos Renew
4 Irrigation system						
(1) Canal						
(a) Main	-	km As it is.	0.5	km Rehabilitation	-	km
(b) Lateral	12	km Partial repair	7	km Rehabilitation	-	km
(c) Sub lateral	19	km Rehabilitation	14	km Rehabilitation	-	km
(2) Pipeline system						
(a) Main	-	km	-	km	11	km Renew
(b) Sprinkler	-	ha	-	ha	356	ha Renew
5 Drainage system						
(1) Drainage canal						
(a) Main	8	km Rehabilitation	2.5	km Rehabilitation	4	km New construction
(b) Lateral	15	km Rehabilitation	7	km Rehabilitation	17	km New construction
(c) Sub lateral	21	km Rehabilitation	14	km Rehabilitation	-	km
(d) Intercept	8	km Rehabilitation	-	km	12	km New construction
(e) Spillway canal	9	km Rehabilitation	-	km	-	km
6 Related structure						
(1) Farm pond	-	nos	1	no New construction	-	nos
(2) Turnout	155	nos Partial repair	70	nos New construction	-	nos
(3) Check	42	nos As it is.	70	nos New construction	-	nos
(4) Syphon	1	no As it is.	13	nos Renew	-	nos
(5) Aqueduct	-	nos	-	nos	-	nos
(6) Drop	1	no As it is.	-	nos	-	nos
(7) Spillway	1	no As it is.	1	no New construction	-	nos
(8) Wasteway	-	nos	1	no New construction	-	nos
(9) Impact box	-	nos	-	nos	22	nos New construction
(10) Measuring device	-	nos	2	nos New construction	-	nos
(11) Bridge	9	nos As it is.	-	nos	-	nos
(12) Irrigation crossing	-	nos	17	nos New construction	-	nos
(13) Drainage culvert	29	nos As it is.	12	nos New construction	50	nos New construction
(14) Drainage gate	1	no As it is.	-	nos	-	nos
7 Farm road	34	km Rehabilitation	12	km Rehabilitation	29	km New const. 27 km
8 Project building						
(1) Pump house	-	nos	1	no Rehabilitation	4	nos New construction
(2) Office	1	no As it is.	1	no Rehabilitation	1	no New construction
(3) Store	10	nos As it is.	1	no Rehabilitation	4	nos New construction
(4) Garage	1	no Rehabilitation	1	no Rehabilitation	1	no New construction
(5) Dry yard	10	nos Rehabilitation	1	no New construction	-	nos
(6) Sorter house	-	nos	1	no New construction	4	nos New construction
9 Others						
(1) Land levelling	214	ha	-	ha	-	ha
(2) Foot bridge	29	nos Rehabilitation	-	nos	-	nos
(1) Electric line	-	km	0.7	km New construction	7	km New construction

Note : Quantities are preliminarily estimated.

**Table A-31 Rehabilitation Plan for the Projects (3/4)**

Project Facilities	Mankessim		Akumadan		Tanoso	
	Quantity	Works required	Quantity	Works required	Quantity	Works required
1 Dam						
(1) Embankment	1 no	As it is.	- nos		- nos	
(2) Spillway	1 no	Partial repair	- nos		- nos	
2 Weir	- nos		1 no	Renew	1 no	Renew
3 Intake						
(1) Gate	1 no	Partial repair	- nos		- nos	
(2) Valve	1 no	As it is.	- nos		- nos	
(3) Pump	5 nos	Renew	2 nos	Renew	2 nos	Renew
4 Irrigation system						
(1) Canal						
(a) Main	2 km	New construction	- km		- km	
(b) Lateral	- km		- km		- km	
(c) Sub lateral	- km		- km		- km	
(2) Pipeline system						
(a) Main	11 km	Renew	2 km	Renew	1.6 km	Renew
(b) Sprinkler	176 ha	Renew	31 ha	Renew	30 ha	Renew
5 Drainage system						
(1) Drainage canal						
(a) Main	2.2 km	New construction	0.5 km	New construction	0.5 km	New construction
(b) Lateral	9 km		1.5 km	New construction	1.6 km	New construction
(c) Sub lateral	- km		- km		- km	
(d) Intercept	11 km	New construction	2 km	New construction	2 km	New construction
(e) Spillway canal	0.5 km	Rehabilitation	- km		- km	
6 Related structure						
(1) Farm pond	1 no	New construction	- nos		- nos	
(2) Turnout	- nos		- nos		- nos	
(3) Check	- nos		- nos		- nos	
(4) Syphon	- nos		- nos		- nos	
(5) Aqueduct	- nos		- nos		- nos	
(6) Drop	- nos		- nos		- nos	
(7) Spillway	1 no	New construction	- nos		- nos	
(8) Wasteway	1 no	New construction	- nos		- nos	
(9) Impact box	14 nos	New construction	2 nos	New construction	2 nos	New construction
(10) Measuring device	1 no	New construction	- nos		- nos	
(11) Bridge	- nos		- nos		- nos	
(12) Irrigation crossing	- nos		- nos		- nos	
(13) Drainage culvert	25 nos	New construction	4 nos	New construction	5 nos	New construction
(14) Drainage gate	- nos		- nos		- nos	
7 Farm road	16 km	New const. 13 km	4 km	Rehabilitation	3 km	Rehabilitation
8 Project building						
(1) Pump house	2 nos	New construction	1 no	Rehabilitation	1 no	Rehabilitation
(2) Office	1 no	Rehabilitation	1 no	Rehabilitation	1 no	Rehabilitation
(3) Store	3 nos	New construction	2 nos	New construction	1 no	New construction
(4) Garage	1 no	New construction	1 no	New construction	1 no	New construction
(5) Dry yard	- nos		- nos		- nos	
(6) Sorter house	3 nos	New construction	2 nos	New construction	1 no	New construction
9 Others						

Note : Quantities are preliminarily estimated.

**Table A-31 Rehabilitation Plan for the Projects (4/4)**

Project Facilities	Bontanga		Subinja		Okeyreko	
	Quantity	Works required	Quantity	Works required	Quantity	Works required
<b>1 Dam</b>						
(1) Embankment	1 no	As it is.	- nos		1 no	As it is.
(2) Spillway	1 no	As it is.	- nos		1 no	As it is.
<b>2 Weir</b>	- nos		1 no	Rehabilitation	- nos	
<b>3 Intake</b>						
(1) Gate	2 nos	Partial repair	- nos		- nos	
(2) Valve	- nos		- nos		2 nos	As it is.
(3) Pump	- nos		3 nos	Renew	3 nos	New construction
<b>4 Irrigation system</b>						
(1) Canal						
(a) Main	12.2 km	As it is.	- km		4 km	New const.2.7 km
(b) Lateral	19 km	Partial repair	- km		4 km	New const.1.2 km
(c) Sub lateral	- km		- km		- km	
(2) Pipeline system						
(a) Main	- km		4 km	Renew	- km	
(b) Sprinkler	- ha		70 ha	Renew	- ha	
<b>5 Drainage system</b>						
(1) Drainage canal						
(a) Main	6 km	Rehabilitation	0.7 km	New construction	2 km	Rehabilitation
(b) Lateral	14 km	Rehabilitation	3.5 km	New construction	4 km	New const. 2 km
(c) Sub lateral	- km		- km		- km	
(c) Intercept	17 km	Rehabilitation	4.5 km	New construction	- km	
(d) Spillway canal	- km		- km		- km	
<b>6 Related structure</b>						
(1) Farm pond	- nos		- nos		- nos	
(2) Turnout	788 nos	Partial repair	- nos		62 nos	New const. 27 nos
(3) Check	19 nos	Partial repair	- nos		16 nos	New const. 15 nos
(4) Syphon	1 no	As it is.	- nos		- nos	
(5) Aqueduct	- nos		- nos		- nos	
(6) Drop	6 nos	As it is.	- nos		50 nos	New const. 20 nos
(7) Spillway	- nos		- nos		2 nos	New construction
(8) Wasteway	- nos		- nos		2 nos	New construction
(9) Impact box	2 nos	As it is.	5 nos	New construction	- nos	
(10) Measuring device	2 nos	Rehabilitation	- nos		2 nos	New const. 1 no
(11) Bridge	- nos		- nos		- nos	
(12) Irrigation crossing	3 nos	As it is.	- nos		2 nos	New const. 1 no
(13) Drainage culvert	5 nos	As it is.	10 nos	New construction	4 nos	As it is. 3 nos & New const. 1 no
(14) Drainage gate	1 no	New construction	- nos		- nos	
<b>7 Farm road</b>	36 km	Rehabilitation	7 km	Rehabilitation	7 km	New const. 2km
<b>8 Project building</b>						
(1) Pump house	- nos		1 no	Rehabilitation	1 no	New construction
(2) Office	3 nos	As it is.	1 no	Rehabilitation	1 no	Rehabilitation
(3) Store	5 nos	Rehabilitation	1 no	New construction	1 no	Rehabilitation
(4) Garage	1 no	As it is.	1 no	New construction	1 no	Rehabilitation
(5) Dry yard	5 nos	Rehabilitation	- nos		1 no	New construction
(6) Sorter house	5 nos	New construction	1 no	New construction	- nos	
<b>9 Others</b>						
Spillway Ayensu river	-		-		1 no	As it is.
Ayense river drain	-		-		2 km	Rehabilitation
Additional pump facility	-		-		1 lot	New construction

Note : Quantities are preliminarily estimated.

