Annex C

Infrastructure Planning/Design

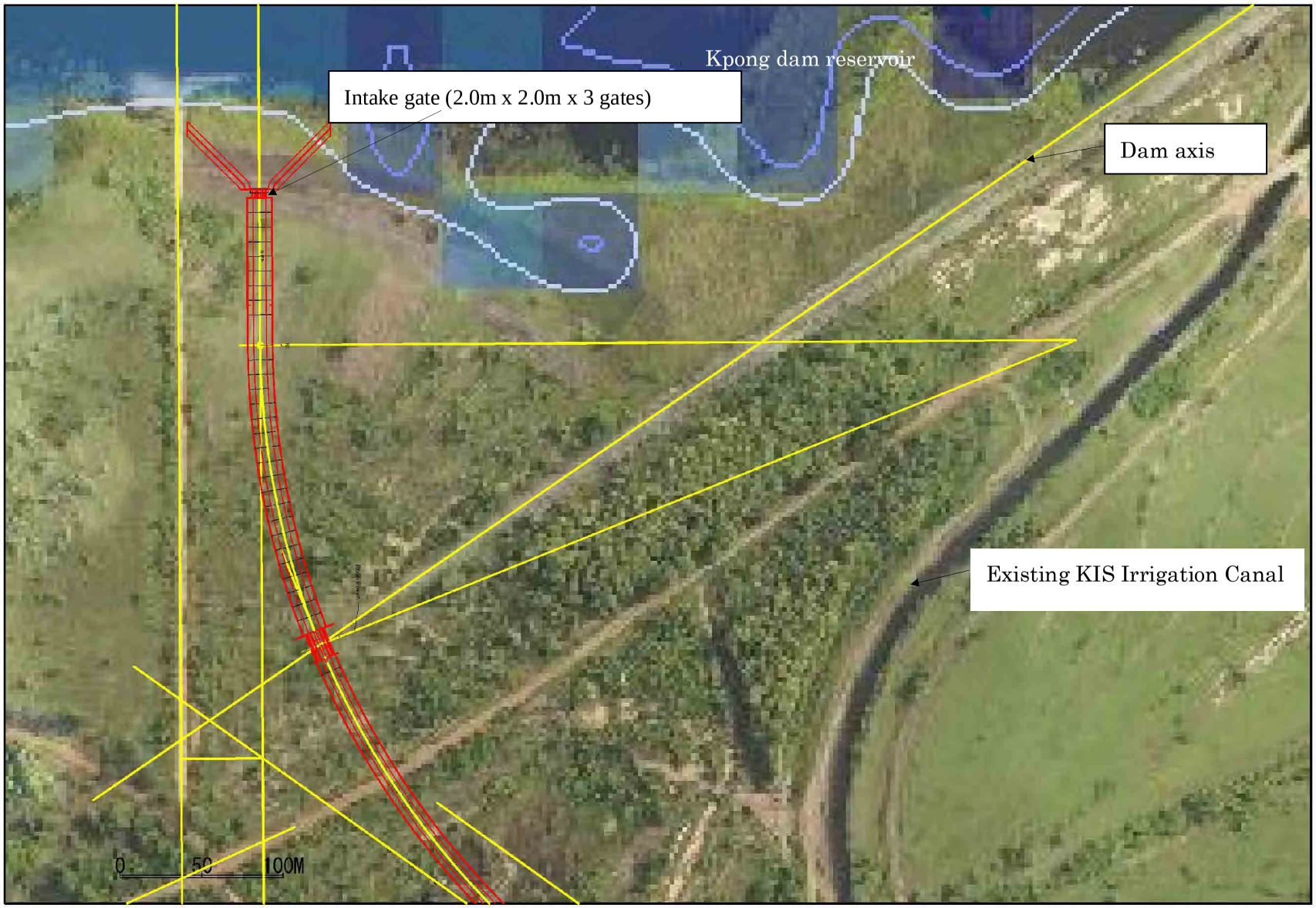


Fig. C.1 (1) Location of Intake in NDIP

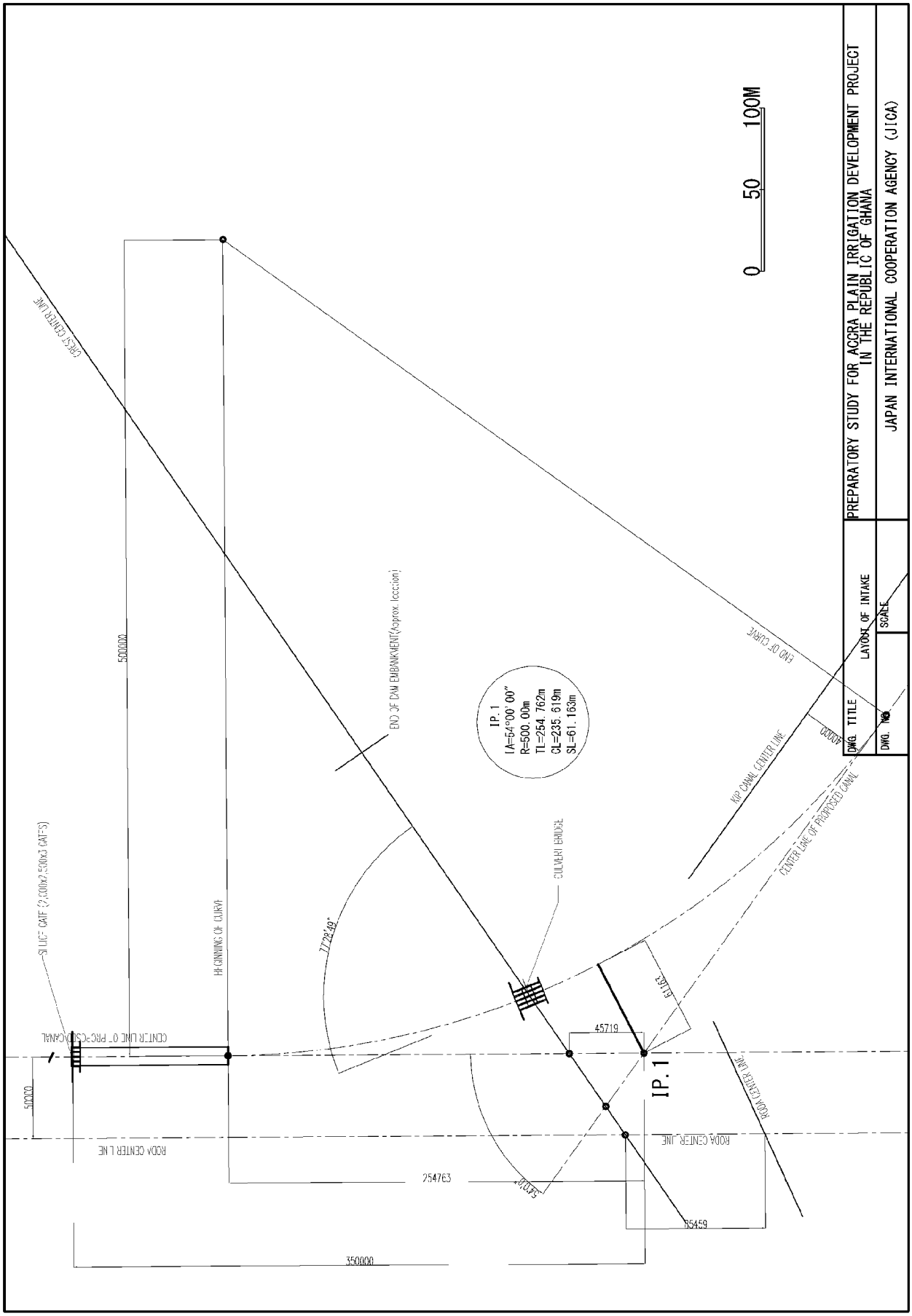


Fig. C.1 (2) Location of Intake in NDIP

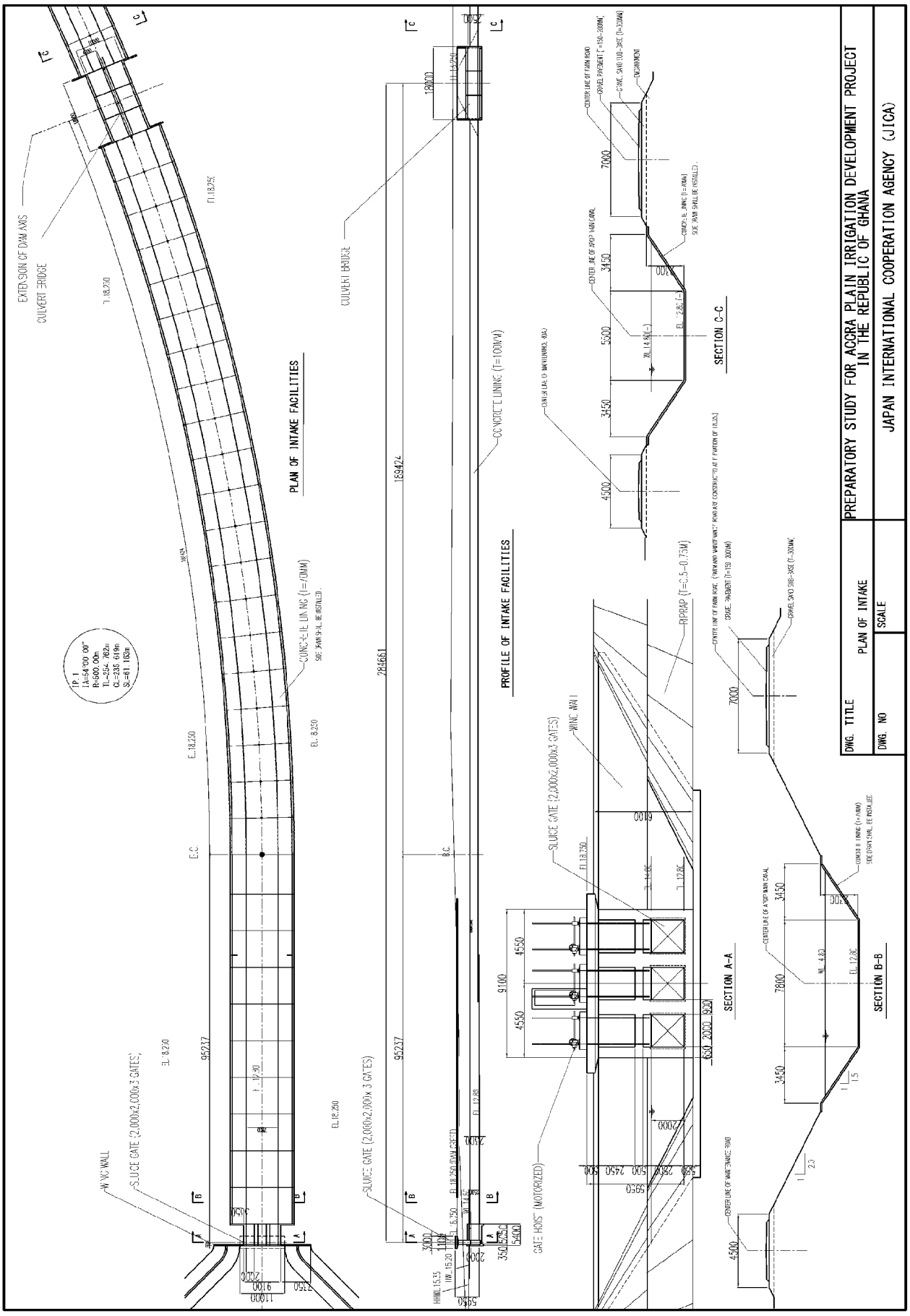


Fig. C.1 (3) Location of Intake in NDIP

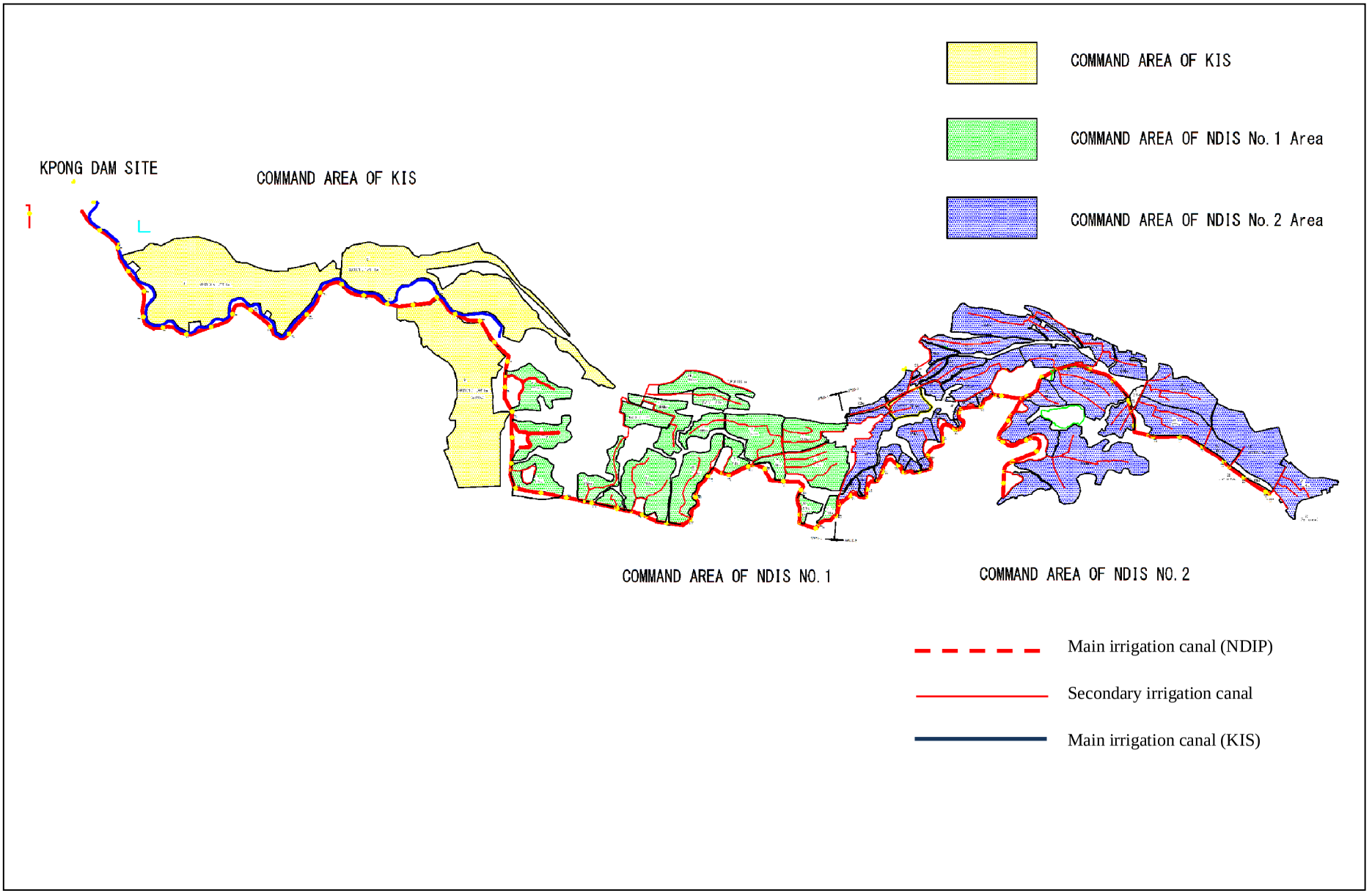


Fig. C.2 Location of Intake in NDIS

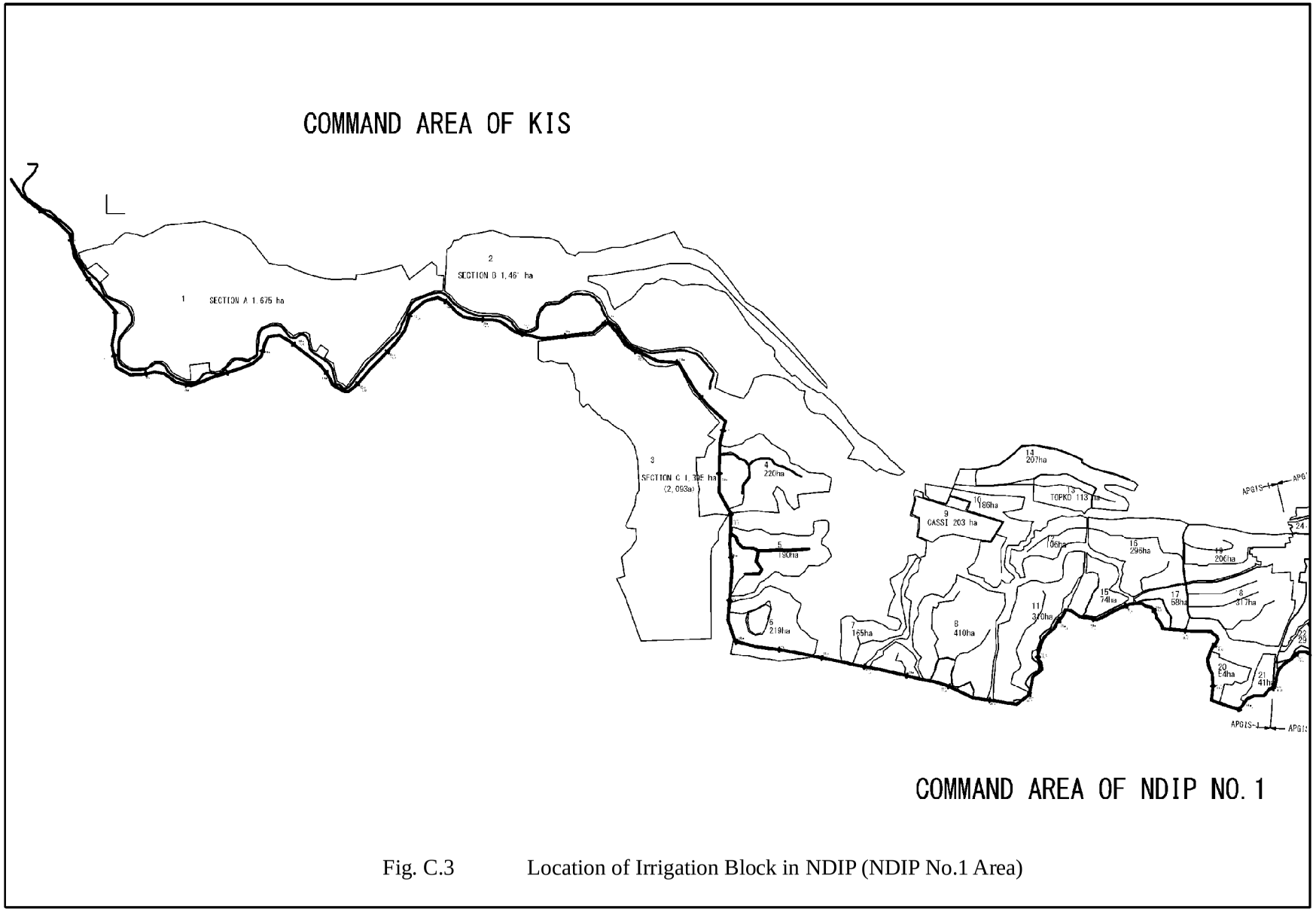


Fig. C.3 Location of Irrigation Block in NDIP (NDIP No.1 Area)

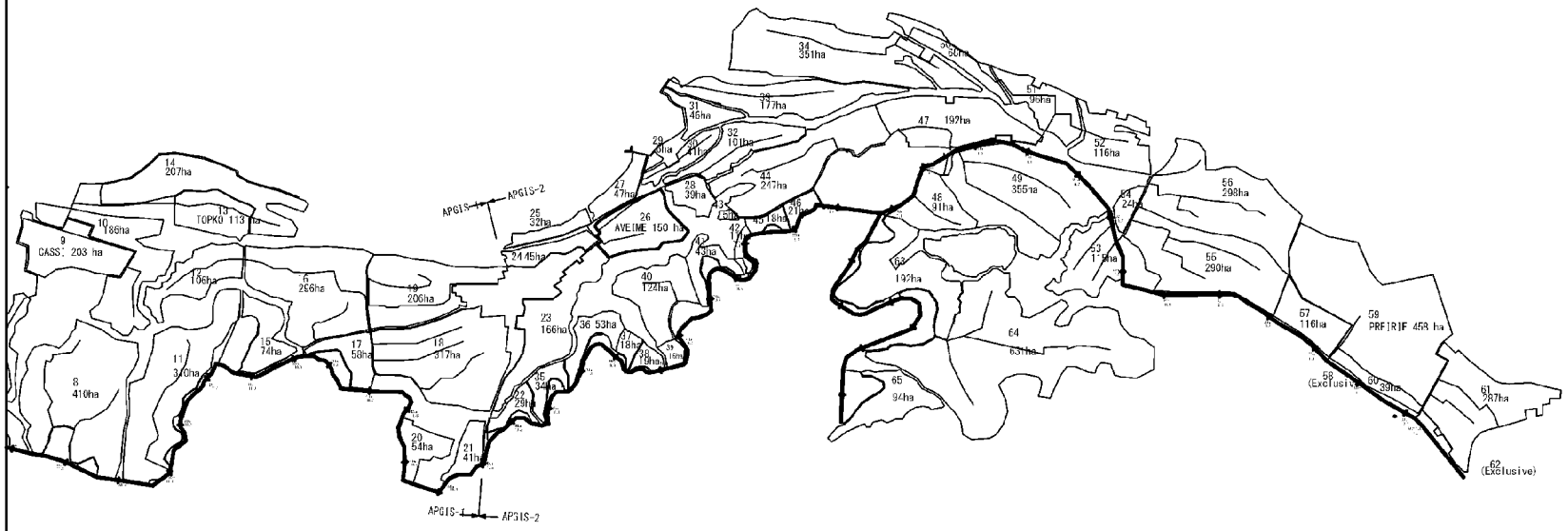


Fig. C.4 Location of Irrigation Block in NDIP (NDIP No.2 Area)

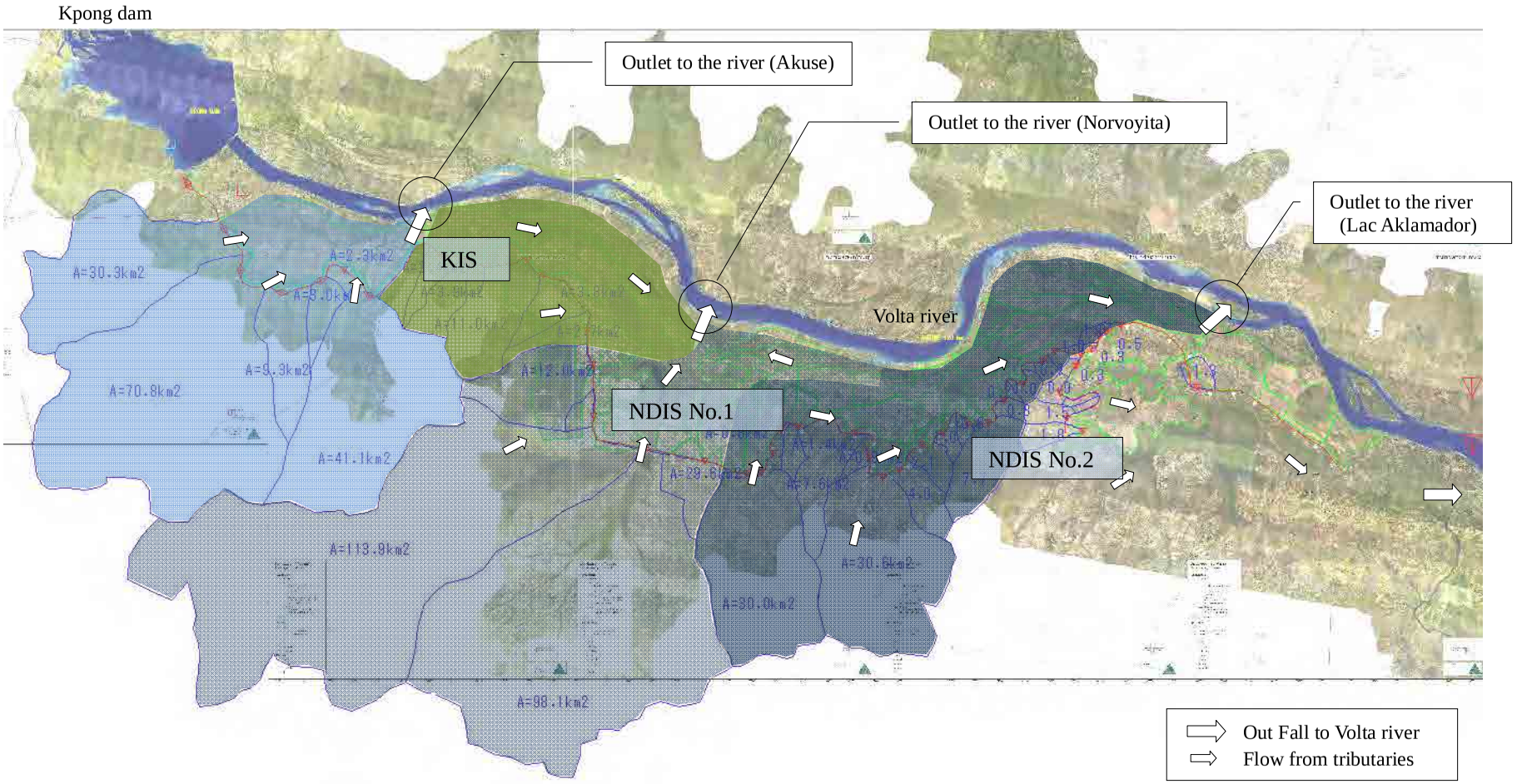
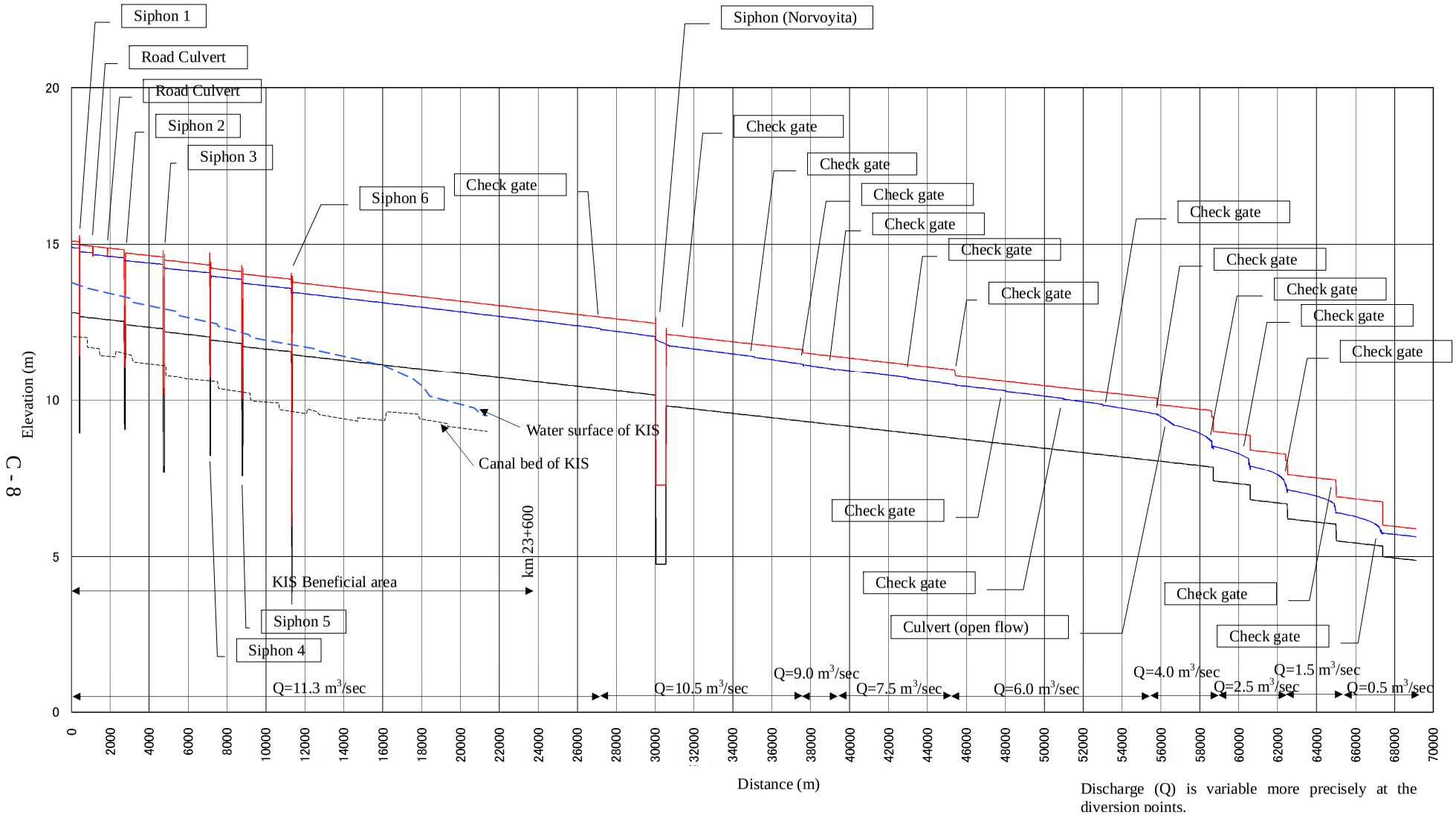


Fig. C.5 Drainage Area in APGIP



Discharge (Q) is variable more precisely at the diversion points.

Fig. C.6 (1) Hydraulic Profile of the Main Canal in NDIS

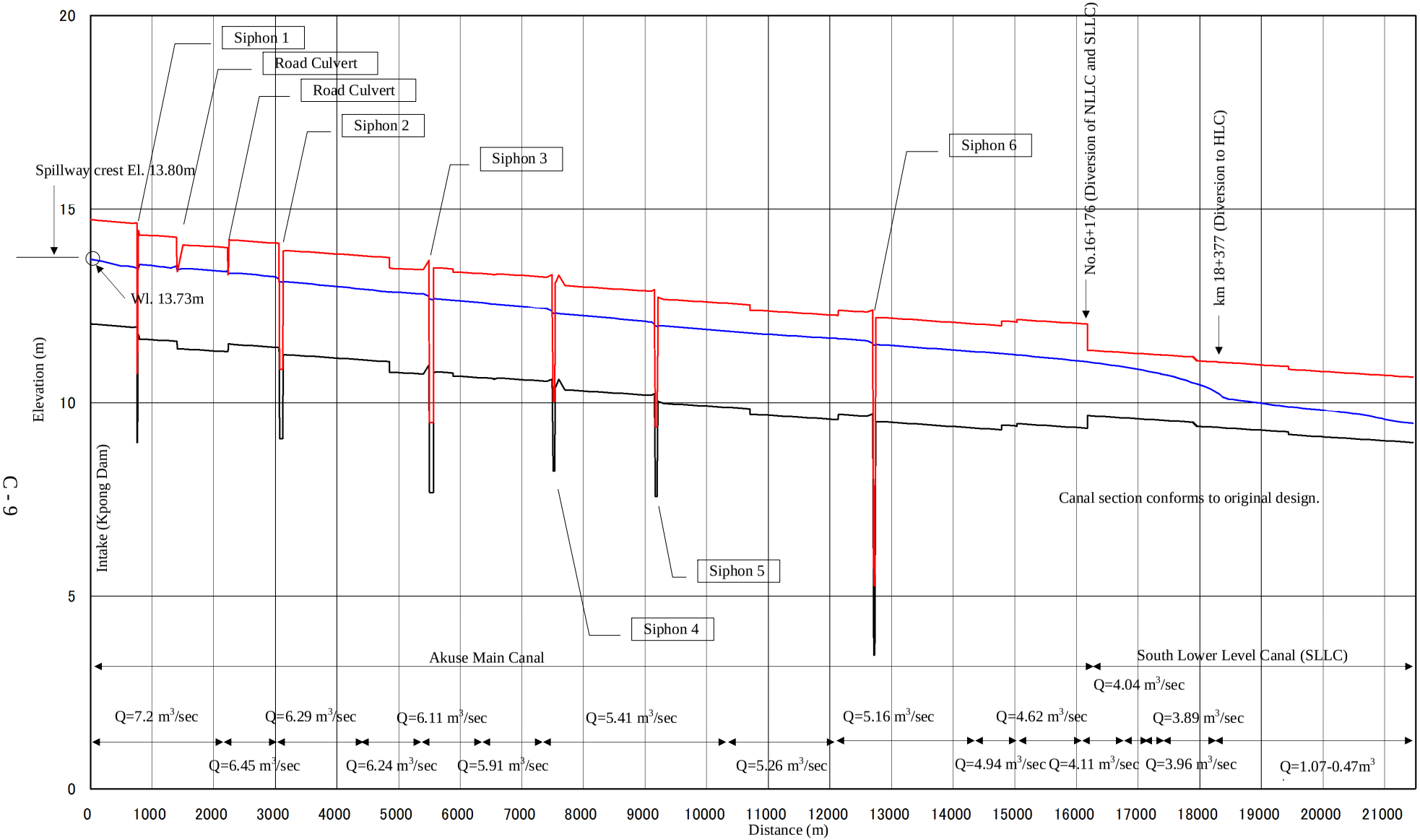


Fig. C.6.(2) Hydraulic Profile of the Main Canal in KIS (Existing)

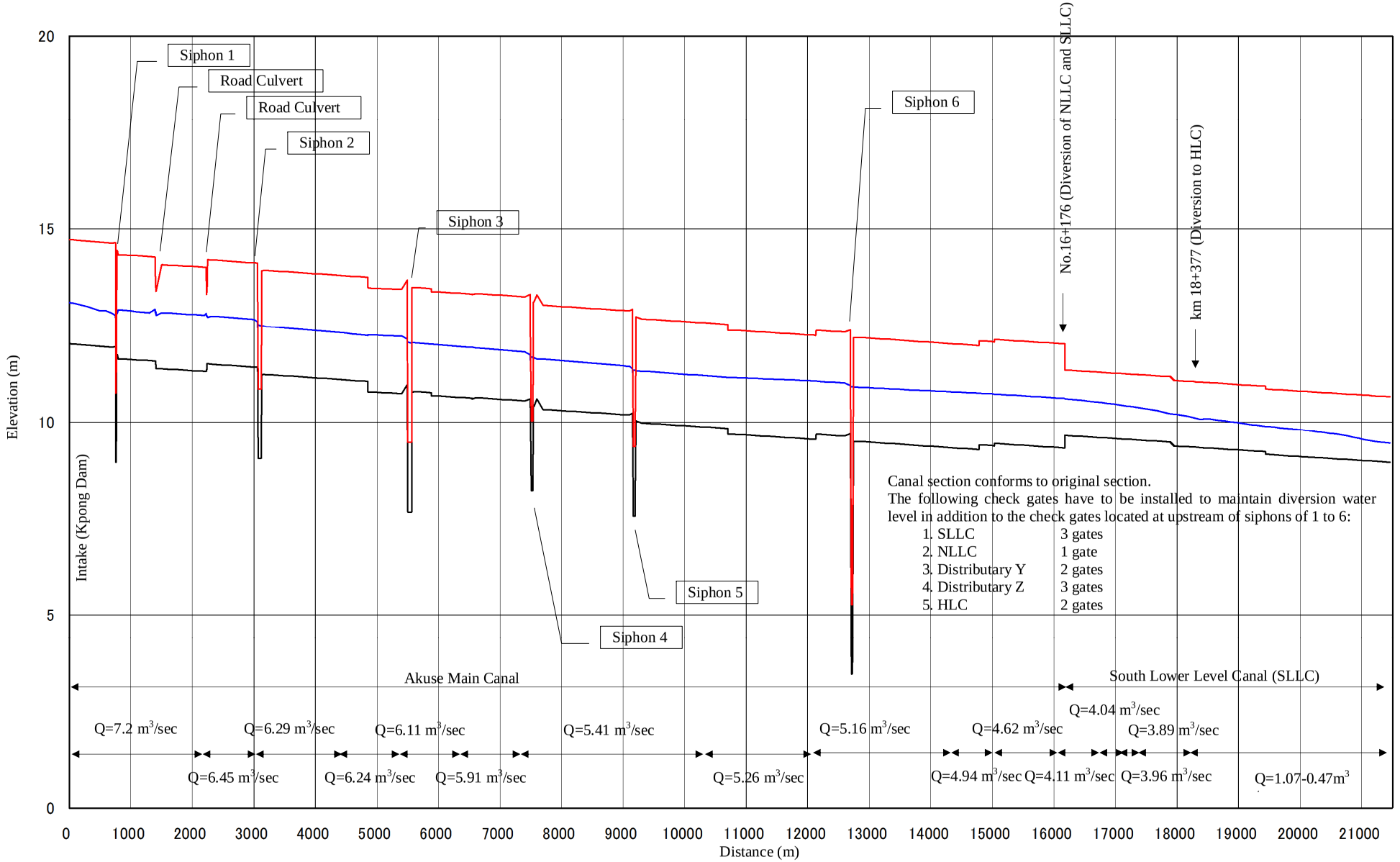


Fig. C.6.(3) Hydraulic Profile of the Main Canal in KIS (Rehabilitation)

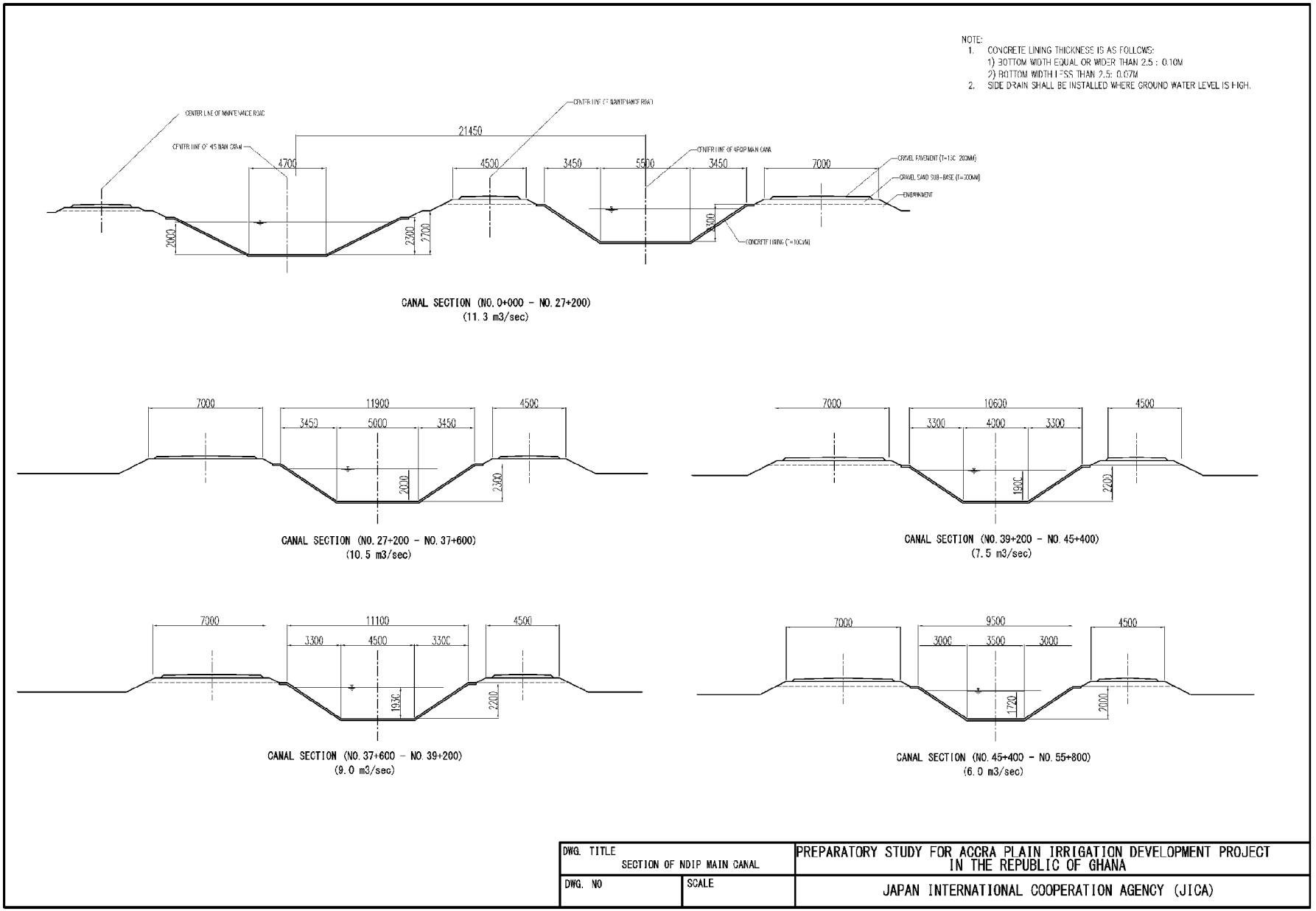
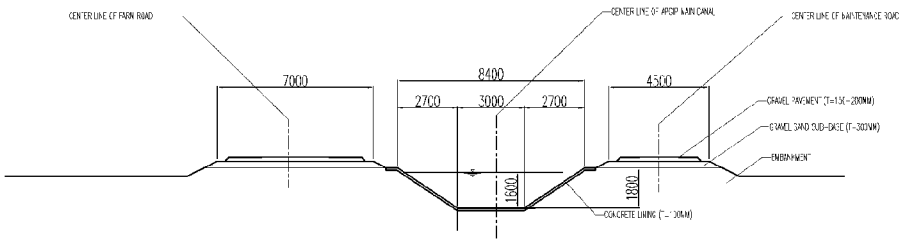
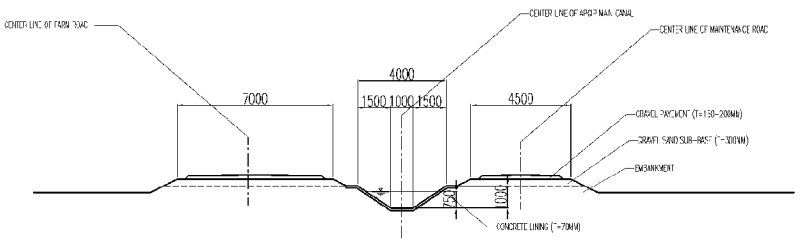


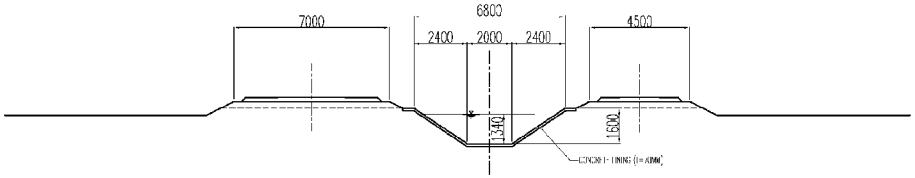
Fig. C.7 (1) Section of Irrigation Canal



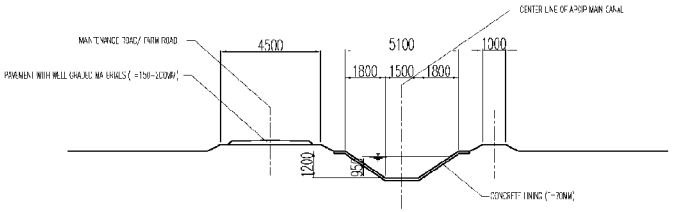
CANAL SECTION (NO. 55+800 – NO. 58+600)
(4.0 m3/sec)



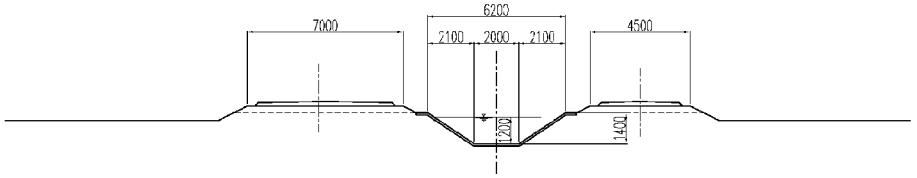
CANAL SECTION (NO. 67+300 – NO. 69+100)
(0.5 m3/sec)



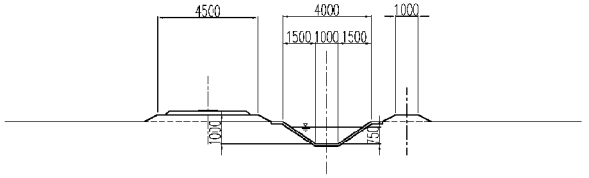
CANAL SECTION (NO. 58+600 – NO. 62+400)
(2.5 m3/sec)



SECONDARY CANAL SECTION
(1.0 m3/sec)



CANAL SECTION (NO. 62+400 – NO. 67+300
(1.5 m3/sec)



SECONDARY CANAL SECTION
(0.5 m3/sec)

NOTE:
1. CONCRETE LINING THICKNESS IS AS FOLLOWS:
   1) BOTTOM WIDTH EQUAL OR WIDER THAN 2.5 : 0.10M
   2) BOTTOM WIDTH LESS THAN 2.5: 0.07M
2. SIDE DRAIN SHALL BE INSTALLED WHERE GROUND WATER LEVEL IS HIGH.