**Table A-32 Estimate on Internal Drainage Requirement  
for Upland Crop Field**

(1)  $Q_d = 0.0029 \times C \times i \times S^{1/5} \times A^{4/5}$

where,

$Q_d$  : Inner drainage module (m<sup>3</sup>/s)

$C$  : Runoff coefficient depending on vegetation, soils and topography

$i$  : Rate of rainfall (mm/hr)

$S$  : Fall of topography in m per 328m

$A$  : Drainage area (ha)

(2) From "Maximum Rainfall Intensity-Duration Frequencies in Ghana", Ghana Meteorological Services Department, Departmental No.23, ratio of 10 years probability rainfall of one hour duration and 24 hours duration is estimated as follows:

(a) Middle area

Wenci	69.3/109.7 =	0.63		
Kumasi	83.8/152.4 =	0.55		
Axima	88.9/201.2 =	0.44	<b>Average</b>	<b>0.54</b>

(b) East area

Ho	73.2/128.0 =	0.57	<b>Average</b>	<b>0.57</b>
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(c) Coastal area

Takoragi	98.0/182.9 =	0.54		
Akuse	86.1/146.3 =	0.59		
Saltpond	103.9/152.4 =	0.68		
Accra	71.9/128.0 =	0.56		
Ada	109.2/182.9 =	0.60	<b>Average</b>	<b>0.59</b>

(3) Calculation

	C	R24	i	S	S <sup>1/5</sup>	Equation
Weija	0.43	116	68	2.7	1.22	$Q_d = 0.104 A^{4/5}$
Amate	0.43	133	76	6.6	1.46	$Q_d = 0.138 A^{4/5}$
Kpando-Torkor	0.43	153	87	6.6	1.46	$Q_d = 0.159 A^{4/5}$
Mankessim	0.39	155	91	3.3	1.27	$Q_d = 0.131 A^{4/5}$
Akumadan	0.43	135	73	10.9	1.61	$Q_d = 0.147 A^{4/5}$
Tanoso	0.43	135	73	10.9	1.61	$Q_d = 0.147 A^{4/5}$
Subinja	0.43	135	73	10.9	1.61	$Q_d = 0.147 A^{4/5}$



Table A-33 Proposed Drainage Plan

Description	Project					
	1. Ashaiman	2. Weija	3. Amate	4. Afife	5. Aveyime	6. Kpando-Torkor
Inner drainage area (ha)*	164	232	214	926	167	375
Crops	Paddy	Upland crops	Upland crops	Paddy	Paddy	Upland crops
Prevailing topography	1/100	1/120	1/50	1/260	1/300	1/50
Design rainfall (10-year recurrence interval)	99	116	133	118	95	153
Hourly rainfall (mm)	-	68	76	-	-	87
3-days consecutive rainfall (mm)	99	-	-	118	95	-
Drainage method	Gravity	Gravity	Gravity	Gravity/Pump	Gravity	Gravity
Soil erosion control measure	-	-	Green belt and intercepting drain	-	-	Green belt and intercepting drain
Allowable water depth (mm)	150	Not allowed	Not allowed	150	150	Not allowed
Drainage requirement (lit/s for "A" drainage are	1 x A	104 x A	138 x A	2.5 x A	1.5 x A	159 x A

Note \* : Internal drainage area is assumed by dividing potential area by 0.95 for upland crop area and 0.90 for paddy area.

Description	Project					
	7. Mankessim	8. Akumadan	9. Tanoso	10. Bontanga	11. Subinja	12. Okyereko
Inner drainage area (ha)*	269	68	121	500	127	117
Crops	Upland crops	Upland crops	Upland crops	Paddy	Upland crops	Paddy
Prevailing topography	1/100	1/30	1/30	1/300	1/30	1/300
Design rainfall (10-year recurrence interval)	91	135	135	126	135	155
Hourly rainfall (mm)	-	73	73	-	73	-
3-days consecutive (mm)	-	-	-	126	-	155
Drainage method	Gravity	Gravity	Gravity	Gravity	Gravity	Gravity
Soil erosion control measure	-	Green belt and intercepting drain	Green belt and intercepting drain	-	Green belt and intercepting drain	-
Allowable water depth (mm)	Not allowed	Not allowed	Not allowed	150	Not allowed	150
Drainage requirement (lit/s for "A" drainage are	131 x A	147 x A	147 x A	2.5 x A	147 x A	3 x A

Note \* : Internal drainage area is assumed by dividing potential area by 0.95 for upland crop area and 0.90 for paddy area.

**Table A-34 Proposed Staffing and Required Facilities of PM Offices**

Projects:	ASH	WBI	AMA	AFI	AVE	KPA	MANAKU	TAN	BON	SUB	OKY	Whole	
<b>1. Project Feature</b>													
1.1 Present Condition													
(1) Potential Area (ha)	148	220	203	880	150	356	256	65	115	450	121	111	3,075
a) Developed Area (ha)	130	220	101	880	63	40	17	65	64	450	60	40	2,130
b) Undeveloped Area (ha)	18	-	102	-	87	316	239	-	51	-	61	71	945
(2) No. of Farmers (Household)	120	115	63	533	62	118	89	101	188	525	25	68	2,007
1.2 Proposed Project													
(1) Development Area (ha)	44	220	203	535	150	356	176	31	30	450	70	111	2,376
<b>2. Staffing</b>													
2.1 Present Condition (Persons)	4	14	3	20	6	3	5	5	4	15	3	2	84
2.2 Proposed Staffing of PM Office*2 (Persons)													
(1) Transition Period of O&M	11	15	11	22	11	14	11	12	19		12	138	
a) O&M staff													
O&M Officers	1	1	1	2	1	1	1	2	2		1	13	
Gate Operators	1			3					2			6	
Pump Attendants/Mechanics		2	2		1	4	1	2			1	13	
b) Extension Officers	1	1	1	2	1	1	1	1	2		1	12	
c) Cooperative Officers	1	1	1	1	1	1	1	1	1		1	10	
d) Monitors	1	1	1	1	1	1	1	1	1		1	10	
e) Administrative staff													
Administrators/Accountants	1	1	1	2	1	1	1	1	1		1	11	
Clerks/Storekeepers				1					1			2	
Drivers	2	2	2	2	2	2	2	1	2		2	19	
Operators of tractor/equipment	2	2	1	5	1	1	1	1	4		2	20	
Others (watchman, labourer, etc.)	1	4	1	3	2	2	2	2	3		2	22	
(2) After handing over of O&M	7	7	6	9	6	6	6	5	8		7	67	
O&M Officers	1	1	1	1	1	1	1	1	1		1	10	
Extension Officers	1	1	1	1	1	1	1	1	1		1	10	
Monitors	1	1	1	1	1	1	1	1	1		1	10	
Driver	2	2	2	2	2	2	2	1	2		2	19	
Operators of tractor/heavy equipment	2	2	1	4	1	1	1	1	3		2	18	
<b>3. Required Facilities</b>													
3.1 Office and Buildings													
(1) PM Offices*2													
Present conditions (m2)	106	305	185	228	175	221	124	-	114	200	101	138	1,897
Proposed offices													
Rehabilitation (m2)	106	305	-	228	-	-	-	-	114	200	101	-	1,054
Construction*1 (m2)	-	-	175	-	175	175	175	80	-	-	-	175	955
(2) Proposed Buildings													
a) Pump house (No.)	-	-	2	-	1	4	2	1	1	-	1	1	13
b) Garage (No.)	-	-	1	1	1	1	1	1	1	-	1	1	9
c) Store (Pipes, etc.) (No.)	-	1	2	-	1	4	3	1	1	5	1	1	20
d) Store houses (for agriculture) (No.)	1	2	2	-	1	4	3	1	1	5	1	-	21
e) Dry yard (No.)		1		10	1					5		1	18
3.2 Proposed Vehicles and Equipment*2													
(1) O&M Equipment													
a) Pick-up (No.)	1	1	1	2	1	1	1	1	1	1	1	1	11
b) Tractor (45HP) with dump trailer (No.)	1	1	1	3	1	1	1	1	2		1	1	13
c) Backhoe (No.)	1	1	1	1	1	1	1	1	1		1	1	5
d) Grass cutter (No.)	3	3	4	8	3	4	3	3	4		3	3	38
e) Radio communication (Set)	1	1	1	1	1	1	1	1	1		1	1	10
(2) Equipment for Extension, Monitoring and Cooperative Activities													
a) Printing machine (Set)	1	1	1	1	1	1	1	1	1		1	1	10
b) Photo copy machine (No.)	1	1	1	1	1	1	1	1	1		1	1	10
c) Overhead projector (No.)	1	1	1	1	1	1	1	1	1		1	1	10
d) Video and TV set (Set)	1	1	1	1	1	1	1	1	1		1	1	10
e) Motorcycle for monitor (No.)	1	1	1	1	1	1	1	1	1		1	1	10
f) Pick-up (No.)	1	1	1	1	1	1	1	1	1		1	1	10
(3) Office equipment and facilities (Set)	1	1	1	1	1	1	1	1	1		1	1	10

\*1 All existing buildings are used as the project construction offices during the rehabilitation stage. After rehabilitation works, the buildings of Ashaiman, Weija, Afife and Bontanga are used continuously as the PM office. As for the other projects, new buildings are constructed in the project area, which include engineering room (25 m2), extension room (25 m2), monitoring room (25 m2), cooperative room (25 m2), meeting rooms (50 m2), and others (25 m2).

\*2 The Akumadan, Tanoso and Subinja projects are managed directly by the Regional Office in Techman, because these projects have a small area and locate within easy access of the Regional Office. The PM office is not constructed, and only the office building including a co-operative room (25 m2), a meeting room (50 m2) and others (5 m2) is constructed in the Akumadan project area. The Regional Office has one set of vehicles and equipment to cover these three projects.

**Table A-35 Training Courses and Contents for O&M and Strengthening of Farmers' Societies  
Conducted during the Transitional Period**

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"> <li>- Outline of O&amp;M and strengthening of the societies,</li> <li>- Outline of agricultural support services,</li> <li>- Farmers' participant management system,</li> <li>- Role of women in development</li> </ul>
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"> <li>- Estimation of water requirement</li> <li>- Preparation of irrigation schedule,</li> <li>- O&amp;M of facilities and handing over process,</li> <li>- Strengthening of the farmers' societies,</li> <li>- Duties of GIDA and the farmers' societies for O&amp;M</li> <li>- Monitoring system, measuring and surveying methods,</li> <li>- Administrative services to the farmers,</li> <li>- Promoting women in development, etc.</li> </ul>
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"> <li>- O&amp;M of facilities, water requirement, water delivery, etc.</li> <li>- Irrigation schedule and cropping calendar,</li> <li>- Management of the farmers' societies such as accounting, book keeping and auditing,</li> <li>- Articles and by-laws for O&amp;M</li> <li>- Duties of GIDA and the farmers' society for O&amp;M</li> <li>- Monitoring system, measuring and surveying methods,</li> <li>- Group loan, cooperative purchasing of farm inputs, etc.</li> </ul>
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"> <li>- Objectives and outline of O&amp;M by the farmers' society,</li> <li>- Activities of farmers' society,</li> <li>- Required agricultural supporting services,</li> <li>- Promoting women in development, etc.</li> </ul>
Course-E	2	20 - 30	1	Village chiefs, elder people in the village, etc.	<ul style="list-style-type: none"> <li>- Outline of O&amp;M by the farmers' society,</li> <li>- Organization and activities of the society,</li> <li>- Duties of GIDA and the farmers' societies, etc.</li> </ul>