DWG. TITLE SECTION OF NDIP MAIN/SECONDARY CANAL		PREPARATORY STUDY FOR ACCRA PLAIN IRRIGATION DEVELOPMENT PROJECT IN THE REPUBLIC OF GHANA
DWG. NO	SCALE	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Fig. C.7 (2) Section of Irrigation Canal

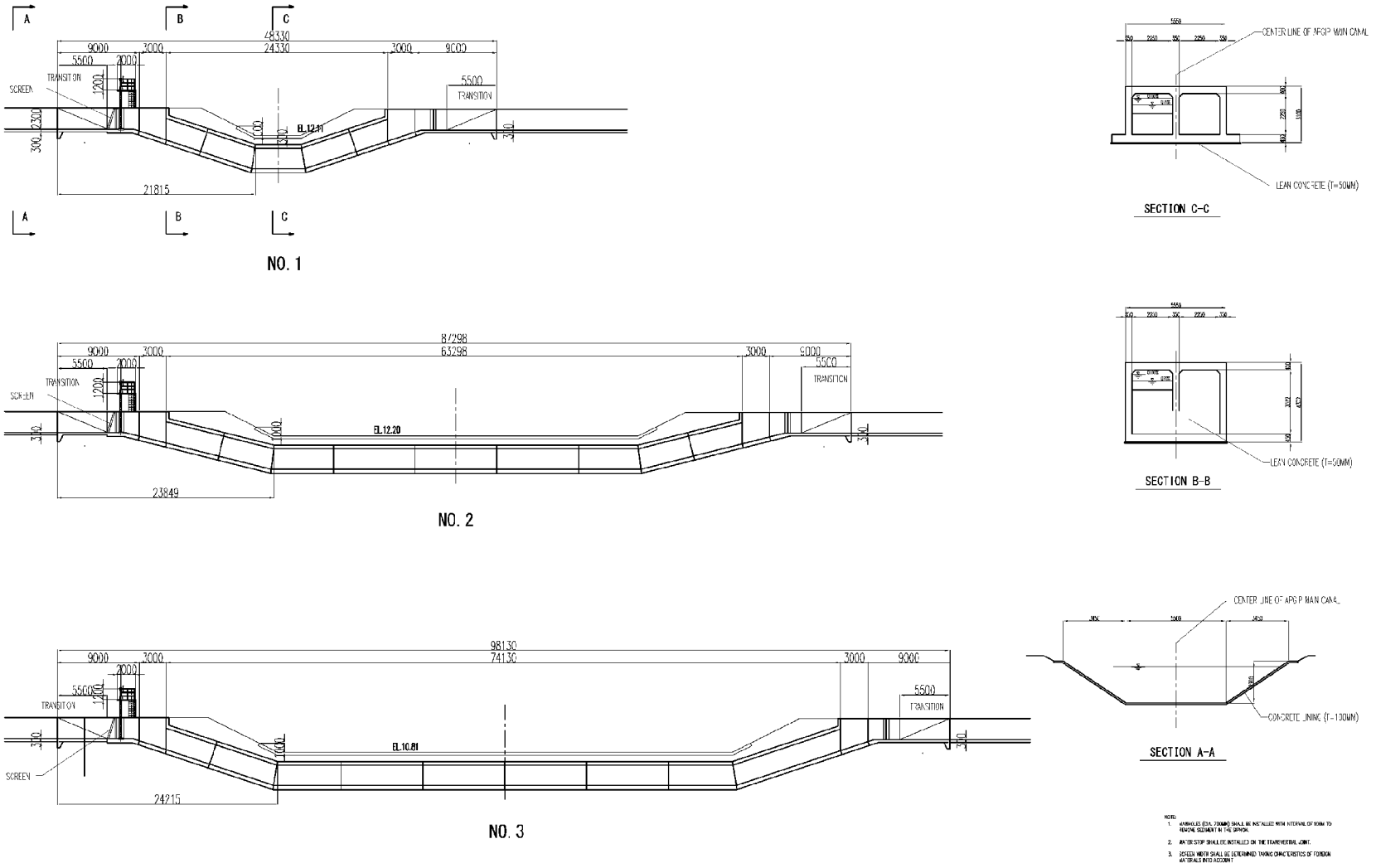


Fig. C.8 (1) Plan of Siphon

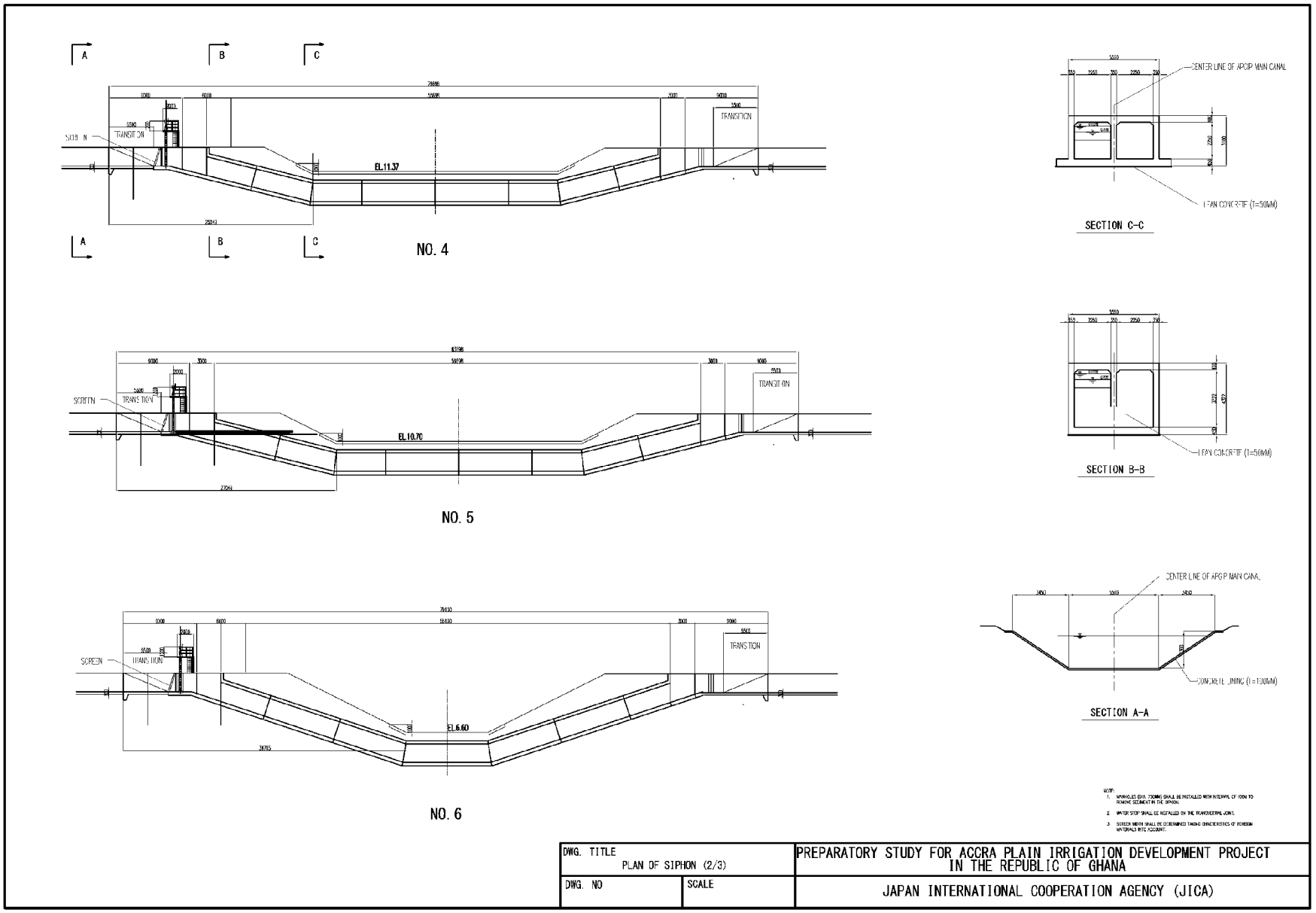


Fig. C.8 (2) Plan of Siphon

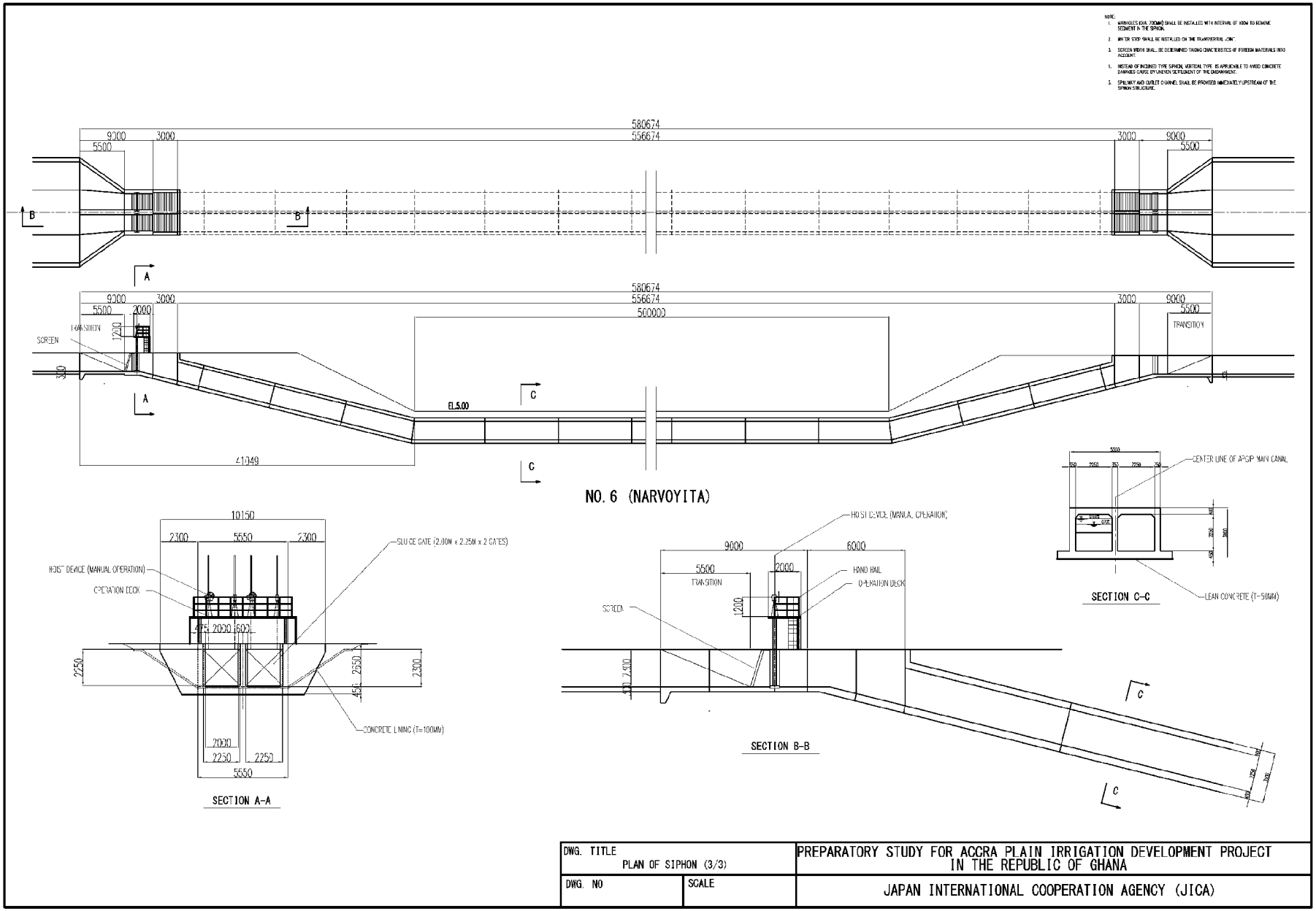
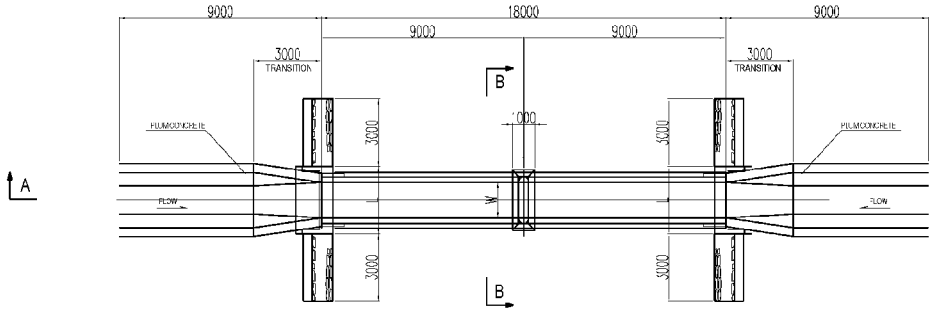
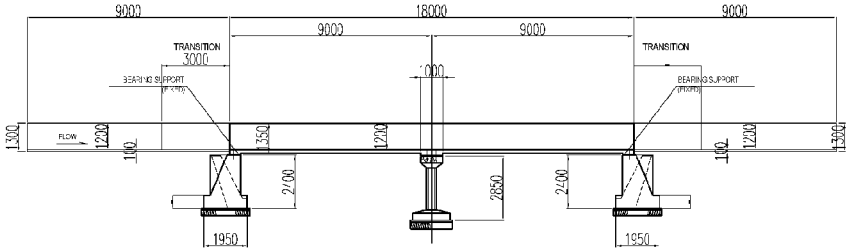


Fig. C.8 (3) Plan of Siphon (Norvoyita Area)

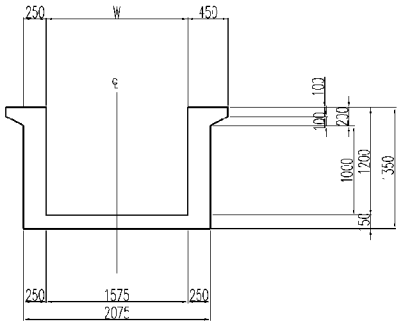
PLAN OF AQUEDUCT (SAMPLE)



PLAN



SECTION A - A



SECTION B - B

DWG. TITLE PLAN OF AQUADUCT (SAMPLE)		PREPARATORY STUDY FOR ACCRA PLAIN IRRIGATION DEVELOPMENT PROJECT IN THE REPUBLIC OF GHANA
DWG. NO	SCALE	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Fig. C.9 Plan of Aqueduct (Sample drawing)

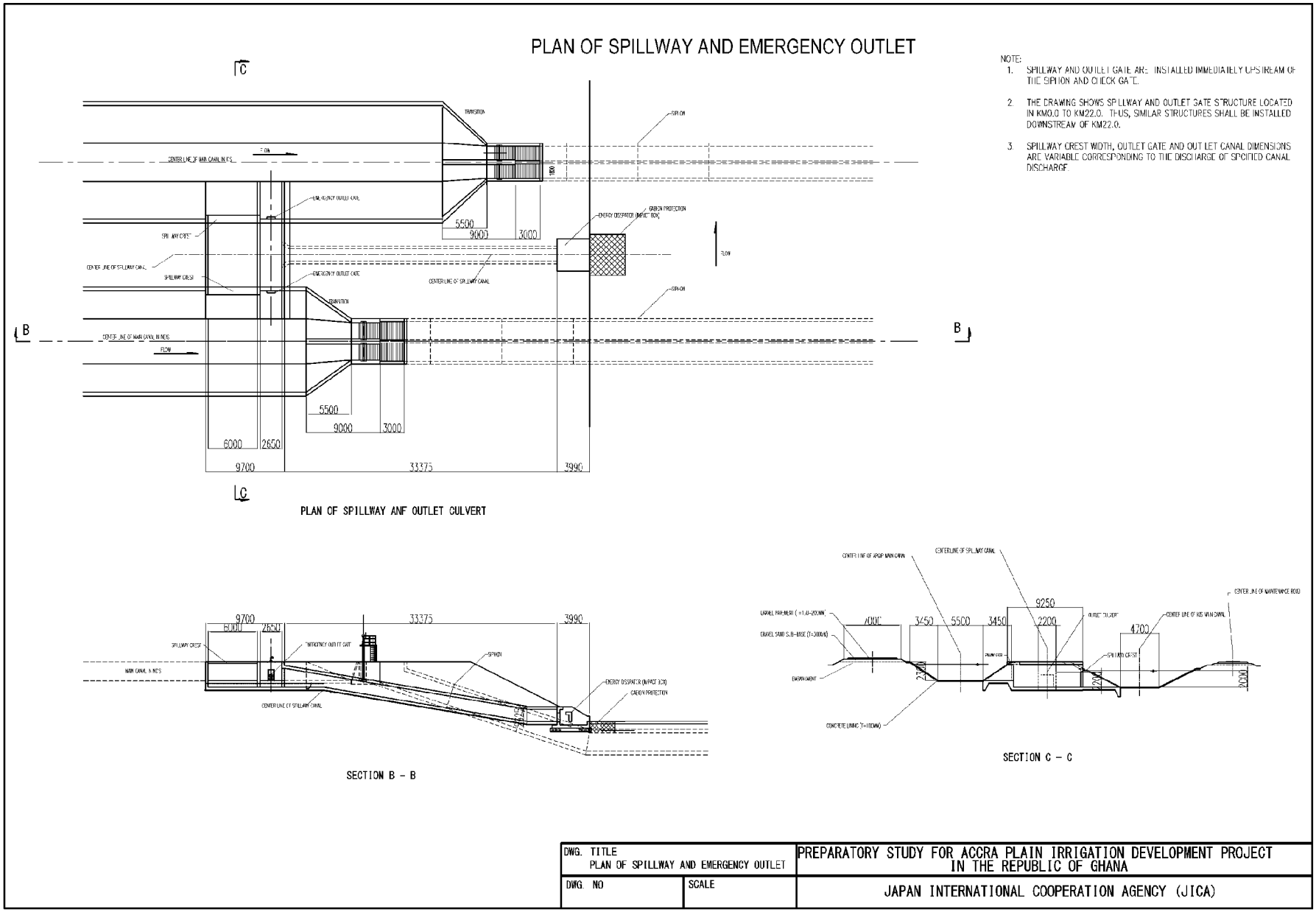
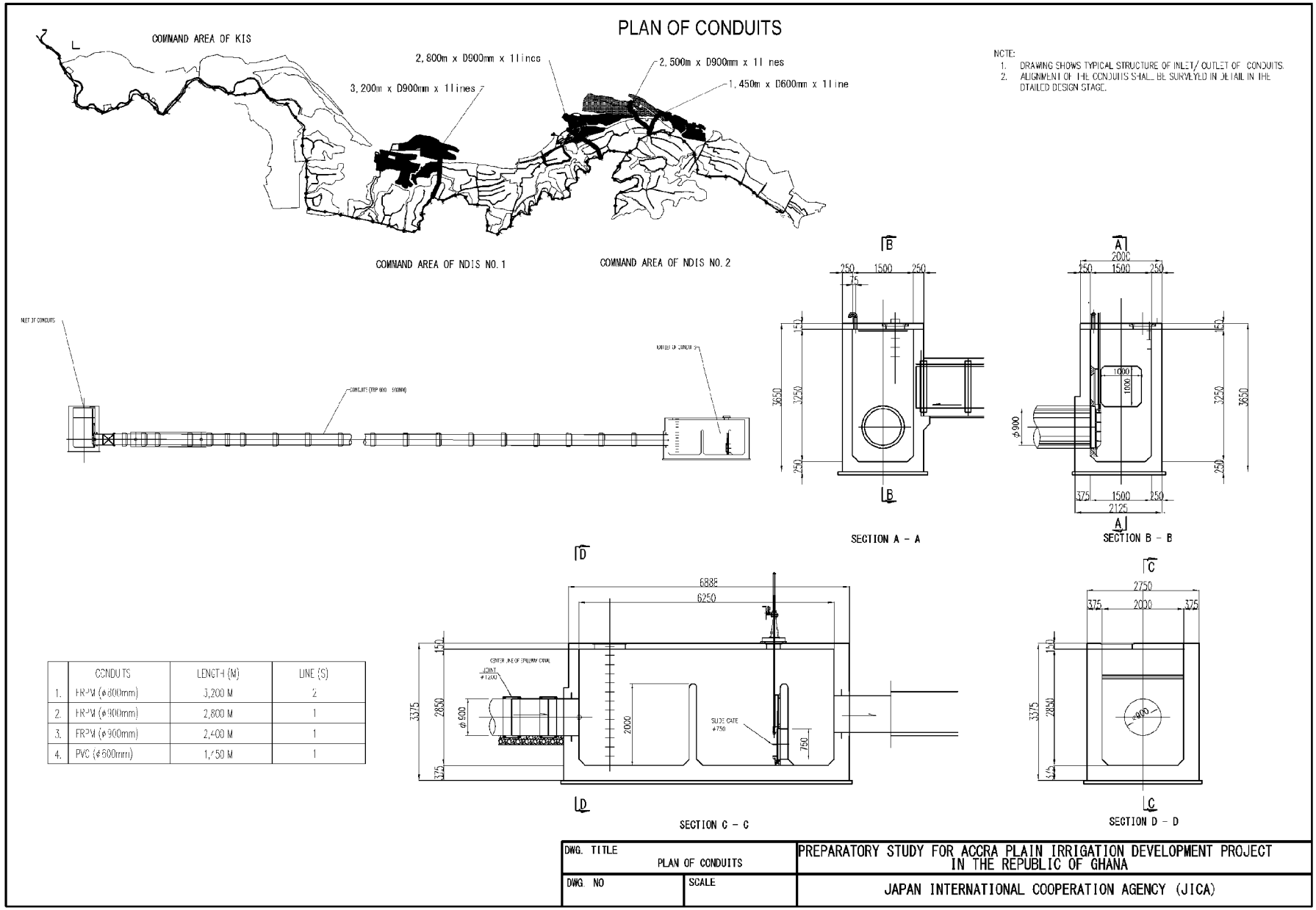


Fig. C.10 Plan of Spillway and Emergency Outlet



	CONDUITS	LENGTH (M)	LINE (S)
1.	RCPM (φ600mm)	3,200 M	2
2.	RCPM (φ900mm)	2,800 M	1
3.	RCPM (φ900mm)	2,400 M	1
4.	PVC (φ600mm)	1,750 M	1

Fig. C.11 Section of Irrigation Canal

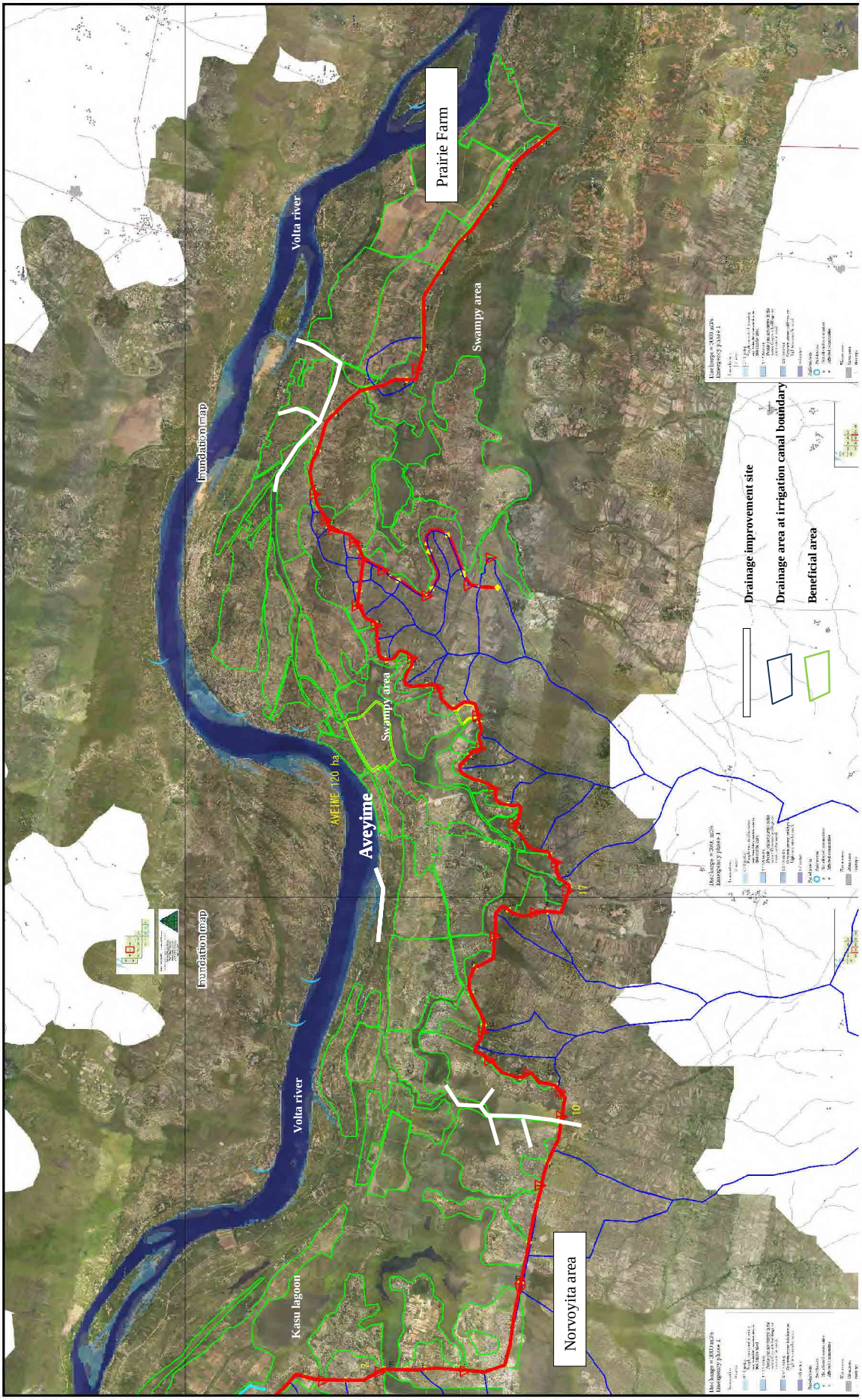


Fig. C.12 Location of Drainage Improvement Works in NDIP

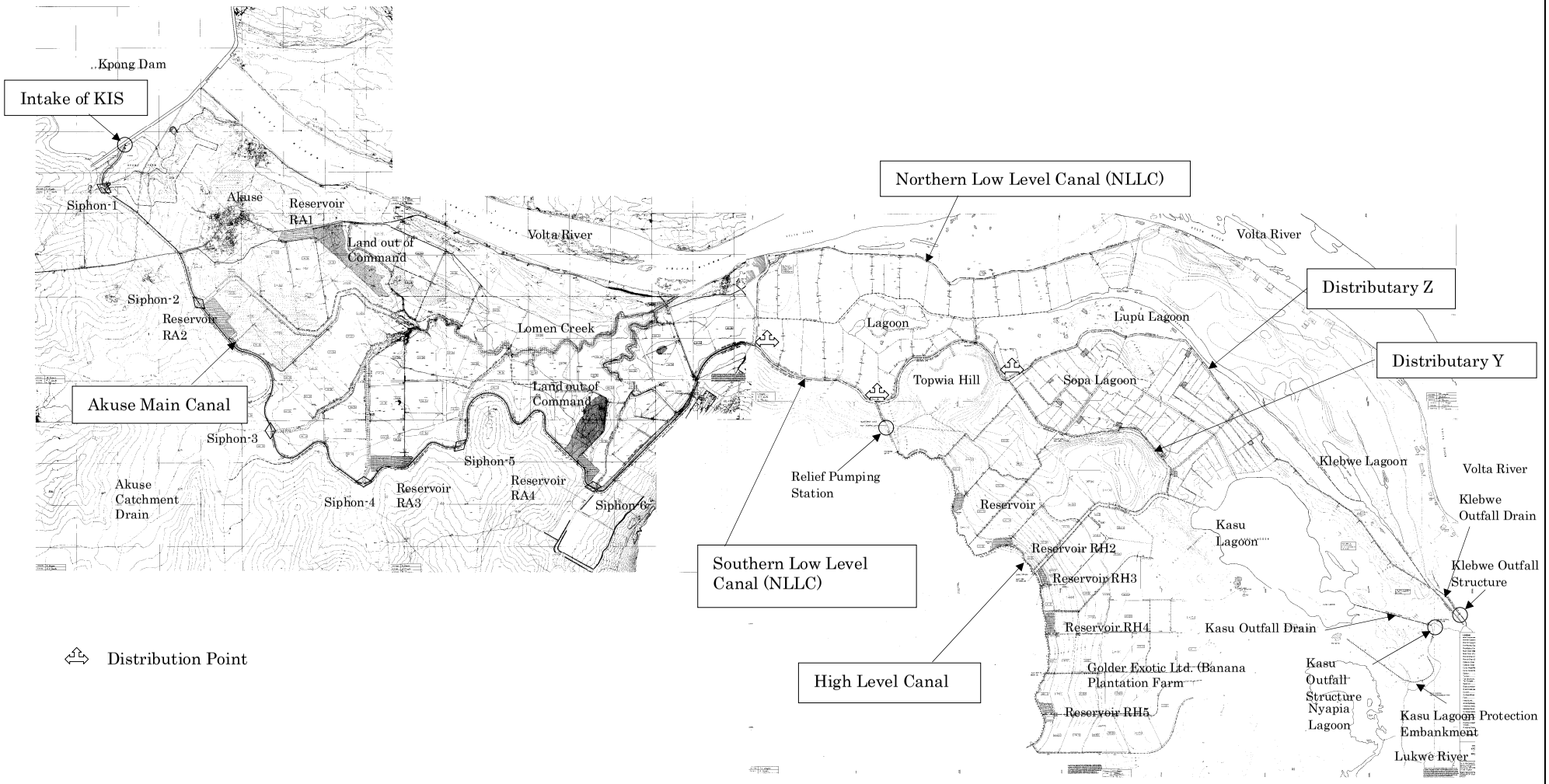


Fig. C.13 Plan of Kpong Irrigation Scheme (KIS)

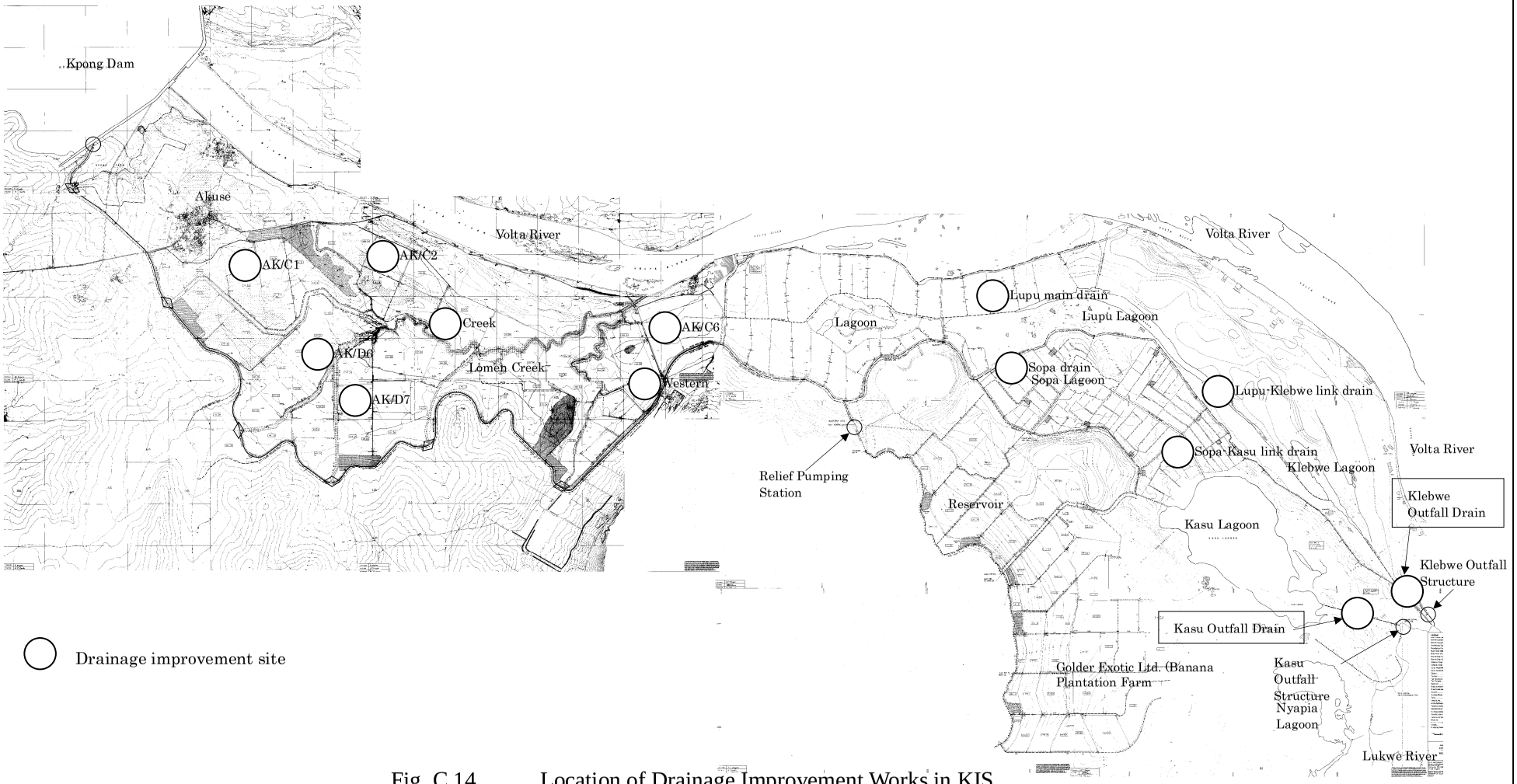


Fig. C.14 Location of Drainage Improvement Works in KIS

Annex D

Agriculture

D-1 Financial Crop Budget per Ha of Rice in KIS & Upland Crops in Upland Field in NDIS & KIS

Rice Production in KIS						
			Major Season Rice (Transplanting)		Minor Season Rice (Transplanting)	
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			4.7		4.0
Unit Price	GHC/t			610		670
Gross Return	GHC/t			**2,867**		**2,680**
2. Production Cost						
(1) Farm Inputs				***412.6***		***466.4***
1) Seed	kg/ha	1.12	65	72.8	110	123.2
2) Fertilizer				301.8		305.2
- NPK	kg/ha	0.54	320	172.8	280	151.2
- Urea	kg/ha	0.50	150	75.0	200	100.0
- SA	kg/ha	0.36	150	54.0	150	54.0
3) Agro-chemicals				38.0		38.0
- Dursban(insecticide)	lit/ha	15	1	15.0	1	15.0
- Furadan (Herbicide)	kg/ha	5	3	15.0	3	15.0
- Rodenticide	tube/ha	8	1	8.0	1	8.0
(2) Farm Machinery				***300***		***300***
- Tilling/crossing 1/	per ha	220	1	220	1	220
- Harrowing	per ha					
- Leveling	per ha					
- Harvesting	per ha					
- Others (carting etc.)	ls	80	1	80	1	80
(3) Labour Requirement			138	***330***	121	***288***
- Family Labour (40%)	man-days		83		73	
- Hired Labour (60%)	man-days	6.0	55	330	48	288
(4) Miscellaneous Expenses	5%			***52.1***		***52.7***
Total Production Costs	rounded			**1,095**		**1,107**
Net Return	rounded			**1,772**		**1,573**
	%			62%		59%

1/: Prevailing machinery hiring services charge for land preparation

Upland Field																	
		Crop Budget per Crop/Ha									Net Return per Ha					
		Cassava			Maize			Pepper			Major Season			Minor S.	
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Unit Price (GHC)	Q'ty	Amount (GHC)	Unit Price (GHC)	Q'ty	Amount (GHC)	Cassava 0.5 ha	Maize 0.3ha	Pepper 0.2ha	Maize 0.3ha	Annual
1. Return															
Unit Yield	t/ha			3.5			1.20			0.70					
Unit Price	GHC/t			350			600			2,500					
Gross Return	GHC/t			**1,225**			**720**			**1,750**	**613**	**216**	**350**	**216**	**1,395**
2. Production Cost															
(1) Farm Inputs				***100.4***			***41***			***265.5***					
1) Seed	kg/ha	-	1ha	90	0.6	25	15	750	0.25	187.5					
2) Fertilizer				10.4			26.0			78.0					
- NPK	kg/ha	1.04	10	10	1.04	25	26	1.04	75	78.0					
- Urea	kg/ha	1.00		0	1.00		0	1.00		0					
- SA	kg/ha	0.76		0	0.76		0	0.76		0					
3) Agro-chemicals				0			0			0					
- Basagran (herbicide)	lit/ha			0			0			0					
- Karate 2.5E (insecticide)	lit/ha			0			0			0					
- Yosidion (rodenticide)	kg/ha			0			0			0					
(2) Farm Machinery				***100***			***100***			***170***					
- Land Preparation 1/	per ha	100	1	100	100	1	100	170	1	170					
- Harvesting	per ha														
- Threshing	per ha														
- Harvesting	per ha														
- Others (carting etc.)	ls														
(3) Labour Requirement			80	***192***		70	***168***		120	***288***					
- Family Labour (60%)	man-days		48			42			72						
- Hired Labour (40%)	man-days	6.0	32	192	6.0	28	168	6.0	48	288					
(4) Miscellaneous Expenses	5%			***19.6***			***15.5***			***36.2***					
Total Production Costs	rounded			**412**			**324**			**760**	**206**	**97**	**152**	**97**	**552**
Net Return	rounded			**813**			**396**			**990**	**407**	**119**	**198**	**119**	**843**
	%			66%			55%			57%		Total	**724**		

1/: Prevailing machinery hiring services charge for land preparation

D-2 Financial NPV (Net Production Value) under Present Condition

1. KIS Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
KIS												
- Irrigated rice field/rice	1,852	1,274	4.7	1,772	2,258	1,440	4.0	1,573	2,265	2,714	2,442	4,523
- Grass land	448	-		-	-	-		-	-		580	260
Sub-total	2,300	1,274	4.7	-	2,258	1,440	4.0	-	2,265	2,714	-	4,782
Golden Exotics Farm		annual for banana										
- Banana farm/banana 1/	1,200	1,200	40	7,404	8,885	-	-	-	-	1,200	7,404	8,885
- Upland field 2/	600	600		724	434	180		396	71	780	843	506
Sub-total	1,800	1,800	-	-	9,319	180	-	-	71	1,980	-	9,390
Total	**4,100**	**3,074**	**-**	-	**11,577**	**1,620**	-	-	**2,336**	**4,694**	-	**14,173**

1/: Estimated farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 = GHC 7,404 2/: Cassava, maize, pepper in major season & maize in minor season

2. New Developed Irrigation Scheme (NDIS)

2-1. No. 1 Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
No. 1 Area												
- Upland field 1/	1,420	1,420	-	724	1,028	426	-	396	169	1,846	843	1,197
- Grass land	1,200	-		-	-	-		-	-		580	696
Sub-total	2,620	1,420	-	-	-	426	-	-	-	1,846	-	1,893
Cassi Farm												
- Irrigated upland field 2/.	162	162				162				324		
Total	**2,782**	**1,582**	**-**	-	-	**588**	-	-	-	**2,170**	-	**1,893**

1/: Cassava, maize, pepper in major season & maize in minor season 2/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

3. No. 2 Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
No. 2 Area												
- Upland field 1/	1,889	1,889	-	724	1,368	567	-	396	225	2,456	843	1,592
- Grass land	1,362	-		-	-	-		-	-		580	790
Sub-total	3,251	1,889	-	-	-	567		-	-	2,456	-	2,382
Prairie Volta Farm 2/												
- Irrigated rice field /rice	490	490	4.0	1,220	598	490	4.0	1,220	598	980	2,440	1,196
- Upland field 1/	532	532		724	385	160		396	63	692	843	449
- Grass land	51	-	-	-	-	-	-	-	-	-	580	30
Sub-total	1,073	1,022	-	-	-	650	-	-	-	1,672	-	1,674
Total	**4,324**	**2,911**	**-**	-	-	**1,217**	-	-	-	**4,128**	-	**4,056**

1/: Cassava, maize, pepper in major season & maize in minor season 2/: Assuming: yield 4.0t/ha x GHC 610/t x net return rate 50% = GHC 1,220/ha/season

2-3. NDIS (No. 1 + No.2 Area)

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
- Upland field 1/	3,841	3,841	-	724	2,781	1,153	-	396	457	4,994	843	3,237
- Grass land	2,613	-		-	-	-		-	-		580	1,516
Sub-total	6,454	3,841	-	-	2,781	1,153	-	-	457	4,994	-	4,753
Prairie Volta Farm												
- Irrigated rice field /rice	490	490	4.0	1,220	598	490	4.0	1,220	598	980	2440	1,196
Cassi Farm												
- Irrigated upland field 2/.	162	162				162				324		
NDIS Total	**7,106**	**4,493**	**-**	-	**3,379**	**1,805**	-	-	**1,054**	**6,298**	-	**5,949**

1/: Cassava, maize, pepper in major season & maize in minor season 2/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

3. Accra Plains Gravity Irrigation Project Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
- Irrigated rice field/rice 1/	1,852	1,274	4.7	1,772	2,258	1,440	4.0	1,573	2,265	2,714	2,442	4,523
- Irrigated rice field/rice 2/	490	490	4.0	1,220	598	490	4.0	1,220	598	980	2,440	1,196
- Banana farm/banana	1,200	1,200	40	7,404	8,885	-	-	-	-	1,200	7,404	8,885
- Irrigated upland field 3/	162	162				162				324		
- Upland field 4/	4,441	4,441	-	724	3,215	1,333	-	396	528	5,774	843	3,743
- Grass land	3,061	-	-	-	-	-	-	-	-	-	580	1,775
Total	**11,206**	**7,567**	**-**	-	**14,955**	**3,425**	-	-	**3,391**	**10,992**	-	**20,122**

1/: KIS 2/: Prairie Volta Farm 3/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