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

**Table A-36 List of Soil Erosion Control Measures**

Descriptions	Merits	Demerits
<b>Vegetative Measures</b>		
<p><b>1. Contour hedgerow (Strip cropping)</b></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"> <li>1. Economical</li> <li>2. Adaptable to various conditions.</li> <li>3. Easier to establish and repair.</li> <li>4. Durable if maintained properly.</li> <li>5. Improve the soil condition, if nitrogen fixing crops are used.</li> </ol>	<ol style="list-style-type: none"> <li>1. It takes some time to attain benefits.</li> <li>2. Less effective when slope is too steep.</li> <li>3. Hedgerows may pose competition with crops.</li> </ol>
<p><b>2. Mulching</b></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"> <li>1. Economical</li> <li>2. Adaptable to various conditions.</li> <li>3. Easier to establish and repair.</li> <li>4. Keeping of soil moisture and temperature.</li> <li>5. Improve the soil condition.</li> </ol>	<ol style="list-style-type: none"> <li>1. Application of mulch may be required on each cropping season in tropical area.</li> <li>2. It requires a large amount of grasses (materials) for mulching.</li> </ol>
<p><b>3. Wattling</b></p> <p>It is vegetative structure established in contour line or intermittently along the contour. It is used to trap the soil particles that are eroded down with surface runoff. Cutting of brushwoods are interwoven to form fence.</p>	<ol style="list-style-type: none"> <li>1. Very effective and stable.</li> <li>2. Early achievement of protection.</li> <li>3. When bushwoods sprout, the leaves can be used as green manure or mulching materials.</li> </ol>	<ol style="list-style-type: none"> <li>1. Difficult to find suitable sprouting brushwood rods.</li> <li>2. Difficult to construct.</li> </ol>
<p><b>4. Agroforestry</b></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"> <li>1. Economically</li> <li>2. Trees can provide fuels, fodder, fruits, etc. to the farmers.</li> </ol>	<ol style="list-style-type: none"> <li>1. It takes some time to attain benefits.</li> <li>2. Trees may pose competition with crops.</li> <li>3. Less effective when slope is too steep.</li> </ol>
<b>Structural Measures</b>		
<p><b>5. Contour bunds</b></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 stripcropping system.</p>	<ol style="list-style-type: none"> <li>1. Relatively easier to construct and repair.</li> <li>2. They are suitable for slopes of 1 to 7 degree.</li> </ol>	<ol style="list-style-type: none"> <li>1. The effectiveness is limited when heavy rains continue long.</li> <li>2. The effectiveness is limited when used in very steep slope.</li> </ol>
<p><b>6. Terraces</b></p> <p>They are series of level or nearly level strips running across the slopes supported by steep risers.</p>	<ol style="list-style-type: none"> <li>1. Most effective measures for minimising soil erosion.</li> </ol>	<ol style="list-style-type: none"> <li>1. They require a lot of time and manpower to construct.</li> <li>2. Soil erosion during construction stage may be high.</li> <li>3. Not suitable for the sites in which topsoils only have thin layer.</li> </ol>
<p><b>7. Waterways (Contour Ditches and Drainage Canals)</b></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"> <li>1. Relatively easier to construct and repair.</li> <li>2. Ditches and canals can be good water impoundment structures that can hold water for plants.</li> </ol>	<ol style="list-style-type: none"> <li>1. The effectiveness is limited when heavy rains continue long.</li> <li>2. The effectiveness is limited when used in very steep slope.</li> </ol>
<b>Cultural Measures</b>		
<p><b>8. Contour Plowing</b></p> <p>It is a plowing method to create furrows following the contour of the land.</p>	<ol style="list-style-type: none"> <li>1. It increases water absorption capacity of the soil.</li> <li>2. It also reduces both the quantity and velocity of surface runoff.</li> </ol>	<ol style="list-style-type: none"> <li>1. A bit difficult to plow properly.</li> </ol>
<p><b>9. Contour Planting</b></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"> <li>1. Easy to adopt.</li> </ol>	<ol style="list-style-type: none"> <li>1. The effect is not high, if only it is adopted.</li> </ol>

Table A-37 Construction Cost for the Projects (1/4)

Project Facilities	Ashaiman		Weija		Amate	
	Quantity	Amount ('000) cedi	Quantity	Amount ('000) cedi	Quantity	Amount ('000) cedi
1 Dam						
(1) Embankment	- nos		- nos		- nos	
(2) Spillway	- nos		- nos		- nos	
2 Weir	- nos		- nos		- nos	
3 Intake						
(1) Gate	- nos		- nos		- nos	
(2) Valve	2 nos	35,496	- nos		- nos	
(3) Pump	- nos		6 nos	2,037,420	4 nos	2,536,173
4 Irrigation system						
(1) Canal						
(a) Main	5 km	339,531	5.7 km	5,910	- km	
(b) Lateral	11 km	376,957	- km		- km	
(c) Sub lateral	- km		- km		- km	
(2) Pipeline system						
(a) Main	- km		12 km	1,650,966	6 km	744,797
(b) Sprinkler system	- ha		0 ha	1,401,089	0 ha	427,161
5 Drainage system						
(1) Drainage canal						
(a) Main	3 km	378,400	5 km	70,950	2 km	111,155
(b) Lateral	6 km	11,494	5 km	15,964	10 km	432,086
(c) Sub lateral	- km		- km		- km	
(d) Intercept	- km		- km		13 km	57,470
(e) Spillway canal	- km		- km		- km	
6 Related structure						
(1) Farm pond	- nos		- nos		- nos	
(2) Turnout	286 nos	169,013	- nos		- nos	
(3) Check	26 nos	6,056	- nos		- nos	
(4) Syphon	1 no	22,881	- nos		- nos	
(5) Aqueduct	- nos		- nos		- nos	
(6) Drop	260 nos	18,080	- nos		- nos	
(7) Spillway	2 nos	682	- nos		- nos	
(8) Wasteway	2 nos	8,135	- nos		- nos	
(9) Impact box	- nos		- nos		13 nos	16,206
(10) Measuring device	2 nos	918	- nos		- nos	
(11) Bridge	nos		- nos		- nos	
(12) Irrigation crossing	10 nos	13,234	- nos		- nos	
(13) Drainage culvert	7 nos	18,714	- nos		28 nos	48,171
(14) Drainage gate	- nos		2 nos	145,727	- nos	
7 Farm road	16 km	161,511	14 km	125,553	20 km	345,675
8 Project building						
(1) Pump house	- nos		- nos		2 nos	55,757
(2) Office	- nos		- nos		1 no	91,476
(3) Store	- nos		1 no	23,232	2 nos	46,464
(4) Garage	- nos		nos		1 no	25,344
(5) Dry yard	- nos		1 no	2,851	- nos	
(6) Souter house	1 no	7,501	2 nos	15,002	2 nos	15,002
9 Others						
Dyke			2 km	318,211		
Foot bridge						
Total		1,568,604		5,812,874		4,952,936

**Table A-37 Construction Cost for the Projects (2/4)**

Project Facilities	Afife		Aveyime		Kpando-Torkor	
	Quantity	Amount ('000) cedi	Quantity	Amount ('000) cedi	Quantity	Amount ('000) cedi
1 Dam						
(1) Embankment	- nos		- nos		- nos	
(2) Spillway	- nos		- nos		- nos	
2 Weir	- nos		- nos		- nos	
3 Intake						
(1) Gate	1 no	28,245	- nos		- nos	
(2) Valve	- nos		- nos		- nos	
(3) Pump	- nos		3 nos	405,677	8 nos	4,569,674
4 Irrigation system						
(1) Canal						
(a) Main	- km		0.5 km	50,450	- km	
(b) Lateral	12 km	227,891	7 km	408,942	- km	
(c) Sub lateral	19 km	176,997	14 km	373,150	- km	
(2) Pipeline system						
(a) Main	- km		- km		11 km	1,350,795
(b) Sprinkler system	- ha		- ha		356 ha	749,111
5 Drainage system						
(1) Drainage canal						
(a) Main	8 km	236,500	2.5 km	34,293	4 km	222,310
(b) Lateral	15 km	38,313	7 km	26,819	17 km	734,545
(c) Sub lateral	21 km	268,191	14 km	86,204	- km	0
(d) Intercept	8 km	20,434	- km		22 km	126,433
(e) Spillway canal	9 km	425,700	- km		- km	
6 Related structure						
(1) Farm pond	- nos		1 no	49,751	- nos	
(2) Turnout	155 nos	38,067	70 nos	283,349	- nos	
(3) Check	- nos		70 nos	81,812	- nos	
(4) Syphon	- nos		13 nos	7,781	- nos	
(5) Aqueduct	- nos		- nos		- nos	
(6) Drop	- nos		- nos		- nos	
(7) Spillway	- nos		1 no	341	- nos	
(8) Wasteway	- nos		1 no	4,067	- nos	
(9) Impact box	- nos		- nos		22 nos	27,426
(10) Measuring device	- nos		2 nos	918	- nos	
(11) Bridge	- nos		- nos		- nos	
(12) Irrigation crossing	- nos		17 nos	22,498	- nos	
(13) Drainage culvert	- nos		12 nos	20,645	50 nos	86,020
(14) Drainage gate	- nos		- nos		- nos	
7 Farm road	34 km	337,353	12 km	214,629	29 km	556,855
8 Project building						
(1) Pump house	- nos		1 no	24,161	4 nos	133,816
(2) Office	- nos		1 no	91,476	1 no	91,476
(3) Store	- nos		1 no	23,232	4 nos	92,928
(4) Garage	1 no	25,344	1 no	25,344	1 no	25,344
(5) Dry yard	10 nos	28,512	1 no	2,851	- nos	0
(6) Souter house	- nos		1 no	7,501	4 nos	30,003
9 Others						
Land levelling	214 ha	2,996,000	ha		ha	
Foot bridge	47 nos	6,922				
Electric line				13,496	7 km	94,474
Total		4,854,468		2,259,388		8,891,210

Table A-37 Construction Cost for the Projects (3/4)