4/: Cassava, maize, pepper in major season & maize in minor season

D-3 Crop Production Plan under With Project Condition

1. KIS

Farm/Crop	Area (ha)	Major Season Rice: Cropped Area (ha)	Major Season Rice: Cropping Intensity (%)	Major Season Rice: Yield (ton/ha)	Major Season Rice: Production (ton)	Minor Season Rice: Cropped Area (ha)	Minor Season Rice: Cropping Intensity (%)	Minor Season Rice: Yield (ton/ha)	Minor Season Rice: Production (ton)	Annual: Cropped Area (ha)	Annual: Cropping Intensity (%)	Annual: Production (ton)
KIS												
Irrigated Rice	2,300	2,300	100	5.5	12,650	2,300	100	5.5	12,650	4,600	200	25,300
Golden Exotic Farm				annual								
Banana 1.	1,800	1,800	100	40	72,000					1,800	100	72,000
Total	**4,100**	**4,100**	**200**	**-**	**84,650**	**2,300**	**100**	**-**	**12,650**	**6,400**	**156**	**97,300**

1/: Figures assumed

2. No. 1 Area

Farm/Crop	Area (ha)	Major Season Rice: Cropped Area (ha)	Major Season Rice: Cropping Intensity (%)	Major Season Rice: Yield (ton/ha)	Major Season Rice: Production (ton)	Minor Season Rice: Cropped Area (ha)	Minor Season Rice: Cropping Intensity (%)	Minor Season Rice: Yield (ton/ha)	Minor Season Rice: Production (ton)	Annual: Cropped Area (ha)	Annual: Cropping Intensity (%)	Annual: Production (ton)
Irrigated Rice	2,538											
Small-scale Farm	1,269	1,269	100	5.0	6,345	1,269	100	5.0	6,345	2,538	200	12,690
Medium-scale Farm	381	381	100	5.5	2,096	381	100	5.5	2,096	762	200	4,191
Large-scale Farm	888	888	100	6.0	5,328	888	100	6.0	5,328	1,776	200	10,656
Total	2,538	2,538	100	5.4	13,769	2,538	100	5.4	13,769	5,076	200	27,537
Cassi Farm												
Maize		162	100							162	100	
Soybeans						162	100			162	100	
Total		162	100			162	0			324	200	

3. No. 2 Area

Farm/Crop	Area (ha)	Major Season Rice: Cropped Area (ha)	Major Season Rice: Cropping Intensity (%)	Major Season Rice: Yield (ton/ha)	Major Season Rice: Production (ton)	Minor Season Rice: Cropped Area (ha)	Minor Season Rice: Cropping Intensity (%)	Minor Season Rice: Yield (ton/ha)	Minor Season Rice: Production (ton)	Annual: Cropped Area (ha)	Annual: Cropping Intensity (%)	Annual: Production (ton)
Irrigated Rice	3,149											
Small-scale Farm	1,575	1,575	100	5.0	7,875	1,575	100	5.0	7,875	3,150	200	15,750
Medium-scale Farm	472	472	100	5.5	2,596	472	100	5.5	2,596	944	200	5,192
Large-scale Farm	1,102	1,102	100	6.0	6,612	1,102	100	6.0	6,612	2,204	200	13,224
Total	3,149	3,149	100	5.4	17,083	3,149	100	5.4	17,083	6,298	200	34,166
Prairie Volta Farm												
Irrigated Rice	1,051	1,051	100	5.5	5,781	1,051	100	5.5	5,781	2,102	200	11,561

4. New Developed Irrigation Scheme (NDIS; No 1 Area + No. 2 Area)

Farm/Crop	Area (ha)	Major Season Rice: Cropped Area (ha)	Major Season Rice: Cropping Intensity (%)	Major Season Rice: Yield (ton/ha)	Major Season Rice: Production (ton)	Minor Season Rice: Cropped Area (ha)	Minor Season Rice: Cropping Intensity (%)	Minor Season Rice: Yield (ton/ha)	Minor Season Rice: Production (ton)	Annual: Cropped Area (ha)	Annual: Cropping Intensity (%)	Annual: Production (ton)
Irrigated Rice	5,687											
Small-scale Farm	2,844	2,844	100	5.0	14,220	2,844	100	5.0	14,220	5,688	200	28,440
Medium-scale Farm	853	853	100	5.5	4,692	853	100	5.5	4,692	1,706	200	9,383
Large-scale Farm	1,990	1,990	100	6.0	11,940	1,990	100	6.0	11,940	3,980	200	23,880
Total	5,687	5,687	100	5.4	30,852	5,687	100	5.4	30,852	11,374	200	61,703
Prairie Volta Farm												
Irrigated Rice	1,051	1,051	100	5.5	5,781	1,051	100	5.5	5,781	2,102	200	11,561
Cassi Farm												
Maize		162	100							162	100	
Soybeans						162	100			162	100	
Total		162	100			162	0			324	200	

5. Accra Plains Gravity Irrigation Project (APGIP)

Farm/Crop	Area (ha)	Major Season Rice: Cropped Area (ha)	Major Season Rice: Cropping Intensity (%)	Major Season Rice: Yield (ton/ha)	Major Season Rice: Production (ton)	Minor Season Rice: Cropped Area (ha)	Minor Season Rice: Cropping Intensity (%)	Minor Season Rice: Yield (ton/ha)	Minor Season Rice: Production (ton)	Annual: Cropped Area (ha)	Annual: Cropping Intensity (%)	Annual: Production (ton)
KIS/NDIS												
Irrigated Rice												
Small-scale Farm	5,144	5,144	100	5.2	26,870	5,144	100	5.2	26,870	10,288	200	53,740
Medium-scale Farm	853	853	100	5.5	4,692	853	100	5.5	4,692	1,706	200	9,383
Large-scale Farm	1,990	1,990	100	6.0	83,940	1,990	100	6.0	11,940	3,980	200	95,880
Total	7,987	7,987	100	5.4	43,502	7,987	100	5.4	43,502	15,974	200	87,003
Golden Exotics Farm												
Banana 1/	1,800	1,800	100	40	72,000					1,800	100	72,000
Cassi Farm	162											
Maize		162	100							162	100	
Soybeans						162	100			162	100	
Total	162	162	100			162	100			324	200	
Prairie Volta Farm												
Irrigated Rice	1,051	1,051	100	5.5	5,781	1,051	100	5.5	5,781	2,102	200	11,561
APGIP Total	**11,000**	**11,000**	**-**	**-**	**121,282**	**9,200**	**-**	**-**	**49,282**	**20,200**	**-**	**170,564**

1/: Figures assumed

D-4 Financial Crop Budget per Ha of Rice under With Project Conditions: KIS & Small-scale Farm in NDIS

KIS (Transplanting)						
			Major Season		Minor Season	
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			5.5		5.5
Unit Price	GHC/t			610		670
Gross Return	GHC/t			**3,355**		**3,685**
2. Production Cost						
(1) Farm Inputs				***308.6***		***308.6***
1) Seed	kg/ha	1.12	30	33.6	30	33.6
2) Fertilizer 1/				237.0		237.0
- NPK	kg/ha	0.54	300	162.0	300	162
- Urea	kg/ha	0.50	150	75.0	150	75
- SA	kg/ha	0.36				
3) Agro-chemicals				38.0		38.0
- Dursban(insecticide)	lit/ha	15	1	15.0	1	15.0
- Furadan (Herbicide)	kg/ha	5	3	15.0	3	15.0
- Rodenticide	tube/ha	8	1	8.0	1	8.0
(2) Farm Machinery				***270***		***270***
- Plowing 2/	per ha	100	1	100	1	100
- Harrowing 2/	per ha	70	1	70	1	70
- Leveling	per ha					
- Harvesting	per ha					
- Others (carting, threshing, spray etc.)	ls	100	1	100	1	100
(3) Labour Requirement			124	***444***	123	***444***
- Family Labour (40%)	man-days		50		49	
- Hired Labour (60%)	man-days	6.0	74	444	74	444
(4) Miscellaneous Expenses	5%			***51.1***		***51.1***
Total Production Costs	rounded			**1,074**		**1,074**
Net Return	rounded			**2,281** 68%		**2,611** 71%

1/: Assuming fertilizer subsidy will continue

2/: Prevailing machinery hiring services charge for land preparation

NDIS: Small-scale Farm (Direct Sowing)						
			Major Season		Minor Season	
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			5.0		5.0
Unit Price	GHC/t			610		670
Gross Return	**GHC/t**			**3,050**		**3,350**
2. Production Cost						
(1) Farm Inputs				***397***		***397***
1) Seed	kg/ha	1.12	100	112	100	112
2) Fertilizer 1/				237.0		237.0
- NPK	kg/ha	0.54	300	162.0	300	162
- Urea	kg/ha	0.50	150	75.0	150	75
- SA	kg/ha	0.36				
3) Agro-chemicals				48.0		48.0
- Dursban (insecticide)	lit/ha	15	1	15.0	1	15.0
- Furadan (Herbicide)	kg/ha	5	5	25.0	5	25.0
- Rodenticide	tube/ha	8	1	8.0	1	8.0
(2) Farm Machinery				***420***		***420***
- Plowing 2/	per ha	100	1	100	1	100
- Harrowing 2/	per ha	70	2	140	2	140
- Leveling	per ha					
- Harvesting	per ha	100	1	100	1	100
- Others (carting, threshing, spray etc.)	ls		1	80	1	80
(3) Labour Requirement			78	***330***	78	***330***
- Family Labour (30%)	man-days		23		23	
- Hired Labour (70%)	man-days	6.0	55	330	55	330
(4) Miscellaneous Expenses	5%			***57.4***		***57.4***
Total Production Costs	rounded			**1,204**		**1,204**
Net Return	rounded			**1,846** 61%		**2,146** 64%

1/: Assuming fertilizer subsidy will continue

2/: Prevailing machinery hiring services charge for land preparation

D-5 Financial Crop Budget per Ha of Rice under With Project Conditions: Medium-scale Farm & Large-scale Farm in NDIS

NDIS: Medium-scale Farm						
		Unit	Major Season		Minor Season	
Items	Unit	Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			5.5		5.5
Unit Price	GHC/t			610		670
Gross Return	**GHC/t**			**3,355**		**3,685**
2. Production Cost						
(1) Farm Inputs				***407***		***407***
1) Seed	kg/ha	1.12	100	112.0	100	112.0
2) Fertilizer 1/				237.0		237.0
- NPK	kg/ha	0.54	300	162.0	300	162.0
- Urea	kg/ha	0.50	150	75.0	150	75.0
- SA	kg/ha	0.36				
3) Agro-chemicals				58.0		58.0
- Dursban (insecticide)	lit/ha	15	1	15.0	1	15.0
- Furadan (Herbicide)	kg/ha	5	7	35.0	7	35.0
- Rodenticide	tube/ha	8	1	8.0	1	8.0
(2) Farm Machinery				***300***		***300***
- Plowing 2/	per ha	65	1	65	1	65
- Harrowing 2/	per ha	45	1	45	1	45
- Leveling	per ha					
- Harvesting 3/	per ha	100	1	100	1	100
- Others (carting, threshing, spray etc.)	ls		1	90	1	90
(3) Labour Requirement			43	***321***	43	***321***
- Field Manager (owner) 4/	GHC/ha		1	0	1	0
- Assistant Field Manager 5/	GHC/ha	75	1	75	1	75
- Hired Labour	mandays	6.0	41	246	41	246
(4) Miscellaneous Expenses	5%			***51.4***		***51.4***
Total Production Costs	rounded			**1,079**		**1,079**
Net Return	rounded			**2,276** 68%		**2,606** 71%

1/: Assuming fertilizer subsidy will continue

2/: Assuming land preparation carried out with own tractor

3/: Prevailing machinery hiring service charge for harvesting

4/: One manager assumed to be a owner operator

5/: One assistant manager; GHC 3,000/year for 20ha = GHC 75/ha/season

NDIS: Large-scale Farm 1/						
		Unit	Major Season		Minor Season	
Items	Unit	Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			6.0		6.0
Unit Price	GHC/t			610		670
Gross Return	**GHC/t**			**3,660**		**4,020**
2. Production Cost						
(1) Farm Inputs				***432***		***432***
1) Seed	kg/ha	1.12	100	112.0	100	112.0
2) Fertilizer 2/				262.0		262.0
- NPK	kg/ha	1.04	300	162.0	300	162.0
- Urea	kg/ha	1.00	200	100.0	200	100.0
- SA	kg/ha	0.76				
3) Agro-chemicals				58.0		58.0
- Dursban (insecticide)	lit/ha	15	1	15.0	1	15.0
- Furadan (Herbicide)	kg/ha	5	7	35.0	7	35.0
- Rodenticide	tube/ha	8	1	8.0	1	8.0
(2) Farm Machinery				***205***		***205***
- Plowing	per ha	40	1	40	1	40
- Harrowing	per ha	30	1	30	1	30
- Leveling	per ha					
- Sowing	per ha	15	1	15	1	15
- Harvesting	per ha	80	1	0	1	0
- Others (carting, spray etc.)	ls		1	120	1	120
(3) Labour Requirement			82	***188***	82	***188***
- Field Manager 2/	GHC/ha	18	1	18	1	18
- Assistant Field Manager 3/	GHC/ha	25	2	50	2	50
- Farm Labour 4/	GHC/ha	120	1	120	1	120
(4) Miscellaneous Expenses	5%			***41.3***		***41.3***
Total Production Costs	rounded			**866**		**866**
Net Return	rounded			**2,794** 76%		**3,154** 78%

1/: Assuming farm size of 200ha

2/: One manager; wage GHC 7,000/year for 200ha = GHC 18/ha/season

3/: Two assistant manager; wage GHC 5,000/year for 100ha = GHC 25/ha/season

4/: Assuming 20 farm labour for 200ha: wage GHC 2,400/year = GHC 120/ha/season

D-6 Financial NPV (Net Production Value) under With-project Condition

1. KIS Area

Block/ Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC)	NPV/Year (GHC 000)
KIS												
Irrigated rice field/rice	2,300	2,300	5.5	2,281	5,246	2,300	5.5	2,611	6,005	4,600	4,892	11,252
Golden Exotic		Annual										
Banana farm/banana 1/	1,800	1,800	40	7,404	13,327		-	-	-	1,800	7,404	13,327
Total	**4,100**	**4,100**	-	-	**18,574**	**2,300**	-	-	**6,005**	**6,400**	**3,840**	**24,579**

Note: NPV = Net Production Value 1/:Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 ≈ GHC 7,404

2. New Developed Irrigation Scheme (NDIS)

2-1. No. 1 Area

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
No, 1 Area												
Irrigated rice field	2,538											
- Small-scale farm/rice	1,269	1,269	5.0	1,846	2,343	1,269	5.0	2,146	2,723	2,538	3,992	5,066
- Medium-scale farm/rice	381	381	5.5	2,276	867	381	5.5	2,606	993	762	4,882	1,860
- Large-scale farm/rice	888	888	6.0	2,794	2,481	888	6.0	3,154	2,801	1,776	5,948	5,282
Sub-total	2,538	2,538	-	-	5,691	2,538	-	-	6,517	5,076	4,810	12,208
Cassi Farm												
Irrigated upland field 1/	162											
- Maize/soybeans		162				162				324		
Total	**2,700**	**2,700**	-	-	**5,691**	**2,700**	-	-	**6,517**	**5,400**	-	**12,208**

Note: NPV = Net Production Value

1/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

2-2. No. 2 Area

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
No, 2 Area												
Irrigated rice field	3,149											
- Small-scale farm/rice	1,575	1,575	5.0	1,846	2,907	1,575	5.0	2,146	3,380	3,150	3,992	6,287
- Medium-scale farm/rice	472	472	5.5	2,276	1,074	472	5.5	2,606	1,230	944	4,882	2,304
- Large-scale farm/rice	1,102	1,102	6.0	2,794	3,079	1,102	6.0	3,154	3,476	2,204	5,948	6,555
Sub-total	3,149	3,149	-	-	7,061	3,149	-	-	8,086	6,298	4,810	15,146
Prairie Volta Farm												
Irrigated rice field 1/	1,051											
- Rice		1,051	5.5	1,678	1,764	1,051	5.5	1,843	1,937	2,102	3,521	3,701
Total	**4,200**	**4,200**	-	-	**8,824**	**4,200**	-	-	**10,023**	**8,400**	-	**18,847**

Note: NPV = Net Production Value

1/: Assuming: yield 5.5t/ha x GHC 610/t (major season) or GHC 670/t(minor season) x net return rate 50% = GHC 1,678/ha/season or 1,843/ha/season = annual GHC 3,521

2-3. NDIS

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
Irrigated rice field	5,687											
- Small-scale farm/rice	2,844	2,844	5.0	1,846	5,250	2,844	5.0	2,146	6,103	5,688	3,992	11,353
- Medium-scale farm/rice	853	853	5.5	2,276	1,941	853	5.5	2,606	2,223	1,706	4,882	4,164
- Large-scale farm/rice	1,990	1,990	6.0	2,794	5,560	1,990	6.0	3,154	6,276	3,980	5,948	11,837
Sub-total	5,687	5,687	-	-	12,752	5,687	-	-	14,603	11,374	4,810	27,354
Prairie Volta Farm												
Irrigated rice field 1/	1,051											
- Rice		1,051	5.5	1,678	1,764	1,051	5.5	1,843	1,937	2,102	3,521	3,701
Cassi Farm												
Irrigated upland field	162	162				162				324	maize/soybeans	
NDIS Total	**6,900**	**6,900**	-	-	**14,515**	**6,900**	-	-	**16,540**	**13,800**	-	**31,055**

Note: NPV = Net Production Value

1/: Assuming: yield 5.5t/ha x GHC 610/t (major season) or GHC 670/t(minor season) x net return rate 50% = GHC 1,678/ha/season or 1,843/ha/season

4. Accra Plains Gravity Irrigation Project

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Rice Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Rice Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
KIS/NDIS												
Irrigated rice field	7,987											
- KIS small-scale farm/rice	2,300	2,300	5.5	2,281	5,246	2,300	5.5	2,611	6,005	4,600	4,892	11,252
- Small-scale farm/rice	2,844	2,844	5.5	1,846	5,250	2,844	5.5	2,146	6,103	5,688	3,992	11,353
- Medium-scale farm/rice	853	853	5.5	2,276	1,941	853	5.5	2,606	2,223	1,706	4,882	4,164
- Large-scale farm/rice	1,990	1,990	6.0	2,794	5,560	1,990	6.0	3,154	6,276	3,980	5,948	11,837
Sub-total	7,987	7,987	-	-	17,998	7,987	-	-	20,608	15,974	4,834	38,606
Golden Exotic		Annual										
Banana farm/banana 1/	1,800	1,800	40	7,404	13,327					1,800	7,404	13,327
Cassi Farm (irrigated upland field)												
Irrigated upland field	162	162				162				324		0
Prairie Volta Farm												
Irrigated rice field/rice	1,051	1,051	5.5	1,678	1,764	1,051	5.5	1,843	1,937	2,102	3,521	3,701
Total	**11,000**	**11,000**	-	-	**20,206**	**9,200**	-	-	**23,057**	**20,200**	-	**55,633**

Note: NPV = Net Production Value 1/:Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 ≈ GHC 7,404

D-7 Financial Incremental NPV (Net Production Value) under With-project & Without-project Condition

1. KIS Area

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
KIS														
Irrigated rice field/rice	2,300	4,600	25,300	4,892	11,252	1,852	2,714	11,748	2,442	4,523	1,886	13,552	2,450	6,729
Grass land 1/						448			290	130	-	-	-	-130
Sub-total	2,300	4,600	25,300	4,892	11,252	2,300	2,714	11,748	2,732	4,653	1,886	13,552	2,160	6,599
Golden Exotic														
Banana farm/banana 2/	1,800	1,800	72,000	7,404	13,327	1,200	1,200	48,000	7,404	8,885	600	24,000	0	4,442
Upland field						600	780	1,566	843	506	-780	-1,566	-843	-506
Sub-total	1,800	1,800	72,000	7,404	13,327	1,800	1,980	49,566	8,247	9,391	-180	22,434	-843	-3,936
KIS Area Total	**4,100**	**6,400**	**97,300**	**5,995**	**24,579**	**4,100**	**4,694**	**61,314**	**3,425**	**14,044**	**1,706**	**35,986**	**2,570**	**10,535**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 580 x 0.5 = GHC 290; negative benefit GHC290/ha
2/: Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 = GHC 7,704

2. New Developed Irrigation Scheme (NDIS)

2-1. No. 1 Area

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
Irrigated rice field/rice														
Small-scale farm/rice	1,269	2,538	12,690	3,992	5,066						2,538	12,690	-	5,066
Medium-scale farm/rice	381	762	4,191	4,882	1,860						762	4,191	-	1,860
Large-scale farm/rice	888	1,776	10,656	5,948	5,282						1,776	10,656	-	5,282
Sub-total	2,538	5,076	27,537	4,810	12,208						5,076	27,537	4,810	12,208
Upland field						1,420	1,846	3,706	843	1,197	-1,846	-3706	-843	-1,197
Grass land 1/						1,200	-	-	290	348	-	-	-	-348
Sub-total						2,620	1,846	3,706	-	1,545	-1846	-3706	-	-1,545
Total	2,538	5,076	27,537	4,810	12,208	2,620	1,846	3,706	417	1,545	3,230	23,831	4,393	10,663
Cassi Farm														
Irrigated upland field 2/	162	324				162	324				0	0		
No. 1 Area Total	**2,700**	**5,400**	**27,537**	**4,521**	**12,208**	**2,782**	**2,170**	**3,706**	**555**	**1,545**	**3,230**	**23,831**	**3,949**	**10,663**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 580 x 0.5 = GHC 290; negative benefit GHC290/ha
2/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

2-2. No. 2 Area

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
Irrigated rice field/rice														
Small-scale farm/rice	1,575	3,150	15,750	3,992	6,287						3,150	15,750	-	6,287
Medium-scale farm/rice	472	944	5,192	4,882	2,304						944	5,192	-	2,304
Large-scale farm/rice	1,102	2,204	13,224	5,948	6,555						2,204	13,224	-	6,555
Sub-total	3,149	6,298	34,166	4,810	15,146						6,298	34,166	4,810	15,146
Upland field						1,889	2,456	4,930	843	1,592	-2,456	-4930	-843	-1,592
Grass land 1/						1,362	-	-	290	395	-	-	-	-395
Sub-total						3,251	2,456	4,930	-	1,987	-2456	-4930	-	-1,987
Total	3,149	6,298	34,166	4,810	15,146	3,251	2,456	4,930	403	1,987	3,842	29,236	4,179	13,159
Prairie Volta Farm														
Irrigated rice field 2/	1,051	2,102	11,561	3,521	3,701	1,051	2,102	11,561	3,521	3,701	0	0		0
No. 2 Area Total	**4,200**	**8,400**	**45,727**	**4,487**	**18,847**	**4,302**	**4,558**	**16,491**	**3,924**	**5,688**	**3,842**	**29,236**	**-**	**13,159**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 580 x 0.5 = GHC 290; negative benefit GHC290/ha
2/: Assuming: yield 5.5t/ha x GHC 610/t (major season) or GHC 670/t(minor season) x net return rate 50% = GHC 1,678/ha/season or 1,843/ha/season = annual GHC 3,521

2-3. NDIS

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
Irrigated rice field/rice														
Small-scale farm/rice	2,844	5,688	28,440	3,992	11,353						5,688	28,440	-	11,353
Medium-scale farm/rice	853	1,706	9,383	4,882	4,164						1,706	9,383	-	4,164
Large-scale farm/rice	1,990	3,980	23,880	5,948	11,837						3,980	23,880	-	11,837
Sub-total	5,687	11,374	61,703	4,810	27,354						11,374	61,703	4,810	27,354
Upland field						3,309	4,302	8,636	843	2,789	-4,302	-8636	-843	-2,789
Grass land 1/						2,562	-	-	290	743	-	-	-	-743
Sub-total						5,871	4,302	8,636	409	3,532	-4302	-8636	-	-3,532
Total	5,687	11,374	61,703	4,810	27,354	5,871	4,302	8,636	409	3,532	7,072	53,067	4,401	23,822
Prairie Volta Farm														
Irrigated rice field 2/	1,051	2,102	11,561	3,521	3,701	1,051	2,102	11,561	3,521	3,701	0	0	0	0
Cassi Farm														
Irrigated upland field	162	324				162	324				0	0		
NDIS Total	**6,900**	**13,800**	**73,264**	**4,501**	**31,055**	**7,084**	**6,728**	**20,197**	**1,021**	**7,233**	**7,072**	**53,067**	3,480	**23,822**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 580 x 0.5 = GHC 290; negative benefit GHC290/ha
2/: Assuming: yield 5.5t/ha x GHC 610/t (major season) or GHC 670/t(minor season) x net return rate 50% = GHC 1,678/ha/season or 1,843/ha/season = annual GHC 3,521

4. Accra Plains Gravity Irrigation Project

Block/ Land Use Category Farm/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
KIS/No. 1/No. 2														
Irrigated rice field														
- KIS small-scale farm/ric	2,300	4,600	25,300	4,892	11,252	1,852	2,714	11,748	2,442	4,523	1,886	13,552	-	6,729
- Small-scale farm/rice	2,844	5,688	28,440	3,992	11,353						5,688	28,440	-	11,353
- Medium-scale farm/rice	853	1,706	9,383	4,882	4,164						1,706	9,383	-	4,164
- Large-scale farm/rice	1,990	3,980	23,880	5,948	11,837						3,980	23,880	-	11,837
Sub-total	7,987	15,974	87,003	4,834	38,606	1,852	2,714	11,748	2,442	4,523	13,260	75,255	4,267	34,083
Upland field						3,909	5,082	10,202	843	3,295	-5,082	-10,202	-	-3,295
Grass land 1/						3,010	-	-	290	873	-	-	-	-873
Golden Exotic														
Banana farm/banana 2/	1,800	1,800	72,000	7,404	13,327	1,200	1,200	48,000	7,404	8,885	600	24,000	-	4,442
Cassi Farm (irrigated upland field)														
Irrigated upland field 3/	162	324			0	162	324				0	0	-	
Prairie Rice Farm 4/														
Irrigated rice field/rice	1,051	2,102	11,561	3,521	3,701	1,051	2,102	11,561	3,521	3,701	0	0	-	0
Total	**11,000**	**20,200**	**170,564**	**5,058**	**55,634**	**11,184**	**11,422**	**81,511**	**1,902**	**21,277**	**8,778**	**89,053**	**3,123**	**34,357**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 580 x 0.5 = GHC 290; negative benefit GHC290/ha
2/: Estimated farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 = GHC 7,404 3/: Maize & soybeans; accessibility to production & cost data limited because of newly establishec
4/: Assuming: yield 5.5t/ha x GHC 610/t (major season) or GHC 670/t(minor season) x net return rate 50% = GHC 1,678/ha/season or 1,843/ha/season = annual GHC 3,521

Annex E

Farmer's Organization, Enterprises / Management of Irrigation System

Annex E.1 Management of KIP

E.1.1 Beneficiaries and Farmers Organization

The current water user of KIS is categorized to 4 groups, i.e., small scale rice farmers, banana estate, fish pond users and vegetable farmers whose farm is out of the project area. Small rice farmer is the majority of the beneficiaries, of which share of land developed is 2,052 ha and the number is approximately 2,500 farm holds. As for small scale rice farmers, residents of the communities of the project area and people from the submerged area of the Kpong dam site were recruited and settled to the project and allocated 1 ha of farmland by the land allocation committee of the project. Small rice farmers had concluded the land allocation agreement with the project, which provide the conditions of land allocation, charged fee, responsibility of farmer and the project. All of small rice farmers are organized to farmer's organization named Osudoku Agricultural Cooperative Society Limited (hereafter "Cooperative"), which has a function of Water Users Association (WUA) as well as Farmer Based Organization (FBO).

Banana estate operated by the Golden Exotics Limited occupies Section C of the irrigation system of KIS. It operates the farm under the concession contract with GIDA, which includes pump station, irrigation canal, night reservoir and farmland. Currently, the Golden Exotics Limited occupies approximately 1,200 ha.

Several fishery ponds are distributed in the project area, of which area is approximately 28 ha in total. Fishery ponds are operated by local community or private owners. Those users who receive water from KIS have contract on water supply with KIP, and they are charged water fee.

There are some farmers taking irrigation water from KIS by pump and cultivating vegetables, even their farmland is out of the project area. They also have a contract on irrigation water supply with KIP and the irrigation service charge is changed. The area such farm is approximately 40ha in 2010.

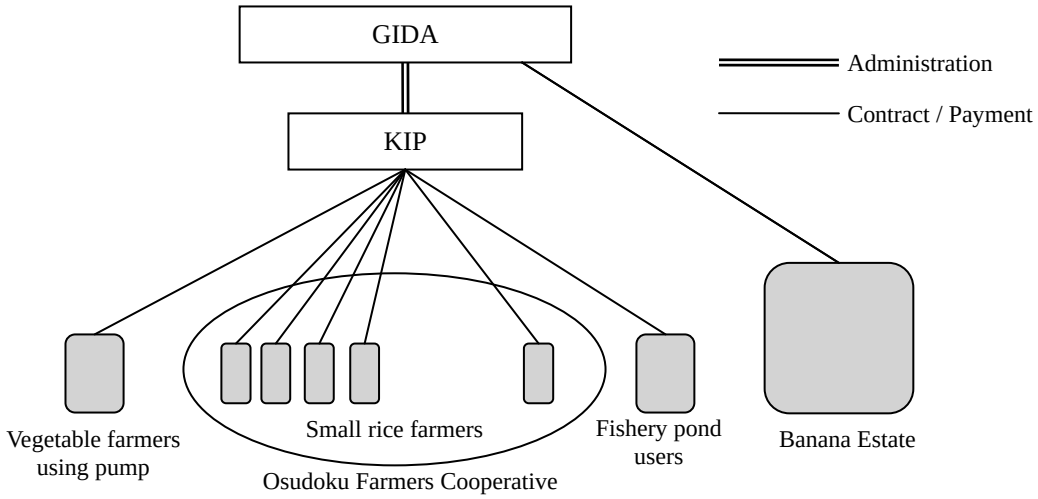


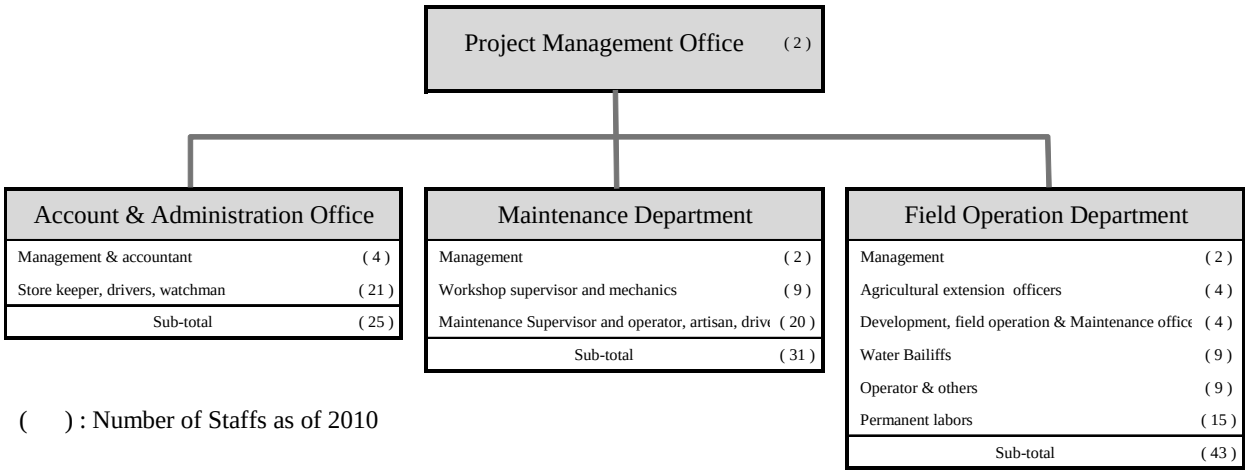
Fig. E.1.1 Management Structure of KIP and Contract of Water Users

E.1.2 Organization and Management Structure

The Kpong Irrigation Scheme is managed by KIP, which is substantial unit of GIDA for project management. Even though KIP was expected to be operated and maintained autonomously in its finance at the design stage, the budgetary allocation from GIDA had been continued from the beginning of the project up to now.

KIP has four core function units in its administration named Project Management, Field Operations, Maintenance, and Finance and Administration. The number of total staff is 101 in 2010, of which 8 staffs are seconded by GIDA head quarter. Under Field Operation Manager, Water Management Officers and Water Bailiffs are assigned to operating irrigation system as well as Field Operation Officers and Extension Officers who are in charged in provide technical extension service to farmers. Maintenance Manager has a responsibility for maintenance of irrigation system. Under the Maintenance Unit, construction plants and machinery are equipped to the KIP workshop.

Project Management Unit (PMU) is set up for making decision affecting famers, which comprises KIP, head of the Cooperative, head of smaller farmer associations, head of micro finance unit of Agriculture Development Bank (ADB).



( ) : Number of Staffs as of 2010

Source: KIP AnnualReport 2010

Fig. E.1.2 Organization Chart of KIP and Number of Staff

E.1.3 Operation and Maintenance of Irrigation System

The demarcation of responsibility for operation and maintenance of the irrigation system is:

- The project (KIP): Operating and maintaining the irrigation system from the intake to secondary canals, main and secondary drainage, access road and other major facilities.
- Farmers: Operating and maintaining the lateral canals as well as lateral drainages.
- Banana estate: Operating and maintaining the pump station and irrigation system after the pump.

KIP controls water delivery to the top of lateral canal and farmers take responsibility of water

distribution within the lateral canal. Operation of the irrigation system is carried out by Water Bailiffs (waterman and/or canal operator) in the field, who operates water regulators and off-take gates to secondary and lateral canals. Some of gate facilities in the secondary canal are operated by block leader[1] and/or lateral leader[2] of farmers under the control of Water Bailiffs. At moment, water discharge or amount of water distributed to each canal, even in the main canal or secondary canal, are not monitored due to lack of measurement facility. Only the water level and gate opening ratio are recorded at the intake at the Kpong dam.

KIP has a machinery workshop and several construction machinery are equipped while many of them are over aged or malfunctioning. Major plant and equipment possessed by KIP are summarized below:

Table E.1.1 Major Plant and Equipment of KIP

No.	Type of Equipment	No. Available	Conditions	No.	Type of Equipment	No. Available	Conditions
1	Bulldozer	1	Serviceable Require minor repair	8	Pick Up	4	Serviceable
2	Hydraulic Excavator	1	Serviceable Require minor repair	9	Fuel Tanker Trailer	1	Serviceable
3	Motor Grader	1	Serviceable Require minor repair	10	Concrete Mixer	1	Serviceable
4	Backhoe	2	Serviceable	11	Tipper Truck	1	Serviceable
5	Wheel Loader	1	Serviceable	12	Crane Truck	1	Serviceable
6	Reapers	2	Unserviceable	13			
7	Tractors with trailers	7	3 serviceable 4 unserviceable	14			

Source: KIP, only machinery used mainly for maintenance work is listed.

E.1.4 Service and Activity

The services provided by KIP a part from operation and maintenance of irrigation system is:

1) Agricultural Extension

Agricultural extension service of KIP is conducted by the extension officers in cooperation with MOFA, IDC and other organizations. The extension work consists of daily filed visit and contact to advice on agronomic practice, farmer's meeting (8 times in 2010), field demonstration which was focused on application of compost and organic manure in 2010, workshop and training which was held 5 times supported by NGO from USA.

2) Machinery Service

Tractor service for land preparation was provided formerly but it dose not work anymore. This service

[1] Farmer's leader representing a Block, that is a group of several lateral groups (usually approximate10 lateral groups). Block leader is appointed by Cooperative."

[2] Farmer's leader representing a Lateral Group, which covers beneficiary if a certain lateral canal. Lateral leader is elected by famers receiving water from the lateral canal.

is taken over by private service providers such as private AMCECs and individual tractor owners. Tractors belongs to KIP are used for carting service and maintenance work of irrigation canal. Harvesting service by rice combine harvester is provided by MOFA's program and KIP facilitates that contract. KIP also provide machinery service of construction equipment that is used for maintaining lateral canal and drainage by farmers.

3) Agricultural Credit

KIP facilitates farmer's access to agricultural credit provided by ADB. However, it is rather difficult to access to ADB credit and only 336 farmers were qualified for credit in 2010 major season. Repayment for the credit is mostly in kind. Farmers are expected to deposit paddy rice in the stores following the procedures of the Credit Inventory System. In this case, KIP is able to collect 100% of ISC from the System through ADB.

4) Seed Production and Sales

KIP contracts with 7 seed farmers in the project area for producing paddy seed. KIP provided 31 ton of paddy seed in 2010. .

E.1.5 Irrigation Service Charge

Irrigation Service Charge (ISC) is changed to water users and collected by KIP based on the contract between users and KIP. ISC is charged to irrigated area without consideration of crop type, however, the price is decided depending on the purpose and condition of water user, i.e., full irrigable area (case of small rice farmers), water access out of the commanded area with pump (case of vegetable farmers) and water access of aquaculture (case of fishery pond user) individually. ISC consists of land rent fee, project development fee, irrigations fee and management fee. As for banana estate, a concession fee including ISC is charged under the contract with GIDA, and the fee is paid to GIDA.

Table E.1.2 Irrigation Service Charge of KIP, 2010

Items	Full irrigable area (GHC/ha-year)	Water access out of the commanded area with pump (GHC/ha-year)	Water access of aquaculture (GHC/ha-year)
Land rent	1.25	1.25	1.25
Project development fee	14.75	2.95	2.95
Irrigation fee	90.00	29.40	122.80
Management fee	6.00	6.00	6.00
Total ISC Charge	120.00	39.60	133.00

In the case of small rice farmers, the bill of ISC is issued at the end of major season (August) and it is to be paid before starting minor season (September to October) in cash or in kind. In many cases, the payment is delayed to after harvesting of minor season crop (March in the next year). Most farmers pay ISC by in kind. The recovery of ISC is as low as 45% in 2010, which is almost same or bit lower than the national average of 53.5% as shown in Table E.1.3.

Table E.1.3 Irrigation Service Charge and Recovery of Irrigation Project in Ghana

No.	Project Name	Location		Irrigation Area (ha)		Construction	Irrigation Water	Beneficiary	ICS Price GHC/ha	Pump or Gravity	Recovery Ratio of ISC	Remarks
		Province	District	Major Crops	Area (ha)	Year of Complete.	Water Source	Pop.				
1	Ashaiman	Greater Accra	Ashiaman	Rice, Okra	130	1968	Dzorwulu River/ Ashiuman Reservoir	93	80		75.3%	
2	Dawhenya	Greater Accra	Dangme	Rice	200	1978	Dechidaw River	235		P		ISD is not collected by GIDA. Farmers burden pump operation cost.
3	Kpong	Greater Accra	Dangme	Rice/ Vergitables	3000	1968	Volta River	2500	120	G	45.0%	
4	Weija	Greater Accra	Ga	Vegetables/Asian Vegetables	220	1984	Weija Lake / Reservoir	149	500	P		Rehabilitation just completion, about to start cropping.
5	Mankessim	Central	Mfantsiman	Pepper,Garden, Egg, Water Melon	17	1984	Aprapong River	58	100	P		Under rehabilitation. No ISC collection because currently rain fed farming.
6	Okyereko	Central	Gomoa	Rice, Vegetables	40	1976	Ayensu River / Okyereko Reservoir	131	100	P	99.2%	
7	Subinja	Brong-Ahafo	Wenchi	Maize, Tomatoes, Cowpea	60	1976	Subin River	33		P		Under rehabilitation
8	Tanoso	Brong-Ahafo	Techiman	Maize, Tomatoes, Cowpea	64	1984	Tano River	209		P		Rehabilitation just completion and waiting for test running of pump.
9	Akumadan	Ashanti	Offinso	Rice, Vegetables	65	1976	Atwetwe River	190	300	P	40.0%	Project competed rehabilitation recently.
10	Sata	Ashanti	Sekyere	Rice, Vegetables	32	1994	Sata River	52		P		Under rehabilitation
11	Anum Valley	Ashanti	Ejisu-Juabeng	Rice	124	1991	Anum/Owerri River	150	20	G	8.6%	
12	Tono	Upper East	Bolgatanga	Rice, Soyabeans, Vegetables	2490	1985	Tono River	4000	40	G	86.3%	2010 Wet season. ICS 60 for rice and recovery 96.91% for 2009/10 Dry season
13	Vea	Upper East	Bolgatanga	Tomatoes, Soyabeans	850	1980	Yarangantanga River	2000	40	G	65.0%	
14	Libga	Northern	Savelugu	Rice, Vegetables	20	1970	Perusua River	51	38	G	33.0%	
15	Bontanga	Northern	Tolon	Rice, Vegetables	390	1983	Botanga Reservoir	497	25	G	31.0%	
16	Golinga	Northern	Tolon-Kumbungu	Rice, Vegetables	20	1974	Korni River	156	25	G	60.6%	
17	Dedeso	Eastern	Fanteakwa	Pepper, Onoins, Tomatoes	8		Volta Lake	13		P		Under rehabilitation
18	Amate	Eastern	Kwahu	Pepper, Onoins, Tomatoes	101	1980	Volta Lake	127		P		Under rehabilitation
19	Afife	Volta	Ketu	Rice, Okra	880	1983	Agali & Kplikpa Rivers	1024	100	G	65.0%	
20	Aveyime	Volta	North Battor	Rice	63	1975	Volta River	83		P		Rehabilitation just completed so farmers are about to start cropping and later fix ISC.
21	Kpando-Torkor	Volta	Kpando-Torkor	Okra, Maize	40	1976	Volta Lake	148	1,000	P	33.0%	
22	Kikam	Western	Nzema East	Rice	27	1993	Franza River	22				Project abandoned

Source: GIDA

Average 53.5%

E.1.6 Budgetary Situation of Maintenance Work and Irrigation Service Charge

The financial resource of KIP consists of the Internally Generated Funds (IGF) and the budgetary allocation by the government (GIDA) for administrative expenditure, service activity and investment activity, even though the budgetary allocation was not done in 2010. In addition, the human expenses including whole of staff salary are paid by GIDA, which was approximately GHC 480,000.

According to the Annual Repot 2010, the Internally Generated Funds (IGF) of KIP was 149,539 GHC of which income of the fiscal year was GHC 111,830. Irrigation Service Charge occupies 61.8% of the revenue of the fiscal year, and Machinery Service Charge is in the second place 28.3%. While on the other hand, the actual expenditure was GHC 119,272 where fuel and lubricants for the maintenance of infrastructure occupies 24.4% (GHC 29,186) and repair and maintenance of vehicles, plants and equipment occupies 28.6% (GHC 34,134).

Table E.1.4 Internally Generated Funds of KIP, 2010

Items	Amount (GHC)	Ratio
Carry over	37,708.39	
Revenue of Fiscal Year		
1. Irrigation Service Charge	69,154.02	61.8%
2. Machinery Service Charge	31,656.41	28.3%
3. Residential/Rent Income	1,344.60	1.2%
4. Seed Rice	2,180.00	1.9%
5. Other Income	7,495.16	6.7%
Sub-total Revenue of F/Y	111,830.19	100%
Total Internally Generated Funds	149,538.58	

Source: KIP Annual Report 2010

The necessary cost for the operation and maintenance work of the irrigation system is estimated by KIP Maintenance Unit as shown below. The total budgetary expenditure of 2010 was GHC 119,272, of which GHC 69,106 was spent for OMM activities. Due to lack of financial source, actual expense in 2010 was reached only 47.5% for operation cost, 34.4% for maintaining plant and equipment, and 29.8 % for regular maintenance of infrastructure. Mid-term and long-term maintenance had not been set to work.

Table E.1.5 OMM Cost and Actual Expense of KIP, 2010

Items	Necessary Cost*1 (GHC)	Actual Expense*2 (GHC)	Ratio
1. Operation Cost	17,224	8,178	47.5%
2. Maintaining plant and equipment	78,267	26,911	34.4%
3. Maintenance of office, houses, stores, workshop, pump house	9,594	2,085	21.7%
4. Regular maintenance of infrastructure	107,193	31,932	29.8%
OMM cost in total (1-4)	212,278	69,106	32.6%
Total budgetary expenditure of KIP		119,272	

*1: Necessary cost for maintenance work was estimated by KIP Maintenance Unit.
*2: Rearranged items by Study Team based on the KIP Annual Report.

Current tariff of water fee changed to farmers, which is called Irrigation Service Charge (ISC) is GHC120 per hector, and it will be accumulated to GHC 222,240 with condition of 100% recovery in cropped area of 1,852ha. Adding the water and land rent fee of the banana estate, that is GHC 64,000 per year, the total revenue of KIP from water fee becomes GHC 286,240. The amount is in the level to cover the annual OMM cost including regular maintenance work but not sufficient to cover the rehabilitation development level maintenance, under the condition that human expense is burdened by GIDA. At moment, because the ISC recovery ratio is approximately 45% as well as the water fee of the banana estate is not counted into the IGF, KIP is not able to secure the financial source even for regular maintenance work.

Table E.1.6 Necessary OMM Cost of KIP in 2010 Price

Items	Necessary Cost*1	Per Year Cost
1. Operation Cost	17,223.80	17,223.80
2. Maintaining plant and equipment	78,267.20	78,267.20
3. Maintenance of office, houses, stores, workshop, pump house	9,594.20	9,594.20
4. Regular maintenance of infrastructure	107,193.38	107,193.38
Sub-total 1~4		**212,278.58**
5. Rehabilitation of infrastructure*2	94,329.82	94,329.82
Sub-total 1~5 (annual cost)		**306,608.40**
6. Development of infrastructure*3	715,928.71	143,185.74
Total 1~6 (annual cost)		**449,794.14**

*1: Necessary cost for maintenance work was estimated by KIP Maintenance Unit.
*2: Rehabilitation is assumed to be repair and maintenance work necessary every year.
*3: Development is assumed to be repair and maintenance work necessary at once a five year.

Annex E.2 Current Situation of Large Scale Farms in the Project Area

E.2.1 Golden Exotics Farm

Name of company: Golden Exotics Limited	Location of company : Accra
Established in 2005	Location of farm: Section C of KIP
Outline of company: The Golden Exotics Limited is a local subsidiary company of La Conmagnbie Froitiors (LCF) which is French company. A part from Golden Exotics Farm in the KIP area, LCF has a 1,000 ha of fruit estate producing pineapples in the Eastern Region of Ghana. Out of Ghana, LCF operates fruits estate farm of 7,000 ha in Ivory Coast and 5,000 ha in Cameroon. The land of farm is rented by the government (GIDA) under the concession contract including irrigation system.	
Farming	
Conventional cultivating of banana	
Area of farm: 1,200 ha	Cropped area: 1,104 ha (average in 2010)
Crops: Desert Banana 100%	Production: 58,000 ton (2010) Average yield is 50 kg/ha.
Destination/market of products: Export to European countries through LCF. Products are exported by ship throuGHCooling storage in Tema.	
Major facilities: 3 packing stations	
Labor force: 1,500 persons (1,200 as permanent worker and 300 as temporary worker)	
Irrigation	
Water resources: KIP main canal The Farm has a contract for water use with GIDA. GIDA supplies 10,000 m3/hr of irrigation water. GIDA rent farm land as well as irrigation system including pump and night reservoirs by concession contract.	
Major irrigation facility and equipment: Pump station in KIP secondary canal, which is head race pump for the irrigation system of the farm. 6 night reservoirs in the irrigation system of the farm. Main pump station, secondary canal in the farm and night reservoirs were developed by GIDA/KIP.	
Irrigation method applied in the field: Drip irrigation with booster pump, liquid manure irrigation is applied.	
Water use: Annual amount of irrigation water is 12 million m^3 for 1,104 ha in 2010. Standard irrigation water requirement is 10,000 m^3/ha.	Even the contract amount with GIDA is 10,000 m^3/hr for 3 days a week, it is not able to secure the amount due to the condition of KIP canal and inadequate water management in the upper reach of canal.
Irrigation cost: Major irrigation cost consists of eclectic fee and diesel for fuel. Those cost is estimated 140 GHC/ha-year in 2010 and it is forecasted to be 200 GHC/ha-year in 2011 due to rapid increase of electricity and fuel cost.	
Water fee and other payment: Concession fee of 64,000 GHC/year is paid to GIDA, which includes rand and facility rent and water fee. According to the contract, the Golden Exotics has a responsibility for operation and maintenance of irrigation system after the main pump station. The amount is to be reviewed and revised in 2011.	
Future expansion plan: By using KIP irrigation water, the Golden Exotics is planning to expand 600 ha of farm land by expanding existing farm. Golden Exotics has already start to negotiate land acquisition with land owners, however, it is necessary to solve the following issues before starting development: - Secure the irrigation water: increase from 12 million m^3/year to 18 million m^3/year, which is still within the contract amount of water but cannot be secured due to condition of KIP canal and water management. - Secure the labor force: it is necessary to hire additional 600 labors.	

As a future plan after above expansion, the Golden Exotics intend to exploit other area and expand the farm up to 3,000 ha in total.
Need for irrigation water of the Project: In order to fulfill expansion of the farm, the Golden Exotics is eager to secure the amount of irrigation water that is promised in the contract with GIDA. When the situation of KIP water supply will be improved, the Golden Exotics will start to expand the farm immediately.

E.2.2 Prairie Volta Farm

Name of company: Prairie Volta Limited	Location of company : Aveyime-Battor
Established in 2008	Location of farm: Right bank of Volta river, after Mepe
Outline of company: The Prairie Volta Limited is a joint ventured company between USA and Ghanaian investment, of which 30 % was received from Government of Ghana, 30% from Ghana Commercial Bank and 40% from Prairie Texas Cooperated. The land of farm was acquired by the Government at once and then rent to Prairie Volta Farm.	
Farming	
Prairie Volta Farm carries out large scale paddy rice cultivation with applying huge tractor and airplane. They are planning to introduce aerial seed broadcasting in 2011. The farm is equipped large scaled post harvest plants, which will be used not only for self production but also providing service to other farms.	
Area of farm: approximately 1,300 ha, of which developed area is 290 ha.	Cropped area: 290 ha (2010)
Crops: Rice (Perfume rice, mainly Jasmine 85 variety)	Production: Total production N/A Yield was 4~5 ton/ha in 2010.
Destination/market of products: Domestic market The bulk of product is sold to domestic grain distributors at the silo station. 105 distributors are registered to the company and the company deals with 20 distributors at moment because production is not yet taken-off. Some of products are sold at the direct sales store of the farm.	The farm produce and sells seed rice as well. The amount was 130 MT in 2010. Those seeds are sold to large scale rice farms such as Hohoe Farm (Ho) and Brasilagro Ltd. (Dabala).
Major facilities: Milling station with 10 ton/hr of capacity (annual capacity is 60,000 ton) Silo station with 13,000 of capacity Mechanical dryer	Prairie Volta gives weight on the post harvest service to other farms and intends to set it one of the core business, as well as own rice producing. Because of low quality of equipment, it does not start to provide service widely at moment. Prairie Volta receives fund of MiDA and renovate milling machinery and silos within 2011. Prairie Volta expects extension of business in post harvest and marketing after renovation of equipment.
Labor force: 95 permanent workers with 5 managers/experts	
Irrigation	
Water resources: Volta River by pumping	
Major irrigation facility and equipment: 6 diesel pumps are used for taking water from Volta river and 2 diesel pump are use for water taking from creeks in the farm. All pump equipment and canal system in the farm were developed by the farm.	
Irrigation method applied in the field: Gravity after pumping	

Water use:	
Irrigation cost: Major irrigation cost consists of e diesel for fuel, which occupies 60% of running cost of pumps. The average cost for fuel is 188 GHC/ha-crop (50 USD/acre-crop). The total cost for pump operation including lubricant and maintenance of equipment is 300 GHC/ha-crop (80 USD/acre-crop).	
Water fee and other payment: At the beginning of business, the company paid USD 400,000 for land rent to the government. Annual payment for land rent and water use is not charged.	
Future expansion plan: In addition to the existing field of 290 ha, Prairie Volta plans to expand 320 ha of paddy field in the existing acquired land within 2011 year. After this exploitation, it will be approximately 610 ha of paddy field. After expansion in the right bank of the Volta river, Prairie Volta plans to shift development to the left bank lower reach of the Volta river. The target of the development is approximately 2,000 ha and it will be developed in 2012 ~ 2014, according to the plan. According to the Managing Director, they intend to go back to the right bank to develop remaining area of the acquired land after left bank, however, it has not yet planned.	
Need for irrigation water of the Project: Prairie Volta showed storing interest in water supplied by APGIP because of possibility to reduce irrigation cost by introducing gravity water instead of pump water. When APGIP will supply water to the boundary of the farmland (acquired land), Prairie Volta intends to switch over the internal canal system from pump at the Volta river to connection with APGIP. The target area of APGIP is expected to be approximately 610 ha at moment.	

E.2.3 Cassi Farm

Name of company: Cassi Farm Limited	Location of company : Accra
Established in 2009	Location of farm: Tokpo
Outline of company: Cassi Farm is established as a private company invested by Ghanaian capitals on 2009. The farm had sought farmland to be developed and negotiated with land owners by themselves.	
Farming	
Centre pivot irrigation system is introduced to cultivate maze, soy beans and vegetables. In the main farm land, the rotation of maize-soy-maize (3 crops in a year) is applied. Vegetables are cropped twice a year.	
Area of farm: 160 ha	Cropped area: 160 ha
Crops: maize 100 ha, vegetables (chili, Okra, Cabbage) 13 ha, Soy beans 47 ha	Production: maize 1,980 kg/ha, vegetables N/A Soy bean has not yet harvested.
Destination/market of products: Maize and soy are for domestic market. Vegetables are sold to Indian exporter.	
Major facilities: Grain silo (for maize and soy): 2,000 MT (total of 4 silos) Warehouse 50m X 25m	
Labor force: 9 managers and experts, 5 machinery operators, 20 permanent workers	
Irrigation	
Water resources: Volta River by pumping Taking water from Volta river by 3 electric pumps which are connected to sprinkler systems directly. The power is supplied by power lines.	
Major irrigation facility and equipment: Center pivot sprinkler: 3 systems (R=520m, 320m, 210m), Electric pump 7.5 KW, 6.0 KW and 3.5 KW are set in the Volta river and drive water to sprinkler system through approximately 2 km of pipeline.	

Irrigation method applied in the field: Centre pivot irrigation	
Water use: amount of irrigation water use was not available.	
Irrigation cost: 156 GHC/ha-crop (maize). In the case of maize-soy bean-maize crop rotation in a year, 156 + 110* + 156 = 422GHC/ha-year. This amount is counting cost for electricity and not include any maintenance cost. *: Irrigation water amount of soy is assumed as 70% of maize.	
Water fee and other payment: Payment for water use is not charged because of taking water from Volta river. Cass Farm has a land lease contract with land owners directly and annual payment for land rent is 40, 000 GHC/yea for 160ha. The contract is for 40 year and is to be renewed one a 5 year.	
Future expansion plan: Cassi Farm plans to expand its farmland from 160 ha to 600 ha in 2011. They have already started to negotiate with land owners and to prepare necessary plants and equipment such as lateral-move sprinkler system and pumps. In future, Cassi Farm intends to expand its farm size up to 800 ha, according to Managing Director.	
Need for irrigation water of Project: Regarding to the existing and planed sprinkler systems, Cassi Farm dose not interest to the water of APGIP because they have already invested current system and it is difficult to find advantage in water of APGIP. However, Managing Direct showed strong interest in water of APGIP for newly development plan in future, where they intend to use gravity water for irrigation water to reduce irrigation cost.	

E.2.4 Volta River Estate Farm (Site-D)

Name of company: Volta River Estate Limited	Location of company : Akurade
Established in 1998 (Site-D was established in 2000)	Location of farm: Astsuare (Site-D)
Outline of company: Volta River Estates Ltd, which has shareholders from Agrofair - a Fairtrade organisation from the Netherlands- and other shareholders within Ghana. Volta River Estate has 4 banana estates in Northern and Greater Accra region, of which total area is 370 ha and the main estate is located in Akurade near by Kpong town. One of the estates, Site-D, is located neighboring with the KIP project area..	
Farming	
This plantations is 90% organic	
Area of farm: Site-D 120 ha	Cropped area: 120 ha
Crops: Banana	Production: N/A
Destination/market of products: 80~90 of products are exported to European countries with certification of organic products. Remaining part is for domestic market.	
Major facilities: Warehouse and office	
Labor force: 217 permanent workers	
Irrigation	
Water resources: Volta River by pumping	
Major irrigation facility and equipment: 2 electric pumps for 200 ha capacity	
Irrigation method applied in the field: Micro sprinkler irrigation	
Water use: N/A	

Irrigation cost: N/A for electric pump. Diels pump which was replaced by electric pump last year consumed 150 L of fuel for 1 hector. It is estimated the cost in case of diesel pump is 338 GHC/ha, where assumption that cost for lubricant and spare parts is equivalent to 50 % of fuel cost.
Water fee and other payment:
Future expansion plan: In and around Site-D, there is no plan to expand estate.
Need for irrigation water of Project: Because Site-D takes water from Volta River by pump and it is connected to the micro sprinkler system, there is no needs for water from KIP or APGIP.

E.2.5 N & D Organic Farms

Name of company: N & D Organic Farms Limited	Location of company : Duffor
Established in 2008	Location of farm: Duffor
Outline of company: N & D Organic Farm is Ghanaian private operated company.	
Farming	
This plantation applies organic cultivation. At moment the farm uses rain-fed cultivation because the irrigation system is under preparation.	
Area of farm: 50 ha	Cropped area: 8 ha
Crops: Banana	Production: N/A
Destination/market of products: Targets export to European countries. Selling to export trader.	
Major facilities:	
Labor force: N/A	
Irrigation	
Water resources: Currently rain-fed. Pump irrigation from Volta river is under preparation.	
Major irrigation facility and equipment:	
Irrigation method applied in the field: Micro sprinkler irrigation is planned to be applied.	
Water use: N/A	
Irrigation cost: N/A	
Water fee and other payment: Land rent fee is paid to land owner	
Future expansion plan: Under developing the farm in the land acquired.	
Need for irrigation water of Project: Because the farm is closed to the Volta rive and the elevation of farm land is high, the farm is planning to put pump to Volta river. There is no needs for water from KIP or APGIP. However, the owner of the farm showed interest in the newly developed area of APGIP for banana and cacao cultivation.	

Annex E.3 Willingness to Pay Survey in KIS Area

As part of pre-feasibility study of the Accra Plains Gravity Irrigation Project, 50 farmers from the Kpong Irrigation project (KIP) who represented almost all the sections of the project were sampled and interviewed to obtain responses on their farming activity, maintenance activity and Irrigation service Charge (ISC) payment, from 15th- 17th March 2011. Their Willingness to pay for improvement in irrigation service was also examined.

Sample size

The respondent farmers were sampled from the various sections, branches, blocks and laterals of KIP. In order to obtain responses from various areas of the scheme, the respondent farmers were selected from the upper, the middle and the lower portions of each lateral for the purposes of this survey.

Water Distribution and ISC

Exactly 80% of the sample population received water and were satisfied with water distribution on KIP. The remaining 20% did not enough water or right quantity of water during the season for production due to three major reasons indicated by the farmers as follows:

Bad condition of the main canal, bad condition of the lateral canals, and poor field leveling/ drainage. The mean ISC paid for the sampled population, was GH¢110.04/ha. The average plot size of the sampled population is 1 ha even though some few respondents had a little less than 1f ha.

About 92% of the sampled population paid ISC in full while only 8% of the respondents made part payment of the ISC. Comparing this 92% with the 45% ISC recovery rate recorded in the 2010 Annual Report of KIP, it can be inferred that, greater number of the respondent farmers selected are part of the farmers with good standing who have paid their ISC in full and form part of the 45% recovery rate. Another inference that can be made from this responses is that, the full ISC payment the respondent farmers are referring to might include some arrears from the previous season which might have been deducted from the full ISC payment they made by KIP before the remaining amount was used to settle part of the current seasons ISC .

The remaining 8% who could not pay their ISC in full gave the following points as the reasons for why they could not pay their ISC in full

- Low market price of their crop
- Low yield of crop
- Poor drainage, bad access roads resulting in expensive harvesting of their produce which increase their production cost and reduce their farm income

Their perception about 120 ISC being charged was also examined, the responses obtained indicated that, 54% of the sample thinks the amount charged for ISC is rather expensive while 44% think the amount charged is reasonable. Only 2% of the sample perceived that the ISC charged is cheap. This

presupposes that the majority of the farmers would not want the ISC amount to be increased, again more than halve of the population think that the ISC amount charged does not merit the kind of irrigation service being offered to them, they think that the service should rather improve before such an amount can be charged.

Willingness To Pay

A hypothetical situation was created and explained to the respondent farmers that if the scheme (KIP) is rehabilitated so that water distribution and drainage were improved so that they could have enough water at the right time to irrigated their crops and also drain the field as and when required and in effect this goes to improve their yield will they be willing to pay for ISC promptly. The responses gave a 100% willingness to pay thus all the respondent farmers gave a 'yes ' (positive) response .

The study went further to ask how much they will be willing to pay. The results show a mean willing to pay amount of GH¢133.94 per ha. The maximum WTP amount was GH¢150 and the minimum WTP amount is GH¢62. This goes to confirm an earlier point that a little over half of the sample population perceived the ISC charged as rather expensive this is reflected in the mean ISC paid of 133.94 which is a little over the current charge of GH¢120

72% of the sample indicated a WTP amount a little above the current GH¢120 being charged and about 8% of the population shows a WTP amount which is less than the current charge of 120 this goes to confirm the point that the ISC charged does not merit the services they are receiving in terms of water distribution on KIP, they think water distribution as well as drainage on the scheme should improve before this amount (GH¢120) can be charged. Therefore they would pay the same amount of GH¢120 when the water distribution is improved.

The 8% of the respondent who gave a lower amount of WTP than the current 120 charge could be part of the farmers who did not receive water on their fields during the season and as well be part of the same category of farmers who think that the ISC being charged is rather expensive.

Supporting Services undertaken by KIP

1. Machinery for land Preparation and Harvesting

The results show that 92% of the respondent farmers use machinery from private people around the scheme to do land preparation and harvesting. Only 4% use machinery from KIP for land preparation and harvesting. The amount charged for the service by both private machinery owners and KIP is the same. However, the private machinery owners are not very organized in the delivery of the service and therefore they are not able to deliver the service in time. The farmers therefore prefer KIP to provide the machinery service which will be more organized and also delivered in time. This will allow their cropping activities to be as planned.

2. Drying floor

48% of the respondent farmers have purchased tarpaulins which they use to dry their rice.52% of the

respondents are able to use the drying floor provided by KIP for drying of their rice, thus about a little over half of the respondent farmers get the chance to dry their rice on the available drying floor on the scheme. This shows that the project is able to provide drying floor for only half of the farmers on the scheme, as 48% of the respondent farmers do not get space on the drying floors available and had to result to purchase of their own tarpaulins for drying of their rice.

3. Credit/Loan

A higher percentage of 84% of the respondent farmers are receiving credit from ADB which is being facilitated by KIP. Only 16% of the respondents sampled self finance their cropping activities. The respondent farmers expressed interest in the continuous and timely provision of credit for farming as they find this facility very useful to them.

4. Rice Seed

94% of the respondent farmers use seed provided by KIP, and only 6% of the respondent farmers are using their own rice seed for sowing. The responses show that greater proportions of the farmers patronize this facility and think is very useful to them.

5. Rice Mill

It was realized from the study that most of the farmers do not mill their rice before selling to the buyers, most of them sell their rice in paddy form (With the husk) this is indicated in the results as 92% of the respondents do not mill their rice. Only 8% of the respondent farmers mill smaller amount of their rice for domestic use and not for sale.

Annex F

Environmental and Social Considerations

Table F.1 Possible Adverse Impact

No.	Items	Possible Adverse Impact	Rating
Social Environment :			
1	Involuntary Resettlement	No involuntary resettlement is expected at present stage, because dam reservoir is not constructed, and irrigation canals don't pass through near the existing communities. The route of the main canal and road has been selected to pass though in the high elevated area along the hilly area in order to increase gravitational irrigable area as much as possible. Normally, residential area and villages are located in the flat area along the Volta River. There are very few houses are located in the hilly and high elevated area where new main canal and road are planned to locate. Therefore, in general, large scale of involuntary resettlement will not be necessary in this project implementation, except a few houses might necessary to be shifted or replaced in case of the layout of the new canals and roads might cross some residential area.	B
2	Local economy such as employment and livelihood, etc.	Animal husbandry is one of main source of local economy. Irrigation canals likely to block cattle grazing, if cattle crossing point is not provided. Land will be cleared during the land preparation stage when the project is fully operational. It is estimated that Pastoralists likely to lose grazing grounds for their livestock.	B+
3	Land use and utilization of local resources	Animal husbandry is one of main source of local economy. Irrigation canals likely to block cattle grazing, if cattle crossing point is not provided. Condition of existing land likely to be changed to farming land. Possible change of land use in case of construction works. Land will be cleared during the land preparation stage when the project is fully operational. It is estimated that Pastoralists likely to lose grazing grounds for their livestock.	B+
4	Social institutions such as social infrastructure and local decision-making institutions	The influx of migrants into these communities as result of the project may dilute some local customary practices and beliefs. For example, within the project area the use a hoe for farming activities is prohibited on the fourth day of every week. The differences in religious beliefs and customs can lead to conflict between local community people and migrants or among different ethnic groups.	B+
5	Existing social infrastructures and services	There are water intakes for 3-Districts Water Supply Scheme and Aveyime Community Water and Sanitation Service at right side of the Volta river in Aveyime. If outlet of drainage of the irrigation project is installed near the water intakes, raw water is polluted. Increase influx settlers likely to put pressure on existing social facilities including educational, health, water and sanitation facilities in the project area.	B+
6	The poor, indigenous and ethnic people	There are no indigenous people in the project area. However, livelihood of the local community people likely to be affected if they need to be relocated due to farm land cleaning and leveling.	B
7	Misdistribution of benefit and damage	Possible misdistribution of benefit among communities. For example, some farmer may receive benefit from irrigation development; however some farmer may not receive benefit from irrigation development.	B
8	Cultural heritage	There are culturally sensitive areas within the project area which may be affected by the development of the irrigation fields.	B

9	Local conflict of interests	The establishment of construction camp within project zone can generate social conflicts between site workers and local residents.	B
10	Water Usage or Water Rights and Rights of Common	Irrigation development causes increase of water intake from Kpong Dam Reservoir. Possible competitions among water users.	B
11	Sanitation	The poor disposal of human and constructional waste and the poor condition of construction camps is likely to exacerbate the incidence of sanitary and water related diseases like diarrhea. A poor sanitation method in the camps is likely to affect the health status of both camp workers and the local communities.	B
12	Hazards(Risk) Infectious diseases such as HIV/AIDS	Uncovered trenches and manholes likely to develop during the construction of irrigation infrastructure including canals, and drains. These can serve as breeding grounds for mosquitoes that transmit malaria. There is also the possibility of transmission of communicable diseases such as HIV/AIDS from construction camp workers to the local population. Disaster likely to be at low level since large scale construction works such as dam construction is not expected.	B＋
Natural Environment：			
13	Topography and Geographical features	Topography may be changed some extent due to construction works. Land will be cleared for farmlands during the land preparation stage when the project is fully operational.	B＋
14	Soil Erosion	Construction works most probably cause soil erosion. Soil erosion is accelerated during heavy rains. Topsoil likely to be washed out. During the construction phase, excavations and earthworks are undertaken for the construction of primary, secondary and tertiary canals as well as drains. These civil engineering works likely to create loose soil particles that are susceptible to erosion under the action of wind and water. Operational phase, activities that can cause erosion are land clearing during the preparation of the agricultural fields.	B＋
15	Groundwater	Ground water likely to be polluted if improper usage of fertilizer and agricultural chemical.	B
16	Hydrological Situation	Irrigation development causes increase of water intake from Kpong dam Reservoir.	B
17	Coastal Zone (Mangroves, Coral reefs, Tidal flats, Salt water intrusion etc.)	No possible direct impact is expected since the Project area is not faced coastal zone. However, Irrigation development promotes farm production during dry season. It means possible increase in usage of chemical fertilizers, pesticides, and herbicides. As a result, runoff containing those chemical from farm land may contaminate coastal zone. Extent of impact is unknown at present stage. New irrigation water intake might not affect to salt water intrusion in the Volta River. It will be almost no affection of such small percentage of water intake in the upstream of Kpong Dam to the salt water intrusion in the downstream of the Volta River.	C

18	Flora, Fauna and Biodiversity	Cutting trees along canals during construction phase of the project likely to affect some of the habitats of insects, reptiles, rodents and other animals. The Project area is not included wetland ecosystem (lake and pond). However, wetland condition likely to change if runoff from farmland come in the lake and pond in wetland area. In this case, habitat value for flora and fauna likely to decrease.	B
19	Meteorology	No adverse impact is expected.	
20	Landscape （Aesthetic value）	Landscape is changed. Land will be cleared for farmlands during the land preparation stage when the project is fully operational.	B
21	Global Warming	No adverse impact is expected.	
Pollution：			
22	Air pollution	Atmospheric pollutant likely to increase due to operation of construction vehicles during construction phase. Increase in dust and suspended particles in air as a result of de-vegetation and the creation of loose particles are expected during construction works.	B
23	Water pollution	During the construction phase of the project, water bodies likely to be polluted through discharge of liquid and solid waste from construction activities into nearby water bodies. Irrigation development promotes farm production during dry season. It means possible increase in usage of chemical fertilizers, pesticides, and herbicides. As a result, over usage of those chemicals may cause water contamination.	B＋
24	Soil Contamination	Possible increase of salinity of farmlands. This can occur through solutes applied in the form of fertilizers and pesticides and other agro-chemicals which are not utilized by the crops. The concentration of salts in the soil may be as a result of plants and evaporation taking up the irrigation water and leaving the salts behind as precipitates.	B＋
25	Waste	Poor waste disposal methods in the construction camps likely affect the health status of both camp workers and the local communities. Generation of soil and sand, and construction waste likely to increase during construction phase.	B
26	Noise and Vibration	During the construction phase, the major source of noise likely to be from construction vehicles and equipments. Level of noise and vibration likely to increase during construction phase.	B
27	Ground Subsidence	No adverse impact is expected.	
28	Offensive Odor	Possible offensive odor by emissions from construction vehicles during construction phase.	B
29	Bottom sediment	No adverse impact is expected.	
30	Accidents	Numbers of traffic accidents may occur due to operation of construction vehicles during construction phase.	B

Rating: A: Serious impact is expected.
B+: Adverse impact is expected to be smaller than A, however some impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses)
No mark: No impact is expected. IEE/EIA is not necessary.

Table F.2 Assumed Mitigation Measures

Items	Rating	Impact severity (e.g. magnitude, area extent, duration, frequency, reversibility, likelihood of occurrence)	Assumed mitigation measures and Monitoring
1. Involuntary Resettlement	B	No involuntary resettlement is expected at present stage, because dam reservoir is not constructed, and irrigation canals don't pass through near the existing communities.	Planning Phase There will no re-location of settlements under this project. However, in case land acquisition is needed, GIDA needs to hold continuous meeting between land owners and project affected peoples based on the State Lands Act (Act 125) of 1963 till basic agreement is obtained.
2. Local economy such as employment and livelihood, etc.	B+	Animal husbandry is one of main source of local economy. Irrigation canals likely to block cattle grazing, if cattle crossing point is not provided. Land will be cleared during the land preparation stage when the project is fully operational. It is estimated that Pastoralists likely to lose grazing grounds for their livestock.	Planning Phase When designing irrigation canals, cattle crossing point needs to be provided. Construction Phase Temporary cattle crossing point needs to be provided. Operation phase There is a proposal to develop 'artificial pasture' in 'grassland' areas within the project area which favour the growth of *Brachiaria falcifera* and other nitrous fodder. These areas may be used for grazing areas for livestock within the project area. Ponds will developed as water points for livestock. Crossing points need to be designed for cattle and other livestock.
3. Land use and utilization of local resources	B+	Animal husbandry is one of main source of local economy. Irrigation canals likely to block cattle grazing, if cattle crossing point is not provided. Condition of existing land likely to be changed to farming land. Possible change of land use in case of construction works. Land will be cleared during the land preparation stage when the project is fully operational. It is estimated that Pastoralists likely to lose grazing grounds for their livestock.	Planning Phase When designing irrigation canals, cattle crossing point needs to be provided. Operation phase Temporary cattle crossing point needs to be provided. Necessary bridges have been planned to be facilitated at the major points of canal crossing.
4. Social institutions such as social infrastructure and local decision-making institutions	B+	The influx of migrants into these communities as result of the project may dilute some local customary practices and beliefs. For example, within the project area the use a hoe for farming activities is prohibited on the fourth day of every week. The differences in religious beliefs and customs can lead to conflict between local community people and migrants or among different ethnic groups.	Planning Phase GIDA continues to hold consultation meetings at the community level. To reflect the voices of communities to the plan as much as possible. Construction Phase Contractor needs to respect local customary practices and beliefs. Operation phase GIDA continues to hold consultation meetings between existing communities and new settlers to create better communication and relationship.

5. Existing social infrastructures and services	B＋	There are water intakes for 3-Districts Water Supply Scheme and Aveyime Community Water and Sanitation Service at right side of the Volta river in Aveyime. If outlet of drainage of the irrigation project is installed near the water intakes, raw water is polluted. Increase influx settlers likely to put pressure on existing social facilities including educational, health, water and sanitation facilities in the project area.	Planning Phase Adequate and careful study is necessary when drainage system is designed. Land around existing social facilities including educational, health, water and sanitation facilities should not be acquired. Construction Phase Contractor needs to pay careful attention to existing social facilities including educational, health, water and sanitation facilities. Operation phase The project needs to consider support of each District Assembly to provide sanitation facilities in communities within the project zone. It will prevent water bodies from being contaminated with fecal matter through open defecation.
6. The poor, indigenous and ethnic people	B	There are no indigenous people in the project area. However, livelihood of the local community people likely to be affected if they need to be relocated due to farm land cleaning and leveling.	Planning Phase Land around the poor should not be acquired, unless they agree to relocate. Construction Phase Contractor needs to respect local customary practices and beliefs. Operation phase GIDA continues to hold consultation meetings between existing communities and new settlers to create better communication and relationship.
7. Misdistribution of benefit and damage	B	Possible misdistribution of benefit among communities. For example, some farmer may receive benefit from irrigation development; however some farmer may not receive benefit from irrigation development.	Planning Phase GIDA needs to hold continuous meeting between land owners and project affected peoples based on the State Lands Act (Act 125) of 1963 till basic agreement is obtained. GIDA needs to hold consultation meetings at the community level to avoid misdistribution of benefit and damage among communities. Construction Phase Contractor needs to pay careful attention to existing social facilities including educational, health, water and sanitation facilities. Operation phase Scheduling of irrigation operations in consultation with farmers within individual blocks. This is expected to reduce flooding and wastage.
8. Cultural heritage	B	There are culturally sensitive areas within the project area which may be affected by the development of the irrigation fields.	Planning Phase Land around the culturally sensitive areas should not be acquired. Construction Phase Alignment of the irrigation canals need to

			make a detour those culturally sensitive areas such as fetish groove and stone. Operation phase The presence of culturally sensitive areas needs to be informed to new settlers. So that new settlers can understand traditional culture and they will respect them.
9. Local conflict of interests	B	The establishment of construction camp within project zone can generate social conflicts between site workers and local residents.	Planning Phase GIDA continues to explain the importance and value of the irrigation development for communities. Construction Phase GIDA tries to lead the contractor make sure to create better communication and relationship between contractor and communities. Operation phase GIDA continues to hold consultation meetings between existing communities and new settlers to create better communication and relationship.
10. Water Usage or Water Rights and Rights of Common	B	Irrigation development causes increase of water intake from Kpong Dam Reservoir. Possible competitions among water users.	Planning Phase GIDA needs to communicate with 3-Districts Water Supply Scheme, pipe works from Aveyime Water Treatment Plant to Madavunu Junction. Construction Phase Contractor needs to implement construction works carefully when works of irrigation canal is done near water supply pipes. Operation phase GIDA needs to promote coordination on water usage among stakeholders (water users). Introduction of valves, gates and checks into the irrigation network to regulate the flow of water to various sections of the fields and avoid water logging.
11. Sanitation	B	The poor disposal of human and constructional waste and the poor condition of construction camps is likely to exacerbate the incidence of sanitary and water related diseases like diarrhea. A poor sanitation method in the camps is likely to affect the health status of both camp workers and the local communities.	Construction Phase Mobile toilet facilities need to be provided for the workforce. Also, implement awareness activities. Operation phase The District Health Management Team needs to assist frequently to organize awareness creation campaigns in communities within the project area.
12. Hazards (Risk), Infectious diseases such as HIV/AIDS	B＋	Uncovered trenches and manholes likely to develop during the construction of irrigation infrastructure including canals, and drains. These can serve as breeding grounds for mosquitoes that transmit malaria. There is also the possibility of	Construction Phase Contractor implements proper guidance to construction workers to prevent infectious diseases. Operation phase The District Health Management Team needs to assist frequently to organize

		transmission of communicable diseases such as HIV/AIDS from construction camp workers to the local population. Disaster likely to be at low level since large scale construction works such as dam construction is not expected.	awareness creation campaigns in communities within the project area.
13. Topography and Geographical features	B＋	Topography may be changed some extent due to construction works. Land will be cleared for farmlands during the land preparation stage when the project is fully operational.	Construction Phase Contractor tries to construct canals considering harmonize with landscape surrounding. Operation phase Tree planting activities need to be promoted around farmlands.
14. Soil Erosion	B＋	Construction works most probably cause soil erosion. Soil erosion is accelerated during heavy rains. Topsoil likely to be washed out. During the construction phase, excavations and earthworks are undertaken for the construction of primary, secondary and tertiary canals as well as drains. These civil engineering works likely to create loose soil particles that are susceptible to erosion under the action of wind and water. Operational phase, activities that can cause erosion are land clearing during the preparation of the agricultural fields.	Construction Phase All erosion susceptible surfaces are protected with fabric, mulch or grass. Areas which will not be used for construction will be re-vegetated. After the completion of the various irrigation infrastructure vegetation will be re-established around the structures so that soil is not exposed to the agents of denudation. To adopt the existing best practice to avoid soil erosion whenever the construction works are necessary. Operation phase A phased approach needs to be adopted during the land preparation stage of the project. The phasing needs to take into account the planting cycle of the crops to be cultivated in a particular section of the irrigated area. Land clearing needs to be supervised by extension officers. To study proper farming system to avoid soil erosion and loss of soil fertility promoting multi cropping instead of mono culture. Excess water from the fields need to be drained by a hierarchy of earth drains into nearby water bodies to prevent water logging during floods.
15. Groundwater	B	Ground water likely to be polluted if improper usage of fertilizer and agricultural chemical.	Operation phase The controlled use of agro-chemicals and fertilizers under the supervision of extension officers is necessary.
16. Hydrological Situation	B	Irrigation development causes increase of water intake from Kpong Dam Reservoir.	Construction Phase High efficiency concrete primary and secondary canals may minimize water loss within the irrigation network as compared to earth canals. Operation phase GIDA tries to promote conservation of water resources among stakeholders (water

			users), and study a proper utilization of water resources. The controlled use of agro-chemicals and fertilizers under the supervision of extension officers will minimize the level of toxic substances in any accidental return flows into the Volta river.
18. Flora, Fauna and Biodiversity	B	Cutting trees along canals during construction phase of the project likely to affect some of the habitats of insects, reptiles, rodents and other animals. The Project area is not included wetland ecosystem (lake and pond). However, wetland condition likely to change if runoff from farmland come in the lake and pond in wetland area. In this case, habitat value for flora and fauna likely to decrease.	Construction Phase The vegetation cover including trees should be not cleared within reservations (1 kilometre) around settlements. These will serve as wind breaks that will protect housing against strong winds. The vegetation cover including trees of areas (of land) adjoining water bodies of minimum distance of 50 meters away from the bank of the water body should be not cleared. Operation phase Tree planting activities need to be promoted around farmlands.
20. Landscape	B	Landscape is changed. Land will be cleared for farmlands during the land preparation stage when the project is fully operational.	Operation phase GIDA tries to propose a guideline for farmlands to harmonize with landscape.
22. Air Pollution	B	Atmospheric pollutant likely to increase due to operation of construction vehicles during construction phase. Increase in dust and suspended particles in air as a result of de-vegetation and the creation of loose particles are expected during construction works.	Construction Phase The engines of the contractor's trucks and equipments must be properly maintained and adjusted not to emit black smoke. Operation phase The project management team needs to undertake inspection of system infrastructure at regular intervals.
23. Water Pollution	B+	During the construction phase of the project, water bodies likely to be polluted through discharge of liquid and solid waste from construction activities into nearby water bodies. Irrigation development promotes farm production during dry season. It means possible increase in usage of chemical fertilizers, pesticides, and herbicides. As a result, over usage of those chemicals may cause water contamination.	Construction Phase Construction materials including oil are handled properly. Such materials are to be kept away from the water bodies as much as possible. Operation phase Supervised application of organic and inorganic fertilizers and agro-chemicals on the fields will reduce the concentration of toxic substances in return flows and discharges into water bodies in the project area. GIDA continues to study farming management with the least application of chemical fertilizers, pesticides, and herbicides. To develop manual for extension. To train research and extension staffs in order to disseminate good practice.
24. Soil Contamination	B+	Possible increase of salinity of farmlands. This can occur through solutes applied in	Operation phase Measures to reduce the incidence of salinity

		the form of fertilizers and pesticides and other agro-chemicals which are not utilized by the crops. The concentration of salts in the soil may be as a result of plants and evaporation taking up the irrigation water and leaving the salts behind as precipitates.	and alkalinisation will involve controlling and supervising the application of organic and inorganic fertilizers and other agro-chemicals by farmers under the scheme. Extension officers need to disseminate that in the application of fertilizers there is a balance between plant nutrient requirements and the carrying capacity of soils.
25. Waste	B	Poor waste disposal methods in the construction camps likely affect the health status of both camp workers and the local communities. Generation of soil and sand, and construction waste likely to increase during construction phase.	Construction Phase Temporary segregation box for waste needs to provide. Also, implement awareness activities to construction workers to promote sound solid waste management such as proper segregation and disposal. Operation phase GIDA tries to promote awareness activities on sound solid waste management such as proper segregation and disposal.
26. Noise and Vibration	B	During the construction phase, the major source of noise likely to be from construction vehicles and equipments. Level of noise and vibration likely to increase during construction phase.	Construction Phase Construction works near schools should be carried out either before classes begin or after closing. Within settlements, no noise producing construction activities should be allowed between 6.p.m. in the evening and 6.a.m. in the morning. Contractor needs to inform construction schedule to communities. Operation phase GIDA continues to hold consultation meetings between existing communities and new settlers to create better communication and relationship.
28. Offensive Odor	B	Possible offensive odor by emissions from construction vehicles during construction phase.	Construction Phase Contractor needs to provide proper construction vehicles and equipments, and maintain those properly.
30. Accidents	B	Numbers of traffic accidents may occur due to operation of construction vehicles during construction phase.	Construction Phase Contractor needs to inform construction schedule for communities, school, and clinic near construction side to avoid traffic Accidents. Operation phase GIDA continues to hold consultation meetings between existing communities and new settlers to create better communication and relationship.

Rating: A: Serious impact is expected.
B+: Adverse impact is expected to be smaller than A, however some impact is expected.
B: Some impact is expected.