Project Facilities	Mankessim		Akumadan		Tanoso	
	Quantity	Amount (000) cedi	Quantity	Amount (000) cedi	Quantity	Amount (000) cedi
1 Dam						
(1) Embankment	nos		- nos		- nos	
(2) Spillway	1 no	572	- nos		- nos	
2 Weir	- nos		1 no	262,199	- nos	
3 Intake						
(1) Gate	1 no	19,096	- nos		- nos	
(2) Valve	nos		- nos		- nos	
(3) Pump	5 nos	864,023	2 nos	291,246	2 nos	334,180
4 Irrigation system						
(1) Canal						
(a) Main	2 km	131,116	- km		- km	
(b) Lateral	- km		- km		- km	
(c) Sub lateral	- km		- km		- km	
(2) Pipeline system						
(a) Main	11 km	1,042,557	2 km	110,109	1.6 km	112,380
(b) Sprinkler system	176 ha	370,347	31 ha	65,232	30 ha	63,127
5 Drainage system						
(1) Drainage canal						
(a) Main	2.2 km	121,511	0.5 km	6,204	0.5 km	6,728
(b) Lateral	9 km	377,874	1.5 km	61,821	1.6 km	67,048
(c) Sub lateral	- km		- km		- km	
(d) Intercept	11 km	62,824	2 km	10,963	2 km	11,890
(e) Spillway canal	0.5 km	32,519	- km		- km	
6 Related structure						
(1) Farm pond	1 no	58,957	- nos		- nos	
(2) Turnout	- nos		- nos		- nos	
(3) Check	- nos		- nos		- nos	
(4) Syphon	- nos		- nos		- nos	
(5) Aqueduct	- nos		- nos		- nos	
(6) Drop	- nos		- nos		- nos	
(7) Spillway	1 no	341	- nos		- nos	
(8) Wasteway	1 no	4,067	nos		- nos	
(9) Impact box	14 nos	17,716	2 nos	2,378	2 nos	2,579
(10) Measuring device	1 no	459	- nos		- nos	
(11) Bridge	- nos		- nos		- nos	
(12) Irrigation crossing	- nos		nos		- nos	
(13) Drainage culvert	25 nos	43,256	4 nos	7,384	5 nos	8,899
(14) Drainage gate	- nos		- nos		- nos	
7 Farm road	16 km	301,496	4 km	68,944	3 km	37,047
8 Project building						
(1) Pump house	2 nos	40,888	1 no	17,192	1 no	20,444
(2) Office	1 no	91,476	1 no	91,476	1 no	91,476
(3) Store	3 nos	69,696	1 no	23,232	1 no	23,232
(4) Garage	1 no	25,344	1 no	25,344	1 no	25,344
(5) Dry yard	- nos		- nos		- nos	
(6) Souter house	3 nos	22,502	1 no	7,501	1 no	7,501
9 Others						
Dyke						
Foot bridge						
Electric line	3 km	40,489				
Total		3,739,127		1,051,226		811,875

Table A-37 Construction Cost for the Projects (4/4)

Project Facilities	Bontanga		Subinja		Okeyreko	
	Quantity	Amount ('000) cedi	Quantity	Amount ('000) cedi	Quantity	Amount ('000) cedi
1 Dam						
(1) Embankment	- nos		- nos		- nos	
(2) Spillway	- nos		- nos		- nos	
2 Weir	- nos		1 no	40,256	- nos	
3 Intake						
(1) Gate	2 nos	41,406	- nos		- nos	
(2) Valve	nos		- nos		- nos	
(3) Pump	- nos		3 nos	539,000	3 nos	337,959
4 Irrigation system						
(1) Canal						
(a) Main	12.2 km	64,269	- km		4 km	220,200
(b) Lateral	19 km	64,165	- km		4 km	196,768
(c) Sub lateral	- km		- km		- km	
(2) Pipeline system						
(a) Main	- km		4 km	347,534	- km	
(b) Sprinkler	- ha		70 ha	147,297	- km	
5 Drainage system						
(1) Drainage canal						
(a) Main	6 km	283,800	0.7 km	8,590	2 km	153,725
(b) Lateral	14 km	71,518	3.5 km	142,670	4 km	7,663
(c) Sub lateral	- km		- km		- km	
(d) Intercept	17 km	568,310	4.5 km	26,566	- km	
(e) Spillway canal	- km		- km		- km	
6 Related structure						
(1) Farm pond	- nos		- nos		- nos	
(2) Turnout	760 nos	186,649	- nos		62 nos	98,805
(3) Check	19 nos	22,206	- nos		16 nos	3,727
(4) Syphon	- nos		- nos		- nos	
(5) Aqueduct	- nos		- nos		- nos	
(6) Drop	nos		- nos		50 nos	3,665
(7) Spillway	- nos		- nos		2 nos	682
(8) Wasteway	- nos		- nos		2 nos	8,135
(9) Impact box	nos		5 nos	5,763	- nos	
(10) Measuring device	2 nos	918	- nos		2 nos	918
(11) Bridge	- nos		- nos		- nos	
(12) Irigation crossing	nos		- nos		1 no	1,323
(13) Drainage culvert	nos		10 nos	17,042	1 no	8,391
(14) Drainage gate	1 no	26,106	- nos		- nos	
7 Farm road	36 km	384,123	7 km	107,309	7 km	93,001
8 Project building						
(1) Pump house	- nos		1 no	23,697	1 no	26,020
(2) Office	- nos		1 no	91,476	1 no	91,476
(3) Store	5 nos	116,160	1 no	23,232	1 no	23,232
(4) Garage	nos		1 no	25,344	1 no	25,344
(5) Dry yard	5 nos	14,256	- nos		1 no	1,901
(6) Souter house	5 nos	37,504	1 no	7,501	- nos	
9 Others						
Dyke						
Foot bridge						
Ayense river drain					2 km	156,090
Weir					1 no	71,250
Canal-1					0.3 km	37,249
Canal-2					0.5 km	64,959
Outlet box					1 no	1,308
Pipeline					0.8 km	104,740
Electric line			2 km	26,993	2 km	26,993
Total		1,881,391		1,580,268		1,765,525



**Table A-38 Cost of O & M Equipment and Agriculture Supporting Equipment**

(Unit : 10<sup>3</sup> Cedi)

Equipment	Unit Price	Ashalman		Weija		Amata		Alife		Aveyime		K-Torket		Mabberstini		Akumadan		Tanoso		Bontsaga		Subinija		Okereko			
		Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount		
<b>I. O &amp; M Equipment</b>																											
1 Pick-up (4 X 4)	30,800	1	30,800	1	30,800	1	30,800	2	61,600	1	30,800	1	30,800	1	30,800	1	30,800	1	30,800	1	30,800	1	30,800	1	30,800	1	30,800
2 Tractor (45 Hp)	56,000	1	56,000	1	56,000	1	56,000	3	168,000	1	56,000	1	56,000	1	56,000	1	56,000	1	56,000	2	112,000	1	56,000	1	56,000	1	56,000
3 Buckhee (0.3 mt <sup>3</sup> )	120,400	1	120,400	1	120,400	0	0	1	120,400	0	0	0	0	0	0	0	0	0	0	0	1	120,400	0	0	0	1	120,400
4 Grasscutter	1,400	3	4,200	3	4,200	4	5,600	8	11,200	3	4,200	4	5,600	3	4,200	2	2,800	2	2,800	4	5,600	3	4,200	3	4,200	3	4,200
5 Radio communication	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000	1	28,000
Sub-total			239,400		239,400		120,400		389,200		119,000		120,400		119,000		117,600		117,600		286,800		127,400		239,400		239,400
<b>II. Agri.Supporting Equipment</b>																											
1 Printing machine	3,500	1	3,500	1	3,500	1	3,500	1	3,500	1	3,500	1	3,500	1	3,500	1/3	1,167	1/3	1,167	1	3,500	1/3	1,167	1	3,500	1	3,500
2 Photo copy machine	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1/3	933	1/3	933	1	2,800	1/3	933	1	2,800	1	2,800
3 Overhead projector	2,100	1	2,100	1	2,100	1	2,100	1	2,100	1	2,100	1	2,100	1	2,100	1/3	700	1/3	700	1	2,100	1/3	700	1	2,100	1	2,100
4 Video and TV set	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1/3	933	1/3	933	1	2,800	1/3	933	1	2,800	1	2,800
5 Motor cycle	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800	1	2,800
Sub-total			14,000		14,000		14,000		14,000		14,000		14,000		14,000		6,533		6,533		14,000		6,533		14,000		14,000
III. Office Equip. and facilities	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200	1	4,200
Total			257,600		257,600		138,600		407,400		137,200		138,600		137,200		128,333		128,333		315,000		138,133		257,600		257,600

**Table A-39 Project Cost**

Item	Unit : 10*6 Cedi											
	Ashaiman	Wejja	Amate	Afife	Aveyime	K-Torkor	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyreko
1 Land evaluation*												
(1) Suitable (ha)	158	232	No map	820	63	107	80	54	49	500	82	122
(2) Restricted suitable (ha)	6	0	No map	158	0	268	158	14	11	0	30	0
Sub-total	164	232	No map	978	63	375	238	68	60	500	112	122
2 Potential area (ha)**	148	220	203	880	150	356	256	65	115	450	121	111
3 Irrigable Area (ha)***	44	220	203	535	150	356	176	31	30	450	70	111
4 Direct Construction Cost												
(1) Dam, and Intake	35	2,037	2,536	28	406	4,570	884	553	334	41	579	338
(a) Dam							1					
(b) Weir								262			40	
(c) Valve/Pump	35	2,037	2,536	28	406	4,570	883	291	334	41	539	338
(2) Irrigation System	716	3,058	1,172	405	833	2,100	1,544	175	176	128	495	417
(3) Drainage System	390	87	601	989	147	1,083	594	79	86	924	178	161
(4) Related Structures	258	146	64	38	471	113	125	10	11	236	23	126
(5) Farm Road	162	126	346	337	214	557	302	69	37	384	107	93
(6) Project Buildings	8	41	234	54	175	374	250	165	168	168	171	168
(7) Other works	0	318	0	3,003	13	94	40	0	0	0	27	463
Sub-total	1,569	5,813	4,953	4,854	2,259	8,891	3,739	1,051	812	1,881	1,580	1,766
5 O & M Procurement	258	258	139	407	137	139	137	128	128	315	138	258
6 Engineering Services (10 % of item (4))	157	581	495	485	226	889	374	105	81	188	158	177
7 Administration Cost (5 % of item (4))	78	291	248	243	113	445	187	53	41	94	79	88
8 Physical contingency (10 % of item (4))	157	581	495	485	226	889	374	105	81	188	158	177
Total	2,219	7,524	6,330	6,475	2,961	11,253	4,811	1,442	1,143	2,666	2,113	2,466
Total in 10*3 US\$	1,585	5,374	4,522	4,625	2,115	8,038	3,436	1,030	816	1,904	1,509	1,761
Cost per ha in 10*3 Cedi****	15,000	34,000	31,000	7,000	20,000	32,000	27,000	47,000	38,000	6,000	30,000	22,000
Cost per ha in US\$****	11,000	24,000	22,000	5,000	14,000	23,000	20,000	33,000	27,000	4,000	22,000	16,000

Note

\* : expressed in gross area as explained in Sub-section 3.3.2

\*\* : see Section 3.4.