Annex G

Project Cost and Implementation Plan

Table G.1 Breakdown of the Project Cost of NDIS (Direct Construction Cost)

ITEM NO.1 Work Site: NDIS

Work Name: Irrigation System Construction

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
1.	Main canal work								
1.1	Earth works								
1.1.1		Excavation/loading	Top soil	Hauling 500m-spread	m3	291,000	0.89	258,990.00	
1.1.2		Hauling	500m		m3	0	2.73	0.00	
1.1.3		Excavation	Clay, sand	BH (Stock piling)	m3	590,565	0.90	531,508.50	
1.1.4		Excavation/loading	Clay, sand	Blance of1.1.2	m3	1,061,855	1.73	1,837,009.15	
1.1.5		Hauling	500m		m3	1,061,855	2.73	2,898,864.15	
1.1.6		Embankment	Spreading+compaction		m3	1,652,420	1.82	3,007,404.40	
1.1.7		Sub-base	Excavation-hauling-compaction		m3	223,190	7.78	1,736,418.20	
1.1.8		Gravel pavement	Excavation-hauling-compaction		m3	95,035	7.78	739,372.30	
		Sub-Total 1.1						11,009,566.70	
1.2	Concrete lining works								
1.2.1		Lining concrete	15kN	incl. 20km hauling	m3	85,395	149.29	12,748,619.55	
1.2.1		Other works			%	5		637,430.98	
		Sub-Total 1.2						13,386,050.53	
1.3	Intake construction								
1.3.1		Reinforced concrete	21kN	incl. 20km hauling	m3	145	152.32	22,086.40	
1.3.2		Form			m2	329	19.75	6,497.75	
1.3.3		Reinforcing bar			ton	13.0	1419.71	18,456.23	
1.3.4		Leveling concrete		incl. 20km hauling	m3	2	127.86	255.72	
1.3.5		Concrete lining	15kN, 270.3m	incl. 20km hauling	m3	462	149.29	68,971.98	
1.3.6		Reinforcing bar			ton	9.2	1419.71	13,061.33	
1.3.7		Excavation			m3	1243	0.90	1,118.70	
1.3.8		Gate installation	2.0 x 2.0 x 3 gates		gate	3	19166.00	57,498.00	

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
	1.3.9	Riprap protection	12m x 2 x 25 x t0.75m		m3	600	838.81	503,286.00	
	1.3.10	Other works			%	10		69,123.21	
		Sub-Total 1.3						760,355.32	
1.4	Siphon construction								
	1.4.1	Excavation	Clay, sand		m3	128,840	0.90	115,956.00	
	1.4.2	Refilling	Clay, sand	Spread-compaction	m3	109,181	1.63	177,965.03	
	1.4.3	Reinforced concrete	21kN	incl. 20km hauling	m3	8,681	152.32	1,322,289.92	
	1.4.4	Form			m2	16,267	19.75	321,273.25	
	1.4.5	Reinforcing bar			ton	781.8	1419.71	1,109,929.28	
	1.4.6	Leveling concrete			m3	711	127.86	90,908.46	
	1.4.7	Check gate installation		2.0m x 2.0m	set	2	19440.00	38,880.00	
	1.4.8	Other works			%	10		317,720.19	
		Sub-Total 1.4						3,494,922.13	
1.5	Drainage culvert construction								
	1.5.1	Reinforced concrete	21kN	incl. 20km hauling	m3	3,871	152.32	589,630.72	
	1.5.2	Form			m2	11,952	19.75	236,052.00	
	1.5.3	Reinforcing bar			ton	347.0	1419.71	492,639.37	
	1.5.4	Leveling concrete		incl. 20km hauling	m3	156	127.86	19,946.16	
	1.5.5	Other works			%	10		133,826.83	
		Sub-Total 1.5						1,472,095.08	
1.6	Road culvert construction								
	1.6.1	Reinforced concrete	21kN	incl. 20km hauling	m3	1,671	152.32	254,526.72	
	1.6.2	Form			m2	3,644	19.75	71,969.00	
	1.6.3	Reinforcing bar			ton	151.0	1419.71	214,376.21	
	1.6.4	Leveling concrete		incl. 20km hauling	m3	67	127.86	8,566.62	
	1.6.5	Other works			%	10		54,943.86	
		Sub-Total 1.6						604,382.41	
1.7	Gate installation								
	1.7.1	Check gate	2m x 2m		set	26	19440.00	505,440.00	
	1.7.2	Check gate	1m x 1m		set	1	7350.00	7,350.00	
		Sub-Total 1.7						512,790.00	

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
1.8	Spillway, outlet works								
	1.8.1	Reinforced concrete		21kN	m3	699	138.00	96,462.00	
	1.8.2	Form			m2	2714	19.75	53,601.50	
	1.8.3	Bar			ton	62	1419.71	88,022.02	
	1.8.4	leveling concrete			m3	42	113.54	4,768.68	
	1.8.5	Other works		River protection	%	10		24,285.42	
		Sub-Total 1.8						267,139.62	
		Total of Main irrigation canal						31,507,301.79	
2.	Secondary canal work								
2.1	Earth works								
	2.1.1	Embankment	Excavation-hauling-compaction		m3	231,090	7.78	1,797,880.20	
	2.1.2	Gravel pavement	Excavation-hauling-compaction		m3	69,327	7.78	539,364.06	
		Total 2.1						2,337,244.26	
2.2	Concrete lining works								
	2.2.1	Lining concrete	15kN	incl. 20km hauling	m3	40,105	149.29	5,987,275.45	
	2.2.2	Other works			%	5		299,363.77	
		Toral 2.2						6,286,639.22	
2.3	Siphon construction								
	2.3.1	Excavation	Clay, sand		m3	16,091	0.90	14,481.90	
	2.3.2	Refilling	Clay, sand	Spread-compaction	m3	13,636	1.63	22,226.68	
	2.3.3	Reinforced concrete	21kN	incl. 20km hauling	m3	1,014	152.32	154,452.48	
	2.3.4	Form			m2	2,093	19.75	41,336.75	
	2.3.5	Reinforcing bar			ton	91.1	1419.71	129,335.58	
	2.3.6	Leveling concrete			m3	72	127.86	9,205.92	
	2.3.7	Other works			%	10		37,103.93	
		Sub-Total 2.3						408,143.24	

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
2.4	Road culvert								
	2.4.1	Reinforced concrete	21kN	incl. 20km hauling	m3	2,392	152.32	364,349.44	
	2.4.2	Form			m2	8,050	19.75	158,987.50	
	2.4.3	Reinforcing bar			ton	212.0	1419.71	300,978.52	
	2.4.4	Leveling concrete			m3	174	127.86	22,247.64	
	2.4.5	Other works			%	10		84,656.31	
		Sub-Total2.4						931,219.41	
2.5	Gate installation								
	2.5.1	Check gate	1m x 1m		set	205	7350.00	1,506,750.00	
	2.5.2	Check gate	1.2m x 1.0m		set	32	8540.00	273,280.00	
	2.5.3	Division gate	0.5m x 0.5m		set	215	1600.00	344,000.00	
		Sub-Total 2.5						2,124,030.00	
2.6	Pipeline								
	2.6.1	FRPM	Dia. 900mm		m	5300	620.43	3,288,279.00	
	2.6.2	FRPM	Dia. 800mm		m	6400	526.43	3,369,152.00	
	2.6.3	PVC	Dia. 600mm		m	1450	202.43	293,523.50	
	2.6.4	Concrete	21 kN	Regulating tank	m3	95	152.32	14,470.40	
	2.6.5	Form		Regulating tank	m2	408	19.75	8,058.00	
	2.6.6	Reinforcing bar		Regulating tank	ton	8.6	1419.71	12,209.51	
	2.6.7	Leveling concrete		Regulating tank	m3	10	127.86	1,278.60	
	2.6.8	Other works			%	10		698,697.00	
		Sub-Total 2.6						7,685,668.01	
		Total of Secondary irrigation canal						19,772,944.14	
3.	Drainage works								
	3.1.1	Excavation	Clay, sand	Excavation-loading	m3	51,500	3.02	155,530.00	
	3.1.2	Disposal of soil	Clay, sand	Hauling 500m-spread	m3	51,500	3.67	189,005.00	
	3.1.3	Other works			%	5		17,226.75	
		Total of Drainage works						361,761.75	
4.	Land development			Gross	ha	6450	2980.35	19,223,257.50	

Description	Production		Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
5. Building							
5.1.1	Dryer	Floor+ GI sheet	m2	16000	42.91	686,560.00	
5.1.2	Rice storage	Floor+ GI sheet +wall	m2	4000	133.88	535,520.00	
5.1.3	Large storage	Floor+ GI sheet +wall	m2	600	157.88	94,728.00	
5.1.4	Project office	Concrete frame	m2	420	800.00	336,000.00	
5.1.5	Dormitory	Concrete frame	m2	400	800.00	320,000.00	
5.1.6	Workshop	Concrete frame	m2	600	600.00	360,000.00	
5.1.7	Garage	Floor+ GI sheet	m2	600	133.88	80,328.00	
5.1.8	Generator room	Concrete frame	m2	30	500.00	15,000.00	
5.1.9	Toilet	Concrete frame	m2	30	500.00	15,000.00	
5.1.10	Fence	Steel wire net	m2	400	60.00	24,000.00	
	Total 5					2,467,136.00	
	Total					73,332,401.18	
					=US$	49,200,000	

Table G.2 Breakdown of the Project Cost of KIS) (Direct Construction Cost)

ITEM NO.2 Work Site: KIS

Work Name: Irrigation System Construction

Description	Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
1. Akuse Main Canal work				km	16.1			
1.1 Earth works								
1.1.1	Excavation/loading	Excavation-hauling -compaction	Hauling 10km	m3	62,895	3.02	189,942.90	Refilling materials
1.1.2	Hauling	Gravel-sand	Man-power	m3	62,895	11.52	724,550.40	
1.1.3	Compaction	Clay, sand	80kg Tamper	m3	20,965	0.90	18,868.50	
1.1.4	Compaction	Clay, sand	Vibrating Roller 3 ton	m3	41,930	0.69	28,931.70	
	Sub-Total 1.1						962,293.50	
1.2 Concrete lining work								
1.2.1	Lining concrete	15kN	incl. 20km hauling	m3	28,701	149.29	4,284,772.29	
1.2.2	Other works			%	5		310,467.96	
	Sub-Total 1.2						4,595,240.25	
1.3 Road bridge (H2.5xB2.0mxdoublex4 bridges)								
1.3.1	Reinforced concrete	21kN	incl. 20km hauling	m3	166	152.32	25,285.12	
1.3.2	Form			m2	497	19.75	9,815.75	
1.3.3	Reinforcing bar			ton	14.9	1419.71	21,153.68	
1.3.4	Leveling concrete		incl. 20km hauling	m3	7.0	127.86	895.02	
1.3.5	Other works			%	10		5,714.96	
	Sub-Total 1.3						62,864.53	
1.4 Spillway, outlet works								
1.4.1	Reinforced concrete		21kN	m3	1087	138.00	150,006.00	
1.4.2	Form			m2	4224	19.75	83,424.00	

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
	1.4.3	Bar			ton	96	1419.71	136,292.16	
	1.4.4	leveling concrete			m3	65	113.54	7,380.10	
	1.4.5	Other works		River protection	%	10		37,710.23	
		Sub-Total 1.8						414,812.49	
		Toal 1						6,035,210.77	
					km	2.2			
2.	South Lower Level Canal work (by Pump station)								
	2.1	Earth works							
	2.1.1	Excavation/loading	Excavation-hauling -compaction	Hauling 10km	m3	6,603	3.02	19,941.06	Refilling materials
	2.1.2	Hauling	Gravel-sand	Man-power	m3	6,603	11.52	76,066.56	
	2.1.3	Compaction	Clay, sand	80kg Tamper	m3	2,201	0.90	1,980.90	
	2.1.4	Compaction	Clay, sand	Vibrating Roller 3 ton	m3	4,402	0.69	3,037.38	
		Sub-Total 2.1						101,025.90	
	2.2	Concrete lining work							
	2.2.1	Lining concrete	15kN	incl. 20km hauling	m3	3,392	149.29	506,391.68	
	2.2.2	Other works			%	5		35,422.17	
		Sub-Total 2.2						541,813.85	
	2.3	Road bridge (H2.5xB2.0mxdoublex1 bridges)							
	2.3.1	Reinforced concrete	21kN	incl. 20km hauling	m3	42	152.32	6,397.44	
	2.3.2	Form			m2	124	19.75	2,449.00	
	2.3.3	Reinforcing bar			ton	3.7	1419.71	5,252.93	
	2.3.4	Leveling concrete		incl. 20km hauling	m3	2.0	127.86	255.72	
	2.3.5	Other works			%	10		1,435.51	
		Sub-Total 2.3						15,790.60	
		Total 2						658,630.35	
3.	South Lower Level Canal work (Downstream of Pump station)				km	3.1			
	3.1	Earth works							

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
	3.1.1	Excavation/loading	Excavation-hauling -compaction	Hauling 10km	m3	5,051	3.02	15,254.02	Refilling materials
	3.1.2	Hauling	Gravel-sand	Man-power	m3	5,051	11.52	58,187.52	
	3.1.3	Compaction	Clay, sand	80kg Tamper	m3	1,684	0.90	1,515.60	
	3.1.4	Compaction	Clay, sand	Vibrating Roller 3 ton	m3	3,367	0.69	2,323.23	
		Sub-Total 3.1						77,280.37	
3.2	Concrete lining work								
	3.2.1	Lining concrete	15kN	incl. 20km hauling	m3	3,603	149.29	537,891.87	
	3.2.2	Other works			%	5		34,622.63	
		Sub-Total 3.2						572,514.50	
		Toal 3						649,794.87	
4.	Noruth Lower Level Canal work				km	6.4			
4.1	Earth works								
	4.1.1	Excavation/loading	Excavation-hauling -compaction	Hauling 10km	m3	3,476	3.02	10,497.52	Refilling materials
	4.1.2	Hauling	Gravel-sand	Man-power	m3	3,476	11.52	40,043.52	
	4.1.3	Compaction	Clay, sand	80kg Tamper	m3	1,159	0.90	1,043.10	
	4.1.4	Compaction	Clay, sand	Vibrating Roller 3 ton	m3	2,317	0.69	1,598.73	
		Sub-Total 4.1						53,182.87	
4.2	Concrete lining work								
	4.2.1	Lining concrete	15kN	incl. 20km hauling	m3	2,976	149.29	444,287.04	
	4.2.2	Other works			%	5		27,532.64	
		Sub-Total 4.2						471,819.68	
		Toal 4						525,002.55	
5.	Distributary Y canal work				km	3.1			
5.1	Earth works								

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
	5.1.1	Excavation/loading	Excavation-hauling -compaction	Hauling 10km	m3	1,408	3.02	4,252.16	Refilling materials
	5.1.2	Hauling	Gravel-sand	Man-power	m3	1,408	11.52	16,220.16	
	5.1.3	Compaction	Clay, sand	80kg Tamper	m3	469	0.90	422.10	
	5.1.4	Compaction	Clay, sand	Vibrating Roller 3 ton	m3	939	0.69	647.91	
		Sub-Total 5.1						21,542.33	
5.2	Concrete lining work								
	5.2.1	Lining concrete	15kN	incl. 20km hauling	m3	1,456	149.29	217,366.24	
	5.2.2	Other works			%	5		13,022.55	
		Sub-Total 5.2						230,388.79	
		Toal 5						251,931.12	
6.	Distributary Z canal work				km	8.1			
6.1	Earth works								
	6.1.1	Excavation/loading	Excavation-hauling -compaction	Hauling 10km	m3	4,897	3.02	14,788.94	Refilling materials
	6.1.2	Hauling	Gravel-sand	Man-power	m3	4,897	11.52	56,413.44	
	6.1.3	Compaction	Clay, sand	80kg Tamper	m3	1,632	0.90	1,468.80	
	6.1.4	Compaction	Clay, sand	Vibrating Roller 3 ton	m3	3,265	0.69	2,252.85	
		Sub-Total 6.1						74,924.03	
6.2	Concrete lining work								
	6.2.1	Lining concrete	15kN	incl. 20km hauling	m3	4,339	149.29	647,769.31	
	6.2.2	Other works			%	5		39,880.87	
		Sub-Total 6.2						687,650.18	
		Toal 6						762,574.21	
7.	High Level Canal work				km	5.6			
7.1	Earth works								
	7.1.1	Excavation/loading	Excavation-haulin-compaction	Hauling 10km	m3	11,980	3.02	36,179.60	Refilling materials

Description		Production			Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
	7.1.2	Hauling	Gravel-sand	Man-power	m3	11,980	11.52	138,009.60	
	7.1.3	Compaction	Clay, sand	80kg Tamper	m3	3,993	0.90	3,593.70	
	7.1.4	Compaction	Clay, sand	Vibrating Roller 3 ton	m3	7,987	0.69	5,511.03	
		Sub-Total 7.1						183,293.93	
7.2	Concrete lining work								
	7.2.1	Lining concrete	15kN	incl. 20km hauling	m3	7,477	149.29	1,116,241.33	
	7.2.2	Other works			%	5		74,141.46	
		Sub-Total 7.2						1,190,382.79	
		Toal 7						1,373,676.72	
8.	Gate installation								
	8.1.1	Check gate	2.0m x 2.0m		set	1	19440.00	19,440.00	
	8.1.2	Check gate	1.5m x 1.5m		set	11	14520.00	159,720.00	
	8.1.3	Division gate	1.5m x 1.5m		set	10	14520.00	145,200.00	
	8.1.4	Division gate	1.0m x 1.0m		set	35	7350.00	257,250.00	
		Total 8						581,610.00	
		Total 1 - 8	Canal rehabilitation works					10,838,430.59	
9.	Drainage works								
	9.1.1	Excavation	Clay, sand	Excavation-loading	m3	139,100	3.02	420,082.00	
	9.1.2	Disposal of soil	Clay, sand	Hauling 500m-spread	m3	139,100	3.67	510,497.00	
	9.1.3	Other works			%	5		46,528.95	
		Total 9 of Drainage works						977,107.95	
10.	Dryer, rice storage								
	10.1.1	Dryer		Floor +GI sheet	m2	17200	42.91	738,052.00	
	10.1.2	Rice storage		Floor +GI sheet +wall	m2	4300	133.88	575,684.00	

Description	Production	Unit	Quantity	Unit Cost (GHC)	Cost (GHC)	Remarks
	Total 10				1,313,736.00	
	Total 1-10				13,129,274.54	
				=US$	8,800,000	

Table G.3 Proposed Plant and Equipment for Agricultural Support Service : Scenario-1 [Private Block : Public Block = 50 : 50]

Items	KIS			NDIS				
	Amount	Price (GHC)	Cost (GHC)	No.1*1	No.2*2	Amount	Price (GHC)	Cost (GHC)
Developed Area								
Total (ha) (Net Irrigable Area)	4,100			2,538	3,149			
For small scale farms in Public Development Block	2,300			888	1,103			
For small scale farms in Private Development Block				381	472			
For medium scale farms in Public Development Block	-			381	472			
For large scale farms in Private Development Block	1,800			888	1,102			
Expected number of secondary blocks	Existing			13	16			
of which Public Development Block				6	8			
1. Extension Service								
Extension officer	Existing 4 + new 2			3 + 2 (GIDA) = 5	4 + 2 (GIDA) = 6			
Motor bike	new 2	3,200	6,400	5	8	13	3,200	41,600
2.. Agricultural machinery service								
- Land Preparation								
Tractor (70 hp)	10	36,000	360,000	11	13	24	36,000	864,000
Attachment								
Caged wheel	10			11	13			
Disc plough	3			3	3			
Moldboard plough	2			2	3			
Rotary cultivator	4			4	5			
Disc harrow	1			1	2			
Tined harrow	1			1	2			
Land plane	1			1	1			
Trailer	10			11	13			
- Carting	included in tractor			included in tractor	included in tractor			
- Harvesting								
Combine harvester (4.2 m width)	4	440,000	1,760,000	2	3	5	440,000	2,200,000
3. Post harvest service								
- Drying								
Drying floor (480m^2) w/Shelter (150t)	42			19	21			
- Rice milling and Storage								
Small rice huller and milling unit				5	5	10	11,500	115,000
Sub total			2,126,400					3,220,600
Spare parts			212,600					322,100
Total			2,339,000					3,542,700
		USD	*1,569,800*				*USD*	*2,377,700*

*1: Area of Cassi Fram is exclueded from No. 1 Area. *2: Area of Priaire Volta Fram is exclueded from No. 2 Area.

*2: 1850(ha) / 45(ha/tractor) X (1 - 1.5/2.5) = 16.4 tractors for shortening work period in existing KIP, 400(ha) / 45 (ha/tractor) = 8.9 tractors for expansion of KIP, Covering 50% ==> 25.3 X 50% = 13 tractors minus existing 3 tractors

Table G.4 Proposed Plant and Equipment for Maintenance Work of Irrigation Systems

No.	Items	Description	KIS					No.1 and No.2 Area			Remarks
			Q'ty req'd	Qty available	Q'ty req'd in addition	Unit Price (USD)	Amount (USD)	Q'ty req'd	Unit Price (USD)	Amount (USD)	
1	Bulldozer	Bulldozer (CatD6 or, Komatsu D65 or similar) with multi shank ripper. (180-205 HP)	1	1 Needs thorough repair	0	390,000	0	1	390,000	390,000	For road maintenance and embankment, cleaning creeks
2	Motor Grader	Cat 140H or Komatsu similar. (135-185HP) 14 foot moldboard, rear ripper scarifier	1	1 Needs thorough repair	0	380,000	0	1	380,000	380,000	For road maintenance
3	Hydraulic Excavator	Cat or Komatsu Crawler mounted, with hydraulic boom and dipper with ground reach of about 12m and depth of 8m. Cat 330 or similar Net power of about 260-270 HP	1	1 Needs thorough repair	0	420,000	0	1	420,000	420,000	For drainage (creek) maintenance
4	Hydraulic Excavator	Small (Komatsu PC100 or similar) with excavating and ditch cleaning bucket	2	0	2	250,000	500,000	2	250,000	500,000	For canal maintenance and localized earth work
5	Hydraulic Excavator (Long reach boom)	Cat or Komatsu Crawler mounted, with hydraulic boom and dipper with ground reach of about 20m. Cat 330 or sim ilar complete with ditch cleaning bucket Net power of about 260-270 HP	1	0	1	450,000	450,000	1	450,000	450,000	For drainage (creek) maintenance
6	Tipper truck	Man Diesel, Mercedes or Volvo, 2 axle at rear, 12m3 bucket . 2–way tipper or similar with 7.5 ton loader crane	1	1	0	180,000	0	1	180,000	180,000	Crane truck, multi use including transportation of small plants
7	Tipper truck	Man Diesel, Mercedes or Volvo, 2 axle at rear, 12m3 bucket 2–way tipper Engine rated at about 400 HP	3	1	2	180,000	360,000	3	180,000	540,000	Localized earth work and embankment, mainly for road maintenance
8	Portable Water pumping machine	Centrifugal pump mounted in carrying frame. Air cooled petrol engine. 50 mm inlet, Approx. 600 liters per minute capacity. 10 m of suction hose and 20 m of delivery hose with couplings.	2	0	2	500	1,000	2	500	1,000	Temporary pump for canal maintenance
9	Trailed diesel water pumping machine	Trailed diesel water pumping machine, 100mm inlet with capacity of 400liters/sec. or more. Head of 45m.	2	0	2	5,000	10,000	2	5,000	10,000	
10	Concrete mixer	Driven by 35 HP engine, capable of mixing more than 1/2 m3 concrete or similar	4	0	4	5,000	20,000	4	5,000	20,000	For concrete repair
11	Mobile diesel air compressor with accessories	Accessories include 19 kg weight Air Drill with two sets (each of two sizes) of integral drills 25 kg Road Breaker with anti-vibration handles and set of tools including asphalt, chisel, moil and clay spade steels. 10 kg Spade pick with chisel, moil, a	2	1	1	12,000	12,000	1	12,000	12,000	Repairing concrete structure
12	Agricultural Tractor	Approximately 60 kW (80 hp) diesel engine, naturally aspirated preferred. Tropical cooling system. Heavy duty air cleaner with pre-cleaner. 8 speed or similar transmission.	4	3	1	15,000	15,000	4	15,000	60,000	Cutting weeds and small trees in canal lot
13	Rotary slasher	Heavy duty rotary slasher suitable for operation with the 60 kW (80 hp) agricultural tractor	4	1	3	5,000	15,000	4	5,000	20,000	

No.	Items	Description	KIS					No.1 and No.2 Area			Remarks
			Q'ty req'd	Qty available	Q'ty req'd in addition	Unit Price (USD)	Amount (USD)	Q'ty req'd	Unit Price (USD)	Amount (USD)	
14	Low loader	40 tons, capability for transportation of excavators.	1	0	0	2,000	0	0	2,000	0	Transportation of heavy plant
15	Tractor unit for low loader	Suitable for low loader above, to transport 40 0r more tons,6 X 4 chassis, with manual transmissi on. Diesel engine, (about 500 HP or more) ABS, power steering, ebs braking system. Volvo, Benz or Man diesel	1	0	0	300,000	0	0	300,000	0	
16	Motor cycle	Honda, Suzuki, Yamaha or similar air cooled, 4 stroke engine approximately 125 cc capacity with heavy duty air cleaner. Raised exhaust.	12	4	8	3,200	25,600	10	3,200	32,000	for operator, supervisor and water bailiffs
17	Level instrument complete	Level, Wild N2 or similar complete with tripod, carrying case and all accessories, with 2 staffs extending 4m long	2	1	1	2,000	2,000	2	2,000	4,000	Survey instruments for 2 teams
18	Theodolite complete with tripod	Theodolite, reading to 20 seconds. 3600, resolution 1'/0.2 gon objective aperture 45mm horizontal reading 1" minimum focusing distance 0.9 m.	2	1	1	8,000	8,000	2	8,000	16,000	
19	Rolling distance Measuring wheel (m)	Medium measuring wheel with electronic counters	3	1	2	500	1,000	2	500	1,000	
SUBTOTAL							1,419,600			3,036,000	
Sapre parts for plants and equipment		10 % of plants and equipment cost					141,960			303,600	
TOTAL							1,561,560			3,339,600	
GRAND TOTAL			4,901,160								

Annex H

Project Evaluation

H-1 Economic Price Structure - 1/2

Items	Operation		US$/ton	GHC/t
Rice			Import Parity	
(1) Thai 5% broken, FOB Bangkok, 2020 (constant 2010 price) 1/ & 3/		=	450	
(2) Freight & Insurance (Bangkok - Tema)		+	75	
(3) CIF at Tema port		=	525	
(4) Conversion to Cedi 2/		+		782
(5) Port handling charge & import margin at 4% of CIF	4%	+		31
(6) Price at Tema Port		=		814
(7) Local transport (Tema to Accra) & handling charge		+		20
(8) Wholesalers margin	3%	+		25
(9) Ex-mill/wholesale price		+		859
(10) Milling cost		-		35
(11) Conversion to paddy	65%	=		558
(12) By-products through processing 4/		+		47
(13) Millgate paddy price		=		605
(14) Local transport (farm to mill)		-		5
(15) Economic farm gate price				**600**
Maize			Import Parity	
(1) FOB Gulf ports, 2015 (constant 2010 price) 1/ & 5/		=	170	
(2) Freight & Insurance (Gulf ports - Tema)		+	75	
(3) CIF at Tema port		=	245	
(4) Conversion to Cedi 2/		+		365
(5) Port handling charge,baggin & import margin at 5% of CIF	5%	+		18
(6) Price at Tema Port		=		383
(7) Local transport (Tema to Accra)		+		5
(8) Wholesalers margin	3%	+		12
(9) Wholesale price at Accra		=		400
(12) Local transportation (project - Accra)		-		20
(13) Economic farm gate price				**380**
Banana			Export Parity	
(1) CIF Hamburg 1/		=	730	
(2) Quality Adjustment (20%)	20%	-	146	
(2) Freight & Insurance (Tema - Hamburg)		-	159	
(3) FOB at Tema port		=	425	
(4) Conversion to Cedi 2/		+		633
(5) Port handling at 1% of FOB	1%	-		6
(6) Transportation (project to Tema) & handling charge		-		10
(7) Economic farm gate price				**617**

1/: Projected price in 2020 at constant 2010 price
Source: World Bank Commodity Forecast, Global Economic Prospect, Dec. 2010

2/: Exchange rate: 1 US$=1.49 Cedis

3/: Thai, white, milled, 5% broken, FOB Bangkok

4/: Rice bran 10% of paddy x 120GHC/t + broken rice 5% of paddy x 700GHC/t = GHC 47/ton of paddy

5/: US, No. 2, yellow, FOB Gulf ports

H-1 Economic Price Structure - 2/2

Items	Operation		Import Parity US$/ton	Cedis/t
Urea				
(1) FOB Europe (2010 constant), bagged 1/		=	240	
(2) Freight & Insurance (Europe - Tema)		+	60	
(3) CIF at Tema port		=	300	
(4) Conversion to Cedi 2/		=		447
(5) Port handling & import margin at 3% of CIF	3%	+		13
(6) Ex-wholesaler price		=		460
(7) Wholesalers margin	3%	+		14
(8) Wholesale price		=		474
(9) Local transport (port to project)		+		10
(10) Retailer margin at 4% of wholesale price	4%	+		19
(11) Retailer price at the project site		=		503
(12) Economic farm gate price				**503**
(13) Nitrogen equivalent (Urea N= 46%)				**1,094**
TSP				
(1) FOB US Gulf (2005 constant), bulk 1/		=	327	
(3) Freight & Insurance (Europe - Tema)		+	60	
(4) CIF at Tema port		=	387	
(5) Conversion to Cedi 2/		=		577
(6) Port handling, bagging & import margin at 4% of CIF	4%	+		23
(7) Ex-wholesaler price		=		600
(8) Wholesalers margin	3%	+		18
(9) Wholesale price		=		618
(10) Local transport (port to project)		+		10
(11) Retailer margin at 4% of wholesale price	4%	+		25
(12) Retailer price at the project site		=		653
(13) Economic farm gate price				**653**
(14) Phosphate equivalent (TSP P2O5= 45%)				**1,451**
Muriate of Potash				
(1) FOB Vancouver (2005 constant), bulk 1/		=	250	
(2) Freight & Insurance (Europe - Tema)		+	60	
(3) CIF at Tema port		=	310	
(4) Conversion to Cedi 2/		+		462
(5) Port handling, bagging & import margin at 4% of CIF	4%	+		18
(6) Ex-wholesaler price		=		480
(7) Wholesalers margin	3%	+		14
(8) Wholesale price		=		495
(9) Local transport (port to project)		+		10
(10) Retailer margin at 4% of wholesale price	4%	+		20
(11) Retailer price at Accra		=		525
(12) Economic farm gate price				**525**
(13) Potassium equivalent (KCl K2O = 60%)				**874**
		N	15%	164
		P2O5	15%	218
		K2O	15%	131
			Total	**513**
Ammonium Sulphate		N	20.5%	**224**

1/: Projected price in 2020 at constant 2010 price
Source: World Bank Commodity Forecast, Global Economic Prospect, Dec. 2010

2/: Exchange rate: 1 US$=1.49 Cedis

H-2 Summary of Financial and Economic Prices Applied

Particulars	Unit	Financial Price 1	Conversion 2/	Economic Price
1. Farm Products				
- Dry paddy 3/	(GHC/ton)	610 & 670	a.	610
- Cassava	(GHC/ton)	350	b.	315
- Maize	(GHC/ton)	600	a.	357
- Pepper	(GHC/ton)	2,500	b.	2250
- Banana	(GHC/ton)		a.	837
2. By-product				
- Rice bran	(GHC/ton)	150	b.	135
3. Seed				
- Rice	(GHC/kg)	1.12	b.	1.01
- Cassava	(GHC/ha)	90	b.	81
- Maize	(GHC/kg)	0.6	b.	0.54
- Pepper	(GHC/kg)	750	b.	675
4. Fertilizer				
- NPK (15-15-15)	(GHC/kg)	1.04	a.	0.61
- Urea	(GHC/kg)	1.00	a.	0.59
- SA (Sulphate of Ammonia)	(GHC/kg)	0.76	a.	0.26
5. Agro-chemical		market price	b.	x SCF 0.9
6. Labor				
- Hired Labor	(GHC/manday)	6	c.	4.2
- Family Labor	(GHC/manday)	6	c.	4.2
- Skilled Labor	(GHC/manday)	market price	b	x SCF 0.9
7. Mechanical Works				
- Plowing	(GHC/ha)	market price	d.	x specific CF 0.88
- Harrowing	(GHC/ha)	market price	d.	x specific CF 0.88
- Harvesting	(GHC/ha)	market price	d.	x specific CF 0.88
- Other Works (carting etc.)	(GHC/ha)	market price	d.	x specific CF 0.88
8. Pumping Cost (Prairie Volta Farm)	(GHC/ton)	298	e.	218

1/ February 2011 prices

2/ Conversion

a. Economic price estimated based on the WB Commodity Forecast; Web "Global Economic Prospect, Dec. 2010"

b. Financial prices converted to economic value multiplying by SCF 0.9

Source: SCF applied in World Bank project, "Ghana Social Opportunity Project, effective from November 2010

SCF calculation by the JICA Study Team Unit: US$ 000

Year	Export (E)	Export Tax (Et)	Import (I)	Import Tax (It)	Import Subsidy (Is	SCF
2007	3,404,752	34,562	7,040,056	1,244,587	306,670	0.920
2008	3,836,344	38,095	8,632,247	1,460,467	275,610	0.916
2009	2,323,210	33,340	6,468,488	1,274,681	135,121	0.888
SCF = (E+I)/{(E-Et) + (I+It-Is)}					**Average**	**0.908**

c. Conversion factor applied: 0.7 (assumed)

d. Multiplied by conversion factor for mechanical works 0.88

Specific conversion factor for mechanical works			Specific CF = 0.88
Depreciation/maintenance	45% x SCF	44.1%	
Fuel/lubricants	18% x fuel CF	11.0%	
Operator	18% x SCF	16.20%	
Administration/margin	19% x SCF	17.1%	
	100%	88.4%	

e. Multiplied by conversion factor for pumping 0.73

Specific conversion factor for pumping			Specific CF = 0.73
Depreciation/maintenance	20% x SCF	18.0%	
Fuel/lubricants	60% x fuel CF	36.6%	
Others	20% x SCF		
	100%	72.6%	

3/ Major season GHC 610/ton & minor season GHC 670/ton

4/ Source - Studi Report 200,000ha

H-3 Economic Crop Budget per Ha of Rice in KIS & Upland Crops in Upland Field under Without-project Condition

Rice Production in KIS						
			Major Season Rice (Transplanting)		Minor Season Rice (Transplanting)	
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			4.7		4.0
Unit Price	GHC/t			600		600
Gross Return	GHC/t			**2,820**		**2,400**
2. Production Cost						
(1) Farm Inputs				***371.05***		***421.1***
1) Seed	kg/ha	1.01	65	65.65	110	111.1
2) Fertilizer				271.2		275.8
- NPK	kg/ha	0.51	320	163.2	280	142.8
- Urea	kg/ha	0.50	150	75.0	200	100.0
- SA	kg/ha	0.22	150	33.0	150	33.0
3) Agro-chemicals				34.2		34.2
- Dursban(insecticide)	lit/ha	13.5	1	13.5	1	13.5
- Furadan (herbicide)	kg/ha	4.5	3	13.5	3	13.5
- Rodenticide	tube/ha	7.2	1	7.2	1	7.2
(2) Farm Machinery				***264***		***264***
- Tilling/crossing 1/	per ha	194	1	194	1	194
- Harrowing	per ha					
- Leveling	per ha					
- Harvesting	per ha					
- Others (carting etc.)	ls	70	1	70	1	70
(3) Labour Requirement			138	***580***	121	***508***
- Family Labour (40%)	man-days	4.2	83	349	73	307
- Hired Labour (60%)	man-days	4.2	55	231	48	202
(4) Miscellaneous Expenses	5%			***60.7***		***59.7***
Total Production Costs	rounded			**1,275**		**1,253**
Net Return	rounded			**1,545**		**1,147**
	%			55%		48%

1/: Prevailing machinery hiring services charge for land preparation

Upland Field																	
		Crop Budget per Crop/Ha									Net Return per Ha						
		Cassava			Maize			Pepper			Major Season				Minor S.		
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Unit Price (GHC)	Q'ty	Amount (GHC)	Unit Price (GHC)	Q'ty	Amount (GHC)	Cassava 0.5 ha	Maize 0.3ha	Pepper 0.2ha	Maize 0.3ha	Annual
1. Return																	
Unit Yield	t/ha			3.5			1.20			0.70							
Unit Price	GHC/t			315			380			2,250							
Gross Return	GHC/t			**1,103**			**456**			**1,575**	**551**	**137**	**315**	**137**	**1,140**		
2. Production Cost																	
(1) Farm Inputs				***95.1***			***41***			***265.5***							
1) Seed	kg/ha	-	1ha	90	0.6	25	15	750	0.25	187.5							
2) Fertilizer				5.1			26.0			78.0							
- NPK	kg/ha	0.51	10	5	1.04	25	26	1.04	75	78.0							
- Urea	kg/ha	0.50		0	1.00		0	1.00		0							
- SA	kg/ha	0.22		0	0.76		0	0.76		0							
3) Agro-chemicals				0			0			0							
- Basagran (herbicide)	lit/ha			0			0			0							
- Karate 2.5E (insecticide	lit/ha			0			0			0							
- Yosidion (rodenticide)	kg/ha			0			0			0							
(2) Farm Machinery				***88***			***88***			***150***							
- Land Preparation 1/	per ha	88	1	88	88	1	88	150	1	150							
- Harvesting	per ha																
- Threshing	per ha																
- Harvesting	per ha																
- Others (carting etc.)	ls																
(3) Labour Requirement			80	***336***		70	***294***		120	***504***							
- Family Labour (60%)	man-days	4.2	48	202		42	176		72	302							
- Hired Labour (40%)	man-days	4.2	32	134	6.0	28	118	6.0	48	202							
(4) Miscellaneous Expenses	5%			***26.0***			***21.2***			***46.0***							
Total Production Costs	rounded			**545**			**444**			**965**	**273**	**133**	**193**	**133**	**732**		
Net Return	rounded			**558**			**12**			**610**	**278**	**4**	**122**	**4**	**408**		
	%			51%			3%			39%		Total	**404**				

1/: Prevailing machinery hiring services charge for land preparation

H-4 Economic Crop Budget per Ha of Rice under With Project Conditions: KIS & Small-scale Farm in NDIS

KIS (Transplanting)						
			Major Season		Minor Season	
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			5.5		5.5
Unit Price	GHC/t			600		600
Gross Return	GHC/t			**3,300**		**3,300**
2. Production Cost						
(1) Farm Inputs				***292.5***		***292.5***
1) Seed	kg/ha	1.01	30	30.3	30	30.3
2) Fertilizer 1/				228.0		228.0
- NPK	kg/ha	0.51	300	153.0	300	153
- Urea	kg/ha	0.50	150	75.0	150	75
- SA	kg/ha	0.22				
3) Agro-chemicals				34.2		34.2
- Dursban(insecticide)	lit/ha	13.5	1	13.5	1	13.5
- Furadan (Herbicide)	kg/ha	4.5	3	13.5	3	13.5
- Rodenticide	tube/ha	7.2	1	7.2	1	7.2
(2) Farm Machinery				***238***		***238***
- Plowing 2/	per ha	88	1	88	1	88
- Harrowing 2/	per ha	62	1	62	1	62
- Leveling	per ha					
- Harvesting	per ha					
- Others (carting, threshing, spray etc.)	ls	88	1	88	1	88
(3) Labour Requirement			124	***521***	124	***521***
- Family Labour (40%)	man-days	4.2	50	210	50	210
- Hired Labour (60%)	man-days	4.2	74	311	74	311
(4) Miscellaneous Expenses	5%			***52.6***		***52.6***
Total Production Costs	rounded			**1,104**		**1,104**
Net Return	rounded			**2,196** 67%		**2,196** 67%

1/: Assuming fertilizer subsidy will continue

2/: Prevailing machinery hiring services charge for land preparation

NDIS: Small-scale Farm (Direct Sowing)						
			Major Season		Minor Season	
Items	Unit	Unit Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			5.0		5.0
Unit Price	GHC/t			600		600
Gross Return	**GHC/t**			**3,000**		**3,000**
2. Production Cost						
(1) Farm Inputs				***372.2***		***372.2***
1) Seed	kg/ha	1.01	100	101	100	101
2) Fertilizer 1/				228.0		228.0
- NPK	kg/ha	0.51	300	153.0	300	153
- Urea	kg/ha	0.50	150	75.0	150	75
- SA	kg/ha	0.22				
3) Agro-chemicals				43.2		43.2
- Dursban (insecticide)	lit/ha	13.5	1	13.5	1	13.5
- Furadan (Herbicide)	kg/ha	4.5	5	22.5	5	22.5
- Rodenticide	tube/ha	7.2	1	7.2	1	7.2
(2) Farm Machinery				***380***		***380***
- Plowing 2/	per ha	88	1	88	1	88
- Harrowing 2/	per ha	62	2	124	2	124
- Leveling	per ha					
- Harvesting	per ha	88	1	88	1	88
- Others (carting, threshing, spray etc.)	ls		1	80	1	80
(3) Labour Requirement			78	***328***	78	***328***
- Family Labour (30%)	man-days	4.2	23	97	23	97
- Hired Labour (70%)	man-days	4.2	55	231	55	231
(4) Miscellaneous Expenses	5%			***54.0***		***54.0***
Total Production Costs	rounded			**1,134**		**1,134**
Net Return	rounded			**1,866** 62%		**1,866** 62%

1/: Assuming fertilizer subsidy will continue

2/: Prevailing machinery hiring services charge for land preparation

H-5 Economic Crop Budget per Ha of Rice under With Project Conditions: Medium-scale Farm & Large-scale Farm in NDIS

Medium-scale Farm 1/						
		Unit	Major Season		Minor Season	
Items	Unit	Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			5.5		5.5
Unit Price	GHC/t			600		600
Gross Return	**GHC/t**			**3,300**		**3,300**
2. Production Cost						
(1) Farm Inputs				***381.2***		***381.2***
1) Seed	kg/ha	1.01	100	101.0	100	101.0
2) Fertilizer 2/				228.0		228.0
- NPK	kg/ha	0.51	300	153.0	300	153.0
- Urea	kg/ha	0.50	150	75.0	150	75.0
- SA	kg/ha	0.22				
3) Agro-chemicals				52.2		52.2
- Dursban (insecticide)	lit/ha	13.5	1	13.5	1	13.5
- Furadan (Herbicide)	kg/ha	4.5	7	31.5	7	31.5
- Rodenticide	tube/ha	7.2	1	7.2	1	7.2
(2) Farm Machinery				***275***		***275***
- Plowing 3/	per ha	57	1	57	1	57
- Harrowing 3/	per ha	40	1	40	1	40
- Leveling	per ha					
- Harvesting 4/	per ha	88	1	88	1	88
- Others (carting, threshing, spray etc.)	ls		1	90	1	90
(3) Labour Requirement			43	***240***	43	***240***
- Field Manager (owner) 5/	GHC/ha		1	0	1	0
- Assistant Field Manager 6/	GHC/ha	68	1	68	1	68
- Hired Labour	mandays	4.2	41	172	41	172
(4) Miscellaneous Expenses	5%			***44.8***		***44.8***
Total Production Costs	rounded			**941**		**941**
Net Return	rounded			**2,359** 71%		**2,359** 71%

1/: Assuming farm size of 20ha

2/: Assuming fertilizer subsidy will continue

3/: Assuming land preparation carried out with own tractor

4/: Prevailing machinery hiring service charge for harvesting

5/: One manager assumed to be a owner operator

6/: One assistant manager; GHC 3,000/year for 20ha = GHC 75/ha/season x SCF 0.9

Large-scale Farm 1/						
		Unit	Major Season		Minor Season	
Items	Unit	Price (GHC)	Q'ty	Amount (GHC)	Q'ty	Amount (GHC)
1. Return						
Unit Yield	t/ha			6.0		6.0
Unit Price	GHC/t			600		600
Gross Return	**GHC/t**			**3,600**		**3,600**
2. Production Cost						
(1) Farm Inputs				***406.2***		***406.2***
1) Seed	kg/ha	1.01	100	101.0	100	101.0
2) Fertilizer 2/				253.0		253.0
- NPK	kg/ha	0.51	300	153.0	300	153.0
- Urea	kg/ha	0.50	200	100.0	200	100.0
- SA	kg/ha	0.22				
3) Agro-chemicals				52.2		52.2
- Dursban (insecticide)	lit/ha	13.5	1	13.5	1	13.5
- Furadan (Herbicide)	kg/ha	4.5	7	31.5	7	31.5
- Rodenticide	tube/ha	7.2	1	7.2	1	7.2
(2) Farm Machinery				***194***		***194***
- Plowing	per ha	35	1	35	1	35
- Harrowing	per ha	26	1	26	1	26
- Leveling	per ha					
- Sowing	per ha	13	1	13	1	13
- Harvesting	per ha	70	1	0	1	0
- Others (carting, spray etc.)	ls		1	120	1	120
(3) Labour Requirement			82	***169***	82	***169***
- Field Manager 3/	GHC/ha	16.2	1	16	1	16
- Assistant Field Manager 4/	GHC/ha	22.5	2	45	2	45
- Farm Labour 5/	GHC/ha	108	1	108	1	108
(4) Miscellaneous Expenses	5%			***38.5***		***38.5***
Total Production Costs	rounded			**808**		**808**
Net Return	rounded			**2,792** 78%		**2,792** 78%

1/: Assuming farm size of 200ha

2/: One manager; wage GHC 7,000/year for 200ha = GHC 18/ha/season x SCF 0.9

3/: Two assistant manager; wage GHC 5,000/year for 100ha = GHC 25/ha/season x SCF 0.9

4/: Assuming 20 farm labour for 200ha: wage GHC 2,400/year = GHC 120/ha/season x SCF 0.9

H-6 Economic NPV (Net Production Value) under Present Condition

1. KIS Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
KIS												
- Irrigated rice field/rice	1,852	1,274	4.7	1,545	1,968	1,440	4.0	1,147	1,652	2,714	1,955	3,620
- Grass land	448	-		-	-	-		-	-		522	234
Sub-total	2,300	1,274	4.7	-	1,968	1,440	4.0	-	1,652	2,714	1,676	3,854
Golden Exotics Farm		annual for banana										
- Banana farm/banana 1/	1,200	1,200	40	7,404	8,885	-	-	-	-	1,200	7,404	8,885
- Upland field 2/	600	600		404	242	180		4	1	780	405	243
Sub-total	1,800	1,800	-	-	9,127	180	-	-	1	1,980	5,071	9,128
Total	**4,100**	**3,074**	-	-	**11,096**	**1,620**	-	-	**1,652**	**4,694**	-	**12,982**