\*\*\* : estimated through a water balance study as explained in Sub-section 4.4.2.

\*\*\*\* : using the irrigable area mentioned in item (2) for Ashaiman and Afife projects and item (3) for remaining projects.

**Table A-40 Replacement Cost of Equipment**

(Unit: 10<sup>6</sup> Cedi)

Item	Durable period	Ashaiman	Weija	Amate	Añife	Aveyime	K.-Torkor	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyereko
1 Pump and accessories	15 yeras	-	2,037	2,328	-	388	4,154	860	287	287	-	539	334
2 Gate	20 yeras	26	56	-	28	263	-	21	-	-	56	-	85
3 Valve	20 yeras	35	-	-	-	-	-	-	-	-	-	-	-
4 Pipeline	20 yeras	-	1,651	745	-	-	1,351	1,043	110	112	-	348	-
5 Sprinkler set	10 yeras	-	1,401	427	-	-	749	339	137	63	-	147	115
6 O & M equipment	10 yeras	258	258	139	407	137	139	137	128	128	315	138	258

Table A-41 O & M Cost for Respective Projects

(Unit : 10<sup>3</sup> Cedi)

Item	Unit	Asbaiman		Wejjo		Amate		Alife		Aveyime		Kpando-Torkor		Mankessin		Akumadan		Taroso		Bontanga		Subinja		Okyeroko	
		Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount	Qty	Amount
1 Irrigable area (ha)		44		220		203		535		150		356		176		31		30		450		70		111	
2 Administration cost																									
(1) Salary of person	1,200	7/3	2,800	7	8,400	6	7,200	9	10,800	6	7,200	6	7,200	6	7,200	5/3	2,000	5/3	2,000	8	9,600	5/3	2,000	7	8,400
(2) Operation cost of office	6,000	0.3	2,200	1.1	6,600	1.0	2,200	1.2	2,640	1.0	2,200	1.0	2,200	1.0	2,200	0.3	733	0.3	733	1.2	2,640	0.3	733	1.1	2,420
Sub-total			5,000		15,000		9,400		13,440		9,400		9,400		9,400		2,733		2,733		12,240		2,733		10,820
3 Pump operation			0		39,144		134,719		0		6,552		74,135		20,387		13,344		18,847		0		28,995		7,014
4 O & M equipment																									
(1) Pick up	1,100	1	1,100	1	1,100	1	1,100	2	2,200	1	1,100	1	1,100	1	1,100	1/3	367	1/3	367	1	1,100	1/3	367	1	1,100
(2) Tractor	900	1	900	1	900	3	2,700	3	2,700	1	900	1	900	1	900	1/3	300	1/3	300	2	1,800	1/3	300	1	900
(3) Backhoe	400	1	400	1	400	0	0	1	400	0	0	0	0	0	0	0	0	0	0	1	400	0	0	1	400
(4) Maintenance cost	0		480		480		400		1,060		400		400		400		133		133		660		133		480
Sub-total			2,880		2,880		2,400		6,360		2,400		2,400		2,400		800		800		3,960		800		2,880
5 Materials & labour, etc.*	2,200		16,608		10,614		26,750		19,053		7,488		3,429		2,739		22,500		25,119		38,700		37,103		26,264
Total			10,080		73,652		157,133		46,550		25,852		104,988		39,675		20,306		25,119		38,700		37,103		26,264
Cost per ha			229		335		774		87		172		295		225		655		837		86		530		237
Cost per ha (US\$)			164		239		553		62		123		211		161		468		598		61		379		169

Note

\* : 0.3 % of direct construction cost for pump project and US\$100/ha for gravity project, but 0.4 % for Wejjo considering large size of canal work.

**Table A-42 Summary of Conversion Factors from  
Financial to Economic Values**

1. Standard Conversion Factor (SCF)*1	93.5%
2. Specific Conversion Factors*1	
(1) Diesel	49.0%
(2) Heavy equipment	85.0%
(3) Pump & O&M	89.0%
(4) Agro-chemicals	78.0%
(5) Skilled labour*2	93.5%
(6) Unskilled labour*2	47.0%
(7) Farm machinery services*3	71.5%
3. Conversion Factors for Project Cost	
(1) Construction Cost*3	
- Dam and intake	79.6%
- Irrigation system	79.6%
- Drainage system,	79.6%
- Related structure	79.6%
- Farm road	79.6%
- Buildings and other works	79.6%
(2) O&M procurement	85.0%
(3) Engineering services*4	93.5%
(4) Administration cost*4	93.5%
4. Conversion Factors for O&M Cost	
(1) Administration cost*4	93.5%
(2) Pump operation	
- Electricity	89.0%
- Diesel	49.0%
(3) O&M equipment	89.0%
(4) Material and labour, etc.*4	79.6%
5. Conversion Factors for Replacement Cost	85.0%

Remarks:

\*1 Source: (1) Agricultural Sector Investment Project, The World Bank, November, 1993.  
(2) Feasibility Report on Okyereko Small-Scale Pilot Irrigation Scheme, November 1991, GIDA.

\*2 Skilled : Opportunity cost 100% x SCF 93.5%  
Unskilled : Opportunity cost 50% x SCF 93.5%

\*3 Conversion factors of farm machinery services and project cost were estimated as follows.

Farm Machinery Component	Specific Factors	Accumulated
Equipment	50.0%	85.0%
Diesel	40.0%	49.0%
Operator	10.0%	93.5%
Total	100.0%	71.5%

Project Cost Component	Specific Factors	Accumulated
Material cost	70.0%	93.5%
Labour cost	30.0%	47.0%
Total	100.0%	79.6%

**Table A-43 Project Economic Costs**

(Unit: Million Cedi)

Item		ASH	WEI	AMA	AFI	AVE	KPA	MAN	AKU	TAN	BON	SUB	OKY
Potential area	(ha)	148	220	203	880	150	356	256	65	115	450	121	111
Irrigable Area	(ha)	44	220	203	535	150	356	176	31	30	450	70	111
(1) Direct Construction Cost		1,249	4,627	3,943	3,864	1,798	7,077	2,976	837	646	1,497	1,258	1,406
(2) O & M Procurement		219	219	118	346	116	118	116	109	109	268	117	219
(3) Engineering Services		147	544	463	453	211	831	350	98	76	176	148	165
(4) Administration Cost		73	272	232	227	106	416	175	49	38	88	74	83
(5) Physical contingency		125	463	394	386	180	708	298	84	65	150	126	141
Total	(Million Cedi)	1,813	6,125	5,150	5,276	2,411	9,150	3,915	1,177	934	2,179	1,723	2,014
	(Thousand US\$)	1,295	4,375	3,679	3,769	1,722	6,536	2,796	841	667	1,556	1,231	1,439
Remarks:	US\$1.00 = Cedi	1,400											

**Table A-44 Economic O & M Cost for Respective Projects**

(Unit: Thousand Cedi)

Item		ASH	WEI	AMA	AFI	AVE	KPA	MAN	AKU	TAN	BON	SUB	OKY
Irrigable area (ha)	(ha)	44	220	203	535	150	356	176	31	30	450	70	111
(1) Administration cost		4,675	14,025	8,789	12,566	8,789	8,789	8,789	2,556	2,556	11,444	2,556	10,117
(2) Pump operation													
- Electricity		-	34,838	-	-	5,831	65,980	18,144	11,876	16,774	-	25,806	6,242
- Diesel		-	-	66,012	-	-	-	-	-	-	-	-	-
(3) O & M equipment		2,563	2,563	2,136	5,660	2,136	2,136	2,136	712	712	3,524	712	2,563
(4) Materials & labour, etc.		1,751	13,220	8,449	21,293	5,970	15,166	5,960	2,729	2,180	17,910	3,642	4,418
Total		8,989	64,646	85,386	39,519	22,726	92,071	35,029	17,873	22,222	32,878	32,716	23,340
Cost per ha	(Cedi 1,000/ha)	204	294	421	74	152	259	199	577	741	73	467	210
	(US\$/ha)	146	210	301	53	109	185	142	412	529	52	334	150
Remarks:	US\$1.00 = Cedi	1,400											

**Table A-45 Economic Replacement Cost of Equipment**

(Unit: Million Cedi)

Item		ASH	WEI	AMA	AFI	AVE	KPA	MAN	AKU	TAN	BON	SUB	OKY
(1) Pump and accessories	15 yeras	-	1,731	1,979	-	330	3,531	731	244	244	-	458	284
(2) Gate	20 years	22	48	-	24	224	-	18	-	-	48	-	72
(3) Valve	20 yeras	30	-	-	-	-	-	-	-	-	-	-	-
(4) Pipeline	20 yeras	-	1,403	633	-	-	1,148	887	94	95	-	296	-
(5) Sprinkler set	10 years	-	1,191	363	-	-	637	288	116	54	-	125	98
(6) O & M equipment	10 years	219	219	118	346	116	118	116	109	109	268	117	219

**Table A-46 Economic Price Structure (1/2)**

Items	Import Parity	
	Operation	US\$/ton Cedi/kg
<b>Rice</b>		
(1) Thai 5% broken, FOB Bangkok, 2005 (Constant 1990 price)*1*3		238
(2) Adjusted to 1995 constant price	115.1%	274
(3) Freight and insurance (Bangkok-Tema)	+	48
(4) CIF at Tema port		322
(5) Conversion to Cedi *2		451
(6) Port handling at 1% of CIF	1% +	5
(7) Transportation (port to wholesaler)	2.5% +	8
(8) Import margin at 2% of CIF	2% +	6
(9) Ex-wholesaler		470
(10) Transport from Tema to Kumasi	+	35
(11) Wholesalers margin	3% +	15
(12) Wholesale price at Kumasi		520
(13) Retailer margin at 4% of wholesale price	4% +	21
(14) Retailer price at Kumasi		541
(15) Milling cost	-	20
(16) Conversion to paddy	65%	339
(16) Transportation (farm to mill)	-	10
(17) Economic farm gate price		<u>329</u>
<b>Maize</b>		
(1) Export price, FOB Gulf ports, 2005 (Constant 1990 price)*4		85
(2) Adjusted to 1995 constant price	115.1%	98
(3) Freight and insurance (Gulf ports-Tema)	+	48
(4) CIF at Tema port		146
(5) Conversion to Cedi *2		204
(6) Port handling at 1% of CIF	1% +	2
(7) Transportation (port to wholesaler)	2.5% +	4
(8) Import margin at 2% of CIF	2% +	3
(9) Ex-wholesaler		213
(10) Transport from Tema to Kumasi	+	16
(11) Wholesalers margin	3% +	7
(12) Wholesale price at Kumasi		236
(13) Retailer margin at 4% of wholesale price	4% +	9
(14) Retailer price at Kumasi		245
(15) Local transportation	-	10
(16) Economic farm gate price		<u>235</u>

Remarks: \*1 Projected price in 2005 at constant 1990 price  
Source: The World Bank, Commodity Markets and the Developing Countries - A World Bank Quarterly, November 1995.

\*2 Exchange rate: US\$ 1.00 = Cedi 1.400

\*3 Thai, white, milled, 5% broken, government standard, Board of Trade-posted price, FOB Bangkok.

\*4 US, No. 2, yellow, FOB Gulf ports.

**Table A-46 Economic Price Structure (2/2)**

Items	Import Parity		
	Operation	US\$/ton	Cedi./kg
<b>Urea</b>			
(1) Export price FOB Europe (1990 constant), bagged *1		128	
(2) Adjusted to 1995 constant price	115.1%	147	
(3) Freight and insurance		+	39
(4) CIF at Tema port			186
(5) Conversion to Cedi *2			261
(6) Port handling at 1% of CIF	1% +		3
(7) Transportation (port to wholesaler)		+	8
(8) Import margin at 2% of CIF	2% +		4
(9) Ex-wholesaler			276
(10) Transport from Tema to Kumasi		+	35
(11) Wholesalers margin	3% +		9
(12) Wholesale price at Kumasi			320
(13) Retailer margin at 4% of wholesale price	4% +		13
(14) Retailer price at Kumasi			333
(16) Transport from Kumasi to farmgate		+	10
(17) Economic farm gate price			<u>343</u>
(18) Nitrogen (46%)			<u>746</u>
<b>TSP</b>			
(1) Export price (1990 constant), FOB US Gulf, bulk *1		108	
(2) Adjusted to 1995 constant price	115.1%	124	
(3) Freight and insurance		+	39
(4) CIF at Tema port			163
(5) Conversion to Cedi *2			229
(6) Port handling at 1% of CIF	1% +		2
(7) Transportation (port to wholesaler)		+	8
(8) Import margin at 2% of CIF	2% +		3
(9) Ex-wholesaler			242
(10) Transport from Tema to Kumasi		+	35
(11) Wholesalers margin	3% +		8
(12) Wholesale price at Kumasi			285
(13) Retailer margin at 4% of wholesale price	4% +		11
(14) Retailer price at Kumasi			296
(16) Transport from Kumasi to farmgate		+	10
(17) Economic farm gate price			<u>306</u>
(18) Phosphate (45%)			<u>680</u>
<b>Muriate of Potash</b>			
(1) Export price (1990 constant), FOB Vancouver, bulk *1		92	
(2) Adjusted to 1995 constant price	115.1%	106	
(3) Freight and insurance		+	39
(4) CIF at Tema port			145
(5) Conversion to Cedi *2			203
(6) Port handling at 1% of CIF	1% +		2
(7) Transportation (port to wholesaler)		+	8
(8) Import margin at 2% of CIF	2% +		3
(9) Ex-wholesaler			216
(10) Transport from Tema to Kumasi		+	35
(11) Wholesalers margin	3% +		8
(12) Wholesale price at Kumasi			259
(13) Retailer margin at 4% of wholesale price	4% +		10
(14) Retailer price at Kumasi			269
(16) Transport from Kumasi to farmgate		+	10
(17) Economic farm gate price			<u>279</u>
(18) Potash (60%)			<u>465</u>
<b>Compound Fertilizer</b>			
	N	15%	112
	P2O5	15%	102
	K2O	15%	70
		Total	<u>284</u>
<b>Ammonium Sulphate</b>			
	N	20.5%	<u>153</u>

Remarks: \*1 Projected price in 2005 at constant 1990 price  
Source: The World Bank, Commodity Markets and the Developing Countries - A World Bank Quarterly, November 1995.  
\*2 Exchange rate: US\$ 1.00 = Cedi 1,400



Table A-47 Economic Net Return per Hectare - Without Project (1/7)

Projects:	Ashajman	Wejja	Amate	Afife	Aveyime	Kpando	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyereko	Average
<b>Cassava</b>													
1. Gross Income													
(1) Unit Yield (t/ha)	-	-	-	3.3	4.1	7.0	16.0	-	12.8	-	22.2	4.4	9.97
(2) Unit Price (CD/kg)	-	-	-	110	150	80	100	-	80	-	230	100	120
(3) Gross Income (CD1,000)	-	-	-	363	615	560	1,600	-	1,024	-	5,106	440	1,196
	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty
	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)
2. Gross Outgoing													
(1) Seed (kg)	-	-	-	931.0	600.0	1015.0	500.0	10	831.7	18	500.0	558.3	705.0
(2) Fertilizers													
Urea	-	-	-	-	-	-	-	-	-	-	31	11	4
Ammonium sulfate (kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Compound fertilizers (kg)	-	-	-	20	6	-	-	-	-	-	31	9	7
(3) Agro-chemicals													
Herbicide (lit)	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit)	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicide (lit)	-	-	-	0.69	1.71	2.50	-	-	-	-	7.50	2.50	2.12
(4) Farm Machinery													
Own machine (hr)	-	-	-	0.52	21	11	-	-	-	-	-	-	0.07
Hired machine (hr)	-	-	-	0.17	7	24	-	-	115.7	-	7.50	87	2.05
Family (man-day)	-	-	-	86.6	95.9	94.8	81.6	-	-	-	96.3	106.7	96.7
Exchange (man-day)	-	-	-	53.7	86.2	89	13.3	13	7.6	8	30.0	24	50.6
Hired (man-day)	-	-	-	4.5	6	8	-	-	3.2	3	-	-	2.2
Miscellaneous	-	-	-	28.4	38	30	68.3	64	104.9	103	66.3	51	43.9
(7) Irrigation Service Fees	-	-	-	11	8	6	4	-	-	-	10	9	8
Total	-	-	-	237	168	129	91	-	139	-	219	180	166
Net Return	-	-	-	126	447	431	1,509	-	885	-	4,887	260	1,030
<b>Sweet Potatoes</b>													
1. Gross Income													
(1) Unit Yield (t/ha)	-	16.4	-	-	-	-	10.0	-	-	-	13.22	-	13.22
(2) Unit Price (CD/kg)	-	130	-	-	-	-	200	-	-	-	-	-	165
(3) Gross Income (CD1,000)	-	2,137	-	-	-	-	2,000	-	-	-	-	-	2,181
	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty
	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)	(CD1,000)
2. Gross Outgoing													
(1) Seed (kg)	-	750	98	-	-	-	375.0	79	-	-	-	-	563.0
(2) Fertilizers													
Urea	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonium sulfate (kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Compound fertilizers (kg)	-	5	1	-	-	-	-	-	-	-	-	-	3
(3) Agro-chemicals													
Herbicide (lit)	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit)	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicide (lit)	-	-	-	-	-	-	-	-	-	-	-	-	-
(4) Farm Machinery													
Own machine (hr)	-	10.00	-	-	-	-	14.69	-	-	-	-	-	12.35
Hired machine (hr)	-	10.00	36	-	-	-	14.69	23	-	-	-	-	12.35
Family (man-day)	-	88.8	81.9	-	-	-	51.9	49	-	-	-	-	85.4
Exchange (man-day)	-	51.9	49	-	-	-	51.9	49	-	-	-	-	51.9
Hired (man-day)	-	36.9	35	-	-	-	30.0	28	-	-	-	-	33.5
Miscellaneous	-	11	11	-	-	-	-	9	-	-	-	-	10
(7) Irrigation Service Fees	-	230	-	-	-	-	188	-	-	-	-	-	209
Total	-	1,907	1,907	-	-	-	1,812	-	-	-	-	-	1,972
Net Return	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A-47 Economic Net Return per Hectare - Without Project (2/7)

Projects:	Ashaiman	Weija	Amate	Afife	Aveyime	Kpando	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyereko	Average
<b>Yam</b>													
1. Gross Income													
(1) Unit Yield (t/ha)						4.1		12.5					8.30
(2) Unit Price (CD/kg)						420		270					345
(3) Gross Income (CD1,000)						1,722		3,373					2,864
2. Gross Outgoing													
(1) Seed (kg)						506		417					461
(2) Fertilizers													
Urea (kg)													
Ammonium sulfate (kg)													
Compound fertilizers (kg)													
(3) Agro-chemicals													
Herbicide (lit.)													
Insecticide (lit.)													
Fungicide (lit.)													
(4) Farm Machinery						2.35		1.67					2.01
Own machine (hr)													
Hired machine (hr)						2.35		1.67					2.01
(5) Labour Requirement													
Family (man-day)													
Exchange (man-day)													
Hired (man-day)						48.5		58.3					53.4
(6) Miscellaneous													
(7) Irrigation Service Fees													
Total						223		190					206
3. Net Return						1,499		3,183					2,658
<b>Maize</b>													
1. Gross Income													
(1) Unit Yield (t/ha)	0.6		2.3	1.0	0.6	2.0	1.9	1.79	2.14	1.5	1.94	2.3	1.63
(2) Unit Price (CD/kg)	235		235	235	235	235	235	235	235	235	235	235	235
(3) Gross Income (CD1,000)	141		541	235	141	470	447	421	503	353	456	541	383
2. Gross Outgoing													
(1) Seed (kg)	25		25	16	12	30	16	12	31	17	12	15	21.0
(2) Fertilizers													
Urea (kg)													
Ammonium sulfate (kg)													
Compound fertilizers (kg)	42												
(3) Agro-chemicals													
Herbicide (lit.)													
Insecticide (lit.)													
Fungicide (lit.)													
(4) Farm Machinery						4.21		0.66	2.02	3.91	4.33	8.10	4.04
Own machine (hr)						0.58				1.48	10		0.30
Hired machine (hr)						3.63		0.66	2.02	2.43	4.33	38	8.10
(5) Labour Requirement													
Family (man-day)													
Exchange (man-day)													
Hired (man-day)						78.4		77.2	90.1	83.4	65.7	112.0	91.3
(6) Miscellaneous													
(7) Irrigation Service Fees													
Total						252		225	317	243	212	243	210
3. Net Return						1,247		1,958	1,813	1,100	1,244	1,298	1,448