1/: Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 ≒ GHC 74,04 2/: Cassava, maize, pepper in major season & maize in minor season

2. New Developed Irrigation Scheme (NDIS)

2-1. No. 1 Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
No. 1 Area												
- Upland field 1/	1,420	1,420	-	404	574	426	-	4	2	1,846	405	575
- Grass land	1,200	-		-	-	-		-	-		522	626
Sub-total	2,620	1,420	-	-	574	426	-	-	-	1,846	459	1,202
Cassi Farm												
- Irrigated upland field 2/.	162	162				162				324		
Total	**2,782**	**1,582**	-	-	**574**	**588**	-	-	-	**2,170**	-	**1,202**

1/: Cassava, maize, pepper in major season & maize in minor season 2/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

2-2. No. 2 Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
No. 2 Area												
- Upland field 1/	1,889	1,889	-	404	763	567	-	4	2	2,456	405	765
- Grass land	1,362	-		-	-	-		-	-		522	711
Sub-total	3,251	1,889	-	-	763	567		-	2	2,456	454	1,476
Prairie Volta Farm 2/												
- Irrigated rice field /rice	490	490	4.0	1,200	588	490	4.0	1,200	588	980	2,400	1,176
- Upland field 1/	532	532		404	215	160		4	1	692	405	216
- Grass land	51	-	-	-	-	-	-	-	-	-	522	27
Sub-total	1,073	1,022	-	-	803	650	-	-	589	1,672	1,322	1,418
Total	**4,324**	**2,911**	-	-	**1,566**	**1,217**	-	-	**591**	**4,128**	-	**2,895**

1/: Cassava, maize, pepper in major season & maize in minor season 2/: Assuming: yield 4.0t/ha x GHC 600/t x net return rate 50% = GHC 1,200/ha/season

2-3. NDIS

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
No. 2 Area												
- Upland field 1/	3,841	3,841	-	404	1,552	1,153	-	4	5	4,994	405	1,556
- Grass land	2,613	-		-	-	-		-	-		522	1,364
Sub-total	6,454	3,841	-	-	1,552	1,153		-	5	4,994	452	2,920
Prairie Volta Farm 2/												
- Irrigated rice field /rice	490	490	4.0	1,200	588	490	4.0	1,200	588	980	2,400	1,176
Cassi Farm												
- Irrigated upland field	162	162				162				324		
Total	**7,106**	**4,493**	-	-	**2,140**	**1,805**	-	-	**593**	**6,298**	-	**4,096**

1/: Cassava, maize, pepper in major season & maize in minor season 2/: Assuming: yield 4.0t/ha x GHC 600/t x net return rate 50% = GHC 1,200/ha/season

4. Accra Plains Gravity Irrigation Project Area

Block/Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Minor Season Cropped Area (ha)	Yield (t/ha)	NPV/Ha (GHC)	NPV/Season (GHC000)	Annual Cropped Area (ha)	Average NPV/Ha/Year (GHC)	NPV/Block (GHC000)
- Irrigated rice field/rice 1/	1,852	1,274	4.7	1,545	1,968	1,440	4.0	1,147	1,652	2,714	1,955	3,620
- Irrigated rice field/rice 2/	490	490	4.0	1,200	588	490	4.0	1,200	588	980	2,400	1,176
- Banana farm/banana 3/	1,200	1,200	40	7,404	8,885	-	-	-	-	1,200	7,404	8,885
- Irrigated upland field 4/	162	162				162				324		
- Upland field 5/	4,441	4,441	-	404	1,794	1,333	-	4	5	5,774	405	1,799
- Grass land	3,061	-	-	-	-	-	-	-	-	-	522	1,598
Total	**11,206**	**7,567**	-	-	**13,235**	**3,425**	-	-	**2,245**	**10,992**	-	**17,078**

1/: KIS 2/: Prairie Volta Farm 3/: Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 ≒ GHC 7,404 4/: Cassi Farm; maize & soybeans

5/: Cassava, maize, pepper in major season & maize in minor season

H-7 Economic NPV (Net Production Value) under With-project Condition

1. KIS Area

Block/ Land Use Category/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC)	NPV/Year (GHC 000)
KIS												
Irrigated rice field/rice	2,300	2,300	5.5	2,196	5,051	2,300	5.5	2,196	5,051	4,600	4,392	10,102
Golden Exotic		Annual										
Banana farm/banana 1/	1,800	1,800	40	7,404	13,327		-	-	-	1,800	7,404	13,327
Total	**4,100**	**4,100**	-	-	**18,378**	**2,300**	-	-	**5,051**	**6,400**	-	**23,429**

Note: NPV = Net Production Value 1/: Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 = GHC 7,404/ha/year

2. New Developed Irrigation Scheme (NDIS)

2-1. No. 1 Area

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
No, 1 Area												
Irrigated rice field	2,538											
- Small-scale farm/rice	1,269	1,269	5.0	1,866	2,368	1,269	5.0	1,866	2,368	2,538	3,732	4,736
- Medium-scale farm/rice	381	381	5.5	2,359	899	381	5.5	2,359	899	762	4,718	1,798
- Large-scale farm/rice	888	888	6.0	2,792	2,479	888	6.0	2,792	2,479	1,776	5,584	4,959
Sub-total	2,538	2,538	-	-	5,746	2,538	-	-	5,746	5,076	4,528	11,492
Cassi Farm												
Irrigated upland field 1/	162	162				162				324	maize/soybeans	
Total	**2,700**	**2,700**	-	-	**5,746**	**2,700**	-	-	**5,746**	**5,400**	-	**11,492**

Note: NPV = Net Production Value 1/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

2-2. No. 2 Area

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
No, 2 Area												
Irrigated rice field	3,149											
- Small-scale farm/rice	1,575	1,575	5.0	1,866	2,939	1,575	5.0	1,866	2,939	3,150	3,732	5,878
- Medium-scale farm/rice	472	472	5.5	2,359	1,113	472	5.5	2,359	1,113	944	4,718	2,227
- Large-scale farm/rice	1,102	1,102	6.0	2,792	3,077	1,102	6.0	2,792	3,077	2,204	5,584	6,154
Sub-total	3,149	3,149	-	-	7,129	3,149	-	-	7,129	6,298	4,528	14,258
Prairie Volta Farm												
Irrigated rice field 1/	1,051											
- Rice		1,051	5.5	1,650	1,734	1,051	5.5	1,650	1,734	2,102	3,300	3,468
Total	**4,200**	**4,200**	-	-	**8,863**	**4,200**	-	-	**8,863**	**8,400**	-	**17,727**

Note: NPV = Net Production Value 1/: Assuming: yield 5.5t/ha x GHC 600/t x net return rate 50% = GHC 1,650/ha/season

2-3. NDIS

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
Irrigated rice field	5,687											
- Small-scale farm/rice	2,844	2,844	5.0	1,866	5,307	2,844	5.0	1,866	5,307	5,688	3,732	10,614
- Medium-scale farm/rice	853	853	5.5	2,359	2,012	853	5.5	2,359	2,012	1,706	4,718	4,024
- Large-scale farm/rice	1,990	1,990	6.0	2,792	5,556	1,990	6.0	2,792	5,556	3,980	5,584	11,112
Sub-total	5,687	5,687	-	-	12,875	5,687	-	-	12,875	11,374	4,528	25,750
Prairie Volta Farm												
Irrigated rice field 1/	1,051											
- Rice		1,051	5.5	1,650	1,734	1,051	5.5	1,650	1,734	2,102	3,300	3,468
Cassi Farm												
Irrigated upland field 1/	162	162				162				324	maize/soybeans	
Total	**6,900**	**6,900**	-	-	**14,609**	**6,900**	-	-	**14,609**	**13,800**	-	**29,219**

Note: NPV = Net Production Value 1/: Assuming: yield 5.5t/ha x GHC 600/t x net return rate 50% = GHC 1,650/ha/season

4. Accra Plains Gravity Irrigation Project

Block/ Land Use Category Farm/Crop	Area (ha)	Major Season Rice Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Minor Season Rice Cropped Area (ha)	Yield (ton/ha)	NPV/Ha (GHC 000)	NPV/Season (GHC 000)	Annual Cropped Area (ha)	NPV/Ha (GHC 000)	NPV/Year (GHC 000)
KIS/NDIS												
Irrigated rice field	7,987											
- KIS small-scale farm/rice	2,300	2,300	5.5	2,196	5,051	2,300	5.5	2,196	5,051	4,600	4,392	10,102
- Small-scale farm/rice	2,844	2,844	5.5	1,866	5,307	2,844	5.5	1,866	5,307	5,688	3,732	10,614
- Medium-scale farm/rice	853	853	5.5	2,359	2,012	853	5.5	2,359	2,012	1,706	4,718	4,024
- Large-scale farm/rice	1,990	1,990	6.0	2,792	5,556	1,990	6.0	2,792	5,556	3,980	5,584	11,112
Sub-total	7,987	7,987	-	-	17,926	7,987	-	-	17,926	15,974	4,489	35,852
Golden Exotic		Annual										
Banana farm/banana 1/	1,800	1,800	40	7,404	13,327				-	1,800	7,404	13,327
Cassi Farm (irrigated upland field)												
Irrigated upland field 2/	162	162				162				324		
Plairie Rice Farm												
Irrigated rice field/rice	1,051	1,051	5.5	1,650	1,734	1,051	5.5	1,650	1,734	2,102	3,300	3,468
Total	**11,000**	**11,000**	-	-	**32,987**	**9,200**	-	-	**19,660**	**20,200**	-	**52,648**

Note: NPV = Net Production Value 1/: Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 = GHC 7,404/ha/year

2/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

H-8 Economic Incremental NPV (Net Production Value) under With-project & Without-project Condition

1. KIS Area

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
KIS														
Irrigated rice field/rice	2,300	4,600	25,300	4,392	10,102	1,852	2,714	11,748	1,955	3,620	2,748	13,552	2,438	6,482
Grass land 1/						448			261	117	-	-	-	-117
Sub-total	2,300	4,600	25,300	4,392	10,102	2,300	2,714	11,748	2,216	3,737	2,748	13,552	2,767	6,365
Golden Exotics														
Banana farm/banana 2/	1,800	1,800	72,000	7,404	13,327	1,200	1,200	48,000	7,404	8,885	600	24,000	0	4,442
Upland field						600	780	1,566	405	243	-780	-1,566	-	-243
Sub-total	1,800	1,800	72,000	7,404	13,327	1,800	1,980	49,566	5,071	9,128	-180	22,434	2,333	4,199
KIS Area Total	**4,100**	**6,400**	**97,300**	**5,714**	**23,429**	**4,100**	**4,694**	**61,314**	**3,138**	**12,865**	**1,706**	**35,986**	**2,577**	**10,564.1**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 522 x 0.5 = GHC 261; negative benefit GHC261/ha
2/: Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 = GHC 7,404/ha/year

2. New Developed Irrigation Scheme (NDIS)

2-1. No. 1 Area

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
Irrigated rice field/rice														
Small-scale farm/rice	1,269	2,538	12,690	3,732	4,736						2,538	12,690	-	4,736
Medium-scale farm/rice	381	762	4,191	3,926	1,798						762	4,191	-	1,798
Large-scale farm/rice	888	1,776	10,656	5,584	4,959						1,776	10,656	-	4,959
Sub-total	2,538	5,076	27,537	4,528	11,493						5,076	27,537	4,528	11,493
Upland field						1,420	1,846	3,706	405	575	-1,846	-3706	-405	-575
Grass land 1/						1,200	-	-	261	313	-	-	-	-313
Sub-total						2,620	1,846	3,706	-	888	-1846	-3706	-	-313
Total	2,538	5,076	27,537	4,528	11,493	2,620	1,846	3,706	339	888	3,230	23,831	4,178	10,605
Cassi Farm 2/														
Irrigated upland field	162	324				162	324				0	0		0
No. 1 Area Total	**2,700**	**5,400**	**27,537**	**4,257**	**11,493**	**2,782**	**2,170**	**3,706**	**319**	**888**	**3,230**	**23,831**	**3,928**	**10,604.8**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 522 x 0.5 = GHC 261; negative benefit GHC261/ha
2/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

2-2. No. 2 Area

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
Irrigated rice field/rice														
Small-scale farm/rice	1,575	3,150	15,750	3,732	5,878						3,150	15,750	-	5,878
Medium-scale farm/rice	472	944	5,192	4,718	2,227						944	5,192	-	2,227
Large-scale farm/rice	1,102	2,204	13,224	5,584	6,154						2,204	13,224	-	6,154
Sub-total	3,149	6,298	34,166	4,528	14,259						6,298	34,166	4,528	14,259
Upland field						1,889	2,456	4,930	405	765	-2,456	-4930	-405	-765
Grass land 1/						1,362	-	-	261	355	-	-	-	-355.482
Sub-total						3,251	2,456	4,930	-	1,120	-2456	-4930	-	-355.482
Total	3,149	6,298	34,166	4,528	14,259	3,251	2,456	4,930	227	1,120	3,842	29,236	4,172	13,139
Prairie Volta Farm 2/														
Irrigated upland field	1,051	2,102	11,561	3,300	3,468	1,051	2,102	11,561	3,300	3,468	0	0	0	0
No. 2 Area Total	**4,200**	**8,400**	**45,727**	**4,221**	**17,727**	**4,302**	**4,558**	**16,491**	**3,527**	**4,588**	**3,842**	**29,236**	**4,172**	**13,138.5**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 522 x 0.5 = GHC 261; negative benefit GHC261/ha
2/: Assuming: yield 5.5t/ha x GHC 600/t x net return rate 50% = GHC 1,650/ha/season

2-3. NDIS

Block/ Land Use Category/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
Irrigated rice field/rice														
Small-scale farm/rice	2,844	5,688	28,440	3,732	10,614						5,688	28,440	-	10,614
Medium-scale farm/rice	853	1,706	9,383	4,719	4,025						1,706	9,383	-	4,025
Large-scale farm/rice	1,990	3,980	23,880	5,584	11,113						3,980	23,880	-	11,113
Sub-total	5,687	11,374	61,703	4,528	25,752						11,374	61,703	4,528	25,752
Upland field						3,309	4,302	8,636	405	1,340	-4,302	-8,636	-405	-1,340
Grass land 1/						2,562	-	-	261	669	-	-	-	-669
Sub-total						5,871	4,302	8,636	-	2,009	-4302	-8636	-	-669
Total	5,687	11,374	61,703	4,528	25,752	5,871	4,302	8,636	233	2,009	7,072	53,067	4,175	23,743
Prairie Volta Farm 2/														
Irrigated upland field	1,051	2,102	11,561	3,300	3,468	1,051	2,102	11,561	3,300	3,468	0	0	0	0
Cassi Farm 3/														
Irrigated upland field	162	324			0	162	324			0	0	0		0
NDIS Total	**6,900**	**13,800**	**73,264**	**-**	**29,220**	**7,084**	**6,728**	**20,197**	**-**	**5,477**	**7,072**	**53,067**	**-**	**23,743.3**

1/: Assumed that return from animal grazing will be reduced to half due to loss of grazing land due to the Project:: GHC 522 x 0.5 = GHC 261; negative benefit GHC261/ha
2/: Assuming: yield 5.5t/ha x GHC 600/t x net return rate 50% = GHC 1,650/ha/season 3/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm

4. Accra Plains Gravity Irrigation Project

Block/ Land Use Category Farm/Crop	With-project Area (ha)	With-project Cropped Area (ha)	With-project Production (ton)	With-project Annual NPV/Ha (GHC)	With-project Annual NPV (GHC 000)	With-out Project Area (ha)	With-out Project Cropped Area (ha)	With-out Project Production (ton)	With-out Project Annual NPV/Ha (GHC)	With-out Project Annual NPV (GHC 000)	Increment Cropped Area (ha)	Increment Production (ton)	Increment Annual NPV/Ha (GHC)	Increment Annual NPV (GHC 000)
KIS/NDIS														
Irrigated rice field														
- KIS small-scale farm/ric	2,300	4,600	25,300	4,392	10,102	1,852	2,714	11,748	1,955	3,620	1,886	13,552	-	6,482
- Small-scale farm/rice	2,844	5,688	28,440	3,732	10,614						5,688	28,440	-	10,614
- Medium-scale farm/rice	853	1,706	9,383	4,719	4,025						1,706	9,383	-	4,025
- Large-scale farm/rice	1,990	3,980	23,880	5,584	11,113						3,980	23,880	-	11,113
Sub-total	7,987	15,974	87,003	-	35,854	1,852	2,714	11,748	1,955	3,620	13,260	75,255	4,036	32,234
Upland field						3,909	5,082	10,202	405	1,583	-5,082	-10,202	-	-1,583
Grass land 1/						3,010	-	-	261	786	-	-	-	-786
Golden Exotic														
Banana farm/banana 2/	1,800	1,800	72,000	7,404	13,327	1,200	1,200	48,000	7,404	8,885	600	24,000	0	4,442
Prairie Rice Farm														
Irrigated rice field/rice	1,051	2,102	11,561	3,300	3,468	1,051	2,102	11,561	3,300	3,468	0	0		0
Cassi Farm (irrigated upland field)														
Irrigated upland field	162	324				162	324				0	0	-	
Total	**11,000**	**20,200**	**170,564**	**4,786**	**52,649**	**11,184**	**11,422**	**81,511**	**1,640**	**18,342**	**8,778**	**89,053**	**-**	**34,307.4**

1/: Maize & soybeans; accessibility to production & cost data limited because of newly established farm 2/: Assuming: farmgate price GHC 617/ton x yield 40 ton x net return ratio 0.3 = GHC 7,404/ha/year

H-9 Project Benefit Flow - 1/2

Unit: GHC 000

Year in Order	Year	Kpong Irrigation Scheme (KIS)										New Developed Irrigation Scheme (NDIS)																
		Financial Benefit					Economic Benefit					Financial Benefit									Economic Benefit								
		Benefit			Negative		Benefit			Negative		Benefit					Negative Benefit				Economic Benefit					Economic Negative Benefit			
		Irrigation/ Drainage	OMM Cost Saving	Total	Loss of Generated Power	Increment	Irrigation/ Drainage	OMM Cost Saving	Total	Loss of Generated Power	Increment	Irrigation/Drainage Benefit No.1 Area	Irrigation/Drainage Benefit No.2 Area	Irrigation/Drainage Benefit Total	Pumping Cost Saving	Pumping Cost Total	Product Forgone 1/	Loss of Generated Power	Total	Increment	Irrigation/Drainage Benefit No.1 Area	Irrigation/Drainage Benefit No.2 Area	Irrigation/Drainage Benefit Total	Pumping Cost Saving	Pumping Cost Total	Product Forgone 1/	Loss of Generated Power	Total	Increment
1	2013																											
2	2014																34.0		34.0	-34.0						16.9		16.9	-16.9
3	2015																79.3		79.3	-79.3						39.3		39.3	-39.3
4	2016	6,748.5	45.2	6,793.7	78.2	6,715.5	5,282.1	36.1	5,318.2	70.4	5,247.8	2,665.8		2,665.8		2,665.8	113.3	31.1	144.4	2,521.4	2,651.2		2,651.2		2,651.2	56.2	28.0	84.2	2,567.0
5	2017	10,122.8	45.2	10,168.0	78.2	10,089.8	7,923.1	36.1	7,959.2	70.4	7,888.8	5,331.5	5,921.6	11,253.1	626.4	11,879.5	113.3	155.6	268.9	11,610.6	5,302.4	5,912.3	11,214.7	458.2	11,672.9	56.2	140.0	196.2	11,476.7
6	2018	11,472.5	45.2	11,517.7	78.2	11,439.5	8,979.5	36.1	9,015.6	70.4	8,945.2	6,931.0	7,237.5	14,168.4	626.4	14,794.8	113.3	155.6	268.9	14,525.9	6,893.1	7,226.2	14,119.3	458.2	14,577.5	56.2	140.0	196.2	14,381.3
7	2019	12,147.3	45.2	12,192.5	78.2	12,114.3	9,507.7	36.1	9,543.8	70.4	9,473.4	7,997.3	9,211.3	17,208.6	626.4	17,835.0	113.3	155.6	268.9	17,566.1	7,953.6	9,197.0	17,150.6	458.2	17,608.8	56.2	140.0	196.2	17,412.6
8	2020	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	9,063.6	10,527.2	19,590.8	626.4	20,217.2	113.3	155.6	268.9	19,948.3	9,014.1	10,510.8	19,524.9	458.2	19,983.1	56.2	140.0	196.2	19,786.9
9	2021	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,129.9	11,843.1	21,973.0	626.4	22,599.4	113.3	155.6	268.9	22,330.5	10,074.6	11,824.7	21,899.2	458.2	22,357.4	56.2	140.0	196.2	22,161.2
10	2022	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
11	2023	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
12	2024	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
13	2025	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
14	2026	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
15	2027	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
16	2028	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
17	2029	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
18	2030	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
19	2031	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
20	2032	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
21	2033	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
22	2034	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
23	2035	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
24	2036	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
25	2037	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
26	2038	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
27	2039	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
28	2040	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
29	2041	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
30	2042	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
31	2043	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
32	2044	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
33	2045	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
34	2046	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
35	2047	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
36	2048	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
37	2049	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
38	2050	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
39	2051	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
40	2052	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
41	2053	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
42	2054	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
43	2055	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
44	2056	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
45	2057	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
46	2058	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
47	2059	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
48	2060	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
49	2061	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
50	2062	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3
51	2063	13,497.0	45.2	13,542.2	78.2	13,464.0	10,564.1	36.1	10,600.2	70.4	10,529.8	10,663.0	13,159.0	23,822.0	626.4	24,448.4	113.3	155.6	268.9	24,179.5	10,604.8	13,138.5	23,743.3	458.2	24,201.5	56.2	140.0	196.2	24,005.3

1/: Land converted to canals etc. (right-of-ways) out side of the Project Area

H-9 Project Benefit Flow - 2/2

Unit: GHC 000

Accra Plains Gravity Irrigation Project (APGIP)												
		Financial Benefit					Economic Benefit					
		Benefit					Benefit					
Year in Order	Year	Irrigation/ Drainage	OMM/ Pumping Cost Saving	Total	Negative Benefit Total	**Increment**	Irrigation/ Drainage	OMM/ Pumping Cost Saving	Total	Negative Benefit Total	**Increment**
1	2013	0	0	0	0	0	0	0	0	0	0
2	2014	0	0	0	34.0	-34.0	0	0	0	16.9	-16.9
3	2015	0	0	0	79.3	-79.3	0	0	0	39.3	-39.3
4	2016	9,414.3	45.2	9,459.5	222.6	9,236.9	7,933.3	36.1	7,969.4	154.6	7,814.8
5	2017	21,375.8	671.6	22,047.4	347.1	21,700.3	19,137.8	494.3	19,632.1	266.6	19,365.5
6	2018	25,640.9	671.6	26,312.5	347.1	25,965.4	23,098.8	494.3	23,593.1	266.6	23,326.5
7	2019	29,355.9	671.6	30,027.5	347.1	29,680.4	26,658.2	494.3	27,152.5	266.6	26,885.9
8	2020	33,087.8	671.6	33,759.4	347.1	33,412.3	30,089.0	494.3	30,583.3	266.6	30,316.7
9	2021	35,470.0	671.6	36,141.6	347.1	35,794.5	32,463.3	494.3	32,957.6	266.6	32,691.0
10	2022	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
11	2023	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
12	2024	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
13	2025	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
14	2026	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
15	2027	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
16	2028	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
17	2029	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
18	2030	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
19	2031	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
20	2032	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
21	2033	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
22	2034	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
23	2035	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
24	2036	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
25	2037	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
26	2038	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
27	2039	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
28	2040	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
29	2041	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
30	2042	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
31	2043	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
32	2044	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
33	2045	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
34	2046	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
35	2047	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
36	2048	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
37	2049	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
38	2050	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
39	2051	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
40	2052	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
41	2053	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
42	2054	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
43	2055	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
44	2056	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
45	2057	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
46	2058	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
47	2059	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
48	2060	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
49	2061	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
50	2062	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1
51	2063	37,319.0	671.6	37,990.6	347.1	37,643.5	34,307.4	494.3	34,801.7	266.6	34,535.1

H-10 Financial & Economic Costs & Disbursement Schedules

1. Kpong Irrigation Scheme (KIS)

Unit: GHC 000

Item	Year 2013 (1)	2014 (2)	2015 (3)	2016 (4)	Total	Remarks
Financial Cost						
I. Preparatory works	324.8				324.8	
II. Construction works						
1. Main irrigation canal construction		3,017.6	3,017.6		6,035.2	
2. Secondary canal construction		2,111.0	2,110.7		4,221.7	
3. Gate installation		290.8	290.8		581.6	
4. Drainage works		977.1			977.1	
5. Farm facilities		1,313.7			1,313.7	
6. Others		1,632.7	1,147.6		2,780.3	
Sub-total	**0**	**9,342.9**	**6,566.7**	**0**	**15,909.6**	
III. Procurement cost for O&M equipment		2,326.7			2,326.7	
IV. Administration		109.4	72.9		182.3	
V. Engineering services		182.4	91.1		273.5	
VI. Physical contingency		598.1	336.5		934.6	
VII. Price contingency		1,004.8	706.7		1,711.5	
Total	**324.8**	**13,564.3**	**7,773.9**	**0**	**21,663.0**	
Economic Cost						
I. Preparatory works	234.4				234.4	(financial cost - price contingency) x 0.765 1/
II. Construction works						financial cost x 0.765 1/
1. Main irrigation canal construction		2,308.5	2,308.5		4,616.9	
2. Secondary canal construction		1,614.9	1,614.7		3,229.6	
3. Gate installation		222.5	222.5		444.9	
4. Drainage works		747.5			747.5	
5. Farm facilities		1,005.0			1,005.0	
6. Others		1,249.0	877.9		2,126.9	
Sub-total	**0**	**7,147.3**	**5,023.5**	**0**	**12,170.8**	
III. Procurement cost for O&M equipment		2,094.0			2,094.0	financial cost x 0.9 2/
IV. Administration		83.7	55.8		139.5	financial cost x 0.765 1/
V. Engineering services		139.5	69.7		209.2	financial cost x 0.765 1/
VI. Physical contingency		457.5	257.4		715.0	financial cost x 0.765 1/
VII. Price contingency		0	0	0	0	excluded
Total	**234.4**	**9,922.1**	**5,406.4**	**0**	**15,562.9**	

	2013	2014	2015	2016	Total	
New Banana Farm Development (600ha)						
Financial Cost		6,034.5	12,069.0	6,034.5	24,138.0	US$27,000/ha 3/
Economic Cost		5,431.1	10,862.0	5,431.0	21,724.1	financial cost x 0.9 2/
Farm Machinery Cost						
Financial Cost			887,000.0		887,000.0	
Economic Cost			798,300.0		798,300.0	financial cost x 0.9 2/

2. New Developed Irrigation Scheme (NDIS)

Unit: GHC 000

Item	Year 2013 (1)	2014 (2)	2015 (3)	2016 (4)	Total	Remarks
Financial Cost						
I. Preparatory works	1,253.3				1,253.3	
II. Construction works						
1. Main irrigation canal construction		9,452.2	12,603.0	9,452.2	31,507.4	
2. Secondary canal construction		5,931.8	7,909.2	5,931.8	19,772.8	
3. Drainage works			361.8		361.8	
4. Land development		5,767.0	7,689.2	5,767.0	19,223.2	
5. Warehouse, building works		2,467.1			2,467.1	
6. Other Works		5,001.5	6,048.4	4,478.9	15,528.8	
Sub-total	**0**	**28,619.6**	**34,611.6**	**25,629.9**	**88,861.1**	
III. Procurement cost for O&M equipment			4,976.0		4,976.0	
IV. Administration		187.7	187.7	187.7	563.1	
V. Engineering services		469.2	469.1	469.2	1,407.5	
VI. Physical contingency		1,463.8	2,012.3	1,314.3	4,790.4	
VII. Price contingency		2,459.2	4,225.7	3,588.1	10,273.0	
Total	**1,253.3**	**33,199.5**	**46,482.4**	**31,189.2**	**112,124.4**	
Economic Cost						
I. Preparatory works	904.5				904.5	(financial cost - price contingency) x 0.765 1/
II. Construction works						financial cost x 0.765 1/
1. Main irrigation canal construction		7,230.9	9,641.3	7,230.9	24,103.2	
2. Secondary canal construction		4,537.8	6,050.5	4,537.8	15,126.2	
3. Drainage works			276.8		276.8	
4. Land development		4,411.8	5,882.2	4,411.8	14,705.7	
5. Warehouse, building works		1,887.3	0.0	0.0	1,887.3	
6. Other Works		3,826.1	4,627.0	3,426.4	11,879.5	
Sub-total	**0**	**21,894.0**	**26,477.9**	**19,606.9**	**67,978.7**	
III. Procurement cost for O&M equipment			4,478.4		4,478.4	financial cost x 0.9 2/
IV. Administration		143.6	143.6	143.6	430.8	financial cost x 0.765 1/
V. Engineering services		358.9	358.9	358.9	1,076.7	financial cost x 0.765 1/
VI. Physical contingency		1,119.8	1,539.4	1,005.4	3,664.7	financial cost x 0.765 1/
VII. Price contingency		0	0	0	0	excluded
Total	**904.5**	**23,516.3**	**32,998.1**	**21,114.8**	**78,533.8**	

1/: {Financial cost - VAT/NHIL 15%} x SCF 0.9 2/: Financial cost x SCF 0.9 3/: Source - Golden Exotics Ltd.

H-11 Project Cost Flow - 1/2

Unit: GHC 000

Year in Order	Year	Kpong Irrigation Scheme (KIS)																New Developed Irrigation Scheme (NDIS)								
		Financial Cost									Economic Cost							Financial Cost					Economic Cost			
		Initial Investment 1/				OMM Cost 2/					Initial Investment				OMM Cost 4/					OMM Cost					OMM Cost 4/			
		KIS Initial Investment	New Banana Farm	Farm Machinery	Sub-total	Annual OMM	KIS Repairing/ Replacement	Banana F. Repairing/ Replacement	Sub-total	Total	KIS Initial Investment	New Banana Farm	Farm Machinery 3/	Sub-total	Annual OMM	KIS Repairing/ Replacement	Banana F. Repairing/ Replacement	Sub-total	Total	Initial Investment	Annual OMM	Repairing/ Replacement	Sub-total	Total	Initial Investment	Annual OMM	Repairing/ Replacement	Sub-total	Total
1	2013	324.8			324.8					324.8	234.4			234.4					234.4	1,253.3				1,253.3	904.5				904.5
2	2014	13,564.3	6,034.5		19,598.8					19,598.8	10,914.2	5,431.1		16,345.3					16,345.3	33,199.5				33,199.5	25,867.9				25,867.9
3	2015	7,773.9	12,069.0	887.0	20,729.9					20,729.9	5,947.3	10,862.0	798.3	17,607.6					17,607.6	46,482.4				46,482.4	36,297.9				36,297.9
4	2016		6,034.5		6,034.5	375.5			375.5	6,410.0		5,431.0		5,431.0	300.4			300.4	5,731.4	31,189.2	279.9		279.9	31,469.1	23,226.3	223.9		223.9	23,450.2
5	2017					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
6	2018					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
7	2019					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
8	2020					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
9	2021					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
10	2022					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
11	2023					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
12	2024					375.5	2,326.7		2,702.2	2,702.2					300.4	2,094.0		2,394.4	2,394.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
13	2025					375.5	273.0	2,700.0	3,348.5	3,348.5					300.4	245.7	2,430.0	2,976.1	2,976.1		1,399.5	6,204.8	7,604.3	7,604.3		1,119.6	5,584.3	6,703.9	6,703.9
14	2026					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
15	2027					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
16	2028					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
17	2029					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
18	2030					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
19	2031					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
20	2032					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
21	2033					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
22	2034					375.5	2,326.7		2,702.2	2,702.2					300.4	2,094.0		2,394.4	2,394.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
23	2035					375.5	311.3	2,700.0	3,386.8	3,386.8					300.4	280.2	2,430.0	3,010.6	3,010.6		1,399.5	6,243.1	7,642.6	7,642.6		1,119.6	5,618.8	6,738.4	6,738.4
24	2036					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
25	2037					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
26	2038					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
27	2039					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
28	2040					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
29	2041					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
30	2042					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
31	2043					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
32	2044					375.5	2,326.7		2,702.2	2,702.2					300.4	2,094.0		2,394.4	2,394.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
33	2045					375.5	273.0	2,700.0	3,348.5	3,348.5					300.4	245.7	2,430.0	2,976.1	2,976.1		1,399.5	6,204.8	7,604.3	7,604.3		1,119.6	5,584.3	6,703.9	6,703.9
34	2046					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
35	2047					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
36	2048					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
37	2049					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
38	2050					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
39	2051					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
40	2052					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
41	2053					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
42	2054					375.5	2,326.7		2,702.2	2,702.2					300.4	2,094.0		2,394.4	2,394.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
43	2055					375.5	311.3	2,700.0	3,386.8	3,386.8					300.4	280.2	2,430.0	3,010.6	3,010.6		1,399.5	6,243.1	7,642.6	7,642.6		1,119.6	5,618.8	6,738.4	6,738.4
44	2056					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
45	2057					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
46	2058					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
47	2059					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
48	2060					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
49	2061					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
50	2062					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6
51	2063					375.5			375.5	375.5					300.4			300.4	300.4		1,399.5		1,399.5	1,399.5		1,119.6		1,119.6	1,119.6

1/: Banana farm costs: assumed based on information provided by Golden Exotics Ltc 2/: Banana Farm replacement cost GHC 4500/ha x 600ha = GHC 27,000, 3/: Financial cost x SCF (0.9) 4/: OMM cost :financial cost x CF (0.8); repairing & replacement cost : financial cost x SCF

H-11 Project Cost Flow - 2/2

Unit GHC 000

Accra Plains Gravity Irrigation Project (APGIP)							
		Financial Cost			Economic Cost		
Year in Order	Year	Initial Investment	Annual OMM/Repairing/ Replacement	Total	Initial Investment	Annual OMM/Repairing/ Replacement	Total
1	2013	1,578.1	0	1,578.1	1,138.9	0	1,138.9
2	2014	52,798.3	0	52,798.3	42,213.2	0	42,213.2
3	2015	67,212.3	0	67,212.3	53,905.5	0	53,905.5
4	2016	37,223.7	655.4	37,879.1	28,657.3	524.3	29,181.6
5	2017		1,775.0	1,775.0		1,420.0	1,420.0
6	2018		1,775.0	1,775.0		1,420.0	1,420.0
7	2019		1,775.0	1,775.0		1,420.0	1,420.0
8	2020		1,775.0	1,775.0		1,420.0	1,420.0
9	2021		1,775.0	1,775.0		1,420.0	1,420.0
10	2022		1,775.0	1,775.0		1,420.0	1,420.0
11	2023		1,775.0	1,775.0		1,420.0	1,420.0
12	2024		4,101.7	4,101.7		3,514.0	3,514.0
13	2025		10,952.8	10,952.8		9,680.0	9,680.0
14	2026		1,775.0	1,775.0		1,420.0	1,420.0
15	2027		1,775.0	1,775.0		1,420.0	1,420.0
16	2028		1,775.0	1,775.0		1,420.0	1,420.0
17	2029		1,775.0	1,775.0		1,420.0	1,420.0
18	2030		1,775.0	1,775.0		1,420.0	1,420.0
19	2031		1,775.0	1,775.0		1,420.0	1,420.0
20	2032		1,775.0	1,775.0		1,420.0	1,420.0
21	2033		1,775.0	1,775.0		1,420.0	1,420.0
22	2034		4,101.7	4,101.7		3,514.0	3,514.0
23	2035		11,029.4	11,029.4		9,749.0	9,749.0
24	2036		1,775.0	1,775.0		1,420.0	1,420.0
25	2037		1,775.0	1,775.0		1,420.0	1,420.0
26	2038		1,775.0	1,775.0		1,420.0	1,420.0
27	2039		1,775.0	1,775.0		1,420.0	1,420.0
28	2040		1,775.0	1,775.0		1,420.0	1,420.0
29	2041		1,775.0	1,775.0		1,420.0	1,420.0
30	2042		1,775.0	1,775.0		1,420.0	1,420.0
31	2043		1,775.0	1,775.0		1,420.0	1,420.0
32	2044		4,101.7	4,101.7		3,514.0	3,514.0
33	2045		10,952.8	10,952.8		9,680.0	9,680.0
34	2046		1,775.0	1,775.0		1,420.0	1,420.0
35	2047		1,775.0	1,775.0		1,420.0	1,420.0
36	2048		1,775.0	1,775.0		1,420.0	1,420.0
37	2049		1,775.0	1,775.0		1,420.0	1,420.0
38	2050		1,775.0	1,775.0		1,420.0	1,420.0
39	2051		1,775.0	1,775.0		1,420.0	1,420.0
40	2052		1,775.0	1,775.0		1,420.0	1,420.0
41	2053		1,775.0	1,775.0		1,420.0	1,420.0
42	2054		4,101.7	4,101.7		3,514.0	3,514.0
43	2055		11,029.4	11,029.4		9,749.0	9,749.0
44	2056		1,775.0	1,775.0		1,420.0	1,420.0
45	2057		1,775.0	1,775.0		1,420.0	1,420.0
46	2058		1,775.0	1,775.0		1,420.0	1,420.0
47	2059		1,775.0	1,775.0		1,420.0	1,420.0
48	2060		1,775.0	1,775.0		1,420.0	1,420.0
49	2061		1,775.0	1,775.0		1,420.0	1,420.0
50	2062		1,775.0	1,775.0		1,420.0	1,420.0
51	2063		1,775.0	1,775.0		1,420.0	1,420.0

H-12 Economic Evaluation of Proposed Project

Normal

Unit: GHC Thousand

EIRR	20.8 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		24,318	56,050	31,733	1.8

Kpong Irrigation Scheme (KIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/ Initial Investment	Annual OMM 1/	Total	Project Benefit 2/	Net Cash Flow
1	2013	234.4		234.4	0	-234.4
2	2014	15,353.1		15,353.1	0	-15,353.1
3	2015	17,066.9		17,066.9	0	-17,067
4	2016	5,431.0	300.4	5,731.4	5,247.8	-484
5	2017		300.4	300.4	7,888.8	7,588
6	2018		300.4	300.4	8,945.2	8,645
7	2019		300.4	300.4	9,473.4	9,173.0
8	2020		300.4	300.4	10,529.8	10,229.4
9	2021		300.4	300.4	10,529.8	10,229.4
10	2022		300.4	300.4	10,529.8	10,229.4
11	2023		300.4	300.4	10,529.8	10,229.4
12	2024		2,702.2	2,702.2	10,529.8	7,827.6
13	2025		3,348.5	3,348.5	10,529.8	7,181.3
14	2026		300.4	300.4	10,529.8	10,229.4
15	2027		300.4	300.4	10,529.8	10,229.4
16	2028		300.4	300.4	10,529.8	10,229.4
17	2029		300.4	300.4	10,529.8	10,229.4
18	2030		300.4	300.4	10,529.8	10,229.4
19	2031		300.4	300.4	10,529.8	10,229.4
20	2032		300.4	300.4	10,529.8	10,229.4
21	2033		300.4	300.4	10,529.8	10,229.4
22	2034		2,702.2	2,702.2	10,529.8	7,827.6
23	2035		3,386.8	3,386.8	10,529.8	7,143.0
24	2036		300.4	300.4	10,529.8	10,229.4
25	2037		300.4	300.4	10,529.8	10,229.4
26	2038		300.4	300.4	10,529.8	10,229.4
27	2039		300.4	300.4	10,529.8	10,229.4
28	2040		300.4	300.4	10,529.8	10,229.4
29	2041		300.4	300.4	10,529.8	10,229.4
30	2042		300.4	300.4	10,529.8	10,229.4
31	2043		300.4	300.4	10,529.8	10,229.4
32	2044		2,702.2	2,702.2	10,529.8	7,827.6
33	2045		3,348.5	3,348.5	10,529.8	7,181.3
34	2046		229.3	229.3	10,529.8	10,300.5
35	2047		229.3	229.3	10,529.8	10,300.5
36	2048		229.3	229.3	10,529.8	10,300.5
37	2049		229.3	229.3	10,529.8	10,300.5
38	2050		229.3	229.3	10,529.8	10,300.5
39	2051		229.3	229.3	10,529.8	10,300.5
40	2052		229.3	229.3	10,529.8	10,300.5
41	2053		229.3	229.3	10,529.8	10,300.5
42	2054		2,702.2	2,702.2	10,529.8	7,827.6
43	2055		3,386.8	3,386.8	10,529.8	7,143.0
44	2056		229.3	229.3	10,529.8	10,300.5
45	2057		229.3	229.3	10,529.8	10,300.5
46	2058		229.3	229.3	10,529.8	10,300.5
47	2059		229.3	229.3	10,529.8	10,300.5
48	2060		229.3	229.3	10,529.8	10,300.5
49	2061		229.3	229.3	10,529.8	10,300.5
50	2062		229.3	229.3	10,529.8	10,300.5
51	2063		229.3	229.3	10,529.8	10,300.5

Normal

Unit: GHC Thousand

EIRR	19.3 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		46,394	110,768	64,374	1.7

New Developed Irrigation Scheme (NDIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/ Initial Investment	Annual OMM 1/	Total	Project Benefit 2/	Net Cash Flow
1	2013	904.5		904.5	0	-904.5
2	2014	23,516.3		23,516.3	-16.9	-23,533.2
3	2015	32,998.1		32,998.1	-39.3	-33,037.4
4	2016	21,114.8	223.9	21,338.7	2,567.0	-18,771.7
5	2017		1,119.6	1,119.6	11,476.7	10,357.1
6	2018		1,119.6	1,119.6	14,381.3	13,261.7
7	2019		1,119.6	1,119.6	17,412.6	16,293.0
8	2020		1,119.6	1,119.6	19,786.9	18,667.3
9	2021		1,119.6	1,119.6	22,161.2	21,041.6
10	2022		1,119.6	1,119.6	24,005.3	22,885.7
11	2023		1,119.6	1,119.6	24,005.3	22,885.7
12	2024		1,119.6	1,119.6	24,005.3	22,885.7
13	2025		6,703.9	6,703.9	24,005.3	17,301.4
14	2026		1,119.6	1,119.6	24,005.3	22,885.7
15	2027		1,119.6	1,119.6	24,005.3	22,885.7
16	2028		1,119.6	1,119.6	24,005.3	22,885.7
17	2029		1,119.6	1,119.6	24,005.3	22,885.7
18	2030		1,119.6	1,119.6	24,005.3	22,885.7
19	2031		1,119.6	1,119.6	24,005.3	22,885.7
20	2032		1,119.6	1,119.6	24,005.3	22,885.7
21	2033		1,119.6	1,119.6	24,005.3	22,885.7
22	2034		1,119.6	1,119.6	24,005.3	22,885.7
23	2035		6,738.4	6,738.4	24,005.3	17,266.9
24	2036		1,119.6	1,119.6	24,005.3	22,885.7
25	2037		1,119.6	1,119.6	24,005.3	22,885.7
26	2038		1,119.6	1,119.6	24,005.3	22,885.7
27	2039		1,119.6	1,119.6	24,005.3	22,885.7
28	2040		1,119.6	1,119.6	24,005.3	22,885.7
29	2041		1,119.6	1,119.6	24,005.3	22,885.7
30	2042		1,119.6	1,119.6	24,005.3	22,885.7
31	2043		1,119.6	1,119.6	24,005.3	22,885.7
32	2044		1,119.6	1,119.6	24,005.3	22,885.7
33	2045		6,703.9	6,703.9	24,005.3	17,301.4
34	2046		1,119.6	1,119.6	24,005.3	22,885.7
35	2047		1,119.6	1,119.6	24,005.3	22,885.7
36	2048		1,119.6	1,119.6	24,005.3	22,885.7
37	2049		1,119.6	1,119.6	24,005.3	22,885.7
38	2050		1,119.6	1,119.6	24,005.3	22,885.7
39	2051		1,119.6	1,119.6	24,005.3	22,885.7
40	2052		1,119.6	1,119.6	24,005.3	22,885.7
41	2053		1,119.6	1,119.6	24,005.3	22,885.7
42	2054		1,119.6	1,119.6	24,005.3	22,885.7
43	2055		6,738.4	6,738.4	24,005.3	17,266.9
44	2056		1,119.6	1,119.6	24,005.3	22,885.7
45	2057		1,119.6	1,119.6	24,005.3	22,885.7
46	2058		1,119.6	1,119.6	24,005.3	22,885.7
47	2059		1,119.6	1,119.6	24,005.3	22,885.7
48	2060		1,119.6	1,119.6	24,005.3	22,885.7
49	2061		1,119.6	1,119.6	24,005.3	22,885.7
50	2062		1,119.6	1,119.6	24,005.3	22,885.7
51	2063		1,119.6	1,119.6	24,005.3	22,885.7