**Table A-47 Economic Net Return per Hectare - Various Project (2/1)**

Projects:	Ashairman	Weija	Amate	Aife	Aveyime	Kpando	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyereko	Average
<b>Paddy (Rice)</b>													
<b>1. Gross Income</b>													
(1) Unit Yield (t/ha)	3.7	3.7	-	4.1	-	-	-	-	-	5.45	-	3.75	4.10
(2) Unit Price (CD/kg)	329	329	-	329	-	-	-	-	-	329	-	329	329
(3) Gross Income (CD/1,000)	1,217	1,217	-	1,349	-	-	-	-	-	1,793	-	1,234	1,349
Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)
<b>2. Gross Outgoing</b>													
(1) Seed (kg)	121	79	27	103	46	-	-	-	-	106	27	59.9	31
(2) Fertilizers	98	34	55	179	61	-	-	-	-	129	44	13	4
Urea	93	14	63	10	-	-	-	-	-	128	20	113	17
Ammonium sulfate	212	60	375	107	51	-	-	-	-	175	30	225	64
Compound fertilizers	-	-	-	-	-	-	-	-	-	-	-	-	233
(3) Agro-chemicals	-	28	-	14	-	-	-	-	-	-	18	-	-
Herbicide	-	12	-	15	-	-	-	-	-	-	3	-	-
Insecticide	-	-	-	-	0	-	-	-	-	-	-	-	-
Fungicide	11.76	3.44	-	8.96	-	-	-	-	-	5.16	-	10.85	8.03
(4) Farm Machinery	-	-	-	7.40	52	-	-	-	-	0.28	3	-	1.54
Own machine	11.76	3.44	57	1.56	11	-	-	-	-	4.88	49	10.85	37
Hired machine	103.9	96.6	-	120.6	-	-	-	-	-	116.0	-	124.7	112.3
(5) Labour Requirement	35.2	48	42.2	25.5	33	-	-	-	-	34.5	18	39.3	46
Family (man-day)	0.7	1	-	4.7	6	-	-	-	-	4.5	2	-	2.0
Exchange (man-day)	68.0	93	54.4	90.4	119	-	-	-	-	77.0	40	85.4	101
Hired (man-day)	19	17	-	20	-	-	-	-	-	14	-	14	17
(6) Miscellaneous	45	125	-	45	-	-	-	-	-	53	-	45	62
(7) Irrigation Service Fees	44	47.6	-	47.3	-	-	-	-	-	342	-	345	416
Total	773	741	-	876	-	-	-	-	-	1,451	-	889	933
<b>3. Net Return</b>													
<b>Egg Plant (Garden Egg)</b>													
<b>1. Gross Income</b>													
(1) Unit Yield (t/ha)	-	10.8	-	-	-	-	-	-	-	-	-	11.3	-
(2) Unit Price (CD/kg)	-	470	-	-	-	-	-	-	-	-	-	230	-
(3) Gross Income (CD/1,000)	-	5,076	-	-	-	-	-	-	-	-	-	2,599	-
Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)	(CD/1,000)
<b>2. Gross Outgoing</b>													
(1) Seed (kg)	-	1	31	-	-	-	-	-	-	-	-	0.4	6
(2) Fertilizers	-	-	-	-	-	-	-	-	-	-	-	-	-
Urea	-	-	-	-	-	-	-	-	-	-	-	58	20
Ammonium sulfate	-	125	19	-	-	-	-	-	-	-	184	28	137
Compound fertilizers	-	319	91	-	-	-	-	-	-	-	197	56	209
(3) Agro-chemicals	-	-	-	-	-	-	-	-	-	-	-	-	-
Herbicide	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide	-	-	92	-	19	-	-	-	-	-	-	41	-
Fungicide	-	-	33	-	13	-	-	-	-	-	-	9	-
Others	-	-	-	-	-	-	-	-	-	-	-	-	-
(4) Farm Machinery	-	18.38	-	-	-	-	-	-	-	-	10.00	-	13.16
Own machine	-	18.38	44	-	-	-	-	-	-	-	-	-	-
Hired machine	-	389.5	-	-	-	-	-	-	-	-	10.00	57	13.16
(5) Labour Requirement	-	234.0	220	-	-	-	-	-	-	-	383.2	-	315.7
Family (man-day)	-	79.6	75	-	-	-	-	-	-	-	258.7	207	192.1
Exchange (man-day)	-	75.9	71	-	-	-	-	-	-	-	-	-	26.5
Hired (man-day)	-	34	-	-	-	-	-	-	-	-	124.5	100	97.1
(6) Miscellaneous	-	125	-	-	-	-	-	-	-	-	26	-	25
(7) Irrigation Service Fees	-	835	-	-	-	-	-	-	-	-	369	-	180
Total	-	4,241	-	-	-	-	-	-	-	-	919	-	702
<b>3. Net Return</b>													
Inter cropping with water melon													

Table A-47 Economic Net Return per Hectare - Without Project (4/7)

Projects:	Ashaiman	Weija	Amate	Afife	Aveyime	Kpando	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyereko	Average
<b>Okra</b>													
1. Gross Income													
(1) Unit Yield (t/ha)	6.0	9.16	-	9.4	-	10.0	4.83	-	-	9.42	-	-	8.14
(2) Unit Price (CD/kg)	290	200	-	500	-	500	300	-	-	150	-	-	320
(3) Gross Income (CD1,000)	1,740	1,832	-	4,700	-	5,000	1,449	-	-	1,413	-	-	2,605
2. Gross Outgoing													
(1) Seed (kg)	7	49	-	4	20	24	91	2.2	25	7	8	-	8.0
(2) Fertilizers													
Urea (kg)	18	26	9	14	5	29	10	-	-	-	-	-	15
Ammonium sulfate (kg)	32	120	18	10	2	262	40	77	12	188	29	-	115
Compound fertilizers (kg)	211	60	156	44	-	262	74	77	22	292	83	-	166
(3) Agro-chemicals													
Herbicide (lit.)	-	-	-	-	-	2	-	-	-	-	-	-	-
Insecticide (lit.)	-	73	-	2	-	218	-	16	-	37	-	-	68
Fungicide (lit.)	-	1	-	-	-	14	-	28	-	3	-	-	10
Others (lit.)													
(4) Farm Machinery													
Own machine (hr)	7.06	12.09	-	0.18	-	5.06	15.00	-	-	4.59	-	-	7.33
Hired machine (hr)	-	-	-	-	-	-	-	-	-	1.67	19	-	0.28
Family (hr)	7.06	39	12.09	74	7	5.06	29	15.00	34	2.92	32	-	7.05
(5) Labour Requirement													
Family (man-day)	164.8	66	104.9	99	43	361.4	312.9	-	-	247.3	-	-	232.4
Exchange (man-day)	4.0	6	-	-	-	193.4	191	211.9	199	124.4	64	-	119.3
Hired (man-day)	112.5	153	63.0	59	-	154.8	153	75.5	71	120.8	63	-	105.6
(6) Miscellaneous													
5%	23	21	-	11	-	42	22	-	-	17	-	-	23
(7) Irrigation Service Fees													
Total	526	568	-	231	-	1,108	542	-	-	409	-	-	566
3. Net Return	1,214	1,264	-	4,469	-	3,892	907	-	-	1,004	-	-	2,039
<b>Onion</b>													
1. Gross Income													
(1) Unit Yield (t/ha)	-	-	-	8.5	-	-	-	-	-	14.5	-	-	11.50
(2) Unit Price (CD/kg)	-	-	-	650	-	-	-	-	-	180	-	-	415
(3) Gross Income (CD1,000)	-	-	-	5,525	-	-	-	-	-	2,610	-	-	4,773
2. Gross Outgoing													
(1) Seed (kg)	-	-	12	587	-	-	-	-	-	10	200	-	11
(2) Fertilizers													
Urea (kg)	-	-	13	4	-	-	-	-	-	-	-	-	7
Ammonium sulfate (kg)	-	-	46	7	-	-	-	-	-	250	38	-	148
Compound fertilizers (kg)	-	-	216	61	-	-	-	-	-	250	71	-	233
(3) Agro-chemicals													
Herbicide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit.)	-	-	-	19	-	-	-	-	-	-	9	-	-
Fungicide (lit.)	-	-	-	33	-	-	-	-	-	-	-	-	-
(4) Farm Machinery													
Own machine (hr)	-	-	9.11	-	-	-	-	-	-	14.25	-	-	11.68
Hired machine (hr)	-	-	9.11	60	-	-	-	-	-	14.25	84	-	11.68
Family (hr)	-	-	314.1	-	-	-	-	-	-	343.9	-	-	329.1
(5) Labour Requirement													
Family (man-day)	-	-	108.4	127	-	-	-	-	-	77.9	40	-	93.2
Exchange (man-day)	-	-	81.4	96	-	-	-	-	-	-	-	-	40.7
Hired (man-day)	-	-	124.3	146	-	-	-	-	-	266.0	138	-	195.2
(6) Miscellaneous													
5%	-	-	57	-	-	-	-	-	-	29	-	-	43
(7) Irrigation Service Fees													
Total	-	-	388	-	-	-	-	-	-	53	-	-	221
3. Net Return	-	-	1,585	-	-	-	-	-	-	662	-	-	1,125
	-	-	3,940	-	-	-	-	-	-	1,948	-	-	3,648

Table A-47 Economic Net Return per Hectare - Without Irrigation (2017)