Normal

Unit: GHC Thousand

EIRR	19.8 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		70,712	166,818	96,107	1.7

Accra Plains Gravity Irrigation Project (APGIP)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/ Initial Investment	Annual OMM 1/	Total	Project Benefit 2/	Net Cash Flow
1	2013	1,138.9	0	1,138.9	0	-1,138.9
2	2014	38,869.4	0	38,869.4	-16.9	-38,886.3
3	2015	50,065.0	0	50,065.0	-39.3	-50,104.3
4	2016	26,545.8	524.3	27,070.1	7,814.8	-19,255.3
5	2017		1,420.0	1,420.0	19,365.5	17,945.5
6	2018		1,420.0	1,420.0	23,326.5	21,906.5
7	2019		1,420.0	1,420.0	26,886.0	25,466.0
8	2020		1,420.0	1,420.0	30,316.7	28,896.7
9	2021		1,420.0	1,420.0	32,691.0	31,271.0
10	2022		1,420.0	1,420.0	34,535.1	33,115.1
11	2023		1,420.0	1,420.0	34,535.1	33,115.1
12	2024		3,821.8	3,821.8	34,535.1	30,713.3
13	2025		10,052.4	10,052.4	34,535.1	24,482.7
14	2026		1,420.0	1,420.0	34,535.1	33,115.1
15	2027		1,420.0	1,420.0	34,535.1	33,115.1
16	2028		1,420.0	1,420.0	34,535.1	33,115.1
17	2029		1,420.0	1,420.0	34,535.1	33,115.1
18	2030		1,420.0	1,420.0	34,535.1	33,115.1
19	2031		1,420.0	1,420.0	34,535.1	33,115.1
20	2032		1,420.0	1,420.0	34,535.1	33,115.1
21	2033		1,420.0	1,420.0	34,535.1	33,115.1
22	2034		3,821.8	3,821.8	34,535.1	30,713.3
23	2035		10,125.2	10,125.2	34,535.1	24,409.9
24	2036		1,420.0	1,420.0	34,535.1	33,115.1
25	2037		1,420.0	1,420.0	34,535.1	33,115.1
26	2038		1,420.0	1,420.0	34,535.1	33,115.1
27	2039		1,420.0	1,420.0	34,535.1	33,115.1
28	2040		1,420.0	1,420.0	34,535.1	33,115.1
29	2041		1,420.0	1,420.0	34,535.1	33,115.1
30	2042		1,420.0	1,420.0	34,535.1	33,115.1
31	2043		1,420.0	1,420.0	34,535.1	33,115.1
32	2044		3,821.8	3,821.8	34,535.1	30,713.3
33	2045		10,052.4	10,052.4	34,535.1	24,482.7
34	2046		1,348.9	1,348.9	34,535.1	33,186.2
35	2047		1,348.9	1,348.9	34,535.1	33,186.2
36	2048		1,348.9	1,348.9	34,535.1	33,186.2
37	2049		1,348.9	1,348.9	34,535.1	33,186.2
38	2050		1,348.9	1,348.9	34,535.1	33,186.2
39	2051		1,348.9	1,348.9	34,535.1	33,186.2
40	2052		1,348.9	1,348.9	34,535.1	33,186.2
41	2053		1,348.9	1,348.9	34,535.1	33,186.2
42	2054		3,821.8	3,821.8	34,535.1	30,713.3
43	2055		10,125.2	10,125.2	34,535.1	24,409.9
44	2056		1,348.9	1,348.9	34,535.1	33,186.2
45	2057		1,348.9	1,348.9	34,535.1	33,186.2
46	2058		1,348.9	1,348.9	34,535.1	33,186.2
47	2059		1,348.9	1,348.9	34,535.1	33,186.2
48	2060		1,348.9	1,348.9	34,535.1	33,186.2
49	2061		1,348.9	1,348.9	34,535.1	33,186.2
50	2062		1,348.9	1,348.9	34,535.1	33,186.2
51	2063		1,348.9	1,348.9	34,535.1	33,186.2

H-13 Sensitivity Analysis - Case 1

Case 1: Construction cost 10% up

Unit: GHC Thousand

EIRR	20.1 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		23,142	56,050	32,909	1.7

Kpong Irrigation Scheme (KIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	234.4		234.4	0	-234.4
2	2014	16,345.3		16,345.3	0	-16,345.3
3	2015	17,607.6		17,607.6	0	-17,608
4	2016	5,431.0	300.4	5,731.4	5,247.8	-483.6
5	2017		300.4	300.4	7,888.8	7,588.4
6	2018		300.4	300.4	8,945.2	8,644.8
7	2019		300.4	300.4	9,473.4	9,173.0
8	2020		300.4	300.4	10,529.8	10,229.4
9	2021		300.4	300.4	10,529.8	10,229.4
10	2022		300.4	300.4	10,529.8	10,229.4
11	2023		300.4	300.4	10,529.8	10,229.4
12	2024		2,702.2	2,702.2	10,529.8	7,827.6
13	2025		3,348.5	3,348.5	10,529.8	7,181.3
14	2026		300.4	300.4	10,529.8	10,229.4
15	2027		300.4	300.4	10,529.8	10,229.4
16	2028		300.4	300.4	10,529.8	10,229.4
17	2029		300.4	300.4	10,529.8	10,229.4
18	2030		300.4	300.4	10,529.8	10,229.4
19	2031		300.4	300.4	10,529.8	10,229.4
20	2032		300.4	300.4	10,529.8	10,229.4
21	2033		300.4	300.4	10,529.8	10,229.4
22	2034		2,702.2	2,702.2	10,529.8	7,827.6
23	2035		3,386.8	3,386.8	10,529.8	7,143.0
24	2036		300.4	300.4	10,529.8	10,229.4
25	2037		300.4	300.4	10,529.8	10,229.4
26	2038		300.4	300.4	10,529.8	10,229.4
27	2039		300.4	300.4	10,529.8	10,229.4
28	2040		300.4	300.4	10,529.8	10,229.4
29	2041		300.4	300.4	10,529.8	10,229.4
30	2042		300.4	300.4	10,529.8	10,229.4
31	2043		300.4	300.4	10,529.8	10,229.4
32	2044		2,702.2	2,702.2	10,529.8	7,827.6
33	2045		3,348.5	3,348.5	10,529.8	7,181.3
34	2046		229.3	229.3	10,529.8	10,300.5
35	2047		229.3	229.3	10,529.8	10,300.5
36	2048		229.3	229.3	10,529.8	10,300.5
37	2049		229.3	229.3	10,529.8	10,300.5
38	2050		229.3	229.3	10,529.8	10,300.5
39	2051		229.3	229.3	10,529.8	10,300.5
40	2052		229.3	229.3	10,529.8	10,300.5
41	2053		229.3	229.3	10,529.8	10,300.5
42	2054		2,702.2	2,702.2	10,529.8	7,827.6
43	2055		3,386.8	3,386.8	10,529.8	7,143.0
44	2056		229.3	229.3	10,529.8	10,300.5
45	2057		229.3	229.3	10,529.8	10,300.5
46	2058		229.3	229.3	10,529.8	10,300.5
47	2059		229.3	229.3	10,529.8	10,300.5
48	2060		229.3	229.3	10,529.8	10,300.5
49	2061		229.3	229.3	10,529.8	10,300.5
50	2062		229.3	229.3	10,529.8	10,300.5
51	2063		229.3	229.3	10,529.8	10,300.5

1/: Including annual OMM cost, repairing & replacement costs details are presented in Annex H-11

Case 1: Construction cost 10% up

Unit: GHC Thousand

EIRR	17.9 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		40,686	110,768	70,081	1.6

New Developed Irrigation Scheme (NDIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	904.5		904.5	0	-904.5
2	2014	25,867.9		25,867.9	-16.9	-25,884.8
3	2015	36,297.9		36,297.9	-39.3	-36,337.2
4	2016	23,450.2	223.9	23,674.1	2,567.0	-21,107.1
5	2017		1,119.6	1,119.6	11,476.7	10,357.1
6	2018		1,119.6	1,119.6	14,381.3	13,261.7
7	2019		1,119.6	1,119.6	17,412.6	16,293.0
8	2020		1,119.6	1,119.6	19,786.9	18,667.3
9	2021		1,119.6	1,119.6	22,161.2	21,041.6
10	2022		1,119.6	1,119.6	24,005.3	22,885.7
11	2023		1,119.6	1,119.6	24,005.3	22,885.7
12	2024		1,119.6	1,119.6	24,005.3	22,885.7
13	2025		6,703.9	6,703.9	24,005.3	17,301.4
14	2026		1,119.6	1,119.6	24,005.3	22,885.7
15	2027		1,119.6	1,119.6	24,005.3	22,885.7
16	2028		1,119.6	1,119.6	24,005.3	22,885.7
17	2029		1,119.6	1,119.6	24,005.3	22,885.7
18	2030		1,119.6	1,119.6	24,005.3	22,885.7
19	2031		1,119.6	1,119.6	24,005.3	22,885.7
20	2032		1,119.6	1,119.6	24,005.3	22,885.7
21	2033		1,119.6	1,119.6	24,005.3	22,885.7
22	2034		1,119.6	1,119.6	24,005.3	22,885.7
23	2035		6,738.4	6,738.4	24,005.3	17,266.9
24	2036		1,119.6	1,119.6	24,005.3	22,885.7
25	2037		1,119.6	1,119.6	24,005.3	22,885.7
26	2038		1,119.6	1,119.6	24,005.3	22,885.7
27	2039		1,119.6	1,119.6	24,005.3	22,885.7
28	2040		1,119.6	1,119.6	24,005.3	22,885.7
29	2041		1,119.6	1,119.6	24,005.3	22,885.7
30	2042		1,119.6	1,119.6	24,005.3	22,885.7
31	2043		1,119.6	1,119.6	24,005.3	22,885.7
32	2044		1,119.6	1,119.6	24,005.3	22,885.7
33	2045		6,703.9	6,703.9	24,005.3	17,301.4
34	2046		1,119.6	1,119.6	24,005.3	22,885.7
35	2047		1,119.6	1,119.6	24,005.3	22,885.7
36	2048		1,119.6	1,119.6	24,005.3	22,885.7
37	2049		1,119.6	1,119.6	24,005.3	22,885.7
38	2050		1,119.6	1,119.6	24,005.3	22,885.7
39	2051		1,119.6	1,119.6	24,005.3	22,885.7
40	2052		1,119.6	1,119.6	24,005.3	22,885.7
41	2053		1,119.6	1,119.6	24,005.3	22,885.7
42	2054		1,119.6	1,119.6	24,005.3	22,885.7
43	2055		6,738.4	6,738.4	24,005.3	17,266.9
44	2056		1,119.6	1,119.6	24,005.3	22,885.7
45	2057		1,119.6	1,119.6	24,005.3	22,885.7
46	2058		1,119.6	1,119.6	24,005.3	22,885.7
47	2059		1,119.6	1,119.6	24,005.3	22,885.7
48	2060		1,119.6	1,119.6	24,005.3	22,885.7
49	2061		1,119.6	1,119.6	24,005.3	22,885.7
50	2062		1,119.6	1,119.6	24,005.3	22,885.7
51	2063		1,119.6	1,119.6	24,005.3	22,885.7

2/: Details are presented in Annex H-9

Case 1: Construction cost 10% up

Unit: GHC Thousand

EIRR	18.6 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		63,828	166,818	102,990	1.6

Accra Plains Gravity Irrigation Project (APGIP)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	1,138.9	0	1,138.9	0	-1,138.9
2	2014	42,213.2	0	42,213.2	-16.9	-42,230.1
3	2015	53,905.5	0	53,905.5	-39.3	-53,944.8
4	2016	28,881.2	524.3	29,405.5	7,814.8	-21,590.7
5	2017		1,420.0	1,420.0	19,365.5	17,945.5
6	2018		1,420.0	1,420.0	23,326.5	21,906.5
7	2019		1,420.0	1,420.0	26,886.0	25,466.0
8	2020		1,420.0	1,420.0	30,316.7	28,896.7
9	2021		1,420.0	1,420.0	32,691.0	31,271.0
10	2022		1,420.0	1,420.0	34,535.1	33,115.1
11	2023		1,420.0	1,420.0	34,535.1	33,115.1
12	2024		3,821.8	3,821.8	34,535.1	30,713.3
13	2025		10,052.4	10,052.4	34,535.1	24,482.7
14	2026		1,420.0	1,420.0	34,535.1	33,115.1
15	2027		1,420.0	1,420.0	34,535.1	33,115.1
16	2028		1,420.0	1,420.0	34,535.1	33,115.1
17	2029		1,420.0	1,420.0	34,535.1	33,115.1
18	2030		1,420.0	1,420.0	34,535.1	33,115.1
19	2031		1,420.0	1,420.0	34,535.1	33,115.1
20	2032		1,420.0	1,420.0	34,535.1	33,115.1
21	2033		1,420.0	1,420.0	34,535.1	33,115.1
22	2034		3,821.8	3,821.8	34,535.1	30,713.3
23	2035		10,125.2	10,125.2	34,535.1	24,409.9
24	2036		1,420.0	1,420.0	34,535.1	33,115.1
25	2037		1,420.0	1,420.0	34,535.1	33,115.1
26	2038		1,420.0	1,420.0	34,535.1	33,115.1
27	2039		1,420.0	1,420.0	34,535.1	33,115.1
28	2040		1,420.0	1,420.0	34,535.1	33,115.1
29	2041		1,420.0	1,420.0	34,535.1	33,115.1
30	2042		1,420.0	1,420.0	34,535.1	33,115.1
31	2043		1,420.0	1,420.0	34,535.1	33,115.1
32	2044		3,821.8	3,821.8	34,535.1	30,713.3
33	2045		10,052.4	10,052.4	34,535.1	24,482.7
34	2046		1,348.9	1,348.9	34,535.1	33,186.2
35	2047		1,348.9	1,348.9	34,535.1	33,186.2
36	2048		1,348.9	1,348.9	34,535.1	33,186.2
37	2049		1,348.9	1,348.9	34,535.1	33,186.2
38	2050		1,348.9	1,348.9	34,535.1	33,186.2
39	2051		1,348.9	1,348.9	34,535.1	33,186.2
40	2052		1,348.9	1,348.9	34,535.1	33,186.2
41	2053		1,348.9	1,348.9	34,535.1	33,186.2
42	2054		3,821.8	3,821.8	34,535.1	30,713.3
43	2055		10,125.2	10,125.2	34,535.1	24,409.9
44	2056		1,348.9	1,348.9	34,535.1	33,186.2
45	2057		1,348.9	1,348.9	34,535.1	33,186.2
46	2058		1,348.9	1,348.9	34,535.1	33,186.2
47	2059		1,348.9	1,348.9	34,535.1	33,186.2
48	2060		1,348.9	1,348.9	34,535.1	33,186.2
49	2061		1,348.9	1,348.9	34,535.1	33,186.2
50	2062		1,348.9	1,348.9	34,535.1	33,186.2
51	2063		1,348.9	1,348.9	34,535.1	33,186.2

H-14 Sensitivity Analysis - Case 2

Case 2: Irrigation & drainage benefit (crop production benefit) 10% down

Unit: GHC Thousand

EIRR	18.9 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		18,692	50,425	31,733	1.6

Kpong Irrigation Scheme (KIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/ Initial Investment	Annual OMM 1/	Total	Project Benefit 2/	Net Cash Flow
1	2013	234.4		234.4	0	-234.4
2	2014	15,353.1		15,353.1	0	-15,353.1
3	2015	17,066.9		17,066.9	0	-17,067
4	2016	5,431.0	300.4	5,731.4	4,719.6	-1,012
5	2017		300.4	300.4	7,096.5	6,796
6	2018		300.4	300.4	8,047.2	7,747
7	2019		300.4	300.4	8,522.6	8,222.2
8	2020		300.4	300.4	9,473.4	9,173.0
9	2021		300.4	300.4	9,473.4	9,173.0
10	2022		300.4	300.4	9,473.4	9,173.0
11	2023		300.4	300.4	9,473.4	9,173.0
12	2024		2,702.2	2,702.2	9,473.4	6,771.2
13	2025		3,348.5	3,348.5	9,473.4	6,124.9
14	2026		300.4	300.4	9,473.4	9,173.0
15	2027		300.4	300.4	9,473.4	9,173.0
16	2028		300.4	300.4	9,473.4	9,173.0
17	2029		300.4	300.4	9,473.4	9,173.0
18	2030		300.4	300.4	9,473.4	9,173.0
19	2031		300.4	300.4	9,473.4	9,173.0
20	2032		300.4	300.4	9,473.4	9,173.0
21	2033		300.4	300.4	9,473.4	9,173.0
22	2034		2,702.2	2,702.2	9,473.4	6,771.2
23	2035		3,386.8	3,386.8	9,473.4	6,086.6
24	2036		300.4	300.4	9,473.4	9,173.0
25	2037		300.4	300.4	9,473.4	9,173.0
26	2038		300.4	300.4	9,473.4	9,173.0
27	2039		300.4	300.4	9,473.4	9,173.0
28	2040		300.4	300.4	9,473.4	9,173.0
29	2041		300.4	300.4	9,473.4	9,173.0
30	2042		300.4	300.4	9,473.4	9,173.0
31	2043		300.4	300.4	9,473.4	9,173.0
32	2044		2,702.2	2,702.2	9,473.4	6,771.2
33	2045		3,348.5	3,348.5	9,473.4	6,124.9
34	2046		229.3	229.3	9,473.4	9,244.1
35	2047		229.3	229.3	9,473.4	9,244.1
36	2048		229.3	229.3	9,473.4	9,244.1
37	2049		229.3	229.3	9,473.4	9,244.1
38	2050		229.3	229.3	9,473.4	9,244.1
39	2051		229.3	229.3	9,473.4	9,244.1
40	2052		229.3	229.3	9,473.4	9,244.1
41	2053		229.3	229.3	9,473.4	9,244.1
42	2054		2,702.2	2,702.2	9,473.4	6,771.2
43	2055		3,386.8	3,386.8	9,473.4	6,086.6
44	2056		229.3	229.3	9,473.4	9,244.1
45	2057		229.3	229.3	9,473.4	9,244.1
46	2058		229.3	229.3	9,473.4	9,244.1
47	2059		229.3	229.3	9,473.4	9,244.1
48	2060		229.3	229.3	9,473.4	9,244.1
49	2061		229.3	229.3	9,473.4	9,244.1
50	2062		229.3	229.3	9,473.4	9,244.1
51	2063		229.3	229.3	9,473.4	9,244.1

1/: Including annual OMM cost, repairing & replacement costs details are presented in Annex H-11

Case 2: Irrigation & drainage benefit (crop production benefit) 10% down

Unit: GHC Thousand

EIRR	17.7 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		35,446	99,820	64,374	1.6

New Developed Irrigation Scheme (NDIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/ Initial Investment	Annual OMM 1/	Total	Project Benefit 2/	Net Cash Flow
1	2013	904.5		904.5	0	-904.5
2	2014	23,516.3		23,516.3	-16.9	-23,533.2
3	2015	32,998.1		32,998.1	-39.3	-33,037.4
4	2016	21,114.8	223.9	21,338.7	2,301.9	-19,036.8
5	2017		1,119.6	1,119.6	10,355.3	9,235.7
6	2018		1,119.6	1,119.6	12,969.4	11,849.8
7	2019		1,119.6	1,119.6	15,697.5	14,577.9
8	2020		1,119.6	1,119.6	17,834.4	16,714.8
9	2021		1,119.6	1,119.6	19,971.3	18,851.7
10	2022		1,119.6	1,119.6	21,631.0	20,511.4
11	2023		1,119.6	1,119.6	21,631.0	20,511.4
12	2024		1,119.6	1,119.6	21,631.0	20,511.4
13	2025		6,703.9	6,703.9	21,631.0	14,927.1
14	2026		1,119.6	1,119.6	21,631.0	20,511.4
15	2027		1,119.6	1,119.6	21,631.0	20,511.4
16	2028		1,119.6	1,119.6	21,631.0	20,511.4
17	2029		1,119.6	1,119.6	21,631.0	20,511.4
18	2030		1,119.6	1,119.6	21,631.0	20,511.4
19	2031		1,119.6	1,119.6	21,631.0	20,511.4
20	2032		1,119.6	1,119.6	21,631.0	20,511.4
21	2033		1,119.6	1,119.6	21,631.0	20,511.4
22	2034		1,119.6	1,119.6	21,631.0	20,511.4
23	2035		6,738.4	6,738.4	21,631.0	14,892.6
24	2036		1,119.6	1,119.6	21,631.0	20,511.4
25	2037		1,119.6	1,119.6	21,631.0	20,511.4
26	2038		1,119.6	1,119.6	21,631.0	20,511.4
27	2039		1,119.6	1,119.6	21,631.0	20,511.4
28	2040		1,119.6	1,119.6	21,631.0	20,511.4
29	2041		1,119.6	1,119.6	21,631.0	20,511.4
30	2042		1,119.6	1,119.6	21,631.0	20,511.4
31	2043		1,119.6	1,119.6	21,631.0	20,511.4
32	2044		1,119.6	1,119.6	21,631.0	20,511.4
33	2045		6,703.9	6,703.9	21,631.0	14,927.1
34	2046		1,119.6	1,119.6	21,631.0	20,511.4
35	2047		1,119.6	1,119.6	21,631.0	20,511.4
36	2048		1,119.6	1,119.6	21,631.0	20,511.4
37	2049		1,119.6	1,119.6	21,631.0	20,511.4
38	2050		1,119.6	1,119.6	21,631.0	20,511.4
39	2051		1,119.6	1,119.6	21,631.0	20,511.4
40	2052		1,119.6	1,119.6	21,631.0	20,511.4
41	2053		1,119.6	1,119.6	21,631.0	20,511.4
42	2054		1,119.6	1,119.6	21,631.0	20,511.4
43	2055		6,738.4	6,738.4	21,631.0	14,892.6
44	2056		1,119.6	1,119.6	21,631.0	20,511.4
45	2057		1,119.6	1,119.6	21,631.0	20,511.4
46	2058		1,119.6	1,119.6	21,631.0	20,511.4
47	2059		1,119.6	1,119.6	21,631.0	20,511.4
48	2060		1,119.6	1,119.6	21,631.0	20,511.4
49	2061		1,119.6	1,119.6	21,631.0	20,511.4
50	2062		1,119.6	1,119.6	21,631.0	20,511.4
51	2063		1,119.6	1,119.6	21,631.0	20,511.4

2/: Details are presented in Annex H-9

Case 2: Irrigation & drainage benefit (crop production benefit) 10% down

Unit: GHC Thousand

EIRR	18.1 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		54,138	150,245	96,107	1.6

Accra Plains Gravity Irrigation Project (APGIP)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/ Initial Investment	Annual OMM 1/	Total	Project Benefit 2/	Net Cash Flow
1	2013	1,138.9	0	1,138.9	0	-1,138.9
2	2014	38,869.4	0	38,869.4	-16.9	-38,886.3
3	2015	50,065.0	0	50,065.0	-39.3	-50,104.3
4	2016	26,545.8	524.3	27,070.1	7,021.5	-20,048.6
5	2017		1,420.0	1,420.0	17,451.8	16,031.8
6	2018		1,420.0	1,420.0	21,016.6	19,596.6
7	2019		1,420.0	1,420.0	24,220.1	22,800.1
8	2020		1,420.0	1,420.0	27,307.8	25,887.8
9	2021		1,420.0	1,420.0	29,444.7	28,024.7
10	2022		1,420.0	1,420.0	31,104.4	29,684.4
11	2023		1,420.0	1,420.0	31,104.4	29,684.4
12	2024		3,821.8	3,821.8	31,104.4	27,282.6
13	2025		10,052.4	10,052.4	31,104.4	21,052.0
14	2026		1,420.0	1,420.0	31,104.4	29,684.4
15	2027		1,420.0	1,420.0	31,104.4	29,684.4
16	2028		1,420.0	1,420.0	31,104.4	29,684.4
17	2029		1,420.0	1,420.0	31,104.4	29,684.4
18	2030		1,420.0	1,420.0	31,104.4	29,684.4
19	2031		1,420.0	1,420.0	31,104.4	29,684.4
20	2032		1,420.0	1,420.0	31,104.4	29,684.4
21	2033		1,420.0	1,420.0	31,104.4	29,684.4
22	2034		3,821.8	3,821.8	31,104.4	27,282.6
23	2035		10,125.2	10,125.2	31,104.4	20,979.2
24	2036		1,420.0	1,420.0	31,104.4	29,684.4
25	2037		1,420.0	1,420.0	31,104.4	29,684.4
26	2038		1,420.0	1,420.0	31,104.4	29,684.4
27	2039		1,420.0	1,420.0	31,104.4	29,684.4
28	2040		1,420.0	1,420.0	31,104.4	29,684.4
29	2041		1,420.0	1,420.0	31,104.4	29,684.4
30	2042		1,420.0	1,420.0	31,104.4	29,684.4
31	2043		1,420.0	1,420.0	31,104.4	29,684.4
32	2044		3,821.8	3,821.8	31,104.4	27,282.6
33	2045		10,052.4	10,052.4	31,104.4	21,052.0
34	2046		1,348.9	1,348.9	31,104.4	29,755.5
35	2047		1,348.9	1,348.9	31,104.4	29,755.5
36	2048		1,348.9	1,348.9	31,104.4	29,755.5
37	2049		1,348.9	1,348.9	31,104.4	29,755.5
38	2050		1,348.9	1,348.9	31,104.4	29,755.5
39	2051		1,348.9	1,348.9	31,104.4	29,755.5
40	2052		1,348.9	1,348.9	31,104.4	29,755.5
41	2053		1,348.9	1,348.9	31,104.4	29,755.5
42	2054		3,821.8	3,821.8	31,104.4	27,282.6
43	2055		10,125.2	10,125.2	31,104.4	20,979.2
44	2056		1,348.9	1,348.9	31,104.4	29,755.5
45	2057		1,348.9	1,348.9	31,104.4	29,755.5
46	2058		1,348.9	1,348.9	31,104.4	29,755.5
47	2059		1,348.9	1,348.9	31,104.4	29,755.5
48	2060		1,348.9	1,348.9	31,104.4	29,755.5
49	2061		1,348.9	1,348.9	31,104.4	29,755.5
50	2062		1,348.9	1,348.9	31,104.4	29,755.5
51	2063		1,348.9	1,348.9	31,104.4	29,755.5

H-15 Sensitivity Analysis - Case 3

Case 3: Irrigation water supply (construction works) 1 year delay

Unit: GHC Thousand

EIRR	20.3 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		21,218	50,016	28,798	1.7

Kpong Irrigation Scheme (KIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	234.4		234.4	0	-234.4
2	2014	3,296.8		3,296.8	0	-3,296.8
3	2015	14,180.8		14,180.8	0	-14,180.8
4	2016	14,942.4		14,942.4	0	-14,942.4
5	2017	5,431.0	300.4	5,731.4	5,247.8	-483.6
6	2018		300.4	300.4	7,888.8	7,588.4
7	2019		300.4	300.4	8,945.2	8,644.8
8	2020		300.4	300.4	9,473.4	9,173.0
9	2021		300.4	300.4	10,529.8	10,229.4
10	2022		300.4	300.4	10,529.8	10,229.4
11	2023		300.4	300.4	10,529.8	10,229.4
12	2024		300.4	300.4	10,529.8	10,229.4
13	2025		2,702.2	2,702.2	10,529.8	7,827.6
14	2026		3,348.5	3,348.5	10,529.8	7,181.3
15	2027		300.4	300.4	10,529.8	10,229.4
16	2028		300.4	300.4	10,529.8	10,229.4
17	2029		300.4	300.4	10,529.8	10,229.4
18	2030		300.4	300.4	10,529.8	10,229.4
19	2031		300.4	300.4	10,529.8	10,229.4
20	2032		300.4	300.4	10,529.8	10,229.4
21	2033		300.4	300.4	10,529.8	10,229.4
22	2034		300.4	300.4	10,529.8	10,229.4
23	2035		2,702.2	2,702.2	10,529.8	7,827.6
24	2036		3,386.8	3,386.8	10,529.8	7,143.0
25	2037		300.4	300.4	10,529.8	10,229.4
26	2038		300.4	300.4	10,529.8	10,229.4
27	2039		300.4	300.4	10,529.8	10,229.4
28	2040		300.4	300.4	10,529.8	10,229.4
29	2041		300.4	300.4	10,529.8	10,229.4
30	2042		300.4	300.4	10,529.8	10,229.4
31	2043		300.4	300.4	10,529.8	10,229.4
32	2044		300.4	300.4	10,529.8	10,229.4
33	2045		2,702.2	2,702.2	10,529.8	7,827.6
34	2046		3,348.5	3,348.5	10,529.8	7,181.3
35	2047		229.3	229.3	10,529.8	10,300.5
36	2048		229.3	229.3	10,529.8	10,300.5
37	2049		229.3	229.3	10,529.8	10,300.5
38	2050		229.3	229.3	10,529.8	10,300.5
39	2051		229.3	229.3	10,529.8	10,300.5
40	2052		229.3	229.3	10,529.8	10,300.5
41	2053		229.3	229.3	10,529.8	10,300.5
42	2054		229.3	229.3	10,529.8	10,300.5
43	2055		2,702.2	2,702.2	10,529.8	7,827.6
44	2056		3,386.8	3,386.8	10,529.8	7,143.0
45	2057		229.3	229.3	10,529.8	10,300.5
46	2058		229.3	229.3	10,529.8	10,300.5
47	2059		229.3	229.3	10,529.8	10,300.5
48	2060		229.3	229.3	10,529.8	10,300.5
49	2061		229.3	229.3	10,529.8	10,300.5
50	2062		229.3	229.3	10,529.8	10,300.5
51	2063		229.3	229.3	10,529.8	10,300.5

Case 3: Irrigation water supply (construction works) 1 year delay

Unit: GHC Thousand

EIRR	18.1 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		38,594	98,834	60,239	1.6

New Developed Irrigation Scheme (NDIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	904.5		904.5	0	-904.5
2	2014	14,214.8		14,214.8	0	-14,214.8
3	2015	22,183.7		22,183.7	-16.9	-22,200.6
4	2016	27,204.3		27,204.3	-39.3	-27,243.6
5	2017	14,026.4	223.9	14,250.3	2,567.0	-11,683.3
6	2018		1,119.6	1,119.6	11,476.7	10,357.1
7	2019		1,119.6	1,119.6	14,381.3	13,261.7
8	2020		1,119.6	1,119.6	17,412.6	16,293.0
9	2021		1,119.6	1,119.6	19,786.9	18,667.3
10	2022		1,119.6	1,119.6	22,161.2	21,041.6
11	2023		1,119.6	1,119.6	24,005.3	22,885.7
12	2024		1,119.6	1,119.6	24,005.3	22,885.7
13	2025		1,119.6	1,119.6	24,005.3	22,885.7
14	2026		6,703.9	6,703.9	24,005.3	17,301.4
15	2027		1,119.6	1,119.6	24,005.3	22,885.7
16	2028		1,119.6	1,119.6	24,005.3	22,885.7
17	2029		1,119.6	1,119.6	24,005.3	22,885.7
18	2030		1,119.6	1,119.6	24,005.3	22,885.7
19	2031		1,119.6	1,119.6	24,005.3	22,885.7
20	2032		1,119.6	1,119.6	24,005.3	22,885.7
21	2033		1,119.6	1,119.6	24,005.3	22,885.7
22	2034		1,119.6	1,119.6	24,005.3	22,885.7
23	2035		1,119.6	1,119.6	24,005.3	22,885.7
24	2036		6,738.4	6,738.4	24,005.3	17,266.9
25	2037		1,119.6	1,119.6	24,005.3	22,885.7
26	2038		1,119.6	1,119.6	24,005.3	22,885.7
27	2039		1,119.6	1,119.6	24,005.3	22,885.7
28	2040		1,119.6	1,119.6	24,005.3	22,885.7
29	2041		1,119.6	1,119.6	24,005.3	22,885.7
30	2042		1,119.6	1,119.6	24,005.3	22,885.7
31	2043		1,119.6	1,119.6	24,005.3	22,885.7
32	2044		1,119.6	1,119.6	24,005.3	22,885.7
33	2045		1,119.6	1,119.6	24,005.3	22,885.7
34	2046		6,703.9	6,703.9	24,005.3	17,301.4
35	2047		1,119.6	1,119.6	24,005.3	22,885.7
36	2048		1,119.6	1,119.6	24,005.3	22,885.7
37	2049		1,119.6	1,119.6	24,005.3	22,885.7
38	2050		1,119.6	1,119.6	24,005.3	22,885.7
39	2051		1,119.6	1,119.6	24,005.3	22,885.7
40	2052		1,119.6	1,119.6	24,005.3	22,885.7
41	2053		1,119.6	1,119.6	24,005.3	22,885.7
42	2054		1,119.6	1,119.6	24,005.3	22,885.7
43	2055		1,119.6	1,119.6	24,005.3	22,885.7
44	2056		6,738.4	6,738.4	24,005.3	17,266.9
45	2057		1,119.6	1,119.6	24,005.3	22,885.7
46	2058		1,119.6	1,119.6	24,005.3	22,885.7
47	2059		1,119.6	1,119.6	24,005.3	22,885.7
48	2060		1,119.6	1,119.6	24,005.3	22,885.7
49	2061		1,119.6	1,119.6	24,005.3	22,885.7
50	2062		1,119.6	1,119.6	24,005.3	22,885.7
51	2063		1,119.6	1,119.6	24,005.3	22,885.7

Case 3: Irrigation water supply (construction works) 1 year delay

Unit: GHC Thousand

EIRR	18.8 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		59,812	148,850	89,038	1.7

Accra Plains Gravity Irrigation Project (APGIP)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	1,138.9	0	1,138.9	0	-1,138.9
2	2014	17,511.6	0	17,511.6	0	-17,511.6
3	2015	36,364.5	0	36,364.5	-16.9	-36,381.4
4	2016	42,146.7	0	42,146.7	-39.3	-42,186.0
5	2017	19,457.4	524.3	19,981.7	7,814.8	-12,166.9
6	2018	0.0	1,420.0	1,420.0	19,365.5	17,945.5
7	2019		1,420.0	1,420.0	23,326.5	21,906.5
8	2020		1,420.0	1,420.0	26,886.0	25,466.0
9	2021		1,420.0	1,420.0	30,316.7	28,896.7
10	2022		1,420.0	1,420.0	32,691.0	31,271.0
11	2023		1,420.0	1,420.0	34,535.1	33,115.1
12	2024		1,420.0	1,420.0	34,535.1	33,115.1
13	2025		3,821.8	3,821.8	34,535.1	30,713.3
14	2026		10,052.4	10,052.4	34,535.1	24,482.7
15	2027		1,420.0	1,420.0	34,535.1	33,115.1
16	2028		1,420.0	1,420.0	34,535.1	33,115.1
17	2029		1,420.0	1,420.0	34,535.1	33,115.1
18	2030		1,420.0	1,420.0	34,535.1	33,115.1
19	2031		1,420.0	1,420.0	34,535.1	33,115.1
20	2032		1,420.0	1,420.0	34,535.1	33,115.1
21	2033		1,420.0	1,420.0	34,535.1	33,115.1
22	2034		1,420.0	1,420.0	34,535.1	33,115.1
23	2035		3,821.8	3,821.8	34,535.1	30,713.3
24	2036		10,125.2	10,125.2	34,535.1	24,409.9
25	2037		1,420.0	1,420.0	34,535.1	33,115.1
26	2038		1,420.0	1,420.0	34,535.1	33,115.1
27	2039		1,420.0	1,420.0	34,535.1	33,115.1
28	2040		1,420.0	1,420.0	34,535.1	33,115.1
29	2041		1,420.0	1,420.0	34,535.1	33,115.1
30	2042		1,420.0	1,420.0	34,535.1	33,115.1
31	2043		1,420.0	1,420.0	34,535.1	33,115.1
32	2044		1,420.0	1,420.0	34,535.1	33,115.1
33	2045		3,821.8	3,821.8	34,535.1	30,713.3
34	2046		10,052.4	10,052.4	34,535.1	24,482.7
35	2047		1,348.9	1,348.9	34,535.1	33,186.2
36	2048		1,348.9	1,348.9	34,535.1	33,186.2
37	2049		1,348.9	1,348.9	34,535.1	33,186.2
38	2050		1,348.9	1,348.9	34,535.1	33,186.2
39	2051		1,348.9	1,348.9	34,535.1	33,186.2
40	2052		1,348.9	1,348.9	34,535.1	33,186.2
41	2053		1,348.9	1,348.9	34,535.1	33,186.2
42	2054		1,348.9	1,348.9	34,535.1	33,186.2
43	2055		3,821.8	3,821.8	34,535.1	30,713.3
44	2056		10,125.2	10,125.2	34,535.1	24,409.9
45	2057		1,348.9	1,348.9	34,535.1	33,186.2
46	2058		1,348.9	1,348.9	34,535.1	33,186.2
47	2059		1,348.9	1,348.9	34,535.1	33,186.2
48	2060		1,348.9	1,348.9	34,535.1	33,186.2
49	2061		1,348.9	1,348.9	34,535.1	33,186.2
50	2062		1,348.9	1,348.9	34,535.1	33,186.2
51	2063		1,348.9	1,348.9	34,535.1	33,186.2

1/: Including annual OMM cost, repairing & replacement costs details are presented in Annex H-11

2/: Details are presented in Annex H-9

H-16 Sensitivity Analysis - Case 4

Case 4: Target yield 10% down

Unit: GHC Thousand

EIRR	18.3 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		16,969	48,702	31,733	1.5

Kpong Irrigation Scheme (KIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	234.4		234.4	0	-234.4
2	2014	15,353.1		15,353.1	0	-15,353.1
3	2015	17,066.9		17,066.9	0	-17,066.9
4	2016	5,431.0	300.4	5,731.4	4,557.8	-1,173.6
5	2017		300.4	300.4	6,853.8	6,553.4
6	2018		300.4	300.4	7,772.2	7,471.8
7	2019		300.4	300.4	8,231.4	7,931.0
8	2020		300.4	300.4	9,149.8	8,849.4
9	2021		300.4	300.4	9,149.8	8,849.4
10	2022		300.4	300.4	9,149.8	8,849.4
11	2023		300.4	300.4	9,149.8	8,849.4
12	2024		2,702.2	2,702.2	9,149.8	6,447.6
13	2025		3,348.5	3,348.5	9,149.8	5,801.3
14	2026		300.4	300.4	9,149.8	8,849.4
15	2027		300.4	300.4	9,149.8	8,849.4
16	2028		300.4	300.4	9,149.8	8,849.4
17	2029		300.4	300.4	9,149.8	8,849.4
18	2030		300.4	300.4	9,149.8	8,849.4
19	2031		300.4	300.4	9,149.8	8,849.4
20	2032		300.4	300.4	9,149.8	8,849.4
21	2033		300.4	300.4	9,149.8	8,849.4
22	2034		2,702.2	2,702.2	9,149.8	6,447.6
23	2035		3,386.8	3,386.8	9,149.8	5,763.0
24	2036		300.4	300.4	9,149.8	8,849.4
25	2037		300.4	300.4	9,149.8	8,849.4
26	2038		300.4	300.4	9,149.8	8,849.4
27	2039		300.4	300.4	9,149.8	8,849.4
28	2040		300.4	300.4	9,149.8	8,849.4
29	2041		300.4	300.4	9,149.8	8,849.4
30	2042		300.4	300.4	9,149.8	8,849.4
31	2043		300.4	300.4	9,149.8	8,849.4
32	2044		2,702.2	2,702.2	9,149.8	6,447.6
33	2045		3,348.5	3,348.5	9,149.8	5,801.3
34	2046		229.3	229.3	9,149.8	8,920.5
35	2047		229.3	229.3	9,149.8	8,920.5
36	2048		229.3	229.3	9,149.8	8,920.5
37	2049		229.3	229.3	9,149.8	8,920.5
38	2050		229.3	229.3	9,149.8	8,920.5
39	2051		229.3	229.3	9,149.8	8,920.5
40	2052		229.3	229.3	9,149.8	8,920.5
41	2053		229.3	229.3	9,149.8	8,920.5
42	2054		2,702.2	2,702.2	9,149.8	6,447.6
43	2055		3,386.8	3,386.8	9,149.8	5,763.0
44	2056		229.3	229.3	9,149.8	8,920.5
45	2057		229.3	229.3	9,149.8	8,920.5
46	2058		229.3	229.3	9,149.8	8,920.5
47	2059		229.3	229.3	9,149.8	8,920.5
48	2060		229.3	229.3	9,149.8	8,920.5
49	2061		229.3	229.3	9,149.8	8,920.5
50	2062		229.3	229.3	9,149.8	8,920.5
51	2063		229.3	229.3	9,149.8	8,920.5

1/: Including annual OMM cost, repairing & replacement costs details are presented in Annex H-11

Case 4: Target yield 10% down

Unit: GHC Thousand

EIRR	17.0 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		30,657	95,031	64,374	1.5