Projects:	Ashaiman	Weija	Amate	Afife	Aveyime	Kpando	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyereko	Average
<b>Hot Pepper</b>													
1. Gross Income (t/ha)	-	0.8	1.0	-	0.5	-	1.0	-	-	-	0.8	-	0.82
(1) Unit Yield (CD/kg)	-	1,600	2,040	-	1,200	-	2,000	-	-	-	1,610	-	1,690
(2) Unit Price (CD/1,000)	-	1,280	2,040	-	600	-	2,000	-	-	-	1,283	-	1,386
(3) Gross Income (CD/1,000)	-	1,280	2,040	-	600	-	2,000	-	-	-	1,283	-	1,386
Qty Value (CD/1,000)	-	1,280	2,040	-	600	-	2,000	-	-	-	1,283	-	1,386
Qty Value (CD/1,000)	-	1,280	2,040	-	600	-	2,000	-	-	-	1,283	-	1,386
2. Gross Outgoing (kg)	-	1	32	-	6	30	1.0	11	-	-	1	7	2
(1) Seed	-	1	32	-	6	30	1.0	11	-	-	1	7	2
(2) Fertilizers	-	-	-	-	-	-	-	-	-	-	-	-	-
Urea	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonium sulfate (kg)	-	94	14	-	-	-	50	8	-	188	29	-	66
Compound fertilizers (kg)	-	78	22	-	-	-	50	14	-	229	65	-	79
(3) Agro-chemicals	-	-	-	-	-	-	-	-	-	-	-	-	-
Herbicide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit.)	-	18	6	-	-	-	7	-	-	-	4	-	18
Fungicide (lit.)	-	13	2	-	-	-	4	-	-	-	19	-	9
Others (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
(4) Farm Machinery	-	4.84	2.86	-	20.00	-	8.75	-	-	-	10.83	-	9.46
Own machine (hr)	-	-	-	-	-	-	-	-	-	-	-	-	-
Hired machine (hr)	-	4.84	2.86	26	20.00	107	8.75	25	-	10.83	65	-	9.46
(5) Labour Requirement	-	270.4	361.4	-	365.0	315	265.3	-	-	316.7	-	-	315.8
Family (man-day)	-	64.1	151.7	178	305.0	315	88.4	83	-	167.1	133	-	153.3
Exchange (man-day)	-	-	14.3	17	-	-	-	-	-	-	3.3	-	3.5
Hired (man-day)	-	206.3	194	195.4	60.0	62	176.9	166	-	146.3	117	-	157.0
(6) Miscellaneous	-	-	30	25	26	-	16	-	-	22	24	-	24.3
(7) Irrigation Service Fees	-	125	388	-	-	-	89	-	-	-	369	-	243
Total	-	540	914	-	540	540	423	-	-	872	712	-	674
3. Net Return	-	740	1,126	-	60	60	1,577	-	-	-	416	-	620
<b>Tomatoes</b>													
1. Gross Income (t/ha)	-	7.35	5.85	-	-	-	2.2	419	7.04	16.02	1.8	4.4	6.20
(1) Unit Yield (CD/kg)	-	200	380	-	-	-	110	480	480	125	350	200	290
(2) Unit Price (CD/1,000)	-	1,470	2,223	-	-	-	242	2,011	3,379	2,003	630	880	1,798
(3) Gross Income (CD/1,000)	-	1,470	2,223	-	-	-	242	2,011	3,379	2,003	630	880	1,798
Qty Value (CD/1,000)	-	1,470	2,223	-	-	-	242	2,011	3,379	2,003	630	880	1,798
2. Gross Outgoing (kg)	-	1	3	48	-	-	0.3	5	1	5	1	5	1.5
(1) Seed	-	1	3	48	-	-	0.3	5	1	5	1	5	1.5
(2) Fertilizers	-	-	-	-	-	-	-	-	-	-	-	-	-
Urea	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonium sulfate (kg)	-	4	1	25	-	-	225	34	125	19	14	22	63
Compound fertilizers (kg)	-	58	16	150	43	-	325	92	213	60	14	40	94
(3) Agro-chemicals	-	-	-	-	-	-	-	-	-	-	-	-	-
Herbicide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit.)	-	15	16	-	-	-	1	26	-	17	-	24	55
Fungicide (lit.)	-	5	27	-	-	-	1	23	-	7	-	6	16
Others (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
(4) Farm Machinery	-	7.74	5.75	-	-	-	5.45	-	28.75	5.77	3.75	5.00	7.81
Own machine (hr)	-	-	-	-	-	-	-	-	-	-	-	-	-
Hired machine (hr)	-	7.74	44	5.75	46	-	5.45	11	0.25	6	28.75	54	5.77
(5) Labour Requirement	-	121.9	195.9	-	-	-	145.0	205.0	147.3	186.2	159.4	-	154.1
Family (man-day)	-	71.8	68	45.6	54	-	78.6	74	100.6	118	96.8	95	81.1
Exchange (man-day)	-	-	84.5	99	-	-	7.3	7	0.8	1	-	-	3.6
Hired (man-day)	-	50.1	47	65.8	78	-	59.1	55	103.6	122	50.5	50	101.5
(6) Miscellaneous	-	-	10	21	-	-	8	-	21	12	11	-	12
(7) Irrigation Service Fees	-	125	388	-	-	-	147	147	249	53	143	-	143
Total	-	344	824	-	162	583	1,620	583	2,696	1,689	225	247	246
3. Net Return	-	1,126	1,392	-	60	60	1,577	-	2,696	1,689	225	247	1,352
Village irrigation													

Table A-47 Economic Net Return per Hectare - Without Project (6/7)

Projects:	Ashaiman	Weija	Amate	Afife	Aveyime	Kpando	Mankessim	Akumadan	Tanoso	Bontanga	Subinja	Okyereko	Average
<b>Cowpea</b>													
1. Gross Income													
(1) Unit Yield (t/ha)	-	0.6	-	-	-	-	-	-	-	0.7	0.98	-	0.80
(2) Unit Price (CD/kg)	-	440	-	-	-	-	-	-	-	300	300	-	350
(3) Gross Income (CD,000)	-	264	-	-	-	-	-	-	-	210	294	-	280
2. Gross Outgoing													
(1) Seed (kg)	-	8	11	-	-	-	-	-	-	15	17	18	13.0
(2) Fertilizers	-	-	-	-	-	-	-	-	-	-	-	-	-
Urea	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonium sulfate (kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Compound fertilizers (kg)	-	63	18	-	-	-	-	-	-	-	-	-	21
(3) Agro-chemicals													
Herbicide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit.)	-	27	-	-	-	-	-	-	-	12	39	-	26
Fungicide (lit.)	-	27	-	-	-	-	-	-	-	-	-	-	9
(4) Farm Machinery													
Own machine (hr)	-	5.63	-	-	-	-	-	-	-	1.35	5.42	-	4.13
Hired machine (hr)	-	5.63	37	-	-	-	-	-	-	1.35	28	34	4.13
(5) Labour Requirement													
Family (man-day)	-	4.4	4	-	-	-	-	-	-	96.1	52.5	-	65.3
Exchange (man-day)	-	43.1	40	-	-	-	-	-	-	81.6	42	10	32.8
Hired (man-day)	-	8	-	-	-	-	-	-	-	14.5	8	32	32.5
(6) Miscellaneous	-	-	-	-	-	-	-	-	-	5	7	-	7
(7) Irrigation Service Fees	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	172	-	-	-	-	-	-	-	112	140	-	142
3. Net Return	-	92	-	-	-	-	-	-	-	98	154	-	138
<b>Groundnuts</b>													
1. Gross Income													
(1) Unit Yield (t/ha)	-	-	1.8	1.0	-	-	-	-	-	0.4	-	-	1.3
(2) Unit Price (CD/kg)	-	-	370	1,020	-	-	-	-	-	360	-	-	210
(3) Gross Income (CD,000)	-	-	666	1,020	-	-	-	-	-	144	-	-	273
2. Gross Outgoing													
(1) Seed (kg)	-	-	78	50	50	-	-	-	-	29	20	-	45
(2) Fertilizers													
Urea	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonium sulfate (kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Compound fertilizers (kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
(3) Agro-chemicals													
Herbicide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
(4) Farm Machinery													
Own machine (hr)	-	-	4.79	1.50	-	-	-	-	-	3.11	-	2.05	2.86
Hired machine (hr)	-	-	-	-	-	-	-	-	-	-	-	-	-
(5) Labour Requirement													
Family (man-day)	-	-	4.79	31	1.50	54	-	-	-	3.11	22	-	2.05
Exchange (man-day)	-	-	105.4	99.0	-	-	-	-	-	119.8	-	-	110.4
Hired (man-day)	-	-	80.0	35.5	47	-	-	-	-	55.8	29	-	84.3
(6) Miscellaneous	-	-	-	-	-	-	-	-	-	7.1	4	-	1.8
(7) Irrigation Service Fees	-	-	25.4	30	63.5	84	-	-	-	56.9	30	-	33.0
Total	-	-	11	12	-	-	-	-	-	5	10	-	9
3. Net Return	-	223	247	773	-	-	-	-	-	110	34	-	203
	-	443	773	-	-	-	-	-	-	34	70	-	338

Source: Farm interview survey and field investigation by the Study Team and data obtained from the PM Offices.

**Table A-47 Economic Net Return per Hectare - Without Project (7/7)**

Projects	Bontanga		Mankessim				Weija					
	Millet		Sugarcane		Water Melon		Cabbage		Clus/Bean		Tinda	
<b>1. Gross Income</b>												
(1) Unit Yield (t/ha)	0.9		62.5		7.67		17.4		6.15		14.57	
(2) Unit Price (CD/kg)	130		10		240		180		300		460	
(3) Gross Income (CD1,000)	117		625		1,841		3,132		1,845		6,702	
	Q'ty	Value	Q'ty	Value	Q'ty	Value	Q'ty	Value	Q'ty	Value	Q'ty	Value
		(CD1,000)		(CD1,000)		(CD1,000)		(CD1,000)		(CD1,000)		(CD1,000)
<b>2. Gross Outgoing</b>												
(1) Seed (kg)	3.0	1	563	39	1.0	27	0.2	59	7.5	75	2.4	36
(2) Fertilizers												
Urea (kg)	-	-	-	-	-	-	-	-	-	-	14	5
Ammonium sulfate (kg)	-	-	-	-	69	11	163	25	-	-	19	3
Compound fertilizers (kg)	-	-	31	9	75	21	348	99	-	-	92	26
Compost (kg)	500	7	-	-	-	-	-	-	-	-	-	-
Others (kg)	-	-	-	-	-	-	-	-	-	-	-	-
(3) Agro-chemicals												
Herbicide (lit.)	-	-	-	-	-	-	-	-	-	-	-	-
Insecticide (lit.)	-	-	-	-	2.84	23	5.66	117	-	-	1.73	30
Fungicide (lit.)	-	-	-	-	2.57	17	0.98	25	-	-	0.48	8
Others (lit.)	-	-	-	-	0.28	4	3.61	19	-	-	4.42	11
(4) Farm Machinery (hr)	10.00		-		10.28		7.99		7.50		6.06	
Own machine (hr)	-	-	-	-	-	-	-	-	-	-	-	-
Hired machine (hr)	10.00	14	-	-	10.28	19	7.99	53	7.50	43	6.06	36
(5) Labour Requirement	64.5		60.1		134.0		223.6		158.8		112.1	
Family (man-day)	10.0	5	28.8	27	79.0	74	165.2	155	108.8	102	65.1	61
Exchange (man-day)	-	-	-	-	1.2	1	-	-	-	-	-	-
Hired (man-day)	54.5	28	31.3	30	53.8	51	58.4	55	50.0	47	47.0	44
(6) Miscellaneous 5%		3		5		12		30		13		13
(7) Irrigation Service Fees						0		0		0		0
Total		58		110		260		637		280		273
<b>3. Net Return</b>		59		515		1,581		2,495		1,565		6,429
						Inter cropping with garden egg						

Source: Farm interview survey and field investigation by the Study Team and data obtained from the PM Offices.