New Developed Irrigation Scheme (NDIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	904.5		904.5	0	-904.5
2	2014	23,516.3		23,516.3	-16.9	-23,533.2
3	2015	32,998.1		32,998.1	-39.3	-33,037.4
4	2016	21,114.8	223.9	21,338.7	2,186.3	-19,152.4
5	2017		1,119.6	1,119.6	9,864.7	8,745.1
6	2018		1,119.6	1,119.6	12,351.8	11,232.2
7	2019		1,119.6	1,119.6	14,947.3	13,827.7
8	2020		1,119.6	1,119.6	16,980.3	15,860.7
9	2021		1,119.6	1,119.6	19,013.4	17,893.8
10	2022		1,119.6	1,119.6	20,592.3	19,472.7
11	2023		1,119.6	1,119.6	20,592.3	19,472.7
12	2024		1,119.6	1,119.6	20,592.3	19,472.7
13	2025		6,703.9	6,703.9	20,592.3	13,888.4
14	2026		1,119.6	1,119.6	20,592.3	19,472.7
15	2027		1,119.6	1,119.6	20,592.3	19,472.7
16	2028		1,119.6	1,119.6	20,592.3	19,472.7
17	2029		1,119.6	1,119.6	20,592.3	19,472.7
18	2030		1,119.6	1,119.6	20,592.3	19,472.7
19	2031		1,119.6	1,119.6	20,592.3	19,472.7
20	2032		1,119.6	1,119.6	20,592.3	19,472.7
21	2033		1,119.6	1,119.6	20,592.3	19,472.7
22	2034		1,119.6	1,119.6	20,592.3	19,472.7
23	2035		6,738.4	6,738.4	20,592.3	13,853.9
24	2036		1,119.6	1,119.6	20,592.3	19,472.7
25	2037		1,119.6	1,119.6	20,592.3	19,472.7
26	2038		1,119.6	1,119.6	20,592.3	19,472.7
27	2039		1,119.6	1,119.6	20,592.3	19,472.7
28	2040		1,119.6	1,119.6	20,592.3	19,472.7
29	2041		1,119.6	1,119.6	20,592.3	19,472.7
30	2042		1,119.6	1,119.6	20,592.3	19,472.7
31	2043		1,119.6	1,119.6	20,592.3	19,472.7
32	2044		1,119.6	1,119.6	20,592.3	19,472.7
33	2045		6,703.9	6,703.9	20,592.3	13,888.4
34	2046		1,119.6	1,119.6	20,592.3	19,472.7
35	2047		1,119.6	1,119.6	20,592.3	19,472.7
36	2048		1,119.6	1,119.6	20,592.3	19,472.7
37	2049		1,119.6	1,119.6	20,592.3	19,472.7
38	2050		1,119.6	1,119.6	20,592.3	19,472.7
39	2051		1,119.6	1,119.6	20,592.3	19,472.7
40	2052		1,119.6	1,119.6	20,592.3	19,472.7
41	2053		1,119.6	1,119.6	20,592.3	19,472.7
42	2054		1,119.6	1,119.6	20,592.3	19,472.7
43	2055		6,738.4	6,738.4	20,592.3	13,853.9
44	2056		1,119.6	1,119.6	20,592.3	19,472.7
45	2057		1,119.6	1,119.6	20,592.3	19,472.7
46	2058		1,119.6	1,119.6	20,592.3	19,472.7
47	2059		1,119.6	1,119.6	20,592.3	19,472.7
48	2060		1,119.6	1,119.6	20,592.3	19,472.7
49	2061		1,119.6	1,119.6	20,592.3	19,472.7
50	2062		1,119.6	1,119.6	20,592.3	19,472.7
51	2063		1,119.6	1,119.6	20,592.3	19,472.7

2/: Details are presented in Annex H-9

Case 4: Target yield 10% down

Unit: GHC Thousand

EIRR	17.4 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		47,626	143,733	96,107	1.5

Accra Plains Gravity Irrigation Project (APGIP)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	1,138.9	0	1,138.9	0	-1,138.9
2	2014	38,869.4	0	38,869.4	-16.9	-38,886.3
3	2015	50,065.0	0	50,065.0	-39.3	-50,104.3
4	2016	26,545.8	524.3	27,070.1	6,744.1	-20,326.0
5	2017		1,420.0	1,420.0	16,718.5	15,298.5
6	2018		1,420.0	1,420.0	20,124.0	18,704.0
7	2019		1,420.0	1,420.0	23,178.7	21,758.7
8	2020		1,420.0	1,420.0	26,130.1	24,710.1
9	2021		1,420.0	1,420.0	28,163.2	26,743.2
10	2022		1,420.0	1,420.0	29,742.1	28,322.1
11	2023		1,420.0	1,420.0	29,742.1	28,322.1
12	2024		3,821.8	3,821.8	29,742.1	25,920.3
13	2025		10,052.4	10,052.4	29,742.1	19,689.7
14	2026		1,420.0	1,420.0	29,742.1	28,322.1
15	2027		1,420.0	1,420.0	29,742.1	28,322.1
16	2028		1,420.0	1,420.0	29,742.1	28,322.1
17	2029		1,420.0	1,420.0	29,742.1	28,322.1
18	2030		1,420.0	1,420.0	29,742.1	28,322.1
19	2031		1,420.0	1,420.0	29,742.1	28,322.1
20	2032		1,420.0	1,420.0	29,742.1	28,322.1
21	2033		1,420.0	1,420.0	29,742.1	28,322.1
22	2034		3,821.8	3,821.8	29,742.1	25,920.3
23	2035		10,125.2	10,125.2	29,742.1	19,616.9
24	2036		1,420.0	1,420.0	29,742.1	28,322.1
25	2037		1,420.0	1,420.0	29,742.1	28,322.1
26	2038		1,420.0	1,420.0	29,742.1	28,322.1
27	2039		1,420.0	1,420.0	29,742.1	28,322.1
28	2040		1,420.0	1,420.0	29,742.1	28,322.1
29	2041		1,420.0	1,420.0	29,742.1	28,322.1
30	2042		1,420.0	1,420.0	29,742.1	28,322.1
31	2043		1,420.0	1,420.0	29,742.1	28,322.1
32	2044		3,821.8	3,821.8	29,742.1	25,920.3
33	2045		10,052.4	10,052.4	29,742.1	19,689.7
34	2046		1,348.9	1,348.9	29,742.1	28,393.2
35	2047		1,348.9	1,348.9	29,742.1	28,393.2
36	2048		1,348.9	1,348.9	29,742.1	28,393.2
37	2049		1,348.9	1,348.9	29,742.1	28,393.2
38	2050		1,348.9	1,348.9	29,742.1	28,393.2
39	2051		1,348.9	1,348.9	29,742.1	28,393.2
40	2052		1,348.9	1,348.9	29,742.1	28,393.2
41	2053		1,348.9	1,348.9	29,742.1	28,393.2
42	2054		3,821.8	3,821.8	29,742.1	25,920.3
43	2055		10,125.2	10,125.2	29,742.1	19,616.9
44	2056		1,348.9	1,348.9	29,742.1	28,393.2
45	2057		1,348.9	1,348.9	29,742.1	28,393.2
46	2058		1,348.9	1,348.9	29,742.1	28,393.2
47	2059		1,348.9	1,348.9	29,742.1	28,393.2
48	2060		1,348.9	1,348.9	29,742.1	28,393.2
49	2061		1,348.9	1,348.9	29,742.1	28,393.2
50	2062		1,348.9	1,348.9	29,742.1	28,393.2
51	2063		1,348.9	1,348.9	29,742.1	28,393.2

H-17 Sensitivity Analysis - Case 5

Case 5: Construction cost 10% up + Irrigation & drainage benefit 10% 17,516

Unit: GHC Thousand

EIRR	18.2 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		17,516	50,425	32,909	1.5

Kpong Irrigation Scheme (KIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	234.4		234.4	0	-234.4
2	2014	16,345.3		16,345.3	0	-16,345.3
3	2015	17,607.6		17,607.6	0	-17,608
4	2016	5,431.0	300.4	5,731.4	4,719.6	-1,012
5	2017		300.4	300.4	7,096.5	6,796
6	2018		300.4	300.4	8,047.2	7,747
7	2019		300.4	300.4	8,522.6	8,222.2
8	2020		300.4	300.4	9,473.4	9,173.0
9	2021		300.4	300.4	9,473.4	9,173.0
10	2022		300.4	300.4	9,473.4	9,173.0
11	2023		300.4	300.4	9,473.4	9,173.0
12	2024		2,702.2	2,702.2	9,473.4	6,771.2
13	2025		3,348.5	3,348.5	9,473.4	6,124.9
14	2026		300.4	300.4	9,473.4	9,173.0
15	2027		300.4	300.4	9,473.4	9,173.0
16	2028		300.4	300.4	9,473.4	9,173.0
17	2029		300.4	300.4	9,473.4	9,173.0
18	2030		300.4	300.4	9,473.4	9,173.0
19	2031		300.4	300.4	9,473.4	9,173.0
20	2032		300.4	300.4	9,473.4	9,173.0
21	2033		300.4	300.4	9,473.4	9,173.0
22	2034		2,702.2	2,702.2	9,473.4	6,771.2
23	2035		3,386.8	3,386.8	9,473.4	6,086.6
24	2036		300.4	300.4	9,473.4	9,173.0
25	2037		300.4	300.4	9,473.4	9,173.0
26	2038		300.4	300.4	9,473.4	9,173.0
27	2039		300.4	300.4	9,473.4	9,173.0
28	2040		300.4	300.4	9,473.4	9,173.0
29	2041		300.4	300.4	9,473.4	9,173.0
30	2042		300.4	300.4	9,473.4	9,173.0
31	2043		300.4	300.4	9,473.4	9,173.0
32	2044		2,702.2	2,702.2	9,473.4	6,771.2
33	2045		3,348.5	3,348.5	9,473.4	6,124.9
34	2046		229.3	229.3	9,473.4	9,244.1
35	2047		229.3	229.3	9,473.4	9,244.1
36	2048		229.3	229.3	9,473.4	9,244.1
37	2049		229.3	229.3	9,473.4	9,244.1
38	2050		229.3	229.3	9,473.4	9,244.1
39	2051		229.3	229.3	9,473.4	9,244.1
40	2052		229.3	229.3	9,473.4	9,244.1
41	2053		229.3	229.3	9,473.4	9,244.1
42	2054		2,702.2	2,702.2	9,473.4	6,771.2
43	2055		3,386.8	3,386.8	9,473.4	6,086.6
44	2056		229.3	229.3	9,473.4	9,244.1
45	2057		229.3	229.3	9,473.4	9,244.1
46	2058		229.3	229.3	9,473.4	9,244.1
47	2059		229.3	229.3	9,473.4	9,244.1
48	2060		229.3	229.3	9,473.4	9,244.1
49	2061		229.3	229.3	9,473.4	9,244.1
50	2062		229.3	229.3	9,473.4	9,244.1
51	2063		229.3	229.3	9,473.4	9,244.1

1/: Including annual OMM cost, repairing & replacement costs details are presented in Annex H-11

Case 5: Construction cost 10% up + Irrigation & drainage benefit 10% down

Unit: GHC Thousand

EIRR	16.4 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		29,739	99,820	70,081	1.4

New Developed Irrigation Scheme (NDIS)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	904.5		904.5	0	-904.5
2	2014	25,867.9		25,867.9	-16.9	-25,884.8
3	2015	36,297.0		36,297.0	-39.3	-36,336.3
4	2016	23,450.2	223.9	23,674.1	2,301.9	-21,372.2
5	2017		1,119.6	1,119.6	10,355.3	9,235.7
6	2018		1,119.6	1,119.6	12,969.4	11,849.8
7	2019		1,119.6	1,119.6	15,697.5	14,577.9
8	2020		1,119.6	1,119.6	17,834.4	16,714.8
9	2021		1,119.6	1,119.6	19,971.3	18,851.7
10	2022		1,119.6	1,119.6	21,631.0	20,511.4
11	2023		1,119.6	1,119.6	21,631.0	20,511.4
12	2024		1,119.6	1,119.6	21,631.0	20,511.4
13	2025		6,703.9	6,703.9	21,631.0	14,927.1
14	2026		1,119.6	1,119.6	21,631.0	20,511.4
15	2027		1,119.6	1,119.6	21,631.0	20,511.4
16	2028		1,119.6	1,119.6	21,631.0	20,511.4
17	2029		1,119.6	1,119.6	21,631.0	20,511.4
18	2030		1,119.6	1,119.6	21,631.0	20,511.4
19	2031		1,119.6	1,119.6	21,631.0	20,511.4
20	2032		1,119.6	1,119.6	21,631.0	20,511.4
21	2033		1,119.6	1,119.6	21,631.0	20,511.4
22	2034		1,119.6	1,119.6	21,631.0	20,511.4
23	2035		6,738.4	6,738.4	21,631.0	14,892.6
24	2036		1,119.6	1,119.6	21,631.0	20,511.4
25	2037		1,119.6	1,119.6	21,631.0	20,511.4
26	2038		1,119.6	1,119.6	21,631.0	20,511.4
27	2039		1,119.6	1,119.6	21,631.0	20,511.4
28	2040		1,119.6	1,119.6	21,631.0	20,511.4
29	2041		1,119.6	1,119.6	21,631.0	20,511.4
30	2042		1,119.6	1,119.6	21,631.0	20,511.4
31	2043		1,119.6	1,119.6	21,631.0	20,511.4
32	2044		1,119.6	1,119.6	21,631.0	20,511.4
33	2045		6,703.9	6,703.9	21,631.0	14,927.1
34	2046		1,119.6	1,119.6	21,631.0	20,511.4
35	2047		1,119.6	1,119.6	21,631.0	20,511.4
36	2048		1,119.6	1,119.6	21,631.0	20,511.4
37	2049		1,119.6	1,119.6	21,631.0	20,511.4
38	2050		1,119.6	1,119.6	21,631.0	20,511.4
39	2051		1,119.6	1,119.6	21,631.0	20,511.4
40	2052		1,119.6	1,119.6	21,631.0	20,511.4
41	2053		1,119.6	1,119.6	21,631.0	20,511.4
42	2054		1,119.6	1,119.6	21,631.0	20,511.4
43	2055		6,738.4	6,738.4	21,631.0	14,892.6
44	2056		1,119.6	1,119.6	21,631.0	20,511.4
45	2057		1,119.6	1,119.6	21,631.0	20,511.4
46	2058		1,119.6	1,119.6	21,631.0	20,511.4
47	2059		1,119.6	1,119.6	21,631.0	20,511.4
48	2060		1,119.6	1,119.6	21,631.0	20,511.4
49	2061		1,119.6	1,119.6	21,631.0	20,511.4
50	2062		1,119.6	1,119.6	21,631.0	20,511.4
51	2063		1,119.6	1,119.6	21,631.0	20,511.4

2/: Details are presented in Annex H-9

Case 5: Construction cost 10% up + Irrigation & drainage benefit 10% down

Unit: GHC Thousand

EIRR	17.0 %	Present Value (at 12% discount rate)			
		NPV	Benefit	Cost	B/C Ratio
		47,255	150,245	102,989	1.5

Accra Plains Gravity Irrigation Project (APGIP)

Unit: GHC Thousand

Year in Order	Year	Economic Cost 1/			Project Benefit 2/	Net Cash Flow
		Initial Investment	Annual OMM 1/	Total		
1	2013	1,138.9	0	1,138.9	0	-1,138.9
2	2014	42,213.2	0	42,213.2	-16.9	-42,230.1
3	2015	53,904.6	0	53,904.6	-39.3	-53,943.9
4	2016	28,881.2	524.3	29,405.5	7,021.5	-22,384.0
5	2017		1,420.0	1,420.0	17,451.8	16,031.8
6	2018		1,420.0	1,420.0	21,016.6	19,596.6
7	2019		1,420.0	1,420.0	24,220.1	22,800.1
8	2020		1,420.0	1,420.0	27,307.8	25,887.8
9	2021		1,420.0	1,420.0	29,444.7	28,024.7
10	2022		1,420.0	1,420.0	31,104.4	29,684.4
11	2023		1,420.0	1,420.0	31,104.4	29,684.4
12	2024		3,821.8	3,821.8	31,104.4	27,282.6
13	2025		10,052.4	10,052.4	31,104.4	21,052.0
14	2026		1,420.0	1,420.0	31,104.4	29,684.4
15	2027		1,420.0	1,420.0	31,104.4	29,684.4
16	2028		1,420.0	1,420.0	31,104.4	29,684.4
17	2029		1,420.0	1,420.0	31,104.4	29,684.4
18	2030		1,420.0	1,420.0	31,104.4	29,684.4
19	2031		1,420.0	1,420.0	31,104.4	29,684.4
20	2032		1,420.0	1,420.0	31,104.4	29,684.4
21	2033		1,420.0	1,420.0	31,104.4	29,684.4
22	2034		3,821.8	3,821.8	31,104.4	27,282.6
23	2035		10,125.2	10,125.2	31,104.4	20,979.2
24	2036		1,420.0	1,420.0	31,104.4	29,684.4
25	2037		1,420.0	1,420.0	31,104.4	29,684.4
26	2038		1,420.0	1,420.0	31,104.4	29,684.4
27	2039		1,420.0	1,420.0	31,104.4	29,684.4
28	2040		1,420.0	1,420.0	31,104.4	29,684.4
29	2041		1,420.0	1,420.0	31,104.4	29,684.4
30	2042		1,420.0	1,420.0	31,104.4	29,684.4
31	2043		1,420.0	1,420.0	31,104.4	29,684.4
32	2044		3,821.8	3,821.8	31,104.4	27,282.6
33	2045		10,052.4	10,052.4	31,104.4	21,052.0
34	2046		1,348.9	1,348.9	31,104.4	29,755.5
35	2047		1,348.9	1,348.9	31,104.4	29,755.5
36	2048		1,348.9	1,348.9	31,104.4	29,755.5
37	2049		1,348.9	1,348.9	31,104.4	29,755.5
38	2050		1,348.9	1,348.9	31,104.4	29,755.5
39	2051		1,348.9	1,348.9	31,104.4	29,755.5
40	2052		1,348.9	1,348.9	31,104.4	29,755.5
41	2053		1,348.9	1,348.9	31,104.4	29,755.5
42	2054		3,821.8	3,821.8	31,104.4	27,282.6
43	2055		10,125.2	10,125.2	31,104.4	20,979.2
44	2056		1,348.9	1,348.9	31,104.4	29,755.5
45	2057		1,348.9	1,348.9	31,104.4	29,755.5
46	2058		1,348.9	1,348.9	31,104.4	29,755.5
47	2059		1,348.9	1,348.9	31,104.4	29,755.5
48	2060		1,348.9	1,348.9	31,104.4	29,755.5
49	2061		1,348.9	1,348.9	31,104.4	29,755.5
50	2062		1,348.9	1,348.9	31,104.4	29,755.5
51	2063		1,348.9	1,348.9	31,104.4	29,755.5

H-18 Financial Evaluation of Proposed Project

Normal

Unit: GHC Thousand

FIRR	(at 12% discount rate)			
	NPV	Benefit	Cost	B/C Ratio
21.6 %	33,085	71,675	38,590	1.9

Kpong Irrigation Scheme (KIS)

Unit: GHC Thousand

Year in Order	Year	Financial Cost 1/ Initial Investment	Financial Cost 1/ Annual OMM	Financial Cost 1/ Total	Financial Project Benefit 2/	Net Cash Flow
1	2013	324.8		324.8	0	-324.8
2	2014	19,598.8		19,598.8	0	-19,598.8
3	2015	20,729.9		20,729.9	0	-20,729.9
4	2016	6,034.5	375.5	6,410.0	6,715.5	305.5
5	2017		375.5	375.5	10,089.8	9,714.3
6	2018		375.5	375.5	11,439.5	11,064.0
7	2019		375.5	375.5	12,114.3	11,738.8
8	2020		375.5	375.5	13,464.0	13,088.5
9	2021		375.5	375.5	13,464.0	13,088.5
10	2022		375.5	375.5	13,464.0	13,088.5
11	2023		375.5	375.5	13,464.0	13,088.5
12	2024		2702.2	2,702.2	13,464.0	10,761.8
13	2025		3348.5	3,348.5	13,464.0	10,115.5
14	2026		375.5	375.5	13,464.0	13,088.5
15	2027		375.5	375.5	13,464.0	13,088.5
16	2028		375.5	375.5	13,464.0	13,088.5
17	2029		375.5	375.5	13,464.0	13,088.5
18	2030		375.5	375.5	13,464.0	13,088.5
19	2031		375.5	375.5	13,464.0	13,088.5
20	2032		375.5	375.5	13,464.0	13,088.5
21	2033		375.5	375.5	13,464.0	13,088.5
22	2034		2702.2	2,702.2	13,464.0	10,761.8
23	2035		3386.8	3,386.8	13,464.0	10,077.2
24	2036		375.5	375.5	13,464.0	13,088.5
25	2037		375.5	375.5	13,464.0	13,088.5
26	2038		375.5	375.5	13,464.0	13,088.5
27	2039		375.5	375.5	13,464.0	13,088.5
28	2040		375.5	375.5	13,464.0	13,088.5
29	2041		375.5	375.5	13,464.0	13,088.5
30	2042		375.5	375.5	13,464.0	13,088.5
31	2043		375.5	375.5	13,464.0	13,088.5
32	2044		2702.2	2,702.2	13,464.0	10,761.8
33	2045		3348.5	3,348.5	13,464.0	10,115.5
34	2046		375.5	375.5	13,464.0	13,088.5
35	2047		375.5	375.5	13,464.0	13,088.5
36	2048		375.5	375.5	13,464.0	13,088.5
37	2049		375.5	375.5	13,464.0	13,088.5
38	2050		375.5	375.5	13,464.0	13,088.5
39	2051		375.5	375.5	13,464.0	13,088.5
40	2052		375.5	375.5	13,464.0	13,088.5
41	2053		375.5	375.5	13,464.0	13,088.5
42	2054		2702.2	2,702.2	13,464.0	10,761.8
43	2055		3386.8	3,386.8	13,464.0	10,077.2
44	2056		375.5	375.5	13,464.0	13,088.5
45	2057		375.5	375.5	13,464.0	13,088.5
46	2058		375.5	375.5	13,464.0	13,088.5
47	2059		375.5	375.5	13,464.0	13,088.5
48	2060		375.5	375.5	13,464.0	13,088.5
49	2061		375.5	375.5	13,464.0	13,088.5
50	2062		375.5	375.5	13,464.0	13,088.5
51	2060		375.5	375.5	13,464.0	13,088.5

1/: Details are presented in Annex H-11 2/: Details are presented in Annex H-9

Normal

Unit: GHC Thousand

FIRR	(at 12% discount rate)			
	NPV	Benefit	Cost	B/C Ratio
14.7 %	23,030	113,153	90,123	1.3

New Developed Area

Unit: GHC Thousand

Year in Order	Year	Financial Cost 1/ Initial Investment	Financial Cost 1/ Annual OMM	Financial Cost 1/ Total	Financial Project Benefit 2/	Net Cash Flow
1	2013	1,253.3		1,253.3	0	-1,253.3
2	2014	33,199.5		33,199.5	0	-33,199.5
3	2015	46,482.4		46,482.4	0	-46,482.4
4	2016	31,189.2	279.9	31,469.1	2,665.8	-28,803.4
5	2017		1,399.5	1,399.5	11,879.5	10,480.0
6	2018		1,399.5	1,399.5	14,794.8	13,395.3
7	2019		1,399.5	1,399.5	17,835.0	16,435.5
8	2020		1,399.5	1,399.5	20,217.2	18,817.7
9	2021		1,399.5	1,399.5	22,599.4	21,199.9
10	2022		1,399.5	1,399.5	24,448.4	23,048.9
11	2023		1,399.5	1,399.5	24,448.4	23,048.9
12	2024		1,399.5	1,399.5	24,448.4	23,048.9
13	2025		7,604.3	7,604.3	24,448.4	16,844.1
14	2026		1,399.5	1,399.5	24,448.4	23,048.9
15	2027		1,399.5	1,399.5	24,448.4	23,048.9
16	2028		1,399.5	1,399.5	24,448.4	23,048.9
17	2029		1,399.5	1,399.5	24,448.4	23,048.9
18	2030		1,399.5	1,399.5	24,448.4	23,048.9
19	2031		1,399.5	1,399.5	24,448.4	23,048.9
20	2032		1,399.5	1,399.5	24,448.4	23,048.9
21	2033		1,399.5	1,399.5	24,448.4	23,048.9
22	2034		1,399.5	1,399.5	24,448.4	23,048.9
23	2035		7,642.6	7,642.6	24,448.4	16,805.8
24	2036		1,399.5	1,399.5	24,448.4	23,048.9
25	2037		1,399.5	1,399.5	24,448.4	23,048.9
26	2038		1,399.5	1,399.5	24,448.4	23,048.9
27	2039		1,399.5	1,399.5	24,448.4	23,048.9
28	2040		1,399.5	1,399.5	24,448.4	23,048.9
29	2041		1,399.5	1,399.5	24,448.4	23,048.9
30	2042		1,399.5	1,399.5	24,448.4	23,048.9
31	2043		1,399.5	1,399.5	24,448.4	23,048.9
32	2044		1,399.5	1,399.5	24,448.4	23,048.9
33	2045		7,604.3	7,604.3	24,448.4	16,844.1
34	2046		1,399.5	1,399.5	24,448.4	23,048.9
35	2047		1,399.5	1,399.5	24,448.4	23,048.9
36	2048		1,399.5	1,399.5	24,448.4	23,048.9
37	2049		1,399.5	1,399.5	24,448.4	23,048.9
38	2050		1,399.5	1,399.5	24,448.4	23,048.9
39	2051		1,399.5	1,399.5	24,448.4	23,048.9
40	2052		1,399.5	1,399.5	24,448.4	23,048.9
41	2053		1,399.5	1,399.5	24,448.4	23,048.9
42	2054		1,399.5	1,399.5	24,448.4	23,048.9
43	2055		7,642.6	7,642.6	24,448.4	16,805.8
44	2056		1,399.5	1,399.5	24,448.4	23,048.9
45	2057		1,399.5	1,399.5	24,448.4	23,048.9
46	2058		1,399.5	1,399.5	24,448.4	23,048.9
47	2059		1,399.5	1,399.5	24,448.4	23,048.9
48	2060		1,399.5	1,399.5	24,448.4	23,048.9
49	2061		1,399.5	1,399.5	24,448.4	23,048.9
50	2062		1,399.5	1,399.5	24,448.4	23,048.9
51	2063		1,399.5	1,399.5	24,448.4	23,048.9

Normal

Unit: GHC Thousand

FIRR	(at 12% discount rate)			
	NPV	Benefit	Cost	B/C Ratio
16.8 %	56,115	184,828	128,714	1.4

Accra Plain Gravity Irrigation Project

Unit: GHC Thousand

Year in Order	Year	Financial Cost 1/ Initial Investment	Financial Cost 1/ Annual OMM	Financial Cost 1/ Total	Financial Project Benefit 2/	Net Cash Flow
1	2013	1,578.1	0	1,578.1	0	-1,578.1
2	2014	52,798.3	0	52,798.3	0	-52,798.3
3	2015	67,212.3	0	67,212.3	0	-67,212.3
4	2016	37,223.7	655.4	37,879.1	9,381.3	-28,497.9
5	2017		1,775.0	1,775.0	21,969.2	20,194.2
6	2018		1,775.0	1,775.0	26,234.3	24,459.3
7	2019		1,775.0	1,775.0	29,949.3	28,174.3
8	2020		1,775.0	1,775.0	33,681.2	31,906.2
9	2021		1,775.0	1,775.0	36,063.4	34,288.4
10	2022		1,775.0	1,775.0	37,912.4	36,137.4
11	2023		1,775.0	1,775.0	37,912.4	36,137.4
12	2024		4,101.7	4,101.7	37,912.4	33,810.7
13	2025		10,952.8	10,952.8	37,912.4	26,959.6
14	2026		1,775.0	1,775.0	37,912.4	36,137.4
15	2027		1,775.0	1,775.0	37,912.4	36,137.4
16	2028		1,775.0	1,775.0	37,912.4	36,137.4
17	2029		1,775.0	1,775.0	37,912.4	36,137.4
18	2030		1,775.0	1,775.0	37,912.4	36,137.4
19	2031		1,775.0	1,775.0	37,912.4	36,137.4
20	2032		1,775.0	1,775.0	37,912.4	36,137.4
21	2033		1,775.0	1,775.0	37,912.4	36,137.4
22	2034		4,101.7	4,101.7	37,912.4	33,810.7
23	2035		11,029.4	11,029.4	37,912.4	26,883.0
24	2036		1,775.0	1,775.0	37,912.4	36,137.4
25	2037		1,775.0	1,775.0	37,912.4	36,137.4
26	2038		1,775.0	1,775.0	37,912.4	36,137.4
27	2039		1,775.0	1,775.0	37,912.4	36,137.4
28	2040		1,775.0	1,775.0	37,912.4	36,137.4
29	2041		1,775.0	1,775.0	37,912.4	36,137.4
30	2042		1,775.0	1,775.0	37,912.4	36,137.4
31	2043		1,775.0	1,775.0	37,912.4	36,137.4
32	2044		4,101.7	4,101.7	37,912.4	33,810.7
33	2045		10,952.8	10,952.8	37,912.4	26,959.6
34	2046		1,775.0	1,775.0	37,912.4	36,137.4
35	2047		1,775.0	1,775.0	37,912.4	36,137.4
36	2048		1,775.0	1,775.0	37,912.4	36,137.4
37	2049		1,775.0	1,775.0	37,912.4	36,137.4
38	2050		1,775.0	1,775.0	37,912.4	36,137.4
39	2051		1,775.0	1,775.0	37,912.4	36,137.4
40	2052		1,775.0	1,775.0	37,912.4	36,137.4
41	2053		1,775.0	1,775.0	37,912.4	36,137.4
42	2054		4,101.7	4,101.7	37,912.4	33,810.7
43	2055		11,029.4	11,029.4	37,912.4	26,883.0
44	2056		1,775.0	1,775.0	37,912.4	36,137.4
45	2057		1,775.0	1,775.0	37,912.4	36,137.4
46	2058		1,775.0	1,775.0	37,912.4	36,137.4
47	2059		1,775.0	1,775.0	37,912.4	36,137.4
48	2060		1,775.0	1,775.0	37,912.4	36,137.4
49	2061		1,775.0	1,775.0	37,912.4	36,137.4
50	2062		1,775.0	1,775.0	37,912.4	36,137.4
51	2063		1,775.0	1,775.0	37,912.4	36,137.4

Annex I

Photographs of the APGIP

Field Photographs

Water Resources and Irrigation System

	
Hydraulic plant of the Akosombo dam located at upstream of the Kpong dam. One penstock has a flow capacity of 200 m^3/sec.	Hydraulic plant of the Kpong dam Power plant is located at the center of the dam. Power units are installed below the control house.
	
Right side of the Kpong dam Intake of NDIS is proposed at far right side the photo.	Intake of KIS at the Kpong dam Intake gate is 2m wide and 1.5m high by manual operation. Stop logs are in the photo.
	
Entrance of the intake (KIS) Intake gate is under the water surface of the reservoir. No foreign material was found on the screen bar.	Most upstream of the KIS canal Spillway (left side of photo) was constructed immediately downstream of the intake. Discharge was about 3.5 m^3/sec in the study period.

Irrigation System of KIS

KIS Akuswe Canal
Canal section about 4km downstream of the intake. OM road is well maintained.

No. 1 division gate of KIS
Overflow type gate (Neyrpic distributor) is installed.

Check gate (KIS)
Check gates are located at upstream of the siphon of the KIS canal. Flowing plants (aquatic weed) were heaped up beside the gates.

Check gate and screen
Relatively wider opening of the screen bar of 0.25 m is appropriate to flowing volume of the foreign materials.

OM road crossing the drainage channel
Vehicles are passable in the water depth of about 0.3m during the rain. Pedestrian bridge is shown in the right of the photo.

Entrance of the Siphon (No. 6)
Water level of the canal was in lower level in the harvest period of paddy.

Irrigation System of KIS

	
Pump station along the KIS South Lower Level Canal Pump station is located at 300m inside of the South Lower Level Canal.	Pumps to the High Level Canal Three pumps have installed to lift canal water to high elevated area of KIS. Two or three pumps are operated in three days a week according to water supply volume through the KIS canal.
	
KIS canal (Akuse Main Canal) About 14 km downstream of the intake. Canal bank is covered in weeds. Periodical weeding work is carried out by the project office.	same as on the left Relatively wider canal bank was well maintained. Bulldozer is used for weeding on the bank.
	
Banana farm and drainage canal Proposed irrigation canal for NDIS is constructed at the left side of the drainage canal.	KIS canal (South Low Level Canal) About 24 km downstream of the intake. Canal and gates were not maintained.

Present Irrigation Projects

Aveyime Irrigation area
Aveyime irrigation project has completed with the financial support by AfDB. Photo shows command area.

Irrigation canal in Aveyime Irrigation project
Canal surface was lined with concrete. Land preparation water was supplied to the paddy. Land leveling work was completed.

Pump station in the Aveyime Irrigation Project
Volta river water is pumped up with three suction pipes.

Pumps of the Aveyime Irrigation Project
Three pumps were installed in the house. Construction was completed in the study period.

Regulating pond in the Aveyime Irrigation Project
Photo shows wall protection works of the regulating pond.

Outlet pit and irrigation canal in the Aveyime Irrigation Project
Irrigation water is diverted to the command area through the open canal.

Present Irrigation Projects

	
Tokpo Irrigation Project Regulating pond Construction of the regulating pond to storage pumped up water from the Volta river is behind the schedule. Land development work is also delayed.	Irrigation canal of the Tokpo Irrigation Project Outlet valve is in front of the photo.
	
Workshop of KIP OM machinery and equipment (bulldozer, backhoe, motor grader, etc.), agricultural machinery (tractor, etc.) are maintained in the workshop.	Workshop of KIP Machinery and equipments
	
Workshop of KIP Machinery and equipments for canal maintenance	OM machinery (Backhoe) Leveling, road maintenance works are periodially carried out by the project office.

Large Commercial Farming

	
Silo of the Cassi Farm Cassi Farm has stared his business since 2009. Maize and legumes are cultivated in 160 ha farm land with pressurized irrigation.	Center pivot system Cassi Farm applied center pivot sprinkler. Pumped up water is supplied from Volta river in 2km away from the farm. Photo shows soybean cultivation.
	
Golden Exotic Ltd. (Banana plantation) All produces are exported Europe. Cultivated area will be expanded from present 1,200ha to 1,800ha. The farm uses water through KIS canal.	KIS High Level Canal Irrigation canal to banana farm. Canal is well maintained by the company.
	
Golden Exotic Ltd. Storage area in the farm before export	Golden Exotic Ltd. Drip tube is installed along the banana trees. Drainage ditch is also placed in the farm.

Large Commercial Farming

	
Golden Exotic Ltd. Farm roads to transport agricultural inputs and produce.	Golden Exotic Ltd. Cable to transport produce
	
Golden Exotic Ltd. Regulating pond KIP included construction of five regulating ponds in the elevated area. Motor driven pumps supply pressurized irrigation water to the farm.	Golden Exotic Ltd. Pumps for drip irrigation Motor pumps, filter tank for drip irrigation
	
Prairie Volta Farm Prairie Volta Farm is located most downstream area of the NIDS. The farm has 290 ha paddy field, rice mill and storage silo. The farm produces rice for domestic market.	Prairie Volta Farm Engine type pumps are installed to pump up irrigation water from the Volta river. Several pumps are used to lift water from the irrigation canal in the farm area.

Large Commercial Farming

Prairie Volta Farm
River water pumped up frpm the Volta river again lifted up to the paddy field by similar engine pumps.

Prairie Volta Farm
Irrigation canal in the paddy field
Irrigation water pumped up from the Volta river is diverted through the irrigation canal.

Prairie Volta Farm
Storage silos of the Prairie Volta Farm in Aveyime
The silos have total capacity of 30,000m^3. The silos are available to store the produce of NDIS.

Prairie Volta Farm
Machinery for farming and facility maintenance.

Prairie Volta Farm
Rice mills in Aveyime

Prairie Volta Farm
Air plane is used for seeding and pesticide spraying.

Command Area in NDIS

	
KIS command area The irrigation canal of NIDS is constructed parallel with the Akuse Main Canal of KIS	Swampy area in upstream of NDIS Relatively wider swampy areas has been developed in the Norvoyita area. Some ponds in the swamp area have surface water through the year. The area shall be protected from soil flow by the construction from an environment point.
	
Upstream of the swampy area in Norvoyita Longer siphon is constructed crossing the river.	Command area of NDIS (3km south of Aveyime town) The photo shows terrain about 44km from the intake. The land is covered with grass and shrub is found along the small stream. The land has small undulation.
	
Swampy area near Aveyime town Command area is extended near the water line of the swamp.	Command area near Aveyime town Roads connecting small villages are well maintained.

Command Area in NDIS

Command area in NDIS (5km east of Aveyime)
The photo shows NDIS-No.2 area along the Aveyime- Mepe road. The area has large potential of labor force.

Command area in NDIS (5km east of Aveyime town)
The area is in a flat plain with less grass covering. Small streams are developed in the area.

Command area in NDIS (60km from the intake)
Since the area is located at the downstream of the large drainage area, the vegetation cover is so thick. Pipeline is proposed to pass over the 50m wide drainage rivers.

Command area in NDIS (65km from the intake)
The area is most downstream of NDIS. The area is relatively plain and has been owned by the Prairie Volta Farm.

Command area in NDIS (Downstream end of the command area)
The land has flat terrain and less grass cover.

Road in downstream end of NDIS
The road of 8m wide is well maintained by the Department of Feeder Roads.

Drainage Condition

Kasu Lagoon at the downstream of KIS
Several lagoons in KIS effectively reduce flood damages with their storage function. Excessively longer inundation in the lagoons sometimes cause damage of rice.

Drainage gates
The gates were installed in KIP to prevent back water from the Volta river. Back water has never found in recent 12 years since the construction of the gates in 1989.

Drainage gates and upstream canal
Drainage canal was planned as a grass surface drainage. Dredging work effectively retrieve drainage capacity of the canal.

Drainage connected to the Volta river
The photo shows drainage culvert in KIS near the Volta river. The section is relatively small. Storage function of the upstream lagoon can reduce peak flood discharge.

Rice harvest in KIS
Rice drying and packing in KIS

Rice threshing work
The farmers thump the paddy on the wooden box to thresh rice.

Infrastructures

	
National road in the south boundary of the Accra plains The road is main road connecting Togo. NDIS is located at the distance of about a half hour by vehicles from the road.	Road in the command area Feeder roads are paved with gravel and sand or clayey materials obtained in the site. Clayey pavement is slippery in the wet condition.
	
Road in the command area Clayey pavement is slippery in the wet condition.	Road in the command area Gravel and sand materials is strong enough for traffic. Drainage ditch is also necessary to protect road surface.
	
Electric network Most of the villages are energized. Road, water are also well equipped in the command area.	The same on the left Electric poles in the vicinity area of the Aveyime town.

Infrastructures

Water supply system
Water supply plant is located in Aveyime and supplies water to related three Districts. The photo shows settlement basin and pump and control office.

Intake tank
River water is pumped up into settlement basin.

Pumps
Conduits pipe have their diameter of 100, 200, 250mm. Water plant is well maintained.

Water supply plant
The photo shows settlement basin. Water is supplied to the elevated water tanks after chlorination in the plant.

Common faucets
Water plant system is operated by the District Governments with a financial support by the donors.

Elevated water tank
Water is supplied to the villages through the elevated water tanks.

Meetings and Seminars

	
Meeting with the Minister of MoFA	Discussion with WB Ghana office
	
Meeting with VRA on water intake plan	Meeting with GIDA on project formulation
	
Seminar with GIDA counterparts on project formulation and details of each project component	Seminar on draft project planning Related bodies of the project, i.e., MoFA, GIDA, KIP, WB, MIDA, and commercial enterprises Cassi Farm, Golden Exotic, Prairie Volta Farm were participated the seminar.

Annex J

List of Collected Data and Document

List of Collected Data and Document

No.	*Title of Data and Document*	*Source*	*Year*
A. National Policy			
1	MEDIUM TERM AGRICULTURE SECTOR INVESTMENT PLAN (METASIP) 2011 - 2015	MoFA	2010
2	MEDIUM-TERM NATIONAL DEVELOPMENT POLICY FRAMEWORK:GHANA SHARED GROWTH AND DEVELOPMENT AGENDA (GSGDA), 2010-2013	NDPC	2010
3	THE COORDINATED PROGRAMME OF ECONOMIC AND SOCIAL DEVELOPMENT POLICIES, 2010 – 2016	PRESIDENT OF THE REPUBLIC OF GHANA	2010
4	Food and Agriculture Sector Development Policy (FASDEP II)	MoFA	2007
5	National Irrigation Policy and Regulatory Measures	GIDA	2010
6	Financial Administration Regulations, 2004	Ministry of Finance	2004
7	Internal Audit Agency Act, 2003	Parliament of the Republic of Ghana	2003
8	Public Procurement Act, 2003	Parliament of the Republic of Ghana	2003
9	Land Registry Act, 1962	-	-
10	National Land Policy	MoLF	1999
11	Irrigation Development Authority Act, 1977	-	-
12	Environmental Protection Agency Act, 1994	-	-
13	Water Use Permits	Water Resources Commission	-
14	Guidelines for the Classification of Contractors for Building and Civil Works	Ministry of Water Resources Works and Housing	-
B. Project			
15	Accra plains irrigation project(Pump)	GIDA	-
16	Kpong Irrigation Project, Detailed Study, Project Preparation and Design	GIDA	1989

No.	*Title of Data and Document*	*Source*	*Year*
17	Kpong Irritation Project's Farmers Cooperative Society Assessment and Re-organizating a Cooperative Society	Kpong Irrigation Project	
18	Annual Report, 2010, Kpong Irrigation Project	Kpong Irrigation Project	2011
19	Annual Report, 2009, Kpong Irrigation Project	Kpong Irrigation Project	2010
20	Annual Report, 2008, Kpong Irrigation Project	Kpong Irrigation Project	2009
21	Fourth Quarterly Operational Report 2010, ICOUR	ICOUR	-
22	Feasibility Report Kpong Left Bank Irrigation Project	MiDA	2010
23	O&M Final Report Kpong Left Bank Irrigation Project	MiDA	2010
24	Emergency Preparedness Plan DTM 5 m contour map	Volta River Authority	2010
25	Environmental Dev. Center-overview	Irrigation Development Center	2010
26	Project Completion Report Kpong Irrigation Project	AfDB	2005
27	Survey Report	Volta River Authority	2010
28	Ghana: Volta River Authority (VRA); Appraisal of the Kpong Hydroelectric Project	WB	1977
C. Statistical Data			
29	2000 Population and Housing Census	Ghana Statistical Service	2005
30	Basic Prices of Materials - July 2009	The Quantity Surveyor	2009
31	2010 Population and Housing Census Provisional Results Summary of Findings	Ghana Statistical Service	2011
D. Environment			
32	Environmental Management Plan for Akosombo and Kpong Hydroelectric Plants	Volta River Authority	2010
33	Environmental Impact Assessment (EIA) Requirements in Ghana	Environmental Protection Agency	-
34	Environmental Assessment Regulations 1999	Environmental Protection Agency	-

No.	*Title of Data and Document*	*Source*	*Year*
32	Environmental Management Plan for Akosombo and Kpong Hydroelectric Plants	Volta River Authority	2010
33	Environmental Impact Assessment (EIA) Requirements in Ghana	Environmental Protection Agency	-
34	Environmental Assessment Regulations 1999	Environmental Protection Agency	-
35	Water bird Ecology and the Management of Coastal wetlands in Ghana	Ghana Wildlife Society/ Netherlands Institute for Sea Research	1995
E. Administration			
36	Dangme East District Road Map	DFR GIS Unit, Department of Feeder Roads	2011
37	Dangme West District Road Map	DFR GIS Unit, Department of Feeder Roads	2011
38	North Tong District Road Map	DFR GIS Unit, Department of Feeder Roads	2011
39	Works Location Map	Community Water and Sanitation Agency	2010
F. Others			
40	1/50,000 Topo Map	-	-
41	Daily Head Water Level Record of Kpong Reservoir (1984-2010)	Volta River Authority	2010
42	Profile of Environmental Partnership	Environmental Partnership	2011
43	Profile of African Environmental Research Consultancy	African Environmental Research Consultancy	2011
44	Profile of Mr. Emmanuel Abeka	Mr. Emmanuel Abeka	2011
45	Laboratory sheet of Water Research Institute	Water Research Institute	2011
46	Laboratory sheet of Soil Research Institute	Soil Research Institute	2011